

Source : DUST EXPLOSIONS IN THE PROCESS INDUSTRIES. ECKHOFF.

Location : Fonda, Iowa, USA

Injured : 0 **Dead :** 0

Abstract

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

[damage to equipment, safety procedures inadequate]

Lessons

The bucket elevators needed explosion relief

Source : CNN.COM, U.S. NEWS, AUGUST 9, 2000, (<http://www.cnn.com>).

Location : Milwaukee, USA

Injured : 0 Dead : 1

Abstract

Part of a crane broke on a construction site killing a worker 220 feet off the ground.

[fatality]

Lessons

[None Reported]

1250721 May 2000

Source : BBC NEWS, 21 MAY, 2000, (<http://www.bbc.co.uk>).

Location : London, UK

Injured : - **Dead** : 3

Abstract

A crane collapsed during construction work killing three workers. The crane arm and its cab fell between two buildings under construction.

An investigation is underway into the cause of the collapse.

[fatality]

Lessons

[None Reported]

1219511 February 2000

Source : BBC NEWS, 11 FEBUARY, 2000, (<http://www.bbc.co.uk>).

Location : Cheshire, UK

Injured : - Dead : 3

Abstract

A road transportation incident. An eight wheel mobile crane collided with an articulated lorry then ploughed through the central reservation and landed on top of an on coming car, which was then struck from behind by a lorry carrying oil drums.

The driver of the crane, the car and the lorry were killed.

Oil drums were scattered over the motorway.

The motorway was closed to allow rescue and recover vehicles to the scene.

[collision, fatality]

Lessons

[None Reported]

1194014 July 1999

Source : CNN.COM, U.S. NEWS, 14 JULY, 1999,
(<http://www.cnn.com>).

Location : Milwaukee, USA

Injured : 5 **Dead** : 3

Abstract

A tower crane collapsed while lifting a roof section into place on a building site adjacent to a baseball stadium. The roof section was one of seven sections with a reported total weight of 12,000 tonnes. The wind was reported as gusting to 30 mph at the time of the incident.

The crane collapsed onto the building site and the stadium. Three workers were reported killed and five were injured including the crane operator.

[construction, fatality, injury]

Lessons

[None Reported]

11098June 1999

Source : BBC NEWS, 17 JUNE, 1999,
(<http://www.bbc.co.uk>).

Location : , BELGIUM

Injured : - **Dead** : 0

Abstract

More than 100 people complained of headaches, dizziness and stomach upsets after drinking canned soft drinks. Investigations into the incident found that the factory had used the wrong type of carbon dioxide gas that gives the drink its fizz, making the drink taste bad, also a fungicide had caused some contamination.

[bottling plant, people, operation inadequate]

Lessons

[None Reported]

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

An incident at an ethylene plant. A crane had completed a lifting operation on the previous day. The driver was asked by contractors to look at another job, and when moving the crane, collided with an overhead pipe track. The direct cause was the crane jib being left in the upright position whilst the crane was being driven away.

Personnel congregating at a muster point spilt onto the road and delayed emergency services getting to the scene.

Damage was sustained by two flare lines, but later declared fit for use following leak and pressure testing. Planned flare operations were suspended whilst the lines were inspected. Damage to the pipe-bridge was relatively minor and it was declared fit for short-term use.

[collision, pipeline, transportation, damage to equipment

Lessons

A notice was issued to all of the contracting company's crane drivers informing them of correct procedures.

An indicator to be installed in the front cab of all cranes to inform the driver when the jib was in the upright position.

Improved control of crane and other large vehicle movements on site, with risk assessments as necessary.

Further familiarisation of the Fire and Emergency Service shift teams.

106051998

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

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

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

[design or procedure error, damage to equipment]

Lessons

[None Reported]

Source : ICHEME

Location : , SOUTH KOREA

Injured : 0 **Dead :** 0

Abstract

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

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

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 2 Dead : 0

Abstract

An accident occurred on a platform during a lifting operation of three and a half inch drill pipe from the moving pipe deck to main deck which resulted in 2 people being injured.

The drill pipe was being lifted in bundles of 15 (11 joints per bundle being the recommended number). The injured persons had positioned themselves between the load and a wire line power pack unit, in addition there was a hanger module lying on the deck directly behind them. As the lift commenced the drill pipe was drawn together and rolled away from the persons involved towards the crane. Once the slack had been taken up in the slings and the load had cleared the dunnage the bundle swung away from the crane back towards the persons involved catching them both off guard. This resulted in one injuring his knee trying to avoid the load with the other being crushed between the bundle and the power pack unit. There were no protective posts in use to protect the persons from the swinging load.

[operational activities, offshore, lifting equipment, inadequate guarding, safety procedures inadequate, injury]

Lessons

The following recommendations were made:

1. Awareness of the risks involved when handling bundled pipe.
 2. The importance of the boom tip position in relation to the center of the load.
 3. Positioning of people during lifting operations.
 4. Ensuring that personnel involved in lifting operations are fully aware of and use the correct procedures.
 5. The use of protective posts for this type of lifting operation.
 6. The maximum recommended number of joints per bundle should not be exceeded.
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Source : CHEMICAL HAZARDS IN INDUSTRY, 1997, OCT.

Location : ,

Injured : 0 Dead : 1

Abstract

During demolition work, sections of a high pressure pipework had to be lifted and relocated. Contrary to instructions to use an electromagnetic hoist to lift the pipe section, the foreman decided to attached a double chain to the centre of a section and lift that with a crane. He attached one length of the chain to the centre of the pipe, moved away and signalled to the crane operator. During the lift, the pipe twisted through 90 degrees and tilted slightly, jamming against a concrete up-right. The operator decided to lower the pipe to try and un-jam it, but this tilted the pipe even further and loosened the chain. The foreman tried to throw the other part of the chain over the pipe, which then fell, striking him on the upper part of the body. He died of internal injuries.

[fatality]

Lessons

[None Reported]

Source : LOSS PREVENTION BULLETIN, 136, 26.

Location : ,

Injured : 1 **Dead :** 0

Abstract

A company has been fined £1,000 (1996) and ordered to pay £2,500 (1996) costs after a skip container being removed by a railway crane fell onto an employee, causing serious injuries.

[safety procedures inadequate, injury]

Lessons

[None Reported]

124291996

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

An lifting incident occurred on a construction site.

The incident occurred when part of a boiler was being lifted from the horizontal to the vertical position using two cranes.

One of the two tail end lifting lugs broke, and the resultant increased load on the second lug caused this to fail as well. The lower end of the boiler element hit the ground but the load was held vertically by the main crane, thus reducing the consequences of this serious incident.

[lifting equipment, mechanical equipment failure, near miss]

Lessons

[None Reported]

3499 22 July 1995

Source : LLOYDS LIST, 1995, JUL, 27.

Location : Tacoma, USA

Injured : 0 **Dead** : 0

Abstract

Three dust explosions in the nine story elevator during unloading.
[storage equipment, silo/hopper]

Lessons

[None Reported]

Source : LOSS PREVENTION BULLETIN, 148, 18.**Location :** ,**Injured :** 0 **Dead :** 0**Abstract**

One of three cranes lifting a pile cluster weighing 260 tonnes failed catastrophically causing the load to fall and sustain damage whilst the crane itself was wrecked totally. The cluster fell against an offshore oil jacket under construction but did little damage. There were no injuries to personnel.

Losses Sustained:

- Total loss of one crane
- Six days on positioning of the cluster
- Monetary loss due to recalculations, clearance of site, revision of procedures, subsequent testing and inspection of lifting equipment
- Damage plate and zinc anode and subsequent rework
- Re-scaffolding of jacket
- Cost of investigation

Immediate Causes:

- Failure in communication between project planners and lift crew. The lift crew were given a procedure, which did not include a documented description of the crane movement. The lift crew were given a procedure, which did not include a documented description of the crane movement. The lift crew devised movement procedure and relayed verbally to others
- Further failure in communication as there was no evidence of briefings on procedures, reviews or execution of plan. No evidence of interface meetings between contractor and subcontractor existed.
- Inadequate warning devices in the crane. The crane was not equipped with a device which would allow the operator to see whether he was working within safe limits, nor was there any means of boom angle measurement.
- Equipment was inadequate to do the job and did not have sufficient capacity to give an adequate factor of safety.

Conclusion:

The investigation into the incident concluded that the boom brake failed on the crane whilst being subjected to an overload, causing the boom to fall out of control. The subsequent impact of the load on the ground and whiplash effect caused severe shock loading to the sleuthing ring. The hook and house rollers sheared, part of the counterweight weighing 8 tonnes was dislodged and fell to the ground.

This particular counterweight would have fallen off the crane as it was tipped forward since it was found under the right hand track. The momentum of the counterweight then sheared the crane's upper works from the base tractor unit with consequence sliding to the final position. The boom fell across the jacket to the final position. This prevented the crane falling completely over.

Whilst the slings used did not contribute to the incident, there was evidence that the identification, certification, selection and testing of slings had been subjected to abuse which had reduced their lifting capacity.

[damage to equipment, design or procedure error, operational activities]

Lessons

The following lessons were learned:

1. All cranes should be tested to good industry practice standards.
2. Records of preventative maintenance, certification, inspection and test should be available on site.
3. A heavy lift specialist should be available for defined critical lifts.
4. Visual/audible alarms should be available on all cranes.
5. Slings which are doubled during a lift should be destroyed.
6. Procedures should be comprehensive.
7. Movement and lift procedures for critical lifts should be reviewed by appointed heavy lift specialists.
8. Procedures should be in place to clearly state roles, responsibilities and lines of communication.
9. A quality plan should be developed for lifting operations.
10. Critical programme elements should be subjected to more proactive management supervision.

124241995

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

An incident occurred at a refinery involving a crane. The incident occurred when a load of scrap metal was to be lifted onto a trailer. At some point in time the crane operator was in the process of lining up a piece of chain, weighing about 8 tonnes on the crane load indicator, on the rear end of the trailer. In order to lay the chain on the trailer properly he swivelled the crane boom past the centre line of the trailer and during this action the crane toppled over. The crane boom smashed on the co-driver side of the prime mover missing the driver who was sitting inside. Fortunately no personal injuries were sustained.

[near miss, plant / property / equipment, safety procedures inadequate, management system inadequate]

Lessons

[None Reported]

6603 26 June 1994

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

Location : A'amshite; Byblos Area, LEBANON

Injured : 28 **Dead** : 8

Abstract

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

[overflow, fire - consequence]

Lessons

[None Reported]

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

Location : Imperial; Saskatchewan, CANADA

Injured : 0 **Dead** : 0

Abstract

Fire destroyed grain elevator. Lightning suspected. Blaze controlled after 5 hours.

[fire - consequence, processing]

Lessons

[None Reported]

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

A rigger was attempting to lift a polymer drier from its mountings using an overhead pneumatic crane, which ran directly above the motor. It would then have been transferred to another lifting beam. The control box for the crane did not have directions marked on the buttons, nor did all the buttons appear to be working. When buttons were depressed there was a delay in the response, and sometimes they did not work at all. The motor was lifted about 6 inches above its mountings, however, it was not possible to move the motor towards the second beam as there was no response to the controls. The control box was passed to the electrician while the rigger climbed up to physically push the crane trolley in the required direction. As the trolley was being pushed, one pair of wheels rose up on the I-beam and the other pair came off the I-beam. The trolley jammed in this position, with the motor still suspended under it. The motor was then transferred to a chain block on a second lifting beam. The causes of this incident were identified as:

1. Defective Equipment - The trolley was unstable and the chain gathering box was damaged.
2. Inadequate Engineering - There was no anti-tilt device fitted, the crane was not balanced and the wheels were not wide enough to stay on the beam in the event of the wheels on the other side tilting.
3. Inadequate Equipment Specification - No anti-tilt device was specified for the crane.

