1258215 July 2100

Source : DUST EXPLOSIONS IN THE PROCESS INDUSTRIES. ECKHOFF.
Location : Fonda, Iowa, USA

Injured : 0   **Dead :** 0

Abstract

Electrical welding on a bucket elevator lead to a dust explosion in the elevator, which was passed to another. The damage was estimated at US$ 0.03 million (1980).
[damage to equipment, safety procedures inadequate]

Lessons

The bucket elevators needed explosion relief

1319101 November 2000

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 perfrom 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]

1317517 October 2000

Source : CHEMICAL SAFETY AND HAZARD INVESTIGATION BOARD, OCTOBER 17, 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 perfrom 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 : Kilgore, Texas, USA

Injured : 3 **Dead :** 1

Abstract

An explosion occurred at a truck repair facility when a worker was trying to weld a ball valve onto the back of an oil tanker truck when residue from a gaseous hydrocarbon ignited. The worker was killed and three others injured in the incident.
An investigation into the incident is underway.
[welding, road tanker, fatality, injury]

Lessons

[None Reported]

1046902 October 2000

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

Injured : 2 **Dead :** 1

Abstract

One worker was killed and two others injured in an explosion during welding operations. The incident occurred during welding on a semitrailer when it is thought fumes ignited.
[road transport, injury]

Lessons

[None Reported]

1303318 August 2000

Source : CHEMICAL SAFETY AND HAZARD INVESTIGATION BOARD, AUGUST 18, 2000, (http://www.chemsafety.gov).
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Location : Terre Haute, USA

Injured : 0 **Dead :** 0

Abstract

A leak of hydrochloric acid occurred at a steam plant power facility. The leak was discovered during routine checks of the equipment at the facility. Hydrochloric acid is an extremely toxic substance used in water treatment facilities. The acid is used to produce steam for the heating and to clean the system. Hydrochloric acid can cause nausea, difficulty in breathing, brain damage and death.
The water supply has been tested, and no chemical leaked into the sewer system.
[inspection, spill, power plant]

Lessons

[None Reported]

1300817 August 2000

Source : BBC NEWS, 17 AUGUST, 2000, (http://www.bbc.co.uk),; YAHOO NEWS, AUGUST 17, 2000, (http://www.yahoo.co.uk).
Location : Southampton, UK

Injured : 0 **Dead :** 1

Abstract

A contract worker was killed during cleaning operations when he fell into a tank containing chemicals. The worker was rescued and taken to hospital where he died.
An investigation into the incident is being carried out.
[fall, fatality, unknown chemicals]

Lessons

[None Reported]

1297608 August 2000

Source : CHEMICAL SAFETY AND HAZARDS INVESTIGATION BOARD, AUGUST 9, 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 perfrom 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 : Samut Prakarn, THAILAND

Injured : 54 **Dead :** 0

Abstract

A gas leak occurred on an old chemical tank at a scrap yard. Fifty-four people were taken to hospital for treatment of gas inhalation. The incident occurred as workers opened the tank for cleaning operations.
[people, injury]

Lessons

[None Reported]

13020August 2000

Source : EDIE NEWSROOM, 21 AUGUST, 2000, (http//:www.edie.net/news/).
Location : Costa del Sol, SPAIN

Injured : 0 **Dead :** 0

Abstract

Cleaning emissions have been blamed for pollution that occurred over nine days on beaches across the Costa del Sol resulting in the closure of resorts and constant coastal clean up. The incident occurred during cleaning operations in the crude tanks of the petrol tanker.
[marine tanker, leak, hydrocarbon, cleaning fluid, ecological damage]

Lessons

[None Reported]

1292831 July 2000

Source : CHEMICAL SAFETY AND HAZARD INVESTIGATION BOARD, AUGUST 1, 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 perfrom 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 : Convent, USA

Injured : 0 **Dead :** 0

Abstract

An explosion occurred at a phosphate plant. The incident occurred when a 12 inch line carrying processed gas exploded and caught fire an hour after the plant began to shutdown.
Damage is thought to be minor.
[fire - consequence, damage to equipment]

Lessons

[None Reported]

1286619 July 2000

Source : CNN.COM, U.S. NEWS, JULY 19, 2000, (http://www.cnn.com).
Location : Los Angeles, USA

Injured : 1 **Dead :** 0

Abstract

A worker fell into a silo operated by a cement company. The incident occurred as the worker was carrying out cleaning operations inside the silo, he fell 30 feet. Fire rescue units rescued the worker.
[fall, silo/hopper, injury]

Lessons

[None Reported]

1278306 July 2000

Source : CHEMICAL SAFETY AND AZARD INVESTIGATION BOARD, JULY 10, 2000, (http://www.chemsafety.gov).
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Location : Tooele, USA

Injured : 6 **Dead :** 0

Abstract

Six workers were injured at a chemical weapons depot whist cleaning a line containing sulphuric acid when a spillage occurred. All six were treated for burns and inhalation of fumes.
[injury]

Lessons

[None Reported]

1277329 June 2000

Source : CHEMICAL SAFETY AND HAZARD INVESTIGATION BOARD, JULY 5, 2000, (http://www.chemsafety.gov).
(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 perfrom 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 : Gilette, USA

Injured : 2 **Dead :** 0

Abstract

An explosion occurred in a coal bed methane gas well injuring two workers. Both received severe burns. The explosion occurred as the two workers were inside the well house attempting to start the well.
Fire fighters at the scene allowed the well to burn until they could shut the flow from another point.
An investigation into the incident is being carried out.
[start-up, injury]

Lessons

The following recommendations were stated in the fire fighting efforts:
It is safer on any gas fire to let it burn until ready to shut off the gas. Doing so prevents gas from lingering near the ground where hot spots from the explosion could re-ignite it.
Methane is one of the most explosive fuels fire fighters deal with.

1269922 June 2000

Source : CNN.COM, U.S. NEWS, JUNE 22, 2000, (http;/www.cnn.com).
Location : Texas, USA

Injured : 0 **Dead :** 0

Abstract

Two window cleaners were left hanging approximately 100 feet in the air when scaffolding they were using collapsed.
Fortunately no one was hurt in the incident.
[cleaning]

Lessons

[None Reported]

1253428 May 2000

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

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]

1252225 May 2000

Source : CHEMICAL & ENGINEERING NEWS, JUNE 5, 2000,; CHEMICAL SAFETY AND HAZARD INVESTIGATION BOARD, 24 MAY, 2000, (http://www.chemsafety.gov)

Location : Donaldsonville, USA

Injured : 10 **Dead :** 1

Abstract

An explosion and fire occurred in an ammonia processing unit at a fertilizer plant killing one worker and injuring eleven others. The incident occurred as workers were cleaning an empty mixing tank.
The fire was brought under control in about twenty minutes, no chemical leaks occurred.
An investigation into the cause of the explosion is underway.
[fire - consequence, fatality, burns, injury]

Lessons

[None Reported]

1252824 May 2000

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

Location : Akron, USA

Injured : 2 **Dead :** 0

Abstract

A flash fire occurred at a paint and varnish plant seriously injuring two workers. The incident occurred when four workers were cleaning equipment in the manufacturing area.

They were using a flammable liquid solvent and it is thought that a tow motor passing nearby ignited vapours from the solvent.

The plant was evacuated and the fire was extinguished.

[fire - consequence, hot surface, evacuation, burns, injury]

Lessons

[None Reported]

1250828 April 2000

Source : CHEMICAL SAFETY AND HAZARD INVESTIGATION BOARD, 30 APRIL, 2000, (http://www.chemsafety.gov)
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Location : Bossier City, USA

Injured : 0 **Dead :** 2

Abstract

A worker collapsed after entering a chemical tanker trailer with out breathing equipment to rescue an unconscious co-worker. Both workers died presumably from the effects of naphtha fumes.
Naphtha is often used for dry cleaning. Acute exposure can damage the central nervous system, according to OSHA guidelines.
[entry into confined space, safety procedures inadequate, road tanker, asphyxiation, fatality]

Lessons

[None Reported]

1248525 April 2000

Source : CHEMICAL SAFETY AND HAZARD INVESTIGATION BOARD, 25 APRIL, 2000, (http://www.chemsafety.gov),
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Location : Hyde Park, USA

Injured : 2 **Dead :** 0

Abstract

An explosion occurred at a foundry spraying two workers with 2,500-degree molten iron.
The incident occurred whilst the workers were making a giant roll in a centrifugal spinner, welding a ladle that held 8,000 pounds of molten iron that they began to pour into a spin caster.
Partway through the process, the caster began to vibrate and then explode.
[burns, centrifuge, injury]

Lessons

[None Reported]

1245906 April 2000

Source : CHEMICAL SAFETY AND HAZARD INVESTIGATION BOARD, 7 APRIL, 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 perfrom 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 : Anchorage, USA

Injured : 0 **Dead :** 0

Abstract

A fire occurred on a tank at a tank farm. The tank contained 2,000 gallons of jet fuel, which caught fire during cleaning operations. Chemical foam was used to extinguish the fire.
No one was injured in the incident.
[fire - consequence]

Lessons

[None Reported]

1248622 March 2000

Source : CHEMICAL SAFETY AND HAZARD INVESTIGATION BOARD, 25 APRIL, 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 perfrom 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 : 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 where 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 forth 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]

1233221 March 2000

Source : CNI NEWS, 21 MARCH 2000, (http://www.cnionline.com),; CHEMICAL SAFETY AND HAZARD INVESTIGATION BOARD, 21 MARCH, 2000, (http://www.chemsafety.gov).
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Location : Channelview, Texas, USA

Injured : 0 **Dead :** 2

Abstract

Two workers carrying out sandblasting work inside a 22-by-27 foot boiler were found dead by a third worker at a chemical plant.
It is not known what hazardous chemicals were involved as the boiler used water to create steam and did not handle chemicals.
The workers were provided with breathing air due to the nature of the space they were in and because of the sandblasting operation.
An investigation into the cause found a low level of oxygen in the cylinders used.
[cleaning, fatality, tools & access equipment, asphyxiation, chemicals unknown]

Lessons

[None Reported]

12364 20 March 2000

Source : CHEMICAL SAFETY AND HAZARD INVESTIGATION BOARD, 24 MARCH, 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 perfrom 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 : 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]

1244715 March 2000

Source : CHEMICAL SAFETY AND HAZARD INVESTIGATION BOARD, 16 MARCH, 2000, (http://www.chemsafety.gov)
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Location : Rosepine, Los Angeles, USA

Injured : 2 **Dead :** 0

Abstract

Two workers were injured during welding operations when an explosion occurred. The incident occurred when the workers were loading diesel tanks and a gasoline air compressor on a logging truck.
An investigation into the incident is being carried out.
[road transport, injury]

Lessons

[None Reported]

1229714 March 2000

Source : CHEMICAL SAFETY AND HAZARD INVESTIGATION BOARD, 14 MARCH, 2000, (http://www.chemsafety.gov).
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Location : Rock Hill, USA

Injured : 2 **Dead :** 2

Abstract

Two workers were killed and two injured when turpentine fumes ignited during welding operations on a tank at a paper plant.
The tank was used to collect liquid product during the papermaking process.
Approximately fifty workers were evacuated.
[evacuation, fire - consequence, fatality, safety procedures inadequate, injury]

Lessons

[None Reported]

1244514 March 2000

Source : CHEMICAL SAFETY AND HAZARD INVESTIGATION BOARD, 16 MARCH, 2000, (http://www.chemsafety.gov)
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Location : Hangzhou, CHINA

Injured : 0 **Dead :** 4

Abstract

Four people were killed during arc-welding operations at a biogas-generating pit.
The incident occurred when the arc-welding device ignited gas in the pit resulting in an explosion.
[hot surface, fatality, fire - consequence]

Lessons

[None Reported]

1226407 March 2000

Source : CHEMICAL SAFETY AND HAZARD INVESTIGATION BOARD, 9 MARCH, 2000, (http://www.chemsafety.gov).
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Location : Lake Alfred, USA

Injured : 0 **Dead :** 0

Abstract

A fire occurred at a fertilizer plant. The incident occurred whilst plant workers were welding a metal bin, which was still containing chemicals.
The fire occurred inside a 12-foot by 30-foot hopper containing a mixture of sludge, or sewage, and ammonium nitrate used to make the fertilizer.
Fifteen workers were evacuated and fire fighters eventually brought the fire under control. Sand was placed around a nearby storm drain to contain the chemicals.
The plant was closed down for repairs and clean up.
No injuries were reported.
[fire - consequence, evacuation, plant shutdown, design or procedure error]

Lessons

[None Reported]

1224605 March 2000

Source : CHEMICAL SAFETY AND HAZARD INVESTIGATION BOARD, MARCH 7, 2000, (http://www.chemsafety.gov).
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Location : Salt Lake City, USA

Injured : 6 **Dead :** 0

Abstract

A series of explosion occurred at a vineyard plant. The incident occurred when workers were taking a steel sample from a furnace. The molten steel, heated to a temperature of 2,300 degrees, hit a water line, releasing steam and setting off a series of explosion.
[burns, sampling, process causes, fire - consequence, evacuation, injury]

Lessons

[None Reported]

12210 18 February 2000

Source : CHEMICAL SAFETY AND HAZARD INVESTIGATION BOARD, FEBRUARY 20, 2000. (http://www.chemsafety.gov).
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Location : Anchorage, USA

Injured : 0 **Dead :** 1

Abstract

An explosion caused a 20-foot by 15-foot hole in the roof of a tank and sent several large steel support beams into the air. At the time of the incident a worker was welding a ventline on top of the large wastewater tank when it exploded. The worker was blown through the roof of the building and killed instantly.
It is thought that the tank was contaminated with combustible or flammable fumes, which may have caused the blast.
[contamination, fatality]

Lessons

[None Reported]

1220012 February 2000

Source : CHEMICAL SAFETY AND HAZARD INVESTIGATION BOARD, FEBRUARY 14, 2000. (http://www.chemsafety.gov).
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Location : Hong Kong, CHINA

Injured : 4 **Dead :** 3

Abstract

An explosion occurred at a construction site killing three and injuring four workers. The incident occurred when workers were welding near pipes containing highly flammable (unidentified) gases. The pipes exploded and sent metal flying into the air.
An investigation into what caused the leak is underway.
[fatality, gas - flammable, injury]

Lessons

[None Reported]

1220109 February 2000

Source : CHEMICAL SAFETY AND HAZARD INVESTIGATION BOARD, FEBRUARY 14, 2000. (http://www.chemsafety.gov).
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Location : Fargo, USA

Injured : 1 **Dead :** 0

Abstract

A worker welding a pipe onto a 55-gallon drum was seriously injured when oil vapours from the drum ignited causing an explosion. The drum had been used to store waste oil.
[drums, leak, storage, injury]

Lessons

[None Reported]

1216719 January 2000

Source : CHEMICAL SAFETY AND HAZARD INVESTIGATION BOARD, JANUARY 24, 2000, (http://www.chemsafety.gov).
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Location : Garrision, USA

Injured : 1 **Dead :** 0

Abstract

An acetylene tank exploded as a plumber was carrying out welding work on pipes at a hospital.
The plumber was involved in maintenance work in a tunnel system under the building at the time of the accident. The plumber suffered minor burn injuries.
[explosion, burns, injury]

Lessons

[None Reported]

1215812 December 1999

Source : CHEMICAL SAFETY AND HAZARD INVESTIGATION BOARD, JANUARY 28, 2000, (http://www.chemsafety.gov).
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Location : Pascagoula, USA

Injured : 2 **Dead :** 0

Abstract

Two workers were seriously injured in an explosion at a chemical plant during pump testing.
The incident occurred when the workers were pressure testing a newly installed vacuum pump in a hydraulic tank. The tank was not in production at the time of the incident.
No release occurred and production at the plant was not effected.
[people, injury]

Lessons

[None Reported]

12108December 1999

Source : CNN.COM, U.S. NEWS, 9 DECEMBER, 1999, (http://www.cnn.com).
Location : , USA

Injured : 3 **Dead :** 0

Abstract

A chemical explosion occurred at a nuclear weapons plant injuring 10 workers whilst cleaning a welding area that had been shuttered since 1993.
Three workers were hospitalised for burns and smoke inhalation. One worker suffered second degree burns over his face and chest. The other workers were treated and released.
The incident occurred whilst workers were removing an old crucible used in casting nuclear weapons parts. The explosion occurred when they were attempting to clean up a sodium hydroxide alloy that had spilled.
It is thought that the alloy might have reacted with moisture, but the exact cause of the explosion was unclear.
[leak, injury]

Lessons

[None Reported]

1217221 November 1999

Source : CHEMICAL SAFETY AND HAZARD INVESTIGATION BOARD, JANUARY 24, 2000, (http://www.chemsafety.gov).
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Location : , CHINA

Injured : 1 **Dead :** 3

Abstract

Cleaning operations were being carried out in a storage tank when an explosion occurred killing three workers and injuring another.
The explosion and fire seriously damaged the 34,000 kl tank.
Cigarettes and a lighter were discovered near the workers bodies.
The policy at the refinery strictly forbids taking cigarettes and cellular phones into tanks to be cleaned.
[storage tanks, fire - consequence, fatality, injury]

Lessons

[None Reported]

12370November 1999

Source : CHEMICAL HAZARDS IN INDUSTRY, MARCH 2000.

Location : ,

Injured : 0 **Dead :** 0

Abstract

A fire occurred during start-up of a cold section of a gas-cracker with imported ethylene causing deep cracks to appear in the top 25 m of an ethylene cracker.
[fire - consequence]

Lessons

[None Reported]

1209609 September 1999

Source : CHEMICAL HAZARDS IN INDUSTRY, DECEMBER 1999,; SAFETY ONLINE, 7 SEP 1999, http://www.safetyon-line.com/
Location : , NORTHERN RUSSIA

Injured : 3 **Dead :** 4

Abstract

An explosion occurred at an ore processing plant killing four workers and injuring three others. The incident occurred when three oxygen cylinders exploded during welding operations. An investigation into the incident is being carried out. It is thought that the cause was due to a breach of company safety rules. [safety procedures inadequate, fatality, injury]

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]

1164414 August 1999

Source : CNN.COM, U.S. NEWS, AUGUST 16, 1999, (http://www.cnn.com).
Location : Georgia, USA

Injured : 8 **Dead :** 1

Abstract

Six workers were injured and one killed in a coal dust explosion and fire at a power generating plant.
Three injured mechanics and electricians were in critical condition at hospital with third degree burns over more than half of their body.
The accident occurred in a unit of the plant's coal burning plant minutes after workers restarted a coal pulverizer.
The pulveriser had been taken off-line for some maintenance work. The mechanics had finished the maintenance and were testing it.
The cause of the explosion is not known.
[fire - consequence, solids processing equipment, fatality, injury]

Lessons

[None Reported]

1222212 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]

12874July 1999

Source : ICHEME
Location : ,

Injured : 0 **Dead :** 1

Abstract

A contractor was killed during cleaning operations. The incident occurred when the contractor entered a storage tank without any proper personal protective equipment, he was immediately overcome by vapour and collapsed. The tank had not been gas freed at the time of entry.
[entry into confined space, fatality, asphyxiation, storage tanks, human causes, management system inadequate]

Lessons

[None Reported]

1124530 June 1999

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]

1180325 June 1999

Source : HAZARDOUS CARGO BULLETIN, SEPTEMBER 1999.
Location : Illinois, USA

Injured : 2 **Dead :** 0

Abstract

Two workers were hospitalised after being affected by fumes after sulphuric acid and bleach had been mixed to clean drains.
[cleaning, gas / vapour release]

Lessons

[None Reported]

1180223 June 1999

Source : HAZARDOUS CARGO BULLETIN, SEPTEMBER 1999.
Location : Quebec, CANADA

Injured : 0 **Dead :** 0

Abstract

A fire occurred during welding activities at a PVC pellet storage warehouse. Nearby residents were evacuated. The building was totally destroyed.
[fire - consequence, evacuation]

Lessons

[None Reported]

1178620 June 1999

Source : HAZARDOUS CARGO BULLETIN, SEPTEMBER 1999.
Location : , UNITED ARAB EMIRATES

Injured : 0 **Dead :** 0

Abstract

A marine incident. Marine tankers discharging tank washings into the ocean caused an oil slick.
[human causes, spill, pollution, cleaning]

Lessons

[None Reported]

1179509 June 1999

Source : HAZARDOUS CARGO BULLETIN, SEPTEMBER 1999.
Location : , FINLAND

Injured : 0 **Dead :** 1

Abstract

An explosion and fire occurred during maintenance shutdown at a chemical plant killing a worker and destroying a reactor.
[fire - consequence, damage to equipment, reactors and reaction equipment, sodium borohydride, fatality]

Lessons

[None Reported]

1261501 June 1999

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

Injured : 0 **Dead :** 0

Abstract

A company was fined £1,500 and costs of £600 (2000) for polluting a creek. The company cleans and jet washes heavy equipment taken from the factory floor. The operation was being undertaken from outside where the yard's concrete surface was heavily polluted with cutting oil and de-greasant. A storage container nearby was also found to be leaking oil from an open tap at the bottom.
Both effluents were found to be draining into a gutter that connected with a public surface water system.
[cleaning, pollution, container, design or procedure error]

Lessons

[None Reported]

1105627 May 1999

Source : CHEMICAL WEEK, JUNE 9, 1999.
Location : Pasadena, Texas, USA

Injured : 1 **Dead :** 0

Abstract

An explosion occurred at a chemical plant critically injuring a worker who was cleaning a 10,000 gallon tank containing a ferric sulphate compound. The explosion was caused by water being mixed with residue inside the tank. The worker suffered second degree burns to the face, neck and hands. An investigation into the incident is being carried out.
[accidental mixing, injury]

Lessons

[None Reported]

1148423 May 1999

Source : CNN.COM, U.S. NEWS, MAY 24, 1999, (http://www.cnn.com).; BBC NEWS, MAY 24, 1999, (http://www.bbc.co.uk).
Location : Khuzestan, IRAN

Injured : 70 **Dead :** 0

Abstract

An explosion and fire occurred on a gas pipeline injuring 70 workers, 30 seriously, but causing no major damage. The blast occurred whilst workers were repairing the pipeline. The injured workers suffered burns.
It is thought that the cause of the explosion was due to a gas leak.
[fire - consequence, repair, injury]

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 filer 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]

1250108 April 1999

Source : CNN.COM, U.S. NEWS, APRIL 8, 1999, (http://www.cnn.com).
Location : Florida, USA

Injured : 50 **Dead :** 2

Abstract

A generator exploded inside a coal-fired power plant killing two workers and injuring fifty others. At least three of the injured suffered serious burns.
An investigation into the incident found that a hydrogen gas leak may have caused the explosion.
The explosion occurred as the generator was being tested following routine maintenance.
The plant was shut down whilst investigations took place to make sure that none of the other generators were affected by the blast.
[testing, plant shutdown, fatality, injury]

Lessons

[None Reported]

12610April 1999

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

Injured : 0 **Dead :** 0

Abstract

Raw sewage spilled into a drainage ditch from a pumping station. The incident occurred when the standby pump had been moved for repair and had not been replaced. The remaining pump had become air locked, and with no back up, sewage began to overfill and spill into the ditch.
A failure of the company's warning system meant the problem had been left undetected.
The company was fined £5,000 and costs of £300 (2000).
[drains & sewers, maintenance inadequate, waste, pollution, design or procedure error]

Lessons

[None Reported]

1208830 March 1999

Source : CHEMICAL ENGINEERING IN AUSTRALIA, JUNE-AUGUST 1999.
Location : , AUSTRALIA

Injured : 0 **Dead :** 0

Abstract

An acid plant and plant smelter were put out of action when a blower taking the off-gasses from the smelter to the acid plant failed causing severe damage to the blower, the blower building and some equipment surrounding the area.
The failure of the sulphur dioxide blower appears to have been caused by failure of the liners in the mist precipitators during start-up, giving off combustible gases.
[mechanical equipment failure, damage to equipment, gas / vapour release, gas - flammable]

Lessons

[None Reported]

1052423 February 1999

Source : CHEMICAL ENGINEERING, MAR, 1999,; LOSS PREVENTION BULLETIN, 146, 24.
Location : Martinez, California, USA

Injured : 1 **Dead :** 4

Abstract

A fire occurred in a distillation unit at a refinery. The unit was shutdown.
Four workers were killed and the other was critically injured when a fireball engulfed them while they attempted to repair a leak in a pipe containing highly flammable naphtha.
[fire - consequence, refining, fatality, burns, injury]

Lessons

[None Reported]

12980 13 January 1999

Source : LOSS PREVENTION BULLETIN 145, 24.
Location : Arkansas, USA

Injured : 3 **Dead :** 3

Abstract

An explosion occurred at an oil refinery killing three people and injuring three others. The explosion occurred as cleaning crew from an independent contractor was working on a valve on a naphtha tank.
All runoff from the foam used to extinguish the fire and water to cool down other tanks had been contained. No harm came to the environment.
[fire - consequence, injury]

Lessons

[None Reported]

128751999

Source : ICHEME

Location : ,

Injured : 0 **Dead :** 0

Abstract

Three nozzles on top of a reactor suffered cracks in the welds during decommissioning of a high-pressure lube oil hydrogenation unit when it inadvertently discharged liquid nitrogen into three reactors. Excessive shrinking occurred, caused by thermal shock.
Damage that occurred to equipment is estimated to be approximately US$55,000 (1999).
[operation inadequate, reactors and reaction equipment, damage to equipment]

Lessons

[None Reported]

128761999

Source : ICHEME
Location : ,

Injured : 1 **Dead :** 1

Abstract

A worker was killed and another seriously injured during leak testing on a heat exchanger.
The workers were using inert gas when a tube bundle ejected with great force striking them both.
An investigation into the cause of the incident found the following immediate causes:
1. Use of an unsafe work procedure for leak testing of the heat exchanger, no test ring was used and the use of high risk pneumatic test method.
2. Failure to stop test when instructed.
3. Inadequate protection from the potential of tube bundle propelling outwards.
[explosion / pressure release, design or procedure error, fatality, injury]

Lessons

[None Reported]

1029920 December 1998

Source : ICHEME
Location : ,

Injured : 0 **Dead :** -

Abstract

A barge exploded whilst docked. Residual jet fuel was being vacuumed from the tanks and being emptied into a petroleum road tanker on a pier at the time of the explosion. The vessel had just delivered aviation fuel and the tank was being cleaned out for an new load of heating oil.
Investigations into the incident found three prime possibilities for the explosions.
Matches, which were found near the body of a crewman may have ignited the fuel vapours. Or one of the barge workers may have dropped and broken a flashlight, causing the blast. Another cause may have been due to the plastic hose which is used to vacuum the fuel accumulated enough static electricity to exploded the fumes.
Traces of alcohol were found in two of the crew members.
[river transport, cleaning, human causes]

Lessons

[None Reported]

11884December 1998

Source : CHEMICAL HAZARDS IN INDUSTRY, SEPTEMBER 1999.
Location : Pennsylvania, USA

Injured : 0 **Dead :** 2

Abstract

Workers were using a welding/cutting torch in an aerial lift when flammable materials seeped out of a pipe and were ignited by the torch. Two workers died.
[leak, fire - consequence, fatality]

Lessons

[None Reported]

1262019 October 1998

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

Injured : 0 **Dead :** 0

Abstract

Sewage was discharged from a wastewater treatment works killing fish in a nearby stream. Two days before the incident maintenance and repair work had been carried out at the site. Sometime shortly after this the electronic device controlling the flow to the treatment works failed and al the flow was directed to storm tanks and to the storm discharge point.
The company was fined £7,500 and costs of £660 (2000).
[ecological damage, pollution, leak, waste, drains & sewers, control failure, spill]

Lessons

[None Reported]

1144829 September 1998

Source : ICHEME
Location : , UK

Injured : 1 **Dead :** 0

Abstract

Part of a benzene plant was shutdown, as part of the annual shutdown programme. As part of the preparations for maintenance the main process sections were drained, purged and steamed in accordance with the set procedures. Work then began on the stripper column reboiler circuit, including two heat exchangers. The actions required for the preparation of one of the exchangers had been highlighted, and so it was assumed these actions had been completed. Under a Permit to Work the foreman and 4 of his team commenced on unbolting the exchanger end plate and the main channel end flange. The work was not completed and was carried forward to the next shift. During the work it was noticed that the exchanger surface was still hot. This was assumed to be due to steaming operations in the shell side of the exchanger. The following day under a re-signed Permit to Work, the team continued with unbolting and the exchanger end plate seal was released. Hot condensate spilled out of the bottom section of the exchanger end channel. When the flow ceased the final bolts were removed from the end plate flange and the end plate cover was rigged ready for lifting down to ground level. Approximately 10 minutes after the end plate was removed, a fitter working adjacent to the area was hit by a large flow of hot condensate, which flowed from the exchanger, impinged on a tube baffle plate and then sprayed over the fitter. He crawled away and colleagues put him under a safety shower until the ambulance arrived. The fitter received scalds to his back and neck. Investigations showed that there had been ineffective isolation of the exchanger system from the live LP plant steam supply. There was also passing valves on the condensate system which contributed to the presence of hot condensate. The highlighted had not in fact been completed and there had been inadequate physical checking of the isolation work prior to handover for maintenance. The Permit to Work system had not highlighted potential hazards, and due to work overload was not being operated effectively.
[permit to work system inadequate, burns, isolation inadequate]

Lessons

The following recommendations were made:
1. Key isolation valves should be checked for passing.
2. All work packs were re-checked for proper system isolation before shutdown work recommenced.
3. The organisation and supervision for the shutdown were reviewed and clear requirements for detailed recording and handover of progress between shift teams were set.
4. A schedule was to be set up for a management review of the progress of the new coordination routine and for general safety auditing of the shutdown activities on the plant.
5. The lessons learnt from the incident were to be circulated to other plants undergoing shutdown, to identify Best Practice for the future.
6. Generic recommendations from other condensate related incidents were to be reinforced.

1033225 September 1998

Source : LOSS CONTROL NEWSLETTER, ISSUE 2, 1996.
Location : Botany Bay, AUSTRALIA

Injured : 0 **Dead :** 0

Abstract

A fire started after a toxic gas leak of ethylene peroxide and polythene occurred during re-start after a maintenance shutdown. This was the third leak in as many weeks, the previous leaks were butane. All eight of the site plants were on a four year maintenance shutdown.
[fire - consequence, start-up, polyethylene]

Lessons

[None Reported]

1279609 September 1998

Source : CHEMICAL HAZARDS IN INDUSTRY, JUNE 2000.
Location : Ludwigshafen, GERMANY

Injured : 0 **Dead :** 1

Abstract

A worker was killed whilst carrying out repairs to a gas pressure shock absorber when a metal part came free from a clamp held by the mechanic and lodged in his chest.
An investigation into the incident is being carried out.
[fatality]

Lessons

[None Reported]

1245422 August 1998

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]

10274August 1998

Source : CNN.COM, U.S. NEWS, 10 AUG, 1998, (http://www.cnn.com).
Location : Ludwigshafen, GERMANY

Injured : 1 **Dead :** 2

Abstract

Two workers were killed and one injured when an explosion occurred at a plant. The accident occurred during repair work in the basement of a building in the plant's polystyrene production unit. The cause is not yet known.
The affected unit had been shutdown and there was no danger to nearby homes or adjoining site.
[fatality, injury]

Lessons

[None Reported]

10272July 1998

Source : CNN.COM, U.S. NEWS, 28 JULY, 1998, (http://www.cnn.com).
Location : Chicago, USA

Injured : 0 **Dead :** 0

Abstract

An explosion and fire occurred on a coal fired electric generating station. Emergency crews were on the scene as heavy black smoke and flames rose from the large steel framed building.
A power surge was reported at various points within the area at the time of the blast.
The cause of the incident may have been due to coal dust and at the time of the incident an outside cleaning contractor was vacuuming in the area where possible ignition may have occurred.
[fire - consequence, dust explosion]

Lessons

[None Reported]

1162302 June 1998

Source : ICHEME
Location : , UK

Injured : 0 **Dead :** 0

Abstract

A factory effluent consent breach ocurred following an upset on an ethylene plant. The incident arose from commissioning problems on the plant, after the plant had been shutdown for maintenance work. Emulsified water was sent to the nearby river foreshore via the plant effluent outlet. The sample of the effluent at the foreshore showed the hydrocarbon content to be 62 ppm against a maximum consent limit for spot samples of 45 ppm.
The incident was caused by a short term loss of efficiency of the waste water stripper. The performance of the stripper was reduced for about two hours due to the base section being full of liquid.
[mechanical equipment failure, spill]

Lessons

1. Contingency plans for holding up any contaminated water should be developed prior to restarting the ethylene plant.
2. The waste water stripper level instrumentation should be reviewed to assess if it is feasible to avoid false zeros.
3. The stripper Operating Instructions should be reviewed to give guidance on the actions to be taken if the tower is not operating efficiently.
4. This incident should be used as a learning event to provide refresher training to plant operators.
5. The ethylene plant radio performance should be reviewed to improve the reliability of the system.

1174513 April 1998

Source : ICHEME
Location : , UK

Injured : 0 **Dead :** 0

Abstract

An ethanol day storage facility consisted of five tanks within a bund.
In preparation for sampling one of the tanks, a technician put it on re-circulation and jet mixing. This involved lining up the tank and starting the pump.
About half an hour later he returned to the tank to take a sample and noticed that ethanol was spilling into the bund from an open drain valve on the jet mix line. He closed the valve, stopped the pump and called for assistance.
The fire service arrived at the scene. The ethanol spill, assessed at 2.5 tonne, was dealt with by allowing some to evaporate, the remainder was diluted with fire water and soaked away within the bund.
[storage tanks, operation inadequate]

Lessons

Company recommendations following the accident included the following:
Shutdown documentation should be formalised to link the documentation for maintenance activities with the process reinstatement and line checks based on marked P&ID's.

1232312 April 1998

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

Injured : 2 **Dead :** 2

Abstract

An explosion occurred at a coal tar distillation plant killing two workers and injuring another two.
The explosion occurred during welding work on a pipe connected to a one million gallon coal tar distillation tank, which was out of service at the time of the incident.
[fatality, injury]

Lessons

[None Reported]

1110227 March 1998

Source : LOSS PREVENTION BULLETIN 154, 9-14,; U.S. CHEMICAL SAFETY AND HAZARD INVESTIGATION BOARD, (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 perfrom 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 : Louisiana, USA

Injured : 1 **Dead :** 1

Abstract

A worker was killed and a contractor was seriously injured due to nitrogen asphyxiation.
On March 27, 1998, at approximately 12:15 pm, two workers at a manufacturing plant, were overcome by nitrogen gas while performing a black light inspection at an open end of a 48-inch-wide horizontal pipe. The 48-inch pipe was open because chemical-processing equipment had been shut down and opened for major maintenance. Nitrogen was being injected into the process equipment primarily to protect new catalyst in reactors from exposure to moisture. The nitrogen was also flowing through some of the piping systems connected to the reactors. The nitrogen was venting from one side of the open pipe where it had formerly been connected to an oxygen feed mixer. No warning sign was posted on the pipe opening identifying it as a confined space or warning that the pipe contained potentially hazardous nitrogen.
The two workers had placed a sheet of black plastic over the end of the pipe to provide shade to make it easier to conduct the black light test during daylight. While working just outside the pipe opening and inside of the black plastic sheet, the two workers were overcome by nitrogen. One worker died from asphyxiation. The other worker survived but was severely injured.
[fatality, entry into confined space, safety procedures inadequate, injury]

Lessons

Nitrogen is an odourless, tasteless, and invisible gas that can cause asphyxiation at high concentrations. When used in confined spaces, nitrogen is especially hazardous because it cannot be detected by human senses but can cause injury or death within minutes by displacing the oxygen that is required to sustain life.
The following recommendations were made:
1. Post signs containing the warning "Danger, Confined Space: Do Not Enter Without Authorization" or similar wording at potential entryways when tanks, vessels, pipes, or other similar chemical industry equipment are opened.
2. When nitrogen is added to a confined space, post an additional sign that warns personnel of the potential nitrogen hazard.
3. Ensure that the plant safety program addresses the control of hazards created by erecting temporary enclosures around equipment that may trap a dangerous atmosphere in the enclosure if the equipment leaks or vents hazardous material.

1199122 March 1998

Source : ICHEME
Location : , SINGAPORE

Injured : 0 **Dead :** 0

Abstract

An explosion occurred in a let down tank during installation work of a disperser and platform. Apparently, contractors were carrying out welding work to secure the position of the let down tank. After the intended welds an explosion occurred inside the tank, blowing off the manway cover and blowing a hole in the roof. There were no injuries.
An investigation found that:
1. The let down tank had been cleaned but not gas freed.
2. No welding work was anticipated by the supervising engineer and a hot works permit was not requested by the contractor.
[cleaning procedure incorrect, permit to work system inadequate, contractor error]

Lessons

[None Reported]

12073 21 March 1998

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]

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]

1137129 December 1997

Source : LLOYDS LIST, 31 DEC, 1997.
Location : , USA

Injured : 0 **Dead :** 0

Abstract

A fire occurred whilst drillers obtaining soil samples ruptured a pipeline carrying natural gas. Nearby business were evacuated and the road was closed off. [exploration, sampling, fire - consequence, evacuation, transportation]

Lessons

[None Reported]

1139817 December 1997

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]

1136811 December 1997

Source : LLOYDS LIST, 15 DEC, 1997.
Location : , USA

Injured : 1 **Dead :** 1

Abstract

A flash explosion occurred on a 6,000 gallon underground gasoline tank, which was being prepared for lining with fibreglass. One person was inside the tank and another by the 3ft by 3 ft manhole.
[storage tanks, fatality, entry into confined space, underground storage, injury]

Lessons

[None Reported]

1120027 November 1997

Source : ICHEME

Location : , FRANCE

Injured : 1 **Dead :** 0

Abstract

During the removal of one of two furnace tube header plugs in preparation for the mechanical decoking of a furnace, the plug ejected under residual nitrogen pressure and struck the contractor's face. The contractor required hospital treatment.

