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.

111451997

Source : ICHEME
Location : ,

Injured : 1 **Dead :** 0

Abstract

A chief engineer was carrying out regular planned maintenance on the emergency back-up ballast override system. The valve in question is designed to "fail safe open". However, in an emergency, this system will close the valve via the regulator, using a nitrogen bottle at 2500 psi. The maintenance procedure called for the regulator to be function checked using the rig air supply. The nitrogen bottle is then weighed to confirm that the correct volume is in place. On this occasion, the chief engineer decided to take one further step and open the nitrogen supply to the regulator, as this is what would take place in practice. When he did, the regulator blew apart and struck his hand, fracturing it. He needed to be hospitalised.
Investigation revealed that the regulator was only rated to 500 psi. The correct one had been orderd for the installation in 1994, however, a 500 psi regulator was supplied and installed, with the error unnoticed until the incident.
[pressure meter/control, incorrect equipment installed, people]

Lessons

The following recommendations were made:
Site managers should ensure checks are performed on similar safety-related devices to ensure that the correctly rated regulators are in place.
Mechanical supervisors/team leader should ensure that adequate checks are made on the rating of pressure regulators when they are supplied to the site or installation.

8671 17 January 1996

Source : SEDGWICK LOSS CONTROL NEWSLETTER, ISSUE 1, 1996.
Location : North Sea, UK

Injured : 0   **Dead :** 0

Abstract

Explosion in the control room of the natural gas platform caused by a circuit breaker (electrical switchgear). No fire followed the blast. Production was shutdown for 1 day pending investigation. Offshore.

Lessons

[None Reported]

3317 31 January 1995

Source : ICHEME
Location : Scotland, UK

Injured : 0 **Dead :** 0

Abstract

Overheating batteries, in a control room resulted in a strong and obnoxious smell of hydrogen sulphide. The batteries were Valve Regulated Lead - Acid (VRLA) type, in which the electrolyte (sulphuric acid) and gases produced during operation, are particularly immobilised in a porous fabric or gel.
Most of the gas re-combines to produce water, so little topping up is required.
The batteries had been receiving an overcharge current (40 amps) and had overheated with resultant battery casing damage. When high current circumstances exist, the H2SO4 electrolyte decomposes to release hydrogen sulphide.
[gas / vapour release]

Lessons

VRLA type batteries have a recommended lifetime of approximately 10 years. These batteries were about 6 years old. However, they had been operating at about 30 degrees C, at which temperature, lifetime would be expected to be reduced to about 5 years.
Thus, they had exceeded their effective expected life span.
Repeated earth fault alarms occurred in the two weeks prior to the incident, but this was never acted upon. The activation of this alarm is indicative of high current conductors.
The stated the following recommendations:
Recommendations were implemented to address the issues of:
1. Failure to respond to earth fault alarm.
2. Failure to respond to pressure of odour (H2S).
3. Need for improved training in the understanding of alarm situations.
4. Need for better battery inspection regimes.
5. Need to ensure a lower operating temperature for batteries.

7587 27 November 1994

Source : LOSS PREVENTION BULLETIN, 126, 3-6.
Location : ,
Injured : 13 **Dead :** 0

Abstract

A breakdown of operations occurred on plant which was caused by the bursting of an acrylic acid tank. This resulted in a large-scale fire fuelled by the escaping acrylic acid/polyacrylic acid. The polyvinyl alcohol storage facility nearby also caught fire
The following combination of events lead to the accident:
1. A power supply failure.
2. External temperature of around 5 degrees C, with a north wind.
3. The open-topped building.
4. Crystallising out by the acrylic acid in both pipeline circuits.
5. Warming-up and polymerisation caused by the pump working against a blocked delivery route.
6. Thawing of the crystallised acrylic acid in the bypass pipeline.
7. Transfer of polymers into the acrylic acid storage tank.
8. Slow warming of the tank's contents by around 0.5 degrees C/hr due to the pump passing against a throttled valve,
9. Ineffectiveness of the temperature monitoring system, since the large circulation pipeline remained blocked all the time.
[cold weather, rupture, fire - consequence, polymerisation, chemical missing, instrumentation failure, temperature meter/control]

Lessons

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

7609 17 October 1994

Source : LOSS PREVENTION BULETIN, 129, 9.
Location : ,

Injured : 0 **Dead :** 0

Abstract

Heavy rains, amounting to approximately 65 cm, resulted in extensive flooding from the surface water as well as overflowing streams. Most of the water that flooded this 90-acre plant. Flood water covered the entire plant in depths ranging from 60 to 150 cm.
Plant management anticipated the flooding and was successful in shutting down all six process units in an orderly manner. Additionally, plant personnel were successful in relocating the smaller and lighter property items to higher ground. This effort notwithstanding, the flood waters caused extensive damage, mainly to computers, electrical substations, switchgear, pumps, motors and buildings. At least 350 electric motors varying in size from 5 to 20 horsepower were completely submerged and required replacement, while the larger electric motors up to 1,500 horsepower were disassembled, baked out, and repaired.
The plant was shut down for approximately two months as a result of this flooding. During this period, the ethylene, polyethylene, olefins, and acetylene black production was shut down, resulting in a business interruption loss estimated at $85,000,000 (1994).
[damage to equipment]

Lessons

[None Reported]

8439 01 July 1994

Source : ICHEME
Location : , RUSSIA

Injured : 1 **Dead :** 0

Abstract

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

Lessons

[None Reported]

6613 July 1994

Source : CHEMISTRY IN BRITAIN, 1994, DEC.; ENDS REPORT, 1994, AUG.
Location : Warrington, UK

Injured : 0 **Dead :** 0

Abstract

1.2 tonnes of vinyl chloride monomer (VCM) released due to operator misinterpreting computer data during polymerisation.
[operator error, pollution, gas / vapour release]

Lessons

[None Reported]

7599 May 1994

Source : LOSS PREVENTION BULLETIN, 128, 3-5.
Location : ,

Injured : 0 **Dead :** 0

Abstract

A high pressure reactor ruptured during a catalyst activation operation. A gaseous stream of hydrogen and light hydrocarbons was released and spontaneously ignited. The unit was immediately shutdown and depressurised. The fire was limited to the vicinity of the ruptured reactor and was extinguished within twenty minutes by onsite emergency services. There were no injuries but damage to equipment included the reactor and some piping, instrumentation and air-fin heat exchangers on an adjacent structure.

An investigation was carried out and the causes identified. The operation in progress was a catalyst activation process which involved reducing an oxide coated form of the catalyst in the presence of hydrogen to its base metal form. The fresh catalyst to be activated was loaded in the top bed of a three bed reactor. The lower two beds of the reactor already contained previously used catalyst. In order to activate the fresh catalyst in the top bed, hydrogen had to be passed over the catalyst for a period of four hours at relatively high temperature and pressure. Target activation temperature was higher than the normal operating range of 300-380 degrees C, but within the reactor design temperature. The hydrogen used was from the site system and contained 70% hydrogen and 30% hydrocarbons in the range C1 to C5 with trace C6+. Since the reactor was a stacked bed reactor with entry at the top, the hydrogen rich gas had to pass over the fresh catalyst and then the older catalyst beds.

The gas was initially warmed-up via a furnace and passed through the reactor. As the inlet bed temperature target was approached, the furnace coil outlet temperature overshot its set point and three out of the four top bed temperature instruments went out of range, with the temperature at the bottom of that bed exceeding the vessel design temperature. In response, furnace firing was reduced and quench gas flows were increased to the reactor. Temperature control was poor as the furnace was tuned for normal process liquid/gas operation rather than gas-only activation. Two hours into the activation, the top bed temperatures had steadied out around the target activation temperature but the bottom temperature reading in that bed and all eight of the temperature readings in the two catalyst beds below remained offscale, beyond the design temperature of the reactor.

The activation step was completed two hours later and the reactor cooled down. Three hours into the cool down phase, the reactor, which had a diameter of one metre and a wall thickness of 50 mm, ruptured at the base of the middle catalyst bed.

[spontaneous combustion, fire - consequence, temperature meter/control, processing, operator error, reactors and reaction equipment]

Lessons

This was only the second time that the activation had been performed on this catalyst system. In hindsight, the actual processes occurring within the reactor were not fully understood and the job preparation could have been improved. However, the root cause of the incident was that temperature instrument readings were discounted. Safety refresher training must emphasise that instrumentation and alarms must not be discounted and, where data conflict, a defensive position should be chosen and a safe operating regime established at all times.

5740 07 August 1992

Source : LLOYDS LIST, 1992, 15 AUG.
Location : Chicoutimi; Quebec, CANADA

Injured : 0   **Dead :** 1

Abstract

An explosion at a silicon plant blew off the furnace room roof and a second explosion blew out the wall and the roof of the main building a second later. The control room was destroyed in the fire afterwards. Fatality.
[fire - consequence, damage to equipment]

Lessons

[None Reported]

5656 04 May 1992

Source : FIRE PREVENTION NO. 255, 1992, DEC.; EUROPEAN CHEMICAL NEWS, 1992, 25 MAY.
Location : Jarrie, FRANCE

Injured : 2 **Dead :** 1

Abstract

An explosion occurred at a hydrogen peroxide plant due to technical failure of computerised control system.
The plant was completely destroyed.
[process control & instrumentation, control failure, computer failure, fatality]

Lessons

[None Reported]

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.

4838 06 January 1990

Source : SEDGWICK LOSS CONTROL NEWSLETTER, FIRST QUARTER, 1990
Location : Sweeney; Texas, USA

Injured : 0   **Dead :** 0

Abstract

An explosion damaged an olefins unit and control room. Cyclohexane unit shutdown and crude throughput reduced. Substance involved: ethylene.
[plant shutdown]

Lessons

[None Reported]

7896 1990

Source : ICHEME
Location : , USA
Injured : 5 **Dead :** 17

Abstract

An explosion occurred which caused significant equipment damage at a chemical plant.
The accident originated in a 90,000 gallon waste storage tank in the utilities area. The tank was demolished by the incident. The waste storage tank was designed to serve several purposes in processing waste water from a propylene oxide-styrene monomer (PO/SM) unit before disposal of the treated waste water into a deep disposal well on site. These purposes included:
1. Temporary storage of waste water.
2. Separation and temporary storage of light hydrocarbon liquids contained in the waste water.
3. Decomposition of light hydrocarbon peroxides produced in the PO/SM process and purged from the unit in the waste.
4. Separation of the resulting free oxygen and purging of the gaseous stream The tank was designed as an atmospheric pressure tank with dual conservation vents to relieve pressure buildup and to break any vacuum resulting from normal operation.
Because gaseous free oxygen was liberated in the tank from light peroxide decomposition, the tank was equipped with an inert nitrogen sweep system to purge the oxygen and maintain an oxygen concentration within safe limits. Due to the presence of light hydrocarbon liquids, the nitrogen sweep leaving the tank also contained hydrocarbon vapours. These hydrocarbon vapours were scrubbed from the tank vapour purge stream by a pressurised recovery tower located in the PO/SM Unit. A compressor was used to transfer the vapour purge stream from the atmospheric pressure tank to the pressurised recovery tower. A side stream from the compressor discharge was recirculated through the tank to ensure a uniform vapour composition.
The tank vapour space was sampled and analysed for oxygen content with a continuous readout in the control room.
The waste water treatment and handling design had been developed over a period of time from a series of technical studies, alternative evaluations, safety reviews, and HAZOP studies. It had operated safely and reliably for several years.
Investigation:
It was believed that the underlying reason for the explosion was an accumulation of oxygen in the vapour space of the tank, which was not detected because of an apparent failure in the oxygen analyser. The oxygen buildup was caused by a reduction in the nitrogen sweep rate, in fact for a period of 34 hours before the explosion, the nitrogen sweep was shut off completely.
Earlier that year the compressor had failed and was removed for repair. During the repair period, several modifications were made to the compressor's piping and instrumentation system to improve its reliability and performance. This action required the shutdown of the nitrogen sweep, and this occurred some 34 hours before the explosion.
Since the oxygen analyser continued to show an extremely low, and safe level, the nitrogen sweep was allowed to remain off, until just a few minutes below the explosion.
It is believed that only a very small amount of energy would have been needed to have ignited the tank vapour space, and that normal unit operations could have provided that energy source, in fact it could have been created by the compressor startup.
The resulting fire rapidly moved through the piping system to the tank vapour space, where the explosion occurred.
The investigation resulted in a number of actions and the cost of the safety enhancements and equipment upgrading is estimated to be $20 million (1990).
Fatality.
[process analyser, instrumentation failure, fire - consequence]

Lessons

1. More fixed monitors to be installed and provision of portable water transfer pumps of the low head, self-priming high capacity type.
2. A review of work procedures, particularly when working on systems likely to cause deposition under valve seats or in drains.
3. Training and retraining on the properties of LPG and butane hydrate, symptoms of blockage, the Permit to Work System, isolation/handover of equipment, and general safety awareness.
4. There were also many aspects of Emergency Handling which needed to be improved.

3996 11 October 1987

Source : LOSS PREVENTION BULLETIN, 099, 25.
Location : Fort McMurray; Alberta, CANADA

Injured : 0 **Dead :** 0

Abstract

An overhead bearing on a mine to mill conveyor belt ignited the belt as well as the tar sand it was carrying to a five-story processing building. It was customary to spray the raw tar sand with diesel fuel to prevent it from sticking to the belt. The diesel fuel accelerated the fire, which was carried into an ore bin. An intense fire developed and spread from the bin throughout the upper levels of the 210 by 240 foot extraction plant processing building. The roof and top three levels of the noncombustible structure eventually collapsed. Fire also involved 10 PCB containing transformers located above the control room, resulting in significant decontamination and cleanup costs. Most of the fire was under control in several hours, but the oil sand in the silo continued to burn for two days.
[fire - consequence, bearing failure, processing, mining]

Lessons

[None Reported]

7298 30 March 1987

Source : LOSS PREVENTION BULLETIN, 080, 19-20.
Location : ,

Injured : 1 **Dead :** 0

Abstract

On the morning of the incident the plant foreman on duty had made a maintenance request for a catalyst line to a reactor to be cleaned, following reports by operators that the line was blocked. This was a routine operation which was carried out approximately twice a month.
The operator started work on the catalyst line and removed the catalyst rotameter. He then reported to the workshop foreman that he had found the blockage in the rotameter. The foreman instructed the operator to run water through the catalyst line to check that the rest of the line was clear. This is normally done by running water by gravity from the elevated catalyst tank.
The operator connected the mains (5 to 7 bars pressure) to the open end of the pipeline and attempted to flush the other pipelines connected to the system. He diverted the flow to the emulsion tank system but left the valve immediately downstream of the emulsion tank rotameter (a borosilicate glass tube rated for normal operation of 7.5 bars) closed.
The valve upstream of the rotameter was then opened and the rotameter shattered explosively severing his safety glasses and causing injury.
The rotameter burst when the valve upstream was opened, with the valve downstream left closed. This would suggest that the rapid flow of water caused the steel rotameter bobbin to rise rapidly in the tube. This could have caused a crack in the glass. The air behind the water would be compressed to the line pressure of 5 to 7 bars, and be released rapidly when the glass tube cracked, thus causing an explosive shattering effect.
[cleaning, flow meter/control, explosion, injury]

Lessons

It has been suggested that there should have been a protective plate of safety glass mounted in front of the rotameter.
Glass is known to be a brittle material and the rotameter was rated for 7 bars. It is designed to be looked at closely and failure in normal service is always possible.
It is uncertain whether a safety glass shield would have been adequate in the circumstances of the accident, but an unshielded piece of glass at 7 bars does present a potential hazard.