[polymer, mechanical equipment failure, maintenance

Lessons

The following actions were taken:

1. All fixed trolleys were to be fitted with some type of anti-tilt device.
2. Checking and maintaining of the anti-tilt devices was to be added to the plant safety checks.
3. Each plant area was to review whether they needed the lifting equipment in place, or whether temporary lifting equipment would be more cost effective.
4. Stores were to be supplied with a new specification for all new fixed lifting equipment. Non-standard equipment was to be fully discussed with the Workshop before purchase.

6067 07 May 1993

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

Location : Salvador, BRAZIL

Injured : 0 Dead : 0

Abstract

Wire rope on crane broke and 2 ISO tanks each containing 10 tonnes of triethyl aluminium fell to sea.

[unloading]

Lessons

[None Reported]

6035 17 April 1993

Source : ICHEME

Location : , UK

Injured : 1 Dead : 0

Abstract

The chain of a lifting hoist broke allowing a lifting bar of 5 kg and the chain hook to fall 2 metres onto the shoulder of the operator. Lost time accident.
[mechanical equipment failure]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

Boiler fan bearing failure at a refinery. Investigation of noisy forced draft fan resulted in monitoring and, thereafter, shutdown of boiler to examine the bearing housing. It was discovered that a considerable amount of sludge had built up in the bearing housing. The immediate cause was sludge forming mechanism that prevented adequate lubrication to the forced draft fan outboard bearing, causing the bearing to fail. Contributing to the incident was oil line to the oiler and other the other level indicator had been plugged with sludge and resulted in false oil level readings. The basic cause was that there was not an adequate means of checking the oil in the housing, therefore, the sludge build-up went undetected. The forced draft fan was a critical piece of equipment, and it was not possible to take it out of service to check the bearing housing without a shut-down.

Losses, unit throughput adjustments, \$95,000 (1993), product adjustments, \$56,000 (1993), maintenance, labour, and materials, \$10,000 (1993), environmental violation.

[refining]

Lessons

1. When there is no redundancy (spare equipment) built into the process, it is essential that high integrity and well maintained lubricating systems are installed.
 2. Quantities of lubricant used should be monitored to detect changes up or down, either of which can indicate potential problems.
 3. Qualities of lubricants supplied should be the subject of routine proof testing.
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Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

Lifting equipment failure at a refinery. A 5-tonne overhead hoist was being removed from the permanent lifting beam on the top deck of a tower structure. As the hoist was being rolled from its permanent support beam onto a lifting beam attached to a crane, it fell onto a pipe rack below. The immediate cause was the hoist removal failure. The basic cause was a lack of pre-planning, with appropriately qualified engineers.

Estimated at \$1.6 million (1993), significant production loss, damage to pipe lane; undetermined impact on the TCC Unit.

[mechanical equipment failure, management system inadequate, damage to equipment, product loss, refining]

Lessons

Lifting operations within operating plant areas must be authorised through the appropriate level of management to ensure all the pre-planning, supervision, and safe-guards have been met.

Lifting above live processing plant/equipment must be carefully assessed, planned

and authorised, and where practicable, avoided or measures taken to limit possible consequences of a dropped load/overturnd crane.

5878 19 December 1992

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

Location : Savona, ITALY

Injured : 0 Dead : 0

Abstract

Crane cable broke when loading gas tanker cargo tank weighing 350 tonnes.

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 1

Abstract

On December 19, 1991, a demolition contractor's employee was fatally injured when several furnace tubes fell on him during an attempted rigging operation.

The furnace tubes were unsecured and resting against the shell of the furnace when the accident occurred.

Several attempts had been made by the crane operator to reposition the tubes safely on the floor of the furnace shell. It was during an attempt by the deceased to place a sling over the tubes that they suddenly shifted and slid off the end of the furnace shell, hitting him and crushing his skull.

[fatality]

Lessons

1. Demolition of plants should be the subject of a project safety review, using checklists. Terms of reference for such a review should include adequacy of the plant preparation, working methods and supervision to be employed, and the interaction of the work on the safety of other refinery activities.
 2. A master plan should be prepared showing the sequence of demolition, predicting the results of each stage of the work.
 3. Buildings, structures and material should be dismantled and stored in such a way as to prevent any foreseeable risk of collapse.
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Source : HAZARDOUS CARGO BULLETIN INCIDENT LOG, 1992, JAN.

Location : New Orleans; Louisiana, USA

Injured : 0 **Dead** : 1

Abstract

A dust explosion occurred during loading at grain elevator. Dust in enclosed space on deck and a power switch are suspected. Fatality.

Lessons

[None Reported]

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

Location : Basford; Nottinghamshire, UK

Injured : 4 **Dead** : 0

Abstract

An explosion and fire occurred at an LPG bottling plant.

[fire - consequence]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

An explosion and flash fire occurred in a wet cake screw conveyor. The pressure wave propagated into the drier. An explosion suppression system was activated and contained the explosion. The screw conveyor had been running for 30 hours without product and the cause was probably due to material being pulverised into a fine powder and ignition from static.

[fire - consequence, processing]

Lessons

[None Reported]

5217 04 January 1991

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

Location : Nhava Shava, INDIA

Injured : 15 Dead : 0

Abstract

A fire occurred as sulphur was being loaded by conveyor belt.

[fire - consequence, loading]

Lessons

[None Reported]

Source : LOSS PREVENTION BULLETIN, 124, 5-6.

Location : ,

Injured : 1 Dead : 0

Abstract

A sphere launcher, on an offshore installation, was being pressurised by an operator manipulating the valves adjacent to it. Failure and detachment of the closure door occurred at approximately 7.93 N/mm². The sphere launcher had been at 7.93 N/mm² for approximately ten minutes when the failure occurred, the normal operating pressure being 8.27 N/mm².

The end closure demolished the platform crane and caused widespread damage to the module structure, secondary steelwork, miscellaneous services, sea line riser and an emergency shutdown valve. The operator was not seriously injured.

It was estimated that the cost of the damage amounted to

£7 million (1991).

[damage to equipment, injury]

Lessons

The following recommendations were made:

1. Carry out a thorough examination of the closure paying particular attention to potential defects in securing bolts, nuts and their housings and their methods of attachment;
2. Ensure that maintenance is carried out in accordance with manufacturer's instructions with particular attention to the replacement of components at appropriate frequencies; and
3. Review the continued suitability of the original design of the closure in the light of current operational requirements.

Maintenance schedules should be reviewed to ensure that any rust-preventing grease used in the 'tube turns' nut pocket is periodically removed and renewed.

Source : SEDGWICK LOSS CONTROL NEWSLETTER, 4TH QUARTER, 1990.

Location : Muang District, THAILAND

Injured : 4 **Dead** : 3

Abstract

During bottle filling operations, one bottle exploded and caught fire and caused a series of explosions and a blaze at two buildings in the factory. Fatality.
[fire - consequence, bottling plant]

Lessons

[None Reported]

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

Location : Los Angeles Harbour; California, USA

Injured : 0 **Dead** : 0

Abstract

A container holding approximately 5,000 gallons of acetonitrile was dropped from a crane during unloading from a container ship. A longitudinal support on the outside of the container broke, causing the container to fall approximately 30 feet onto a deck cover on the ship where it ruptured. It was estimated that 50 percent of the acetonitrile leaked from the container onto the deck, and into the hold of the ship, and into the water. The probable cause was a structural failure in a welded seam of the top rail of the frame of the container.

[material of construction failure, weld failure]

Lessons

[None Reported]

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

A faulty limit switch on the cage door of a hoist cage nearly caused a very serious incident, fortunately the persons involved were not injured.

The incident occurred when an operator boarded the hoist at ground level. The hoist was stopped at the designated area, the cage and landing doors opened.

The operator stepped out of the cage but as he did so, with out warning, the cage began to move downwards. The operator fell back into the cage but, fortunately, was caught by his colleague, who then attempted to stop the cage with the stop button but found that when he released the button the cage continued downwards.

The cage was eventually stopped by pressing the power isolation button.

The following conclusion was made:

The cage moved downwards with both cage and landing doors open when the ground floor #down# button was pressed, because two separate safety interlock systems failed to work.

[near miss, safety equipment failure, lifting hoist, mechanical equipment failure]

Lessons

[None Reported]

4385 15 December 1988

Source : THE GLOBE AND MAIL, 1989, 14 SEP.

Location : , ATLANTIC

Injured : 0 Dead : 0

Abstract

An offshore oil rig was being towed to the North Sea when the tow rope broke and the oil rig sank in a heavy storm.

[weather effects, sinking]

Lessons

[None Reported]

Source : HAZARDOUS CARGO BULLETIN, JAN, 1989.

Location : , SINGAPORE

Injured : 0 Dead : 0

Abstract

A marine transport incident. For reasons unknown, a ship began to capsize during loading operations. The cargo included plywood, drilling mud, drilling equipment, general cargo containers and other containers laden with cyanide. A deck crane on the edge of the jetty prevented the ship from rolling over. Fortunately there were no injuries.

Within a few hours, a heavy lift crane was being prepared to come to the aid of the stricken vessel.

Fortunately, the floating crane was already close by and by the afternoon of the same day it had arrived at the scene.

The crane, which has a 1,000 tonnes maximum lift capacity, supported the vessel and gave full control as operations began to pump out the flooded engine room and steering gear space.

Water in the flooded hold was sampled and found to be contaminated with cyanide.

[near miss, contamination, cyanide product, unidentified cause]

Lessons

1. Cyanides are toxic if swallowed, by skin contact or dust inhalation. On contact with water cyanide may form a weak hydrogen cyanide solution.
 2. Cyanides must be stowed away from acids with which they react, giving off highly toxic and flammable cyanide gas.
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13125July 1988

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

Some 6.1 tonnes of palletized goods had been placed into the cabin of a hydraulic elevator. Although the maximum permissible load was 7,3 tonnes, an employee drove a loaded forklift truck with a total weight of approx. 4 tonnes into the elevator.

After a short moment, the lift moved downwards. The driver pushed the stop button, which produced no effect. He saved himself by jumping out of the cabin into the building. The loaded forklift, on its downward trip, ground against the wall of the elevator well, moved to a diagonal position and broke through the elevator door on the lower floor; it fell sideways when it rolled out of the elevator.

Cause:

The elevator had been overloaded by some 40%. Due to this overload, a weak component in the hydraulic system failed.

[damage to equipment, human causes, near miss]

Lessons

The following recommendations were made:

Installation 'of barriers in the cabin of the elevator so that the floor space, where pallets can be placed, is more limited
Technical improvement of the hydraulic system Instructions

4066 January 1988

Source : RICHES P.A, AFTER PIPER ALPHA - THE INSURANCE ASPECTS, IN: OFFSHORE OPERATIONS POST PIPER ALPHA SYMPOSIUM, 6-8 FEBRUARY 1991, LONDON, INSTITUTE OF MARINE ENGINEERS, 1991, 2/1-2/9.

Location : West Sole Field; North Sea, UK SECTOR

Injured : 0 **Dead** : 2

Abstract

A crane on a fixed platform collapsed onto supply vessel. Fatality.