The furnace contains a radiation section consisting of four passes of vertical 4-inch diameter hairpin tubes. Each pass consists of 31 tubes, with a height of 20 meters arranged with plug headers at the top returns and "U" bends at the bottom. Nitrogen at 12 bar pressure through a three quarter inch hose was connected to each tube pass to push the gas oil out of the furnace to slops. This was not effective (unknown at the time) with the result that nitrogen was trapped in the top of the tube(s) between legs of gas oil. Pressure of the nitrogen in the top of the tubes being equivalent to the hydraulic pressure/height of gas oil in the tube legs. The strongback (clamp) holding the plug was removed after which a whistling sound was heard and the plug shot out of the header striking the contractor's head.

[preparation for maintenance, maintenance, furnace, design inadequate, injury]

Lessons

The following recommendations were made:

1. Preparation of plant for maintenance procedures should be subject of a hazard/job safety analysis.
2. A nitrogen purge may not clear lines of liquids and trap hidden pressure.
3. Always have a second safeguard when breaking into process systems and communicate this requirement on the work permit.

1162403 November 1997

Source : ICHEME
Location : , UK

Injured : 0 **Dead :** 0

Abstract

Radiography was taking place on a plant. A restricted area had been taped off, checked and was believed to be free of personnel. A process technician left the control room and entered approximately 2m inside the radiography barrier to take a routine sample. Before he could take the sample he was advised to leave the area immediately by another technician (not involved in the radiography). The process technician left the area.
The calculated dose of possible exposure was less than the background radiation and therefore it was concluded that the potential radiation exposure was minimal.
[sampling, radioactive]

Lessons

1. A review of the Radioactive Substances Certificate is recommended.
2. Local rules for radiography should reflect current HSE guidance on minimising the exclusion area.
3. The use of a marked up plot plan showing the exclusion zone should be considered for all radiography work to assist permit control and work planning.
4. Familiarisation with radiography procedures is recommended for manufacturing team members.
5. Review the source strength being used for site radiography with a view to increase the source strength allowing exposure time minimisation.

896 02 November 1997

Source : LLOYDS LIST, 3 NOV, 1997.
Location : , ISRAEL

Injured : 0 **Dead :** 1

Abstract

A fire occurred in a diesel storage tank following explosion caused fatality. Worker had gone for a test sample when the explosion occurred.
[storage tanks, fire - consequence, fatality, sampling, explosion / pressure release]

Lessons

[None Reported]

1139329 September 1997

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]

1138626 September 1997

Source : LOSS CONTROL NEWSLETTER, 1997.
Location : , RUSSIA

Injured : 21 **Dead :** 0

Abstract

Natural gas compression station was completely destroyed by an explosion during start-up operations despite warnings that the pipeline was in poor condition. [transportation]

Lessons

[None Reported]

1114911 September 1997

Source : ICHEME
Location : ,

Injured : 1 **Dead :** 0

Abstract

An ammonia tank was taken out of service in the July for its scheduled 3-year inspection and hydraulic pressure test. At that time, the opportunity was taken to replace valves A and B (part of a block and bleed system) on the steaming-out line to the tank. On August 13, during the first discharge of ammonia from a truck, an operator discovered valve B was leaking. He identified this valve as type suitable for steam but unsuitable for ammonia service. As a precautionary measure the tank was taken out of service with the ammonia depressured through a water drum to absorb the gas. At 09:00 hrs. on September 11, three contractors (including the supervisor) arrived to get their work permit signed and issued. The work to replace valves A and B involved the dismantling of the small diameter pipe that was fixed to the ammonia tank at flange 2. The Operator (Issuing Authority for the work permit) wrote on the permit form that the tank still contained ammonia vapours. He also informed the contractors that it would be necessary for them to wear breathing apparatus for all the work associated with the piping/valves to the tank. He did not, however, write this requirement on the permit form. At 14:00 hours, two of the three contractors (excluding the supervisor who was busy on another job) returned to disconnect flange 1. The contractor working on the flange wore breathing apparatus while the other stood by the breathing air gas bottle. While working on flange 2, the contractor's supervisor returned, put on breathing apparatus and assisted his colleague in removal of the pipe. The contractor's supervisor then decided to remove the leaded joint and clean it by scraping. At that moment he decided to remove his breathing apparatus (presumably to see more clearly) because he considered the atmosphere to be safe. As he bent down near the flange opening he was exposed to ammonia vapour. He was driven to the first aid station by one of his colleagues and transferred to hospital.
[unloading, gas / vapour release, safety procedures inadequate, permit to work system inadequate, asphyxiation]

Lessons

The issue of a work permit which, after all, is only a piece of paper does not by itself make a maintenance job safe. This is dependent upon the care and attention given by the Issuing Authority in the removal of known hazards and making certain that those performing the work are made fully knowledgeable of any remaining potential hazards and precautionary measures to be followed.
During any maintenance/repair work, replaced equipment or parts thereof must have exactly the same specification unless the modification is authorized under the Management of Change procedure.
Those who issue permits-to-work must be formally trained and certified as a competent Issuing Authority for a specific process area/unit.
Contractor's supervisors who act as a Performing Authority by accepting permits and the conditions for the work must be trained in this responsibility.

1135117 August 1997

Source : LOSS CONTROL NEWSLETTER, 1997.
Location : , INDONESIA

Injured : 0 **Dead :** 0

Abstract

A blowout and subsequent fire resulted in an offshore platform catching fire and later sinking into the sea. Two nearby fields were shutdown as a precaution.
[fire - consequence, plant shutdown]

Lessons

[None Reported]

2165 11 August 1997

Source : LOSS CONTROL NEWSLETTER, 1997.
Location : , JAPAN

Injured : 0   **Dead :** 0

Abstract

A fire broke out when heated residue oil leaked from a pipe extending from the crude distillation unit and caught fire. The leakage occurred when workers were checking a flowmeter in the pipe.
[fire - consequence, inspection]

Lessons

[None Reported]

1261909 August 1997

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

Injured : 0 **Dead :** 0

Abstract

A 16-inch subterranean pipeline was being cleared ready for decommissioning when a large quantity of oil was noticed to be floating on the surface of a creek.
The incident occurred when using a method, which would force any residual oil out at low pressure, allowing the pipe to then be flushed with seawater.
No booms or pollution prevention measures had been deployed.
The company was fined £7,500 and costs of £5,438.
[pollution, design or procedure error]

Lessons

[None Reported]

8965 August 1997

Source : THE SAFETY AND HEALTH PRACTITIONER, APRIL, 1997.
Location : Iowa, USA

Injured : 0   **Dead :** 0

Abstract

Contractors carrying out spot welding on the steel doors of an explosive magazine ignited the fireworks within. Approximately 17 tones of fireworks were consumed in the fire. Fortunately no one was injured but in addition to the destruction of the stock, the magazine suffered considerable damage. A permit to work system was not operated containing advise on precautions.
The company was fined £1000.
[explosion, fire - consequence, damage to equipment, permit to work system inadequate]

Lessons

[None Reported]

1115515 July 1997

Source : ICHEME
Location : , USA

Injured : 0 **Dead :** 0

Abstract

A second plug inserted into a "U" tube reactor blew out while the shell side of the Alkylation Unit's "Exchanger/Reactor" was pressurised with nitrogen at 50 psi to detect leaking tubes. The plug blew out as the craftsmen were about to drive it in, spraying a mist of liquid on to the face shield of one of the craftsmen.
The reactor had been prepared in accordance with the procedure to test for leaking tubes. The reactor had been blocked in, depressurised and drained. The shell side had been caustic washed to neutralize any alkylation acid and the reactor was blinded off from the acid settler. When the front cover plate was removed, some residual liquid was found in the bottom of the channel head and fire water was used to flush the channel head and tube sheet area. Dry nitrogen at 50 psig was then used to pressure up the shell side of the exchanger in order to find the leaking tubes. As this is a "U" tube bundle, the bottom leaking tube is usually found to dribble liquid out with the nitrogen. When a plug is driven in this end, then the top end of the leaking tube has to be found by detecting the escape of nitrogen. The top plug was put in place with the nitrogen pressure still applied on the shell side and tapped into place. The craftsmen were then preparing to drive the plug in completely when it blew out, spraying a mist of liquid on to the face shield of one of the craftsmen.
There is no written maintenance procedure specifically for repairing a leaking "U" tube in the reactors at Alkylation Unit. There is a Job Aid for repairing a leaking exchanger tube and the most significant difference between the Job Aid and the typical practice at the Alkylation 2 is that the Job Aid calls for water to be used to fill up the shell side of the exchanger and then this is pressured up (if necessary) to detect tube leaks. The investigation team discussed this at length and agreed that the use of nitrogen for the Alkylation Unit's reactor/exchanger is acceptable and can be done safely. The Job Aid, however, does specifically call for the shell side to be depressurised and drained before tube plugs are installed. Plugging a reactor tube while there is still nitrogen pressure on the exchanger shell was not typical practice. Nitrogen is normally blocked in and allowed to depressure first. The craftsman alleges that he was directed to attempt to plug the leaking tube while nitrogen pressure was still on the shell. The technique of inserting and driving home a plug does not require the craftsmen to enter the channel head area, as he uses an extension piece to reach into the tube sheet and insert the plug. This means a confined entry permit is not required. However, to detect which tube is leaking requires the inspectors to use a portable instrument which detects the sound of a leak. To use this instrument they must climb into the channel head, following the issue of an entry permit by the safety inspector. The safety inspector had been called for a confined space entry permit, and was present when the plug blew out. He had refused to issue the confined spaced entry permit, advising the operator that the nitrogen had to be blocked out and the shell depressurised.
A safety inspector will not issue a confined space entry permit until the nitrogen is disconnected from the reactor shell. However, the corrosion inspector must have the nitrogen connected and under pressure for the instrument to "hear" the leak. Accordingly, the typical practice is for the nitrogen to be disconnected from the shell, have the shell depressurized and obtain a confined space entry permit. After this, pressurise the shell and enter the channel head area to use the instrument to detect the leak. The investigating team agreed that this was an unacceptable practice, because as soon as nitrogen is used to repressurize the shell the conditions of the confined space entry permit are invalid.
[reactors and reaction equipment, maintenance, tube, heat exchanger, reactor tube, design or procedure error, blowout, permit to work system inadequate, entry into confined space]

Lessons

The following recommendations were made:
1. Failure to have a detailed procedure with a task analysis and periodic observations for unusual jobs will lead to attempts to short cut normal practices.
2. Gas under pressure has a great deal of potential energy waiting to be released. Plugs under pressure whether in heat exchanger tubes or furnace tubes present a potential hazards.
3. A robust permit to work system is essential to prevent accidents.

8917 09 July 1997

Source : HAZARDOUS CARGO BULLETIN, 1997, SEP. REUTER.
Location : Craiova, ROMANIA

Injured : 2 **Dead :** 16

Abstract

An experimental, multiple-detonation bomb exploded during loading onto a fighter bomber as part of a test.
[explosion, testing, air transport]

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]

1136225 June 1997

Source : LOSS CONTROL NEWSLETTER, 1997.
Location : , RUSSIA

Injured : 0 **Dead :** 0

Abstract

A crude oil fire occurred due to failure or careless use of maintenance welding equipment. The situation was aggravated by the high pressure gas pipeline located nearby. The fire was extinguished by foam.
[fire - consequence, design or procedure error]

Lessons

[None Reported]

1136025 June 1997

Source : LLOYDS LIST, 7 JUNE, 1997.
Location : , RUSSIA

Injured : 5   **Dead :** 0

Abstract

A fire on the crude oil pipeline was started during repair and maintenance work and was probably caused by the failure or misuse of welding equipment. The oil leaking from the damaged pipe was channelled into a special reservoir dug into the ground. The fire was extinguished in 2 days.
[fire - consequence, design or procedure error, transportation, injury]

Lessons

[None Reported]

8892 06 June 1997

Source : HAZARDOUS CARGO BULLETIN, 1997, AUG. LLOYDS LIST.
Location : Lagos, NIGERIA

Injured : 0 **Dead :** 4

Abstract

A marine transportation incident. Two explosions occurred in the ballast of a chemical tanker at anchorage during welding caused by naphtha vapours. Considerable damage to the tanker occurred.
[damage to equipment, fatality]

Lessons

[None Reported]

8891 04 June 1997

Source : HAZARDOUS CARGO BULLETIN, 1997, AUG. TRADE WINDS.
Location : , TURKEY

Injured : 0 **Dead :** 4

Abstract

A marine transportation incident. An explosion occurred in a tank on a marine tanker the cause was due to welding operations during repairs on a "gas free ship" at anchorage.
[hot surface, fatality]

Lessons

[None Reported]

1137203 June 1997

Source : THE CHEMICAL ENGINEER, 11 JUNE, 1998.
Location : , NETHERLANDS

Injured : 0 **Dead :** 1

Abstract

An explosion occurred in the chemical area of a refinery whilst cleaning operations were being carried out in the methyl tert butyl ether storage tank. The contractor that was fatally injured was working on the empty tank.
[storage tanks, fatality]

Lessons

[None Reported]

11981 24 May 1997

Source : ICHEME
Location : , UK
Injured : 1 **Dead :** 0

Abstract

Cleaning operations were being carried out on an acetyl chloride drum. Residual acetyl chloride reacted with the water releasing hydrogen chloride and acetic acid. The drum exploded across the yard, puncturing a drum of ethyl acetate. No ethyl acetate was lost. A worker was injured in the incident, receiving burns.
[drums, explosion, unwanted chemical reaction, injury]

Lessons

[None Reported]

8902 22 May 1997

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

Injured : 0 **Dead :** 0

Abstract

A large part of a waste treatment and tank cleaning depot was destroyed by fire due to a burst incinerator exhaust pipe igniting vapours.
[fire - consequence]

Lessons

[None Reported]

1133708 May 1997

Source : ENDS REPORT, MARCH 1997.
Location : , UK

Injured : 0 **Dead :** 0

Abstract

A backup of effluent during commissioning of new pipework resulted in a major spill/release of acidic effluent into the a near-by river. The release also knocked out a sewage works and caused serious pollution of a river.
[drains & sewers, backflow]

Lessons

[None Reported]

1134104 May 1997

Source : LOSS CONTROL NEWSLETTER, 1997.
Location : , CHINA

Injured : 0 **Dead :** 0

Abstract

An explosion occurred when unauthorised welding set fire to a vat of paint. A large tank of chemically polluted water also exploded.
[fire - consequence, human causes]

Lessons

[None Reported]

8981 May 1997

Source : CHEMICAL HAZARDS IN INDUSTRY, 1997, OCT.
Location : ,

Injured : 0 **Dead :** 0

Abstract

A gas cylinder exploded in a van taking the roof off. The incident happened when bitumen which was being heated for road repair work overflowed and set the van alight. The workers had placed a drum containing bitumen on a gas ring to heat while they carried out road resurfacing work.
[explosion]

Lessons

[None Reported]

8865 May 1997

Source : HAZARDOUS CARGO BULLETIN, 1997, AUG. FAIR PLAY.
Location : Muang, THAILAND

Injured : 20 **Dead :** 4

Abstract

An explosion occurred when workers were welding a barge at dock. The hull was full of thinner and gas after being painted.
[marine transport, hot surface, fatality]

Lessons

[None Reported]

8874 May 1997

Source : HAZARDOUS CARGO BULLETIN, 1997, AUG. STATUS WEEKLY.
Location : Ronningen, NORWAY

Injured : 0 **Dead :** 0

Abstract

A plate suffered a blowout followed by a loud bang when a rupture disc broke during a reactor shutdown. 1,800kg of ethylene gas escaped.
[reactors and reaction equipment, leak, bursting disc]

Lessons

[None Reported]

1114224 April 1997

Source : ICHEME

Location : , SINGAPORE

Injured : 1 **Dead :** 0

Abstract

A refinery reactor incident. An inspector was working from a rope ladder. He slipped from the rope ladder, falling 4-5 m to the stainless steel bottom head. The refinery's emergency medical team arrived in about 10 minutes, by which time the man had lost quite a lot of blood. (The injured man had a two and a half inch cut behind his left temple.) The emergency team applied first aid to slow the bleeding. The man showed clear signs of dizziness. They decided that the local Civil Defence Force (CDF) was required to remove the injured man from the reactor, as they are specifically trained to rescue victims. With the help of CDF it was 2 hours before he was out of the reactor.

The whole incident occurred in the middle of the night, which possibly added to the delays which were encountered. At the hospital it was determined that the injured man had a hairline fracture of the skull and a severe concussion. Additionally, he had a severely broken thumb, a somewhat smashed foot, various bruises, and scrapes and cuts. He had not been wearing a safety harness for this inspection, which was being carried out from a rope ladder. A standby man had been in attendance, and was the one who summoned help.

It is now mandatory that those working at height from non-rigid, non-railed platforms or ladders are attached to a proper safety harness, secured tight with a fall arrestor to an appropriate anchor point.

[safety procedures inadequate, reactors and reaction equipment, injury]

Lessons

The following recommendations were made:

1. People working at height on non-rigid non handrailed platform or ladders must wear a safety harness with a fall arrestor attached to a secure anchor point.
2. It is essential to have the correct rescue equipment available on site for foreseeable incidents.
3. It is necessary to train rescue teams in the difficult process of removing injured people through vessel manways.

1134413 March 1997

Source : ICHEME
Location : , USA

Injured : 0 **Dead :** 0

Abstract

The 10 inch natural gas liquids (NGL) pipeline ruptured 50 ft below a creek bed while a construction crew were laying a parallel pipeline. Blow-down valves closest to the rupture were opened to de-pressurise an 8 mile section of the line. While repairs were being carried out, product was diverted to a nearby pipeline. The local community was evacuated as a result of the incident and release.
[material of construction failure, evacuation]

Lessons

[None Reported]

9010 March 1997

Source : CHEMICAL HAZARDS IN INDUSTRY, 1997, SEP.
Location : ,

Injured : 0 **Dead :** 0

Abstract

A leak of molten aluminium and salt. About 100 kg of aluminium chloride mixture was released. The incident occurred whilst staff were attempting to clean a blocked feed pipe. The molten material reacted with atmospheric water from a toxic vapour cloud of hydrogen chloride gas.
[cleaning, unwanted chemical reaction, gas / vapour release]

Lessons

[None Reported]

8801 19 February 1997

Source : LLOYDS LIST, 28 FEB, 1997,; LOSS CONTROL NEWSLETTER, JAN, 1997.
Location : , RUSSIA

Injured : 0 **Dead :** 0

Abstract

A fire occurred in a storage tank containing hexachloromelamine occurred during maintenance repair work. Chlorine release from the tank when workers tried to extinguished the fire with water.
[fire - consequence, storage tanks, gas / vapour release]

Lessons

[None Reported]

2715 16 February 1997

Source : LLOYDS LIST, 18-21 FEB, 1997, LOSS CONTROL NEWSLETTER, JAN, 1997.
Location : , RUSSIA

Injured : 0   **Dead :** 0

Abstract

A spill occurred of about 1,500 tonnes of crude oil of which 400 tonnes went into the Volga after pipeline ruptured while under repair. A 60 ft section of the pipeline was replaced.
[transportation, pollution, material of construction failure]

Lessons

[None Reported]

1113708 January 1997

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.

111961997

Source : ICHEME
Location : ,

Injured : 1 **Dead :** 0

Abstract

An incident involving entry into a glycol contactor vessel. The vessel had been purged of fumes with an inert gas and then ventilated before entry. A worker, on entering, removed a mist screen in the lower part of the vessel and lowered himself down into the space below the mist screen level. He immediately felt disorientated but was able to climb up, and out of, the vessel. Subsequent investigation showed that there was only a 3.6% level of oxygen in the atmosphere of this compartment, some 4.4% less than the minimum oxygen level that a person can survive within.
[entry into confined space, reaction vessel, atmosphere not tested, asphyxiation, glycol]

Lessons

This incident highlights the need to be aware of the hazards associated with confined space entry.

111441997

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.

111971997

Source : ICHEME

Location : ,

Injured : 1 **Dead :** 0

Abstract

During a routine operation to sterilise a carbon filtration vessel, a Shift Technician closed a keystone butterfly valve on the 4 inch vent line of the vessel as a slug of steam/water/air discharged from the line. The vent line moved violently as his hand was on the valve handle and the lockinglever struck the side of the vessel causing pinching motion. Such was the force of this movement that the top 2 cm of his ring finger was amputated.
[cleaning, reaction vessel, design inadequate, injury]

Lessons

The vent line should be secured to the adjacent 8 inch drain line with a pipe clamp to prevent movement in this process.

110661997

Source : ICHEME
Location : , TURKEY
Injured : 1 **Dead :** 0

Abstract

A shift supervisor suffered a broken rib as a result of the fall sustained when he became unconscious following exposure to hydrogen sulphide (H2S) during the draining of a level controller. Process operators noticed an abnormally low hydrocarbon level in the overhead accumulator drum on a kerosene stripper tower. Since it was not possible from the control room to increase the level, the shift supervisor on duty decided to check the level controller on site. With a field operator to assist him, the shift supervisor closed the two 2-inch block valves on the level control system isolating it from the drum. The field operator then unscrewed the drain plug of the level controller to clean the level buoy. Gas was released containing approximately 3.6-5.0% H 2 S; and the shift supervisor who was kneeling down, checking the level transmitter nearby, immediately felt unwell. It was suspected that one or the other of the isolation valves was passing. The supervisor then directed the field operator to close the drain and in the process of moving away to obtain fresh air, collapsed on the platform. Within a minute he recovered sufficiently to return to the control room. The immediate cause of the accident was the failure to wear respiratory protection where there was a potential exposure to H2S. The basic cause was due to failure to follow safety rules - all H2S zones are clearly marked with warning signs and yellow paint.
[level meter/control, asphyxiation, safety procedures inadequate]

Lessons

The following recommendations were made:
1. A permit-to-work must be issued when dealing with leaks or breaking containment of plant/equipment that has contained H2S.
2. The permit-to-work must stipulate all the necessary precautionary measures including the wearing of positive pressure self-contained apparatus or air-line masks.

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.

9013 1997

Source : CHEMICAL HAZARDS IN INDUSTRY, 1997, SEP.

Location : ,

Injured : 1 **Dead :** 0

Abstract

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

Lessons

[None Reported]

8966 1997

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

Location : , UK

Injured : 0 **Dead :** 1

Abstract

A fire fighter saved the lives of two men when he died in a chemical quick sand in a silo. The two workers had entered the silo through a small hatch to carry out cleaning operations but had become trapped when encrusted in soda ash on the sides of the silo had come down like an avalanche. The fire-fighter wearing breathing apparatus tried to enter the hatch but was unable to do so because of the size of the cylinder on his back so therefore entered without breathing apparatus. The fire-fighter stood for 45 minutes on an internal ladder reassuring the trapped men while his colleagues arranged for a hole to be cut in the side of the silo. But when a further fall of ash covered one mans head, he abandoned the ladder and crossed the ash surface to dig away ash with his hands. In a matter of seconds he had disappeared below the surface and died from asphyxiation. Shortly afterwards, the two men were rescued.
[fatality, silo/hopper]

Lessons

[None Reported]

8800 1997

Source : CHEMICAL HAZARDS IN INDUSTRY, 1997, NOV.
Location : ,

Injured : 3 **Dead :** 1

Abstract

A decommissioned boiler that was being removed from its supports started rolling. A lug on its side gashed a hole in a cylinder of propane gas. The gas ignited and the cylinder exploded. Four men were severely burnt and one of them died as a result of his burns.
[decommissioning, explosion, fatality]

Lessons

[None Reported]

11071 30 December 1996

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 folowing 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.

1197027 November 1996

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]

1196921 November 1996

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]

8848 18 November 1996

Source : ICHEME
Location : , NEW ZEALAND

Injured : 0 **Dead :** 0

Abstract

A dangerous occurrence at a coatings plant.
An operator was obtaining a sample of solvent from a room on the third floor of a production building. On completion, he left the drain valve to the manifold open to drain the manifold, but had not realised that the xylene valve into the manifold was not fully closed.
Xylene was seen to be running down through the building and outside past an adjacent administration block.
Approximately 700 to 900 litres of xylene were thought to have been lost. Clean up of the spill required the site electrical system to be turned off.
[operation inadequate, sampling,

Lessons

[None Reported]

1196607 November 1996

Source : ICHEME
Location : , UK

Injured : 0 **Dead :** 0

Abstract

A night shift was converting bright dope into matt dope using a mixer by adding titanium paste. When the operator went to discharge the mixer he opened the wrong valves. The dope was discharged to old pipework which at the time was being decommissioned and had an open end. Approximately 2000 kilograms of matt dope was released. The dope was approximately 73% acetone and 27% acetate.
[operator error, mixing, spill, decommissioning]

Lessons

[None Reported]

1233705 November 1996

Source : NATIONAL TRANSPORTATION SAFETY BOARD, 1999, (http://www.ntsb.gov),; LOSS PREVENTION BULLETIN 155, 16-17.
Location : Murfreesboro, Tennessee, USA

Injured : 0 **Dead :** 0

Abstract

An incident occurred whilst preparing for maintenance on an 8-inch pipeline containing diesel fuel. The incident occurred during isolation and purging when approximately 84,700 gallons of diesel fuel was released due to overpressure rupture. The line section containing the leak was isolated.
Fortunately the incident did not cause a fire or explosion and no one was injured.
[overpressurisation, operator error, spill, near miss, preparation for maintenance, operation inadequate]

Lessons

[None Reported]

8471 13 October 1996

Source : EUROPEAN CHEMICAL NEWS, 1996, OCT, 21.
Location : Texas, USA

Injured : 0 **Dead :** 0

Abstract

Plant ruptured while being brought back on stream following maintenance work. Substance involved: acrylic acid.
[Start-up]

Lessons

[None Reported]

1113512 October 1996

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.

1197831 August 1996

Source : ICHEME
Location : , UK

Injured : 0 **Dead :** 0

Abstract

Approximately 1.3 tonnes of aqueous acetone was released (70% acetone) when a bursting disc failed due to a high base pressure during start-up.
[bursting disc failure, high pressure, spill]

Lessons

[None Reported]

1036817 July 1996

Source : LOSS CONTROL NEWSLETTER, ISSUE 3, 1996.
Location : West Yorkshire, UK

Injured : 7 **Dead :** 0

Abstract

There were two sulphur trioxide gas releases - the first while a vessel was being opened for routine cleaning, the second from a relief valve while operations to cap the leak were under way. The cloud, which reached a height of around 650m, drifted over the town and residents were told to stay indoors.
[gas / vapour release]

Lessons

[None Reported]

1153414 July 1996

Source : ICHEME
Location : , UK

Injured : 1 **Dead :** 0

Abstract

A pipeline connecting 3rd and 4th stage suction drums on a cracked gas compressor on an ethylene plant was being modified as part of a series of wider plant modifications, using contractors. After new pipework had been prepared and positioned a welder struck an arc to complete welding, when there was a detonation. The source of the fuel for the explosion was gasoline from residual pockets of hydrocarbons which had evaporated fron the cracked gas system and migrated into the line under modification. The total mass of fuel estimated to have been in the line was 48 grams. the welder was only slightly injured, and others working in the vicinity were unharmed.
Investigation showed that there had been failure to observe fully the permit to work and hot work systems in the factory; and that there had also been a failure to ensure that the part of the plant on which welding was to take place had been effectively isolated and purged.
[permit to work system inadequate, injury]

Lessons

The following lessons were learnt:
1. This incident classically illustrates the risks associated with hot work on plant and vessels in which flammable substances might be found,and emphasises the need for rigourous observance of adequate operational precautions.
2. Although there were clear operational failures in this case,investigation of the incident led to analysis and modification of the company peremit to work systems, with the objective of increasing the protection afforded by them.

8952 07 July 1996

Source : ENVIRONMENTAL INFORMATION BULLETIN, 1997, JUL,; THE CHEMICAL ENGINEER, 10 APR, 1997

Location : , UK

Injured : 0 **Dead :** 0

Abstract

320 kg of 1,2-dichloroethane spill from vinyl chloride plant during recommissioning operations. The DCE was used during the decommissioning stage to flush ouut to remove water and iron, then flushing with nitrogen to remove the DCE. Operators failed to close a valve which allowed DCE into the nitrogen system. Pressure built up and a flexible hose blew off, releasing a jet of DCE. Operators stopped the flow within 2 minutes and covered drains but 29 kg reached the canal.

The company was fined £15,000 (1996).

[spill, design or procedure error]

Lessons

[None Reported]

1158405 July 1996

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

Abstract

While radiography of furnaces was taking place on a petrochemical plant a workshop technician discovered that he and a colleague had been working in the exclusion area inadvertently. He alerted his colleague and both then left the area. Personnel did not suffer exposure because of where they were in the exclusion area and the size of the source in use. The exclusion area had deliberately been made large to encompass all the required test sites in a single zone. The sweep for personnel that had been carried out failed to locate the technicians in question.
The zone had been set up in the knowledge of HSE requirements to minimise the size of such areas. This was blamed on the large amount of planned radiography work during a shutdown.
The enquiry recommended:-
1. A review of procedures associated with issuing radiography work permits.
2. Additional training in radiography work procedures for the shutdown teams.
It also recommended considering:-
1. The use of higher level sources to reduce the exposure period.
2. Improved communication between the personnel responsible for radiological protection and those controlling the issue of permits.
[radioactive, testing, design or procedure error, near miss, training inadequate]

Lessons

The investigation concluded that the exclusion zone selected had been too large to control effectively. This was attributed to pressure of work. It also identified weaknesses in allocation of responsibility for sweeping the area and controlling the perimeter.

8411 04 July 1996

Source : ICHEME
Location : ,

Injured : 0 **Dead :** 0

Abstract

Compressor flywheel failure. A north recycle hydrogen compressor was started after several unsuccessful attempts. Within seconds, the two cast iron flywheels disintegrated, launching missiles in all directions. It was found that the compressor had been started in a wholly unsatisfactory condition: the flywheels were cracked and the compressor cylinder was badly fouled. The cause of this incident was a failure to devise and implement appropriate mothballing measures to ensure the unit would be available to meet future production needs. In addition there had been deficient design, particularly in the design of the key-way, and the machine design long predated current design tools.
[mechanical equipment failure, standards inadequate, start-up]

Lessons

Idle process plant must be carefully preserved if it is to be safely used in the future.
Even the most familiar tasks can present unexpected hazards, especially if carried out under unusual circumstances.

8465 July 1996

Source : EUROPEAN CHEMICAL NEWS, 1996, JUL, 22,; ENDS REPORT 267, APRIL 1997.
Location : West Yorkshire, UK

Injured : 7 **Dead :** 0

Abstract

During routine cleaning of a storage tank prior to maintenance and inspection. The tank was used as a vent tank to relieve pressure during unloading of delivery tankers before the gases were discharged to the site's scrubbing system. The sight glasses were obscured and the process operators assumed that the tank was empty. When water was added to the tank it reacted with an estimated 3.5 tonnes of sulphur trioxide which had built up in the tank over several months. The result was a muffled bang and the release of a white cloud. The fumes filled the building and spread some 2 miles from the site. The firm was fined £13,000 (1996).
[storage tanks, gas / vapour release, operator error]

Lessons

[None Reported]

9011 July 1996

Source : CHEMICAL HAZARDS IN INDUSTRY, 1997, SEP.
Location : Yorkshire, UK

Injured : 1 **Dead :** 0

Abstract

A vapour cloud was released when a chemical storage tank was being cleaned prior to inspection. The vessel was used as a vent tank to relieve pressure during the unloading of delivery tankers before the gases were discharged to the scrubbing system. The sight glasses on the tank were obscured and the process operators assumed that the tank was empty. However, when water was added to the vessel it reacted with an estimated 3.5 tonnes of solid sulphur trioxide which had built up within the tank over several months. The result was a muffled bang followed by the release of a cloud of dense, acidic white mist. The plant manager sustained minor burns to his hand while trying to close the tank lid. The fumes filled the building and spread some two miles from the site. The cloud was blown over a largely un-populated area.
The company was fined £26,000 with costs of £12,800 (1997).
[gas / vapour release, storage tanks, cleaning, unwanted chemical reaction]

Lessons

[None Reported]

8602 18 June 1996

Source : LLOYDS LIST, 1996, JUN, 24.
Location : Rostov, RUSSIA

Injured : 0 **Dead :** 1

Abstract

Oil leaking from a broken seam on a pipeline spilt onto an electric welding apparatus and consequently sparked a fire during repair work. 70,000 cubic feet of oil spillage. Fatality.
[fire - consequence]

Lessons

[None Reported]

8463 07 June 1996

Source : EUROPEAN CHEMICAL NEWS, 1996, JUN, 17.
Location : Gelsenkirchen, GERMANY

Injured : 0 **Dead :** 0

Abstract

An explosion on No.3 cracker occurred during the start-up of the plant after unplanned maintenance.
[cracking]

Lessons

[None Reported]

2573 06 June 1996

Source : LLOYDS LIST, 1995, JUN, 7.
Location : Zhuhal, Southern China, CHINA

Injured : 40   **Dead :** 2

Abstract

Powerful explosion in polyester reactor on fourth floor of the building in a factory. The equipment was recently constructed and was undergoing testing when explosion occurred. A fire ensued which was quickly extinguished. Fatality.
[reactors and reaction equipment, fire - consequence]

Lessons

[None Reported]

1107903 June 1996

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 rough 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 than 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.

1036325 May 1996

Source : LOSS CONTROL NEWSLETTER, ISSUE 2, 1996.
Location : New Jersey, USA

Injured : 0 **Dead :** 1

Abstract

An explosion occurred when a contract welder was in the process of cutting up a metal sump which had been removed from a partially dismantled tank.
[welding, hot surface, fatality, maintenance]

Lessons

[None Reported]

8592 14 May 1996

Source : LLOYDS LIST, 1996, MAY, 20.

Location : ,

Injured : 0 **Dead :** 0

Abstract

A leak of ammonia followed by another on the 16 May from a recently constructed plant during start-up operations.

Lessons

[None Reported]

8413 14 May 1996

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.

8588 23 March 1996

Source : LLOYDS LIST, 1996, MAR, 25.

Location : Uttar Pradesh, INDIA

Injured : 1 **Dead :** 3

Abstract

An explosion of a tank of methane gas at an effluent treatment plant was caused by welding on the roof of the tank to repair leaks. Police have registered a case of criminal negligence against the company. Fatality.
[safety procedures inadequate]

Lessons

[None Reported]

8392 09 March 1996

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.

8701 28 February 1996

Source : SEDGWICK LOSS CONTROL NEWSLETTER, ISSUE 1, 1996.
Location : Samara, RUSSIA

Injured : 0 **Dead :** 2

Abstract

A mixture of fuel and air caused an explosion when a furnace was being lit to start-up a catalytic reforming facility. Fatality.
[catalytic reformer, residue]

Lessons

[None Reported]

1041123 February 1996

Source : LOSS PREVENTION BULLETIN, 139, 24.; HEALTH, SAFETY AND ENVIRONMENT BULLETIN, 264, DECEMBER 1997.
Location : , UK

Injured : 1 **Dead :** 0

Abstract

A rail transportation incident. An engineering train rammed scaffolding, injuring three workers.
The incident occurred when two tower scaffolds were erected on the railway lines to allow repairs to the station footbridge.
The line was closed to passenger services during the weekend and the scaffolding should have been removed to allow engineering trains to pass through.
The first engineering train passed through the station without incident. But a second train started out after a shift change and its guide was not told about the repairs. As the station was sited on a curve, the guide was unable to see the scaffolding in time despite braking, the train hit the scaffolding at 30 mph. Two workers scrambled to safety onto the footbridge, a third man fell onto the tracks and suffered a broken leg and severe lacerations to his head and had to be airlifted to hospital.
[rail transport, maintenance, human causes, fall, injury]

Lessons

[None Reported]

8404 1996

Source : ICHEME

Location : ,

Injured : 0 **Dead :** 0

Abstract

Infringement of work permit system. During a shut-down of the high pressure hydrogenation unit to change-out catalyst, checking of and maintenance on valves in the high pressure loops was to be carried out as well. When work on the first valve had just begun, the operating authority, who happened to be passing by, stopped the work. Pressurised airline masks had been specified for removal of the valve bonnets, but the contractor supervisor had not communicated this to his crew. In addition the contractor supervisor had not posted a work permit at the work site, which was required by the permit-to-work system.
[permit to work system inadequate, near miss]

Lessons

Specifications for use of airline breathing masks when breaking lines must be complied with in order to provide protection to the individuals doing the work.

8646 1996

Source : LLOYDS LIST, 1996, NOV, 8, NOV, 9.
Location : Rayong, THAILAND

Injured : 17 **Dead :** 17

Abstract

An explosion and fire at a bunker oil depot lasted 5 hours. Welding was being carried out. Fatality.
[fire - consequence]

Lessons

[None Reported]

8393 1996

Source : ICHEME

Location : ,

Injured : 1 **Dead :** 0

Abstract

Compressor cover failure at a refinery. During a pressure test of a make-up compressor, there was a pressure increase in the distance piece. This, together with an insufficient vent of the distance piece to flare, led to a build-up of pressure; and the distance piece cover was blown away. There was injury and damage to equipment. This was due to design inadequate that allowed suction pressure to atmospheric to be taken over the last ring of packing versus across the full number of packing rings, which is the normal design.
Examination of ruptured door fragments showed an undetected fault running through the material.
[testing, injury]

Lessons

The distance piece vent line should be able to vent large amounts of high pressure gas in the event of total mechanical seal failure.

8385 1996

Source : ICHEME
Location : ,

Injured : 0 **Dead :** 1

Abstract

Contractors were attempting to unplug a blockage in a pump suction line in the bottom of a mix tank used in their process to convert hazardous waste material into cement kiln fuel. One of the contractors decided to enter the tank, contrary to instructions from his supervisor, in an attempt to expedite the work. He was wearing an air purifying respirator (canister mask) and protective clothing but quickly became disoriented and lost consciousness. He had been exposed to benzene. Fatality
[entry into confined space, asphyxiation, operator error]

Lessons

There was lack of sufficient appreciation for the acute toxic hazards of petroleum hydrocarbons.
There is a need to ensure that contractors effectively carry out their written safety programmes in the field.