8005 10 January 1987

Source : LOSS PREVENTION BULLETIN, 091, 16.; ICHEME
Location : ,

Injured : 0 **Dead :** 0

Abstract

A release of propylene gas occurred when an instrument technician unscrewed a thermowell from a compressor by mistake.
The escape continued for 10 minutes and resulted in the plant being shut down. The gas cloud did not ignite.
The instrument technician had already successfully removed one low temperature alarm probe capillary tube from a compressor.
He then proceeded to remove the tube from another low temperature alarm. He first slackened nut No. 1 which is a compression fitting on to nut No. 2. He then went on to slacken nut No. 2 which unfortunately was seized to nut No. 3 (which is part of the thermowell) and unscrewed the thermowell. He mistakenly believed that he was working on a flanged thermowell similar to a type fitted to an adjacent compressor in which the thermowell is integral with the flange.
[operator error, gas / vapour release, temperature meter/control, plant shutdown]

Lessons

It is obviously essential that technicians are fully aware of the construction details of equipment on which they are working particularly when there are important fabrication differences between otherwise similar fittings as in this case.

7951 April 1986

Source : ICHEME
Location : ,

Injured : 0 **Dead :** 0

Abstract

Oxidised bitumen blowing nominal temperature was 270 degrees C, but could have in fact been as high as 300 degrees C due to errors in temperature indicating instruments. There was no heat exchange between the blower and the storage tanks and depending on the level of bitumen in the receipt tank, conditions could be conductive to ignition.
[material transfer, instrumentation failure, temperature meter/control]

Lessons

[None Reported]

3511 15 January 1986

Source : INSTITUTE OF INSURERS
Location : Habshan, ABU DHABI

Injured : 0 **Dead :** 0

Abstract

An operator in a control room noticed that there had been an automatic shutdown of two of the four burners in the base of a heater tower, on an oil plant. He tried to re-ignite one of the burners without success. He then left the control room to carry out a manual inspection, when there was an explosion and fire.
[fire - consequence, heating equipment]

Lessons

[None Reported]

7953 January 1986

Source : ICHEME
Location : ,

Injured : 0 **Dead :** 0

Abstract

A minor fire occurred on a bitumen blowing unit necessitating relagging of the vessel. The incident was the indirect result of a failure in a computer card, which had the snowballing effect of tripping out all process units, in a refinery.
[fire - consequence, computer failure, refining]

Lessons

[None Reported]

7959 21 January 1985

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

Abstract

A leak developed from an eductor pressure gauge during a tetramethyl lead (TML)/gasoline blending operation.
Investigation of the shutdown system, revealed that the leak resulted from hairline cracking on the bourdon tube of the pressure gauge.
Two technicians were assigned to the TML blending operation at 0300 hrs. The operating steps taken were correctly carried out according to detailed instructions.
Vibrations of the eductor and associated piping/gauges had been observed at every TML blending when throttling down the bypass valve of the eductor. This is because of cavitation in the gasoline stream which caused rapid pressure fluctuations leading to the mechanical vibrations.
At 0555 hrs., one of the technicians returned to the TML blending area. He did not notice or smell anything abnormal initially because he had a cold, however, he subsequently saw a leaking pressure gauge downstream of the eductor. He radioed control room about the leakage and hurriedly left the area.
On instructions from the Acting Supervisor, two technicians, carrying canister respirators from the control room, returned to the site, and proceeded to shut down the system.
Under cover of water spray protection and using canister respirators, the two technicians isolated the ball valve of the leaking pressure gauge. They continued washing the piping, valves, surroundings, etc. with water for the next 20-30 minutes. The spillage was confined within the bunded area of the TML Meter Package Unit and flushed to the leaded slop pit.
The Shift Superintendent was informed and the Acting Supervisor came to the site. He detected the smell from a distance and did not go nearer.
By 0630 hrs., the situation was under control. The three personnel at the scene of leakage were advised by the Shift Superintendent to have medical check ups.
Cause of Incident:
Dye penetrant checks on both failed bourdon tubes revealed hairline cracks at similar locations with similar configurations. Subsequently, one of them was sent for metallurgical examination, and this pointed to stress corrosion cracking characteristic of austenitic stainless steel.,
Based on this information, the most likely theoretical cause of the stress corrosion cracking is the presence of moisture and organic chlorides environment.
The moisture most probably came from the gasoline circulation line while the organic chlorides are present in TML as 18.8% of EDC.
The secondary contributing factor is the mechanical vibration and pressure surge of the gasoline which aggravate the stress on the bourdon tubes.
[pressure meter/control, excessive vibration, tube failure, incorrect material of construction, processing]

Lessons

The following recommendations were made:
1. Modifications to be made to drain as much water from the blending components as possible.
2. The original specification of phosphor bronze bourdon tube pressure gauge to be reinstated. If for any reason not possible, then monel, inconel or ferritic stainless steel tubes can be used to avoid stress corrosion.
3. To reduce vibration, separate the gauge mounting from the eductor mounting using an impulse line with one or two anti-vibration loops. The material used will be compatible with the piping and gauge.
4. Compressed air breathing apparatus will be provided to deal with leakage, because the duration of leakage and concentration of the toxic leaded vapours is not predetermined and canister masks can be saturated even in an open ventilated area.
5. Whenever possible a technician should stay at site during the additive blending operations. If not possible, regular checks to be made of the area, to ensure the earliest warning is obtained should an emergency arise.
6. At least two complete sets of protective equipment to be readily available kept in UNLO.

2991 04 May 1984

Source : INSTITUTE OF INSURERS

Location : St.Johns; Antigua, WEST INDIES

Injured : 0   **Dead :** 0

Abstract

Fire caused damage to control room involving hydrocarbons. Cause was electrical, sabotage.
[fire - consequence]

Lessons

[None Reported]

2875 02 January 1984

Source : ICHEME
Location : , FRANCE

Injured : 0 **Dead :** 0

Abstract

Fire in a control room involving an electrical cable at a refinery utilities. Source of ignition was electrical.
[fire - consequence, electrical equipment failure, refining]

Lessons

[None Reported]

2616 June 1983

Source : EUROPEAN CHEMICAL NEWS, 1983, 27 JUN.
Location : Dunkerque, FRANCE

Injured : 0 **Dead :** 0

Abstract

Fire in control room at steam cracker.
[fire - consequence, cracking]

Lessons

[None Reported]

2403 04 October 1982

Source : 100 LARGEST LOSSES 9TH EDITION, MARSH & MCLENNAN PROTECTION CONSULTANTS, 1986.
Location : Freeport; Texas, USA

Injured : 0 **Dead :** 0

Abstract

Failure of a 15 kV transformer containing 235 gallons of mineral oil was the probable cause of this explosion and fire in the electrical power plant of a large petrochemical complex. Heavily loaded cable trays also ignited from the fire causing heavy smoke and evacuation of the power block control room and making fire fighting difficult. After 6 hours the concrete roof of the control room collapsed.
[fire - consequence, electrical, electrical equipment failure]

Lessons

[None Reported]

2124 1981

Source : ICHEME
Location : , KUWAIT

Injured : 0 **Dead :** 0

Abstract

Fire at a refinery desulphuriser plant in the control room.
[fire - consequence, refining]

Lessons

[None Reported]

2107 20 December 1980

Source : ICHEME
Location : , UK

Injured : 0   **Dead :** 1

Abstract

A sample point was causing trouble due to a blockage in the cooler and an alternative arrangement was provided and mentioned in the log book. An operator who was starting a new shift rota tried to use the old sample point and used another valve.   He was overcome by benzene vapours. Fatality.
[incorrect flow rate]

Lessons

[None Reported]

8453 25 March 1980

Source : ICHEME

Location : ,

Injured : 0 **Dead :** 0

Abstract

A radioactive source (Cobalt 60), used as part of a tank level detector, was removed into its lead shield container prior to tank cleaning and inspection. It was subsequently discovered that the lead plug (of the shield container) had fallen out thus giving rise to a radiation field with potential for affecting personnel. In fact no such effect occurred.
[level meter/control]

Lessons

Need for adequate procedures, training and control in the use of radioactive sources.
Need for appropriate `hardware' systems:-
1. plug locking device.
2. proper service storage arrangements.
Need to set up a clearly defined organisational chain of responsibility for radioactive sources (and other radioactive materials).

8076 1980

Source : ICHEME

Location : ,

Injured : 1 **Dead :** 0

Abstract

A shift electrician at a refinery received serious burns to his face, neck, right arm and hand when a short circuit occurred during work on an isolator switch. The electrician had been instructed to investigate an electrical fault associated with a gantry crane control box in the workshop. It appears that the accident occurred whilst the electrician was operating the fused isolator with the compartment door open.

The electrician reported that the purpose of opening the switch door was to remove the fuses so that work could be carried out safely on the gantry equipment. (The reason for going to remove the fuses was because there was no locking device on the handle of this type of switch). The switch is fully interlocked to prevent the door being opened with the switch closed and to prevent the switch being closed whilst the door is open.

[electric shock, maintenance]

Lessons

[None Reported]

1886 02 August 1979

Source : ICHEME
Location : , KUWAIT

Injured : 0 **Dead :** 0

Abstract

A fire occurred in a control room of a refinery crude distillation plant.
[fire - consequence, refining]

Lessons

[None Reported]

1838 20 March 1979

Source : 100 LARGEST LOSSES, 9TH EDITION, MARSH & MCLENNAN, 1986.
Location : Linden; New Jersey, USA

Injured : 0 **Dead :** 0

Abstract

Failure of a dead ended section of pipeline in a fluid catalytic cracking unit allowed the release of propane and butane. The vapour cloud had covered an area of about 1.5 acres to a depth of 5 to 6 ft when it ignited. Water sprays were ineffective in dispersing the vapours. An unused control room filled with vapours and exploded. Flying bricks and debris severed small pipelines in the area releasing further hydrocarbons. Pipeline failure.
[vapour cloud explosion, catalytic cracker]

Lessons

[None Reported]

9387 26 February 1979

Source : ICHEME
Location : , UK

Injured : 0 **Dead :** 0

Abstract

A fire occurred on a computer system in a butadiene plant. The factory fire service was called to the scene and fire was extinguished using carbon dioxide extinguishers.
[fire - consequence]

Lessons

[None Reported]

1715 07 August 1978

Source : ICHEME
Location : , SWITZERLAND

Injured : 0 **Dead :** 0

Abstract

Lightning caused fire in refinery building and damaged computer.
[fire - consequence, refining]

Lessons

[None Reported]

1508 08 December 1977

Source : GUARDIAN, 1977, 9 DEC.; CHEMICAL AGE, 1977, 16 DEC. AND 30 DEC.; 100 LARGEST LOSSES 9TH EDITION, MARSH & MCLENNAN PROTECTION LTD.

Location : Brindisi, ITALY

Injured : 22 **Dead :** 3

Abstract

A major gas release in the cold box of an ethylene unit became ignited and caused severe blast and fire damage. Two nearby ethylene units were also damaged. Blast overpressure blew out the wall panels of the control room and destroyed the controls. Water supplied by 40 fire tenders could not be carried off by sewers resulting in an 18 inch backup of floating burning liquid. The fires were controlled within 8 hours and extinguished in 3 days. Fatality. Leak.
[fire - consequence, damage to equipment, gas / vapour release, explosion]

Lessons

[None Reported]

1202718 August 1977

Source : ICHEME

Location : ,

Injured : 1 **Dead :** 0

Abstract

During the morning shift of the 18th August 1977, the blowing tower of this bitumen plant was re-commissioned.
The operator on the afternoon shift observed that the temperature in the top section of the tower was abnormally high, at 222 degrees C, he started injection of spray water. As this action did not produce a drop in temperature, he then opened the valve on the bypass line between the spray water and the 3 bar steam system. This was done because he thought that the spray water line might be blocked with bitumen. Blowing air was still in commission to the column throughout the incident.
After a short period of time, he heard a rumbling noise in the blowing tower, the explosion door opened and bitumen foam was discharged from the top elbow of the blow down pipe.
The man who was working without a safety helmet and in short sleeves, began to run away, but stumbled and was splashed with hot bitumen foam on his head and forearms, sustaining second degree burns which kept him in hospital for one week.
The subsequent investigation established that there had been a high level in the tower but that a false level was being indicated due to blockage of the level transmitter with bitumen (this had occurred after previous plant shutdowns). The pressure surge was attributed to the sudden injection of about 25 litres of water into the tower under the 3 bar steam pressure. The tower explosion door was set for a relieving pressure of 0.45 kg/cm 2. The rupture of the top elbow of the blowdown pipe was understandable, since this is designed as a very light weight construction.
The operator took the wrong action in injecting water under steam pressure. He could have reduced the tower level with the second bottoms pump and shut off the air supply to stop the temperature excursion.
[commissioning, processing, level meter/control, flow restriction, burns, spill, bitumen]

Lessons

[None Reported]

1202930 July 1977

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

Abstract

On the 30th July 1977, three offsite operators who were in the vicinity of an LPG pumpstation observed that there was a fire around the pumps. The control room was informed and the fire alarm raised.
When the operators approached the fire they found that a half inch pressure gauge tapping on a regasser pump (No. 2 pump) was broken and that escaping propane had ignited. There also appeared to be a fire at a vent valve on the adjoining pump to the left (No. 1) and around the seal of the pump to the right (No. 3).
While one of the operators stopped and shut the suction and discharge valves of the No.2 pump the other operators attacked the fire with dry powder extinguishers. All the fires were put out and the "all clear" given within five minutes of the start of the incident.
The No.2 pump had been commissioned some five minutes before the incident to transfer liquid propane to the regasser.
After the incident the following conclusions and findings were made:
1. The screwed pressure gauge connection on No.2 pump was completely broken off at the pump housing. Because of the stiff connection of the other end of the gauge line to the vent line the gauge line remained in its position.
2. The electric motor of No.2 pump was found jammed with the coupling between the pump and its motor broken.
3. It was probable that the vent valve of the No.1 pump and the seal of the No.3 pump were leaking slightly and that under the pressure of about 13 bar the leaking jet from the No.2 pump had been sufficient to ignite these smaller leaks.
4. No explanation was found for the fracture of the half inch screwed connections.
5. It was postulated that the broken connection and emission of the jet of LPG could have caused an imbalance of the pump, followed by failure of its coupling and the jamming of the motor.
6. Sparks produced during this stage were assumed to have ignited the leaking propane.
[processing, pump, pressure meter/control, connector, mechanical equipment failure,
gas / vapour release, fire - consequence, LPG, propane]

Lessons

An in-depth review of pipework at the LPG pumpstation was conducted. Increased radiographic surveys were made, and any screwed connections in the system back-welded.