Lessons

[None Reported]

4062 1988

Source : ICHEME

Location : Porsgrunn, NORWAY

Injured : 0 **Dead :** 0

Abstract

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

[fire - consequence]

Lessons

[None Reported]

4004 30 October 1987

Source : LLOYDS WEEKLY CASUALTY REPORTS, 1987, 17 NOV.; HOUSTON CHRONICLE, 1989, 24 OCT.

Location : Texas City; Texas, USA

Injured : 0 **Dead** : 0

Abstract

4000 residents evacuated following leak of hydrofluoric acid. Crane carrying 620 barrels lost its load which severed the pipeline.
[evacuation]

Lessons

[None Reported]

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]

Source : ICHEME

Location : ,

Injured : 1 Dead : 0

Abstract

A fitter was struck by falling scaffolding poles. The poles fell from a load of scaffolding material which was being lifted by a crane up to an elevated walkway during a major overhaul. The fitter received severe bruising to his right elbow.

In order to perform a modification to instrumentation a scaffolding platform had to be constructed adjacent to an elevated walkway (30ft above ground) at fin-fan headers. All scaffolding required for the overhaul was being handled by a contractor and a foreman arranged for the use of a crane working in the area lifting heat exchangers to lift scaffolding tubes and boards up to the fin-fan walkway. In all four scaffolding boards and ten poles were required to build the scaffold.

When the crane became available to make the lift a rigger went in search of short slings as those already on the crane were too long and too highly rated for the lift and he doubted if they would be able to "bite" the scaffolding adequately. Whilst he was searching for the correct slings he noticed that the scaffolding gear had started to be lifted as a single bundle.

It transpired that while the rigger was away two of the scaffolders and a supervisor had rigged the scaffolding equipment as a single load using one of the long slings already on the crane hook with half hitches at the end of the load.

The load was lifted having checked for stability but the crane jib was too short to be able to land the load on the walkway.

While the crane driver was lowering the load for re-rigging it hit the underside of the walkway. This tilted the load and the scaffold poles fell vertically. The fitter working underneath, who was unaware of the lift, ran clear of the area when he heard a "clanging sound" from above. Nevertheless he was hit directly on the elbow from a falling pole and received glancing blows on the head and buttock from other falling poles. A scaffold board on which he had been working was pierced through by a falling pole.

The following conclusions were made:

1. The load was inadequately rigged.
2. The wrong types of slings were used both to allow the lift to be successfully completed and to bind all the equipment tightly.
3. Two slings should have been used.
4. Scaffold boards and poles should not be lifted together.
5. Lifting both allow the boards to assume a diamond arrangement or other similar patterns to be set up in the load which prevents the poles being held tightly.
6. Checks to ensure that all personnel were away from the area were not carried out.
7. The rigger who was designated to carry out the work was overstepped by other personnel, who used equipment which the trained rigger had deemed unsuitable.

[maintenance, safety procedures inadequate]

Lessons

The following recommendations were made:

1. Only suitably qualified and identified personnel must be allowed to rig materials for lifting.
2. Scaffold boards and poles must not be lifted together.
3. Areas below lifts must be thoroughly checked to ensure they are evacuated.

123551987

Source : ICHEME

Location : ,

Injured : - Dead : -

Abstract

A crown ram failed on a 20-tonne crane as it was unloading a container weighing 17 tonnes. The load was subsequently dropped on the back of the crane.
[mechanical equipment failure, plant / property / equipment, safety procedures inadequate]

Lessons

123561987

Source : ICHEME

Location : ,

Injured : - Dead : -

Abstract

An incident occurred when a tandem lift using a 50 tonne and a 30 tonne crane to lift a launch out of the water. In attempting to slew both cranes together to position the ramp, as the launch moved, the 50 tonne crane became unstable and its rear lifted off the ground as the launch plunged back into the water. [transportation, plant / property / equipment, safety procedures inadequate]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 1 **Dead :** 0

Abstract

A worker was seriously injured during movement of a crane platform.

The incident occurred when the crane controller did not see the worker as the worker was standing outside the crane platform railing. He became trapped between the platform and a vertical wall stanchion and suffered a fractured pelvis and internal injuries as a result.

[safety procedures inadequate, injury]

Lessons

[None Reported]

123541987

Source : ICHEME

Location : ,

Injured : - Dead : -

Abstract

A pedestal crane suddenly tilted forwards due to the failure of bolts on the rear hook roller housings.

An investigation into the incident found that the bolt material was of low quality steel and there was a possibility that they had been insufficiently torqued.

[bolt failure, material of construction failure, plant / property / equipment, safety procedures inadequate]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A road transportation incident. A vehicle loaded with a skip containing highdensity-spent catalyst had been reversed to the edge of the chute to a barge. The hydraulic supports were lowered, but not checked for correct positioning.

It is thought that they were actually positioned onto the 10cm high wooden beam on the ground in front of the chute. The driver started the unloading by means of the control levers inside the cabin and supervised the unloading whilst sitting in the open cabin door.

Suddenly the lever between the hydraulic arm and hook of the vehicle and the iron rod of the container broke, causing the container to swing out. The whole vehicle was shifted backwards and the hydraulic legs lost their support. The centre of gravity was shifted too far backwards and resulted in the vehicle toppling over onto the barge. The driver was thrown into the water and escaped injury.

[plant / property / equipment, near miss, design or procedure error]

Lessons

[None Reported]

125571987

Source : SAFETY MANAGEMENT, MARCH 1987.

Location : , UK

Injured : 1 **Dead :** 0

Abstract

A contract steel erector fell 30 feet whilst a new smelter was being installed at a smelting firm. The incident occurred as the worker stood on a three inch wide beam while a platform was being lifted into place by a crane. The contractor was struck by the railing and fell.

The company was fined £200 (1987).

[fall, near miss, construction, injury]

Lessons

[None Reported]

Source : SEDGWICK LOSS CONTROL NEWSLETTER, 1986

Location : Cheshire, UK

Injured : 0 **Dead** : 0

Abstract

The collapse of a 250 ft high crane on a refinery caused considerable damage to newly constructed plant.

[damage to equipment, refining]

Lessons

[None Reported]

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

A marine transportation incident. An ethylene ship was being prepared for sailing. The ethylene loading arm had been removed and a fitter and jetty operator were in process of disconnecting the water supply hose from the ship.

A single masted, two jibbed, crane had been in use for the loading operation. One jib supported the ethylene loading hose and the other, the cooling water hose. The wire lifting rope, supporting the ethylene loading hose, failed. As a result, the hose fell approximately 20 feet onto the jetty head, narrowly missing the jetty operator.

[near miss, mechanical equipment failure]

Lessons

Inspection showed extensive corrosion of the failed rope, in the area of failure and tests confirmed that corrosion was the predominant failure mechanism.

About 60% of the 95 individual wires had corroded through, due to a general lack of lubrication. Lack of lubrication, the marine environment concerned, would result in rapid corrosion. An inspection, about one month before the incident, had revealed a need for rope cleaning and lubrication. This had not been done, but was planned for the week following the incident.

Clearly, the main lesson was the need to ensure regular and routine rope lubrication. Other recommendations included:

1. A standard rope to be specified, to avoid use of various types of rope.
 2. Inspection and testing of all associated equipment (loading hoses, the other rope, mast, jibs, winches, pulley, blocks) before further use.
 3. Review of inspection schedule frequency.
 4. review of material and construction of rope with a view to identifying a more corrosion resistant system.
-

Source : FIRE PREVENTION, NO. 195, DECEMBER 1986.

Location : London, UK

Injured : 0 Dead : 0

Abstract

The first storey of a factory was occupied by a bottling and packing department of a perfumery manufacturing operation. An electric motor drove the feed pump to the bottling machine, and it appears that this was normal, ventilated, single phase motor with an internal, speed-sensitive switching device. Such devices usually spark and on this occasion, there was sufficient vapour present from the alcohol solvent in the perfume for sparking to start a fire.

The process operators detected the fire and the fire brigade were present in a few minutes. They contained the fire to the room of origin, although some smoke damage occurred to the rest of the storey and a little water damage on the floor below. The roof lights of the room of origin were broken by the fire brigade to improve ventilation and aid smoke dispersal.

Estimated damages: £300,000 (1986).

[processing, bottling plant, fire - consequence, damage to equipment]

Lessons

Although not a very large dramatic fire, this highlights two points:

1. The need to use suitably protected electrical equipment where flammable materials are present.
 2. The value of a quick mean of ventilation to reduce smoke density and contamination.
-

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

A crane was being used to lift a 16 inch diameter spectacle blank for insertion into a pipeline flange on a butadiene plant. The lift had been completed, the load detached, crane jib retracted, block lowered and lifting slings removed. The block was then raised and the jib slewed back towards its travelling position. As the jib was slewed, the crane overturned onto its side. The crane driver jumped from the cab and escaped without injury. No other personnel injured. Significant damage to the crane occurred.

[damage to equipment, design or procedure error]

Lessons

The main reason for the crane overturning was that the crane outriggers were not in use during the operation. This was contrary to design and operating procedure for the type of crane involved.

Adequate training had been provided but needed re-emphasis.

The company code of practice inspection was overdue. This was considered to be unsatisfactory, but an inspection after the incident revealed no depth that could have caused the incident.

The investigation also revealed some defects in the emergency response actions. The most significant of these was that the vehicle batteries were disconnected by cutting the cables with bolt cutters.

This resulted in significant sparking due to earthing and presented a serious ignition risk.

Nevertheless, overall, the emergency team were commended for their prompt actions in coping with the incident.

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

During the overhaul of an Alkylolation Unit, a contractor's lorry was delivering scaffolding materials to the plant. Materials on the back of the lorry were unloaded by the driver using a hydraulic articulated crane fitted to the lorry itself. On completion of unloading the lorry was driven out of the plant without the jib/arm of the crane having been properly stowed. The jib/arm struck the bottom of a scaffold which had been suspended from an overhead pipetrack causing damage to the scaffold. Fortunately, two men working from the scaffold were not injured.

[damage to equipment, unloading, human causes]

Lessons

It was fortunate that this incident did not result in injury to the men working on the scaffold or others in the general area if the scaffold had collapsed. While scaffolding is perfectly satisfactory and acceptable for sustaining vertical loads it is not, unless specifically designed, capable of withstanding lateral or shock loadings. It is extremely important, therefore, to recognise this aspect in overhaul planning and to mark vulnerable sections of scaffolding accordingly with warning signs, coloured tape etc.

Source : ICHEME

Location : , UK

Injured : 1 Dead : 0

Abstract

A refinery crane driver was trapped between his crane and a contractor's lorry when the former rolled down a slight incline as the individual was preparing to assist in towing the lorry which was struck in soft ground.

The lorry had entered the unit to deliver materials to a work site. On attempting to leave, the vehicle became bogged down in soft ground.

The driver requested the assistance of a passing crane driver to tow the vehicle free. The crane driver positioned the crane in position to allow a tow rope to be attached, which required it to be parked on a slight down slope.

While the driver was attaching a tow rope, the crane moved down the incline and trapped him between two vehicles. Pressure exerted by the vehicles restricted his breathing capability and caused him to lose consciousness for a considerable time.

Emergency action by the fire service, first aid and medical personnel resulted in his release and resuscitation. The crane driver received no permanent injuries, but was detained in hospital for a period to assist recuperation.

The cranes parking brake mechanism was the subject of extensive investigation and faults were discovered in a component part.