8245 21 December 1995

Source : THE GUARDIAN, 1995, DEC, 23,; THE CHEMICAL ENGINEER, 1996, JAN, 11.
Location : North Shields, UK

Injured : 4 **Dead :** 3

Abstract

High pressure testing with nitrogen resulted in an explosion. Fatality.

Lessons

[None Reported]

8247 05 December 1995

Source : NEWSGRID
Location : Middletown, Ohio, USA

Injured : 14 **Dead :** 0

Abstract

Three explosions occurred in a gas pipe associated with a stove which preheats air to support blast furnace operations. The blast furnace had been shut-down for maintenance at the time of the explosion.

Lessons

[None Reported]

8238 01 December 1995

Source : LLOYDS LIST, 1995, DEC, 7.
Location : McCamey, Texas, USA

Injured : 3 **Dead :** 2

Abstract

An explosion in tank farm when welders were welding on a tank. Valve work was also said to be in progress. Fatality.

Lessons

[None Reported]

8232 24 November 1995

Source : SEDGWICK LOSS CONTROL NEWSLETTER, ISSUE 4, 1995.
Location : Taipei, TAIWAN

Injured : 0 **Dead :** 0

Abstract

One of three operating crackers was shut-down following a fire and minor damage to two of the plants twelve furnaces.
[fire - consequence, damage to equipment, cracking]

Lessons

[None Reported]

8253 21 November 1995

Source : SEDGWICK LOSS CONTROL NEWSLETTER, ISSUE 4, 1995.
Location : Sao Bernardo do Campo, Sao Paulo, BRAZIL

Injured : 5 **Dead :** 1

Abstract

A fire broke out in a valve box when staff were cleaning the pipeline which was not in use at the time. Fatality.
[fire - consequence]

Lessons

[None Reported]

8252 18 November 1995

Source : SEDGWICK LOSS CONTROL NEWSLETTER, ISSUE 4, 1995.
Location : Arauca, COLOMBIA

Injured : 0 **Dead :** 0

Abstract

Transportation. Pumping stopped on pipeline to allow repair after sabotage attempt. Spillage 10,000 bbl of oil.

Lessons

[None Reported]

8206 21 October 1995

Source : HAZARDOUS CARGO BULLETIN, 1995, DEC.
Location : Off Suva, FIJI

Injured : 0 **Dead :** 3

Abstract

A marine transportation incident. Chief officer and 2 ratings were overcome by fumes and killed after entering No. 3 deep tank during deballasting on cargo ship. Fatality.
[entry into confined space]

Lessons

[None Reported]

1760 20 October 1995

Source : SEDGWICK LOSS CONTROL NEWSLETTER, 3RD QUARTER, 1995.
Location : Meraux, Louisiana, USA

Injured : 1 **Dead :** 0

Abstract

A fire occurred at the start-up of the refinery after a power supply failure.
[fire - consequence, refining]

Lessons

[None Reported]

8260 12 October 1995

Source : SEDGWICK LOSS CONTROL NEWSLETTER, ISSUE 4, 1995.
Location : Ras Tannurah, SAUDI ARABIA

Injured : 0 **Dead :** 0

Abstract

A fire occurred when a maintenance worker was carrying out some welding work on a pipe.
[fire - consequence]

Lessons

[None Reported]

8466 05 October 1995

Source : EUROPEAN CHEMICAL NEWS, 1996, AUG, 12.
Location : Yorkshire, UK

Injured : 0 **Dead :** 0

Abstract

Sulphur trioxide escaped from low level temporary chimney during the start-up of the sulphuric acid plant following a biannual shutdown. Gas oil was being used in the burner to preheat the catalyst, and the combustion gases were being emitted through a temporary chimney just 20 ft high. At the same time the company decided to use the plant's oleum scrubbing tower to produce pure sulphur trioxide for sale. The tower was incapable of being isolated from the upstream section of the process, and some of the evaporated sulphur trioxide escaped to air via the temporary chimney. The company claimed that only a few kilograms had been released. The discharge continued for 2-3 hours and formed a mist.
[gas / vapour release]

Lessons

[None Reported]

8373 01 October 1995

Source : ICHEME
Location : ,

Injured : 7 **Dead :** 0

Abstract

Fire at hydrofiner compressor on a refinery. During recommissioning, the west recycle gas compressor on a hydrofiner was overpressurised. The cylinder head was blown off, resulting in explosive decompression and fire. It was found that the discharge valve was installed in the wrong direction. The cause was the criticality of the task to replace the valve not being understood or reflected in procedures. Though the compressor was purchased to the standard of API 618, which
requires a design that prevent valves from being installed in the wrong direction, the equipment did not meet specification.
Production losses and repair costs were estimated at $500,000 (1995) (£318,300) and $400,000 (£254,600) (1995), respectively.
[fire - consequence, overpressurisation, installation inadequate, product loss]

Lessons

There have to be measures in place, as part of contractors' and suppliers' quality assurance programs, where critical issues on machines are identified and reviewed.

1109207 September 1995

Source : ICHEME
Location : , USA
Injured : 4 **Dead :** 2

Abstract

An incident in a vertical sulphur converter vessel involving six contract maintenance personnel resulted in two fatalities and four injuries. The personnel were removing residual catalyst and refractory debris from the lower converter when the inner baffle failed under pressure. The failure of the inner baffle fatally injured one of the two workers in the lower converter and injured the other. A second fatality occurred when one man outside the manhole of the lower converter was blown from the working platform and fell to the ground. Two other workers outside the lower converter on the platform, were also injured. (A third worker reported injury the following day). The Refinery general alarm was sounded immediately after the incident and the advance call-out system activated. External emergency services were also notified. The injured inside the vessel were pulled out and lowered to grade level where emergency first aid was provided. Entry into the vessel for the other worker could not be immediately carried out due to low oxygen level and high hydrogen sulphide and sulphur dioxide concentrations. The three injured were transported to hospital.

The sulphur converter vessel involved was located in one of two sulphur recovery units. The vessel was lined with refractory and was divided into two converters by a steel wall, referred to as an inner baffle. The vessel was about 0.5 m I.D. and 9.1 m overall length, was fabricated in 1954 and had a name plate pressure rating of 65 psi. The vessel as a whole had been designed to withstand this pressure but the inner baffle was not.

An investigation found that the vessel O_2 and H_2S levels were tested on the morning of September 6 and found to be within permissible limits. An entry permit was issued for the removal of catalyst from both top and bottom converters and the task was completed by about 19:00 hrs. the same day. Another gas test at 19:10 hrs. for the job order to remove residual catalyst and refractory debris from under the screen grids of the lower converter indicated a H_2S concentration of 50 ppm. High H_2S continued to be detected in the top converter despite attempts at steam purging, air purging and nitrogen purging. A decision was then made to seal the upper converter and to introduce nitrogen into it from a utility header with a pressure of about 60 psig. An entry permit was issued for the lower converter. The nitrogen flow was initiated at about 01.45 hrs., September 7, and maintenance contractors began work in the lower converter at about 02.00 hrs. The job was carried out by a two man entry crew and a four man crew assisting the cleaning effort by handling the residual materials as they were removed from the lower converter. At about 02:35 hrs. the inner baffle which separated the lower converter from the upper converter failed under the differential pressure built up between the two converters, resulting in the above fatalities and injuries.

The following corrective actions were carried out after the incidents:

1. modified the internal baffle design of the replacement vessel.
2. reviewed Process Safety Information to identify the existence of any similar vessel designs so that future maintenance procedures can address any comparable over-pressure issues.
3. modified refinery policies such that any new or unique situations that arise during the course of operation or maintenance will require a high level of management participation prior to the implementation of any actions to address the said situations.
4. reviewed the Confined Space Entry procedure to determine if further practical improvements can be made, even though all regulatory requirements were met.

[high pressure, fall, explosion / pressure release, entry into confined space, fatality, design or procedure error, injury]

Lessons

All parts of a vessel must be designed to withstand the pressures that may be required during maintenance activities.
Departures from normal operational or maintenance practices must be subjected to a Management of Change review.
Rescue of trapped personnel in confined spaces should be included in the emergency procedures and rehearsed in drills.

1109308 August 1995

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 Mbpd 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.

7654 19 July 1995

Source : HAZARDOUS CARGO BULLETIN, 1995, SEP.
Location : Tacoma, Washington, USA

Injured : 0 **Dead :** 0

Abstract

Port operation shut-down for 4 hours due to phosphorus fire in a tank container.
[fire - consequence, plant shutdown]

Lessons

[None Reported]

2733 18 June 1995

Source : LOSS PREVENTION BULLETIN, 069, 25-28; FINANCIAL TIMES, 1983, 19 SEP.

Location : , UK

Injured : 0 **Dead :** 1

Abstract

An explosion in the hydrocarbon recovery plant caused considerable damage to the adsorber and other equipment as it was being shutdown. Flammable gases were drawn into the blower/heater/adsorber circuit, mixed with air and ignited on a hot spot in the carbon bed. The possibility of air, vent gases and hot spots in the carbon bed had not been identified at the design stage. Fatality.

[separation equipment, design inadequate]

Lessons

The following recommendations were made relating both to improving the safety of the plant and improving procedures.

1. New procedures for shutting down and starting up the plant should be established which avoids the process use of air. The recommended procedure involves placing the bed under nitrogen cover after extended steaming followed by cooling by water flooding. This leaves the carbon bed cool and wet prior to opening up for entry and the beds should be kept wet when open for maintenance. Restart of the plant would use plant off-gas to dry the beds. For a shutdown where entry to the absorber is not required, the absorber would be simply extended steamers and left to cool down under nitrogen cover.
2. A discipline and design practice should be established to deal with programmable logic controllers. In particular functional description sequence diagrams, etc., should be prepared by the design team in terms intelligible to operating personnel and should be treated as addenda to P&I diagrams.
3. The existing temperature measuring point in the outlet gas 'Y' piece from each absorber should be relocated so as to measure both the outlet gas and the regeneration outlet gas temperature.
4. Operating instructions for shutdown and start-up will need complete revision.
5. The procedure for monitoring and controlling changes to an agreed design should be improved and method of referral back to the original design team for approval of significant changes established.
6. Changes of personnel at critical points in a project should be avoided if at all possible. If such changes occur, management must ensure that continuity is maintained and that successors are fully aware of important design and operating aspects. Overlap from design to operation is essential to ensure that operating practice does not dilute design intent.
7. It is recommended that the company guidelines for the implementation of the technical safety procedure for project development be revised.
8. To make the necessary separation of design responsibilities and the safety auditing responsibilities of technical safety group clear, with guidance on the implementation of the latter.
9. To give clear guidance on standards of reporting.
10. To state clearly the inherent responsibility of line management to ensure that the review of procedures is followed, that the scope and the depths of the reviews are adequate and that the technical safety group report gives a clear statement of activities and outstanding actions.

8403 15 June 1995

Source : ICHEME
Location : ,

Injured : 1 **Dead :** 0

Abstract

Injury at steam condensate sump. While assisting with the modification of some pipework in the steam generation area, a process technician lost his balance, and his right foot and lower leg were submerged into a steam condensate sump. There were no guards or barriers around the sump. In addition there was generally poor housekeeping in the area, including temporary scaffolding and numerous hoses in the vicinity and a lack of suitable warning signs. The site regulations relating to sumps and pits were not followed. There was also a lack of awareness by personnel working in the area of the severe hazard presented by the open sump. A more rigorous safety assessment of the area prior to the issue of permits should have identified the hazard.
[inadequate guarding, safety procedures inadequate, permit to work system inadequate]

Lessons

Holes left by the removal of equipment, however temporary, must not be tolerated. Either securely cover the opening or provide guards/warning signs.
Work permit issue requires actual work site evaluation to consider the potential hazards that may be generated by the work to be done.
Supervisors need to monitor work being done to spot potential hazards.

2233 06 June 1995

Source : SEDGWICK LOSS CONTROL NEWSLETTER, ISSUE 2, 1995.
Location : Zhuhai, Guangdong, CHINA

Injured : 20 **Dead :** 2

Abstract

Explosion when equipment was being inspected killing two engineers and twenty others. The explosion started a fire which spread to other floors in the building housing the affected equipment and involved unknown chemicals stored in the building. Fatality.
[inspection, fire - consequence, damage to equipment]

Lessons

[None Reported]

1786 02 June 1995

Source : SEDGWICK LOSS CONTROL NEWSLETTER, 3RD QUARTER, 1995.
Location : Wilmington, California, USA

Injured : 0 **Dead :** 0

Abstract

Explosions ignited fires in a crude unit shortly after start-up. Power was being restored following a total electric power failure.
[fire - consequence, power supply failure]

Lessons

[None Reported]

2997 13 May 1995

Source : LLOYDS LIST, 1995, JUN,; KNIGHT-RIDDER FINANCIAL NEWS
Location : Los Angeles, California, USA

Injured : 0 **Dead :** 0

Abstract

Explosion in coker plant at refinery during start-up after power outage caused shut down of all units.
[power supply failure, refining]

Lessons

[None Reported]

8374 10 May 1995

Source : ICHEME
Location : ,

Injured : 0 **Dead :** 0

Abstract

Isocracker explosion at a refinery. While pressure testing discharge valves on an out-of-service reciprocating compressor, 2100 psig process pressure blew out a gasket at the blinded flange in the system. A vapour cloud was released and subsequently ignited. It was found that the temporary compressor side blank failed due to pressure above its design capability. Operations personnel conducting the pressure testing were not familiar with the pressure limitations of the blind that was in place.
[vapour cloud explosion, overpressurisation, refining]

Lessons

Need to ensure that correct blinding is always used to meet the maximum pressure capability of the system. Need to ensure that Operations personnel are knowledgeable of the application limitations of various blinding systems which may be used.

1159727 April 1995

Source : ICHEME
Location : , UK
Injured : 2 **Dead :** 0

Abstract

One operator suffered a burned hand and two others were treated for shock, following a hydrocarbon fire at a chemical facility. A cracking furnace was being isolated, in preparation for de-coking and subsequent maintenance work, when the incident occurred.
The furnace was being isolated from the downstream process and the atmospheric vent valve opened. When the valve was fully opened, steam, as expected, was seen coming from the vent. Discoloured steam was then observed and a 'green distillate like material' was emitted from the atmospheric vent silencer. A 'bang' was heard and a fire was observed. The site emergency services were called.
The hydrocarbon fire burned itself out quickly, leaving small scaffolding fires on the furnace structure, which were dealt with by the emergency services.
Following the incident, it was identified that the block valve, which isolated the de-coking vent line from the cracked gas header, was passing. This allowed cracked gas and steam to enter the downstream pipework and de-coke drum, where steam and some hydrocarbon condensed. During normal operation, with the valve passing, a build up of liquids could have occurred.
The furnace was turned to atmosphere through this piping and steam flow lifted the liquids up and out of the atmospheric vent silencer. Liquids were ignited on the hot furnace surfaces.
Up to five tonnes of material was released in the incident.
[fire - consequence, burns, decommissioning, hot surface]

Lessons

1. The de-coking line should be positively isolated from the cracked gas header during normal operation.
2. Operating instructions for normal operation and for decommissioning should be updated in light of the incident. Operator training should also be reviewed.
3. Single line isolations, integrity of valves, locations of vents and valve operation should all be reviewed.
4. Review of the HSE's findings should be undertaken.

1173626 April 1995

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.

8390 23 April 1995

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.

8384 31 March 1995

Source : ICHEME

Location : ,

Injured : 0 **Dead :** 0

Abstract

Flare knock-out drum overflow. During the start-up of the CDU/Hydrotreater units, light gasoline entered the flare system via a pressure control valve. The flooded flare knock-out drum spilled over into the seal of the flare and, from there, via the overflow of the water seal. Light gasoline spilled over into the oily-water system of the flare area and further downstream into the flare area trap. The oily-water drain system in the flare area filled up until product overflowed at various locations of the paving. It was found that the level controller on the gasoline fractionator reflux drum had failed. The basic cause was due to the high level alarm on the flare knock-out drum being overlooked because of many other alarms appearing during the start-up of the plant.
[environmental]

Lessons

Flare stack drums must receive regular operating personnel attention if potentially dangerous situations are to be avoided.
Indications from critical alarm functions are ideally separated from others of less importance, to assist operators at periods of high activity such as start-ups. Careful selection is necessary.

8126 23 March 1995

Source : SEDGWICK LOSS CONTROL NEWSLETTER, ISSUE 2, 1995.
Location : Shanghai, CHINA

Injured : 1 **Dead :** 1

Abstract

On first day of annual maintenance shut-down, two empty hydrochloric acid containers exploded due to violation of operating instructions.
[explosion, human causes]

Lessons

[None Reported]

2331 13 March 1995

Source : SEDGWICK LOSS CONTROL NEWSLETTER, 2ND QUARTER, 1995.
Location : Blue Island, Illinois, USA

Injured : 3 **Dead :** -

Abstract

A fire occurred at a refinery which was caused by leak of gasoline additive ignited by faulty heater. Soot from the fire settled over a nearby school causing smoke inhalation injuries to students.
The accident occurred during repair work on a valve for a hydrocracking unit used in producing gasoline. Operators not trained in maintenance procedures were performing the work and did not properly lock out the equipment. Pressure in the line blew off the valve bonnet, shooting flammable liquid and vapour 70 feet into a welding shop, were it exploded into a fire that flashed back to the hydrocracking unit. The employees who were killed had been eating lunch in the welding shop. The three operators in the hydrocracking unit shuffered severe burns. Fatality.
[fire - consequence, training inadequate, vapour cloud explosion, injury]

Lessons

[None Reported]

1193910 March 1995

Source : ICHEME
Location : , UK

Injured : 0 **Dead :** 0

Abstract

A small explosion was heard and a fire spread across the hammer mill floor. The fire was brought under control in about 2 hours. Most of the damage was to electrical cables and hydraulic hoses.
The total plant outage was only 20 hours as new equipment, which was being commissioned, was brought into use to minimise the outage.
The exact cause of the incident was not clear but it was believed to be related to a previous jam in number 2 hammer mill. Hot spots or embers may have been left from this jam which was cleared less than an hour before the incident.
[fire - consequence, damage to equipment, commissioning, solids processing equipment, hot surface]

Lessons

The investigation recommended inspection of the hammer mill to ensure that the blades were sharp and that the pusher mechanism was operating correctly.
There was also a recommendation to install additional emergency lighting and ventilation as spread of smoke hampered dealing with the incident.

8364 March 1995

Source : ICHEME

Location : ,

Injured : 0 **Dead :** 0

Abstract

Reformer extended outage on a refinery. During a planned shut-down to regenerate catalyst, internal damage and a loss of catalyst containment occurred within the reactor system. It was found that the catalyst beds were disturbed and the seal at top of reactors lost allowing the catalyst to migrate out of reactors. The cause was due to the current regeneration procedure not adequately alerting personnel to problems during the regeneration process. Current data and tracking capabilities did not indicate any potential problems within the reactors.

Loss including $3.5 million (1995) and £2.1 million (1995) in lost opportunity.

[damage to equipment, product loss, reactors and reaction equipment, safety procedures inadequate]

Lessons

Procedures acceptable over many years still need review when operating parameters are changed e.g., feed rates, feed quality, and severity of operation.

1193403 February 1995

Source : ICHEME
Location : , UK

Injured : 0 **Dead :** 0

Abstract

During commissioning of a distillation column, operation of the ESD system resulted in pressurisation and failure of a bursting disc. Repeated reset and initiation of the ESD resulted in flooding of the column. This flooding resulted in the discharge of about 2 tonne of 5% aqueous acetone into the bund when the bursting disc opened.
A bursting disc was provided, as it was believed at the time that no suitable relief valve was available. The column normal operating pressure was 3.5 psig and the design pressure was 5 psig.
[bursting disc failure, spill, overpressurisation]

Lessons

The investigation concluded that: -
1. The installation of the level switch that initiated the ESD should be reviewed. It appeared that the switch spuriously indicated low level when the effluent pump was started.
2. The location of the bursting disc and its vent line should be reviewed to consider whether it is acceptable to allow an uncontrolled release of a flammable vapour and liquid into an accessible bund.
3. The operating procedures should be reviewed with particular emphasis on restarting the column after an ESD.
Subsequently the possibility of rating the column for a higher design pressure (8 psig versus 5 psig) and installing relief valves was considered.

1250226 January 1995

Source : ICHEME
Location : , UK

Injured : 0 **Dead :** 0

Abstract

A fire occurred in a final degasser on a plant. At the time of the incident the plant was in the process of starting up, soon after a production operator heard an unusual noise and thought he could smell burning. The operator identified the degasser as the source of both and noticed smoke emitting from the degasser cyclone vents. The control room was informed and the fire station was contacted. The damage sustained to the vessel was minor.
The maintenance costs amounted to £140 K (1995).
[fire - consequence, start-up, damage to equipment]

Lessons

The report stated the following conclusions:
1. The incident was caused by loss of full fluidisation in the final degasser, creating a stagnant area of high hydrocarbon concentration within the vessel. At a localised fluidised air/hydrocarbon interface a flammable atmosphere developed and was ignited by static from the fluidised powder bed. The resulting flame front initiated combustion of the polymer powder within the vessel.
2. The final degasser ws partially fouled with a build up of old powder, polymer strings, agglomerated and tiles when powder withdrawals from the reactor were recommissioned. This was probably the root cause of loss of full fluidisation in the degasser.
3. Ineffective degassing could potentially lead to the creation of flammable atmospheres in downstream powder silos.

8541 18 January 1995

Source : SEDGWICK LOSS CONTROL NEWSLETTER, ISSUE 1, 1995.
Location : Atlantic Ocean, NIGERIA

Injured : 10 **Dead :** 10

Abstract

A fire resulted from a suspected gas leak during maintenance welding activity resulting in loss of 85,000 bpd of production. Minor damage to the production platform includes electrical cables and process control & instrumentation equipment. Fatality.
[offshore, fire - consequence, damage to equipment]

Lessons

[None Reported]

8395 02 January 1995

Source : ICHEME
Location : ,

Injured : 1 **Dead :** 0

Abstract

Separator explosion at a refinery. During bar screen raking (the first treatment step) to clean out any large debris which might have been filtered, an explosion occurred within the
enclosed bar screen vapour space. There was injury and damage to equipment. It was found that modifications made had created an explosive hazard, and a new inherent process hazard was not completely understood or managed.
[cleaning, fire - consequence, refining, modification procedures inadequate, injury]

Lessons

Process hazard analysis teams should be reminded to consider all modes of operation during a review. The rake operating procedure should have been considered when discussing the potential for oxygen entering the bar screen vapour space.
Some of the technical information supplied by the carbon canister vendor was found to have been misleading, and following the recommended procedures did not necessarily eliminate the inherent hazards. This affected the quality of the hazard analysis.

8499 January 1995

Source : HSE NEWS RELEASE
Location : Hunterston, UK

Injured : 0 **Dead :** 0

Abstract

During pressure repair work on a reactor to seal a leaking valve flange on the low pressure feed system, the emergency feed and backup cooling system on three separate dates were isolated.
[cooling equipment]

Lessons

[None Reported]

8354 January 1995

Source : ICHEME
Location : ,

Injured : 0 **Dead :** 0

Abstract

Steam supply near miss. During a draining operation, a pipefitter encountered high pressure in a line thought to have been isolated. In fact the line had not been isolated when work was begun. In addition the work crew had failed to obtain a work permit, and valves in work area were not labelled.
Facility's engineer, who authorised the job, had instructed lock-out/tagout crew to isolate the wrong valves. A work permit would have provided pipefitter with better information about the valves, hot lines, and unusual problems.
[permit to work system inadequate, labelling incorrect]

Lessons

Isolation of systems must be verified before starting work on them. For single valve isolation, a full review of flow diagrams, site line-up, and permit requirements should ensure that the correct valves are identified to secure the work area.

8377 January 1995

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.

124271995

Source : ICHEME
Location : ,

Injured : 0 **Dead :** 0

Abstract

An incident occurred during the removal of a plug from a depressured furnace coil.
The incident occurred during pressure testing of a radiant cell tube pass of a crude distiller furnace with gasoil, a leak was noted on one of the tubes.
In order to be able to repair the leak, it was decided to empty the coil using nitrogen as the driving medium. A hose was fitted to a steam-out point at the overhead line connected to the coil with the hole in it. The nitrogen purge was left on overnight and the steam-out connection at the coil outlet was checked the next morning.
It was found that only nitrogen was blowing from the drain and this was interpreted as evidence that the coil content had been displaced completely. The nitrogen connection was broken and the coil depressured to atmosphere which was checked at a local pressure indicator and at the drain point itself.
Since all indications were that the system was pressure-free, a clearance was given to the fitters to remove the plug from the horse-shoe type fitting on the tube. When carrying out this job the plug was ejected from the tube with great force into the air by vapour, followed by a stream of gasoil.
Fortunately nobody was injured.
[repair, explosion / pressure release, near miss, piping & fittings, gas oil]

Lessons

[None Reported]

7626 1995

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'.

8540 31 December 1994

Source : SEDGWICK LOSS CONTROL NEWSLETTER, ISSUE 1, 1995.
Location : North Sea, UK

Injured : 0   **Dead :** 0

Abstract

Production was halted from this 75000 bpd production platform following storm damage to safety, pipeline and fire detection equipment. Repairs to electrical equipment on the Floating Storage Unit were disrupted, due to bad weather.
[offshore, damage to equipment, weather effects, product loss]

Lessons

[None Reported]

1193006 December 1994

Source : ICHEME
Location : , USA

Injured : 0 **Dead :** 0

Abstract

During testing of a new polyester resin reactor, a line ruptured releasing about 50 to 100 US gallons of heat transfer oil. Four employees on site were evacuated and no one was injured. The oil did not ignite but the fire department was called as a precaution.
[reactors and reaction equipment, evacuation, spill, near miss, mechanical equipment failure]

Lessons

[None Reported]

6777 26 November 1994

Source : LLOYDS LIST, 1994, 6 DEC.
Location : Obi-obi, NIGERIA

Injured : 3 **Dead :** 1

Abstract

Explosion and fire at gas installation during welding work. Fatality.
[fire - consequence]

Lessons

[None Reported]

1023024 November 1994

Source : ICHEME
Location : , UK

Injured : 0 **Dead :** 0

Abstract

During a plant shutdown, on an isobutene plant, a new section of pipework was connected into the wrong line. The error was disconnected during a check carried out before re-commissioning so the fault was rectified before any incident occurred.
[modification, flange, blank, pipeline, plant / property / equipment, design or procedure error, near miss]

Lessons

1. The specific modification, itself, had not been included in the overall shutdown work list. Thus a detailed "job preparation" had not been made out.
2. The wrong line was selected, and marked up, for modification by the project team personnel.
3. Plant personnel did not notice the error.
4. The workers carrying out the work did not react to the fact that they were issued with the wrong type of "blank" for fitting to the line that should have been modified.
5. The blanks issued to them fitted the wrong line.

The following recommendations were stated:

1. Plant personnel to physically check proposal mods.
2. Full details of all mods to be specified, with supporting diagrams.
3. Personnel to be reminded to stop and review when something unexpected arise (in this case, issue of the wrong size blanks).

6770 18 November 1994

Source : SEDGWICK LOSS CONTROL NEWSLETTER, 4TH QUARTER, 1994.
Location : Takasago; Hyogo Prefecture, JAPAN

Injured : 1 **Dead :** 2

Abstract

Liquid vinyl chloride monomer tank was being inspected by personnel when it caught fire and exploded. Fatality.
[inspection, explosion, fire - consequence]

Lessons

[None Reported]

1171316 November 1994

Source : ICHEME

Location : , UK

Injured : 0 **Dead :** 0

Abstract

An explosion and small fire occurred in a tri-acetate mill hopper. The hopper explosion relief panel lifted but the explosion relieved through a bag-filter door. There was limit damage to the plant and no injuries. A blockage had occurred in the transfer line from the base of the rotary drier. The valve at the base of the drier has stopped presumably due to choking. The blockage was clearer following standard practice. The explosion occurred during the unblocking operation. The cause of the explosion remains unclear. An explosible dust concentration was ignited within the hopper. The most likely ignition sources are tramped material or thermal degredation of tri-acetate material.

[solids processing equipment, flow restriction, cleaning, unwanted chemical reaction, overheating]

Lessons

1. Restrict access to the processing area - it was fortunately that no one was exposured to the force of the explosion.
2. Formalise procedures for clearing blockages.
3. Review instrumentation and control requirements for system to prevent blockages and allow automatic shutdown to be instigated.

6761 10 November 1994

Source : LLOYDS LIST, 1994, 12 NOV.
Location : Lake St. Catherine; Louisiana, USA

Injured : 3 **Dead :** 1

Abstract

Explosion on offshore platform blew a salvage worker into the water. Men cutting a motor out of a housing with welding torch ignited waste oil in storage tank causing the explosion. Fire being allowed to burn itself out. Fatality.
[fire - consequence]

Lessons

[None Reported]

6748 01 November 1994

Source : LLOYDS LIST, 1994, 3 NOV.

Location : Leipzig, GERMANY

Injured : 5 **Dead :** 4

Abstract

Explosion in gas turbine power station during testing. Several buildings nearby were damaged. Fatality.

Lessons

[None Reported]

8376 November 1994

Source : ICHEME

Location : ,

Injured : 0 **Dead :** 0

Abstract

Catalytic cracker vapour line deformation. During start-up of the reduced crude conversion unit (a heavy oil cracker), the reactor vapour line was heated up to a temperature sufficient to ignite coke in the line, resulting in overheating and deformation of the line. There was damage to equipment.
It was found that the line was heated beyond it's maximum capability. The cause was due to inadequate instructions, concerning operating limits, in the start-up procedure for the operators. In addition an air line heater outlet temperature indicator was not properly calibrated to read above the maximum allowable temperature.
[faulty instructions, cracking]

Lessons

Start-up procedures should include consequences of deviation as well as procedural steps to take to control temperatures and quench the reactor.

11576November 1994

Source : ICHEME
Location : , UK

Injured : 0 **Dead :** 0

Abstract

During a maintenance shutdown on a petrochemical plant a new pipework tie-in was incorrectly made to a redundant line. The error was discovered before any attempt was made to commission the new pipework. There were no actual consequences but there were safety implications if the error had remained undetected. The internal enquiry blamed the fact that the tie-in point had not been marked on the respective pipe by a competent member of the Process team. Instead it was identified by the Project supervisor from drawings alone. These contained some errors, in particular in relation to presence or absence of lagging. The tradesmen carrying out the work ignored pointers to a possible error such as being (correctly) issued with wrong flanges for the line they were working on.
[design or procedure error, near miss, operation inadequate]

Lessons

1. The problem would have been avoided by physical marking of the tie-in.
2. The package of engineering information for such jobs should be enhanced to include a general arrangement drawing or sketch showing the proposed arrangement in detail.
3. Personnel should be alert to clues such as issue of unsuitable flanges.
4. On-site supervision should be increased to include a supervisor visit to every job.

6744 28 October 1994

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1994, OCT.; LLOYDS LIST, 1994, 31 OCT.
Location : Lake Charles; Louisiana, USA

Injured : 9 **Dead :** 1

Abstract

Explosion in fluid bed catalytic cracker during start-up operations after a one week repair. Fatality.
[cracking]

Lessons

[None Reported]

6738 21 October 1994

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1994, OCT.; LLOYDS LIST, 1994, 22 OCT.
Location : Montreal, CANADA

Injured : 1 **Dead :** 1

Abstract

Bunker oil storage tank at an asphalt plant exploded and led to fire. 2 employees were preparing to clean or were cleaning the tank. Fatality.
[explosion, fire - consequence]

Lessons

[None Reported]

6733 19 October 1994

Source : OIL & GAS JOURNAL, 1994, 26 DEC., 27.
Location : Torrance; California, USA

Injured : 21 **Dead :** 0

Abstract

LPG pipeline was being brought back on line after maintenance work when there was a leak at a flange which ignited.
[flange leak, fire - consequence, start-up, inspection inadequate]

Lessons

[None Reported]

6712 October 1994

Source : EUROPEAN CHEMICAL NEWS, 1994, 31 OCT.
Location : Montreal, CANADA

Injured : 1 **Dead :** 1

Abstract

Fire occurred in a tank that was being brought back into service. Fatality.
[fire - consequence, commissioning]

Lessons

[None Reported]

6710 28 September 1994

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

Injured : 0 **Dead :** 3

Abstract

3 killed during routine maintenance. A contract worker was asphyxiated by nitrogen in a vessel of an air separation unit, the other two died in the rescue attempt. Fatality.
[entry into confined space, asphyxiation, separation equipment]

Lessons

[None Reported]

6709 27 September 1994

Source : CHEMICAL ENGINEER, 1994, 13 OCT.
Location : Ellesmere Port, UK

Injured : 0 **Dead :** 1

Abstract

Body of 15 year old boy found in a toluene storage tank when opened for cleaning prior to demolition. The boy had disappeared 7 years previously. Fatality.

Lessons

[None Reported]

1193323 September 1994

Source : ICHEME
Location : , UK

Injured : 0 **Dead :** 0

Abstract

A smell of chlorine from a bleach plant was detected within the adjacent site. There was some uncertainty about the exact sequence of events. It is believed that routine sampling of the chlorine stream with a syringe led to a very small leak of chlorine into a drain line. This triggered a chlorine detector and led to shutdown of an electrolytic cell. Coincidentally there was a problem with a circuit breaker, which delayed the restart of the plant. On restarting there was a transient high chlorine flow to a reaction vessel that was not fully neutralised. The pH record showed a fall from the normal pH 8 to pH 5. This led to free chlorine being released in a bleach tank, which is only enclosed with a loose fitting lid.
[operation inadequate, gas / vapour release, start-up, design inadequate]

Lessons

The investigation recommended improving the tank ventilation to prevent a recurrence.
Immediate provision of an extract fan was not a complete solution.
A plant HAZOP study was scheduled after a previous incident and it was recommended that the current incident was included in the study.

6702 21 September 1994

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

Injured : 3 **Dead :** 3

Abstract

Explosion outside cracking furnace during commissioning test run by contractors. Fire spread in open drainage channels. Fire attributed to accumulation of naphtha in oil/water drainage system. Vapour cloud formed when hot water discharged into system. Ignition of vapour occurred at the high pressure steam main. Fatality.
[fire - consequence]

Lessons

[None Reported]

7520 09 September 1994

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

Injured : 0 **Dead :** 0

Abstract

This incident ocurred 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.

8349 September 1994

Source : ICHEME
Location : ,

Injured : 0 **Dead :** 0

Abstract

Catalytic reformer shut-down due to coking at a refinery.
Thermal sensitive paint alerted to hot spots in third reactor. After shut down and coke burn, all three reactors were opened for inspection, at which time the third reactor was found to have sustained considerable damage. Oxidation led to creation of hot spots, which further led to catalyst destruction, contributing towards equipment destruction.
The cause of this incident was a lack of facility for measuring catalyst bed temperatures or monitoring oxygen levels in the reactors.
[chemical causes, reactors and reaction equipment, damage to equipment, operation inadequate]

Lessons

All modifications to plant, or changes in procedures, must be subject to the formal review procedure, taking account of designers/licensers information and/or approval.

1171025 August 1994

Source : ICHEME

Location : ,

Injured : 0 **Dead :** 0

Abstract

A near miss incident occurred following modification to a nitrogen pressure control system on a flaking process in a slurry plant. A new nitrogen pressure let down station was fitted at a plant shutdown with a plant modification request being completed. The "slurry bell" being fed with nitrogen was designed for 22 psig working pressure and had been tested to 38 psig. The existing 22 psig nitrogen supply system was replaced with one which allowed 60 psig pressure. Plant operators unaware of this had been running the process for several days with a manual valve throttled back to control the process. Subsequent investigation showed that the equipment had not been subject to any commissioning trials. Swarf was blown into the reducing valve blocking it open and allowing upstream pressure to run on through it.
[process control & instrumentation, design or procedure error]

Lessons

The Change Control procedure was immediately strengthened to avoid reoccurrence.

6677 25 August 1994

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

Injured : 0 **Dead :** 0

Abstract

At 05.00 hrs. on April 8, 1994, a leak on the main fractionator column of this crude distillation unit at a refinery resulted in a fire and shutdown of the unit.
At the time of the incident the unit was in the process of starting up after a short shutdown. Feed had previously been removed from the unit at 02.00 hrs. on April 5 and the unit put on warm circulation. This was to repair leaking tubes in the kero/stabilizer feed exchangers. Since the shut-down was as the result of a conscious decision to carry out maintenance work, temperatures were reduced relatively slowly when the unit was taken off-stream. Similarly, during the start-up process temperatures were brought up again relatively slowly. At the time of the incident the unit had just been streamed, with base stripping steam in commission, and the fired heater almost up to normal operating temperature.
Taken from data in the PI computer system, it appears that conditions in the column were steady before the incident. The only difficulty reported by the operator was difficulty picking up flow on the bottom pump-around, which was confirmed by PI data which showed irregular flow through the flow controller. Two peaks of large flow (for this stage of the start-up) were indicated at 05.10 and 05.13 hrs., close to the time of the incident. At 05.10 hrs. the temperature of the pump-around was 15 degrees C, rising to 50 degrees C over the next few minutes. The majority of the material entering the column at this time would have been around 15 degrees C. The temperature of that section of the column was 267 degrees C. Operators reported that irregular flow from the bottom pump-around is not unusual.
A few minutes before the incident, when checking the repaired kero exchangers, an operator noticed a cloud of vapour coming from the direction the main fractionator. Initially he thought it was a steam leak, but on investigation, suspected it was hydrocarbon vapour. As he moved to further investigate, the vapour ignited. The operator immediately informed the operator, who activated the plant Emergency Shutdown System (ESD), and contacted the fire service.
The seat of the fire was at the location of nozzles N7, 8, 15, and 15A, located at platform 9 of the column.
An inquiry found that the operators were following normal start-up procedures; and that, from log books, it appears that the correct sequence of actions was followed. The PIB (Plant Inspection Branch) report indicates that the vapour leak probably came initially from the 6 inch blanked nozzle N8, as indicated by fire markings on the column, supported by the fact that the flange showed significant leakage when tested subsequent to the incident, with the column under a nitrogen blanket. Another flange, N7, also showed slight leakage; but this could have been caused by radiant heat from the fire at the N8 flange. PIB confirm that the materials used for the flange joints were suitable for the duty, and that the gaskets and bolts appeared to have been correctly fitted.
During inspection of the main fractionator column, the inquiry team noticed that redundant HGO pipework was not adequately supported; e.g., one of the HGO lines which terminates at a block valve at platform 8 (the level below the fire) was lashed with wire to the platform above and further supported by a block of wood resting on platform 8. It is believed that the fire caused the lashing to relax; and the additional weight of the pipework on to platform 8 caused, or contributed to, the platform distortion which occurred.
[fire - consequence, flange, nozzle, material of construction failure, leak, gas / vapour release, start-up]

Lessons

Recommendations:
1. Operating procedures for the unit start-up should be amended, to minimize fluctuations of flow during the initial introduction of cold material from the bottom pump-around system.
2. Refinery guidelines should be issued regarding routine checking of flanges (particularly those at high level) during normal operation and unit start-ups. Checks to be recorded.
3. The refinery should review their present capability to deal with high level fires and the risk represented, and determine whether facilities should be upgraded.
4. Redundant HGO pipework on the unit should be properly supported.
Lessons:
The incident also demonstrated the difficulties in fighting fires located at an elevated location on processing units, with the need for pre-planning on simulated fire situations to assess adequacy of fire fighting equipment, fixed and mobile.
Processing plant operating procedures should be the subject of regular review to ensure that thermal shocks to equipment are minimized at every point in procedures.
Redundant equipment/pipework on plant is best removed completely; if not, it must be adequately supported.
Operator routine walks through plants should include checking for flange leaks, especially during condition changes, also during dramatic weather condition changes; e.g., heavy rain may produce thermal stress on hot flanges sufficient to cause relaxation.