1387 June 1977

Source : ICHEME
Location : ,

Injured : 0   **Dead :** 0

Abstract

A thermometer had to be removed from a temperature sensor in a pipeline as it was defective. The retaining grub screw was slackened but the thermometer was a tight fit so the mechanic unscrewed the temperature sensor resulting in the release of material. The design of the temperature sensor was unsatisfactory as had the thermometer been removed with a wrench it is likely that the sensor would have been unscrewed. A back weld should have been used if this design was used.
[design fault, temperature meter/control, maintenance]

Lessons

[None Reported]

9573 01 May 1977

Source : ICHEME
Location : , UK

Injured : 1 **Dead :** 0

Abstract

A ships officer suffered burns to his face and eyes as a result of ammonia liquid being ejected from and ammonia gas sample point.
[leak]

Lessons

[None Reported]

1022603 March 1977

Source : ICHEME
Location : Wales, UK

Injured : 0 **Dead :** 0

Abstract

A control room alarm indicated a fault on the electrical supply. There was a smell of burning in the switchroom and a fuse failure light was showing "on". A test was carried out and indicated that the switchboard was "dead". This was, in fact, an erroneous conclusion but, based on this conclusion, the emergency generator was started up by "tripping" out the normal electrical supply to the switchboard. However, its circuit breaker remained open because the locking lever was in the "free" position (because the normal electrical supply had not, in fact, been lost). This, all supplies to the switchboard were lost and the switchboard remained without power for 32 minutes. Plant instrumentation was drastically affected.
[ethylene, damage to equipment, human causes, electrical equipment failure]

Lessons

The main lesson was that the incident was caused by human error, the incorrect deduction from the voltage test carried out as above. This set in train the sequence of events leading to loss of plant instrumentation availability.
The recommendations were:
1. More detailed training on the operation of emergency supply systems.
2. An engineer of the appropriate discipline should be contacted immediately in case where a fault develops on factory performance.
3. All electrical portable test equipment should be equipped with the necessary accessories.

120311977

Source : ICHEME
Location : , AUSTRALIA

Injured : 1 **Dead :** 0

Abstract

An operator was sprayed with splintered glass when a flow indicator blew out whilst he was checking the air flow to the slurry line on a copper chloride unit at a refinery.
The man sustained minor facial injuries, fortunately his eyes were saved by the prescription safety spectacles he was wearing. Both lenses of these spectacles were marked by flying glass.
The air pressure at the flow indicator was about 7 bar, which was within its pressure rating.
However, it is believed that the flow indicator had suffered some previous damage which caused it to shatter. The armoured glass shield was also shattered.
[inspection, flow meter/control, personal protective equipment, mechanical equipment failure, injury]

Lessons

Wire guards to be fitted in addition to the armoured glass shield, to prevent flying glass should another failure occur.

116851976

Source : ICHEME

Location : ,

Injured : 0 **Dead :** 0

Abstract

A near miss incident with a very serious potential occurred on the No.1 Distillate Hydrotreater several days after recommissioning.
During steady operation of the unit, a dull bang was heard by operations personnel, and simultaneously, a large discharge of gas was observed.
It was quickly established that the gas discharge originated from the base of the DHT reactor, and emergency shutdown and depressuring of the unit was immediately initiated. The prevailing wind caused the gas cloud to drift towards the feed residue heat exchangers of the No. 2 Crude Distillation Unit.
Ignition did not occur, and the gas cloud dispersed as the plant was depressured. Subsequent inspection of the DHT reactor system revealed that the leakage had occurred at a temporary pressure gauge assembly, fitted to the reactor differential pressure instrumentation piping. The pressure gauge had been put in during the overhaul to measure the slight positive pressure of nitrogen being maintained over the catalyst to prevent ingress of air. Under DHT operating pressure, the rubber seal rings of the coupling were blown out, the maximum recommended working pressure for such a coupling is 10 kg/cm 2.
[commissioning, pressure meter/control, temporary, incorrect equipment installed, inspection inadequate, gas / vapour release, near miss]

Lessons

The refinery's conclusions and actions were as follows:
1. The incident demonstrated the potentially disastrous consequence of the use of fittings which did not meet the recommended Engineering Standards for a given duty.
2. The incident emphasised the importance of and the need for thorough and effective inspection of plant at the pre-commissioning stage following an overhaul. More time for check-outs will be allocated in future.
3. During an overhaul, much of the work carried out affects the integrity of the plant, and must be properly executed. The procedures and practices of the Refinery engineering and operations departments are under review with the intention of reducing the risk of the plant being returned in an unsafe condition.

116671975

Source : ICHEME

Location : ,

Injured : 11 **Dead :** 2

Abstract

An explosion occurred recently in a control room of an olefine unit which took the lives of two operators. Eleven other people were injured. The damage, was confined to the control room and its electronic equipment, the unit itself remained undamaged.

The explosion occurred in a cellar underneath the control room in which the central heating facilities were installed. This included a steam supplied hot water heater. The steam trap from this heater relieved into an atmospheric receiver in the cellar. Before the explosion a tube leakage occurred in a steam supplied preheater on the unit. The exchanger had exhaust steam on the tube side and hydrogen rich gas on the shell side. This leak allowed hydrogen rich gas to penetrate into the exhaust steam system and to escape via the steam trap into the cellar underneath the control room. When the smell of the gas was noticed, an operator descended into the cellar and switched off a non-explosion proof motor on a condensate pump. It is not known for certain if this switching operation ignited the gas accumulated in the cellar, but the subsequent explosion blast destroyed the ceiling of the cellar and caused the control room to partly collapse.

An operator, who happened to be smoking in the rest room on top of the cellar, was killed immediately. Eleven other people were hurt when the control room collapsed. The operator, who had descended into the cellar, was not hurt by the explosion blast, although at the centre of the explosion, but he was unfortunately so severely burnt that he died later in hospital.

The reason for the internal leakage of the steam preheater was that during a previous commissioning operation, condensate had been frozen within the tubes and split some of the tubes open.

[processing, heat exchanger, heater, leak, tube failure, fatality, injury]

Lessons

Where the steam pressure in an exchanger is exceeded by the process stream pressure then a non-return valve should be fitted in the steam supply to the exchanger. Consideration is also necessary of the exhaust steam/condensate routes and types of steam traps. This may well involve a detailed study to determine possibilities of inter linking contamination of steam and condensate, specific to a particular refinery.

6918 February 1974

Source : LOSS PREVENTION BULLETIN, 009, 5.
Location : ,

Injured : 0 **Dead :** 0

Abstract

It is common refinery practice to route process water from light ends vessels through a water disengaging drum before it is sent to the sewer. The water disengaging drum is usually vented to the flare system so that any light ends hydrocarbons which might break through with process water from the vessel can be adequately disengaging from the water and then vented safely, so ensuring that only hydrocarbon-free water is routed to the sewer.
On the day of the incident, the level control valve at a butylene wash tower failed wide opened due to a freezing problem. A large quantity of butylene came out of the outlet seal leg from the water drum, at the sewer, and covered a considerable area at grade with hydrocarbon vapour. Fortunately the source of butylene was found quickly enough to prevent a gas cloud explosion. However, the circumstances clearly class this event as a near miss accident.
[level meter/control, valve failure, instrumentation failure, separation, cold weather]

Lessons

Design Lessons
1. During the initial design stage, it was intended to route process water to offsite handling facilitates requiring a battery limit pressure of 125 p.s.i.g. The level control valve on the wash tower was specified to pass 4 GPM water with a pressure drop of 15 p.s.i (i.e. 140 p.s.i.g = 125 p.s.i.g + 15 p.s.i.g. When the decision was made later on to install the onsite water disengaging drum, this control valve pressure drop was not changed from 15 p.s.i (i.e. 140 p.s.i.g = 125 p.s.i). this oversized control valve passed far more liquid butylene during the instrument failure than would have occurred with a properly sized control valve.
2. Flare systems pressures above 0 p.s.i.g under normal conditions were not considered. Venting to a flare system introduces the problem of maintaining adequate water hold-up within the vessel.
3. The line size of the vapour vent to the flare system was too small. Furthermore, the downward leg of the water seal would have been more effective with a larger cross-sectional area.

1116407 September 1973

Source : ICHEME
Location : , SWITZERLAND

Injured : 0 **Dead :** 0

Abstract

A tank was overfilled with diesel oil resulting in the spillage of about 650 barrels. The oil was contained within the bund walls and transferred to the API slops tank using vacuum truck. The tank roof was damaged and repairs have been estimated at ca £12,000 (1973).
Investigations showed that the incident resulted from a number of causes.
1. The automatic tank gauge showed a reduced rate (ca 45%) of increase in level but no action was taken e.g the supply tank level was not checked.
2. A capacity factory of 690 bbls/ft was used instead of 1,400 bbls/ft.
3. The automatic tank gauge, installed in June 1973, had given five erroneous readings prior to the incident and in fact was found to be reading 10ft. too low.
4. There was a high work load at the time of the incident e.g. 22 tank movements were being carried out on this particular shift.
[storage tanks, overflow, damage to equipment, material transfer, level meter/control, control failure]

Lessons

The refinery have since ruled that in all future transfers the supply tank level, as well as that of the receiving tank, should be check gauged.

6321 29 July 1972

Source : ICHEME

Location : ,

Injured : 0 **Dead :** 0

Abstract

Following an operational upset on the catalytic cracker on 29th July, 1972, flow through the south pass tubes of the unit's feed preheater furnace was interrupted for about 10 minutes while the heater was still being fired. The heater tubes were subjected to `creep shock' which resulted in leakage at the expanded ends of 11 of the tubes. The leaking vapours ignited and a minor fire occurred in the east end header box of the south radiant wall tubes. The fire was readily extinguished by a fire steam hose and the vapours blanketed by the fixed snuffing steam.

There were no injuries to personnel and damage to the heater was minimal.

Prompt emergency action was taken by the operating staff in opening steam to the header boxes and shutting down the furnaces. The refinery fire service was on site within 2 mins. of receiving the alarm and the fire in the header box was extinguished without difficulty using a fire steam lance and controlled thereafter by the snuffing steam to the header boxes.

The initiating cause of the incident was the loss of the gas compressor but the tube overheating and subsequent escape of oil with a fire was due to the faulty furnace temperature controller.

[fire - consequence, refining, instrumentation failure, cracking, temperature meter/control]

Lessons

The heater outlet thermocouples were located ca 30 ft. downstream of the heater and sufficiently remote so as not to be influenced by conducted heat from the furnace. This `dead-leg' location was responsible for no temperature increase being recorded during the no-flow condition.

Source : ICHEME
Location : ,

Injured : 2 **Dead :** 0

Abstract

An operator on a sulphur recovery unit noticed a drop off in the air flow to the main H2S (hydrogen sulphide) furnace and shortly afterwards yellow smoke was observed coming from the incinerator stack.
He took certain corrective action but there was no improvement and toxic gases blew out of the seals of the sulphur pit in reverse flow through the suction filters of the air blower. The plant was crash shutdown using the emergency button in the control room but in this period some of the escaping gas penetrated an area of the unit including the control room. Two men were seriously affected by the gas and lost consciousness. There were other people in the area at the time and the affected men were quickly removed to the Medical Centre and later transferred to hospital where they made a full recovery. One of the men had put on a H2S cartridge mask as soon as he noticed the strong smell of gas on the plant, but he was either too late in taking this action or the cartridge mask was ineffective.
[gas / vapour release, plant shutdown]

Lessons

1. It is extremely important that unit operators and maintenance workers are aware of the hazards of H2S and that they know what and where the protective facilities are on plants containing this gas at toxic levels.
2. Because of the high toxic risk, if there is a break-out of H2S on one of these plants it has been recommended that an alarm should be installed to warn other units in the vicinity that a serious gas leak has occurred.

4833 1972

Source : ICHEME
Location : ,

Injured : 0 **Dead :** 0

Abstract

On two occasions in 1972 gas and oil have escaped from pressure gauge connections on a ferrofiner plant. In both instances, it is believed that the large pressure gauge (150 mm diameter) was knocked against by someone and that this was sufficient to turn the pipe and loosen the screwed connection. Fortunately the escaping material although ejecting at high pressure (25 bars), and at a temperature of 220 degrees C failed to ignite. In the first incident, the plant had to be de-pressured before the gauge could be isolated, this caused 6 hours of lost production. In the second case an operator, suitably clad, was able to shut off the pressure gauge isolating valve without interruption to plant operation.
[gas / vapour release, product loss, processing, pressure meter/control]

Lessons

The pressure gauges were fitted to horizontal piping and are susceptible to being turned to a loose position with relatively little force, the turning moment being so great at the screwed connection. The company made modifications such as fitting supports to the gauge connections so as to prevent the accident recurring.

107 22 October 1971

Source : ICHEME
Location : ,

Injured : 0 **Dead :** 0

Abstract

On the 22nd October, 1971 a relief valve on an 800m3 sphere lifted and discharged liquid butane.
The release was of short duration and the valve reseated correctly. Before the incident occurred the particular sphere was receiving butane and was interconnected by a balance line with other spheres in the same storage area.
An operator who was supervising roadcar loading nearby heard the distinctive noise of the relief valve lifting and shut off the feed to the sphere, when the valve reseated.
The alert was given to the refinery fire service by a road tanker driver who saw liquid butane running down the side of the sphere.
When the fireman arrived, they commissioned water to the leaking sphere and adjoining ones until all signs of butane had disappeared.
Fortunately a strong wind rapidly dispersed the cloud of vapour which was drifting towards a main highway. There was no ignition of the escaping vapour and nobody was injured nor any damage incurred.
An investigation revealed that the telemetering dip indicator was in error due to a fault in the magnetic transmission within the vessel. It is believed that this could have been caused by liquid disturbance when the level in the sphere was low, a result of pump circulation.
This `near miss' describes a potentially dangerous situation which arose because a cloud of flammable vapour was emitted which drifted towards a major road where ignition sources were present. Had the relief valve not reseated the incident could have assumed major proportions. Initial level gauges are not 100% reliable and it is normal for storage spheres to have high level alarms also fitted from a separate offtake. In this case none of the vessels were equipped with this feature but modifications for this will be carried out as soon as practicable.
The presence of a balance line between the spheres (single RV's per vessel) did not prevent the overfilling and overpressuring which led to the relief valve lifting; it has been locally decided to increase the size of these lines.
[gas / vapour release, storage tanks, overflow, overpressurisation, level meter/control]

Lessons

In this case the company's fire service has to approach flammable vapour leaks with caution because its appliances were petrol driven and thus an ignition risk.
In addition under certain wind directions, the LPG storage is almost impossible to reach upwind using the present access ways. Additional emergency routes were therefore being considered.

1012824 July 1971

Source : ICHEME
Location : , USA

Injured : 1 **Dead :** 0

Abstract

An explosive force was generated in effluent piping during steam-air decoking of a raffinate heater on a phenol treating unit. The force bent the effluent pipe back over the heater, causing the pipe to strike a stack damper control and a purge steam line. An operator was struck on the mouth by the door of a flow recorder associated with the steam meter.
Instrumentation consisted of a steam meter and an air meter. Flow was controlled by gate valves installed in each pass of the two-pass heater. Decoking was initiated by the introduction of steam to each pass of the heater. When steam flow was established, quench water was injected into the common effluent line and two burners were fired in the heater compartment. The temperature of each outlet pass was raised simultaneously to 900 degrees F. However, as steam flow increased, the temperature of one outlet pass began to rise faster than the other until there was a 300 degrees F difference. The steam flow to each pass was adjusted to bring these temperatures together. After the outlet temperatures were stabilized, a third burner was fired. Again the outlet temperatures became erratic, but before further adjustments could be made, the explosion occurred.
[heating, maintenance, flow meter/control, instrumentation failure, flow rate too low]

Lessons

Conclusions:
It is theorized that insufficient steam flow in one pass of the heater allowed the quench water to back into that coil, vaporize and generate the explosive force. It is also believed that the actual steam flow through the coils was less than that indicated by the steam meter, even though the meter had been recently calibrated. As a result, the flow control gate valves would have been very sensitive to adjustments. This could explain the erratic behaviour of the outlet temperatures.
Recommendations:
1. All steam-air decoking procedures on process heaters were revised to include:
2. Separate steam and air meters for each heater pass.
3. A check valve in each steam and air line.
4. A steam trap and a bleeder immediately upstream of the block valve on each steam line.
5. The piping of the effluent, after quenching, to one or more disengaging pots.
6. The installation of thermocouples to measure skin temperatures within the heater to obtain better temperature control.
7. The installation of a pressure gauge in the inlet to each heater pass.
8. In addition, a standard set of safety guidelines was developed.