[material of construction failure, injury]

Lessons

[None Reported]

3284 10 April 1985

Source : ICHEME

Location : , SOUTH AFRICA

Injured : 0 Dead : 0

Abstract

Mechanical equipment failure occurred involving a conveyer belt. Chemical oil from coal plant.

Lessons

[None Reported]

3258 13 March 1985

Source : LLOYDS LIST, 1985, 14 MAR.

Location : Bahia Blanca, ARGENTINA

Injured : 25 **Dead** : 5

Abstract

A violent dust explosion caused a serious fire in an elevator, virtually destroying the elevator complex. The shock wave was felt 11 km away, producing breakage of windows and power cuts.

A further explosion ripped through the structure 32 minutes later. Several hundred grain workers were in the vicinity at the time of the explosion. Firefighters brought the fire under control.

The explosion may have been caused by a fire that began in the cables of a lift used by the workers and travelled down the shaft to the basement of the silo where it ignited accumulated gases. More than 30 ships waiting to load grain at the port were pulled away from the area.

[silo/hopper, damage to equipment, storage, fatality, fire - consequence]

Lessons

[None Reported]

Source : FIRE PREVENTION NO. 195, DECEMBER, 1986.

Location : , UK

Injured : 0 Dead : 0

Abstract

Thirty five employees were working in a factory which produced structural steel sections. One part of this included a tank for paint dipping of components. Above this tank, a grinder being used in the track of an overhead crane. Sparks from the grinder ignited the paint, leading to a fire that caused damage of £325,000 (1985). This was made worse due to the flammable nature of the roof lining. Extensive smoke-logging made the task of fire-fighters much more difficult.

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

Lessons

The following recommendations were made:

1. Replacement of roof liner with non combustible materials, in this case a metal liner tray with 100 mm thick rockwool insulation was used.
 2. The paint dipping process was discontinued. All paint application at this factory was changed to paint spraying, in a different part of the factory.
 3. The risks associated with overhead grinding work were not appreciated, especially with a flammable material being in use below.
-

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

The jib of a contractors crane collapsed as it was being raised into position. The 300 tonne capacity crane was being fitted with a long jib to enable high lifts to be carried out at the hydrocracker complex major overhaul. The crane had already successfully carried out a high lift and was being moved to carry out a further lift on an adjacent flare stack.

The jib had been removed to allow the crane to be re-positioned. On reaching the new work site the jib was reconnected and was being lifted into position when the failure occurred. Fortunately no injuries occurred and no equipment, other than the crane, was damaged.

Initial enquiries indicate that the two pins which locate the mast fall back system had been incorrectly inserted from the inside, with the result that it was possible for the jib root section to come into contact with the pins.

[operational activities]

Lessons

[None Reported]

9680 07 January 1985

Source : ICHEME

Location : , UK

Injured : 1 Dead : 0

Abstract

The length of the jib of a refinery crane was being extended by adding an extra 25ft. girder section. The extra section of girder is fixed to the jib with pins, the pins in turn being held in with special spring clips.

There was trouble in the fitting of the last pin and clip and in tapping the pin into place the clip flew off and struck a rigger in the eye. Although no recognisable faults could be found in the work system used, retaining on the fitting of such clips and pin was done.

[construction]

Lessons

[None Reported]

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

A fire was discovered in the communal bathroom and toilet of a block of guest flats. The fire was caused by the extractor fan overheating and setting light to the plastic cover. This caused the fan unit to fall out of its housing and into the bath. Damage was caused to the bathroom and nearby corridor. All the guests were safely evacuated from the building. The smoke emitted by the fire was noxious and could have caused harm to the residents. There was no smoke detection equipment in place.

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

Lessons

Smoke detectors were fitted and signs displayed explaining that time delay in the lights and fans switching off. Fire Instructions in the rooms and on the landing were updated and the booking forms included information on the Fire Procedures.

Source : ICHEME

Location : , UK

Injured : 1 Dead : 0

Abstract

A transportation incident. While moving a mobile crane to the work site, brake failure occurred and a person was struck by the offside crane wheels resulting in fractured bones of the left foot.

The crane was equipped with air brakes that required a pressure of 50 to 75 psig in the air reservoir for adequate brake operation. Although the operating manual identified the need for an indicated air pressure of 50 to 75 psig before operating the crane, it did not indicate that this was essential for brake operation. A pressure gauge was fitted but it was not labelled. At the time of the incident the glass in the pressure gauge was broken but the gauge was fully operational. There was no low pressure alarm.

Subsequent investigation identified a leak on a compression fitting next to the air reservoir. No identifiable reason for the leak was apparent from inspection or metallurgical analysis. Simulation of the incident showed that a leak could have led to loss of braking efficiency between starting the crane and the occurrence of the incident.

[brakes faulty, people]

Lessons

A number of recommendations were made:

1. Install an audible low pressure alarm on the brake system.
 2. Provide a warning label on the pressure gauge highlighting the importance of brake pressure.
 3. Remove the crane from service until the above modifications are fitted.
 4. Include a brake system pressure drop test in the weekly maintenance.
 5. Provide training to remind all drivers of the importance of checking the brake system.
 6. Check all other vehicle with air braking systems to determine whether they are fail safe and take appropriate action to remedy deficiencies.
-

9138 30 March 1984

Source : LLOYDS LIST.

Location : , ARGENTINA

Injured : - Dead : 3

Abstract

A dust explosion occurred involving a loading elevator and silos. The whole site caught fire causing severe damage to the site.

[silo/hopper, fire - consequence, damage to equipment]

Lessons

[None Reported]

2960 30 March 1984

Source : LLOYDS LIST, 1984, 2 APR.

Location : , ROSARIO

Injured : 0 Dead : 0

Abstract

Dust explosion at loading elevator and silo for grain.
[storage equipment]

Lessons

[None Reported]

2893 20 January 1984

Source : ICHEME

Location : , SOUTH AFRICA

Injured : 0 Dead : 0

Abstract

Fire at a chemical oil from coal plant involving a conveyor belt.

[fire - consequence]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 1 Dead : 0

Abstract

During demolition of redundant pipework, a mobile crane became stuck in the mud. A JCB excavator was on hand and it was decided to use this to pull the crane out. A crane-chain was attached between the JCB and the crane, but as tension was applied the anchorage point on the crane failed and flew off striking one of the contractor's workers on the left leg.

A deep wound and fracture of both bones in the man's lower leg resulted.

The following recommendations and conclusions:

1. The state of the ground along the pipetrack was such that it was obvious that a mobile crane would be likely to become bogged down. A large wheel or caterpillar lifting appliance should have been used or, if these were not available, some sort of matting should have been laid down to prevent the mobile crane from getting bogged down.
2. Although some attempts were made to remove the mobile crane's towing shackle-pin, greater endeavour would surely have broken a layer of paint.
3. If all attempts at removing the mobile crane's towing shackle-pin failed another shackle should have been obtained as a link between the towing shackle and the crane-chain.
4. A crane-chain is not designed for pulling or towing. The chain used was adequate strengthwise, but a towing bar should have been used to prevent extreme variations in tension.
5. The mobile crane's stowing bracket was used instead of the recognised towing shackle. Under no circumstances should a part of a vehicle not specifically designed as a towing connection, be used to tow or pull that vehicle.
6. The injured person was standing between the mobile crane and the JCB when tension was applied to the crane-chain. Before any chain, cable, rope, etc., is put under tension it is imperative that ALL personnel move themselves to a position safe from the effects of any failures.

[injury]

Lessons

[None Reported]

2726 14 September 1983

Source : HAZARDOUS MATERIALS INTELLIGENCE REPORT, 1983, 30 SEP.

Location : Texas, USA

Injured : 0 Dead : 0

Abstract

Crane caused rupture of pipeline and spill of hydrochloric acid.

Lessons

[None Reported]

122951983

Source : ICHEME

Location : ,

Injured : 0 Dead : 1

Abstract

A contractor's supervisor was killed when he became trapped between the moving counterweight and an outrigger part of the crane whilst he was watching material being lifted from a lighter by a mobile crane belonging to his company.

[safety procedures inadequate, fatality]

Lessons

[None Reported]

2450 1983

Source : NFPA REPORT

Location : David Creek; Virginia, USA

Injured : 17 **Dead** : 0

Abstract

Transportation. A natural gas pipeline was ruptured by a crane. A subsequent explosion levelled a supermarket.

Lessons

[None Reported]

Source : ICHEME

Location : , SAUDI ARABIA

Injured : 0 **Dead :** 0

Abstract

Fire occurred on a steel plant involving a conveyor belt.

[fire - consequence]

Lessons

[None Reported]

Source : ICHEME

Location : , UK

Injured : 1 Dead : 0

Abstract

Whilst being refitted after tube cleaning operations, the return bonnet of a superfractionator column condenser fell trapping the fitter and causing which is understood to be severe bruising to his right leg and broken bone in his knee.

The reef knot joining the ends of the polypropylene rope used in the movement of the bonnet became undone due to the efforts being made to orientate the bonnet correctly, i.e. one standing part of the rope was in tension and the other standing part was slack, allowing it to be pushed back through the knot loop and become free. Had the free ends of the rope at the knot been secured, i.e. by half hitches or whipping, it would not have become undone.

[design or procedure error]

Lessons

The following recommendations were made:

1. Where possible, bonnets are not to be landed on platforms or walkways, preferably rest bonnets at ground level.
 2. When installing scaffolding, ensure minimum interference with proposed lifting and for maintenance operations without infringing good scaffolding practice.
 3. Only certified lifting gear, suitably load rated, to be used when raising, lowering or supporting loads.
-

9135 14 May 1982

Source : LLOYDS LIST, 1982, MAY, 18. 1982, MAY, 19. 1982, MAY, 28.

Location : Montreal, CANADA

Injured : 0 **Dead** : 0

Abstract

A fire occurred on a grain elevator due to a dust explosion which was caused by faulty electrical wiring.

[fire - consequence, electrical equipment failure]

Lessons

[None Reported]

9136 20 April 1982

Source : LLOYDS LIST, 1982, APR, 22. 1982, APR, 23.

Location : Iowa, USA

Injured : 16+ Dead : 6

Abstract

An explosion occurred on a grain elevator injured many people. Fire spread to two of the structures, six grain bins.
[fire - consequence, injury]

Lessons

[None Reported]

Abstract

A fire in a warehouse containing chemical herbicides including 325,620 gals of diquat, 11,000 gals of paraquat and 20,000 kg of octyl phenol resulted in severe contamination of soil and the local river system. It is thought that the fire was caused by the overheating of a pallet of octyl phenol while it was being shrink-wrapped. It is also thought that the fire was exacerbated by the application of water rather than foam in an attempt to extinguish the blaze. The water carried flakes of burning octyl phenol to other parts of the warehouse, igniting the pallets on which the drums of chemicals were stored and causing them to leak. The water then carried the chemicals into highway drains and into local rivers, and into the site's foul sewer. The fire was extinguished by foam, but more water was used to flush the warehouse discharge into the river system in order to prevent the diquat/paraquat/water mixture drying out to form highly toxic crystals. [fire - consequence, warehousing, storage, pollution, design or procedure error, spill, shrink wrapper]

Lessons

The long term effects of large doses of diquat and paraquat on plant life, soil, stream and river bed silts were monitored. The conclusion was drawn that no major pollution would have occurred if foam or fog rather than water had been applied to the burning octyl-phenol. Water should be applied to extinguish burning octyl phenol.