7519 15 August 1994

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

Injured : 1 **Dead :** 0

Abstract

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

Lessons

The following steps should be taken to prevent or control fires associated with roof fires.
1. Identify and communicate all potential hazards before work begins.
This process is particularly important when unseen hazards exist, such as the presence of flammable vapours. Precautions to ensure that materials do not reach their flashpoints should be planned and executed. All required thermometers, thermostats, and other safety devices for heating equipment should be routinely inspected by qualified personnel.
2. Control hazardous materials on the job site.
This should include co-ordination of concurrent work so that hazards are recognised and minimised. Ensure that nearby workers are not exposed to hazards.
3. Develop fire protection plans that will minimise the potential for roof fires and ensure their control.
4. Plans for responding to potential roof fires should include controlling a fire to prevent its spread to other areas.

6665 15 August 1994

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1994, OCT.; LLOYDS LIST, 1994, 18 AUG, & 24 AUG.
Location : Baton Rouge; Louisana, 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]

6660 10 August 1994

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1994, OCT.
Location : Ventura; California, USA

Injured : 4 **Dead :** 3

Abstract

Workers inhaled hydrogen sulphide gas during maintenance work in an enclosed space. Fatality.
[asphyxiation, entry into confined space]

Lessons

[None Reported]

2493 09 August 1994

Source : SEDGWICK LOSS CONTROL NEWSLETTER, 2ND QUARTER, 1995..
Location : SemBeth Shipyard, SINGAPORE

Injured : 6 **Dead :** 5

Abstract

Poor control of work led to ignition of paint solvent vapours during a paint spraying operation in the double bottomed tank of the stern block of a cargo ship. Fatality.
[human causes, repair, marine transport]

Lessons

[None Reported]

8362 August 1994

Source : ICHEME

Location : ,

Injured : 0   **Dead :** 0

Abstract

A fire occurred on an absorber tower piping. After an equipment modification, there was a severe surge created, with major vibration. Flange leaks, loss of containment, and fire followed. There was damage to equipment. It was found that the control valve was oversized which led to surge condition within piping. The basic cause was that the management of change system did not require engineering specialist reviews for control valve changes.
[maintenance inadequate, fire - consequence, management system inadequate]

Lessons

Management of change processes should include clear requirements for the various types of equipment, and, as a minimum, should cover the following: pertinent documentation, relevant calculations, and special reviews by engineering.

6641 24 July 1994

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 lightening 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.

6640 22 July 1994

Source : HSE REPORT, STATEMENT OF NUCLEAR INCIDENTS AT NUCLEAR INSTALLATIONS, 5 JAN. 1995
Location : Oldbury, UK

Injured : 0 **Dead :** 0

Abstract

Safety sheet suspended to catch items that might have fallen during inspection operation on a boiler was ignited by weld metal which had fallen through gaps in fire blankets.

Lessons

[None Reported]

1157717 July 1994

Source : ICHEME
Location : , UK

Injured : 2 **Dead :** 0

Abstract

A fire occurred when a hydrogenation reactor was being prepared for operation after a routine regeneration. The fire occurred when gas escaped as a flange was being unbolted to remove a blank on the process inlet line. The fire burned for one minute before being extinguished, either by the efforts of the personnel on the spot or when it ran out of fuel, it is not clear which. One man was burned on the arm, face and neck. He was treated in hospital and sent home after an hour, returning to work six weeks after the incident. A second man suffered from the effects of either smoke or extinguisher powder inhalation. He was treated on site and returned to work immediately. Some signal cables suffered external charring but were still functional.
The internal enquiry blamed failure of the normal purging procedures to eliminate all residual hydrocarbon. It was not clear whether this material was on the reactor or feed manifold side of the blank. On balance the reactor side was thought more likely as that material would have been richer in hydrogen and hence easier to ignite. On the other hand leaking 14 inch valves on the manifold side were cited as a possible cause.
Immediate improvements in the purging procedure were implemented to eliminate the possibility of residual hydrocarbon on both sides of all blanks. Improvements in the dismantling procedure were also made. In the long term changing to double block and bleed to eliminate the need for dismantling flanges was recommended. As an interim measure the pipework was altered to allow more direct purging to flare.
[fire - consequence, reactors and reaction equipment, leak, burns, maintenance, design or procedure error]

Lessons

1. The existing procedures for purging to remove hydrocarbon were inadequate on both sides of the blank being removed.
2. The dismantling procedure was also in need of improving to reduce the risk of fire.
3. The reliance on dismantling and fitting and removing blanks was in itself less desirable than a permanently installed double block and bleed system for carrying out the regeneration.

6627 11 July 1994

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1994, OCT.; LLOYDS LIST, 1994, 11 JUL.
Location : Windsor; Ontario, CANADA

Injured : 32 **Dead :** 0

Abstract

During welding a welders torch ignited toluene in a paint booth at a car maunfacturing plant.
[fire - consequence]

Lessons

[None Reported]

8439 01 July 1994

Source : ICHEME

Location : , RUSSIA

Injured : 1 **Dead :** 0

Abstract

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

Lessons

[None Reported]

6604 26 June 1994

Source : LLOYDS LIST, 1994, 29 JUN., &, 1 JUL.
Location : El Tablazo, VENEZUELA

Injured : 7 **Dead :** 0

Abstract

During testing an explosion followed by fire occurred in a 5 year old storage tank containing propylene. Alternatively fire occurred following a fuel oil leak during material transfer to a road transport vehicle.

Lessons

[None Reported]

8370 05 June 1994

Source : ICHEME

Location : ,

Injured : 9 **Dead :** 0

Abstract

During hot work modifications to a knockout drum, a flash fire occurred. It was found that there was incomplete gas displacement in downcomer of knockout drum off-gas line.
Procedure did not specify the need to open high point bleed at the top of the off-gas line to allow trapped gas to vent and this caused the incident.
[fire - consequence, design or procedure error]

Lessons

Gas freeing of vessels must take account of all attached pipework in the system; this is particularly important where the position of isolating blanks introduces "deadlegs" into the system.

6581 04 June 1994

Source : LLOYDS LIST, 1994, 6 JUN.; ICHEME
Location : Lavera, FRANCE

Injured : 5 **Dead :** 2

Abstract

A crude oil distillation unit at a refinery was shut down and undergoing major overhaul. The main fractionating tower and associated pipework had been flushed and emptied, steamed, water washed and isolated following normal procedures. Work permits had been issued to contractors permitting entry; cold work; and, subject to special permission, hot work. Before the incident, work had already been carried out in the tower and internal manways removed from the 48 trays in the tower.
On the morning of June 4, a contractor was granted permission to cut a coupon from a relief valve pipe on the lower end of the 50 inch tower overheads line. This line was open to the tower top and had open ends at the overhead/crude exchangers. A satisfactory gas test and a visual inspection was conducted through the relief valve stub. The difficulty of effectively draining the overheads 50 inch line was demonstrated when a sample of gas oil was later recovered from it some 20 meters or more distant from the tower. This gas oil was almost certainly distilled over during the steaming out stage. It is probable that a fire started inside the line at the point of hot work, as evidenced by the welder#s statement and confirmed by the melting of a synthetic textile sling in contact with the pipe. This melting was subsequently shown to require a temperature of about 300 degrees C. It would appear that the resultant smoke and hot vapours ascended the overhead line to the top of the tower. This upward flow was probably assisted by the aerodynamic effect of the 4.5 m/s wind around the 7.8 meter diameter tower, which induced a draft at the manway door. Once hot vapours started to rise up the line, a strong chimney effect resulted, rapidly carrying smoke and fumes to the top of the tower and out of manway. The scaffolder working in the tower dome detected the fumes and, fortunately, managed to escape. Smoke and fumes were then carried down the tower to lower manways by a down draft around the tower. It was this rapid penetration of smoke down the tower which most probably asphyxiated the two company personnel.
There were reports of pyrophoric fires within the top section of the tower during the incident. Scale believed to have been earlier taken from trays removed from the tower, indicated the presence of iron, sulfur and some combustible material. The elevated temperatures produced by the hot fumes from the overhead line would have dried out pyrophoric deposits in the upper section of the tower and caused them to ignite.
The actions to extinguish the fire were hindered by two factors.
1. The inability to get sufficient water to the top of the tower.
2. General lack of knowledge about the original fire in the overhead line; although the welder and the safety agent were both aware of this fire, they did not believe this to be relevant to the attack on the fire which they now perceived to be in the tower. Firewater was introduced into the manway by 10:15 hours, but this proved ineffective. The difficulty in raising hoses up a 70 meter tower in high winds complicated the fire attack and also resulted in injuries to personnel. Eventually it was decided to de-spade the top reflux line to introduce water; and this was successful, the smoke subsiding by 12:00 hours.
Immediate causes:
The method of isolation and hydrocarbon freeing of the tower and contiguous systems did not satisfactorily drain all liquid from the large 50 inch overhead line.
Hot work on the overhead line most probably caused an internal fire, the line was free of gas but not hydrocarbon free.
The resultant hot combustion products entered the tower from the overhead line and were pulled down the tower and out of the lower manways by an aerodynamic effect produced by the wind.
These combustion products almost certainly promoted subsequent pyrophoric fires which may have been fuelled by carbonaceous deposits.
Personnel were working in the tower at the time when the fire broke out in the overhead line.
[fire - consequence, fatality, entry into confined space, hotwork, distillation, draining of line insufficient, isolation inadequate, management system inadequate, weather effects, asphyxiation, injury]

Lessons

Be aware of the risks posed by pyrophoric deposits in vessels which are shutdown and subject to entry - expect them on any unit containing H2S or high sulphur materials - and initiate a programme of nightly water flushing until vessels are free of pyrophoric material.
The term "gas free" does not simply mean "vapour free" testing and inspection of equipment must encompass checks for materials which could produce flammable/ toxic vapours on heating, or other hazards such as pyrophoric deposits or lack of oxygen.
Gas testers and those involved in the issue of permits must have sufficient technical background to understand the complexities of ensuring safe permit conditions, especially when entry and hot work is involved.
Sites must establish sufficient control systems to ensure that work being done does not hazard other adjacent personnel, it is particularly important to protect personnel in confined spaces.
Well trained rescue teams are needed to safely attempt rescues in situations such as encountered in this incident. Sites need to plan how best this can be achieved rapidly.

6546 09 May 1994

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1994, JUL.
Location : Ossett; West Yorkshire, UK

Injured : 12 **Dead :** 1

Abstract

A worker became unconscious and died from fumes when steam cleaning a valve at a transport depot. Substance involved, p-chlorocresol. Fatality [asphyxiation].

Lessons

[None Reported]

6541 08 May 1994

Source : CHEMICAL WEEK, 1994, 18 MAY.; HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1994, JUL.
Location : Texas City; Texas, USA

Injured : 0 **Dead :** 0

Abstract

Leak of ammonia during start-up. Leak controlled.
[gas / vapour release]

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]

8468 May 1994

Source : ENDS REPORT, 1996, JUL.
Location : Atherstone, UK

Injured : 0   **Dead :** 1

Abstract

An operator entered a tank without breathing apparatus or protective clothing nor been trained in the work. He died after inhaling trichloroethylene. Fatality.
[entry into confined space, management system inadequate]

Lessons

[None Reported]

8315 May 1994

Source : ICHEME
Location : ,

Injured : 0 **Dead :** 0

Abstract

Damage to vacuum tower trays at a refinery. This incident occurred when the vacuum tower experienced lower than acceptable levels when on recirculation, forcing recirculation to be stopped. Recirculation was again started but, when accumulator levels of light and heavy gas oils could not be sustained, the start-up efforts were aborted. It was found that there had been deviation from standard operating practice for normal start-up. Substantial amounts of water were present in the vacuum unit which were allowed to vaporise rapidly, creating enormous localised forces on the trays and beams. The cause of this incident was due to personnel rotation that left people assigned who were relatively inexperienced on crude/vacuum units and were unable to address the unusual situation. In addition operating procedures did not cover a scenario for starting up the vacuum tower from recirculation mode, without first having been completely shut down according to.
Losses, equipment damage and cost of repair $1.4 million (1994), production loss $5.3 million (1994).
[design or procedure error, damage to equipment, refining]

Lessons

Operating stages for start-up of vacuum distillation columns from cold or recirculation must follow strictly to agreed procedures, with great care taken to remove water from the system and to stay at all times within acceptable parameters of pressure and temperature.

6515 19 April 1994

Source : SEDGWICK LOSS CONTROL NEWSLETTER, 2ND QUARTER, 1994.
Location : Runcorn; Cheshire, UK

Injured : 1 **Dead :** 0

Abstract

Fire broke out in heating system of fluoro chemicals plant while it was shutdown.
[heating equipment, fire - consequence]

Lessons

[None Reported]

6510 14 April 1994

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1994, JUN.
Location : Punjab, PAKISTAN

Injured : 4 **Dead :** 0

Abstract

Fire during adjustments by commissioning engineers when high pressure oil ignited after leak at new thermal power station plant. Extensive damage to roof.
[fire - consequence]

Lessons

[None Reported]

1092008 April 1994

Source : ICHEME
Location : ,

Injured : 0 **Dead :** 0

Abstract

A leak occurred on a main fractionator column of the CDU at a refinery resulted in a fire and shutdown of the unit. No injuries resulted from the incident and damage to the column was relatively minor. There was damage to access ladders and sections of grating, to a one inch service air line, and instrumentation cabling and lighting which was in the flame impingement path was destroyed.
The release of hydrocarbon vapours from the column was most likely caused by the relaxation of flange bolts on a 6 inch blanked nozzle. Relaxation of the bolts was not caused by any unusual action of the operators, but was probably due to thermal stresses created during shutdown and start-up of the unit, though a contributory factor could have been the introduction, in an uneven flow, of significant volumes of cool oil from the bottom pump-around circuit.
Autoignition of the vapours is considered as most likely.
Response to the incident was efficient, both the refinery and Central Regional Fire brigades responded rapidly to the emergency calls.
Initial fire fighting was hampered by the fact that the available fire monitors had difficulty reaching to the height of the fire source. However, additional monitors were brought from the nearby Alkylation Unit, and with these and better positioning it became possible to direct water at the fire area.
The local fire brigade was able to get additional water coverage by use of a hose from the elevated fin-fan air coolers deck.
[fire - consequence, damage to equipment, mechanical equipment failure]

Lessons

The incident demonstrated the difficulties in fighting fires located at an elevated location on processing units, with the need for pre-planning on simulated fire situations to assess adequacy of fire fighting equipment, fixed and mobile.
Processing plant operating procedures to be the subject of regular review to en-sure that thermal shocks to equipment are minimised at every point in procedures.
Redundant equipment/pipework on plant is best removed completely; if not, it must be adequately supported.
Operator routine walks through plants to include checking for flange leaks, especially during condition changes, also during dramatic weather condition changes, e.g., heavy rain may produce thermal stress on hot flanges sufficient to cause relaxation.

8336 April 1994

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.

6488 April 1994

Source : LOSS PREVENTION BULLETIN, 121 ,20

Location : ,

Injured : 1 **Dead :** 0

Abstract

During a power outage an electrician was nearly electrocuted while performing circuit testing. Although the power to the feeder system was initially turned off, it was turned just before he connected cables to perform the test. The accident was not fatal as he was wearing protective clothing.
[maintenance, electrical, design or procedure error]

Lessons

1. Procedures for pre-job briefings and proper lock and tag should be followed meticulously.
2. Communication complications for job supervisors should be minimised when safety-critical tasks are being performed.
3. Programme of training in formal communications for safety-critical tasks should be developed.
4. The need to report incidents without delay should be emphasised.

6487 31 March 1994

Source : LLOYDS LIST, 1994, 4 APR.
Location : Aix-en-provence, FRANCE

Injured : 4 **Dead :** 1

Abstract

An explosion occurred during cleaning of a vat of slightly radioactive sodium. Fatality.

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]

6470 18 March 1994

Source : EUROPEAN CHEMICAL NEWS, 1994, 28 MAR.; CHEMICAL WEEK, 1994, 20 APR.
Location : Frankfurt, GERMANY

Injured : 0   **Dead :** 0

Abstract

An explosion occurred at this plant producing hydrochlorofluorocarbon substitute. Explosion occurred during maintenance shutdown possibly when air entered a storage container and 1.5 tonnes was released.
[gas / vapour release]

Lessons

[None Reported]

6462 14 March 1994

Source : EUROPEAN CHEMICAL NEWS, 1994, 21 MAR.
Location : Droylesden; Manchester, UK

Injured : 3 **Dead :** 0

Abstract

An explosion occurred when a phosphorus oxychloride tank was flushed through with water after the material had been off-loaded into drums.
[decomposition, cleaning]

Lessons

[None Reported]

6444 01 March 1994

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

Injured : 5   **Dead :** 0

Abstract

Fire during contractor welding operations on gas processing unit.
[fire - consequence]

Lessons

[None Reported]

6409 05 February 1994

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1994, APR.; LLOYDS LIST, 1994, 7 FEB, & 8 FEB.
Location : Tabasco, MEXICO

Injured : 30 **Dead :** 8

Abstract

Workers were cleaning a natural gas pipeline when there was a sheet of fire 1500 ft around the site. The explosion was heard 3 miles away. The 24 inch pipeline was damaged along 60 ft. Crater 660 ft across and 23 ft deep. 500 people evacuated and some houses destroyed.
[evacuation, fatality, fire - consequence, maintenance inadequate]

Lessons

[None Reported]

8433 February 1994

Source : INDUSTRY ENVIRONMENT BUSINESS, 1995, MAR, 29.
Location : , UK

Injured : 0   **Dead :** 0

Abstract

A tank was being repaired when there was a delivery of 550 gallons of heavy fuel oil. The fuel oil flowed through the tank and the bund, which was also being maintained, and into the river. The two companies were fined £15000 (1994) each for polluting the river.
[pollution]

Lessons

[None Reported]

6401 February 1994

Source : THE CHEMICAL ENGINEER, 1994, 28 APR.
Location : Wem; Shropshire, UK

Injured : 0 **Dead :** 0

Abstract

During commissioning a pilot plant for recovering solvents was in the start-up stages and testing of pipework was being carried out when there was a spill of chemicals into a river. Water supplies affected. Substances involved; xylene, butyl butanoate, 2-methyl-3-hydroxy-propanoic acid, 2,4,4-trimethyl pentyl ester, dichlorobenzene, 2-ethyl-4methyl-1,3-dioxolane.
[pollution]

Lessons

[None Reported]

6398 28 January 1994

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

Injured : 2 **Dead :** 0

Abstract

A fire occurred within a desulphurisation unit following the commissioning of a spare hydrogen compressor. Fire lasted one hour.
[fire - consequence]

Lessons

[None Reported]

8434 1994

Source : CHEMICAL HAZARDS IN INDUSTRY, 1995, MAY.

Location : , France

Injured : 0 **Dead :** 1

Abstract

A warehouse employee was asked to clean out an empty a wine vat which had just been emptied. He was later found dead near the manhole at the bottom of the vat. The autopsy found death was due to asphyxiation. Carbon dioxide, sulphur dioxide and hydrogen sulphide had accumulated at the bottom of the vat. Fatality.
[cleaning, warehousing, entry into confined space, testing inadequate]

Lessons

[None Reported]

124201994

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

Abstract

An explosion occurred on an effluent water treatment tank resulting in a contractor suffering severe burns.
The incident occurred whilst contractors were constructing a tank and following heavy rain the tank had filled with water and a submergible electric pump was installed to pump the tank dry. While checking the water level through the tank's manhole, an explosion occurred injuring the contractor.
An investigation into the incident revealed the presence of flammable vapours inside the tank which are believed to have been ignited by the pumps connection to the electrical socket (located outside the tank). This could have resulted in a flash back due to the vapours coming through the tank manhole.
Vapour/Gas had been noted from the onset of the job and contractor personnel had been equipped with respirators. There was no thought at the time that these vapours might be flammable.
Work throughout the job was in the open until the lid of the tank was built.
The confined the space, concentrated the gasses and together with the source of ignition produced an explosive situation.
Tank construction was suspended until the accident was investigated.
Samples of the water remaining in the tank were taken for analysis. Ketones, aromatics and possible degradation compounds of agrochemical products were identified.
The source of flammable liquids/gases was determined and mechanical aeration and gas freeing of the tank was performed. Gas analysis showed presence of propane, butane, benzene, toluene and xylene.
1. Subsoil analysis was used to establish the source of the flammable gases or liquids and avoid their entry into tanks.
2. The procedures regarding the issue and renewal of work permits are to be reinforced with direct on-the-job training.
3. Soil contaminants will be contained until such time as the appropriate measures can be taken for clean up.
4. Direct supervision of the jobs at the site was reinforced.
[construction, leak, entry into confined space, injury]

Lessons

The report stated the following recommendations:
Contaminated soil can produce gases which can build up to explosive mixtures in (semi)confined spaces such as cellars, tanks during construction, etc.

124191994

Source : ICHEME

Location : ,

Injured : 0 **Dead :** 0

Abstract

During recommissioning of a multi-stage LPG pump a near miss incident occurred.
The multi-stage verticle pump was mounted in a barrel sump, a 12 inch pipe of approximately 2 metres ling, which was fixed in grouting.
Upon pressurising the pump, gas leakage followed by an explosion which took place underground, fracturing the concrete and hurling lumps of it around, fortunately without further consequences.
[design inadequate]

Lessons

[None Reported]

124111994

Source : ICHEME
Location : ,

Injured : 0 **Dead :** 2

Abstract

Two workers were killed as a result of asphyxiation. The direct cause of this accident was due to welding work, whilst the two men were inside the column, which ignited gasoil remaining in the overhead line of a distillation column.
The accident occurred during a shutdown of a very large crude distiller, which had a 50-inch diameter overhead line to the condensers.
While the two workers were inside the column, welding work was done on the overhead condenser system where a gas test was made. The large overhead line had only a very small slope, and the gas test did not reveal the presence of virtually pure gasoil lying in the line. It is believed that the gasoil entered the overhead system as a result of steam distillation during the gas freeing operation.
The fumes from the burning gasoil were sucked back into the column by the draught caused by the wind blowing across the open manholes. The fumes asphyxiated the two workers inside the column before they could be rescued.
[fatality, safety procedures inadequate, entry into confined space, gas oil]

Lessons

[None Reported]

124121994

Source : ICHEME
Location : ,

Injured : 0 **Dead :** 0

Abstract

An incident occurred on a tank roof at an oil storage terminal causing an explosion and resulting in damage to the roof structure.
The explosion occurred when twenty one of the stiffener boxes on the tank in question had been cold cut, hot cut, welded and tested satisfactorily. However as the worker approached box twenty two to carry out hot cut operations there was a rumble, subsequently followed by an explosion which distorted the stiffener box severely. An alarm was immediately sounded, tank evacuation procedure instigated, tank area evacuated and the appropriate authorities notified.
An investigation into the explosion revealed that an emulsion of oil/water had accumulated inside the stiffener box close to the centre pontoon. At the time of the incident jacking points were being welded to the underside of the centre pontoon. It is believed that this caused gas to be evolved from the accumulated oil/water emulsion resulting in a build up of flammable gas within the stiffener box. After the incident approximately 50 gallons of emulsion was drained from the stiffener box.
[welding, storage tanks, process causes]

Lessons

The report stated the following recommendations:
1. No hot work to be permitted on either side of floating roofs until all the enclosed spaces have been confirmed as being free of hydrocarbons.
2. A detailed method permitting proper identification of stiffener boxes containing crude oil/gas to be adopted. It is recommended that a series of inspection holes are drilled in the top of the lower end of the box section, large enough to allow proper gas checking and dipping to determine the presence of potentially flammable liquids.
3. Should flammable liquids e.g. oil/water emulsion be present then holes to be drilled up through the roof into the stiffener box to allow effective draining. Access holes to be cold cut into the side panel of the stiffener box to provide access for cleaning.
4. Gas checks to be continuous, and even if some stiffener boxes appear gas free they to be monitored on a constant basis. Gas checks to be made immediately prior to the commencement of any hot work.
5. Hazard analysis to be re-appraised and hazards such as explosion, fire, hot metal, etc. to be identified and addressed during tool box meetings.
6. Review the Permit-To-Work system and check that all the job precautions specified are being followed during the execution of work.
7. Update pre-commissioning checks and service inspection procedures for floating roofs of this type to include the identification of possible ingress points for water and hydrocarbons into the stiffening beam box structure e.g. discontinuous welding of the box structure, local corrosion etc. Seal those that are identified as a hazard with the potential for the above situation.

6343 15 December 1993

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

Injured : 0 **Dead :** 0

Abstract

Factory roof destroyed by fire following welding work within rubber factory.
[fire - consequence]

Lessons

[None Reported]

6340 14 December 1993

Source : LLOYDS LIST, 1993, 16 DEC.
Location : Prudhoe Bay; Alaska, USA

Injured : 0 **Dead :** 0

Abstract

A crude oil pipeline pressure surge caused a spill of 30 gallons of oil water mixture over an acre of snow covered tundra. The accident occurred at a well pad where production was restarting after maintenance work. The surge raised the pipeline from its supports and one of the supports punctured the pipeline. [start-up]

Lessons

[None Reported]

1172810 December 1993

Source : ICHEME
Location : ,

Injured : 1 **Dead :** 0

Abstract

During routine cleaning operations on a casting machine, a pipefitter was rendered briefly unconscious when hydrogen sulphide was emitted whilst chemicals were being drained from the machine tanks. The fitter fell, sustaining minor injuries.
The casting machine had being having some problems, during operation, which had lead to it being taken out of service so that washing operations and tank checks could be undertaken.
The drain valves on a sulphide tank were opened, allowing the contents of the tank to drain into a gully, beneath the machine. (From there the fluid would flow into the main drain).
The pipefitter was proceeding with the cleaning of the viscose feed to the casting machine. At this time other fitters were preparing to start jet washing tasks. This initially involved removing particles of viscose from the acid baths, where the jets had been dripping the viscose, prior to the cleaning operations commencing. Following removal of the viscose particles, the drain valves under the acid baths were opened, draining the baths' contents into the main drain. The main drain was flushed with water (as per normal operation) to dilute the contents of the drain.
It is believed that the sulphide tank and the acid baths were drained at the same time. The hydrogen sulphide was emitted and the incident occurred.
The plant Operating Manual did include a detailed warning of the dangers which would be faced in the event that the tanks / baths were drained simultaneously.
The Company investigated the incident. The Factory Inspector made a site inspection and considered the actions taken by the Company.
[draining, gas / vapour release, fall, asphyxiation, accidental mixing, injury]

Lessons

1. The Company reinforced it's Operating Procedure. Draining of the tanks / baths became an operation subject to a General Permit to Work.
2. The Factory Inspector made a number of recommendations to try and prevent a similar incident occurring. These included:
· That human error could still be the cause of such an incident and if possible the Operating Procedure should be tightened further.
· Consideration should be given to providing fixed audible alarms for hydrogen sulphide (and chlorine).
· The main drain should be checked for acidity before dropping alkaline baths into the drain.
· The potential for separate piping should be considered (although leakage could still provide a problem).
· Provision of suitable breathing apparatus.

6333 08 December 1993

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]

6325 December 1993

Source : LLOYDS LIST, 1994, 31 JAN.
Location : Geelong, AUSTRALIA

Injured : 0 **Dead :** 0

Abstract

A dust extraction plant at a rail receival track shed, at a grain terminal, suffered a dust explosion during repairs. A fire followed.
[fire - consequence, separation equipment]

Lessons

[None Reported]

1156327 November 1993

Source : ICHEME
Location : , UK

Injured : 1 **Dead :** 0

Abstract

A technician working under a permit to work to inspect scaffolds on a waste heat boiler plant fell backwards down the plant staircase. The technician lost his footing and fell backwards, head over heals landing on a pillar. He sustained injuries to his back and head. The technician was holding the bottom handrail with his left hand and the handrail with his right hand his centre of gravity whilst ascending was such that he fell down rather than up the stairs. The staircase was inspected and found to be in good condition, with good tread and was not considered a slipping hazard. The technicians footware was also found to be sound. The staircase was unusually steep (68 degrees) but had not caused any problems over 25 years of installation. Normal stair inclines on site were limited to 45 degrees.
[scaffolding, fal, inspection, injury]

Lessons

Two staircases were aligned in such a way as it was possible to fall down two flights. This is not good design practice and should be avoided.

6315 25 November 1993

Source : SEDGWICK LOSS CONTROL NEWSLETTER, 4TH QUARTER, 1993.
Location : Amazon Jungle, ECUADOR

Injured : 0 **Dead :** 0

Abstract

A crude oil well about to start production caught fire after well gases ignited by a spark. Fire extinguished in five days.
[start-up, fire - consequence]

Lessons

[None Reported]

7522 23 November 1993

Source : LOSS PREVENTION BULLETIN, 123, 12-13.
Location : ,

Injured : 0 **Dead :** 0

Abstract

A door to a sodium bisulphite dosing room displayed a hand-written notice stating 'only enter wearing breathing apparatus or ventilate room'. The door of the room was opened and it was found that the room could not be entered due to a high level of irritation to the eyes and respiratory system. Breathing apparatus were to be worn.
On entry it was noticed that two small bunds each contained approximately 15 litres of sodium bisulphite. A leak was found on the dosing pumps.
There was no fixed gas detection installed in the dosing pump room.
As a result of the leak, the dosing pumps were both mechanically and electrically isolated and also locked-off. The spillage was diluted with water, the area cleaned and permission was obtained for the diluted solution of sodium bisulphite to be flushed into the local sewer.
[testing inadequate, commissioning]

Lessons

The following recommendations were made:
1. It is not acceptable to a commission plant and allow it to continue operating with essential safety equipment missing, or inoperative. Such equipment is not an optional extra, but a pre-requisite to being legally permitted to operate the plant or process.
2. Where defects are identified as a result of commissioning, or subsequent operation, safety critical defects need to be clearly identified and rectified promptly. It would be useful if safety critical items could be distinguished from minor snagging items to enable prioritisation.
3. Where it is not possible to achieve either of the above, alternative arrangements need to be put into place which achieve an equivalent standard of safety and arrangements made to communicate these clearly to all staff. Specialist advice should be taken in these circumstances.
4. In all cases, staff training provided for new processes and plant must include relevant health and safety items and, in particular, the hazards of the materials involved. This again is a fundamental legal obligation.

8322 14 November 1993

Source : ICHEME
Location : ,

Injured : 0 **Dead :** 0

Abstract

Bitumen blower column overpressurised at a refinery. During start-up of the bitumen blowing unit, the bitumen blowing column was overpressured. Residue was blown from the top of the vessel and fell for a distance of about 150 metres. Water, that had entered the column undetected, vaporised to steam when it reached high temperature zone. Start-up procedures were slightly modified by individual experience of different shifts. Contributing was poor communications within the shift on at the time of the incident. The cause was due to start-up procedures being modified, albeit slightly; and no procedure existed for checking the guilty steam line.
[overpressurisation, refining, design or procedure error]

Lessons

Operating instructions must be carefully followed to ensure that water/light oils are not allowed to contact hot oils to avoid overpressurising equipment with possible rupture.

1090614 November 1993

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

Abstract

During the start-up of a Bitumen Blower Unit, the Bitumen Blowing Column was overpressured. The bolt and safety pin mechanism on the top cover of the vessel broke and about 7 meters 3 of residue was blow some 60 meters in the air and for a distance of about 150 meters.
There were no injuries sustained and no damage to plant, but there was a 3-day loss in bitumen production.
The cause of the incident was an accumulation of water in the bottom of the blowing column and/or bottom line following flushing of the unit. The water came into the column either through a steam line or from the blowing air line. During commissioning of the column, the water reached a high temperature zone, immediately flashed to steam and overpressured the column, causing the top cover to lift and release residue to the atmosphere.
[product loss, gas / vapour release]

Lessons

The report stated the following recommendations:
1. Ensure that water/light oils are not allowed to contact hot oils to avoid overpressuring equipment with possible rupture.
2. The hazards of mixing cold and hot phases in equipment must be stressed.
3. Good communication between shift personnel is essential to avoid incidents.

6295 13 November 1993

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1994, FEB.
Location : Khulna, BANGLADESH

Injured : 2 **Dead :** 5

Abstract

Explosion during repair in engine room of an inland marine tanker carrying 800 cum (cubic metres) of gasoline and diesel. Fatality.

Lessons

[None Reported]

1172305 November 1993

Source : ICHEME
Location : , UK

Injured : 0 **Dead :** 0

Abstract

An explosion occurred in a furnace, causing some minor, localised damage to the furnace itself.
In the days preceding the incident the furnace had been overhauled. At the time of the incident, the furnace had been air purged, to remove any pockets of gas and the pilots were all successfully lit. Two of the main burners - located in different sections of the furnace - had just been lit. The explosion occurred.
The main gas supply was closed down. All of the pilots were isolated and an air purge of the unit was initiated.
It was identified that the most likely cause of the incident was that the burner in one section of the furnace had gone out, filling the furnace with gas. Lighted pilots would have ignited the build-up of gas within the furnace. There was a known history of burners going out and the pilot arrangements for the unit were considered 'unreliable'.
It was considered that the burner had been running slightly air rich, causing the flame to progressively move off the burner and then to blow out.
[start-up, purging, utility failure]

Lessons

A number of recommendations were made. These included:
1. Inspection and overhaul of the furnace.
2. Revision of the furnace operating procedure.
3. Determination of the requirements for an explosion vent on the furnace and to fit a pressure vacuum gauge to the furnace.
4. Control systems (for gas, burners etc) to be uprated.
5. Uprating of pilots and flame failure.
6. A procedure for informing emergency services of a major incident to be put in place.
7. To consider the requirements for a burner service contract.

6285 04 November 1993

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1994. FEB.
Location : Nam Khe, VIETNAM

Injured : 60 **Dead :** 39

Abstract

Explosion and fire following repairs to damaged gasoline pipeline passing through village. Leak ignited after repairs. Fatality.
[fire - consequence]

Lessons

[None Reported]

6284 04 November 1993

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1994, FEB.
Location : Tracy; Quebec, CANADA

Injured : 1 **Dead :** 0

Abstract

Spill of 5 cum of titanium tetrachloride due to part of piping being removed for repairs.
[pipe

Lessons

[None Reported]

6278 31 October 1993

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

Location : Chaguaramas, TRINIDAD

Injured : 12 **Dead :** 5

Abstract

A marine tanker was alongside pier to allow hot work repair to replace steel plates inside no. 1 starboard ballast tank. Explosion blew a hole in the bow of the vessel. Fatality.

Lessons

[None Reported]

1090827 October 1993

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

Abstract

A near miss incident occurred when there was an escape of butylene during the cutting of a 4 inch LPG pipeline near a FCCU battery limits. A contractor's workman cutting the line became aware that the line was not gas free, stopped work and reported the incident to the control room. The gas alarm was raised and measures taken to contain the gas release.
The "all clear" was given after making some repairs to the pipeline, however, a few minutes later gas leaked from the line and the alarm was again raised. The situation was successfully dealt with and the all clear finally given half an hour later. Ignition did not occur, there was no damage or injury to personnel. The incident was reported to the authorities and local fire brigade.
[maintenance, leak,

Lessons

The report stated the following recommendations:
It is essential to gas free and prove by checking every part of a pipeline system before handover for modification; e.g., cutting into the system.
When venting down LPG systems the possibilities of forming ice plugs in the system, leading to a false conclusion that the pressure has been vented down satisfactorily, must always be allowed for and precautions taken to avoid.
The importance of employing contractors with sufficient knowledge to stop work
when an unexpected situation arises is clearly demonstrated in this incident.
The incident could have been much more serious if "hot work" had been in progress.

6260 13 October 1993

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1993, DEC.
Location : Pulau Ayer Merbau, SINGAPORE

Injured : 0   **Dead :** 0

Abstract

Overfiring in furnace box during maintenance shutdown damaged 3 of 8 furnaces of naphtha cracker on petrochemical complex. Awaiting delivery of furnace tubes.
[cracking]

Lessons

[None Reported]

6256 09 October 1993

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1993, DEC.
Location : Galveston; Texas, USA

Injured : 12 **Dead :** 3

Abstract

Explosion on a marine tanker while 2 workers were welding in cargo area. Explosion blew holes in the side of the ship which sank in the ship canal.
Substance involved: gasoline.
[fatality]

Lessons

[None Reported]

8325 October 1993

Source : ICHEME
Location : ,

Injured : 0 **Dead :** 0

Abstract

Release during cutting of butylene pipeline.
An escape of butylene occurred during the cutting of a 4 inch LPG pipeline near the Fluid Catalytic Cracker Unit (FCCU) battery limits. The area in which "cold cut" was to be made had not been secured. A general work permit had been issued for modification work, but not all work required prior to cutting the line had been completed. [maintenance, permit to work system inadequate, gas / vapour release]

Lessons

The importance of employing contractors with sufficient knowledge to stop work
when an unexpected situation arises is clearly demonstrated in this incident. The incident could have been much more serious if "hot work" had been in progress.