503 05 December 1970

Source : 100 LARGEST LOSSES A THIRTY YEAR REVIEW OF PROPERTY DAMAGE LOSSES IN THE HYDROCARBON CHEMICAL INDUSTRIES, MARSH & MCLENNAN PROTECTION CONSULTANTS, 9TH EDITION, 1986; OIL AND GAS JOURNAL, 1971, 4 JAN, 58.

Location : Linden; New Jersey, USA

Injured : 6 **Dead :** 0

Abstract

A 7 inch thick reactor of a wide range hydrocracking unit being operated by computer at 2500 psi failed explosively due to localised heating. The blast caused widespread damage over a 300 yard radius including an adjoining catalytic cracker and crude pipe still where the roof of the control building collapsed. Other units were safely shut down from a blast resistant control building which sustained minor damage.
[processing, high temperature, damage to equipment, reactors and reaction equipment, computer failure]

Lessons

[None Reported]

497 16 November 1970

Source : MCARTHUR J.G, AMMONIA STORAGE TANK REPAIR, AMMONIA PLANT SAFETY, VOL 14, 1972, 1-5.
Location : Blair; Nebraska, USA

Injured : 0 **Dead :** 0

Abstract

A refrigerated 40,000 tonne anhydrous ammonia storage tank overflowed, 160 tonnes of ammonia was lost during unloading operations from a barge. The oveflow occurred due to failure of a high level alarm system and shutdown system which was being relied upon.
[alarm failure, spill, refrigerated storage tank, level meter/control]

Lessons

[None Reported]

397 23 April 1968

Source : MARSHALL VC, MAJOR CHEMICAL HAZARDS, ELLIS HORWOOD, 1987. ENVIRONMENTAL PROTECTION BULLETIN, 035, 15.
Location : Bolsover; Derbyshire, UK

Injured : 79 **Dead :** 1

Abstract

The oil temperature control of a heater on a reactor containing 2,4,5-trichlorophenol failed causing a runaway reaction. The reactor exploded releasing dioxins.

[reactors and reaction equipment, temperature meter/control, explosion, fatality]

Lessons

[None Reported]

9814 16 August 1967

Source : LOSS PREVENTION, VOL. 3.

Location : ,

Injured : 0 **Dead :** 0

Abstract

An idle analogue computer was left energised and caught fire. It was controlled by one sprinkler head. Other computers in the room suffered minor smoke damage.
[fire - consequence, damage to equipment]

Lessons

[None Reported]

159 08 January 1957

Source : 100 LARGEST LOSSES 9TH EDITION, MARSH & MCLENNAN PROTECTION CONSULTANTS, 1986; GUGAN K, UNCONFINED VAPOUR CLOUD EXPLOSIONS, ICHEME, 1979.

Location : Montreal, CANADA

Injured : 0 **Dead :** 1

Abstract

An error in the gauge level on a 5000 barrel storage sphere was discovered and as a result of a series of errors the sphere was overfilled. A large quantity of butane formed in the bund system with two other spheres. A large vapour cloud formed and was ignited 600 ft away. About 30 minutes later a sphere developed a split followed 30 minutes later by the rupture of the other 2 spheres. A 30 ft piece travelled 1175 ft. 2 tanks were hit by missiles and exploded. A tank in an adjacent refinery exploded.
Estimated loss $3,164,000 (1957).
[overflow, operator error, vapour cloud explosion, level meter/control, fatality]

Lessons

[None Reported]

7158 Date Unknown

Source : LOSS PREVENTION BULLETIN, 047, 7-12.
Location : ,

Injured : 0 **Dead :** 0

Abstract

During transfer of oleum by gravity from the storage tank to the plant head tank, oleum was seen leaking down the head tank. The fumes produced within the building were so dense that it was not possible to see where the leak had occurred.
The operator operated the isolation cock on the storage tank outlet, but inexplicably the oleum leak persisted.
It was subsequently discovered that the level indicator on the storage tank was sticking and when freed it was seen that oleum was still flowing from the storage tank. Finally the outlet cock was properly closed and the flow and leak ceased.
What went wrong?
1.The filling valve failed to operate both on the weight signal and the high level signal.
2. An incorrect joint had been used when the vent line was mounted on the tank which had deteriorated due to the effect of fumes in the vent.
3. The storage tank outlet cock spindle was not visible due to the method of fixing of the extended spindle.
4. The cast stops on the gland of the outlet cock had broken off.
5. A painted indication of the open and shut positions on the lagging cladding had been removed a week earlier when the lagging had been repaired.
6.The storage tank level indicator was sticking.
7. The plug valve mechanism was siezed up.
[material transfer, level meter/control, spill, storage tanks]

Lessons

The following corrective actions were taken:
1. Reinforcement of instructions on correct joint materials to be used for oleum, together with scheduled programme of joint replacement.
2. Provision of substantial well marked positive stops for the storage tank outlet cock.

8013 Date Unknown

Source : ICHEME

Location : ,

Injured : 0 **Dead :** 0

Abstract

A 100 tonne capacity storage sphere was overfilled with butane.
An independent high level alarm had recently been installed but due to teething troubles operatives regarded it as unreliable indication of maximum level. On the night of the incident, the alarm activated at 58% according to the level recorder.
Subsequent investigations found that in fact it had activated at 68% because of a fault with the level instrument/recorder which was registering a level 10% lower than it actually was.
The operator then believed that there was time to carry out other tasks before there was a need to check the level again.
However due to an increase in flow of butane from the hydrocracker, the sphere overflowed before the operator had returned to check the level again.
It was very fortunate that no ignition occurred and that the resultant vapour cloud dispersed very quickly due to the wind.
Refineries are requested to review the reliability of level instrumentation, particularly the frequency of testing and operating procedures, associated with LPG storage vessels.
[gas / vapour release, level meter/control, instrumentation failure, near miss]

Lessons

[None Reported]

7661 Date Unknown

Source : HAZARDS OF OVER AND UNDER PRESSURING OF VESSELS, ICHEME, TRAINING PACKAGE, 001, 15.
Location : ,

Injured : 0 **Dead :** 0

Abstract

The access stairway to a butane storage sphere was found to have broken loose. On closer examination it was found that the sphere, originally 14 m diameter, had increased in diameter by 150 mm.
The cause:
The sphere was fitted with a level gauge, the float of which consists of three 200 mm diameter stainless steel balls. One of the balls broke loose and when the sphere was over filled the ball formed a perfect fit in the relief valve pipe.
[overflow, mechanical equipment failure, level meter/control]

Lessons

Check all new and existing vessels containing floats to make sure this cannot happen again. If necessary fit a grid underneath the relief valve pipe or use a different sort of level gauge.

7688 Date Unknown

Source : HUMAN ERROR, ICHEME, TRAINING PACKAGE, 008, 43.
Location : ,

Injured : 0 **Dead :** 0

Abstract

There were two furnace temperature controller records, A & B, side-by-side on the panel. Each was fitted with a high temperature trip.
To test the trips the tester asked the operator to put the controller on manual. He then went behind the panel, connected a potentiometer to the record-controller, injected a current and noted the current (and hence the temperature) at which the trip operated.
On the day of the incident the tester and operator agreed that the trip on A recorder-controller would be tested first.
The operator put the controller on manual.
The tester when behind the panel and carried out the test as normal. The furnace tripped and it took 24 hours to get the plant back to normal
[operator error, testing inadequate, temperature meter/control]

Lessons

[None Reported]

7643 Date Unknown

Source : LOSS PREVENTION BULLETIN, 134, 7-9.
Location : ,

Injured : 0 **Dead :** 0

Abstract

A fire occurred on a carbon bed adsorber. The replacement of the carbon was completed and the adsorber beds were then deemed ready for pressure testing. This was carried out by closing the manual steam isolating valve to avoid the programmable logic controller (PLC) opening any incorrect connections, and pressurising with instrument air to 2 bar(g). Some leaks were repaired at this time. The Number 2 adsorber bed was in the correct step in the sequence for pressure testing the regeneration step, so the steam which had been on for some time was isolated manually, and the bed was pressurised to 2 bar(g) with instrument air and left for a period of two hours. The temperature of bed Number 2 rose rapidly from 138 degrees C at the start of the pressure test, but stabilised at about 150 degrees C, slowly rising a few more degrees over the next 2 hours. At this point, the PLC cycle was stepped on manually to allow the pressure testing of bed Number 3. This vented bed Number 2 and placed it on primary duty, so that it now had a large flow of air passing through it. The temperature of bed Number 2 dropped as soon as it had it had been vented, and shortly afterwards, the temperature rose rapidly, exceeding 450 degrees C. The maximum temperature was not recorded as the thermocouple failed at 454 degrees C.

This high temperature was spotted by the operators, on seeing the outside of the lagging on bed Number 2 glowing red hot. Realising that there was a bed fire, the operators investigated and in conjunction with the Fire Service, opened the bed and slowly applied water to the top of the bed to quench the embers. Whilst the fire in bed Number 2 was being extinguished, it was realised that bed Number 1 was on fire, and attention was subsequently switched to extinguishing bed Number 1. This was because the hot combustion products from the primary bed Number 2 were passing into the secondary bed Number 1, as arranged by the sequence of valves controlled by the PLC.

[adsorption, separation, fire - consequence, process control & instrumentation, computer]

Lessons

The following recommendations were made:

1. Those operating and maintaining the carbon bed adsorber system need to appreciate the potential hazards associated with carbon bed adsorption systems.
2. Immediately prior to making any changes to a carbon bed adsorber system, the effect of the changes on the safe operation should be assessed, and the reasoning behind the changes should be documented accurately.
3. Consideration should be given to the fitting of a form of over-temperature trip on the steam used for regeneration of carbon bed adsorbs.
4. Since the early detection of combustion in a bed can save the considerable damage that occurs before it is apparent externally that the bed is on fire, consideration should be given to the installation of carbon monoxide detectors on the outlets of the beds.

5371 Date Unknown

Source : ICHEME
Location : ,

Injured : 4 **Dead :** 0

Abstract

A flash fire of short duration occurred in a control room basement which was under construction in an established refinery. A number of men were injured with four being sent to hospital for burns treatment, two men having 20% burns.
The accepted cause was an accumulation of light hydrocarbon (naphtha and gasoline components) which leaked through with ground water into the below ground basement. It was thought to have been ignited by an electric grinding tool in use in two of the rooms of the basement where the fire developed.
The basement (total size 31 x 43 metres) is split up into a number of rooms, in which a variety of different work activities were in hand by different sub-contractors at the time of the incident. The roof over the basement was only partially completed.
Work control and housekeeping seems to have been poor. Some welding was in progress on air ducts, grinding to finish concrete floors, some flammable adhesives and solvent thinners were in evidence, and there was not control over smoking. There was also a broken electric light lead.
There had been a refinery history of leaking floating roof tank roof drains which had been in the past directed to ground and also some tank bottom leakage. There were a number of "inspection wells" which had been drilled in the site to locate oil levels, and from which oil could be removed.
Apart from technical engineering investigations regarding the design and construction of basement, remedial actions had to be taken to correct seepage through the walls, and a much improved safety control system instigated, including regular gas testing in excavations, and discussion with workers safety representatives.
[fire - consequence, injury]

Lessons

[None Reported]

1704 Date Unknown

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

Abstract

Following interruption of oil flow through a hot oil circulating plant and due to a failure of the flow measuring instrumentation, the low flow heat-off trip to the burner failed to operate and resulted in overheating and partial evaporation of the oil in the heater tubes. The hot oil plant including a storage vessel is sited inside a building with the fired heater located outside. The hydrocarbon vapours produced by the overheating were pushed through the system and escaped from the vent of the storage vessel into the building where they were ignited. The source of ignition could have been electrical equipment in the vicinity or autoignition may have occurred since the outlet temperature of the heater reached above 450 degrees C.
Two employees present at the time suffered minor burns. Electrical cables and a switchboard near the storage vessel were severely damaged.
The fire was extinguished by the work's and local authority's fire brigades using high and medium expansion foam generators.
Heat-off on the burner is automatically initiated by:
1. low flow through the orifice plate in the discharge line from the circulation pump
2. high temperature in the transfer line from the heater to the user vessels
3. high temperature in the fire box of the heater On the day when the incident occurred, the plant had just been started up. It was frequently shut down and started up because of the varying demand for hot oil from the batchwise operated grease vessels. The operator's first action was to start the circulation pump and to open the bypass around the user vessels since the signals "pump is running" and "no low flow" were required to obtain the "all clear" signal necessary for burner ignition. When the operator checked the temperature instruments on the control panel, he noticed that No.1 oil transfer temperature was reading zero whereas No.2 was reading 200 degrees C and the heater box temperature showed 220 degrees C. The instrument mechanic was called to check No.1 temperature. 15 minutes later a repeated check of the instrument panel showed that the heater box temperature had risen to 350 degrees C, the level at which heat-off is initiated. Simultaneously rumbling noises were heard from the pipework system and fumes were seen emerging from the storage vessel's vent. Although the burner had been extinguished, the temperature in the transfer line continued to rise above 400 degrees C. The oil fumes from the storage tank vent then ignited.
The refinery investigation led to the finding that the incident was initiated by an interruption of oil flow through the circulating system possibly due to coke formation in the heater tube, but that the following aspects were largely responsible for it reaching serious proportions:
1. The low flow alarm/shutdown trips failed to operate because an orifice impulse line was blocked.
2.   The No.1 temperature indicator/alarm/shutdown trip thermocouple was installed in a section of transfer line that was not used during the start-up phase.
3. The oil storage vessel vented to atmosphere inside the building instead of outside.
[flow meter/control, refining, instrumentation failure, flow rate too low, fire - consequence]

Lessons

The refinery plan to demolish the unit and take heating oil from a more modern unit on the site.
Alarm/trip arrangements should preferably be taken from separate measuring points to those used for indicating and controlling process flows through a fired heater unless the design and control instrumentation provides a reliable alternative to alert the operator of low flow.

2802 Date Unknown

Source : ICHEME
Location : ,

Injured : 0 **Dead :** 0

Abstract

Electrical power failure occurred at a refinery.
A false trip of the pilot wire control cables resulted in an interruption to the 35 kV power supply. Fluctuation in generator output, from accelerating/decelerating machinery, caused one too many false trips and system disabled to prevent recurrence. While in the process of cutting the old cable tray for removal, the pilot wire control cable was cut (serviced equipment in operation), which, further, prevented the system from being able to discriminate as to where the fault existed (made safety device inoperative).
Losses included; lost opportunity, additional maintenance.
The cause was the person performing the work was not aware of the location of the pilot wire control cable.
[power supply failure, operator error, refining]

Lessons

1. Work on or near to refinery electrical incoming feeders and segments of the distribution system needs to be rigorously planned and controlled.
2. Protective systems do not always work as expected/designed, they should be reviewed and, where justified, updated.