2334 09 February 1982

Source : THE EXPLOSION DISASTER IN BRUCHKOBEL, HSE TRANSLATION 85/1

Location : Bruchkobel; Maine-kinzig, GERMANY

Injured : 0 **Dead :** 0

Abstract

An explosion occurred at a perfumery aerosol filling station. A master valve and one valve at the filling machine were found to be open and a flexible hose screwed connection was found loose causing propane/butane to escaped into the building. The mixture was ignited by a cigarette lit in the recreational area. The explosion destroyed the building.

[leak]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

An explosion occurred in a churn system, which resulted in minor damage being sustained by the churn associated equipment and instrumentation. A churn vent fan and ventilation ducting were more severely damaged. The vent fan room door was blown off.

The explosion occurred shortly after the start of a venting cycle. Operating staff intervened to prevent the continuation of the automatic churn cycle, stopping the churn paddle and vent fan. These had continued to operate.

Heavy smoke and fumes were reported in the churn room, with some smoke and fume observed in an adjacent corridor. The vent fan room was filled with smoke.

The churn was blanketed with nitrogen and all personnel were cleared from the area, prior to pumping out the viscose batch. When two thirds of the batch had been discharged, the batch tank's attritor jammed. When opened up, this was found to be stripped of many teeth. A small piece of metal was recovered from it. When the churn rough cutter was examined, it too showed evidence of metal objects passing through.

When an examination of a conveyor (common to more than one churn) was made no loose bolts or other objects were identified. A length of the conveyor was however not protected by covers, allowing for potential foreign body ingress.

It was concluded, after examination, that the vent fan was not the source of ignition for the explosion. It was suggested that metal, trapped in the churn paddle was in fact the source, igniting a flammable atmosphere that would normally be present only during the first few minutes of the venting cycle.

[conveyor, vent, explosion, flammable atmosphere, air cooler]

Lessons

A number of recommendations were made following the investigation. These included:

1. The provision of additional covers on conveyors feeding churns.
 2. A trial to look at stopping the churn paddle during the critical stage of the venting cycle.
 3. A design review of the venting systems to improve personnel safety.
 4. Maintenance checks should include for inspection of items that could fall into conveyors, if loose.
-

9415 22 October 1981

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

Operational problems were experienced on a post fractionator column and the tower was taken off line for inspection. Examination of the tower revealed collapse had occurred to the odd number trays, No. 89 to 55 of 90 tray tower. To ease the removal of these trays, the centre section of the even numbered trays was removed down to tray 56.

The tray parts were removed from the tower via the top mandoor, which is approximately 180 feet above ground level. The initial winch set-up to lower the tray section to ground was considered unsatisfactory by the rigging engineer and an alternative method using a hired mobile high lift crane and cage was adopted. The lifting cage was used for transporting personnel and tray sections to the top and middle mandoor of the tower. Use of the cage by personnel was on a voluntary basis (as an alternative to using the cat ladders on this high tower).

The crane was set up and work commenced. All damaged tray sections were removed, repaired and replaced.

A few days later when two men were being lowered from the middle pick-up point, the cage caught a protruding metal bracket, tilted and damaged one of the tie bars before any corrective action could be taken.

No injuries to personnel resulted from this incident but an enquiry was initiated.

There is no serious safety problem associated with the use of a high lift crane and cage provided qualified personnel, proper equipment and the proposed instructions are followed.

[damage to equipment, near miss]

Lessons

[None Reported]

2056 15 September 1980

Source : FIRE PREVENTION, 1981, APR.

Location : San Fernando, TRINADAD

Injured : 3 **Dead** : 0

Abstract

Fire destroyed LPG filling plant and an adjacent 2 storey residential building. Plant's automatic filler short circuited.

[fire - consequence, filling machine]

Lessons

[None Reported]

Source : ICHEME

Location : , UK

Injured : 1 Dead : 0

Abstract

An electrolytic cell anode assembly dropped approximately 8 inches, onto the cell base whilst it was being lifted with an overhead crane. It injured an operator's hand. The crane was one of a pair of similar units, each having a slow, and fast, lifting motor, interconnected by a gearbox on the main drive.

Gearbox failure will:

1. Allow the fast lift facility to remain operational
2. Allow a load to fall if the "slow" hoist or lower buttons are pressed. The breaks remain operational and will operate if either of these buttons are released, or if the "stop" button is pressed.

The crane had a defected slow hoist system (failed gearbox). Thus, the lift was being made with the "fast" lift system. After pausing, to steady the load, the slow hoist button was pressed, thus allowing the load to drop. It was known that a fault existed at the time.

Previous gearbox failures had occurred on each crane and had been attributed to shearing of nylon bondings of the assembly parts.

The gearbox on the other crane had been uprated (to 11 tonnes) two months prior to the incident and there had since been no further failures on this unit. The crane involved in the incident, however, had not had gearbox uprate, though the crane, itself, had been uprated to 11 tonnes. Thus, this gearbox would have been operating very close to its design limit.

[electrical, mechanical equipment failure, injury]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

The hook of a mobile crane failed when the crane attempted to lift a small box heater weighing approximately 15 tonnes. Fortunately, the heater had not been raised from its supports when the failure occurred and no one was injured. There was no damage to property.

The failure was due to corrosion of the threads on both the hook and nut of the assembly, resulting in the hook being pulled from the block when sufficient weight was applied.

After the investigation it was found that: The threads on the hook and on the nut were badly corroded and the only piece that had been holding the two parts together was a 3/8 inch diameter pin, inserted through the nut and hook to prevent the nut from turning. The corrosion was probably caused by exposure to moisture over an extended period of time.

The contractor stated that the problem with the hook had been noticed by one of his crane operators some time previously, and that he had taken it into his workshop and instructed the mechanic to repair it. However, he admitted that he had not followed up on it, and that someone had taken it out of the shop and placed it on the crane, unaware of the defect.

[human causes, near miss, operational activities]

Lessons

The following points should be checked before lifting plant is permitted on site:

1. Check that valid crane test and insurance inspection certificates are available.
2. Check that test and inspection certificates are available for all "loose" items, including hook blocks, ropes, slings, shackles, etc.
3. Examine condition of such items on site and check that rope terminations are in accordance with good practice.
4. Inspect the machine's general condition; if it looks shabby then items that cannot be readily seen may be in a poor condition.
5. Check with the Contractor that the safe load indicator and all other safety devices are functioning correctly.
6. Check the condition of tyres if wheel mounted.
7. Check that ropes are spooling correctly on the drums - refuse acceptance if rope is piled-up towards one drum flange.
8. Check that the crane hook is fitted with safety latch.
9. Check for loose items such as bolts, washers, etc. in the driver's compartment - these items have often become wedged under brake pedals and prevented effective operation.

Although the list appears lengthy, it should only take a competent person about 15 minutes to complete.

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]

Source : ICHEME

Location : ,

Injured : 0 **Dead :** 1

Abstract

A 7 ton crane owned by the sub-contractor was travelling from a stores area towards the main gate roundabout down a hill. At a point two thirds of the way down the hill the crane gained speed.

It crossed on the wrong side of a roundabout, mounted the pavement and travelled over the steps and wall opposite the main gate building.

At this point the crane leaned to the left and the passenger fell from the cab. The crane continued over the grass lawn, back onto the road near the Medical centre and came to a stop.

Examination of the crane established that the brakes had failed because the main air feed pipe had fractured at the connection with the compressor. This meant that the air supply was depleted each time the brakes were applied resulting in a gradual loss of pressure.

A low pressure alarm should have been activated in the cab to warn the driver when the air pressure dropped below 80 psig.

[brakes faulty, alarm failure, fatality]

Lessons

Ensure brake systems fail safe.

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

A crane overturned whilst unloading scaffolding boards and tubes from an articulated lorry to a rigging compound. The crane was being operated by a Rigger/HED Improver. The outriggers were not extended at the time of the incident, and as a result the crane overturned when the load and radius exceeded the safe limits for "free duties". The incident was the result of driver error. Although the Rigger/HED Improver had completed a formal crane driving programme and had experience of driving the crane, officially he should have been supervised by an experienced Rigger/HED.

Lessons

The following recommendations were made:

All Rigger/HEDs should be reminded that they must not increase the radius of the load on a crane even by the smallest amount, once the warning bell has sounded to indicate an overload condition. The rules for training of Rigger/HED Improvers must be adhered to.

Source : ICHEME

Location : , UK

Injured : 1 Dead : 0

Abstract

Whilst manually emptying oxalic acid from a poly-ethylene lined, polypropylene woven sack into a batch reactor via the vessel manway/charge port, ignition occurred and a small fire erupted from the reactor. The operator received burns to his arms, chest and face.

Investigation into the incident revealed that most likely cause of ignition was the discharge of static electricity to the vessel. The charge being generated by the emptying of oxalic acid from the composite plastic sack. Vessel atmosphere at time of operation would have contained inflammable liquids above their flash point.

[reactors and reaction equipment, fire - consequence, charging reactor, lack of earthing, screw conveyor]

Lessons

1. A new charging system was installed by the company, in which oxalic acid was not charged directly into the reactor but instead was charged via an earthed screw conveyor.

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

Under high wind conditions a flare stack collapsed due to all guy ropes being severely corroded and those on the south side failing. The flare stack fell partly over a roadway. The relatively rapid corrosion, they had been in use for only ten years, was attributed to the use of ungalvanised wire rope in a corrosive environment. The flare stack was isolated at the time when the plant was decommissioned.

[strong winds, corrosion]

Lessons

The following recommendations were made:

1. Galvanised steel wire rope should be used for guying.
 2. Guy ropes should be greased to protect them from the environment.
 3. P.I.D and contract inspection and maintenance of guy ropes and associated equipment should be carried out at regular intervals. 4-5 years suggested. Initially, re-greasing should be carried out on a similar time scale, but varied in the light of experience.
 4. Guy ropes should be renewed when there is evidence that the galvanising is starting to deteriorate.
 5. Guy rope anchor points should be kept clear of pools of water and debris.
-

1561 19 January 1978

Source : THE TIMES, 1978, 21 JAN.

Location : Liberty; Missouri, USA

Injured : 6 Dead : 3

Abstract

Dust explosion in grain elevator. Fatality.

Lessons

[None Reported]

1521 27 December 1977

Source : FIRE JOURNAL, 1978 SEP.; LATHROP J.K, 54 KILLED IN TWO GRAIN ELEVATOR EXPLOSIONS, FIRE JOURNAL, SEPT, 29-35 & 55; THE TIMES, 1977, 29 DEC.; GUARDIAN, 1978, 3 JAN.; HOUSTON CHRONICLE, 1989, 24 OCT.

Location : Galveston; Texas, USA

Injured : 0 **Dead** : 18

Abstract

Rail transport. A dust explosion at grain elevator ignited by a spark caused a serious fire when offloading grain from rail cars. Wheat was being loaded onto a ship. There was no explosion venting on silo. Fatality.
[fire - consequence, loading, silo/hopper]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

Smoke was noticed coming from a pallet of containers which was shrink wrapped with polyethylene. The curved polyethylene focussed the sunray's onto the cardboard and the closed nature of the wrap resulted in the ignition of the cardboard separating a layer of containers. The pallet was stored in the open air.
[fire - consequence, shrink wrapper, sunlight, storage]

Lessons

[None Reported]

1451 25 August 1977

Source : LLOYDS LIST, 1977, 29 AUG.