6243 28 September 1993

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1993, DEC.
Location : El Mehir; Temda, ALGERIA

Injured : 7   **Dead :** 4

Abstract

Fire broke out damaging a section of the 700 km crude oil pipeline. Cause attributed variously to the ignition of a condensate leak being ignited by a passing car killing 4 occupants, a leak hitting nearby domestic fire or repairs being carried out on the pipeline. Fatality.
[fire - consequence]

Lessons

[None Reported]

6237 26 September 1993

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1993, DEC.
Location : Oakland; California, USA

Injured : 16 **Dead :** 1

Abstract

Cleaning worker died after falling into vat of toxic waste. Second worker overcome by fumes in rescue attempt and fell into vat. Vat turned over to release men. Fatality.
[asphyxiation]

Lessons

[None Reported]

1092523 September 1993

Source : ICHEME
Location : ,

Injured : 0 **Dead :** 0

Abstract

An incident occurred on the reactor system of a CRU (Platformer Unit). On the September 23 , 1993, at 10.11 hours, the outside operator on the unit observed a small fire on the inlet flange of the reactor. He immediately notified the control room and the fire service.
The unit was taken off-stream. Depressuring the reactor system took about 24 minutes, and the reactor was fully drained by 15.00 hours. Maintenance work then commenced on replacement of flange bolts on the reactor and tightening of inlet flanges for all the reactors.
Repairs continued during the night, and were completed by 01.30 hours on September 24. Unit start-up then commenced following standard procedure, i.e., nitrogen purge removed and hydrogen introduced, and pressures and temperatures raised slowly. Feed was introduced at 09.00 hours on the 24th, at a temperature of 370 degrees C. By 18.00 hours the reactor temperatures were at 524 degrees C, when a fire was observed on the bottom flange of the reactor.
The fire was immediately dealt with by the unit outside operator and a decision made to remain on-stream once the leak had been stopped. However, the unit charge rate and severity was reduced slightly, to stabilise water content in the recycle gas. By 10.00 hours on the 25th this had been reduced from 40 ppm to 15 ppm, and unit conditions were reverting to normal.
There were no injuries sustained in the incident and the damage costs were minimal - cost for the foam compound used, maintenance repair work, and some lost production. However, the refinery considers that the potential for a major incident was high.
[fire - consequence, reactors and reaction equipment, damage to equipment, product loss, high temperature]

Lessons

The report stated the following lessons learnt:
1. It is essential that correct gaskets are used on flanges especially in high severity condition systems. Inspection monitoring of correct gasket insertion between flanges may be necessary depending on confidence in reliability of workers.
2. Flange bolt tightening techniques need to be correctly done, appropriate to the temperature range of the system from start-up to operating conditions.
3. Flange bolting can be loosened during heavy rainfall, e.g., flanges or fittings with the shanks of bolts exposed can be particularly vulnerable.
4. As well as gasket materials, materials of manufacture of bolts, nuts, and any guide rods associated with flanges or piping must be correct for the duty.

6231 21 September 1993

Source : THE VICTORIA ADVOCATE, 1993, 22 SEP.
Location : Green Lake; Texas, USA

Injured : 0 **Dead :** 1

Abstract

A contractor working on an electrical substation was killed by an electric shock during maintenance work in a shut-down. Fatality.

Lessons

[None Reported]

6213 19 September 1993

Source : EUROPEAN CHEMICAL NEWS, 1993, 27 SEP.
Location : Ludwigshafen, GERMANY

Injured : 0   **Dead :** 0

Abstract

An accident at a synthesis plant caused a release of 8 tonne of methyl diethanolamine, 200 kg of piperazine and 2 kg of monomethyl ethanolamine into the atmosphere, when offgases were flared off during start-up of the plant after an inspection by the state authorities.
[gas / vapour release, flare system]

Lessons

[None Reported]

6221 06 September 1993

Source : EUROPEAN CHEMICAL NEWS, 1993, 13 SEP.
Location : Ludwigshafen, GERMANY

Injured : 0 **Dead :** 0

Abstract

Fire broke out during welding in a gas scrubbing plant.
[scrubber, fire - consequence]

Lessons

[None Reported]

8343 September 1993

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.

6214 September 1993

Source : OIL AND GAS JOURNAL, 1993, 4 OCT.
Location : Samara, RUSSIA

Injured : 0 **Dead :** 0

Abstract

Explosion during repair work on a gasoline installation.

Lessons

[None Reported]

10917 20 August 1993

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]

1091820 August 1993

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]

1091618 August 1993

Source : ICHEME

Location : ,

Injured : 0 **Dead :** 0

Abstract

Following an emergency shutdown due to instrument air failure, an explosion occurred during attempts to relight the furnace of the Crude Fired Heater. There were no injuries to personnel, but damage to the furnace roof and duct work was extensive.
Environmental impact was minimal as was public exposure. The total incident cost is estimated to be $8.2 million (1993), including $5.8 million (1993) of production losses and maintenance and other costs of $2.4 million (1993).
The crude unit heater was repaired and back on stream on September 21, 1993.
The basic cause of the explosion was a failure of the operators involved to follow established safe isolation and start-up procedures on the fired heater. The haste to relight the furnace, to prevent shut down of the FCCU and related equipment, resulted in the failure to satisfactorily isolate the fuel gas during the purging stage and to carry out a proper gas test of the heater's atmosphere, before introduction of the lighted torch.
It is considered that the provision of functional pilot burners would have prevented the flameout, eliminating the need for a re-light of the furnace.
[damage to equipment, isolation inadequate, operation inadequate]

Lessons

The following recommendations were made:
1. There are no short-cuts in lighting/relighting fired heaters if safety is to be ensured.
2. Standard procedures must be followed rigorously.
3. Operators must be trained and made aware of the hazards involved in not following safe practices.
4. The provision of pilot burners/flame out detection needs careful assessment for individual fired heaters, and where the decision is taken to install, these facilities must be in good working order at all times.
5. Operators need to be adequately trained in the use of gas testing instruments, particularly in the limitations of the instruments as well as at what locations on equipment gas tests are to be carried out. Gas testing instruments require routine checking as to their being in working order and giving correct readings (calibration tests).

8087 13 August 1993

Source : HAZARDOUS CARGO BULLETIN, 1995, DEC.
Location : Sudbury, Ontario, CANADA

Injured : 0 **Dead :** 0

Abstract

An incorrectly fitted and deteriorated manway nozzle gasket caused a leak of hydrogen sulphide from a rail tanker car involved in a derailment. Two cars were derailed around a 7 degree curve taken at 8 kmph. One contained vinyl acetate residue and the other 2,700 kg of hydrogen sulphide residues. The bill of loading accompanying this tank wagon identified it as an "empty car which last contained hydrogen sulphide". The tank car was taken to a repair yard where a concentration of 600 ppm was recorded. The gas was flared off. The investigation showed that the derailment occurred because the tank wagon had insufficient side bearing clearance to permit the bogies to rotate sufficiently on the curve. The side bearing clearance did not meet the appropriate regulations. The manway gasket, from which the hydrogen sulphide gas leaked, had not been replaced for at least 4 years.
[human causes]

Lessons

The following lessons were learnt:
1. The placarding of the tankwagon did not give the appropriate warning for hydrogen sulphide.
2. The hydrogen sulphide was being carried in a single compartment tank wagon under a temporary permit. This practice was now under review.
3. Several loading and inspection procedures did not comply with the regulations and neither the wagon owners or the shipper were aware of these regulations. A review of compliance with these regulations was being carried out to see if it was the cause of other accidents.

6182 06 August 1993

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

Location : Ringskiddy; Cork, IRELAND

Injured : 5 **Dead :** 0

Abstract

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

Lessons

[None Reported]

1089302 August 1993

Source : ICHEME
Location : ,

Injured : 0 **Dead :** 0

Abstract

Operators noticed an overheated line at an offgas treater unit. At that time, preparations were in hand to shut the unit down the following day, for a scheduled shutdown to screen the catalyst. The overheated section of line runs between the sulphur plant tail gas diverter valves and the treater unit in-line burner. A breech of this line would have led to a significant release of hydrogen sulphide to the atmosphere.
The line was red hot in locations near the treater unit in-line burner when the problem was discovered.
The in-line burner was promptly shutdown and the gas flow diverted to the incinerator stack. Nitrogen was introduced into the treater unit to cool the piping. The emergency response team was activated, and a nearby building in the refinery was evacuated as a precaution. An advanced warning was given, of the situation, and the potential for a leak. However, since the situation was promptly brought under control, only an "all clear" call was necessary. No environmental excursion resulted, no injuries were sustained.
[overheating, shutdown, evacuation, near miss]

Lessons

1. Operators must frequently be reminded of the hazard of high concentration hydrogen sulphide, found particularly in sulphur plant areas, and the need to wear safety equipment when responding to emergencies or breaking equipment containment in any way which can lead to escape of gas or sour liquids.
2. Overheating of lines due to uncontrolled combustion/sulphur pockets is not uncommon on such units; operators must be aware of rapid actions to take to prevent line or vessel rupture as was done successfully in this incident.
3. The provision of remote isolating facilities and skin couples on lines where experience indicates problems.

8310 02 August 1993

Source : ICHEME
Location : ,

Injured : 0 **Dead :** 0

Abstract

A SCOT Unit at this refinery was scheduled for shut down on 3 August, to screen catalyst, as a high pressure drop across the reactor was limiting sulphur production. The shutdown procedure had been issued the week before, and it was re-issued again over the weekend in preparation for the shutdown. At 11.30 hours on 2 August, in preparation for the unit shutdown, and in order to stabilize the unit operation, the 16" start-up blower suction valve on the absorber overhead line, was cracked open. This move lowered the back pressure on the No. 2 Sulphur Train, allowing more process gas and air flow into the sulphur train. While the air to the train was being adjusted the heater outlet temperature dropped slightly. Fuel gas flow was increased to compensate for this temperature drop. Outside operators checked heater firing and reported the flames as slightly hazy. Additional fuel gas flow cleared this haze. Heater outlet temperature stabilized and unit operation looked okay. At about 15.30 hours the 16" blower suction valve on the absorber overhead line was opened further, and shortly afterwards, at about 16.00 hours, the SCOT heater inlet line was reported to be "cherry red". This line is insulated and has no temperature indication installed on it. Hydrogen to the SCOT unit was cut off immediately, the heater shutdown, and unit feed (Claus tail gas) diverted to the incinerator. Nitrogen flow was started through the heater via the blower suction line.

After the heater inlet line began to cool, additional nitrogen was added to the heater hydrogen supply line and later to the start-up blower discharge piping to aid in cooling. The 16" blower suction valve on the absorber overhead line was closed to prevent drawing heat back from the inlet line towards the incinerator. The heater outlet temperature dropped steadily and no further problems were noted.

An Incident Investigation Committee was set up and came to the following conclusions and recommendations.

1. The normal loop used for the blower operation was suspected to be plugged based on previous blower operation and the use of x-rays, it was recommended that the normal loop (Quench Tower Bypass) be insulated (this has been done).
2. The pressure drop across the SCOT reactor was too high for stable operation of the Sulphur Train; therefore develop shutdown guidelines based on plant performance, sulphur dioxide emissions versus allowable.
3. The lack of temperature indication on the inlet of the SCOT heater provided no early warning of an abnormal condition in the inlet line, so local skin couples should be installed on the line. Temperature sensitive paint will also be evaluated.

Other factors and recommendations arising from the incident:

1. There is a need for control room indication of the SCOT reactor pressure drop.
2. Operators responding to the incident should have worn self-contained breathing apparatus; this requirement will be incorporated into the Emergency Response Manual, other guidance.
3. A backflow prevention device on the blower is required and a request for a check valve should be submitted.
4. The ability to divert tail gas and the use of nitrogen purge could be hampered by the location of equipment; therefore, an engineering request will be submitted to specify the use of equipment needed for both the manual and automatic systems for nitrogen purge and for remote switches on the diverter valves.

[refining]

Lessons

Operators must frequently be reminded of the hazard presented by high concentration hydrogen sulphide found particularly in sulphur plant areas and the need to wear PPE when responding to emergencies or breaking equipment containment in any way
which can lead to escape of gas or sour liquids.

Overheating of lines due to uncontrolled combustion/sulphur pockets is not uncommon on such units, and operators must be aware of the rapid actions to take to prevent line or vessel rupture, as was done successfully in this incident.

8334 August 1993

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.

6170 August 1993

Source : OCCUPATIONAL SAFETY OBSERVER, 1994, MAR.
Location : Shelbyville; Kentucky, USA

Injured : 3 **Dead :** 1

Abstract

Four workers at a packaging plant were performing maintenance on a parts cleaning system when an explosion and fire ripped through the room. The room contained a number of highly flammable and toxic substances including methyl ethyl ketone, ethyl acetate, acetone and toluene used as solvents. The operation consisted in the removal of a pump from the cabinet system and repairing the filter system. The pump had been removed and a welder was preparing to repair the basket cover when the explosion occurred. Some attempt had been made to clear flammable material but 2 soak tanks were not removed and their lids were unsealed. Fatality.
[packaging equipment, welding, permit to work system inadequate]

Lessons

[None Reported]

1160222 July 1993

Source : ICHEME
Location : , UK

Injured : 0 **Dead :** 0

Abstract

A tower on an ethylene plant was shut down for cleaning. The internals (trays) were to be water washed. Due to the potential for trapped benzene within the tower, breathing apparatus was specified for the operators entering the tower.
Two fitters were assigned the task of removing the tray manways prior to cleaning tasks being undertaken. A third person was assigned the role of 'buddy'. All three were provided with breathing air masks.
After the two fitters had been working inside the tower for approximately half an hour, the air compressor tripped and the men were signalled to evacuate the tower. It took the men approximately five minutes to evacuate, in which time their air supply had run out and they had removed their masks whilst still inside the tower.
Following the incident it was determined that the back up air supply had failed due to the maloperation of the air compressor unit and that this was the main cause of the incident.
[shutdown, evacuation, safety equipment failure]

Lessons

[None Reported]

6140 05 July 1993

Source : LLOYDS LIST, 1993, 6 JUL.
Location : Oilfields; Huabel, CHINA

Injured : 0 **Dead :** 4

Abstract

Thieves were welding a pipe to divert oil and accidentally started a fire which raged for 5 days. Fatality.
[fire - consequence, deliberate acts]

Lessons

[None Reported]

8308 June 1993

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.

6078 21 May 1993

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1993, JUL.
Location : Zaorozhye, UKRAINE

Injured : 1 **Dead :** 1

Abstract

Explosion and fire at a nuclear power plant when hydrogen leaked during routine repairs. Fatality.

Lessons

[None Reported]

1089114 May 1993

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]

6066 07 May 1993

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1993, JUL.
Location : , HONG KONG

Injured : 2 **Dead :** 0

Abstract

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

Lessons

[None Reported]

6059 02 May 1993

Source : EUROPEAN CHEMICAL NEWS, 1993, 10 MAY.
Location : Stade, GERMANY

Injured : 1 **Dead :** 1

Abstract

Maintenance worker killed in explosion on chlorine plant. They were engaged in repairs to the unit when a plastic container exploded. Fatality.

Lessons

[None Reported]

1088823 April 1993

Source : ICHEME

Location : ,

Injured : 0 **Dead :** 0

Abstract

A Carbon Black Feedstock (CBFS) storage tank was found to be leaking oil through a hole (created by a muskrat-like rodent) in its dike. At the time the 185-foot diameter tank contained 109,000 barrels of product (approximately 2/3 full). On inspection the tank appeared to be leaking from its floor to the ditches within the surrounding diked (bunded) area.

Air monitoring set-up to test for vapour concentrations. Spill response was swift and cost effective with 95 percent of the oil content of the tank pumped out for sale and most of the spilled oil recovered and sent to slops storage.

Despite losing the containment perimeter through a leaking dike drain valve and sending CBFS to the segregated stormwater sewer, no violations of the water discharge permit limits occurred.

Clean-up costs were $140,000 (1993) and the lost oil (5,000 barrels) had a value of $65,000 (1993) although no credit has been made for the oily/water mixture sent to slops. Tank repair and soil removal costs are additional. No injuries were sustained in the incident and clean-up operations.

[storage tanks]

Lessons

1. Account to be taken of local soil conditions and characteristics in determining the best approach for tank floor repairs.
2. Regular inspection of tank dike (bund) walls and associated drain valves to ensure integrity to be done.
3. Atmospheric monitoring to be done at spillages before allowing the approach and use of vacuum tankers, to ensure that there is no risk of ignition of spillage.

6032 14 April 1993

Source : LLOYDS LIST, 1993, 23 APR.
Location : Ansan, SOUTH KOREA

Injured : 0 **Dead :** 0

Abstract

Accident at refinery during annual shut-down caused extended shutdown.
[refining]

Lessons

[None Reported]

1194306 April 1993

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

Abstract

An explosion and fire occurred in the final powder degasser on a polyethylene plant. There were no injuries or danger outside the factory, and no loss of planned production. However, significant repair and cleaning costs were incurred. Leading up to the incident, the plant was in the process of shutting down. A trial had been running, and difficulties had been experienced with the vent recover unit (VRU), which could not cope with the hydrocarbon quantities being degassed at the given reactor withdrawal rates. This affected the operation of the secondary degasser to the extent that eventually there was no effective degassing of the powder in this unit. Significant quantities of hydrocarbon therefore passed into the final air degasser where a flammable atmosphere was established.The source of ignition was static. Vessel earthing was adequate but static generated inherently in the degasser fluidised bed would have provided sufficient ignition energy to ignite the flammable hydrocarbon/ air mixture.The damaged vessel was found to have only minor damage; during the fire it had been subjected to temperatures of 600-700 degrees C and some slight deformation had occurred because of reduced mechanical strength at such conditions.An analyser was highlighted as a key area in monitoring hydrocarbon in the degassing train. Following the incident the alarm setting was reduced and equipment redundancy provided to ensure a reliable reading. Relevant operating instructions were reviewed and training carried out to ensure that appropriate actions are taken when there are high hydrocarbon levels in the system. Limitations of the VRU and associated systems were established and corrective engineering identified. Response from the emergency services was excellent and only minor concerns were raised.
[fire - consequence, shutdown, vapour recovery system, polymerisation, incorrect chemical concentration, hydrocarbon]

Lessons

Root cause analysis identified the following:
1. Immediate causes:·
Breakthrough of hydrocarbon into the final degasser creating a flammable hydrocarbon/ air mixture.
Source of ignition was static, inherently generated in the fluidised bed.
The resulting fire was burning polymer
2. Basic causes:·
The degassing system was unable to achieve the required degassing of the powder during the shutdown phase at the given reactor product withdrawal rates. This allowed increased quantities of hydrocarbon to pass into the air degasser.For over four hours prior to the explosion, a flammable atmosphere existed in the interface between the inert powder conveying system and the air degasse.
Plant operating instructions were inadequate and the potential risks associated with increasing hydrocarbon levels in the degassing system were not recognised.
Equipment constraints in the VRU significantly impacted the hydrocarbon removal capability of the degassing system.

6012 02 April 1993

Source : EUROPEAN CHEMICAL NEWS, 1993, 12 APR.; WASTE ENVIRONMENT TODAY, 1993, MAY.
Location : Frankfurt, GERMANY

Injured : 0 **Dead :** 0

Abstract

Pipe joining 2 vats burst during repairs releasing several tonnes of oleum. A cloud drifted towards a nearby town and airport.
[gas / vapour release, sulphur trioxide, sulphuric acid]

Lessons

[None Reported]

6010 April 1993

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

Injured : 1 **Dead :** 1

Abstract

Gas escaped from damaged hydrogen sulphide pipe during repairs at heavy water plant. Fatality.
[gas / vapour release]

Lessons

[None Reported]

6001 25 March 1993

Source : LLOYDS LIST, 1993, 27 MAR, & 2 APR.
Location : Lama; Lake Maracaibo, VENEZUELA

Injured : 0 **Dead :** 11

Abstract

Apparent failure of intercooler led to explosion and severe fire. Control room destroyed. Initial explosion occurred on start-up of gas turbine driven compressor. Adjacent offshore platforms affected by blast. Fatality.

Lessons

[None Reported]

5997 24 March 1993

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1993, MAY.
Location : Leverkusen, GERMANY

Injured : 0 **Dead :** 0

Abstract

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

Lessons

[None Reported]

5986 15 March 1993

Source : WASTE ENVIRONMENT TODAY, 1993, 6, MAY.; LLOYDS LIST, 1993, 16 MAR.;
Location : Frankfurt, GERMANY

Injured : 1 **Dead :** 1

Abstract

Explosion in polyvinyl alcohol plant during start-up following maintenance on drier. Release of methanol and vinyl acetate in cloud 3 miles long, 1800 ft high and 1500 ft wide. Fatality.
[gas / vapour release]

Lessons

[None Reported]

5977 06 March 1993

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1993, MAY.
Location : Siberia, RUSSIA

Injured : 0 **Dead :** 0

Abstract

A spill of 20 000 tonnes of oil occurred from a pipeline after minor repairs.

Lessons

[None Reported]

5972 02 March 1993

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1993, MAY.; LLOYDS LIST, 1993, 4 MAR.

Location : Agioi Theodoroi, GREECE

Injured : 7 **Dead :** 0

Abstract

An explosion occurred during the testing of an empty oil tank by hydraulic pressure. Substance: water.

Lessons

[None Reported]

5960 21 February 1993

Source : ICHEME
Location : , UK

Injured : 1   **Dead :** 0

Abstract

A turbo expander was being removed for repair from a cold box. A small nitrogen flow was maintained. During the replacement phase two fitters complained of nausea and this was attributed to the nitrogen flow which was reduced. Following replacement of the instrument a fitter became unwell due to carbon monoxide poisoning but recovered. 750 ppm of carbon monoxide was found near an unblanked flange.
[poisoning, operation inadequate]

Lessons

The report stated the following conclusions:
1. There was inadequate preparation of plant for maintenance.
2. A preparation procedure was not used.
3. Failure to properly use the toxic gas monitors provided.
4. Requirments were not complied with in respect of the permit to work issued.

The following recommendations were stated in the report:
1. All work involving the breaking of toxic gas containment to be reviewed.
2. Preparation procedures to be reviewed.

5951 13 February 1993

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1993, APR.
Location : Off Madeira, MADEIRA

Injured : 2 **Dead :** 1

Abstract

A marine transportation incident. Explosion during tank cleaning in ballast of a marine tanker. Substance involved: oil residue. Fatality

Lessons

[None Reported]

1053721 January 1993

Source : ICHEME
Location : ,

Injured : 0 **Dead :** 1

Abstract

During the unplugging of a steam mixer with steam (steam purge), the increase in pressure forced the material back up the chute and into the washer. The impact of the expelled material blew off the partial hood of the pulp washer. The hood (approximately weight: 1,000 pounds) landed on a nearby worker and killed him.
Steam mixers are used to increase the effectiveness of bleaching chemicals on pulp by raising its temperature. They are meant to operate at atmospheric pressure.
[fatality, purging, high pressure, explosion / pressure release, reverse flow]

Lessons

The following recommendations were made:
1. It is recommended that the purging of a plugged steam mixer be done using low-pressure water and/or by physically opening the vessel to manually remove the stock. These methods are currently in use in many mills.
2. If steam is to be used to purge a plugged mixer, all workers to be evacuated from areas at risk of rupture and discharge (e.g. washer and steam mixer areas) to a safe location during a steam purge operation.
3. Although a fully enclosed hood on the washer (as opposed to a partial hood) may not contain a steam purge, it would improve containment of periodic steam "blow-backs" which occur during normal operation when a steam mixer is downstream of a washer.
4. Any opening in the full-enclosure hoof (e.g. inspection doors, sampling ports) shall be offset at least 10 feet from the pipe connecting the washer to the steam mixer.

5932 20 January 1993

Source : SEDGWICK LOSS CONTROL NEWSLETTER, 1ST QUARTER, 1993.
Location : Punta Negra, PERU

Injured : 8 **Dead :** 0

Abstract

An explosion occurred after a leak whilst workers were attempting a repair on an offshore platform.

Lessons

[None Reported]

5923 15 January 1993

Source : ICHEME
Location : , USA

Injured : 1 **Dead :** 0

Abstract

Contractor working in a ditch welding a 6 inch pipe. When he climbed out of the ditch he sliped and landed on his knees. He did not report the accident until 10 days later when the fitter saw his doctor.

Lessons

[None Reported]

5921 14 January 1993

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

Injured : 4 **Dead :** 2

Abstract

Explosion on ship as it was during loading with naphtha. Boiler was being examined when explosion occurred. Fatality.
[inspection]

Lessons

[None Reported]

5919 13 January 1993

Source : CHEMICAL ENGINEER, 1993, 28 JAN.; HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1993, MAR.
Location : Pyle; Mid Glamorgan; Wales, UK

Injured : 3   **Dead :** 1

Abstract

Fire broke out during cleaning of process tank and swept through plastics factory on industrial estate. Fatality.
[fire - consequence]

Lessons

[None Reported]

8297 January 1993

Source : ICHEME
Location : ,

Injured : 0 **Dead :** 0

Abstract

Cracking unit kiln temperature excursion at a refinery. Temperature excursion encountered during start-up of a catalytic cracking unit.
The investigation team concluded that there were, actually, three separate incidents being realised at the time of the temperature excursion. An immediate and basic cause is provided for each of the three incidents.
Immediate cause
1. Deviation from normal operating procedures during start-up (Operating (equipment) without authority).
2. Leaving plate (blind) in the kiln outlet hopper after maintenance (Failure to secure).
3. Faulty board level instrumentation (Warning system).
Losses: catalyst damage, loss on margins, maintenance, environmental fines, for a total of $3.25 million (1993).
[damage to equipment, refining, human causes, catalytic cracker]

Lessons

1. Clear, written instructions covering all operating phases, operating limits, safety systems and their functions.
2. Safe work practices and mechanical integrity program to assure the integrity of plant and instrumentation prior to start-up.
3. Thorough training of operators.

5903 January 1993

Source : CHEMICAL WEEK, 1993, 3 FEB.
Location : Houston; Texas, USA

Injured : 1 **Dead :** 1

Abstract

Welding on the top of a tank caused an explosion in a nearby tank containing sodium sulphide and residual hydrocarbons. Fatality.

Lessons

[None Reported]

8327 1993

Source : ICHEME

Location : ,

Injured : 2 **Dead :** 1

Abstract

A marine transportation incident. Gassing incident during unloading of sour crude oil from a marine tanker. Two inspectors and one crew member were gassed during sampling/measuring of the ship's tanks. Protective equipment was not used in this hazardous atmosphere, and workers were not aware of the potential hazards of H2S, hydrogen sulphide. Fatality.
[asphyxiation, safety procedures inadequate]

Lessons

With the introduction of inert gas blanketed cargo tanks, the latter no longer "breathe" on voyage; and, therefore, even small concentrations in the liquid space build up to high values in the vapour space. Exposure of personnel to this inert gas/H 2 S mixture will produce rapid loss of consciousness leading to death. Rescue attempts should only be made when wearing the appropriate respiratory protection.

124011993

Source : ICHEME
Location : ,

Injured : 1 **Dead :** 0

Abstract

An incident occurred during emptying of a water drain pit for modification. Pneumatic plugs were inserted into two 900 mm drain lines entering the pit from a rainwater interceptor. The plugs were gradually inflated with compressed air to approximately 2-bar pressure. Whilst the pit was being pumped out one of the plugs burst, causing one of the ends to be ejected with considerable force. It ricocheted out of the pit.
The ejection of the plug was not due to explosion of flammable mixtures but to the explosive release of pressure.
One contractor was injured in the blast.
[explosion / pressure release, high pressure, injury]

Lessons

[None Reported]

124031993

Source : ICHEME
Location : ,

Injured : 0 **Dead :** 0

Abstract

A job requiring the use of a pipe plug had been set up with a nitrogen purge to a safe location, identical to the second incident (see record 12402). A second crew required nitrogen for purging operations. After some discussion, it was agreed that they could use the same header as the first crew were using and the connection was made. A person who was not a member of the first crew opened the valve supplying nitrogen purge to the pipe plug beyond the vent capacity. Pressure built up in the line and the plug was violently expelled.
[purging, explosion / pressure release, high pressure]

Lessons

[None Reported]

124021993

Source : ICHEME
Location : ,

Injured : 0 **Dead :** 0

Abstract

A job was being done that required the use of a pipe plug. A nitrogen purge, venting to a safe location, was set up behind the plug. Some time after the work started, the plug was violently blown out of the line.
It is thought that the excessive pressure build-up resulted from a restriction in the vent capacity caused by a vehicle's wheels running over the vent hose, which was lying on the ground.
[purging, explosion / pressure release, high pressure]

Lessons

[None Reported]

124041993

Source : ICHEME

Location : ,

Injured : 0 **Dead :** 0

Abstract

A 450 mm dia. crude oil line was cold cut in order to install a flange. The pipe was cleaned near the end and a twin seal pipe plug installed.
The plug was an inflatable type with the two seal bags interconnected.
Two vent points were opened upstream of the plug to facilitate nitrogen purging of the job via a purge line through the plug. There was an expansion loop in the piping between the vents and the plug. During welding, the rear seal bag burst. The pressure wave thus created reflected from the expansion loop and ejected both parts of the plug out of the open end of the pipe.
Flammable vapour in the pipe ignited on the hot weld area and flashed back into the pipe. There was no injury as a result of this incident.
[maintenance, fire - consequence, explosion / pressure release, high pressure]

Lessons

[None Reported]

5891 1993

Source : CHEMICAL HAZARDS IN INDUSTRY, 1994, MAR.
Location : Boston, USA

Injured : 13 **Dead :** 0

Abstract

2 explosions occurred at tantalum plant when residual sodium was being cleaned out of drums.
[cleaning]

Lessons

[None Reported]

109101993

Source : ICHEME
Location : ,

Injured : 2 **Dead :** 1

Abstract

The following tragic incident is short on detail, however, it provides yet another warning of the hazards of hydrogen sulphide to be found in some crude oils in higher than normal concentrations.
The incident took place sometime in early part of 1993 by exposure to a very high hydrogen sulphide content during the unloading of crude oil. The operation was under the control of specialist cargo inspectors. Two inspectors and one crew member were gassed during sampling/measuring of the ship's tanks.
All three victims were transported immediately to hospital A crew member, unfortunately, did not survive.
[inspection, asphyxiation, leak, fatality]

Lessons

The following recommendations were made:
If sour crude or other oils are discharged into shore tanks these will probably remain sour in their
vapour space for some considerable time, despite subsequent sweet imports. Care is, therefore, needed with operations involving such tanks.

5895 1993

Source : CHEMICAL HAZARDS IN INDUSTRY, 1993, DEC.
Location : , GERMANY

Injured : 0 **Dead :** 0

Abstract

Rupture of dinitrobenzene tank. During cleaning of a tank at 130 degrees C, the tank split and fractured pipework. It was thought that picric acid and styphnic acid had become enriched in the residue through insufficient washing on previous occassions.
[cleaning inadequate]

Lessons

[None Reported]

1088405 December 1992

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.

5861 27 November 1992

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1993, JAN.
Location : , SINGAPORE

Injured : 16 **Dead :** 6

Abstract

Explosion and flash fire during hot work in centre tank of a marine tanker at repair yard. Fatality.
[fire - consequence]

Lessons

[None Reported]

5853 20 November 1992

Source : SEDGWICK LOSS CONTROL NEWSLETTER, 4TH QUARTER, 1992.
Location : Statfjord, NORWAY

Injured : 3 **Dead :** 0

Abstract

Small fire during compressor repair.
[fire - consequence]

Lessons

[None Reported]

946 08 November 1992

Source : ICHEME

Location : ,

Injured : 7 **Dead :** 0

Abstract

On the 8th November, 1991, a contractor's pipefitter removed a 3/4" plug from the outlet of a coalescer in order to replace a thermal relief valve. Isobutane was released and the subsequent vapour cloud ignited by a welder working on the repair of a pipe at a point some 20 feet away.
The isobutane coalescer pressure was approximately 40 psig at the time.
Seven contractor employees were injured in the incident, two were admitted to hospital with serious burns.
[fire - consequence, vapour cloud explosion, management system inadequate, injury]

Lessons

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

5846 07 November 1992

Source : SEDGWICK LOSS CONTROL NEWSLETTER, 4TH QUARTER, 1992.
Location : Matsumoto, JAPAN

Injured : 0 **Dead :** 3

Abstract

Explosion during weld repair to storage tank. All killed were inside the tank. Substance involved: oxygen. Fatality.
[welding]

Lessons

[None Reported]

5837 28 October 1992

Source : SEDGWICK LOSS CONTROL NEWSLETTER, 4TH QUARTER, 1992.
Location : Sandes, NORWAY

Injured : 0 **Dead :** 0

Abstract

Fire occurred on a drilling rig whilst under repair.
[fire - consequence]

Lessons

[None Reported]

1091216 October 1992

Source : ICHEME
Location : ,

Injured : 7 **Dead :** 10

Abstract

An explosion and fire took place at a refinery, at 15.52 hours on October 16, 1992, resulting in 10 fatalities and 7 injured. It was caused by the failure of a breech-lock closure on a high pressure heat exchanger on a unit (Heavy Oil Indirect Desulphurization Unit).
Part of the refinery facilities were lost, as well as part of the storage tanks and lubricant manufacturing plant located next door. The total amount of direct property loss is 2.4 billion yen (about £15
million, or $22 million) (1992).
The incident occurred during shutdown for catalyst replacement work, the process was being returned to operation. At about 15.52 hours, when the process was nearing normal operating conditions, the lock ring, the channel cover and a few other parts of one of the Feed/Reactor Effluent Exchangers burst apart, projecting to more than a hundred meters away. There was a simultaneous explosion of released hydrogen and fire developing near the exchangers.
A few minutes before the explosion, a major emission of hydrogen, probably accompanied by VGO liquid, noisily arose from vent and drain holes and other locations. The explosion took place while plant operators and site workers were taking measures to stop the emission.
During the shutdown for catalyst replacement, the feed/reactor effluent exchangers (including the failed one) were not opened for inspection.
[fire - consequence, fatality, mechanical equipment failure, processing, leak, injury]

Lessons

[None Reported]

5788 21 September 1992

Source : THE CHEMICAL ENGINEER, 1992, 15 OCT., & 10 DEC., & 1994, 30 JUN.; CHEMICAL TECHNOLOGY EUROPE, 1994, JUL/AUG, 30-31.; A REPORT OF THE INVESTIGATION BY THE HEALTH AND SAFETY EXECUTIVE INTO THE FATAL FIRE AT HICKSON & WELCH LTD., HMSO, 1994, ISBN, 07176 0702 X.

Location : Castleford; West Yorkshire, UK

Injured : 14 **Dead :** 5

Abstract

Incident during cleaning of a nitrotoluene distillation still vessel. The mintenance procedure involved using a steam coil in the base of the still to indirectly heat solid residues to soften them prior to removal. Hot spots develeoped in the waste and a decomposition began leading to an exothermic reaction and eventually a fireball. A temperature of 80 degrees C was to be used for the softening process, however it is believed that much higher temperature was reached. This may have occurred if the thermometer in the still did not register the true temperature as it was not submersed in the residue. The 2-3 tonnes of residue was heat sensitive and produced a fierce jet of flame which shot out of the manhole opening and consumed the wooden built control room. Fatality.
[fire - consequence]

Lessons

1. Where the batch distillation of highly energetic materials (such as mononitrotoluenes or other organic nitro compounds) is carried out still residues should be analysed, monitored and removed at regular intervals to prevent possible build up of unstable impurities.
2. The use of chemical plant for a different process or purpose should be treated as a plant change procedure requiring rigorous assessment. Consequently, before plant is used to carry out non-routine operation authorisation should be obtained from an appropriate level of management who should ensure that plant hazards have been identified, risks assessed and the precautions determined.
3. Safe systems of work covering all aspects of operation and maintenance of all process plant should be established and defined in comprehensive instructions including those operations undertaken at frequent intervals. These systems should be monitored by management and reviewed at appropriate intervals.
4. The nature, operation and limitations of control systems on process plant should be determined, and their implications for health and safety taken into account, before non-routine operations requiring their use are authorised.
5. Companies should assess and monitor the workload and other implications of restructuring levels of management and supervision to ensure that key personnel have adequate resources, including time and cover, to discharge their responsibilities.
6. Persons authorised to issue permits to work should be sufficiently knowledgeable about the hazards associated with relevant plant. If authorised personnel are relocated to former workstations refresher training should be given and recorded before re-authorisation.
7. The design and location of control and other buildings near chemical plant which processes significant quantities of flammable and/or toxic substances should be based on the assessment of the potential for fire, explosion and/or toxic releases at these plants. Companies should assess the suitability of existing control buildings and, if they are found to be vulnerable, reasonably practicable mitigating action should be taken.
8. Companies should regularly monitor and audit their own compliance with performance standards defined in their fire certificates. Particular attention should be paid to the effects of material alterations, e.g. installation of pipework and cable ducts and other works in areas concealed by false ceilings, to ensure that fire-resisting integrity of protected routes is maintained and fire training records should be regularly updated.
9. When exercising their own on-site emergency plans companies should ensure that roll call information on missing persons is passed immediately, accurately and directly to the senior fire officer in charge. Roll call procedures should be practised routinely to ensure that they are effective when carried out at all periods of the working day.

5784 18 September 1992

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1992, NOV.
Location : Piraeus, GREECE

Injured : 0 **Dead :** 2

Abstract

An explosion in a marine tanker when cleaning squad with torch tried to enter cofferdam between No's 1 and 2 tank. Substances involved: white spirit and hexane. Fatality.