6899 Date Unknown

Source : LOSS PREVENTION BULLETIN, 007, 5-6.
Location : ,

Injured : 0 **Dead :** 0

Abstract

On one plant a stream of high pressure water was heated to 300 degrees C by hot oil.
If a tube leaks, water will leak into the oil and will be very quickly turned into steam, causing a rapid rise of pressure.
A pressure switch is therefore installed on the oil line and the signal from this switch closes valves in the oil and water lines.
When a tube leaked, this system operated, but the valves closed so slowly that hot oil was blown out of the expansion tank. The oil caught fire, causing serious damage and loss of production. After the fire, it was discovered that:
1. The setting on the pressure switch had been raised from 75 p.s.i.g to 140 p.s.i.g.
2. The pilot valves had not been lubricated.
3. The trip had not been tested for six months.
[testing inadequate, fire - consequence, tube failure, pressure meter/control, oil - hot]

Lessons

The set point of the pressure switch has now been put back to 75 p.s.i.g, the pilot valves are lubricated regularly and the trip is tested every week. In addition, the expansion tank has been moved to a new position, away from the structure, so that if there is another fire, it will not cause so much damage.
In a protective system such as the one described, it is necessary to consider the speed with which a pressure rise can be detected following a leak of high pressure water into the oil and the time taken for the valves in the oil and water lines to close. If this time is significant, discharging to a safe place.

The specific recommendations and measurements taken as a result of the incidents described are as follows:
1. Design Philosophy and Procedures
(a) There should be a clear design philosophy for the specification of instrumentation, control and projective systems.
(b) There should be a through Hazard and Operability analysis carried out on the plant design to ensure that all possible eventualities which could lead to a hazardous condition have been eliminated.
(c) The reliability of the instrumentation should be assessed quantitatively whenever possible.

2. Design Principles
a) Generally, the process parameters of direct interest should be measured, and displayed in the right places.
b) The same measurement should not be used for control and protection.
c) The possibility of instrument failure must be fully taken into account. It should be ensured that failure of instruments does not produce hazardous conditions.
d) The action of control loops should be to fail safe.
e) Instrumentation designed to deal with a fault must not be disabled by the fault itself.
f) The system must be designed for abnormal as well as normal operating conditions, e.g. start-up and shut-down.
g) Steam tracing to be provided for instruments liable to freeze.

3. Inspection
All instruments, systems and alarms and trips should be regularly checked under real life conditions. Adequate test facilities should also be incorporated in the system at the design/construction stage.

4. Operators
a) A process operator has a finite error rate. This can and should be reduced by good ergonomics, but cannot be eliminated.
b) A process operator should not be used instead of a trip system.
c) The instrument system should not be allowed to degrade even if the operator seems to compensate for this.

6901 Date Unknown

Source : LOSS PREVENTION BULLETIN, 007, 6-7.
Location : ,

Injured : 0 **Dead :** 0

Abstract

A high temperature trip detected a rise in temperature but the trip valve in the feed line failed to close.
Afterwards, it was found that the pressure drop through the valve was so high that the valve could not close against it. It was a globe type valve and to close, the valve had to move against the flow. Butterfly valves can behave similarly.
The trip was tested regularly, but normally the flow control valve shuts as well as the trip valve and this reduces the pressure drop through the trip valve.
When the temperature run-away occurred, the flow control valve had failed in the full open position, this was the cause of the run-away, and the full upstream pressure was applied to the trip valve. This prevented it closing.
[flow meter/control, instrumentation failure, high temperature]

Lessons

Whenever possible, trip valves should be installed so that the flow assists closing and the valves should be tested against the maximum flow and differential pressure likely to occur during the trip conditions.
The specific recommendations and measurements taken as a result of the incidents described are as follows:
1. Design Philosophy and Procedures
(a) There should be a clear design philosophy for the specification of instrumentation, control and projective systems.
(b) There should be a through Hazard and Operability analysis carried out on the plant design to ensure that all possible eventualities which could lead to a hazardous condition have been eliminated.
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f) The system must be designed for abnormal as well as normal operating conditions, e.g. start-up and shut-down.
g) Steam tracing to be provided for instruments liable to freeze.

3. Inspection
All instruments, systems and alarms and trips should be regularly checked under real life conditions. Adequate test facilities should also be incorporated in the system at the design/construction stage.

4. Operators
a) A process operator has a finite error rate. This can and should be reduced by good ergonomics, but cannot be eliminated.
b) A process operator should not be used instead of a trip system.
c) The instrument system should not be allowed to degrade even if the operator seems to compensate for this.

9630 Date Unknown

Source : LOSS PREVENTION IN THE PROCESS INDUSTRIES, F. LEES.
Location : ,

Injured : 0 **Dead :** 0

Abstract

In a furnace cracking ethylene dichloride to vinyl chloride under computer control the flow of ethylene dichloride to the furnace was controlled to maintain an optimum temperature in the cracked gas exit line. A furnace tube split and reduced the cracked gas flow and the cracked gas temperature. The control action increased the flow of ethylene dichloride. The furnace tubes burned up.
[tube failure]

Lessons

[None Reported]

6900 Date Unknown

Source : LOSS PREVENTION BULLETIN, 007, 6.
Location : ,

Injured : 0 **Dead :** 0

Abstract

A high temperature trip on a failed to operate with the result that the furnace was seriously damaged and was out of action for several months. The trip did not work because the pointer touched the plastic front of the instrument case and this prevented it moving to the trip level. The instrument was tested regularly by injecting a current from a potentiometer but to do this, the instrument was removed from its case and taken to the workshop.
[temperature meter/control, instrumentation failure]

Lessons

When ever possible, temperature alarms and trips should be tested by injecting a current from a potentiometer, not by altering the set point. If they are tested by altering the set-point, this will not show up faults which prevent the instruments responding to high (or low) temperatures.
The specific recommendations and measurements taken as a result of the incidents described are as follows:
1. Design Philosophy and Procedures
(a) There should be a clear design philosophy for the specification of instrumentation, control and projective systems.
(b) There should be a through Hazard and Operability analysis carried out on the plant design to ensure that all possible eventualities which could lead to a hazardous condition have been eliminated.
(c) The reliability of the instrumentation should be assessed quantitatively whenever possible.
2. Design Principles
a) Generally, the process parameters of direct interest should be measured, and displayed in the right places.
b) The same measurement should not be used for control and protection.
c) The possibility of instrument failure must be fully taken into account. It should be ensured that failure of instruments does not produce hazardous conditions.
d) The action of control loops should be to fail safe.
e) Instrumentation designed to deal with a fault must not be disabled by the fault itself.
f) The system must be designed for abnormal as well as normal operating conditions, e.g. start-up and shut-down.
g) Steam tracing to be provided for instruments liable to freeze.
3. Inspection
All instruments, systems and alarms and trips should be regularly checked under real life conditions. Adequate test facilities should also be incorporated in the system at the design/construction stage.
4. Operators
a) A process operator has a finite error rate. This can and should be reduced by good ergonomics, but cannot be eliminated.
b) A process operator should not be used instead of a trip system.
c) The instrument system should not be allowed to degrade even if the operator seems to compensate for this.

6855 Date Unknown

Source : LOSS PREVENTION BULLETIN, 001, 2.
Location : ,

Injured : 0 **Dead :** 0

Abstract

A tank which was normally used for storing petrol (gasoline) (specific gravity 0.81) was equipped with a differential pressure cell level indicator.
A new fluid Pentane (specific gravity 0.69) was then added, the tank was overfilled and one ton of pentane lost. Thus, when the tank was full of pentane the level indicated only 85% full. The high level alarm, which did not sound, was fixed to the level indicator.
A Hazard and Operability Study was not effected before the change. Such a study should have revealed that:
1. Level indicators measuring volume are better than those measuring weight.
2. The high (or low) level alarm should be a separate detector from the main level indicator.
[overflow, level meter/control, spill, alarm failure]

Lessons

[None Reported]

6885 Date Unknown

Source : LOSS PREVENTION BULLETIN, 006, 8.
Location : ,

Injured : 0 **Dead :** 0

Abstract

Hydrogen formed by corrosion can diffuse through steel. A company found that mercury-in-steel thermometers were reading high. The outsides of the steel bulbs were corroding and the hydrogen was diffusing onto the thermometer. The remedy was to coat the steel bulbs with another metal.
[temperature meter/control]

Lessons

[None Reported]

6895 Date Unknown

Source : LOSS PREVENTION BULLETIN, 007, 2.
Location : ,

Injured : 0 **Dead :** 0

Abstract

In an ethylene cracking furnace the flow of fuel to the furnace was manipulated to control the temperature of the cracked gas leaving the furnace. The temperature measuring instrument failed and gave a low reading. The control action increased the heat to the furnace. The furnace was designed to supply mainly latent heat of vaporisation to the process stream with a small amount of superheat. Thus the vapour temperature was sensitive to the additional heat input and rose rapidly. The piping overheated and ruptured, releasing ethylene gas which was ignited by the burners of an adjacent furnace. The resultant fire did severe damage.
[pipe, overheating, instrumentation failure, fire - consequence, temperature meter/control, damage to equipment]

Lessons

The specific recommendations and measurements taken as a result of the incidents described are as follows:
1. Design Philosophy and Procedures
(a) There should be a clear design philosophy for the specification of instrumentation, control and projective systems.
(b) There should be a through Hazard and Operability analysis carried out on the plant design to ensure that all possible eventualities which could lead to a hazardous condition have been eliminated.
(c) The reliability of the instrumentation should be assessed quantitatively whenever possible.

2. Design Principles
a) Generally, the process parameters of direct interest should be measured, and displayed in the right places.
b) The same measurement should not be used for control and protection.
c) The possibility of instrument failure must be fully taken into account. It should be ensured that failure of instruments does not produce hazardous conditions.
d) The action of control loops should be to fail safe.
e) Instrumentation designed to deal with a fault must not be disabled by the fault itself.
f) The system must be designed for abnormal as well as normal operating conditions, e.g. start-up and shut-down.
g) Steam tracing to be provided for instruments liable to freeze.

3. Inspection
All instruments, systems and alarms and trips should be regularly checked under real life conditions. Adequate test facilities should also be incorporated in the system at the design/construction stage.

4. Operators
a) A process operator has a finite error rate. This can and should be reduced by good ergonomics, but cannot be eliminated.
b) A process operator should not be used instead of a trip system.
c) The instrument system should not be allowed to degrade even if the operator seems to compensate for this.

6896 Date Unknown

Source : LOSS PREVENTION BULLETIN, 007, 2.
Location : ,

Injured : 0 **Dead :** 0

Abstract

A differential pressure cell measuring liquid chlorine flow failed due to a diaphragm rupture and a violent reaction occurred in one of the impulse lines. Subsequent investigation showed that the explosion could have been due to a reaction of the chlorine with silicone oil which leaked from the damping fluid in this application.
[flow meter/control, instrumentation failure, contamination, unwanted chemical reaction]

Lessons

The specific recommendations and measurements taken as a result of the incidents described are as follows:
1. Design Philosophy and Procedures
(a) There should be a clear design philosophy for the specification of instrumentation, control and projective systems.
(b) There should be a through Hazard and Operability analysis carried out on the plant design to ensure that all possible eventualities which could lead to a hazardous condition have been eliminated.
(c) The reliability of the instrumentation should be assessed quantitatively whenever possible.

2. Design Principles
a) Generally, the process parameters of direct interest should be measured, and displayed in the right places.
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All instruments, systems and alarms and trips should be regularly checked under real life conditions. Adequate test facilities should also be incorporated in the system at the design/construction stage.

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b) A process operator should not be used instead of a trip system.
c) The instrument system should not be allowed to degrade even if the operator seems to compensate for this.

10571Date Unknown

Source : INSTRUMENTATION TECHNOLOGY, 1972, 19 (10): 39.
Location : ,

Injured : 0 **Dead :** 0

Abstract

A case history of inadequate instrumentation (overlooked design revision).
A 'duplicate plant' was built. The unit in question was designed to vaporize cumene from a mixture of cumene and cumene hydroperoxide, and send a suitably rich stream of the peroxide compound to a reactor where it would split into phenol and acetone. Although the project involved a 'duplicate plant', the drawings finally approved for construction had been revised 20 times.
Not long after the plant was put on stream, there was an explosion in the still reboiler. Investigation showed no significant changes in reboiler design through 12 drawing revisions, but revision 13 showed a much deeper reboiler. However, the instrument system on the original unit called for an alarm to be given when the reboiler level fell to X inches, indicating (indirectly) a dangerous concentration of hydroperoxide.
The change went unnoticed by the instrument engineer, so the level instrument in the new plant was still set to signal at X inches when the figure should have been 1-1 X or 2X.
[reaction, level meter/control, instrumentation failure, design inadequate, reactors and reaction equipment]

Lessons

The following recommendations were made:
Redesign of the safety control system to provide better measurements of important variables and more reliable control through redundancy or by diversity of the systems.

10567Date Unknown

Source : INSTRUMENTATION TECHNOLOGY, 1972, 19 (10): 38.
Location : ,

Injured : 0 **Dead :** 0

Abstract

A case history of inadequate instrumentation (fouled thermocouple well).
A process stage involved the recovery of epichlorohydrin from a mixture of epichlorohydrin and a tar. A thermocouple in a reboiler acted to cut back the steam heat supply if temperature rose to the point where epichlorohydrin polymerization might be initiated. However, after a period of time, the thermocouple became cocooned in tar meaning that the only control over the distillation was the operator's reaction to the temperature signal from the top of the column. This proved inadequate, the reboiler overheated and an explosion resulted.
[temperature meter/control, instrumentation failure, fouling, reboiler, distillation]

Lessons

The following recommendations were made:
1. Redesign of the safety control system to provide better measurements of important variables and more reliable control through redundancy or by diversity of the systems.
2. Keeping the exterior of some thermocouple wells clean is a difficult problem. Frequent scheduled inspection (preventative maintenance) is one answer.

10569Date Unknown

Source : INSTRUMENTATION TECHNOLOGY, 1972, 19 (10): 38.
Location : ,

Injured : **Dead :**

Abstract

A case history of inadequate instrumentation (frozen transmitter legs).
To generate dowtherm vapour for heat transfer purposes, there are two types of water tube boilers. One is a very slightly modified water tube boiler with multiple tubes, water drum, steam drum, etc. In the other type, dowtherm is heated in a single coil in the firebox and the superheated liquid flashes into vapour in an external tank.
The latter type is used when operating at temperatures near that at which Dowtherm decomposition will foul the internal heat transfer surfaces in the firebox. Since heating stagnant Dowtherm causes almost immediate tube fouling, one safety instrumentation item is a transmitter that monitors flow through an orifice in the heater's discharge line. Unless this instrument measures a pressure drop across the orifice, fuel cannot be introduced into the firebox.
After a shutdown, a single-coil heater was restarted. The thermocouple in the hot dowtherm discharge line naturally called for maximum firing to get the system up to operating temperature. The coil in the heater ruptured and shot out of the firebox.
[heating, flow meter/control, rupture, high pressure, instrumentation failure]

Lessons

The following conclusions were made:
1. The difficulty here was that the heater (as is normal) was located outside. However, the weather was very cold. 2. Following normal shutdown procedure, flow was maintained through the system for a short time after firing had ceased. But the dowtherm in the tubing to the transmitter froze while dowtherm flowed in the loop. When flow stopped, the transmitter continued to signal a differential pressure across the orifice. When firing started up again, a plug of frozen dowtherm in the exit line didn't have time to melt before pressure built up enough to rupture the coil in the heater.
The following recommendations were made:
1. Redesign of the safety control system to provide better measurements of important variables and more reliable control through redundancy or by diversity of the systems.
2. The pressure sensing lines should have been heated by a separate system.