Location : Cairo, EGYPT

Injured : 6 Dead : 14

Abstract

Explosion and fire in butane bottling plant. Fatality. (Full text)
[fire - consequence]

Lessons

[None Reported]

1402 21 June 1977

Source : RICHES P.A, AFTER PIPER ALPHA - THE INSURANCE ASPECTS, IN: OFFSHORE OPERATIONS POST PIPER ALPHA SYMPOSIUM, 6-8 FEBRUARY 1991, LONDON, INSTITUTE OF MARINE ENGINEERS, 1991, 2/1-2/9.

Location : Uk Sector; North Sea, NORTH SEA

Injured : 0 **Dead** : 1

Abstract

Pile section fell from crane of barge during jacket installation on an offshore platform. Fatality.

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 **Dead :** 0

Abstract

A crane was overturned while positioning a section of effluent pipe. The crane was operated by contractors without the outriggers in operation. It was being operated in an overload condition due to operator error.

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 33 Dead : 0

Abstract

Two kilograms of cyanuric fluoride had to be disposed of. A unknown part of the substance was carried away by the powerful "storm" ventilation of a special laboratory. Due to the peculiar, unfavourable direction of prevailing winds, the substance was sucked in by the fresh air fan of the building and blown into various rooms. Thirty three people were effected.

[laboratory work, strong winds, gas / vapour release, cyanuric fluoride, injury]

Lessons

[None Reported]

Source : ICHEME

Location : , FRANCE

Injured : 0 Dead : 0

Abstract

During the overhaul of a crude oil distillation unit, an air driven winch was being used to transport equipment to various levels of the 90 ft. high main distillation column. To assist the descent of the winch hook, a 56-lb static measuring weight was being used as ballast. This was attached to the winch by a 18 inch wire sling threaded through the 18 inch diameter handle of the static weight.

The incident occurred when the winch was being lowered, the handle of the static weight failed and the 56-lb weight fell to ground level. The weight landed within the roped off area of the winch drive and there was no injury to personnel.

On inspection it was found that the handle of the weight had been previously cracked through a section of approximately 80%.

[maintenance, winch, mechanical equipment failure, near miss]

Lessons

It has been recommended that in future bolted weights be used for this duty.

This incident also shows the degree of care needed, not only with the major components of any lifting equipment used but also with its associated equipment such as lifting eyes, hooks, shackles, etc. It also demonstrates the value of roping off areas beneath lifting operations.

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

An employee was going from ground floor to fifth floor in a freight elevator, when arriving at the fifth floor he could not open the door because the elevator had stopped 30 cm too low. He directed the elevator back to the first floor to inform supervision. During this he noticed a pungent smell of overheated rubber and pieces of smouldering rubber fell on the roof of the elevator cage. Investigation into the cause of the incident found that a fault in the elevator control equipment activated the brake before the motor creeping speed was switched off. Consequently, the motor had to work against the brake for some considerable time which caused it to overheat and finally to ignite the belts.

[instrumentation failure, overheating, fire - consequence]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A flexible hydraulic oil line inside the engine compartment of a crane burst. The air filter to the engine was missing and oil sprayed into the engine intake causing loss of control of the engine. Some oil also spilt onto the hot exhaust manifold causing a small fire which was quickly extinguished. The hose failure was due to it being incorrectly fitted.

[operation inadequate]

Lessons

[None Reported]

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

Lifting gear incident. A crane engine ran out of control when an incorrectly fitted hydraulic oil line burst and sprayed oil into the engine air intake. The air filter, had it been fitted, would have prevented this.

[loss of control]

Lessons

[None Reported]

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

Maintenance was being carried out on the drill stem on a rig used to drill coke out of the drums on a delayed coking unit. The operator started to move the stem to facilitate other work and put the maintenance men working on the drill stem in danger. Fortunately another worker noticed the error in time and stopped the drill stem.

[repair, shutdown, winch, pipe, near miss, operator error, safety procedures inadequate]

Lessons

From the work permit system the operator should have known that work was in progress on the drillstem. In addition he should have checked visually before moving the stem.

However, safety procedures should allow for an operator making an occasional mistake particularly during a busy shutdown. In this case that should have taken the form of locking out or tagging the switched which actuated the drill stem.

The same applies to all power actuated equipment.

Source : FIRE PREVENTION, NO. 119.

Location : , NORWAY

Injured : 0 Dead : 6

Abstract

A worker was filling 200 litre cans of 'shop primer' (Flashpoint 0 degrees C) when a leak occurred and some primer entered the man's eyes, preventing him from closing a valve from the supply tank which contained about 4,000 litres of the primer.

Supply from the tank was by gravity.

The fire appears to have been ignited by a nearby shrink wrapper or other (unprotected) electrical equipment. An explosion totally destroyed the building, damaged other buildings and started new fires. The fires spread to the paint factory, warehouse and laboratories and continued to be fed by flammable liquids from the high-level tanks. The narrow site made fire-fighting difficult, and the works water main was damaged by the explosion.

Six men were killed, and the fire was the largest to occur in Scandinavia in peacetime.

[solvent, material transfer, filling machine, fire - consequence, fatality, design or procedure error, loading]

Lessons

[None Reported]

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

A 30 ton mobile crane on a chemicals site ran into a stationary platform truck, which in turn ran into a stationary 100 ton crane. All 3 vehicles sustained some damage.

It was established that an untrained driver of the 30 ton crane had started the engine of the vehicle without setting the handbrake and selecting neutral gear. He then left the vehicle to get a pair of gloves. During this time, operation of the engine primed the hydraulic transmission of the crane and built up normal operating pressure in the air brake system, thus releasing the brakes. The crane moved forward without a driver.

The crane was found to be in good mechanical condition, but a small stone was found under the accelerator pedal, which would have increased the engine speed above the normal idling condition. Tests showed that under these conditions the crane would, in fact, move forward.

[maintenance, damage to equipment, driver error, competency lacking, training inadequate, design or procedure error]

Lessons

The following recommendations were made:

1. Enforcement of the training and certification of crane operators .
 2. Provision of clearer indication of the handbrake condition
 3. Improved operating procedures.
 4. Other changes to the crane controls.
-

Source : DUST EXPLOSIONS IN THE PROCESS INDUSTRIES. ECKHOFF

Location : Kambo, NORWAY

Injured : 0 **Dead :** 0

Abstract

A dust explosion from grain started in the bucket elevator and initiated by burning material from an overheated hammer mill. A secondary explosion occurred in the head house, which damaged most of the front wall. Two-bucket elevators were bulged out and the dust extraction system damaged which led to the secondary explosion.

[grain, processing, material transfer, conveying, solids handling, bucket elevator, solids processing, solids processing equipment]

Lessons

The floors were supported by a rigid framework and the light-weight wall elements could serve as vent covers.

1130 22 February 1976

Source : THE HOUSTON POST, 1989, 24 OCT.; HOUSTON CHRONICLE, 1989, 24 OCT.

Location : Houston Ship Channel; Texas, USA

Injured : 0 **Dead** : 9

Abstract

An explosion and fire occurred on a grain silo elevator.

[silo/hopper, fire - consequence, storage, fatality]

Lessons

[None Reported]

955 06 November 1974

Source : NORTHERN ECHO, 1974, 7 NOV.

Location : Consett; Co Durham, UK

Injured : 0 Dead : 0

Abstract

Fire believed to have started in fan system in textile factory.

[fire - consequence]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 2

Abstract

A serious accident which took the lives of two men occurred at an LPG bottling plant. Information received suggests that an inexperienced assistant and driver of a contractor's LPG bridger were transferring the vehicle's cargo into the storage bullet without supervision from the depot. They opened the filling line valve without properly connecting the loading hose, a massive release of gas occurred. The gas cloud enveloped the full bridger and ignition occurred almost immediately probably because the engine had been left running. Both men were badly burned and later died in hospital. Minutes after the initial outbreak the vehicle exploded, carrying the fire to nearby factories and warehouses. Water sprays on the storage bullet were actuated during the early stages of the incident, but failed after about 10 minutes due to an unknown cause.

Due to the presence of many gas bottles and other flammable materials at the site the fire brigade could do little more than contain the fire and allow it to burn out.

[material transfer, fire - consequence, burns, fatality, competency lacking]

Lessons

This incident clearly highlights the importance of establishing and maintaining disciplinary control at loading or off-loading gantries.

This is particularly important where contractors employees are concerned and it is strongly recommended that an assurance of competence is obtained following completion of an approved training course, either run by the company or the contractor. The incident also emphasises the importance of automatic valves and fixed water sprays at LPG loading/discharging gantries.

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

A 30 tonne hired crane overturned resulting in the fracture of a process line and a steam line. The crane had lifted a unit out of a plant. Having done this the crane was moved to allow other traffic to pass and returned to re-stack the unit previously moved. The crane driver commenced slewing operations without the crane outriggers being extended, subsequently the crane overturned.

This type of crane has "No free duties" and is inherently unstable when slewing without the outriggers in position. The crane driver was trained and had 15 years experience.

[maintenance, crane, damage to equipment, operation inadequate, design or procedure error]

Lessons

The following recommendations were made:

1. Crane drivers must be experienced and not distracted in their work.
 2. Consideration should be given to the fitting of appropriate alarms if the outriggers are not in position.
-

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

The hoist wire of the jetty crane came off the drum, lodged between the drum end and drum shaft bearing housing and was sheared. There were no injuries to personnel.

Whilst lowering the block for hooking onto a jetty oil hose, the crane wire became sufficiently slack to enable it to come off the drum. The slackening of the wire probably occurred as a result of the hoist control not being fully in the neutral position during hooking on; these controls need careful centering the weight of the hose string sheared the wire on the back outside edge of the bearing pedestal. Fortunately the hose string had not been lifted from its permanent support so there was no possibility of the load, or any part of it, falling.

[drums]

Lessons

1. Renew hoist wire.
 2. Fabrication and fitting of extension pieces to drum flanges (of the involved crane and the other jetty crane) allowing a clearance of 1/2" from the nearest obstruction during drum rotation.
 3. Operators are instructed to make a visual check of the hoist drum prior to lifting after lowering and hooking onto a load.
-

Source : ICHEME

Location : , FRANCE

Injured : 0 Dead : 1

Abstract

A contractor's employee was killed as the result of a fire at a depot. It occurred when an outside maintenance firm was fitting a valve to a line supplying product to the gantry.

They were using a diesel engined winch in the pumping area to facilitate the "springing" of the flanges. This was unsuccessful, however, and instead the flanges of two adjacent valves were parted resulting in a leak of product. Vapour was sucked into the diesel engine causing it to over-speed. A serious fire broke out almost immediately. Ignition was most certainly due to the over-speeding engine. The fire was extinguished in some thirty minutes by foam. A pump motor was burnt out and the winch vehicle damaged beyond repair. Unfortunately, one of the contractors men was so severely injured that he died later.

It was later established that no work permit had been issued for the job.

The incident illustrates the problems that may be encountered when contractors are employed. Contractors are not always aware of the hazards that exist in the Oil Industry. It is therefore imperative that they are made aware of the safe working standards required and are adequately supervised to ensure that these standards are adhered to.

[maintenance, valve, winch, leak, contractor error, permit to work system inadequate, fatality, fire - consequence]

Lessons

In this incident, failure to issue a work permit and enforce its conditions must be regarded as the fundamental cause of the accident. The practice of using a winch for this purpose is not recommended and the use of a diesel engine in these circumstances should not have been sanctioned.

112231973

Source : ICHEME

Location : , GREECE

Injured : 0 Dead : 0

Abstract

A small fire broke out at the road tanker off-loading point at the this bottling plant. It was quickly extinguished by plant personnel using portable dry powder fire extinguishers. The only casualty was the road tanker driver who was slightly burnt on the right hand and face.