Lessons

[None Reported]

5780 09 September 1992

Source : LLOYDS LIST, 1992, 19 SEP.
Location : Jurong, SINGAPORE

Injured : 0   **Dead :** 0

Abstract

A fire broke out at a crude distillation unit during start-up after a month's maintenance work had been completed. Fire was under control in half an hour. The fire started in a sewer.
[fire - consequence]

Lessons

[None Reported]

5777 08 September 1992

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]

5772 01 September 1992

Source : CHEMICAL WEEK, 1992, 9 SEP.
Location : Deepwater; New Jersey, USA

Injured : 3 **Dead :** 0

Abstract

An explosion occurred during cleaning using a pressurised water to clean a 22,000 gallon tank that contained sludge, motor fuel, antiknock compounds and gasoline. No environmental damage occurred.

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]

5769 September 1992

Source : LLOYDS LIST, 1992, 22 OCT.; EUROPEAN CHEMICAL NEWS, 1992, 5 OCT.
Location : Gelsenkirchen, GERMANY

Injured : 2 **Dead :** 1

Abstract

A fire occurred during start-up after pygas leaked from a connection pipe in an olefin cracker plant. Fatality.
[fire - consequence, cracking]

Lessons

[None Reported]

5763 28 August 1992

Source : LLOYDS WEEKLY CASUALTY REPORTS 289/12

Location : Tampa; New Orleans, USA

Injured : 2 **Dead :** 0

Abstract

Transportation. A fire occurred in a gasoline pipeline under repair at a point where outlet pipes from 8 storage tanks converge at a fuelling area. No tanks damaged.
[fire - consequence]

Lessons

[None Reported]

5756 25 August 1992

Source : THE SCOTSMAN, 1992, 26 AUG.
Location : Bruce Field; North Sea, UK SECTOR

Injured : 0 **Dead :** 0

Abstract

A fire occurred on the leg of an offshore platform during welding.
[fire - consequence, construction]

Lessons

[None Reported]

5743 10 August 1992

Source : THE CHEMICAL ENGINEER, 1992, 15 OCT.
Location : St Fergus; Peterhead; Scotland, UK

Injured : 1 **Dead :** 0

Abstract

During commissioning of a process heater a rise in gas pressure extinguished the flame by blowing it off the burner. This allowed a build-up of gas which was ignited by the pilot light. The resulting explosion badly damaged the heater. Substance: oil.
[overpressurisation, damage to equipment]

Lessons

[None Reported]

1080010 August 1992

Source : ICHEME
Location : , UK

Injured : 1 **Dead :** 0

Abstract

An operator operating a forklift truck was lifting trash into an open top trash disposal unit. During the operation some pellets leaked onto the ground. The operator backed up the forklift truck and started to clean up the pellets. He stepped on some of the loose pellets and lost his footing. He struck the ground with his head. The employee got back on his feet and walked to the locker room where he sent another employee for help. The ambulance was called and he was transported to the local hospital emergency room.
[waste, cleaning, fall]

Lessons

[None Reported]

5734 August 1992

Source : CHEMICAL WEEK, 1992, 26 AUG.
Location : Geismar; Louisiana, USA

Injured : 0 **Dead :** 0

Abstract

A minor explosion occurred in the hydrogen system when restarting a chlorine plant after a shut down.
[start-up]

Lessons

[None Reported]

5732 29 July 1992

Source : HEALTH AND SAFETY AT WORK, 1994, AUG.
Location : Bishopton; Renfrewshire, UK

Injured : 0 **Dead :** 1

Abstract

An explosion occurred when a supervisor entered a dispatch bay to inspect storage tanks containing highly volatile substances such as nitroglycerine.
Fatality.
[training inadequate, management system inadequate, inspection]

Lessons

[None Reported]

1084913 July 1992

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.

5712 12 July 1992

Source : LLOYDS LIST, 1992, 14 JUL. ICHEME
Location : , SINGAPORE

Injured : 60 **Dead :** 6

Abstract

A marine transportation incident. Flash fire erupted on marine tanker undergoing repairs in shipyard. Fire could have occurred when cleaning fluid accidentally splashed on an engine in the boiler room.
Six people were killed and 60 others injured (8 critically) when a flash fire erupted on board a chemical tanker, which was undergoing repair at a Singapore shipyard on the morning of July 12, 1992. Initial investigations indicated that the fire was caused when cleaning fluid splashed down onto hot work being done further below in the engine/boiler rooms.
Police said there were 225 people working on the 24,000 dwt tanker when the fire broke out.
The dead, and most of the injured, were working in the boiler and engine rooms at the time.
Witnesses said there was panic when fire and intense smoke engulfed the rooms. Many people scrambled to the only staircase leading to the ship's main deck above.
Fire safety officers from the shipyard were the first at the scene and were joined within minutes by firemen of the Singapore Civil Defense Force (SCDF). Half of the firemen concentrated on the fire while the rest evacuated the casualties. The fire was put out within 30 minutes.
Over eighty firefighters were involved in the operation
A foreman led 15 workers to shelter behind a thick steel wall of a control room where they were protected from the fire but not from smoke. This group, however, was rescued after about 30 minutes, the foreman using his mobile radio to attract help. Most of the injured who survived the initial fire were overcome by the dense smoke and fumes, which filled the three levels of the boiler room.
The probable cause of the incident was a `Permit to Work' on the ship which had been issued following gas free tests by port chemists.
Workers said that some cleaning liquid which was being used to clean pipes fell onto a boiler on a lower deck where welding was being done. A leak in cleaning hoses was mentioned.
Witnesses said they saw the fluid begin to burn as it hit the boiler, with a flash fire. Some workers said that the fluid smelled like thinner or kerosene. The fire spread to insulation material inside the boiler room, and this is believed to have released toxic fumes. Fatality.
[fire - consequence, hot surface, evacuation, toxic fumes, injury]

Lessons

1. Strict control of hot work and use of flammable materials is essential to avoid incidents.
2. Safe means of emergency escape from work area should be provided.
Ship board repairs, when alongside refinery jetties (docks), must only be allowed subject to site and Maritime Code restrictions - e.g., International Oil Tanker Terminal Safety Guide (IOTTSG), national and harbor regulations, etc.

5703 04 July 1992

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1992, AUG.
Location : Philadelphia; Pennsylvania, USA

Injured : 0 **Dead :** 0

Abstract

During tank cleaning on marine tanker a spill of 3800 litres of oil occurred.

Lessons

[None Reported]

1084804 July 1992

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]

5698 30 June 1992

Source : LLOYDS LIST, 1992, 8 JUL.
Location : Fort Mifflin; Pennsylvania, USA

Injured : 0 **Dead :** 0

Abstract

1000 gallons of crude oil spilled into a river during tank cleaning operations.

Lessons

[None Reported]

5680 15 June 1992

Source : ICHEME
Location : ,

Injured : 0 **Dead :** 0

Abstract

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

Lessons

[None Reported]

5668 25 May 1992

Source : THE CHEMICAL ENGINEER, 1992, 11 JUN.
Location : Ekofisk; North Sea, UK SECTOR

Injured : 0 **Dead :** 0

Abstract

Cleaning of gas turbine with high pressure water and chemicals had been completed and the gas alarm turned off as it was affected by the cleaning chemicals. On running up the gas turbine to full power a flameout occurred but because the gas alarm had not been reset the build-up of gas in the combustion chamber went undetected. On re-ignition there was an explosion which set fire to the inlet air filter.
[fire - consequence, operation inadequate]

Lessons

[None Reported]

5666 21 May 1992

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1992, JUL.
Location : Grangemouth; Scotland, UK

Injured : 0   **Dead :** 0

Abstract

A leak developed on a marine tanker when loading polyethylene.
As a result of this the emergency services were called. The Fire Service sprayed water on the escaping vapour and sections of the surrounding dock areas, all ships crews were evacuated.
The tanker had approximately 650 tonnes of propylene gas in the effected tank.
The effected area was sealed off by the police, the wind was carrying the vapours to the west of the dock area.
Gas readings were taken from the area which showed low levels.
[instrument/controller, gas / vapour release, human causes]

Lessons

[None Reported]

7610 08 May 1992

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]

5651 May 1992

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]

379   29 April 1992

Source : ICHEME

Location : ,

Injured : 0   **Dead :** 3

Abstract

Three workers were killed while cleaning an above ground storage tank at a plant. The safety manager and a co-worker died while trying to rescue a contractor.
The incident occurred in an 8,000-gallon tank used to store a clear vinyl coating. The contractor was applying the solvent cyclohexonane (sic probably, in fact, cyclohexanone) from a hatch on the tank's roof with a pressurized wand. At some point, the worker entered the confined space of the tank. The deaths were probably caused by chemical exposure, lack of oxygen, or some other reason.
The worker had been trained on confined space entry and hazardous materials handling.
The spraying of solvents can itself be hazardous and needs to be assessed before permission is given to do so - e.g. toxic risks, static ignition if a flammable solvent used, etc.
[storage tanks, entry into confined space, asphyxiation]

Lessons

1. Entry to confined spaces must only be allowed in strict compliance with Safety Regulations; e.g., satisfactorily gas tested, sufficient oxygen levels, entry permit issued, standby watch, etc.
2. Rescue attempts must not be made, unless rescuers are provided with and wearing appropriate protection - e.g., breathing apparatus, protective clothing, rescue lines, etc.
3. Adequate training and supervision is required to ensure that the two lessons above are complied with.
Work methods need to be assessed to ensure that they are safe before work starts.

5644 25 April 1992

Source : HEALTH AND SAFETY OPERATIONAL NOTE, 1992, 9 DEC.
Location : Harwell; Oxfordshire, UK

Injured : 0 **Dead :** 0

Abstract

The radio-isotope tritium was released during decommissioning operations.
[radioactive release, radioactive isotopes]

Lessons

[None Reported]

5624 06 April 1992

Source : SEDGWICK LOSS CONTROL NEWSLETTER, 2ND QUARTER, 1992.
Location : Texas City; Texas, USA

Injured : 0 **Dead :** 0

Abstract

Propane leaked during start-up of gasoline upgrading unit after maintenance. Water was used to contain the leak when it ignited. Fire under control in 50 minutes.
[fire - consequence]

Lessons

[None Reported]

1079131 March 1992

Source : ICHEME

Location : ,

Injured : 0 **Dead :** 0

Abstract

A mechanical worker was installing a blind joint on the nitrogen line coming in the tower in order to prepare a plant shutdown. The joint was separated from the tower by a valve and check valve. An ethylene oxide leak developed at a one and a half inch flange on the nitrogen injection nozzle on an aldehyde distillation tower.

The following actions were taken:

1. A sea water hose was disposed to absorb the ethylene oxide leak.
2. The heat was stopped on the tower reboilers to reduce the leak.
3. The plant was shut down in order to depressurise the tower as soon as possible.

[preparation for maintenance, plant shutdown, near miss]

Lessons

[None Reported]

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.

8045 March 1992

Source : ICHEME

Location : ,

Injured : 0   **Dead :** 0

Abstract

Shutdown of alkylation unit at a refinery.
Operational problems were incurred because of poor feedstock quality. The immediate cause was foaming and reduced acid concentration in alky plants because of high concentration of C5+ hydrocarbons in feedstock (reactive chemical). Inadequate testing of feedstock by shipping end was the basic cause.
Losses: maintenance and materials $52 000 (1992) production loss $163 000 (1992).
[testing inadequate]

Lessons

1. Changes in feedstock composition may have wider ramifications on processing plant than is first apparent.
2. Operators should be aware that excursions from design parameters may result in rapid corrosion/erosion in certain processing plants and steam raising systems.

378   17 February 1992

Source : ICHEME
Location : , SINGAPORE

Injured : 0   **Dead :** 5

Abstract

A marine transportation incident. An explosion ripped through a marine tanker while it was in Singapore waters. Workers were carrying out repairs and maintenance work on the tanker at the time. Five men died in the blast, which left a gaping hole about 40m wide in the centre of the tanker. Fatality.
[hot work]

Lessons

1. Strict control of hot work and use of flammable materials is essential to avoid incidents.
2. Safe means of emergency escape from work area should be provided.
Ship board repairs, when alongside refinery jetties (docks), must only be allowed subject to site and Maritime Code restrictions - e.g. International Oil Tanker Terminal Safety Guide (IOTTSG), national and harbor regulations, etc.

1046114 February 1992

Source : ICHEME
Location : ,

Injured : 0 **Dead :** 0

Abstract

Two technicians were involved in carrying out chemical cleaning to the condenser tubes No.1 centrifugal chiller unit located in the basement refrigeration plant room.
The procedure involved pumping a formic acid/water solution through the condenser tubes via a holding tank for a period, this was then to be neutralised and when reaching a specific pH value, was to be pumped down the drains. The previous day the procedure had been carried out to No.2 chiller using the formic acid/water solution as described, and using sodium carbonate as the neutralising agent. On the Friday afternoon, it had been decided that instead of sodium carbonate, sodium nitrite would be used this was added to the formic acid solution within the holding tank and the pumping action commenced.
The operator noticed that gas was forming from this solution and immediately summoned assistance. A colleague telephoned the product helpline number which was printed clearly on the bag of sodium nitrite and asked for advice. They were told to evacuate the room, provide full ventilation and seal all entrances and exits as the gas that was being formed could be toxic. This was immediately carried out.
Advise to all people who could have possibly been in contact with the gas be sent to hospital in order to be checked over.
Air sampling tests were carried out with a nitrous oxide tube, and neutralisation of the existing solution was followed using sodium carbonate until the pH level was acceptable to flush away down the drains. These actions were carried out using full breathing apparatus gear and the whole solution was flushed out from the chiller unit and disposed of down the drain safely.
[unwanted chemical reaction, evacuation, gas / vapour release]

Lessons

The following recommendations were given:
1. Sodium nitrite should not be mixed with any form of acid.
2. Nitrogen monoxide and nitrogen dioxide are toxic gases, anyone who is exposed to either should be moved to an area where there is plenty of fresh air. They should be watched for any difficulties in breathing and given oxygen if necessary and medical advice should be sought, even if anything appears to be normal as the gas could have delayed effects.

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]

5562 28 January 1992

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

Injured : 1 **Dead :** 4

Abstract

A fire and explosion occurred on supertanker when repairs were being carried out. Fatality.
[fire - consequence, marine transport]

Lessons

[None Reported]

1088915 January 1992

Source : ICHEME
Location : ,

Injured : 1 **Dead :** 0

Abstract

An operator went to carry out a gas test at the feedline on a tower. The feedline discharged into a low pressure flare gas header.
The gas test was required to allow a hot work permit to be issued so that flash assisted pictures could be taken of the flange facings of the lines connected to feedline. The pictures were required for investigation of an incident which occurred earlier in the day at the same location. There was scaffolded access platform beneath the safety valve.
A work permit issued by the chief operator of the unit to maintenance to remove the safety valve, required that air supplied breathing apparatus be worn for this job. Two maintenance contractor#s pipefitters were on the scaffolding with air supplied breathing apparatus had removed the safety valve.
The operator climbed the scaffolding to take the gas test, he was not wearing air supplied breathing apparatus. Before he could fully perform the test he was overcome by gas, suspected to be nitrogen emanating from the open flare line. He backed away, turned and slumped to his knees.
He was disoriented and briefly lost consciousness.
One of the pipefitters grabbed the operator to prevent him falling under the scaffold guardrail. After one to two minutes the operator felt better and was assisted to ground-level by maintenance personnel.
He was forcibly given fresh air, later oxygen, and taken to the nurse#s station. Shortly afterward he was taken to hospital for examination. He was released and sent home that evening.
Conclusion:
1. The gassing of the operator was due to inhalation of low pressure gas, primarily nitrogen, which had entered the section of flare system involved inadvertently.
2. The operator should have been aware and followed permit restriction regarding requirements. further, he did not use sound judgement in entering a potentially hazardous area with only minimum protection.
[testing, safety procedures inadequate, people]

Lessons

[None Reported]

7611 13 January 1992

Source : LOSS PREVENTION BULLETIN, 129, 11.
Location : Texas, USA

Injured : 0 **Dead :** 0

Abstract

A reaction vessel in a raw material process unit at this chemical plant ruptured during a cleaning operation. This vessel was a centrifugal feed tank with an 31,000 litre capacity and maximum allowable working pressure of 15 psi (1.03 bar).
The rupture and subsequent plant damage was caused by steam pressure that was generated by heat from a chemical reaction. A continuously increasing, highly exothermic reaction provided the heat source for the expanding supply of steam. The decomposition of this material resulted from overheating the vessel with steam to the coils during the cleaning operation.
The reconstruction of the new facility was completed one to two months ahead of schedule.

Lessons

[None Reported]

5548 13 January 1992

Source : ICHEME

Location : ,

Injured : 2 **Dead :** 0

Abstract

Centrifuge feed tank exploded during a cleaning operation. The rupture was caused by steam pressure due to heat from the chemical reaction of an alkaline catalysed polymerisation of hydrogen cyanide. The hydrogen cyanide came from a decomposition of a product.

Lessons

[None Reported]

1085209 January 1992

Source : ICHEME
Location : ,

Injured : 0 **Dead :** 0

Abstract

An incident occurred on a 90,000 bpd FCCU. The regenerator was being opened for inspection when an incident occurred in the regenerator resulting in a pressure wave and flame, which travelled downstream to the separator, expander train, waste heat boiler, seal pot, stack and interconnecting piping. Mechanical damage to the plant occurred as flash fire came out of manways and isolation breaks made in the piping circuit. The pressure wave damaged the waste heat boiler and further downstream piping and supports.
Investigations found ten possibilities as to how gas could have entered the regenerator:
1. Fuel gas purge to instruments: All connections had been dismantled.
2. Contamination of utilities: Some gas connections to air and nitrogen systems on other process units were on valve isolation only; however, the valves were tight and no contamination of the utilities was found.
3. Gas from flare header: A positive steam seal existed in the Stripper or the Reactor Overhead blind was in place, no other connections were found.
4. Air heater fuel gas: The FG blind was removed only for a short while on the 7th in anticipation of a restart, and although this blind was negated by a drain connection it was found that the valve was leak free when tested at twice the differential pressure experienced during the period that the combustible gas accumulated.
5. Fresh feed through riser to Stripper to Regenerator: No evidence of fresh feed in Regenerator, (as stated above) and the closed Fresh Feed CV additionally blocked in within
2-4 minutes of safety circuit trip.
6. Torch oil: No evidence found (as stated above) valves were shut also,
7. Catalyst flow reversal: No evidence found (as stated above), SCSV and feed valves closed immediately on safety circuit trip,
8. Gas contamination from sewers: The only open part of the circuit near a sewer was at the removed expander inlet valve, and any gas pulled in at this point would have gone up the
stack under stack draft, not into the dead ended Regenerator. No evidence was found of light material in the sewers.
9. Dust explosion: Catalyst by itself is not combustible, and after consultation it was revealed that the hydrocarbon content of the spent/regenerated catalyst mixture was insufficient to
propagate a dust explosion.
10. Gas generation from coke on the catalyst: Having eliminated from the investigation what was felt to be the most likely contributing factors for the incident, attention was then turned to the possibilities of a gas generation mechanism.
[explosion / pressure release, mechanical equipment failure, damage to equipment,

Lessons

[None Reported]

7581 09 January 1992

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]

8306 January 1992

Source : ICHEME
Location : ,

Injured : 1 **Dead :** 0

Abstract

Gassing incident. An operator, not wearing protective equipment, was overcome by gas while he was performing a gas test. It was found that a nitrogen valve leaked when pressuring up the feed system. The employee did not clearly understand the requirements of the job.
[operator error, management system inadequate, testing]

Lessons

Personnel must abide by instructions given on need to wear respiratory personal protective equipment (PPE), and must ensure that the correct type is used. The hazards of nitrogen, i.e. the rapid effect it can have on the respiratory system, needs regular reminding to personnel.

7872 January 1992

Source : LOSS PREVENTION BULLETIN, 109, 7-10.
Location : ,
Injured : 0 **Dead :** 0

Abstract

A centrifuge feed tank, of 30 m3 capacity, manufactured of rubber lined carbon steel and containing an aqueous slurry of iminobaisacetonitrile (IBA), ruptured due to overpressurisation caused by decomposition reactions during a cleaning operation. Although personnel injuries were minor, there was extensive damage to plant facilities. The cost of plant rebuilding and the business interruption loss amounted to the equivalent of well over £10 million (1992).
On the day of the incident a large build-up of solids was noticed on the internal coil and in the tank headspace, and level instrumentation problems were experienced. Further investigation revealed that the tank vent was blocked and causing the level transmission errors by allowing a vacuum in the tank. Realising that tank clean out was necessary, operational staff stopped transfers into the tank and continued feeding forward to the centrifuge via a side outlet. When the level dropped to this outlet, an attempt to empty the heel of slurry to the centrifuge through the tank bottom was made, but the connection was blocked. The blockage was cleared but the heel was not emptied.
The tank was then filled with process water until the level reached the upper tangent line of the top head, as observed through a sightglass. At 1615 hours circulation was started and steam was turned on to the coil, with the objective of heating the contents to 70 degrees C and then allowing circulation of the hot water for a further 30 minutes. Soon after the steam flow was started the level indicator reading returned to normal, suggesting that the tank vent was at least partially open.
At 1640 hours the tank contents reached 40 degrees C, the upper limit of the installed temperature indicator. Subsequently, temperature measurements were made using a portable surface-reading pyrometer on the circulation pump suction piping. At 1740 the temperature was 55 degrees C and at 1835 it had reached 74 degrees C. Steam was then shut-off from the coil, the circulation was stopped, and an operator tried to empty the tank contents via a gravity drain line.
Draining was unsuccessful due to a blockage in the pipe, a flexible hose to a drain valve on the discharge of the pump. At 1910 hours draining was started via the hose to a floor drain. The operator looked through the tank sightglass to confirm that the level had started to decrease before returning to the control room.
At about 1920 hours two field operators responded to what sounded like a high pressure steam leak in the feed tank area of the plant. Almost immediately they came within view of the tank, at a distance of about 12 metres, it violently ruptured. They were blown backwards and sprayed with a black residue, but returned to the control room unaided and sustained only minor injuries.
The tank overpressurisation was caused by the steam pressure that was generated by the heat of chemical reactions. Initially the IBA started to decompose due to overheating during the cleaning operation. The hydrogen cyanide (HCN) formed then polymerised, significantly augmenting the heat evolution, and provided the heat essential for vessel rupture.
The chemical reactions were initiated by the use of a tank cleaning operation which was unsuitable for the process material, particularly in respect of heating medium, water quality and procedure.
[vent blocked, solids deposition]

Lessons

As a result of the investigation a series of preventative recommendations were made:
1. Reduction in IBA build-up.
Consider the impact of upstream equipment performance and operations on solids build-up in the feed tank.
Consider the installation of nozzle inserts in the feed tank entry and re-circulation piping to minimise splashing and run-down on the head.
Consider operating the feed tank through the bottom outlet only and decide on the need for a side outlet.
2. Reduction in IBA quantity at clean out.
Establish clear guidance on the planning and minimum frequency of feed tank clean outs.
Enssure that cleaning is carried out before the build-up is too large, and only after the feed tank is fully drained.
3. Reduction in temperature to safe level below IBA decomposition.
Enssure that steam is not used for cleaning the feed tank and for unblocking/decontaminating associated piping. Remove steam connections to the coil.
Develop a safe temperature controlled method for cleaning the feed tank and associated piping, provide the necessary facilities to support the method, and establish formal instructions for clean out.
Enssure that steam is not used for cleaning all other vessels where IBA is present and for unblocking/decontaminating associated piping. Provide for temperature controlled cleaning as above. Where steam heating is employed as part of normal operation, evaluate the use of tempered water or gain formal approval of continued use of steam.
4. Reduction in IBA exposure time to heat.
Provide for specified time limits as part of new cleaning procedures.
5. Prevention of contact with alkaline solutions.
Connect only non-basic pH controlled water to the feed tank.
Connect only non-basic pH controlled water to other vessels containing IBA and/or HCN .
6. Improvement in process instrumentation.
Provide an improved temperature measuring system on the feed tank to reliably monitor both normal and clean out temperature ranges.
Provide a high temperature alarm, high temperature interlock, and high rate of temperature rise interlock on the feedtank. Either interlock should discontinue cleaning operations and initiate corrective actions.
Provide a high temperature alarm, high temperature interlock, and high rate of temperature rise interlock on other vessels containing IBA and/or HCN. Either interlock to be discontinue normal operations and cleaning operations, and initiate corrective actions.
Provide an improved level measuring system on the feed tank to operate reliably independently of vessel pressure.
7. Improvement facilities in emergency.
Consider the provision of quench systems to terminate a reaction if started in the feed tank and other vessels containing IBA. Ensure that the feed tank and other vessels containing IBA are provided with vent systems of adequate size which can be monitored and maintained operational.
8. Improvement in process knowledge and documentation.
Enssure that all process documentation is updated to effectively emphasise the reactivity and thermal stability characteristics of IBA. Establish a procedure to review, incorporate and communicate changes or new information impacting process safety at least annually. Educate all personnel on the hazards of IBA reactivity, particularly in respect to the revised operating and cleaning procedures introduced.
9. Additional hazard assessment.
Conduct HAZOP studies on designated IBA/HCN containing vessels throughout the manufacturing process.

5532 January 1992

Source : LLOYDS WEEKLY CASUALTY REPORTS 287/2
Location : Pembroke; Dyfed, UK

Injured : 15 **Dead :** 0

Abstract

Two fireball explosions ripped through a steel vessel striking the workers carrying out maintenance. The two explosions at this catalytic cracker plant were heard several miles away. The accident occured when 30 men were working inside the 40 ft diameter regeneration vessel which had been emptied whilst repairs were being carried out. Production not affected.
[cracking, reaction vessel]

Lessons

[None Reported]

5533 January 1992

Source : LLOYDS WEEKLY CASUALTY REPORTS 287/6; HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1992, AUG.
Location : Grande Isle Area, GULF OF MEXICO

Injured : 0 **Dead :** 0

Abstract

12,000 gallons of oil spilled from a pipeline causing a threat to marshes and beaches. Pipeline ruptured as crews were attempting to clean it. Pipe burst in 3 sections. At height of spill slick was 9 km wide and 24 km long. Impact on 13 km of beaches.
[cleaning]

Lessons

[None Reported]

124001992

Source : ICHEME

Location : ,

Injured : 0 **Dead :** 1

Abstract

A worker was killed during welding operations. A new pipeline was being installed and as a result of heavy rainfall the previous night, the soil was saturated with water. A corrugated metal sheet was placed on the ground for the welder to lie on his back when welding the lower part of the pipe. After being given a new electrode, he was heard to say that he had suffered an electric shock. His head was seen to fall back and the workers around immediately dragged from under the pipes. He was still breathing and was given first aid and then transported to hospital but was pronounced dead on arrival.
An investigation into the incident revealed that the welder's clothing and gloves were wet from the contact with the surroundings and his perspiration.
[electric shock, fatality, safety procedures inadequate]

Lessons

[None Reported]

5529 1992

Source : LOSS PREVENTION BULLETIN, 120, 3-4.
Location : ,

Injured : 0 **Dead :** 0

Abstract

In an organic chemical plant, a hydroextractive distillation column produced hot water at the bottom of the column. This hot water was used to wash out a fertiliser plant where hot work, welding, was taking place. A factory steam and power failure caused organic material to exit from the column base and to be released from the drains of the fertiliser plant where it was ignited by the welding operation.
[steam failure, power supply failure, fire - consequence, chemical - organic]

Lessons

[None Reported]

6856 1992

Source : ICHEME
Location : ,

Injured : 0 **Dead :** 1

Abstract

An employee of a roofing consultant fell through an asbestos sheeting section of a bitumen blending shed while walking on the roof and landed on the concrete floor 7.5m below. The workman was replacing hail-damaged fiberglass sheeting with new sheeting. At the time of the accident, the weather was fine, dry and sunny with moderate winds.
The man died where he fell, a short time later.
An in-house investigation was carried out. All persons involved in the work activity and the incident were interviewed and statements taken.
The immediate cause of the accident was the failure of the contractor to use crawl boards as specified in the Fire and Safety Certificate, and as defined by legislation.
[contractor error, fatality, repair, fall]

Lessons

1. Contractors have a safety plan for the work to be carried out, and it must be adhered to.
2. Ensure that all the company and contractor's supervisory staff and employees understand the Work Permit System.
3. Ensure that company employees understand the responsibility placed on them with regard to enforcing safety requirements.

108571992

Source : ICHEME
Location : ,

Injured : 1 **Dead :** 0

Abstract

An explosion occurred whilst an electrician was testing for central voltage with a hand-held tester. The incident occurred when the tester was connected to a 2400 volt line, it exploded, because the tester was designed for only 600 volts.
The electrician received electrical shock and burns on his hand and fingers, and he required medical treatment. There were also equipment and material losses. Even though the actual losses seem small, the potential existed for life threatening injury, electric shock significant equipment damage, and, even, disruption of process.
The immediate cause was improper use of equipment, a tester designed for 600 volt lines was connected to a 2400 volt line and insufficient knowledge of the potential hazards. Contributing to this incident was a failure to follow procedures to check electrical ratings prior to beginning work.
[damage to equipment, electrical, design or procedure error, safety procedures inadequate, injury]

Lessons

[None Reported]

5515 25 December 1991

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1992, FEB.
Location : , ADRIATIC SEA

Injured : 0 **Dead :** 3

Abstract

An explosion and fire occurred on the cleaning deck tank of a chemical marine tanker. Fatality.
[fire - consequence]

Lessons

[None Reported]

5513 22 December 1991

Source : LLOYDS LIST, 1991, 24 DEC.
Location : Han-nan; Osaka, JAPAN

Injured : 2 **Dead :** 8

Abstract

An explosion occurred in an edible oil tank at an oil processing plant following worker's inspection of an oil crusher. Work on extraction vessel undertaken without regard to safety procedures for purge time, gas test or work permit issue. Fatality.
[reaction vessel, operator error, oil - edible]

Lessons

[None Reported]

1200615 December 1991

Source : ICHEME
Location : , UK

Injured : 0 **Dead :** 0

Abstract

A magnetic flow meter in the instrument workshop, awaiting repair, ruptured with a loud bang and sprayed a foamy acid a distance 5-10 feet for 3-4 minutes. There were no injuries. The instrument had previously been sent to the manufacturer where they had noticed some liquid in the window of the electronic amplifier. A decontamination certificate was requested but they were told that it had been flushed out with water. On loosening the casing there was a hissing sound and acidic material came out. The valve was repacked in polythene and returned to the works by Friday evening and placed in the workshop. The meter ruptured on the Sunday.The cause of the pressure in the casing was hydrochloric acid reacting with the aluminium coil housing causing the generation of hydrogen. The path of the acid into the coil housing was past the gasket at one end of the meter spool piece between the meter flange and the process pipe flange. The acid behind the the PTFE liner of the spool piece and corroded the spool, created a path between liner and spool, and eventually entered the coil housing via the magnet pole pieces. The process ran at 2.5 bar forcing acid into the coil housing.
[hydrochloric acid, maintenance, repair, meter, environmental, spillage, contamination, maintenance inadequate]

Lessons

The following recommendations were made:
1. The wrong gasket was used which did not give enough sealing area and there was poor installation.
2. The flange and liner overlap was not corrected, i.e., 1 inch flange-liner overlap for 1/2 inch flange on vendor supplied unit. This did not match the vendor's certified drawings
3. Formulate a decontamination procedure and issue certificates for all equipment leaving the works.

1049215 November 1991

Source : ICHEME
Location : , FRANCE
Injured : 0 **Dead :** 1

Abstract

A firm of contractors was employed to carry out repair work on the roof of a building. A work permit was prepared, and access was to be via stairs and a platform inside the building. However it was necessary to place boards on the roof to provide safe access from the outside. One worker was sent to fetch these boards. He appears to have taken the boards up to the roof via some unused scaffolding and a ladder outside the building (rather than via the inside stairs). He seems to have fallen through a transparent panel in the roof whilst carrying the boards. He fell about 10 metres and was found dead.
[maintenance, fall, fatality, training inadequate, safety procedures inadequate]

Lessons

Immediate local actions included strengthening the roofs and reinforcing the ban on walking on roofs. The contractor concerned was banned from the site for 6 months.
More fundamental recommendations were:
1. Review of work permit system.
2. Contractors' foremen to be tested for ability to read and understand French.
3. Manuals and training for contractors to be reviewed.
4. A safety competition to be organised.
5. Company to commission an external safety audit.

3694 02 November 1991

Source : ICHEME
Location : ,

Injured : 0 **Dead :** 0

Abstract

A regenerator was being opened for inspection, when flash fires erupted from within. The fires came out of the manways and isolation breaks in the piping circuit, and a pressure wave traveled through the plant. There was mechanical damage to the plant from flash fires and damage to the waste heat boiler, and to downstream piping and supports from the pressure wave. Combustion of methane, carbon monoxide, and hydrogen in the presence of Fluid Catalytic Cracker Unit (FCCU) catalyst caused the accident. The basic cause was insufficient knowledge on how thermocouples behave in steam fluidized and slumped beds of catalyst. This led to the belief that the temperature was low enough to open the vessel safely. In addition, emergency steam was introduced when air from the blower was lost.
There was no normal operational limitation on unloading temperature.
[fire - consequence, damage to equipment, competency lacking]

Lessons

1. If an air blower is lost, sufficient medium must be available to adequately purge the whole bed; use of nitrogen may not be practicable.
2. Delay in introducing cooling air, and if steam enters the regenerator during this period, gives a risk of producing flammable gas.

1847 November 1991

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

Abstract

HF (Hydrogen fluoride) alkylation unit depropanizer charge pump leak, on a refinery.
Following switching of the depropanizer charge pump, an open bleed valve resulted in the release of a HF vapor cloud. One person was injured while attempting to knock down the cloud with water spray. Once ice had thawed, the open bleeder was closed and the electric charge pump was restored to normal operation. The immediate cause was that the pump start-up procedures were not followed and a bleeder valve was left open on pump discharge when pump was activated. Contributing was failure to physically check bleeder valves. Bleeder valve rising stems appeared as closed. Improper personal protective equipment (PPE) used by response person. Activation of remote controlled fire sprays while response personnel in area. Weather-winds rendered turret control station ineffective
Losses $38,000+ (1991) cost of investigation, alky shutdown, material losses and medical treatment.
[design or procedure error, refining, injury, gas / vapour release]

Lessons

Tag, visibly, open bleeder valves. Bull plug all bleeders in Alky Unit. Refresher training along with periodic task observation (JSA) should be conducted to ensure awareness of potential hazards and proper procedures.

5462 November 1991

Source : LLOYDS WEEKLY CASUALTY REPORTS 286/9

Location : Rosiori De Vede, ROMANIA

Injured : 8 **Dead :** 7

Abstract

An explosion in a welding workshop of rolling stock factory was caused when leaking gas was ignited by an electrical switch. Fatality.

Lessons

[None Reported]

5453 25 October 1991

Source : SEDGWICK LOSS CONTROL NEWSLETTER, 4TH QUARTER, 1991.
Location : Jamuna, BANGLADESH

Injured : 0 **Dead :** 0

Abstract

An explosion occurred during commissioning of fertiliser plant.

Lessons

[None Reported]

3530 21 October 1991

Source : ICHEME

Location : ,

Injured : 0   **Dead :** 0

Abstract

An operator was overcome by H2S (hydrogen sulphide) while removing a pressure gauge on an acid gas line.
The cause was failure to wear respiratory protection when opening the line. The basic cause was insufficient motivation or knowledge of potential hazards. Contributing to the accident were the design of the sulfiding line which was prone to plugging, and failure to follow procedures for unplugging lines. In addition there was no work permit system for line breaking.
[design or procedure error, operator error]

Lessons

1. H2S personal monitor programme that addresses training, use, testing, calibration and maintenance should be established.
2. Refresher training along with periodic task observation should be conducted to insure awareness of potential hazards and proper procedures.
3. Testing of the Emergency Response Plan with periodic drills should be conducted to
4. Insure issues such as communication and responder's roles are addressed.
5. Work permit system must be used for all line breaking.

5451 19 October 1991

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1991, NOV.; LLOYDS LIST, 1991, 22 OCT.

Location : Tabasco; Mexico City, MEXICO

Injured : 2 **Dead :** 6

Abstract

Transportation. An explosion occurred when men were repairing a crude oil pipeline near an oilfield. Fatality.

Lessons

[None Reported]

1194415 October 1991

Source : ICHEME
Location : , UK

Injured : 0 **Dead :** 0

Abstract

A non-vital nitrogen reticulation was contaminated with 300 litres of an ethyl aluminium dichloride (EADC)/ heptane mixture. Some of this was released to atmosphere when the EADC reacted with moisture to release hydrogen chloride vapour.The flame arrestor on the vent line of a catalyst blowdown drum had blocked and the drum became pressurised by a vital nitrogen purge. The blockage mechanism was catalyst vapour reacting with water in the flame arrestor to form solid aluminium hydroxide. After the non-vital nitrogen system was isolated for maintenance, the non-vital nitrogen header pressure dropped through leaks. The bursting disc connecting this to the drum pressured in the reverse direction and burst. The pressure pushed liquid up into the non-vital nitrogen system.The vital nitrogen to the drum had a low flow alarm; insufficient attention was paid to this.
[unwanted chemical reaction, gas / vapour release, flow restriction, preparation for maintenance, flame arrestor, additional chemical present, cleaning inadequate]

Lessons

Root cause analysis identified the following:
1. Immediate causes:·
Over-riding/ ignoring safety devices: sounding of low flow alarm was not adequately investigated.
Defective equipment: blockage in flame arrestor.
Inadequate procedures: actions in the event of the alarm sounding not defined.
2. Basic causes:·
Inadequate maintenance: no programme for checking for blockage in the flame arrestor·Inadequate engineering: design of system did not fully take into account the potential for cross contamination of the nitrogen system arising from overpressure of the blowdown drum and failure of the bursting disc.
Inadequate work standards: procedures not adequate to arrive at correct interpretation of the cause of the alarm sounding.Lack of knowledge: causes and consequences of sounding low flow alarm were not appreciated.