10570Date Unknown

Source : INSTRUMENTATION TECHNOLOGY, 1972, 19 (10): 39.
Location : ,

Injured : 0 **Dead :** 0

Abstract

A case history of inadequate instrumentation (loss of ratio control).
An exothermic process for splitting cumene hydroperoxide into phenol and acetone used an acid gas as the catalyst. The process required that the acid gas addition vary directly with the hydroperoxide concentration, which was variable. To control the rate of catalyst addition, a slip stream of feedstock was fed into a small calorimeter, where it was split using an excess of acid gas. The calorimeter measurement determined the addition of acid gas catalyst to the main splitter.
One cold night, the vapour pressure fell in the acid gas cylinder. The calorimeter no longer had an excess of catalyst so it falsely reported back that the peroxide stream to the reactor was dilute. Acid gas feed to the splitter was, therefore, cut back. With the reduction of the vaporization rate in the gas cylinder, vapour pressure gradually built up, the calorimeter was again fed an excess of acid gas so it reported a more concentrated stream, and catalyst feed to the splitter was increased. But in the meantime, the splitter had accumulated a dangerous concentration of hydroperoxide and an explosion occurred.
[exothermic reaction, instrumentation failure, process analyser]

Lessons

The following recommendations were made:
1. Redesign of the safety control system to provide better measurements of important variables and more reliable control through redundancy or by diversity of the systems.
2. The acid gas cylinder is now in a heated environment.

10573Date Unknown

Source : INSTRUMENTATION TECHNOLOGY, 1972, 19 (10): 40.
Location : ,

Injured : 0 **Dead :** 0

Abstract

A case history of inadequate instrumentation (false level measurement in manufacture of hydrogen peroxide).
In a plant manufacturing hydrogen peroxide, safety instrumentation consisted of a liquid level control on the reboiler plus a temperature control in the vapour phase. Failure of feed to the reboiler could not result in a hazardous concentration without a drop in liquid level. Also, to vaporize a dangerous concentration of peroxide, a higher vapour temperature would be required than for the safe concentration. Low liquid level in the reboiler or a high vapour temperature operated a valve which dumped deionized water into the reboiler. An explosion followed.
Investigation revealed that the liquid level indicator on the reboiler had been operating erratically. This action was traced to boiling hydrogen peroxide solution which produced copious quantities of heavy foam. The float on the instrument was measuring foam level rather than liquid level.
[heating, level meter/control, instrumentation failure]

Lessons

The following recommendations were made:
Redesign of the safety control system to provide better measurements of important variables and more reliable control through redundancy or by diversity of the systems.
In the reconstructed control system, the float is located in a leg off the reboiler rather than in the boiling liquid. The original design also overlooked the fact that boiling point decreases as vacuum increases. Consequently, when the liquid level fell and the concentration became dangerous, the float did not respond because it was operating on foam and the thermocouple did not respond because the vacuum became harder and the temperature did not go up. Vapour phase control is now a system that integrates temperature and vacuum.

11771Date Unknown

Source : ICHEME
Location : , USA

Injured : 0 **Dead :** 0

Abstract

Over a period a crude oil distillation unit had been modified to double its capacity. This required the crude sure drum capacity from 6 to 3 minutes holding time and required turbine driven pumps to operate close to the overspeed trip stetting. Due to a minor upset the pump taking solution from the surge drum tripped out. The surge drum filled and the relief valve received to before the operators realised there was a problem. A fire followed.
[normal operations, modification, level meter/control, vent, control valve, spill, fire - consequence, overflow, design inadequate, safety equipment failure, modification procedures inadequate, crude oil]

Lessons

[None Reported]

11805Date Unknown

Source : ICHEME
Location : , USA

Injured : 0 **Dead :** 0

Abstract

A faulty interface level controller in a butane water wash column, allowed liquid butane to enter a degassing draw with the water. Due to sub-zero winter temperatures, little evaporated and the deagassing drum level controller allowed the liquid butane into the sewer system where it was vaporised by warm waste water. A drain cover blew off and the vapours were ignited by a furnace.
The fault in the interface control was not determined but may have been due to freezing.
[instrumentation failure, level meter/control, draining, fire - consequence, low temperature, safety procedures inadequate, product loss]

Lessons

[None Reported]

11820Date Unknown

Source : ICHEME
Location : , USA

Injured : 0 **Dead :** 0

Abstract

An upset operation of a butane water wash system resulted in poor interface level control. The control valve did not have a tight shutoff, therefore, small amounts of butane flowed with the wash water into the cooling water return. The cooling tower riser pulled away from its supports and water loss caused a refinery shutdown. The riser supports were weak and had previously moved slightly.
Water slugging caused by the presence of butane vapour increased the strain on it.
[cooling water system, separation, pipe, level meter/control, rupture, water slug, design inadequate, safety procedures inadequate, operation inadequate]

Lessons

[None Reported]

11850Date Unknown

Source : ICHEME
Location : , USA

Injured : 0 **Dead :** 0

Abstract

Two 316 stainless steel thermowells in the top of a catalytic reformer reactor failed causing a fire. Thermocouple failures had occurred previously in the same location near the top of the well. At that point tests showed that the temperature was slightly under 100 degrees C. Examination of wells which had not failed showed they were brittle in this area. The cause proved to be chloride corrosion in an area where water was condensing.
[hydrogen, water, chloride, continuous reaction, temperature meter/control, fire - consequence, plant shutdown, corrosion, brittle fracture, design inadequate, inspection inadequate]

Lessons

1. Aluminised 4-6% chloride alloy thermowells, which had been trailed in an unsuccessful attempt to reduce hydrogen penetration, had not become brittle. They are not used through out.
2. Normal thermocouples were replaced by ones in sheaths which were a close fit in the thermowell.
3. No further failures of either wells or thermocouples have occurred.
4. A detailed study of the earlier thermocouple failures might have found the cause and prevented the fire.

11887Date Unknown

Source : ICHEME
Location : , USA

Injured : 0 **Dead :** 0

Abstract

The level transmitter on a high pressure high temperature separator of a gas oil hydrotreater froze due to failure of the heat tracing on the level bridge. The operator did not realise this and ignored the independent high level alarm in the separator. When his mistake became obvious the level control valve was put on manual and opened further. His action was too abrupt so the down stream separator overflowed, its condenser was overloaded and hot sour gas/liquid flowed to an amine scrubber unit. The sour gas pipeline expanded forcing a draw nipple against a pipe support and shearing it off. Due to confusion over the identity of the line concerned, between two operators, it was some time before the leak was stopped. Fortunately it did not ignite.
[gas oil, normal operations, heat tracing, level meter/control, rupture, product loss, near miss, operator error, freezing, design inadequate]

Lessons

1. Heat tracing and other safety related items need to be checked on a routine basis to ensure they remain in working order.
2. Operators need to be trained to detect frozen control valves and transmitters. Almost always one chart recorder trace will start drawing a straight line rather than the drift of an indicated variable or the minor wobbles of a controlled variable.
3. Alarms which affect the safety of the plant should never be ignored until it has been roved that they are faulty. In the present case the lack of any movement in the controlled level should have suggested that the fault was there.
4. Small bore connections to long lines must be located well away from pipe support.
5. All personnel should be trained to identify equipment unambiguously when talking to others. In the present case the term "vent gas line" was used which could have referred to several pipes in the area.

357 Date Unknown

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

Abstract

Maintenance personnel were steam tracing and lagging instrument lines when a small valve on an impulse line to a pressure transmitter was accidentally closed.
The pressure transmitter was part of the pressure control system for the reactor. The accidental closure of the valve, possibly assisted by a small leak, caused the pressure recorder controller to sense a loss of pressure in the reactor thereby initiating the appropriate control action to increase the pressure. During the rise in pressure, a relief valve on the top of the reactor lifted and ejected acidic material from the relief stack. There were no injuries but a number of personnel working in the vicinity received facial irritation.
Plant operating personnel immediately shut down the plant and the pressure in the reactor never reached a level (750 psig) necessary to trip the automatic shutdown system. The `reactor head' relief valve had been `cold set' to 778 psig in order that it would lift at 770 psig under operating conditions. Investigations revealed that the relief valve lifted 30 psig light. The relief valve at the back end of the reactor's overhead condensing system never lifted although it had been set in the workshops to lift at 720 psig. When tested in the workshops after the incident it lifted at 780 psig. The `back end' relief valves were fitted with PTFE seats some years earlier in order to overcome the failure of the original metal seated valves to reseat after lifting.
[pressure meter/control, gas / vapour release

Lessons

A number of recommendations were made following the incident which have been summarised to include:
1. review of valves on this type of duty to see if there is a practical method of preventing accidental closure.
2. tighter control of work of this nature which is associated with instrument control systems.
3. review of the suitability of PTFE seats because valves currently installed have a tendency to drift, possibly in the adverse direction.
4. review pressure setting for the high pressure trip shutdown system.
5. tighter control of the work procedures governing the inspection, testing and maintenance of relief valves.
6. provision of facilities for post testing of relief valves. The valve should be removed from its position to a workshop facility and immediately tested on a test rig to check the pressure at which the valve would have lifted in service, making due allowance and consideration for temperature effects on the spring and viscous fluids being handled by the valve. Following this, the valve should be dismantled, cleaned, inspected, repaired, restored, lapped and react to its correct cold set pressure. Should the valve fail to lift at the correct cold set pressure when tested following removal from its operational position (i.e. within a tolerance of +5% of the cold set pressures it shall be classed as a defaulter and the interval permitted to elapse from the time it is returned to service to the date of the next inspection shall be reduced to a period which the tolerance stipulated. The reasons for causing the valve to default should be investigated.

7146 Date Unknown

Source : LOSS PREVENTION BULLETIN, 030, 7-8.
Location : ,

Injured : 0 **Dead :** 0

Abstract

The manufacture a of seamless pipe in a steel rolling mill was interrupted for almost one year when an electrical fire began in a cable tray located in an unprotected underground tunnel. Fire spread rapidly. Dense smoke, inaccessibility and intense heat made it almost impossible to effectively combat the six and a half hour cable fire.
Over 70 miles of power and control PVC cables were destroyed along with the steel mill's central computer and numerous motor control centres. It was estimated that 20 and 30 tonnnes of PVC decomposed during the fire releasing 10 to 15 tonnes of hydrogen chloride gas which contaminated buildings, reinforcing steel, concrete walls, sensitive electronic/electrical equipment and computer systems. The use of highly combustible cables coupled with the absence of automatic fire protection and fire-stops/breaks contributed to the severity of this loss.
[fire - consequence, design inadequate, computer]

Lessons

[None Reported]

7062 Date Unknown

Source : LOSS PREVENTION BULLETIN, 021, 78-79.
Location : ,

Injured : 0 **Dead :** 0

Abstract

Incident during start-up of a reactor. It was filled with reaction mixture from another reactor which was already on line and the panel operator started to add fresh feed, gradually increasing the flow while he watched the temperature on a recorder conveniently situated at eye level. He intended to start a flow of cooling water to the reactor cooler as soon as the temperature started to rise, the usual method.
Unfortunately, there was a fault on the temperature recorder and although the temperature actually rose this was not indicated. Resulting in a runaway reaction.
The rise in temperature was, however, indicated on a six point temperature recorder at a lower level on the panel, but the operator did not notice this.
Fortunately the runaway was not serious because a high temperature alarm on the six point recorder alerted the operator before the temperature got dangerously high.
[temperature meter/control, instrumentation failure]

Lessons

[None Reported]

7429 Date Unknown

Source : LOSS PREVENTION BULLETIN, 088, 6-8.
Location : ,

Injured : 0 **Dead :** 0

Abstract

During a lightning storm a level and pressure control system on a pipeline network was affected in a way that bypassed one of its prime control functions. The system is based on a microprocessor supplied by the 240 volts ac mains. The microprocessor program consists of a series of blocks which operate in sequence.
Detailed investigation revealed that one of the blocks had lost its execution step number. It was therefore being ignored by the microprocessor as it worked through the program. As it happened this particular block was concerned with setting a critical control parameter.
The cause of the failure was the lightning storm giving interference and fluctuations on the supply mains.
[level meter/control, pressure meter/control, control failure]

Lessons

The main lesson is that in thinking about a new installation of this kind, its susceptibility to such interference should be questioned and a test carried out in corroboration.
1. The intention to use a computer should be recognised early in a project.
2. The computer should be regarded as an integral part of a project, not as an add on extra to the intended plant.
3. Control computer designers should be included in early project discussions. This is particularly important if the process is complex, so that the potential influence, and interactions of the computer may be debated.
4. Pertinent and probing questions should be asked early in order to establish what the computer is intended to do. Equally, what it is intended it shall not do. This would be the first phase of preparing a clear and useable specification for the new computer.

7063 Date Unknown

Source : LOSS PREVENTION BULLETIN, 021, 79.
Location : ,

Injured : 0 **Dead :** 0

Abstract

The temperature controller on the base of a still went out of order at 5 a.m. and drew a straight line but this was not noticed. Between 5 a.m. and 12 noon the temperature of the 19th tray rose from the normal 145 degrees C but this was not noticed. Five other temperatures also rose, as indicated by charts or by entries on the log sheet. The level in the base of the still fell, the level in the reflux drum rose and the take-off rate also rose. All these readings were put down on the record sheet but their significance was not realised.
Finally at 12 noon liquid came out of the reflux drum vent.
The operator was a trainee but a leading hand was in the control room throughout and two supervisors visited it from time to time.
[temperature meter/control, spill, training inadequate, instrumentation failure]

Lessons

Fundamental training of process operators and supervisor should not be overlooked.
In addition the following:
1. It has been suggested that the control limits should be printed in red at the top of each column on the record sheet. The operator would be expected to report any readings out side these limits.
2. Alternatively, a master copy of the record sheet might be marked up with these limits and displayed in the control room or the limits might be marked on the individual instruments.
3. The key readings might be collected together on a "Key Readings Sheets". Record sheets are often so big that supervisors on their tours do not always look through a small number of readings on a key readings sheet. (Why have the full reading sheets? - the information may be useful to the manager or foreman when he is trying to diagnose the cause of a fault, but on at least one subscriber's plant no readings are taken apart from a handful required for record purposes).