However, the electric cables and some of the upholstery in the vehicle were damaged.

The semi-trailer road tanker, carrying a full load of approximately 15 tonnes of LPG, arrived at the bottling plant. The driver bolted the discharge hose flange to the pump inlet while the co-driver connected the other end of the hose to the installation manifold. The co-driver completed his task and without waiting to see if the other end of the hose was secured, opened the valve. A quantity of LPG escaped form the loose flanges, and ignited almost simultaneously. Depot staff extinguished the fire in some two and a half minutes minutes.

[material transfer, bottling plant, road tanker, operator error, fire - consequence]

Lessons

The incident illustrates the obvious importance of checking all connections prior to opening valves and pressurising lines.

Source : ICHEME

Location : , Gulf Of Asia

Injured : 0 Dead : 0

Abstract

An incident occurred at approximately 08.40 hours on 18th September, 1972, when two cranes were engaged in raising and turning a damaged LPG storage sphere. The jib of one crane collapsed sideways and extensive damage was caused to the centre section of the jib and the drum brake mechanism. There were no injuries to personnel on this occasion.

The two cranes had satisfactorily lifted the sphere on the previous day and prior to commencing lifting operations each crane had been inspected and had satisfactorily lifted a test load of 40 tonnes.

[storage tanks, damage to equipment]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

At 18.30 hours on 27th June, 1972, whilst a section of a stack of a furnace on a crude distillation unit was being dismantled, the boom of a crane (belonging to a contractor in charge of dismantling operations) collapsed and most of the stack fell 30 metres, causing serious damage to pipes and installations. No personnel were injured.

The boom of the lifting crane was additionally supported by a link-belt from a second crane, and it was the breaking of this link-belt which resulted in the boom collapsing. The incident was attributed to miscalculations by the specialist contractor in underestimating the weight of the stack being handled. However, the utilisation of a second crane in this manner to aid the lifting crane should not be used in any lifting operation.

[contractor error]

Lessons

Further involvement of the company beyond the hiring of specialist contractors is called for since there may be dangers to surrounding plant and personnel as well as a possible risk to the contractors' employees if some emergency arises. The company has a responsibility in both circumstances.

Companies should consider the liaison (and if necessary supervision) required to ensure that any demolition work being undertaken is carried out as safely as possible in relation to other operations.

9344 13 May 1972

Source : ICHEME

Location : , UK

Injured : 0 Dead : 0

Abstract

A crane lurched whilst attempting to lift a channel cover from heat exchanger. Warning lights failed to operate on 50% overload.
[maintenance]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 3

Abstract

Two company engineers and one contractor's foreman were killed whilst inspecting the interior of a 150 m (490 ft.) high chimney stack, when the platform they were using fell 130m (426 ft.).

The platform was suspended by a steel rope over the lip of the chimney and connected to a winch.

The winch, manually operated by contractor's personnel, was equipped with two gear speeds, a ratchet locking device (unlocked with a descending load) and two braking systems, one a main brake and the other an auxiliary brake on the winch drum. Communication between the personnel on the winch and the men on the platform was by radio.

The platform and men had been raised to the top of the stack and shortly afterwards the contractor's foreman requested the winch team to lower them slowly.

After the platform had descended 15 - 20m (50 - 65 ft.) the contractor's foreman requested the winch team to increase descent speed. To enable this to be done the ratchet should have been engaged. Some difficulties arose whilst changing gear and apparently the ratchet device was lifted, there was a jolt and the platform started falling. Attempts to arrest the fall by using the brakes failed and the platform fell approximately 130m (426) ft. killing the occupants. Fatality.

[inspection]

Lessons

[None Reported]

Source : LOSS PREVENTION BULLETIN, 030, 160.

Location : ,

Injured : 0 Dead : 0

Abstract

The dyestuff was dried at 100 degrees C to 150 degrees C in a circulating air drier. The air fan and the steam were shut off at 16.00 hours. The dyestuff remained in the drier overnight. The temperature chart showed a temperature rise starting at 20.00 hours. The decomposition of the dyestuff was first discovered on the following morning when the oven was opened.

Fortunately no-one was injured. However, the cause of the incident is unknown. According to tests made, the dyestuff belongs to hazardous class Tr O, maximum allowable wall temperature 140 degrees C.

[high temperature, dyestuffs]

Lessons

[None Reported]

Source : FIRES AND EXPLOSIONS, ICHEME, TRAINING PACKAGE, 003, 5-6.

Location : ,

Injured : 0 Dead : 0

Abstract

A 1000 m³ storage tank containing a hydrocarbon, flash point 35 degrees C, was contaminated with a small amount of acetone which lowered the flash point to below the ambient temperature.

The source of ignition was not identified with certainty. Although the tank was being splash-filled, the conductivity of the liquid was too high for a charge of static electricity to accumulate on it. The source of ignition may have been sparks caused by mechanical vibration. A swing arm was stuck in the upright position and was vibrating, causing a wire rope attached to the end of it to rub against a pulley.

[mechanical spark, fire - consequence,]

Lessons

The following recommendations were made:

1. Air and fuel, mixed in the right proportions, are liable to go 'bang' even though we do what we can to eliminate known sources of ignition.
 2. Air and fuel must not, therefore, be allowed to mix in flammable proportions unless the risk of explosion can be accepted.
 3. Storage tanks containing hydrocarbons above their flash points should be blanketed with inert gas.
 4. The tanks must be checked regularly and the atmosphere inside analysed for oxygen to make sure that the blanketing is in operation.
 5. Tanks should never be splash-filled.
-

Source : DUST EXPLOSION HAZARDS, ICHEME, TRAINING PACKAGES, 022, 4.17.

Location : ,

Injured : 0 Dead : 0

Abstract

A large sanding machine in a plant manufacturing wood based boards, was draughted by a fan with two dust collectors attached. The dust collected by these filters fell under gravity into screw conveyors, through a rotary valve and was then blown to a cyclone. Clean air from the cyclone was recycled and the fines were discharged via a rotary valve to a silo.

During routine operation, an explosion occurred damaging duct work, both filters and the cyclone. The filter units were fitted with relief but the casing was found to be distorted after the event. The cyclone was also fitted with an explosion vent but this was either poorly designed or assembled and failed to open. The rotary valve below the filters was fitted with plastic edges to the blades and it appeared that the blades had allowed the explosion to propagate to the cyclone.

It was very fortunate that unburnt dust emitted from the ducting (during the explosion) did not ignite.

The following conclusions were made:

It seemed clear that the ignition source had arisen at the sander unit. However, it was questionable whether there was sufficient dust generated during the conveying operation to form a flammable atmosphere in the ducting. However, even if there was no flammable atmosphere present in the ducting, a smouldering particle could pass through igniting dust clouds in downstream units.

The damage to the ducting could have arisen from pressure developed from the flammable mixture within or blow-back from the filter units. The rotary valve did not provide effective explosion isolation. This may have been due to the plastic edged blades or the fact that the rotary valve was not stopped. Interlocking devices such as this, which prevent the transfer of burning material in the event of ignition, are an essential part of the protection system.

[design inadequate, solids processing, explosion suppression]

Lessons

The following recommendations were made:

1. On rebuilding the plant, additional features included explosion relief on the ductwork.
 2. Explosion relief is essential if the concentration of fines within the ducting lies within the flammable range during normal operation. Explosion relief must vent outside the building.
 3. Temperature monitoring of the sander bearings was recommended although this was for warning purposes only. However, temperature monitoring could not prevent an explosion occurring due to immediate bearing failure. The design of the relief systems for both filters and cyclone was also improved, together with the rotary valves.
 4. Additional features that were considered included interlocks to the screw feeders and rotary valves which stopped when the explosion vents opened. Strengthening of the conveying pipework and fan casing from the filters to the silo to withstand the possible explosion pressure and a rapid action valve on the clean air outlet from the cyclone were also required.
-

2963 Date Unknown

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A mobile crane was lifting a reciprocating pump when the load fell approximately 20 ft to the ground. An examination showed that the failure occurred in the reduction gear driving the hoist drum. The gear wheel was made of a cast iron hub with an outer section of bronze, which had broken away from the hub and was found in three pieces. The keyway on the end of the drive shaft was also found to be distorted. Indications are that, at a previous occasion, the crane had been subjected to some form of overloading.

An inspection of a similar crane showed no defects.

[operational activities]

Lessons

[None Reported]

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A contractor's crawler crane was supporting a 13.5 tonne jetty loading arm when the hoist rope of the crane snapped without warning.

Two of the contractor's employees jumped over the jetty guard rail into the water to avoid being struck by the loading arm. Both men were rescued by the safety boat.

The test certificates for the crane were in order and the condition of the crane and the manner in which it was being used conformed with statutory requirements and good practice.

Investigations have not revealed the precise cause of the failure and it appears that the rope may have been inadvertently damaged at an earlier date.

[mechanical equipment failure, maintenance, near miss]

Lessons

Attention should be drawn to the following points which should be checked before lifting plant is permitted:

1. Check that valid crane test and insurance inspection certificates are available for the configuration of the crane specified for the job.
 2. Check that test and inspection certificates are available for all "loose" items, including hook blocks, ropes, slings, shackles, etc.
 3. Check that the supplier of the crane has a `safe system of work which should cover the following additional points before the crane is permitted on site.
 4. Competence of driver to operate the specified equipment supported by documentation;
 5. Examination of `loose' items at site and check that rope terminations are in accordance with good practice
 6. Check of safety load indicator and all other safety devices to ensure that they are functioning properly.
 7. Check of condition of tyres if wheel mounted
 8. Check of ropes to ensure they are spooling correctly on the drum
 9. Check of crane hook to ensure that it is equipped with a safety latch
 10. Check of general housekeeping, e.g. driver's compartment free of loose items such as bolts, washers etc.
-

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

An incident occurred during the overhaul of a unit. A 15 tonne diesel hydraulic mobile jib crane was lifting a valve down from a vessel when the rope broke. The valve weighed approximately 100 kg and the jib was being retracted at the time of the incident. The investigation was carried out by an independent insurance surveyor, and from the information available it was concluded that the rope broke when either slack rope between the compensating pulleys, or a kink in the rope, jammed between the lower compensating pulley flange and guard. The load did not fall because the end of the broken rope was trapped in the guard bracket at the pulley.

[maintenance, mechanical equipment failure, near miss]

Lessons

Attention should be drawn to the following points which should be checked before lifting plant is permitted:

1. Check that valid crane test and insurance inspection certificates are available for the configuration of the crane specified for the job.
 2. Check that test and inspection certificates are available for all "loose" items, including hook blocks, ropes, slings, shackles, etc.
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 4. Competence of driver to operate the specified equipment supported by documentation;
 5. Examination of `loose' items at site and check that rope terminations are in accordance with good practice
 6. Check of safety load indicator and all other safety devices to ensure that they are functioning properly.
 7. Check of condition of tyres if wheel mounted
 8. Check of ropes to ensure they are spooling correctly on the drum
 9. Check of crane hook to ensure that it is equipped with a safety latch
 10. Check of general housekeeping, e.g. driver's compartment free of loose items such as bolts, washers etc.
-

6827 Date Unknown

Source : LOSS PREVENTION BULLETIN, 003, 12.

Location : ,

Injured : 1 Dead : 0

Abstract

A man knelt down near an open manhole to recover a rope which was half inside and was caught on something inside. The vessel contained nitrogen and he was overcome.