5578 15 September 1991

Source : LOSS PREVENTION BULLETIN, 119, 13-14.
Location : Sellafield; Cumbria, UK

Injured : 0 **Dead :** 0

Abstract

This incident in a nuclear reprocessing plant was caused by a design error. The processing at the plant is carried out behind heavy shielding. It converts the radioactive liquid into molten glass which is poured into stainless steel containers where it solidifies. The containers are closed, decontaminated, monitored and transferred to another store. The containers remain highly-radioactive and any penetrations in the shielding such as doors must therefore be protected by multiple safety devices so that they cannot be opened during processing. The incident happened when a container was brought into a control cell for monitoring when the inner and outer protective doors, which should have been interlocked so that only one could be opened in such situations, were both standing open. No one was hurt. Prompt action by a plant operator averted the danger, which could have had serious effects on anyone close to the doors with the container present in the cell.

The original design intent was that one of the two access doors must be closed at all times since the need for entry into the control cell would be extremely infrequent. If it was necessary this would be subject to special arrangements. The two access doors were therefore interlocked by a key exchange system to prevent both doors from opening at the same time.

During installation and early commissioning of the control cell it was established that the robotic swabbing system required maintenance much more frequently than had been anticipated. A modification was therefore undertaken on the door interlock to allow both doors to be opened at the same time so that there would be no barrier to emergency exit. This involved the use of an override key.

Two other interlocks exist which could have prevented the incident from occurring. These were, in effect, process controls built into the software of a programmable logic controller to ensure that events occurred in a particular order. These controls were:

1. A sequence to prevent the in-cell crane from being in a position to lift a container into the control cell while the inner-shield door was open.
2. A sequence to prevent the control cell floor trap door from being opened while the inner-shield door was open. In addition to the key exchange interlock and process controls, two managerial procedures existed to ensure correct operation of the doors during man access. These were:
3. A strict cell-entry procedure and check sheet; and
4. A permit to work procedure.

The investigation into the incident, carried out by the HSE's Nuclear Installations Inspectorate (NII), has established that a design error coupled with modifications subsequently carried out in the interests of safety, had the effect of weakening the effectiveness of the mechanisms controlling and interlocking the doors. This situation went undetected during commissioning operations and NII were not informed of the changes which invalidated part of the safety case for the plant which had originally been made to them. Nevertheless, even after these modifications, sufficient protective systems, both automatic and procedural, remained in place to have prevented a container being brought into the cell with both doors open. The principal remaining automatic safeguard was the interlock which prevented the inner door opening when the crane used to draw up the containers was in position. Due to a series of apparent errors of judgement and procedural shortcomings at the plant during a maintenance operation, this remaining safeguard was deliberately suspended and the possibility of a container being brought in with both doors open was left unguarded.

[design or procedure error, process control & instrumentation]

Lessons

[None Reported]

5423 September 1991

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

Injured : 0 **Dead :** 0

Abstract

Superheater of main boiler sprang a leak during trial run.
[commissioning, heating equipment]

Lessons

[None Reported]

7920 24 July 1991

Source : ICHEME

Location : ,

Injured : 0 **Dead :** 0

Abstract

A transfer pump was hooked up to the water draw off connection of tank A, and the last 4' of product was transferred to tank B (11th July 1991). This was completed on the 17th July. Tank transfer line blinds were inserted on the 18/19th and arrangements were made to start cleaning the tank as soon as the manways were opened. This was the same procedure used for sister tanks B and C in 1990/91.
On the 24th July the manways on the north and south side of tank 68 were removed by fitters, who reported that the tank was open shortly after 11.00 hours.
At approximately 11.30 hours the Area Supervisor arrived at the tank to verify that the tank was open and to assess the amount of material to be removed. As he approached the bundwall to walk around the tank, a fire erupted inside the tank with flames initially shooting out of the manway.
No one else was in the vicinity of the tank at the time and there were no injuries.
The supervisor immediately activated the Emergency Response Team, and they controlled the fire by cooling the tank shell and injecting foam into the open manway on the north side of the tank.
The fire was finally extinguished by 13.30 hours.
The most probable cause of the fire was from pyrophoric scale which ignited residual naphtha in the tank.
Between the tank being emptied on the 17th July and when it was opened on the 24th, there had been extremely high ambient temperatures (95 degrees F), which had most likely dried out the scale in the tank.
The introduction of air by opening the manways and the continuing high ambient temperatures completed the drying out of the scale and led to the fire incident.
[material transfer, fire - consequence, spontaneous combustion, hot weather]

Lessons

The following recommendations were made:
1. Flooding the tank with at least 4' of water immediately after the connection blinds are installed, and maintaining this water level in the tank until the manpower is available to remove the manways and begin cleaning the tank.
2. The cleaning process to begin immediately after the tank is opened.
3. The incident clearly shows how rapidly pyrophoric scale can react following a drying out period and then exposure to the air. Refineries must pay particular attention to this aspect when tanks are known or suspected to have been on 'sour duties' and adjust their procedures accordingly, for example cross flows of air (i.e. opposite manholes open) should be avoided at the early stage, keeping deposits well wetted down with water.

5386 22 July 1991

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]

7914 16 July 1991

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]

1049627 June 1991

Source : ICHEME
Location : , UK

Injured : 1 **Dead :** 0

Abstract

During a plant start-up, a plant superintendent was splashed with ethylene oxide whilst closing a drain valve on a reactor feed system. She developed a large blister and swelling of the foot and ankle. She was not wearing appropriate protective clothing. Although she used a safety shower to remove ethylene oxide from her overalls, she did not strip off contaminated clothing and wash thoroughly until about 1 hour later. She did not inform a First Aider.
The valve had apparently been checked shut (by two people) as part of start-up procedures: however it may have been jammed open (giving the impression of being shut). When an upstream block valve was opened, the leak of ethylene oxide occurred and the supervisor moved quickly to shut the drain valve to minimise the danger of fire/explosion.
[start-up, , isolation inadequate, safety procedures inadequate, reactors and reaction equipment, near miss]

Lessons

The large number of recommended actions included:
1. The blanking/plugging of open vents and drains on ethylene oxide/propylene oxide duty, and a survey for the need to do this on other similar chemicals.
2. Better procedures for valve operation (ie ensuring that valves are not left 'hard open'.
3. Improved awareness of the need for full protective clothing if dealing with loss of containment of ethylene oxide.
4. Reinforcement of the correct decontamination procedures if splashed with ethylene oxide. Also the need to inform First Aider and note in Accident Book.
5. Improved training in the correct action to be taken in the event of an accident.

5338 29 May 1991

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1991, JUL.
Location : Cape Town, SOUTH AFRICA

Injured : 0 **Dead :** 6

Abstract

An explosion occurred in a cargo tank of an oil marine tanker prior to maintenance repairs. Fatality.
[crude oil]

Lessons

[None Reported]

7909 24 May 1991

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.

1049520 May 1991

Source : ICHEME
Location : , UK

Injured : 0 **Dead :** 0

Abstract

During the start-up of a furnace system, about 4 tonnes of quench oil escaped to a local river due to a drain valve being left open.
The valve was piped to an oil/water separator intended to prevent gross contamination of the sewer by light oil. Unfortunately, because the density of quench oil is very similar to that of water, the separator was not effective and the oil went to the river.
The river board was notified, but no significant contamination was found.
[start-up, commissioning, waste water treatment, spill, pollution, operation omitted, design inadequate]

Lessons

The following recommendations were made:
Apart from the immediate measures to stop the escape of quench oil, an investigation was put in hand to prevent recurrence.
A design was to be developed to effect permanent modifications to the separator to handle quench oil.

7906 21 April 1991

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]

5282 12 March 1991

Source : THE VICTORIA ADVOCATE, 1991, 13 MAR.; LLOYDS LIST, 1991, 14 MAR.; THE CHEMICAL ENGINEER, 1991, 11 APR.; VIERA G.A, WADIA, P.H, ETHYLENE OXIDE EXPLOSION PART 1 BACKGROUND AND TECHNICAL FINDINGS, AICHE LOSS PREVENTION SYMPOSIUM, HOUSTON, TEXAS, MAR- APR, 1993; SIMPSON L.L & MINTON P.E, ETHYLENE OXIDE EXPLOSION PART 2 REBOILER SAFETY, AICHE LOSS PREVENTION SYMPOSIUM, HOUSTON, TEXAS, MAR-APR, 1993; REAM, B.C, ET. AL., ETHYLENE OXIDE EXPLOSION PART 3 IRON OXIDE CHEMISTRY, AICHE LOSS PREVENTION SYMPOSIUM, HOUSTON, TEXAS, MAR-APR, 1993; ICHEME;
EUROPEAN CHEMICAL NEWS, 1991, 18 MAR.; CHEMICAL WEEK, 1991, 20 MAR.; CHEMICAL AND ENGINEERING NEWS, 69, (11), 6; CHEMICAL ENGINEER,1993, 8 APR.; VIERA, G.A, LESSONS LEARNED FROM THE ETHYLENE OXIDE EXPLOSION AT SEADRIFT, TEXAS, CHEMICAL ENGINEERING PROGRESS, 1993, 89, AUG., 66-75.

Location : Seadrift; Port Lavaca; Texas, USA

Injured : 25 **Dead :** 1

Abstract

An explosion occurred in an ethylene oxide purification system which destroyed a distillation column. Substantial damage was also suffered by the glycol ether unit and pipe rack. The incident began when minor upsets occurred during start-up, which resulted in a low level in a reboiler. Circulation fell and the upper parts of the reboiler tubes were not covered by liquid. The ethylene oxide vapour in them, above the liquid level, was heated above its boiling point (60 degrees C) to the temperature of the steam (150 degrees C). Then a film of ethylene oxide polymer and iron oxide in the tubes catalysed a previously unknown reaction, a mixture of disproportionation and polymerisation, which raised the vapour temperature to 500 degrees C. This led to an explosive decomposition of ethylene oxide.
[liquid liquid separation, distillation, fatality]

Lessons

To prevent recurrence the following modifications were made;
1. Maintain the base liquid levels at or above the top reboiler tube sheets at all times with automated shut downs just below this point.
2. Avoid condensate backup in reboiler shells
3. Positively purge inert gases from reboiler shells
4. Ensure minimum heating media temperature.

1049103 March 1991

Source : ICHEME
Location : , UK

Injured : 1 **Dead :** 0

Abstract

An operator received serious burns when the bursting disc ruptured on a catalyst pot feeding a polyethylene glycol reaction vessel. The operators feet and lower legs were sprayed with caustic soda/ethylene oxide at about 140 degrees C discharged from a ground level vent. (The pressure rating of the disc was 10 bar, but it apparently failed below its design rating).
Following modifications to the reactor system some time before, it had been realised (late in the modification project) that under certain conditions it would be possible to overpressurise the catalyst pot. Operating procedures had been issued requiring the catalyst pot to be isolated (and valves padlocked) at a certain stage of the process. However these new procedures had not been formally authorised, and did not call for a signature to confirm that the isolation procedure had been completed. Other catalyst pots on the plant did not require these special isolation procedures.
An operator on the previous shift had set the reactor system up, but had failed to isolate the catalyst pot. This omission was noticed by the incoming operator, who was operating valves to remedy the situation when the bursting disc ruptured (although the catalyst pot appears not to have been overpressurised at this time).
[gas / vapour release, bursting disc failure, isolation inadequate, design or procedure error, safety procedures inadequate]

Lessons

The investigation team made the following comments/recommendations:
1. The modification project team failed to identify the possibility of over-pressurising the catalyst pot until just prior to commissioning.
2. The 'locking out' system introduced to overcome the problem was inadequately written up and controlled.
3. The location of the vent from the catalyst pot was not in a safe position.
4. The bursting disc failed below the design rating
5. The operator on the previous shift omitted to carry out the isolation of the catalyst pot
6. The incoming operator felt that corrective actions were within his competence and did not require help from supervision.
Specific changes to the system included eliminating the need to isolate the catalyst pot, either by uprating the current equipment or providing a new uprated pot.
More general recommendations focused on improvements to training, operating procedures and the conduct of technical safety reviews.

5273 03 March 1991

Source : THE CHEMICAL ENGINEER, 1991, 25 APR., & 15 AUG.
Location : Lake Charles; Louisiana, USA

Injured : 12 **Dead :** 5

Abstract

An explosion occurred when one of three catalytic cracker units came back on stream after shutdown for routine maintenance. Steam used at start-up is normally condensed and pumped out of the fractionator into a vessel. The water from the vessel is drained by a valve. This valve was closed and the water could not drain. When hot oil hit the water it vapourised and ruptured the vessel. The hot oil ignited. The relief valve could not cope with the quantity of steam produced. Fatality.
[reactors and reaction equipment, operation inadequate, cracking]

Lessons

[None Reported]

5247 07 February 1991

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1991, APR. ENERGETIC EVENTS, THE NEWSLETTER OF WILFRED BAKER ENGINEERING INC.

Location : Valletta, MALTA

Injured : 0 **Dead :** 0

Abstract

A fire occurred in a forward cargo tank of oil tanker at repair yard.
[marine tanker, fire - consequence]

Lessons

[None Reported]

5246 05 February 1991

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1991, APR.
Location : Off Dubai, UNITED ARAB EMIRATES

Injured : 1   **Dead :** 0

Abstract

A marine transportation incident. Explosion in No. 5 port cargo tank during steam cleaning of toluene on ballast voyage, internals buckled.

Lessons

[None Reported]

5236 19 January 1991

Source : THE WASHINGTON TIMES, 1991, 21 JAN.; CHEMICAL ENGINEER, 1993, 28 JAN.; ICHEME
Location : Ferndale; Washington, USA

Injured : 6 **Dead :** 1

Abstract

During start-up of a processor unit, after repairs, a fire and explosion occurred on this oil refinery. An employee was removing a 24 inch transfer line between the crude heater and the crude fractionation tower. Hydrocarbon vapour escaped and ignited. After investigation it was found that there had been a failure to follow procedure.
[fire - consequence]

Lessons

Here is a case where a seemingly routine job of blind removal became a hazard. Even though existing general maintenance procedures and permit procedures have proved to be adequate, it is critical that each job be examined in totality and any unusual or special circumstances be provided for. Clearly, it is always important to verify that there is minimal pressure on both sides of a blind before removing it. Likewise a job requiring fresh-air permits also would require consideration of adjacent ignition sources such as a furnance.

5226 11 January 1991

Source : SEDGWICK LOSS CONTROL NEWSLETTER, 1ST QUARTER, 1991.
Location : Curacao, NETHERLANDS ANTILLES

Injured : 2 **Dead :** 0

Abstract

During maintenance, fitters were inserting blinds prior to working on fractionating column base pump. Vapours escaped through upstream valve and ignited at fired heater.
[blind/spade/slip plate, fire - consequence, slip plate insertion/removal]

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]

7899 1991

Source : ICHEME
Location : , SWEDEN

Injured : 0 **Dead :** 0

Abstract

A number of the originally open top floating roof tanks had been fitted with aluminium weather protection domes. The space below the dome was well ventilated to prevent vapour buildup.
During maintenance work on one of the gasoline tanks fitted with such a dome, it was discovered that four of the roof pontoon compartments contained product. After emptying the pontoons, cleaners and plant inspectors were allowed to enter these pontoons for cleaning and inspections for leaks.
They were exposed to remaining hydrocarbon vapours and suffered nausea, despite usage of personal protective equipment prescribed for work in the tank, they had to withdraw from the work. They recovered and returned to work the following day.
Subsequent investigation showed that there had been a mistake in applying the entry permit system, in that clearance had been given for the work going on above the roof (under the dome), but nobody had specifically checked the pontoons for any dangers that might be present.
[entry into confined space, personal protective equipment, cleaning, inspection inadequate,]

Lessons

There should be separate entry permission given for entry into the tank, for work between the roof and the dome, and for in the pontoons.

7901 1991

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 hydroflouric 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.

5202 31 December 1990

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1991, MAR.
Location : , GULF OF ADEN

Injured : 25 **Dead :** 2

Abstract

An explosion on oil marine tanker in ballast during repairs to bulkhead between No's. 4 and 5 centre tanks. Substance involved: hydrocarbons. Fatality.

Lessons

[None Reported]

1092324 December 1990

Source : ICHEME
Location : ,

Injured : 0 **Dead :** 0

Abstract

An incident occurred on FCCU at a refinery. The unit, constructed in 1957, had undergone many technological upgrades, with its last maintenance turnaround before the incident in 1987. At the time of the incident it was 46 months through its planned 48-month shutdown interval.
The unit was experiencing catalyst flow problems due to a trip of the slide valves, the usual steps were being taken to re-establish normal operations. At 09.00 hrs., an 8 inch diameter gas oil line failed around its circumference, opening up a 1 inch wide gap, spraying gas oil over an area to the east of the main pump row.
The failed pipe connected the discharge header of the intermediate reflux pumps to the reflux kettle boiler. This boiler had been out of service for the 4 years before the incident, the result of modifications to the heat recovery system, and the failed pipe was under "no flow conditions."
Operators detected the leak, and had begun to isolate it, when a fire broke out at 09.05 hrs. The fire was brought under control by the plant fire brigade by 10.30 hrs., contained to an area of approximately 2,500 sq. ft. The cost of repairs was $850,000 (1990).
[process causes, mechanical equipment failure, fire - consequence]

Lessons

The report stated the following lesson learnt:
1. 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 fully documented.
2. Strict control on quality, storage, handling and identification is required for welding rods.
3. Where plant modifications introduce sections of pipelines with normally "no flow".
4. conditions, this may produce later problems leading to failures.

5199 20 December 1990

Source : LLOYDS LIST, 1990, 22 DEC.
Location : South Riding Point, BAHAMAS

Injured : 3   **Dead :** 2

Abstract

An explosion and fire occurred at a terminal in the manifold pit when personnel were attempting to weld damaged pipelines. Fatality.
[welding, maintenance, fire - consequence]

Lessons

[None Reported]

5188 09 December 1990

Source : LLOYDS LIST, 1990, 10 DEC.
Location : Tomsk, USSR

Injured : 0 **Dead :** 0

Abstract

An explosion occurred in a petrochemical plant during start-up of an ethylene plant.

Lessons

[None Reported]

1075208 December 1990

Source : ICHEME
Location : ,

Injured : 1 **Dead :** 0

Abstract

An explosion occurred during commissioning of an ethylene cracker. The unit, with capacity for 300,000 m.t./year was completely destroyed in the blast. The explosion critically injured an operator and seriously damaged the unit. The explosion occurred in a gas pipeline feeding petrochemicals. Apparently the pipeline was not secure and was probably effected by vibrations from nearby machinery.
[cracking equipment, damage to equipment, injury]

Lessons

[None Reported]

5185 02 December 1990

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1991, FEB.
Location : Ufa, USSR

Injured : 8 **Dead :** 2

Abstract

An explosion and fire occurred in a plant producing high octane gasoline fuel at refinery. Repairs were being carried out at the time to stop a small leak in a heat exchanger element. Fatality.
[fire - consequence, refining]

Lessons

[None Reported]

5168 06 November 1990

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1991, FEB.
Location : Salisbury; Missouri, USA

Injured : 0 **Dead :** 0

Abstract

Transportation. Pipeline ruptured as pig scouring device was being used prior to decommissioning. A spill of 965 tonnes of crude oil occurred to a creek.

Lessons

[None Reported]

5129 23 September 1990

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1990, NOV.
Location : Lisbon, PORTUGAL

Injured : 0   **Dead :** 3

Abstract

Explosion in a marine tanker in drydock for repairs. 3 killed during tank cleaning, second explosion on vessel in 3 months. Substance involved: oil residue. Fatality.

Lessons

[None Reported]

8564 04 September 1990

Source : ICHEME
Location : , UK

Injured : 0   **Dead :** 0

Abstract

An ethylene plant was shutdown due to a sequence of events that occurred over a two-day period.
Two mechanical problems on ethylene cracker caused the shutdown of the plant for repair. During the process of shutting down the plant, a fire occurred on a furnace which was extinguished by site fire service.
[mechanical equipment failure, fire - consequence, plant shutdown, cracking]

Lessons

[None Reported]

4655 24 August 1990

Source : ICHEME
Location : , USA

Injured : 100 **Dead :** 0

Abstract

An explosion and fire at a chemical factory injured more than 100 people and polluted the drinking water of the city. It occurred at a newly-constructed factory producing phenol and acetone as it was preparing to start operations. The blaze lasted more than 5 hours. Phenol from the factory seeped into the river, the source of the city's drinking water along with foam from dozens of fire engines.
[fire - consequence, pollution, processing, environmental, start-up, spill, injury]

Lessons

[None Reported]

5100 23 August 1990

Source : LLOYDS LIST, 1990, 30 AUG.
Location : Ufa; Urals; Bashkir Republic, USSR

Injured : 110 **Dead :** 0

Abstract

An explosion occurred during a factory start-up which led to fire lasting 5 hours. Phenol seeped into local river causing pollution of local drinking water supplies.
[fire - consequence, spill]

Lessons

[None Reported]

5082 06 August 1990

Source : LLOYDS LIST, 1990, 9 AUG.
Location : Zilina, CZECHOSLOVAKIA

Injured : 12 **Dead :** 1

Abstract

Explosion at chemical works during maintenance repair work. Fatality.

Lessons

[None Reported]

5074 31 July 1990

Source : LOSS PREVENTION BULLETIN, 118, 14.
Location : Essex, UK

Injured : 0 **Dead :** 0

Abstract

A double compartment stainless steel road tanker was steam cleaned than loaded with fermentation ethanol. After unloading, the driver noticed a blue and yellow mark on the bottom of the tanker barrel below the manway. The matter was investigated and the most likely explanation for this incident was as follows:
The road tanker became charged with static operation (the driver carried out the steam cleaning and says that the tanker was not earthed during this operation). The road tanker was still highly charged when it arrived at the loading bay and it seems likely that the flexible loading hose was lowered into the tanker barrel before the earthing clamp was attached to the tanker. This could have led to a static discharge occurring between the bottom of the tanker barrel and the end of the flexible hose. It seems likely that the small amount of ethanol drainings left in the hose from a previous filling operation were ignited by the static discharge and caused the discoloration of the stainless steel tanker barrel.
[near miss]

Lessons

1. That tankers should always be earthed during steam cleaning operations.
2. That tankers should be earthed immediately on entering a flammable liquids loading bay prior to carrying out any other operation.

5068 26 July 1990

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 190, SEP.
Location : Mobile; Alabama, USA

Injured : 3 **Dead :** 0

Abstract

A river transportation incident. A fire occurred when two 570 litre diesel tanks onboard a grain river barge suffered explosions during repair work. Blast launched tanks into a river where spillage occurred.
[fire - consequence]

Lessons

[None Reported]

5063 24 July 1990

Source : THE SUN BALTIMORE, 1990, 25 JUL.
Location : Balto City; Baltimore; Maryland, USA

Injured : 0   **Dead :** 0

Abstract

A road transportation incident. A spill from a 55 gallon drum leaked foul smelling solvent onto road causing traffic jam while cleaning operations were carried out.
[drums]

Lessons

[None Reported]

5056 20 July 1990

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

Injured : 0 **Dead :** 0

Abstract

Leak in high pressure hydrogen storage tank during first start-up of plant. Explosion after plant cleared.
[pressurised tank]

Lessons

[None Reported]

5057 19 July 1990

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

Location : Cincinnati; Ohio, USA

Injured : 63+ **Dead :** 2

Abstract

An explosion and fire occurred at a coatings plant killing one worker, injuring approximately 70 other people and causing considerable damage to the neighbourhood. A reactor in the resin building was being cleaned with a solvent when a ruptured valve or pressure seal failure released the vapour cloud into the building. The exact cause of ignition is still unknown but could be due to the area being near a boiler room where gas generators, electrical switches could have created a spark. There was a build-up of pressure in the reaction as a result of the improper setting of a valve. The company fined $1.7 million for 133 safety and health violation.
The company criticised for not equipping kettles in the plant with alarm devices for excessive temperature and pressure, not furnishing kettles with automatic high temperatures and high-pressure shutdown devices, not requiring that an operator be present during kettle use and not having written instructions for kettle cleaning.
[unidentified cause, reactors and reaction equipment, gas / vapour release, damage to equipment, fatality, injury]

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]

5027 20 June 1990

Source : LLOYDS LIST, 1990, 11 JUL.
Location : Calumet; Louisiana, USA

Injured : 0 **Dead :** 0

Abstract

An explosion caused plant to close for 4 weeks. Blast damaged electrical systems when operators restarted a recompressor after a routine maintenance shutdown. Substance involved: natural gas.
[start-up, damage to equipment]

Lessons

[None Reported]

1081103 June 1990

Source : ICHEME

Location : , GERMANY

Injured : 0 **Dead :** 0

Abstract

During a routine test of an instrument powersupply, a short voltage interruption caused a total breakdown of the cracker.
The task of the instrument powersupply system is the interruptless supply of important electrical and electronic systems for the operating of the cracker.
[testing, cracking equipment, plant / property / equipment, electrical equipment failure]

Lessons

[None Reported]

1099103 June 1990

Source : ICHEME
Location : , GERMANY

Injured : 0 **Dead :** 0

Abstract

A short voltage interruption during a routine test of an instrument power supply caused the total shutdown of a cracker unit. As part of a routine test backup power supply 1 was disconnected from the instrument supply busbar, leaving only backup supply 2 running in the motor mode. A 160A fuse in the S phase of a machine failed, so operating as a 2 phase engine. This led to a voltage drop in the R and T phases and caused the backup supply to switch to generator mode, switching in the diesel generators. This resulted in the whole power supply system being disconnected. The power supply system also provided services to several other production units. The system started operating in 1969 and since the start of operations there had been only one other breakdown. This was related to a malfunction of the diesel backup power supply system.
[testing, reactors and reaction equipment, electrical equipment failure, plant / property / equipment, design or procedure error]

Lessons

The fuse had been wrongly sized. The instrument power supply system will now have a battery buffered, non-interruptible electronic AC and DC supply. The existing diesel back up supply will be maintained to take over from the battery backed supplies in the event of a long outage.

4980 11 May 1990

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1990, AUG.
Location : Houston Ship Channel, USA

Injured : 0   **Dead :** 0

Abstract

A marine transportation incident. Cargo residues spilled from a marine tanker moored for tank cleaning and ignited by a welding torch from ship repairers at an adjacent birth.
[fire - consequence]

Lessons

[None Reported]

4962 15 April 1990

Source : LLOYDS LIST, 1990, 28 APR.; THE SUN BALTIMORE, 1990, 16 APR.
Location : Tampa; Florida, USA

Injured : 0 **Dead :** 1

Abstract

A fire following an explosion at a vapour recovery system at a gasoline storage terminal while being repaired. Fatality.
[fire - consequence]

Lessons

[None Reported]

1194512 April 1990

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 retorqueing 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.

7608 09 April 1990

Source : LOSS PREVENTION BULLETIN, 129, 8.

Location : ,

Injured : 0   **Dead :** 0

Abstract

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

Lessons

[None Reported]

365   15 March 1990

Source : ICHEME
Location : ,
Injured : 2   **Dead :** 4

Abstract

A marine transport incident. A major explosion and a flash fire occurred in the bow section of a 105,000t marine supertanker in a shipyard. Four men were killed and two injured.
[fatality, injury]

Lessons

1. Strict control of hot work and use of flammable materials is essential to avoid accidents.
2. Safe means of emergency escape from work area should be provided.

Ship board repairs, when alongside refinery jetties (docks), must only be allowed subject to site and Maritime Code restrictions - e.g., International Oil Tanker Terminal Safety Guide (IOTTSG), national and harbor regulations, etc.

4923 13 March 1990

Source : SEDGWICK LOSS CONTROL NEWSLETTER, 1ST QUARTER, 1990.
Location : Brent B; North Sea, UK SECTOR

Injured : 0   **Dead :** 0

Abstract

Release of gas from the compression module caused offshore platform shutdown.

Lessons

[None Reported]

4908 March 1990

Source : LLOYDS WEEKLY CASUALTY REPORTS 280/1
Location : Mutare, ZIMBABWE

Injured : 0 **Dead :** 0

Abstract

An explosion occurred when testing a new pulp storage tank. Tank filled with water when it ruptured damaging property and destroying tank. Test carried out with water as company believed that tank was not designed properly.
[design fault, storage tanks]

Lessons

[None Reported]

1061105 February 1990

Source : ICHEME
Location : , UK

Injured : 0 **Dead :** 0

Abstract

A depropaniser heat exchanger had been cleaned. The polymer that was removed was put into drums labelled "Aluminium Chloride". The cleaning team asked the shift manager to arrange for disposal of the drums.
However, there was a delay of several months in removing the drums. They were left on a gravelled area close to passing traffic.
The situation was brought to the attention of the shift manager when an instrument supervisor noticed that one of the drums was pierced.
It was realised that events of this kind could lead to serious consequences if the waste material could react with remains of the substance left in an uncleaned drum or if the waste material were itself hazardous.
[near miss, storage, design or procedure error]

Lessons

The following recommendations were made:
1. A procedure is needed to cover all aspects of depropaniser cleaning.
2. All drums must be correctly labelled.
3. Provide labels for all materials put in drums.
4. Drums awaiting disposal to be stored in a cordoned off area.
5. Expedite the removal of drums. They should be removed within one week after completion of the cleaning operation.
6. Drums supplied to the cleaning team must be clean.

4876 01 February 1990

Source : SEDGWICK LOSS CONTROL NEWSLETTER, 1ST QUARTER, 1990
Location : Porvoo, FINLAND

Injured : 0 **Dead :** 0

Abstract

An explosion occured in a bitumen storage tank as a result of repair work.
[storage tanks]

Lessons

[None Reported]

4869 29 January 1990

Source : SEDGWICK LOSS CONTROL NEWSLETTER, FIRST QUARTER 1990.
Location : Eider; North Sea, UK SECTOR

Injured : 0 **Dead :** 0

Abstract

A gas leak on an offshore platform caused shutdown of an installation but strong winds dispersed the gas.

Lessons

[None Reported]

9314 23 January 1990

Source : ICHEME

Location : , FRANCE

Injured : 0 **Dead :** 0

Abstract

A cloud of steam and dust was seen immediately after a loud bang. In the prepoly area, the reactor was in process of being steam cleaned.
The operator who went out on the plant saw that the manway lid had been blown off the reactor, three of the four bolding clamps were blown off the reactor, three of the four holding clamps were broken and that a jet of stream had broken the sheeting on the prepoly roof. The spray water system and hydrogen analyser lines were damaged.
[cleaning, explosion, reactors and reaction equipment, damage to equipment]

Lessons

[None Reported]

4862 23 January 1990

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1990, MAY.
Location : Rotterdam, NETHERLANDS

Injured : 0   **Dead :** 4

Abstract

An explosion and fire killed contractors in centre tank of a marine tanker. Leaking heating and hydraulic lines under repair. Fatality.
[fire - consequence]

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]

4842 13 January 1990

Source : ICHEME
Location : ,

Injured : 0 **Dead :** 3

Abstract

A fire occurred in a tank at refinery storage. Source of ignition was welding. Fatality.
[design or procedure error, fire - consequence]

Lessons

[None Reported]

4824 1990

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.

4821 1990

Source : CONCAWE REPORT 4/91
Location : , WESTERN EUROPE

Injured : 0 **Dead :** 0

Abstract

Transportation. A 105 cubic metre gross spillage occurred during a pipeline stopple operation. In the course of the stoppling procedure a 1 inch drain valve on one of the sandwich valves was knocked and broken. Two hours pipeline shutdown was required to stop the leak by repairing the damage. The spillage was of light product in a rural area with porous ground which caused no significant pollution problems.
[spill]

Lessons

[None Reported]

123951990

Source : ICHEME

Location : ,

Injured : 0 **Dead :** 0

Abstract

A near miss incident occuured on a platformer. The incident occurred when using the nitrogen main to purge out pipework on the regeneration section, operators noticed that the hose was icing up and immediately stopped the operation.
Investigation intothe incident revealed that the nitrogen system was contaminated with an LPG type material.
The operators quickly traced the source of contamination to a nitrogen purge connection on the suction side of a compressor in the unit normally operating at 12 bar(ga).
Further investigation into the purge connection found that the spectacle blind was in the open position and that one valve was still in the open position and the closed valve was passing.
[purging, contamination, mechanical equipment failure]

Lessons

[None Reported]

4825 1990

Source : CHEMISTRY IN BRITAIN, 1993, JUN.
Location : Ellesmere Port, UK

Injured : 1 **Dead :** 0

Abstract

A contractor was using acetone for the repair of the lining of vessel when it ignited possibly from portable light bulb.
[fire - consequence]

Lessons

[None Reported]

123961990

Source : ICHEME
Location : ,

Injured : 0 **Dead :** 0

Abstract

A near miss incident. As part of the routine start-up procedure for a gas-treating plant, the sulfinol section was subjected to a leak test under nitrogen pressure.
After passing this test satisfactorily, the section was being filled with sulfinol solution while another section of the gas-treating facilities was prepared for inerting and pressure testing.
Before being connected between the nitrogen utility points and the process piping, the hoses were routinely blown to atmosphere to ensure that they contained no foreign matter. In this instance, however, the operators noticed that the nitrogen system contained sulfinol solution.
Investigation showed that on the permanent nitrogen connection to the sulfinol system:
1. A manual valve had not been closed;
2. A spectacle blind was not turned to the closed position;
3. The internals of a non-return valve were not installed.
[design or procedure error]

Lessons

[None Reported]

123921990

Source : ICHEME
Location : ,

Injured : 1 **Dead :** 0

Abstract

At the end of a maintenance stop, catalyst was refilled into a reactor vessel. No special breathing equipment was needed as the reactor was filled with air.
At the end of the working day, the job was not yet finished; the crew covered the manhole with a metal sheet, returned the work permit to the control room and left the site.
Next day, the men returned to the reactor to continue the filling operation. The supervisor went to the control room to collect the work permit. In the meantime, the rest of the crew removed the metal cover from the manhole and one of them donned his harness, to be lowered into the reactor by a crane.
Just as the man entering the vessel was disappearing through the manhole, the crane driver noticed that he suddenly collapsed. The man was pulled out immediately, and after receiving medical treatment he recovered completely.
[reactors and reaction equipment, asphyxiation, near miss, permit to work system inadequate, entry into confined space, injury]

Lessons

4806 24 December 1989

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]

1082818 October 1989

Source : ICHEME
Location : , UK

Injured : 0 **Dead :** 0

Abstract

A C3 hydrogenation reactor was being checked for deslip-plating when at the top inlet slip-plate was found to have been left out and a slip-plate had been inserted in the bottoms route between the vessel and its low point drain valve. The reactor inlet valve had passed and the vessel was full of C3s. All other process side slip-plates (including relief valves) had been left in.
The following conclusion was made:
The problem arose because the top bed of the reactor was fitted and slip-plates were neither removed from the vessel nor fitted in the inlet line. At this stage the reactor was left in a very unsafe state and there was no documentation of the implications.
[reactors and reaction equipment, inspection, operation inadequate, plant / property / equipment]

Lessons

[None Reported]

4744 12 October 1989

Source : LLOYDS LIST, 1989, 24 OCT.; HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1990, MAR.
Location : Tobolsk, USSR

Injured : 0 **Dead :** 0

Abstract

During the high pressure water test of a gas pipeline to 3 times normal pressure, the pipeline ruptured and released a large quantity of gas which was then burnt off. Many evacuated for controlled explosion.
[testing, overpressurisation, evacuation]

Lessons

[None Reported]

4725 26 September 1989

Source : LLOYDS LIST, 1989, 27 SEP.; HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1989, NOV.
Location : Karachi, PAKISTAN

Injured : 0 **Dead :** 0

Abstract

A fire occurred during welding work on new gasoline pipeline.
[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 : Aspropyrogos, 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]

1052602 August 1989

Source : ICHEME
Location : , UK

Injured : 2 **Dead :** 0

Abstract

A mechanic received serious burns to his arms and legs when an explosion occurred at a transport depot.
The seriously injured mechanic was carrying out welding operations on an aluminium trailer when the explosion occurred.
[injury]

Lessons

[None Reported]

4664 August 1989

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1989, NOV.
Location : Wymondham; Suffolk, UK

Injured : 0   **Dead :** 1

Abstract

Worker suffered 90% burns while welding in paint vat which was empty but retained sludge and puddles of paint stripper/solvents. Fatality.

Lessons

[None Reported]

3872 11 July 1989

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

Abstract

Failure of a tank roof. The incident occurred during a temporary shutdown of the distillate hydrotreater.
The crude oil distillation units main column overhead product was pumped to a gasoline storage tank via the straight run gasoline rundown line. When restarting the distillate hydrotreater, a valve in the start-up line to the high pressure separator branching off the crude oil distillation unit main column overhead product line was opened before the line to tankage was closed.
Hydrogen gas at a pressure of 30 bars consequently reached the tank, overpressured it and caused substantial damage. The tank shell was lifted upwards by approximately 110mm.
No one was injured in the incident and there was no leakage of liquid product.
[overpressurisation, damage to equipment]

Lessons

The reports recommendations were:
Consider training of operators for routes by which storage tanks can erroneously receive unwanted pressure and ensure that facilities and/or procedures procedures prohibit this as far as possible.
A second important lesson to be learnt from this incident is that the pressure of volatile hydrocarbons must always be considered as a possibility in any refinery storage tanks until shown to be otherwise. This is very important when considering dipping and sampling procedures (e.g., adequate relaxation time to dissipate static charge), and when giving clearance for tank entry and repair work.

4636 07 July 1989

Source : EASTERN DAILY PRESS, 1989, 9 JUL.
Location : Wymondhman, UK

Injured : 0 **Dead :** 1

Abstract

Welding was taking place in a vat where there were puddles of flammable material, sodium hydroxide and methylene chloride. Fatality.

Lessons

[None Reported]

4633 06 July 1989

Source : LLOYDS LIST, 1989, 8 JUL.; HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1989, AUG.
Location : , UK

Injured : 0 **Dead :** 0

Abstract

A fire in a fuel line at the site power station caused damage to an instrument cable which lead to total shutdown of the site. Lack of steam meant flaring was very smoky. Local residents complained.
Recommissioning of the cracker and downsteam plant took two weeks. Flaring (a necessary safety control during start-up and shutdown) was needed. The associated use of steam (to reduce the smoky appearance of the emissions) was also noisy.
[fire - consequence, damage to equipment, plant shutdown, flare system, cracking equipment, power plant, gas / vapour release, power supply 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.
The company placed an advert in the local paper explaining the situation and apologising to the local community.