7068 Date Unknown

Source : LOSS PREVENTION BULLETIN, 021, 72-73.
Location : ,

Injured : 0 **Dead :** 0

Abstract

In a vinyl chloride monomer plant the temperature of the outlet stream from the EDC cracker was reduced by injection below the liquid level in a quench tower. Water supply to the top mounted condenser was controlled by the level in the bottom of the quencher. The level controller was locally mounted and operation of the cooling water control valve therefore was not possible from the control room.
On one occasion the level transmitter failed due to clogging. The cooling water control valve got fixed in a position delivering too little water so that the liquid phase in the bottom of the quencher disappeared. Consequently the hot gases passed through unquenched. The high temperature, approximately 500 degrees C, caused the gasket material in the flange below the condenser to soften and the gasket blew out. The escaping gas immediately ignited.
The operator in the control room observed the sudden temperature rise in the quencher bottom, but the leak occurred before it was possible to get the cooling water valve opened.
The cracker was immediately shut down, the flow of flammable material ceased and the fire went out. The fire caused some damage to electrical cables and instrument lines, and the plant was out of operation for one week. No one was injured.
[level meter/control, temperature meter/control, instrumentation failure, fire - consequence, processing, vinyl chloride monomer (VCM)]

Lessons

After this accident the following changes were made:
1. The temperature recorder was equipped with an alarm.
2. The level controller was mounted on the control panel in the control room.

7070 Date Unknown

Source : LOSS PREVENTION BULLETIN, 021, 70-71.
Location : ,

Injured : 0 **Dead :** 0

Abstract

A tube burst occurred in a furnace as a result of overheating. Many tubes were damaged and others bowed.
The furnace was being started up and the flow through the tubes was low, so low that it did not show on the flowmeter. The tubes temperature recorders were out-of-order and drawing straight lines.
[start-up, tube failure, temperature meter/control, instrumentation failure, damage to equipment]

Lessons

The company report recommends:
1. Low flows through the tubes should always be measured (using an additional or re-scaled flowmeter if necessary).
2. All instruments should be checked before start-up.
3. All recorded temperatures should also be connected to a temperature indicator.
These recommendations apply to all furnaces.

7078 Date Unknown

Source : LOSS PREVENTION BULLETIN, 022, 104-105.
Location : ,

Injured : 0 **Dead :** 0

Abstract

A recent survey in one company showed a number of control room doors propped open or tied open with pieces of string. Perhaps the people who had propped them open did not realise why they should be kept closed.
Most control rooms contain sparking electrical equipment. In some of them people are allowed to smoke. It there is a leak of flammable gas or vapours on the planet outside, it is important to prevent this gas or vapour getting into the control room. This is done by sweeping the control room with air. Air is blown into the cracks and crevices in the building. As the air is leaking out, gas or vapour cannot get in. If a door is kept open all the time or a window is broken, the flow of air will not be sufficient to prevent gas or vent gas or vapour getting in.
[near miss, safety procedures inadequate]

Lessons

[None Reported]

7115 Date Unknown

Source : LOSS PREVENTION BULLETIN, 037, 1.
Location : ,

Injured : 0 **Dead :** 0

Abstract

As a result of an error in setting a valve, a tank overflowed. It was then found that the tank high level alarm light was glowing, this showed that the alarm had sounded and that someone had cancelled the alarm. The operating team had not done so, as none of them had been in the control room.
The alarm is on the same panel and has the same sound and colour as the low flow alarm on a tanker filling line which can operate 70 times per day, every time a driver starts to load a compartment of a road tanker. This alarm is installed to warn the operators that the flow is too low to drive the pump that adds dye to the load and it usually operates before the flow builds up to its normal rate. It is believed that someone passing through the control room heard the alarm, assumed that the flow alarm was operating and cancelled the hooter.
[level meter/control, operator error, design or procedure error]

Lessons

[None Reported]

7140 Date Unknown

Source : LOSS PREVENTION BULLETIN, 041, 11.
Location : ,

Injured : 0 **Dead :** 0

Abstract

This incident occurred at a propane treatment facility in a refinery. Propane was being treated in the caustic treater V-1 and V-2 was being filled with caustic. The caustic return line from V-2 was valved off. As soon as a sufficient level of caustic was established propane was routed to and from this treater.
After some two and a half hours of filling V-2, a sight-glass check apparently showed a high level of caustic in the treater, but the panel-mounted level recorder (LCR) recorded a low level. An operator believed the sight-glass and opened the level control valve (LRCV) and its bypass fully.
The level of caustic in V-2 was in fact low and was quickly lost to tank 12. The subsequent build-up of pressure in the tank, caused by the expansion of the liquid propane entering it, ruptured its roof, completely separating it from the tank walls. There were no injuries to personnel and no damage to other equipment was sustained.
The subsequent investigation showed the sight-glass and LCR to be functioning correctly but highlighted several deficiencies in the facility's safeguard system:
1. Tank 12 had no safety valve against the possible build-up of pressure. The 50 mm (2 inch) liquid overflow on the roof, adequate for normal service, was unable to cope with the sudden build-up of propane pressure.
2. The LPG treating vessels have no low-level alarms or trips which could prevent LPG being routed to tank 12 by maloperation or malfunction.
3. The caustic return lines to the storage tank have no executive alarms.
4. The level control valves on V-1 and V-2 are incorrectly sized.
5. The bypass valves allowed a high flow of propane to tank 12.
[high pressure, level meter/control, design inadequate, refining, caustic soda]

Lessons

Recommendations to prevent a recurrence include:
1. Replacing tank 12 with a correctly designed caustic storage vessel with a relief valve connection to the fire.
2. Using correctly sized tight shut off (TSO) control valves without a by-pass on V-1 and V-2.
3. Rationalising the caustic treating system and removing any redundant pipework.
4. Installing temperature executive alarms (TEA) downstream of the TSO level control valves on V-1 and V-2.

7061 Date Unknown

Source : LOSS PREVENTION BULLETIN, 021, 78.
Location : ,

Injured : 0 **Dead :** 0

Abstract

A reactor was being cleaned out by filling it with a level alarm, (at 70%), which was accepted and cancelled and to continue filling until the level approached 100%. An operator was then sent from the control room to switch off the corrosive wash and to start the agitator.
The incident occurred when the operator forgot to switch off the wash. Within a short time the reactor was overfilled and liquid squirted out of the vent some 20 ft above the reactor, drenching the area.
The resulting investigation found that the only isolation for the corrosive wash was local to the pump, at the opposite end of the plant from the control room, and that by completely filling the reactor, the chart recorder would not help in checking that the feed into the vessel had stopped.
[cleaning, level meter/control, overflow, operator error, spill, reactors and reaction equipment]

Lessons

It was recommended that the vessel should never be completely filled. A smaller volume would not only allow control of the operation by using the level recorder, but would also increase the time interval, from realising that something was wrong, to liquid coming out of the vent. In addition, a 100% washing charge was unnecessary as the top of the reactor was always clean.

7196 Date Unknown

Source : LOSS PREVENTION BULLETIN, 051, 7.
Location : ,

Injured : 0 **Dead :** 0

Abstract

A control unit was located in a zone 2 area and was therefore purged with nitrogen to prevent any flammable vapour diffusing in from outside. Vapour is not normally present in the area but could be present if there was a leak or spillage on the neighbouring plant. Nevertheless, an explosion occurred in the control unit. The nitrogen had become contaminated with a flammable liquid. The nitrogen pressure was so low that air diffused in to the control unit. The low pressure trip which should have isolated the power supply when the nitrogen pressure fell was not in working order.
[contamination, pressure meter/control, instrumentation failure, purging]

Lessons

If the control unit had been installed a few metres further from the plant (at negligible extra cost in longer cable run), it would have been outside the zone 2 area and purging would have been unnecessary.

7056 Date Unknown

Source : LOSS PREVENTION BULLETIN, 021, 76-77.
Location : ,

Injured : 0   **Dead :** 0

Abstract

An electrical heater heats a circulating nitrogen system. A choke occurred elsewhere in the system and caused the circulation to stop. The flowmeter was not working so this was not apparent to the operators. The heater got too hot and a high temperature trip shut off the electrical supply. The operator assumed that the trip was faulty and reset it. Ten minutes later it tripped out again. The operator again assumed it was faulty and reset it for the second time. After another ten minutes the power was tripped out for the third time and for the third time the operator reset the trip. Soon afterwards the shell of the heater split open.
The immediate cause of the rupture was the readiness of the operator to assume that the trip was faulty. Even though it repeatedly tripped out he did not investigate. Contributory factors were:
1. The temperature setting on the trip was too high.
2. During the time the accident took place the supervisor was not present. He was handing over his job to the next shift and this is traditionally done, not in the control room, but in a distance office.
[flow meter/control, instrumentation failure]

Lessons

[None Reported]

7307 Date Unknown

Source : LOSS PREVENTION BULLETIN, 068, 35-36.
Location : ,

Injured : 0 **Dead :** 0

Abstract

This incident occurred on an indoor plant built for the continuous polymerisation of chemicals. For a long period there had been no significant problems until a near miss occurred. On this occasion the bearings failed on a centrifugal pump handling mixed monomers, leading to considerable overheating, much smoke generation, etc. No fire occurred because no flammable liquors were in contact with the hot surfaces. The most alarming feature was perhaps that an operator had detected the problem during other duties and that the temperature monitoring systems had not reacted correctly.
After investigation it was found that:
1. The temperature monitor on the pump had apparently first failed 23 hours before the incident, indicating minus 47 degrees C. It had then indicated a normal 22 degrees C for some hours but did not show any temperature rise until after the pump was shut-down when 90 degrees C was indicated. None of this was observed until the enquiry was started.
2. It was thought that continuous mild vibration had caused this temperature probe to become slightly displaced. It was clear that other causes of failure were possible at the plant end including poor connections and broken wiring. Detailed attention was given to the type of sensor used at the various points and their mechanical attachment to the pumps and motors. In addition wiring standards were reviewed and it was seen that a 2 wire system had better fail safe properties for slight loss of temperature indication accuracy than the installed 3 wire system.
3. The plant was seen to be exceptionally vulnerable to escalating damage with very high consequential losses. There was considerable discussion about the strategic aspects of preventing losses in it. There was a view that temperature monitoring was necessary because:
1. The probability was low that hot spots would coincide with flammable escapes (1 x 10 per year estimated by one investigator).
2. It was not likely that the metals would reach around 400 degrees C before the pumps tripped on mechanical overload.
3. The premises were sprinklered to a high standard.
4. Gas detectors were placed adjacent to likely sites of flammable emissions.
5. Maintenance policies meant that hot spots would be rare and that flammable emissions were also, estimated as one in five years.
6. It would be a better investment to resite the more dangerous pumps outside, or certainly from under the stocks of flammable liquors.
[bearing failure, instrumentation failure, operator error]

Lessons

1. Hardware is useless in itself unless supported by personnel able to see and hear what it is doing for them (chart readability, alarm indicators).
2. Means of verifying, at appropriate intervals of time, that the critical instruments and valves are working correctly, must be designed into the equipment and into the operating organisation (simulation of activation techniques, memory systems, records).
3. Elaborate hardware often leads to over confidence in it, and plant tours and log sheet patrols continue to be necessary.
4. Avoidance is better then prevention. A plant designed to good standards will often not require elaborate safety devices.

7406 Date Unknown

Source : LOSS PREVENTION BULLETIN, 041, 3.
Location : ,

Injured : 0 **Dead :** 0

Abstract

Liquid ammonia at 375 m bar (millibar) was to be used as a solvent in a small pilot plant process. An operability study was carried out on the unit and all causes of deviation and their consequences were recorded in the standard tables.
During commissioning an isolation valve down stream of a rotameter was not opened before the circulating pump was started. The rotameter fractured and liquid sprayed out. Luckily the plant was being commissioned on water not liquid ammonia.
Checking the operability study of the appropriate line showed that the isolating valve had been considered to give less flow or no flow if it were insufficiently opened. The consequence of high pressure had been overlooked.
The rotameters were capable of operating at 10 m bar but the pump was capable of 14 m bar pumping against a restriction. There was a kick-back on the pump for flow control, but no pressure limiting kick-back. This was added, in parallel with the flow controller, after the commissioning incident.
[flow meter/control, spill]

Lessons

[None Reported]

7426 Date Unknown

Source : LOSS PREVENTION BULLETIN, 088, 3-4.
Location : ,

Injured : 0 **Dead :** 0

Abstract

A valve on a batch reactor opened unexpectedly under automatic control. The valve should have been shut. In opening, it released several tonnes of flammable material to atmosphere. The event occurred on restoring computer control following maintenance on the reactor.
The plant, normally operated by digital output signals from a main computer, could be switched to local control and then operated by push button from a panel. (In either mode, the input signals are being fed both to the computer and to the local panel). On switching to local, the outputs from the computer to the plant are isolated and hose from the panel are activated. When switching from local to computer, the reverse occurs, a computer sequence is run which arranges the digital outputs of the computer to match the plant status as indicated by the digital inputs. This sequence was introduced on initially commissioning the plant because it was frequently necessary to move from computer to manual control. On restoring computer control it was then noticed that valves sometimes moved unexpectedly. The software was therefore modified so that the computer checked every valve before taking over control.
To carry out the maintenance on the reactor, an interlock on the valve had been achieved by interchanging limit switches so that the valve was signalled as open when, really, it was closed.
The air supply to the valve, however, remained connected. So, when maintenance work was complete and there was a switch from local panel to main computer, the computer saw the closed valve as open and set its digital output accordingly. The valve responded and moved from its actual, closed, position to open, releasing flammable material from the reactor.
The incident illustrates the undesirable consequences which may arise by desirable modifications to solve short term problems, e.g. on initial commissioning.
[spill, reactors and reaction equipment, batch reaction, control failure]

Lessons

The main lesson is that in thinking about a new installation of this kind, its susceptibility to such interference should be questioned and a test carried out in corroboration.
1. The intention to use a computer should be recognised early in a project.
2. The computer should be regarded as an integral part of a project, not as an add on extra to the intended plant.
3. Control computer designers should be included in early project discussions. This is particularly important if the process is complex, so that the potential influence, and interactions of the computer may be debated.
4. Pertinent and probing questions should be asked early in order to establish what the computer is intended to do. Equally, what it is intended it shall not do. This would be the first phase of preparing a clear and useable specification for the new computer.

7428 Date Unknown

Source : LOSS PREVENTION BULLETIN, 088, 5-6.
Location : ,

Injured : 0 **Dead :** 0

Abstract

This incident occurred on a large batch plant, having a number of reactors nominally arranged in groups of three. Each of these groups shares a feed and preparation system and is controlled by a computer. In turn, these computers are directed by one of two supervisory machines. Processing conditions can reach 300 degrees C, and 17 bar g pressure. Nitrogen is used for blanketing the reactors since the product, in the form of polymer, might otherwise degrade to give flammable vapours.
One control computer failed resulting in the plant being shutdown in an uncontrolled manner. A number of valves, control and electrically operated isolating valves, opened out of cycle spilling molten polymer onto the operating floor. Nitrogen also escaped. Plant operators and equipment were hence put at risk.
An investigation revealed that a fault had occurred in the drive card circuit of a media unit. This unit transmits control signals to the plant. Further a watchdog electronic card, incorporated into the unit to protect the system from such a fault, had failed to prevent valves moving to an unsafe position, itself being affected by the fault.
A broad view of the whole installation revealed that the computers had been added to the plant at the time of other changes intended to meet developing market demand. The nature of the plant was such that numerous changes had been made to the software as market requirements changed. This resulted in the computer software, at the time of the incident being substantially different to the original installation.
[spill, computer failure]

Lessons

The main lesson is that in thinking about a new installation of this kind, its susceptibility to such interference should be questioned and a test carried out in corroboration.
1. The intention to use a computer should be recognised early in a project.
2. The computer should be regarded as an integral part of a project, not as an add on extra to the intended plant.
3. Control computer designers should be included in early project discussions. This is particularly important if the process is complex, so that the potential influence, and interactions of the computer may be debated.
4. Pertinent and probing questions should be asked early in order to establish what the computer is intended to do. Equally, what it is intended it shall not do. This would be the first phase of preparing a clear and useable specification for the new computer.