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]

4578 12 May 1989

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

Location : Brenner Pass, AUSTRIA

Injured : 7 **Dead :** 2

Abstract

A gas cylinder explosion during repairs caused polyurethane lining to ignite. Fatality.
[fire - consequence]

Lessons

[None Reported]

12123May 1989

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.

4560 26 April 1989

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1989, JUN.
Location : St. Fergus, UK

Injured : 0 **Dead :** 0

Abstract

Plant shutdown after a routine inspection showed serious equipment problems at a gas separation plant.

Lessons

[None Reported]

4555 25 April 1989

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1989, JUN.
Location : Bass Straits, AUSTRALIA

Injured : 3 **Dead :** 0

Abstract

A fire occurred near a leaking oil pump which was undergoing repair. Offshore platform shutdown.
[plant shutdown, fire - consequence, spill]

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]

4525 April 1989

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]

4516 25 March 1989

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

Location : Monrovia, LIBERIA

Injured : 4 **Dead :** 3

Abstract

Welding work on deck piping of a marine tanker just after discharge of gasoline. Illegal hotwork. Fatality.
[operator error, hot surface]

Lessons

[None Reported]

4490 06 March 1989

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.

4477 23 February 1989

Source : EUROPEAN CHEMICAL NEWS, 1989, 6 MAR.; HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1989, MAY.
Location : Grand-quevilly; Rouen, FRANCE

Injured : 0 **Dead :** 2

Abstract

Two workers were killed in an explosion and fire on an ammonia unit. The workers were part part of a maintenance team belonging to an out side company. The incident occurred during inspection work on a valve of the ammonia synthesis circuit of the unit. The 330,000 tonne/year plant was closed pending an inquiry into the cause of the incident.
The incident was contained within the site's safety zone and there was no danger to the environment.
[inspection, fatality, fire - consequence]

Lessons

[None Reported]

1013304 February 1989

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.

1258628 January 1989

Source : DUST EXPLOSIONS IN THE PROCESS INDUSTRIES. ECKHOFF.
Location : Malmo, SWEDEN

Injured : 0   **Dead :** 0

Abstract

Production had been stopped for some hours when an explosion occurred in a silo containing pelletised wheat bran. The roof of the 36 metre high by 20 square metres cross section silo was blown off. Carbon dioxide was pumped into the silo from the top and nitrogen from below to extinguish the smouldering material.
[silo/hopper, shutdown, design or procedure error]

Lessons

A large quantity of gas is necessary to extinguish smouldering material in a silo, which may not withstand the additional weight of water if used.

Emergency Response
Some 6000 kg of carbon dioxide was pumped from the top and several tonnes of nitrogen injected from below to extinguish the smouldering material.

3962 1989

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 JOIN RESEARCH CENTRE, 1991, ISBN 9282622894.

Location : ,

Injured : 0 **Dead :** 2

Abstract

A minor leak had been detected in a flange on the piping of the ammonia synthesis loop. On-stream repair by a specialised external contractor had been attempted (fabrication of a special bracket for the flange to hold filling material). During the repair some stud bolts broke. The escaping mixture exploded, killing 2 workers. Piping of the plant was damaged and a prolonged shut-down was necessary. Investigations showed that the flange stud bolts had been replaced with others made of a material not equivalent to the originally specified one, and that the maintenance company had not taken into account the overpressure that was to be created by the injection of the filling material. Fatality.
[explosion, damage to equipment, operator error]

Lessons

1. Compilation of written maintenance procedures with emphasis on safety issues.
2. Establishment of the sequence of operations to be followed during repair of such valves.

2266 1989

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 JOIN RESEARCH CENTRE, 1991, ISBN 9282622894.

Location : ,

Injured : 8 **Dead :** 0

Abstract

A marine transport incident. During gasoline loading of a motorship at the refinery pier, the ship responsible mechanic requested the stopping of the loading to proceed with necessary repairs. 20 minutes after the interruption of loading a strong explosion occurred at the ship machinery shop, followed by a fire. The refinery fire fighting crew was mobilised within a few minutes, while 4 injured members of the ship's crew were transported to the hospital.
The ship was disconnected from the loading hoses and was transferred away from the pier (the fire did not spread to the refinery loading installations). Then fire fighting activities were undertaken using special fire fighting tags (water foam) supported by a crew from the special national fire fighting services. After 6 hours the fire was almost under control and the ship was about 1.5 km away from the refinery installation on the pier. However, the next morning the fire reached the first tank and spread with repeated explosions. 4 firemen were injured. Navigation in the gulf was interrupted and fire fighters tried to prevent the fire from spreading to nearby anchored ships. They tried to avoid environmental pollution by using a 400 m long boom. Finally the ship sank 48 hours after the first explosion.
[fire - consequence, sinking, environmental, damage to equipment, injury]

Lessons

1. The upgrading of pier fire fighting system.
2. The crew of ships and especially tankers must be well trained in fire prevention and fire fighting. Fire fighting means for this type of tanker must be improved.
3. Fire fighting tags must be equipped with large quantities of a foam compound.

3836 1989

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 JOIN 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 workpermit 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.

123891989

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

Abstract

An explosion occurred during hot work operations on a pipeline system.
In preparation for installing a valve in a 12-inch branch of a crude oil line, the system had been isolated on valves from live system, water washed to two open ends and cold cut in two places.
An airbag was fitted in the branch as a final safeguard against hydrocarbon vapours reaching the point where the flanges were to be welded on.
A stand-by authorised gas tester was stipulated on the hot work permit issued for welding flanges on the branch line.
Shortly after the flange had been made up, gas escaped from around the airbag and ignited on the welder's torch causing an explosion. The welder suffered burns to his body.
An investigation into the incident revealed that the piping was being bolted-up and became pressurised before the welding work was complete.
It was found that the airbag had been sealed with a piece of wire instead of a clip and had deflated; the seal with the pipewall had been lost.
[welding, leak, hot surface, design or procedure error, injury]

Lessons

[None Reported]

123871989

Source : ICHEME
Location : ,

Injured : 2 **Dead :** 0

Abstract

An explosion and fire occurred at a plant during the recommissioning after bundle retubing of a kerosene reboiler in a crude distillation unit. The incident caused about £1 million (1989) worth of damage.
The kerosene reboiler had been out of service fore retubing. The incident occurred after re-installation of the tube bundle and hydrotesting of both the shell and tube sides.
The reboiler was despaded and recommissioning started by admitting kerosene at 148 degrees C to the tube side. Subsequently the shell side was backfilled from the outlet with hot long residue above its auto-ignition temperature.
Approximately 15 to 20 minutes after filling the shell side, the long residue inlet block valve was very slowly opened to start the long residue circulation. The progress of this operation was monitored by checking the warm-up of the uninsulated long residue inlet nozzle by hand feeling, using a ladder to reach it.
Approximately 5 minutes after the start of opening of the long residue inlet block valve, when it was 2 to 3 turns open, a sharp bang occurred. This was immediately followed by an outbreak of fire and heavy smoke development. Within a few minutes the unit was shutdown, using the emergency shutdown switches. The operator who had been checking the warm-up of the long residue inlet nozzle suffered first-degree burns. Both the operator and the supervisor, who was also in the area, were splashed with long residue.
The fire fed by leaking kerosene and long residue, took one and a quarter hours to extinguish.
Inspection of the reboiler after the incident clearly pointed to an explosive pressure increase in the shell as the cause of the product release and fire.
An investigation concluded that a hydrocarbon vapour explosion was more likely the cause of the pressure surge and subsequent leakage and fire.
[fire - consequence, high pressure, damage to equipment, injury]

Lessons

[None Reported]

123861989

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

Abstract

A worker was injured in a ball valve incident.
The incident occurred when a ball valve in liquid SO_2 (sulphur dioxide) service was removed from the plant.
The valve was cleaned and transported to the stores in its open position.
In storehouse the valve was opened and a jet of liquid SO_2 under pressure was discharged from the valve, hitting the worker in the face and eyes.
The incident occurred due to the valve's construction, a cavity exists between the body and ball. This cavity can contain residual material. In this case the valve was cleaned and transported in the open position with liquid SO_2 at relatively high pressure (ambient temperature) trapped in the cavity.
[cleaning, transportation, design or procedure error, injury]

Lessons

The report stated the following lessons learned:
The incident occurred with the ball valve, left in the open position.
Had the valve been removed and left in the closed position, a similar accident could have happened.
Leaving the valve in the half opened position during removal from the plant and subsequent cleaning can prevent recurrence.
In this position there is no locked-in cavity, and so the valve, including the cavity, can be purged and cleaned thoroughly.

8330 1989

Source : ICHEME
Location : ,

Injured : 0 **Dead :** 0

Abstract

Cracked Fluid Catalytic Cracker Unit (FCCU) reactor vapour line at a refining company. During start-up of the FCCU, and shortly after the introduction of feed, vapour was noticed to be coming from the insulation around the reactor vapour pipeline and support hanger. There was product loss and damage to equipment. Failure of the line was due to thermal fatigue. A contributing factor was inadequate insulation that allowed plates to remain cool and not expand with the line, acting as a restraint. Insufficient maintenance of insulation around the line in recent years was the cause of this incident, in addition to inadequate design of support section.
[maintenance inadequate, design inadequate, fluid cracker]

Lessons

Particular care is needed in regular inspection and necessary repair of plant which is the subject of significant temperature cycles with possibilities of thermal fatigue.

123901989

Source : ICHEME
Location : ,

Injured : 0 **Dead :** 1

Abstract

A worker was killed whilst welding a flange when an explosion and fire occurred. A gas test was carried out several hours before the incident that showed no gas mixture present at the welding location.
An investigation in to the incident showed that the quick-stop sewer plug used for the job was completely unsuitable, and had broken parts at the edge and that the inflatable ring was damaged.
An amount of crude had been left in the 32-inch line, (which was the reason why the quick-stop had been installed) and an explosive mixture could have been formed behind the plug.
[fire - consequence, design or procedure error, fatality]

Lessons

[None Reported]

109131989

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 as 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.

8777 1989

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 JOIN RESEARCH CENTRE, 1991, ISBN 9282622894.

Location : ,

Injured : 0 **Dead :** 0

Abstract

A lightning stroke caused voltage fluctuation in the control unit of the nitric acid plant which, in turn, led to the shut-down of the plant. Due to incomplete depressurisation of the unit during repeated start-up trials, a back flow of process gas containing nitrogen oxides occurred in the suction line of the secondary air compressor, resulting in nitrogen oxide emission within the plant at ground level.
After this accident, it has been decided that a one-way valve will be fitted to the suction line of the compressor to prevent unintentional backflow of the process gas to the environment.
[gas / vapour release]

Lessons

[None Reported]

8761 1989

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 JOIN RESEARCH CENTRE, 1991, ISBN 9282622894.

Location : ,

Injured : 3 **Dead :** 4

Abstract

Hydrogen escaped when a venting valve was opened for inspection of a cap. The escaped hydrogen caught fire, which resulted in the death of 4 persons, injuries to another 3 and damage to the plant. The causes of the accident are under investigation. A similar accident seems to have taken place in the same installation 5 years ago. A safety study of the facility has been requested before the start-up of the plant. Fatality.
[fire - consequence, leak, injury]

Lessons

[None Reported]

8774 1989

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 JOIN RESEARCH CENTRE, 1991, ISBN 9282622894.

Location : ,

Injured : 0 **Dead :** 0

Abstract

A storage tank for aqueous ammonia solutions was up for maintenance (replacement of the bottom part). After mechanical completion of the replacement work, a trial had been undertaken to fill the tank up, but overpressure was registered and the flange connecting the feeding line to the tank leaked. The problems were reported to the maintenance department, the flange connection was repaired and the pressure relief line checked, the trial to fill the tank was not reported to the shift supervisor. The next day a safe work-permit was issued to the mechanics to disconnect the piping associated with this tank for further repair. The repair work proceeded and during the grinding of a disconnected pipe, a mechanic noticed a whistling sound and hid, together with the other mechanics, behind a concrete tankfarm wall. Soon afterwards the tank exploded. The top of the tank was blown over an adjacent building and the office buildings, and bumped into another office building (approximately 60 m away), which was empty. The explosion is believed to be caused by the ignition of ammonia vapour caused by the repair works. Also the pressure relief line failed to perform as expected.
[storage tanks, overpressurisation, maintenance inadequate, damage to equipment, design inadequate]

Lessons

1. Improvement of procedures.
2. Improvement of communication.
3. Improvement of training of personnel.
4. Re-design of vapour relief lines.

8072 12 December 1988

Source : ICHEME

Location : , GERMANY

Injured : 3 **Dead :** 0

Abstract

Three men inside a reactor vessel experienced breathing difficulties. They had inhaled vapour containing 1,1,1-trichloroethane as a result of using a cleaning agent in a poorly ventilated confined space. The three men were taken to hospital for observation and tests. They were discharged on the day following the incident and returned to work fully recovered two days later.
The incident resulted from using a hazardous cleaning solvent in an inadequately ventilated confined space. The solvent contained 1,1,1-trichloroethane a harmful substance which should not be inhaled. In addition to the air flow being inadequate to effectively dilute the solvent vapours, the direction of ventilation was wrong. For this heavier than air vapour the air flow should have been from the top downwards.
[entry into confined space, asphyxiation, cleaning procedure incorrect]

Lessons

1. No cleaning agents containing solvents should be used in restricted spaces - such as tankers, columns, reactors, large pipelines etc. For the weld testing, water should be used instead of solvent based agents. Investigations should take place as to whether a harmless test process could be used instead of the dye disclosure method.
2. When using a solvent based cleaner, adequate air supply and ventilation should be ensured. If the fumes are heavier than air, they should be extracted from below.
3. If the ventilation is insufficient, independent breathing apparatus must be used.
4. If possible, work should not be carried out on a vessel at the same time as work in the vessel. If this is unavoidable, the persons working inside should be informed of the nature and scope of work being carried out on the outside. We should also check that safety measures governing work in tanks are adequate. A special co-ordinator is required for this.
5. On medical recommendation, various medications should be kept on site, such as Folon A 200 mg injection ampules and Auxilosan measured dose aerosols.
6. All jobs should be carefully planned from beginning to end. Deviations from the plan should require formal authorisation at a high level. Existing work permits should be withdrawn and new permits issued to cover the change in scope. There is a tendency to take less care towards the end of a job as the pressure to recommission plant and equipment increases.
7. The site policy on the use of solvents (and other hazardous chemicals) should be made absolutely clear to everyone who could be affected by their use. Inherent methods of enforcement of the policy should be devised. e.g. if particular solvent based cleaners are not allowed on site the purchasing system should prevent orders for them from being processed.

13133December 1988

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

Abstract

In a 1600 litre reaction kettle, after completion of a batch, an attempt was made to clean the kettle with steam.
But during this trial, the vapour line became plugged by sublimated aluminium chloride. To complete the cleaning operation, water was given into the kettle which had been warmed up by the steam applied previously. After a while, the vapour line and the glass receiver ruptured, and hydrochloric acid fumes spread throughout the building and its surroundings.
Cause:
Violent reaction between aluminium chloride and water. Large quantities of hydrochloric acid gas were generated and caused a pressure shock which ruptured the vapor line and the glass receiver.
In this incident, the aluminium chloride sticking to the cover of the kettle fell down into the water, probably because the kettle had been heated up by steam.
[cleaning, gas / vapour release, unwanted chemical reaction]

Lessons

The kettle is now cleaned by means of a special handheld water/steam nozzle.

4342 09 November 1988

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1988, DEC.; TIMES OF INDIA, 1988, 16 NOV.
Location : Mahul; Bombay, INDIA

Injured : 40   **Dead :** 12

Abstract

During start-up a naphtha pipe ruptured and causing a spill that caught fire and ignited 6 naphtha and benzene tanks whose roofs blew off. Fatality.
[management system inadequate]

Lessons

[None Reported]

4328 29 October 1988

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1989, JAN.
Location : Genoa, ITALY

Injured : 6 **Dead :** 0

Abstract

An explosion occurred whilst a chemical marine tanker was under repair in drydock.

Lessons

[None Reported]

4278 06 September 1988

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1988, NOV.
Location : Pireaus, GREECE

Injured : 0 **Dead :** 10

Abstract

A marine transportation. An explosion during repair work on a marine tanker caused it to break in two.
[sinking]

Lessons

[None Reported]

1019405 September 1988

Source : ICHEME
Location : , UK

Injured : 0 **Dead :** 0

Abstract

At approximately 14.00 hours on 5th September 1988, an air supply hose on the discharge side of a portable breathing air receiver became detached whilst in use.
One individual was carrying out an internal inspection of the Solvent Recovery Column at the time. He was therefore immediately deprived of an air supply. Very prompt action by the compressor attendant, with the assistance of a fireman enabled restoration of the air supply within a few seconds. An emergency call was made to the Fire Station for additional backup, but the individual concerned was able to make his own way out of the column, and suffered no physical effects.
On examination the crimping rings attaching the pressure hose to the bayonet connection were found to be loose and showed no signs of ever being compressed.
Following the incident, all work involving mobile breathing air systems was stopped. It turned out that all hoses arrived in vacuum sealed packs which were only opened at the work-site. No inspection or testing was therefore performed and no documentation accompanied the hose to indicate what Quality Assurance procedures had been followed.
[inspection, entry into confined space, near miss, breathing apparatus, air line, human causes, design fault]

Lessons

All hoses were examined and certified on site immediately.
Some hose lengths were found to have only one crimp-ring applied, rather than the usual two. Initially it was accepted that a second ring should be applied. However, the contractor subsequently discussed this matter with the supplier who advised against this course of action. Clamping is normally carried out whilst the hose is being heat-shrunk onto the fitting. Any attempt to add a second clamp 'cold' might affect the integrity of the original bond.
All such hoses were therefore withdrawn from service, and have been replaced by others, which incorporate an improved coupling design.
For vessel entry the statutory requirement is for an outside observer who is similarly clothed (and therefore has breathing apparatus (BA) at the ready) whose primary responsibility is to summon assistance in the event of a dangerous situation arising, and to then attempt a rescue. The shutdown arrangements require each party to make its own arrangements for observers. This could therefore involve personnel who had only limited BA training. This situation was revised.

4277 03 September 1988

Source : ICHEME

Location : ,

Injured : 0 **Dead :** 0

Abstract

A therminol heating coil developed a leak causing polymerised nylon salt at 250 psig to leak into the primary system causing contamination of the therminol system. On the 10 Sep, after cleaning the whole system, a tube in the therminol vaporiser ruptured spraying therminol into the firebox. It ignited immediately and caused extensive damage. Probable cause was a blocked tube.

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

Lessons

[None Reported]

8069 01 September 1988

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.

1054530 August 1988

Source : ICHEME
Location : , INDIA

Injured : - **Dead :** 6

Abstract

Vapour which occurred from a spill of naphtha at a rail loading gantry was ignited by a vehicle being used for a drain cleaning operation in the gantry area. The 6 workers were killed by the fire. The further release of liquid from the rail wagons and pipework added to the fire, which caused extensive damage to the loading gantries and 35 rail wagons. The fire lasted for over 8 hours before being extinguished. The cause of the initial release was not positively identified.
[gas / vapour release, fire - consequence, rail transport]

Lessons

The lessons recorded in the report were:
1. Ignition sources like gully sucker to be avoided in hazardous gantry areas.
2. Provision of remote operated valves on main naphtha header and isolating it will help in minimising leakage which will reduce the hazard zone.
3. All vehicles used within hazardous areas in refinery to be fitted with flame arrestors so as to avoid ignition.
4. It is advisable to avoid carrying out activities like desludging and cleaning during loading.
5. The blocked gantry drains resulted in the large pool fire.

4267 28 August 1988

Source : VANDERWATER R.G, CASE HISTORY OF AN ETHYLENE TANK CAR EXPLOSION, CHEMICAL ENGINEERING PROGRESS, 1989, 85, (12), 16-20.

Location : Deer Park; Texas, USA

Injured : 0 **Dead :** 0

Abstract

An ethylene oxide road tanker was sent for cleaning and was filled with water. Odour was smelt and valves were closed. The tanker exploded due to reaction with water.
[explosion, unwanted chemical reaction]

Lessons

The following conclusions and recommendations were made:
1. In preparing a tanker for servicing, it is important to verify that the quantity of ethylene oxide unloaded is consistent with the amount expected. Even routine operations can go wrong. Also the completion of the unloading must be confirmed by weighing the tanker.
2. The mixing of water and ethylene oxide can fail to occur even though the two are completely miscible. Thus, the residual liquid left in an ethylene oxide tanker prior to cleaning (filling with water) should be nil.
3. Weighing is not accurate enough to prove that a tanker is completely free of liquid. Hence, purging the vapour space with nitrogen after unloading would aid by allowing residual liquid to evaporate.
4. When cleaning an ethylene oxide tanker by water washing, the filling and emptying and the disposal of the liquid should be worked to completion.
5. The cleaning shop should independently ensure that a tanker is empty prior to beginning the cleaning process.

4252 12 August 1988

Source : ICHEME
Location : ,

Injured : 0 **Dead :** 0

Abstract

A marine transport vessel berthed with some tanks containing crude oil with 200ppm hydrogen sulphide. During the inspection of the tanks prior to filling a crew man collapsed but recovered later. Later complaints of a smell was found to be due to the venting of the tanks via the filling tank vents and the other tank vents. Loading was slowed down so that only the filling tank vents were used. Additionally the inert gas system allowed the hydrogen sulphide to spread through all tanks.
[gas / vapour release]

Lessons

1. Vessels arriving partly laden must give name and nature of part load.
2. If the part cargo has a characteristic greatly different to the cargo to be loaded or where a health hazard may exist, then:-
a) The vessel will require to isolate the venting system of the tanks containing the part cargo from that of the tank to be loaded.
b) The tanks to be loaded must not be contaminated with gasses from the part cargo.
c) Venting of a part cargo will not be permitted except in an emergency.
d) Ullaging and dipping of tanks containing a part cargo will only be permitted using either fixed gauging systems or sonic tapes using approved vapour locks.
e) Sampling of part cargo will not be permitted. If cargo inspectors require to take samples then they will have to make arrangements to do so either before the vessel berths or after the vessel sails.

4229 16 July 1988

Source : FIRE PREVENTION, 1989, MAR.; LLOYDS WEEKLY CASUALTY REPORTS
Location : ,

Injured : 7   **Dead :** 1

Abstract

Two unconnected explosions occurred at the oil refinery. The first erupted in a waste water tank while welding a rod to the top of the tank. Sparks ignited vapours rising from the contaminated water. The second occurred in a pipeline to a large storage tank where three workers were cleaning. 600 barrels of hydrogen peroxide, bromine and arsenic was spilled from the pipeline. Fatality.
[refining]

Lessons

[None Reported]

4214 July 1988

Source : LLOYDS WEEKLY CASUALTY REPORTS
Location : Newton; Ohio, USA

Injured : 0 **Dead :** 1

Abstract

A fire destroyed part of a plant set off by explosion. Believed to have started where worker was welding safety device onto metal ladder on outside of tank containing asphalt coating. Fatality.
[fire - consequence]

Lessons

[None Reported]

13132July 1988

Source : ICHEME

Location : ,

Injured : 0 **Dead :** 0

Abstract

A cleaning procedure which had been practiced in a smaller installation (1000 1itre) to remove sublimated aluminium chloride after a Friedel Crafts reaction, was applied for the first time in a 1600 1itre kettle.
When water was filled into the kettle, the 400 litre glass receiver connected to it burst and hydrochloric acid vapours were released into the building.
Cause:
Violent reaction between aluminium chloride and water. Large quantities of hydrochloric acid gas were generated and caused a pressure shock, which ruptured the vapor line and the glass receiver.
In this incident, the reaction took place when the water level had risen to the layer of sublimated aluminium chloride on the inner surface of the cover of the kettle.
[gas / vapour release, unwanted chemical reaction]

Lessons

The following recommendations were made:
1. Installation of a larger vapour line.
2. Thermal insulation and heating of the vapor line and the receiver.
3. Thermal insulation of the cover of the kettle; now deposits of sublimated aluminium chloride can only form at the sealing element between agitator shaft and cover, which is cooled by a sealing liquid.
4. The kettle is now cleaned by means of a special handheld water/steam nozzle.

7515 28 June 1988

Source : LOSS PREVENTION BULLETIN, 122, 9-10.
Location : ,

Injured : 0 **Dead :** 5

Abstract

The accident occurred in a plant making dyes and a chromate dip for electroplated products. These products were treated in a series of open-topped tanks located in a sub-basement, known as the zinc-plating room, which contained two parallel rows of tanks separated by a grated walkway. A concrete drainage pit lay beneath the walkway. Ventilation in the zinc-plating room was provided by two ceiling exhaust fans, five windows and the door to the room were closed at the time of the accident.
The last tank in the series, where the accident occurred, was used for drying parts after they had been electroplated. The tank measured 1.5 x 1.2 x 1.5 metres. The parts were suspended above the tank, and excess zinc cyanide solution dripped into the tank. Waste zinc cyanide was pumped from the tank once each year.
On the day before the accident, an industrial cleaning and hauling company pumped the waste from the tank, leaving a layer of zinc cyanide sludge in the bottom. On the day of the accident the night shift leader began preparations to clean the remaining sludge by spraying 1 or 2 gallons of hydrochloric acid into the drying tank.
After investigation it was concluded that the night shift leader unknowingly created hydrogen cyanide, a highly toxic compound, by combining sulphuric acid and zinc cyanide, two commonly used industrial chemicals. Hydrogen cyanide acts to block absorption of oxygen by the lungs and can cause death.
After adding the sulphuric acid, the night shift leader, who worked alone and wore no respirator, climbed a ladder and descended into the tank. He did not test or ventilate the tank before entering. After several minutes, co-workers saw him struggling to climb out of the tank.
Four other workers attempted to help and were quickly overcome. Two were forced back by the vapours. The other two collapsed, one inside the tank and the other with his head hanging over the edge. Fatality.
[accidental mixing, testing inadequate, entry into confined space, safety procedures inadequate]

Lessons

Chemical safety.
Ensure that good chemical safety practices are followed in the workplace:
1. Chemicals must be clearly labelled. Labels must be legible and in English. Warnings to be provided in other languages, as necessary.
2. More emphasis must be placed on dangers that can result from combining chemicals. Workers to be trained to recognise and anticipate hazardous chemical reactions.
3. Materials safety data sheets must provide necessary warnings as well as other important information on chemical hazards.
Ensure that confined spaces are clearly identified and that workers can perform tasks safely within these areas.
1. Workers must be trained to recognise confined spaces, and management must take appropriate precautions to ensure that work is performed safely.
2. A confined-space work plan must include a method or plan for rescue. The safest methods for confined-space rescue do not require that rescuers enter these hazardous areas. Body harnesses, safety lines, and reliance on the buddy system can prevent unnecessary risks.
3. Entry permit systems are a must, and issue of these is likely to be subject to environmental analysis for toxic or flammable gases, and oxygen content.
Ensure that all personnel know what to do in the event of an emergency.
1. Notify authorities immediately when an emergency occurs. Workers or supervisors who are likely to witness or discover an injured or collapsed co-worker should be trained to initiate an emergency response sequence.
2. Ensure that workers (first responders at the operations level) are training to take appropriate actions and precautions. Workers must never enter a confined space for the purpose of rescue without suitable breathing apparatus.
3. Ensure that all emergency response personnel are properly informed and trained. In this instance, emergency response crews were initially unaware that hydrogen cyanide was involved.

1019528 June 1988

Source : ICHEME
Location : ,

Injured : 0 **Dead :** 0

Abstract

A fire occurred whilst an operator was carrying out routine engine starting in an engine testing room. The incident occurred when the engine backfired and a small fire started. The operator attempted to extinguish the fire with a hand extinguisher, but the room soon became smoke-logged and he had to withdraw. The works brigade responded, closed the doors and proceeded to deal with the fire. The local Fire Brigade arrived quickly and everything was under control by 8.15am.

There was damage to the cables and electronics associated with the engine testing facility. There were no personal injuries but two operators were affected by smoke. There was no damage beyond the close confines of the engine room.

[start-up, fire - consequence, engine, fire/explosion]

Lessons

[None Reported]

4209 27 June 1988

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1988, OCT.
Location : Barcelona, SPAIN

Injured : 0 **Dead :** 4

Abstract

4 crew inspecting a marine transport ship's hold died from asphyxiation. Not clear whether fumigant or fermentation of the cargo of soya beans was to blame. Fatality.
[inspection]

Lessons

[None Reported]

4175 26 May 1988

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1988, SEP.
Location : Newtown; Ohio, USA

Injured : 0 **Dead :** 1

Abstract

An explosion occurred after welding a safety device onto a metal ladder on the outside of a tank. Fatality.
[personal protective equipment]

Lessons

[None Reported]

8062 02 May 1988

Source : ICHEME
Location : , HOLLAND

Injured : 0 **Dead :** 0

Abstract

Whilst carrying out preparatory work for a turnaround a fire broke out on the gasoline caustic wash drum. There were no injuries to personnel. Financial loss due to damage and services, was estimated to be approximately 14,000 GPB (1988).
During turnarounds on this plant it was common practice for operations personnel to be incorporated into `turnaround organisations'. They work in temporary jobs on a day hours basis. Consequently it is not unusual to have a limited reduction of manning on normal operating shifts.
In preparing for a particular turnaround preparatory work had to be carried out by the shift personnel over the weekend. Due to limited manpower the work was held over and had to be carried out on the Monday morning.
On the day in question the gasoline caustic washdrum was empty and being steamed, with vent and drain open. The spent caustic line from the discharge of two pumps had not yet been flushed. Caustic make up was flushed and clean.
Water hoses were connected in order to flush out sludge. Steaming out was stopped. The washdrum was completely empty. It was then filled with water which was drained off. It appeared that the drum was still dirty and this operation had to be repeated. In the meantime it was decided to flush the spent caustic line to the drum and, as the drum was filling up, to dispose of this line content to slops.
With the drum filling up and the spent caustic line flushing to the drum, the operators went on with other work.
When the drum was full, hydrocarbons, which had collected on the top of the water in the drum, were pushed out of the 12" open vent valve, and caught fire as they fell on a hot steam line below the drum.
Financial loss due to damage and services, was estimated to be approximately 14,000 GPB (1988).
[damage to equipment, hot surface, cleaning, fire - consequence, caustic soda]

Lessons

Normally lines would have been drained down prior to flushing out and steaming the drum. The fact that this action had not been carried out can only be attributable to the inexperience of the personnel involved in combination with insufficient supervision.
There was however one particular oversight, namely that the vent on the drum was overlooked and left open. Through this vent hydrocarbons which entered the drum from the slop line and the spent caustic line escaped.
The incident must therefore be attributable to operational error, in not following the procedures correctly. Recommendations made at the time included:
1. Reviewing the organisation and responsibilities during special operations such as preparations for turn-around.
2. Looking for ways to improve start-up/shutdown procedures (use of computer programs was recommended)
3. During special operations close supervision must ensure detailed and timely sign off of all steps in the procedures to guarantee a proper sequence of actions.

8063 01 May 1988

Source : ICHEME
Location : ,

Injured : 0 **Dead :** 0

Abstract

A flash-back occurred as a blind was being removed from the outlet pass of a furnace, as it was being prepared for recommissioning after steam/air decoking.
A crude preheat furnace was shutdown mid-run for decoking. On completion of the Steam-Air decoking procedure a maintenance fitter was deblinding prior to recommissioning.
As a precaution, because hydrocarbons could be present, the fitter was instructed to wear a fresh air mask, which was supplied by an air line.
Working from the burner platform, the fitter loosened the flange bolts (6" x 300 joint) with an accompanying whistle noise as the nitrogen pressure released from the flange joint. As the fitter lifted the blind (approximately half out) some liquid drained out (most likely condensate from the steam purge which was done when the blind was installed prior to the Steam-Air Decoking).
There was an explosion, and a fire ball flashed across the burner platform from the central burners back to the loosened flange. The gas, escaping from the tower side of the blind, had entered the heater through the slots for the air register adjustment lever. The fitter left the platform, fortunately only receiving some singeing to his hair.
The source of ignition was a pilot burner the potential hazard of ignition from this source was overlooked during the preparation for removal of the blind. The source of ignition may not have been a hazard had both sides of the blind been purged.
[fire - consequence, near miss]

Lessons

The accident investigation report recommended:
1. Positive isolation on both sides eg. at a double block and bleed. "Positive isolation" should be checked by opening the bleed, although care should still be exercised when breaking the flange in case the bleed is plugged, or
2. Positive isolation on one side and show of steam on the other. "Positive isolation" should be checked by carefully breaking of the flange to ensure that the valve is not passing, or
3. Show of steam on both sides.

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.

4137 07 April 1988

Source : LENOIR E.M & DAVENPORT J.A, A SURVEY OF VAPOUR CLOUD EXPLOSIONS SECOND UPDATE, PROCESS SAFETY PROGRESS, 1993, 12, (1), 12-33; HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1988, JUN.

Location : Beek; Geleen, NETHERLANDS

Injured : 0 **Dead :** 0

Abstract

During start-up of a high pressure polyethylene plant, the rupture disc opened due to overpressurisation. The discharge line failed and ethylene was released in partially confined compressor shed. The ethylene ignited and damaged the compressor shed.
[overpressure relief, damage to equipment, processing, gas / vapour release, reactors and reaction equipment]

Lessons

[None Reported]

1072330 March 1988

Source : ICHEME
Location : , BELGIUM
Injured : 2 **Dead :** 0

Abstract

An accident involving 2 employees occurred in asbestos removal in an ethylene oxide unit. In order to remove the asbestos insulation around the system generator safely, the removal company was told to build a plastic tent with a lock round the steam generator.
A form was drawn up for this purpose which stated that flanges and valves could not be built in the tent and 'without roof'. An oxygen test was carried out on the tent in four different places on man's height and each time, normal values were measured. Based on this, the foreman gave permission to continue working.
Almost immediately of mounting the ladder in the tent, the two workers started to feel sick, became dizzy and everything turned black before their eyes. They managed to stumble outside and report the incident to the foreman.
Within 10 minutes of the accident, the oxygen test by the operator was done again which gave normal values. The general foreman carried out another test with another meter and normal values were noticed again. Later inspection showed that the tent was built with a closed roof and a bypass line on the nitrogen line was built in the tent with two locked block valves. Several used spray cans of glue and other substances were found in the tent and it was stated on the cans that they should only be used in ventilation rooms.
The actual cause of the accident is unknown and although nitrogen leaks in the tent cannot be excluded, there is reason to assume that other gases may have caused the symptoms of the 2 workers of feeling sick, throat irritation and breathing difficulties.
[gas / vapour release, maintenance, additional chemical present, testing, injury]

Lessons

1. It is now required to enter the tent and carry out the job with two people.
2. In the specific case of tents around ethylene oxide reactors in which nitrogen leaks can never be excluded, the tent must be built with windows of translucent plastic on each wall and entering the tent and execution of works in the tent is exclusively reserved for people carrying fresh air masks.
3. A safety guard will watch the tent for the whole period of the activities equipped with air apparatus and a knife to cut open the tent if necessary. The guard must be trained in using compressed sir apparatuses. A guard must also be provided for each work level.
4. Oxygen tests must be carried out every two hours on different heights.
5. The use of spray cans of glue or polyurethane in closed tents is prohibited unless the roof is open.
6. Asbestos removal personnel will be formally re-instructed about the procedure and that the conditions on the form must be observed.

12728 29 March 1988

Source : ICHEME
Location : , UK

Injured : 0 **Dead :** 0

Abstract

An incident occurred when a manhole cover on an underground drainage system lifted. On investigation it was found that there was a high level in the drain sump, which was hot and steaming and local ground drains had back-flowed.
The area was roped off and water lines put into the quench water outfall. This had an immediate cooling affect. Soon after the conditions of the drains were back to normal.
The drains and downstream drains levels and temperatures were later checked and found to be normal.
The report stated the following conclusions:
The design of the oily drains system is such that a 100-200mm layer of hydrocarbons is always present in the sump drains. Hot water from the quench vessel vaporised light hydrocarbons in the drain system.
The resultant overpressure pushed liquid back up the sumps, lifting the manhole covers.
The water from the quench vessel was hotter that normal due to a dip in the raw water supply pressure.
[drainage system, overpressurisation, draining]

Lessons

The report stated the following recommendations:
1. Fit a pressure gauge to the quench vessel raw water supply to monitor fluctuations in supply pressure during reactor regeneration. Consider fitting a temperature alarm to the outfall.
2. Check all vents on the gas separation drains system.
3. Remove accumulated hydrocarbons from the gas separation drain sumps.
4. Check drain sumps for solid debris and remove. Consider need to clean main drain runs at shutdown.

4123 12 March 1988

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1988, APR.
Location : Isla Refinery, CURACAO

Injured : 0   **Dead :** 0

Abstract

An explosion occurred during cleaning a tank of a marine tanker at a terminal, 3 tanks damaged.
[damage to equipment]

Lessons

[None Reported]

4092 25 January 1988

Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1988, MAR.
Location : Plaquemine; Louisiana, USA

Injured : 9 **Dead :** 0

Abstract

An explosion occurred in a phenol plant during start-up following routine maintenance.

Lessons

[None Reported]

9989 05 January 1988

Source : ICHEME
Location : , UK

Injured : 0 **Dead :** 0

Abstract

Men who were cleaning a tank were wearing breathing apparatus as a safety measure for entry into confined space. Soon after they started they found that the air supply failed, but they were able to exit the tank without any adverse effect. This safety equipment failure was found to be due to ice blockage in the air filters, and was a near miss of asphyxiation.
[entry into confined space, safety equipment failure, management system inadequate]

Lessons

There was inadequate testing and inspection of the operation for recharging the air supply to the breathing apparatus. Concern was expressed over the apparent failure to meet statutory requirements.