6916 Date Unknown

Source : LOSS PREVENTION BULLETIN, 009, 2.
Location : ,

Injured : 0 **Dead :** 0

Abstract

Most trips develop faults which prevent them operating on the average once every 18 months. If a trip is not tested regularly it may not work when required. On a plant, a tank was fitted with a high level trip which switches off the feed pump. The operators developed the habit of relying on the trip to stop the influx of material with the knowledge and approval of the plant manager. Instead of carefully observing the level, they worked on other jobs.
Eventually the trip failed to operate and the tank was overfilled. The trip which was originally intended to protect the vessel against overfill was being misused as a process controller.
A second trip should have been installed as a real protective device.
In this case, instead of making the plant safer, the so called trip made it less safe.
[overflow, level meter/control, operator error]

Lessons

[None Reported]

7510 Date Unknown

Source : LOSS PREVENTION BULLETIN, 121, 3-4.

Location : ,

Injured : 0 **Dead :** 0

Abstract

A process throughput was to be uprated by 50% and the velocities would rise accordingly. The proposals were subjected to a Hazop study but the effects of high flow were not fully appreciated. The following were identified.

1. Increased noise.
2. Increased erosion.
3. Increased pressure drop.

Some months after the start-up a thermowell failed in a fatigue mode. Increased vortex shedding frequency was not identified.

[material of construction failure, temperature meter/control]

Lessons

[None Reported]

7576 Date Unknown

Source : LOSS PREVENTION BULLETIN, 104, 11.
Location : ,

Injured : 0 **Dead :** 0

Abstract

The incident occurred at a manufacturing location.
The control instrumentation was through a distributed system with a unit operations controller (UOC) to provide overall process control. A lightning strike resulted in a software lock up on the UOC and loss of all indication on one console. A second console continued to work, but the operators did not know whether it was correct or not. The process interlocks which were on a separate system did operate, but there was a loss of all indication of process variables, which made it more difficult to decide on the best way to respond and could in time further hazards. All power, including battery back up, had to removed from the UOC in order to clear the lock up condition.
Computer equipment often experiences unpredictable problems when power surges occur. The control system in this case was well protected against such a power line surge and the indications are that this was not the problem. However, during a lightning strike the ground potential can surge by millions of volts over several square miles. In general this phenomenon does not hurt people or damage equipment. The ground surge occurs when lightning allows this ground potential to suddenly dissipate, and the sudden dissipation is the most probable cause of the problems that occurred. There is no device or means to preventing ground surges by lightning strikes.
[process control & instrumentation, computer, control failure,lightning]

Lessons

It was recommended the instrumentation/control systems should be renewed to identify those that would produce a dangerous situation if a lightning strike resulted in loss of control even through the power was not lost.
Plants should be able to provide:
1. The ability to rapidly shutdown the unit safely.
2. Sufficient hard wired indications of critical process variables and the ability to control the unit manually until automatic control is regained.
These safeguards also provide protection against loss of the computer system due to any other unforeseen cause.

7055 Date Unknown

Source : LOSS PREVENTION BULLETIN, 021, 76.
Location : ,

Injured : 0 **Dead :** 0

Abstract

A plant consisting of three reactors was being brought on line. Reaction conditions had been established in No. 1 but not in the other two. Thus when the temperature started to rise and eventually went off scale in No. 2, it was ignored, the rise being attributed to an instrumentation failure. Accordingly the high temperature was referred to instrument maintenance for correction, no other action being taken.
Steps to reduce the temperature of No. 1 reactor were taken when it was found that the inlet pipe was red hot, the high temperature registered on No. 2 reactor because the thermocouple connections had been switched in error by instrument maintenance.
Because there was no sign of a pressure rise the reaction must have been localised, the thermocouple measuring the temperature of the hot gas passing through the reactor. Had there been a pressure rise, then this would have provided the operator with convincing information that something was wrong.
[temperature meter/control]

Lessons

The mix-up of instrument indicators strikes at the heart of our safety operations. The Chemical Industry could not exist without reliable instruments.
If the couple had been in the correct reactor, then this would have made the operator more ready to believe that the reactor was behaving abnormally, rather than blame the instrument. It illustrates graphically the tendency to blame instruments for a 'wrong' reading, rather than to assume that they are correct and to act on what appears as an unusual warning. Note the importance of 'redundant' indication (in this case the reactor pressure) where critical operations are involved.

7054 Date Unknown

Source : LOSS PREVENTION BULLETIN, 021,75.
Location : ,

Injured : 0 **Dead :** 0

Abstract

A furnace feed pump tripped out but the flowmeter was frozen up and the low flow trip did not operate. Two tubes burst causing a long and fierce fire. The structure and tubes of the furnace were seriously damaged and the stack collapsed.
In cold weather the steam tracing on key instruments should be inspected regularly. A good plan is to make it part of the trip test routine.
[tube failure, flow meter/control, inspection inadequate, freezing, processing]

Lessons

Insufficient attention is sometimes paid to the design of steam tracing because it consists of small-bore tubing wound or strapping onto the process equipment by the pipe-fitters after the process equipment's completion. Common faults with steam traps are insufficient numbers, incorrect placing (i.e. not placed at lowest points), and inadequate maintenance. All these faults can cause water logging resulting in long stretches of line going cold. Insufficient care over lagging maintenance can also cause water logging.

7052 Date Unknown

Source : LOSS PREVENTION BULLETIN, 021, 74.
Location : ,

Injured : 0 **Dead :** 0

Abstract

A level indicator on a still base was reading "empty", although there was ample evidence that there was a level in it. The level indicator was of the radioactive type in which the source is on one side of the still and the detector on the other side. When the still is nearly empty, more radiation falls on the detector. Radiography of pipe-welds was in operation 70 yards (64m) away from the still and the gamma-ray source was shining in the direction of the still detector. This detector could not distinguish between the two sources of radiation and therefore indicated a low level in the still.
[level meter/control, instrumentation failure]

Lessons

At first sight the chance of this happening again seems so remote that preventative measures can be ignored. On the other hand in some circumstances a false reading could be dangerous. Before a Permit to Work is issued to carry out any radiography the issuing supervisor should therefore check round to see if there are any radioactive instruments in the area which might be affected. In addition, radiographers should be issued with a list of places on the site where radioactive instruments are used.

7659 Date Unknown

Source : HAZARDS OF OVER AND UNDER PRESSURING OF VESSELS, ICHEME, SAFTEY TRAINING PACKAGE, 001, 12.

Location : ,

Injured : 0 **Dead :** 0

Abstract

A 200 kW electric heater split open. After the incident the circulating system was found to be choked with catalyst dust so that there was no circulation. The flowmeter which measures the gas circulation rate was out of order. The cooler by-pass was closed at 11.00 and this was probably the time when the circulation stopped.

The high temperature trip operated and the operator reset it. The trip operated again ten minutes later and again eight minutes later, on both occasions the operator reset it. An hour later the shell burst. The operator did not know what action to take if the trip operated and the operating instructions did not cover this point. He therefore assumed that the trip had operated in error.

The pressure was just below 62 bar (900 lbf/in2) when the relief valve would lift. As the shell was hot it burst at what is a safe pressure at normal temperature.

[flow meter/control, instrumentation failure, rupture, heating]

Lessons

The following recommendations were made:

1. The thermocouple that operated the trip was fixed to the shell instead of the heating element and set at 400 degrees C, the relief valve setting was lowered, arrangements were made to test the tip every time the equipment was used.
2. The operators should have been given a better understanding of the purpose of trips in general and this trip in particular.
3. The supervisor should make the control room his H.Q. His entire area is controlled from this control room.

7730 Date Unknown

Source : LEARNING FROM ACCIDENTS, ICHEME, SAFETY TRAINING PACKAGE, 020, 47.
Location : ,

Injured : 0 **Dead :** 1

Abstract

An explosion occurred in a plant which made oxygen and hydrogen by the electrolysis of water. As a result of undetected internal corrosion in the cells, hydrogen entered the oxygen stream and was ignited, causing an explosion which killed the process operator. To guard against this possibility, and also to protect product quality, both the hydrogen and oxygen product gas streams were supposed to be analysed for quality every hour. Due to the slow operation of the process this would have been adequate to give early warning of any cross contamination.
When the plant record sheets were examined after the explosion it was found that they had been filled in weekly with exactly the same figures on every occasion. It was concluded that the gas analysis had probably never, or hardly ever, been carried out over the several years period since the plant had been commissioned.
[process analyser, management system inadequate, processing]

Lessons

The following recommendations were made:
1.The introduction of continuous instrumental gas analysis coupled with an alarm and shut-down system would improve this situation.
2. Because the plant had been trouble free over a number of years, both management and operators had become complacent and no longer took any interest in the way in which the plant was running.

7777 Date Unknown

Source : BARTON J AND ROGERS R, CHEMICAL REACTION HAZARDS, 2ND EDITION, ICHEME, 1997, APPENDIX 1, 178.
Location : ,

Injured : 0 **Dead :** 0

Abstract

An explosion occurred in a 2.2 m3 jacket reactor in which p-nitrotoluene was being dissolved in sulphuric acid. The charge was overheated, apparently caused by failure of the diaphragm valve on the automatic steam temperature controller. Subsequent attempts at manual control failed to check the temperature rise resulting from the strongly exothermic reaction which set in shortly after the failure of the temperature controller.
[overheating, valve failure, instrumentation failure, temperature meter/control, reactors and reaction equipment]

Lessons

[None Reported]

7778 Date Unknown

Source : BARTON J AND ROGERS R, CHEMICAL REACTION HAZARDS, 2ND EDITION, ICHEME, 1997, APPENDIX 1, 179.

Location : ,

Injured : 0 **Dead :** 0

Abstract

A plant producing dyestuffs, a first batch using a new, more efficient catalyst was being prepared. There was a misalignment of the temperature control probe which allowed overheating by 10 K, combined with partial failure of a control valve on the cooling system for the reactor jacket. Major damage was caused.
[valve failure, temperature meter/control, reactors and reaction equipment, damage to equipment]

Lessons

[None Reported]

7829 Date Unknown

Source : BARTON J AND ROGERS R, CHEMICAL REACTION HAZARDS, 2ND EDITION, ICHEME, 1997, APPENDIX 1, 192.

Location : ,

Injured : 0   **Dead :** 8

Abstract

A chlorinator exploded. The accident occurred in the chlorination step during methyl parathion production. The temperature was controlled automatically, on this occasion, however, the thermocouple output was very low. A leak in the thermowell was discovered and an instrument mechanic was called to carry out repairs. Chlorine was added faster than normal due to the fault. The agitator and brine cooling were stopped while the faulty thermowell was being replaced.
[cooling equipment, explosion, temperature meter/control, instrumentation failure, chemicals added incorrectly, fatality]

Lessons

[None Reported]

6991 Date Unknown

Source : LOSS PREVENTION BULLETIN, 015, 18-19.
Location : ,

Injured : 0 **Dead :** 0

Abstract

An explosion occurred in a switch panel at an amines plant control room. There was a slight deformation in the electrical installation.
The explosion proof meter was used to check the area and an explosive mixture was found in a conduit that fed into the control room panel from the hydrogen compressor shed. The conduit started at the control box in for explosion proof electrical installation.
The explosion proof panel in the hydrogen compressor shed had been opened in the past and had only four or five bolts installed and the rest of the bolts were on the floor under the panel. A nitrogen purge was on the panel in the hydrogen compressor shed, and was flowing and venting properly. The department supervisor and plant manager were not advised of the incident until after 8.00 am.
The cause of this accident was as follows. A fitting on a tee connection which was not properly sealed was found in a piece of copper tubing that fed hydrogen to a pressure switch inside the panel at the compressor shed. This apparently filled the panel box and permeated through the seals to the panel inside the control room where it was able to mix with air and reach the lower explosive level. When the switch activated, the arc ignited the explosive mixture.
Had there not been the nitrogen purge and had there not been the conduit seals to impede the hydrogen volume and flow, there could have been a major explosion.

Lessons

Preventive Measures:
1. Purging procedures are being initiated for maintenance in the area.
2. N2 purge is being installed on the conduit, between seals, with flow from the control room to the compressor shed in order to oppose the flow of H2 to the control room.
3. Seals are to be checked and repaired, possibly second seals added, to each end of conduit.
4. Instructions are being issued to maintenance personnel that explosion proof panels are to be properly secured and all bolts removed from the panel are to be replaced when a job in the panel is completed.
5. Instructions are being issued to production supervisory personnel that they are to ensure that purging and proper security of panel are accomplished.
6. Investigate the installation of a H2 detector on the panel in the compressor shed with an alarm and/or shutdown on the H2 compressor.
7. Procedures are being initiated to have maintenance personnel check pipe work in the panel any time work is done in the area.

6972 Date Unknown

Source : LOSS PREVENTION BULLETIN, 016, 6.
Location : ,

Injured : 0 **Dead :** 0

Abstract

A pressure gauge on a caustic soda pump suddenly came away and sprayed a passing operator who suffered several small burns to the face. He was wearing safety glasses in accordance with the plant-wide eye protection policy.
On investigation, the pressure gauge was found to have been fitted with an aluminium threaded connection which had corroded due to the action of the caustic soda.
[pressure meter/control, corrosion, spill]

Lessons

It was recommended that in future pressure gauges in caustic and sulphuric acid service will be checked to be sure that all are 316 stainless steel. Those found not to be of this type will be replaced. Fitters and supervisors will be notified that only 316 stainless steel gauges are to be used in caustic and sulphuric acid service. Stainless steel gauges are marked on the face of the gauge as being 316 SS. The gauge storage area will be marked for the non-stainless gauges as "Do not use in acid or caustic service".

6925 Date Unknown

Source : LOSS PREVENTION BULLETIN, 009, 2.
Location : ,

Injured : 0 **Dead :** 0

Abstract

A level indicator on a storage tank gave a low indication and in consequence a high level in the tank remained undetected. The tank was provided with an overflow and a high level alarm but this was fitted above the overflow. This curious arrangement was designed to check overfilling with a blocked overflow pipe.
It is intended to use the high level alarm more constructively in the future, by fitting a vent to the top of the tank and removing the existing overflow pipe.
It is vital to recognise when protective devices are set for such extreme conditions that they offer no safeguard for normal operations.
[level meter/control, instrumentation failure, storage tanks]

Lessons

On the tank described, a first class reliable level indicator was essential, because at the time of the incident it was not backed up by an effective high level alarm.

6917 Date Unknown

Source : LOSS PREVENTION BULLETIN, 009, 2.

Location : ,

Injured : 0 **Dead :** 0

Abstract

An incident occurred during a period of high activity in a control room. A compressor was being shut-down, the opportunity being taken to test the associated alarms and trips. Extra men were also present because of a high work load caused by considerable process activity, in addition a reactor was giving trouble and needed special attention.

In the middle of this period an alarm sounded indicating a high level in a storage tank. It was accepted but no action was taken, the tank overflowing sometime later.

The investigation recognised the importance of this alarm and recommended than an extra high level alarm should be fitted taking the form of flashing lights. It would not be possible to cancel the alarm manually but it would be designed to switch off when the level dropped below the present high level alarm.

[level meter/control]

Lessons

[None Reported]