[asphyxiation]

Lessons

[None Reported]

7238 Date Unknown

Source : LOSS PREVENTION BULLETIN, 063, 15-16.; QUARTERLY SAFETY SUMMARY, 1971, VOL. 42, NO. 165.

Location : ,

Injured : 1 **Dead :** 0

Abstract

A member of a cleaning squad decided to recover a rope which was half inside a vessel and was caught up on something inside. While kneeling down, trying to disentangle the rope, he was overcome by nitrogen. Afterwards he admitted that if necessary he would have entered the vessel.

[asphyxiation]

Lessons

[None Reported]

Source : LOSS PREVENTION BULLETIN, 051, 17.

Location : ,

Injured : 0 Dead : 0

Abstract

When an employee was going from the ground floor to the fifth floor in a freight elevator he could not open the door because the elevator stopped 0.3 m too low. He directed the elevator back to the first floor to inform the supervisor. During this trip he noticed a pungent smell of overheated rubber and pieces of smouldering rubber fell on the roof of the elevator cage.

The cause of the incident was a fault in the elevator control equipment which activated the brake before the motor. This gave a creeping speed before the motor was switched off. Consequently, the motor had to work against the brake for some considerable time which caused it to overheat and finally to ignite the belts.

[fire - consequence, overheating]

Lessons

[None Reported]

Source : LOSS PREVENTION BULLETIN, 047, 26-27.

Location : ,

Injured : 0 Dead : 0

Abstract

For environment reasons, all the vents on a chemical plant were collected in a vent main and passed to a furnace. To balance the vent flow and furnace requirement, the vents passed into the furnace fan and constituted about 30% of the furnace air flow requirement.

The vent main normally ran at 1% to 4% of lower explosive limit.

Following a power cut all the electric motors were tripped. One distillation unit in the chemical plant recovering solvent ran at atmospheric pressure. The condenser cooling water circulation was tripped with the power cut but the steam supply went down slowly.

The result was a heavy build up of un-condensed flammable solvent vapours in the vent manifold (by calculation, above the higher explosive level).

Soon after the furnace was returned on line, the ducting between the fan and the furnace exploded, blowing the ducting apart causing no damage.

It is believed that the explosion was caused by vapour from the vent to the furnace inlet ducting lowering the vapours to within the explosive range, which ignited from the furnace.

[power supply failure]

Lessons

[None Reported]

Source : LOSS PREVENTION BULLETIN, 033, 27.

Location : ,

Injured : 0 Dead : 0

Abstract

This incident shows how irritation of the face of an assembly worker was caused by the inappropriate positioning of a fan. When any work area tends to become hot and stuffy the usual and simplest practice is to install a fan. In this case a stream of air was wafted over towards the assembly worker and directed naturally into her face. The fan had been placed on top of the equipment with the epoxy resin and hardener system being used between the fan and the operator. Epoxy hardeners are in general irritant to the skin and significantly volatile.

This emphasises the genuine lack of awareness that operators, supervisors and managers may have of the potential effects of irritant chemicals on the skin. Removal of the fan controlled this problem.

[people]

Lessons

Ideally this type of work is often best done under exhaust extraction.

Source : CONTROLLING ELECTROSTATIC HAZARDS, ICHEME, SAFETY TRAINING PACKAGE, 016, 4.25.**Location :****Injured :** 0 **Dead :** 0**Abstract**

A fluid bed drier was being used to dry powder, damp with propyl alcohol. The drying process was two stage. As the drier was being started up to initiate the second stage, a violent explosion occurred within the drier. Explosion relief vents limited the extent of the damage but not enough to prevent considerable damage.

The source of ignition was thought to be a static spark occurring between the filter frame, a metal assembly in the form of a round web and the wire rope supporting the frame. The rope terminated in a boss which was clamped into the centre of the support frame. However, it was found that there was a degree of play between the boss and the frame. When the air supply fan was switched on, the filters ballooned and the suggested hypothesis was that this was now separated from the support rope, earthed continuity was lost and the frame became charged by contact by close proximity to the highly charged filter fabric.

[lack of earthing, damage to equipment, heating]

Lessons

[None Reported]

Source : LOSS PREVENTION BULLETIN, 015, 15-16.

Location : ,

Injured : 2 Dead : 0

Abstract

An explosion occurred in a mess-room and blew down a partition wall. Two men in the room suffered shock.

A drainage gully ran alongside the outside wall of the mess-room. When the pressurising fans were shut down for a few days for planned maintenance, vapour from the gully entered the mess-room through a 1 inch diameter hole in the wall. The vapour may have been sucked in by a chimney effect caused by the flow of warm air up the ventilation inlet pipe. At one time a drain pipe had gone through the hole but when the drain pipe was removed the hole was not blocked up. Vapour accumulated in a cupboard under a sink.

While the pressurising fans were shut down, smoking was stopped in the mess-room and the electric equipment was not used. The explosion occurred 7 hours after the pressure was restored and was ignited by a hotplate. The cupboard had not been opened and the vapour had not dispersed.

Air normally flowed outward through the 1 inch hole because the mess-room was pressurised. When the pressurising was shutdown, air and vapour flowed into the mess-room.

Lessons

1. All pressurised buildings in an area where flammable materials are handled should be examined carefully to make sure there are no openings which have been overlooked and through which vapour can enter. This examination should be repeated at 12 monthly intervals.
 2. If the pressuring fan has been shutdown, the nooks and crannies in the building should be checked with a gas detector before it is started up again and before smoking is permitted
 3. On new plants obvious sources of vapour such as gullies should be located away from buildings.
-

Source : LOSS PREVENTION BULLETIN, 014, 5-6.**Location :** ,**Injured :** 0 **Dead :** 0

Abstract

Maintenance requested process for a clearance certificate for a job which in the event took well over a month. Work continued uneventfully until finally a vent line had to be removed. This ran from the general area of maintenance work, through a curtain wall and finished outside in an area with other vent pipes. They obtained a mobile crane and were busy working on the vent line when they were stopped.

Because of the danger from 'live' vents, work on the wall is not allowed, unless either the equipment is shut down or the vents isolated. In this incident no such precautions were taken, and it must be classed as a 'near miss'. Had a live vent occurred whilst work was in progress, the men could have been scalded by the vapours ejected or suffered toxic effects. There is also the possibility of ignition of the vapour by the maintenance equipment. The works operates a daily endorsement procedure, which applies to both 'outside' contractors, as well as their own in works maintenance teams. The endorsement is intended to assist process in locating personnel in an emergency and to ensure that should plant conditions change, and so invalidate some or all of the provisions of the clearance certificate, then maintenance are prevented from resuming work.

On the day of the incident the clearance was not endorsed but it is doubtful whether an endorsement would have prevented the incident, the removal of the vent pipe could have taken place at any time during the previous four weeks.

As a result of this incident, the works has stressed the need for both process and maintenance to know the relevant works instruction governing work on the curtain wall.

Lessons

This incident raises the issue of including on one clearance certificate a job that can be split in two, each with different hazards and appropriate precaution, particularly if a long time interval between the two parts is likely and/or the second is only a small part of the overall job. Secondly, the incident illustrates the need for process to check all maintenance operations thoroughly, particularly when the approach for permission to do work originates with the maintenance group. Indeed, if process find it difficult to foresee all the hazards in a long complicated job, then they should not issue a certificate for the whole job but only for those parts that can be fully appraised.

6919 Date Unknown

Source : LOSS PREVENTION BULLETIN, 010, 4.

Location : ,

Injured : 0 **Dead :** 0

Abstract

A radio controlled overhead crane in a workshop suddenly started to move without any signal from the driver.

A transistor in the crane's receiver had failed and as a result the receiver responded to the radiation from a high frequency argon arc welding unit.

According to the manufacturer of the radio control system, no similar failure has occurred before, although 2,000 control systems have been in use for an average of five years. Nevertheless, they have designed and installed a duplicate circuit. Failure of both will be needed before a similar event can happen again.

[electrical equipment failure]

Lessons

[None Reported]

Source : LOSS PREVENTION BULLETIN, 008, 16-17.**Location :** ,**Injured :** 2 **Dead :** 0

Abstract

In a sugar refinery, the product was conveyed the full height of the 13 storey building by two bucket elevators. Two minutes after one of the elevators had been switched on, following a nine-day shutdown, an explosion occurred. It appeared that the sugar had accumulated in the elevator boot from another part of the plant. This put abnormal strain on the elevator which had to dredge through this accumulation, causing a maladjusted tensioning device to fail. The elevator ran severely out of alignment and rubbed hard against the bucket guides and was struck heavily by the sprocket wheels. The heat generated by friction between the various metal surfaces was sufficient to ignite a cloud of sugar dust. The elevator duct and parts of the associated ventilation and sieving plant were severely damaged in the dust explosion. Some window frames and many of the windows were blown out and internal partitions were damaged by the blast. Two employees were severely burnt.

[friction heat, fire - consequence, damage to equipment, processing, burns, sucrose]

Lessons

If not properly adjusted and maintained, bucket elevators can generate friction and impact, and as there is often a cloud of dust in suspension in the casing, the conditions for dust explosion are readily obtained.

Source : LOSS PREVENTION BULLETIN, 115, 9-11.

Location : ,

Injured : 0 Dead : 0

Abstract

A coal grinding plant, which was attached to a cement factory, was in need of adjustments. The instrumentation associated with the unit and the grinder itself were shutdown for ten minutes. The extraction fan was located downstream of the bag filter units with dampers in the ductwork on either side of the bag filters.

On restarting the fan, before the mill was restarted, an explosion occurred at the moment when the second damper was opened up.

The cause of the explosion is as follows:

When the extraction fan was restarted, it drew up into suspension all of the powdered coal that had collapsed in the ductwork during the involuntary shutdown of the plant by the computer. It also drew into suspension, burning particles of coal from the hot spot. These ignited the coal dust cloud that had been formed in the ductwork and caused the violent explosion. The resulting pressure wave permeated both upstream and downstream of the roller crusher mill and was relieved by the explosion relief panels incorporated in the plant.

Lessons

The following recommendations were made:

Precautions recommended are to extend a no go area around the vent outlets and resuming the practise of adding powdered limestone to the system at the start-up, inerting the initial dust cloud.

It is also good practice to run the fan for several minutes after the mill is stopped to prevent dust deposition in the ducting.

Source : LOSS PREVENTION BULLETIN, 004, 11-12.

Location : ,

Injured : 0 Dead : 0

Abstract

A 25 tonne telescopic jib crane overturned onto a plant. A relief valve weighing 258 lb was being removed from the plant when the incident occurred. The crane fell on to some process pipework and, to recover the machine, the plant was de-pressured, thus interfering with production. The crane was working with a jib length of 124 feet and the maximum safe radius for this jib length is 80 feet. The driver omitted to observe this, and, in fact, went out to 102 feet radius. The crane was fitted with a safe load indicator of the type that weighs the load through the pulley on the hoist rope, it does not take into account the weight of the job, because of this, the driver got no warning of an unsafe condition and, as he lifted the valve, the crane was overturned. Although the driver had been driving telescopic jib cranes for several years, he did not seem to appreciate the need not to exceed the maximum jib radius. [training inadequate]

Lessons

An investigation highlighted a number of needs, the most important of which are:

1. The need for effective training of crane drivers.
 2. The need for an audible warning when the crane approaches unsafe conditions, such as a radius greater than that for which the machine has been designed.
 3. The need for all those concerned with lifting operations to be kept up-to-date with developments in the type of crane available.
-

Source : CONTROLLING ELECTROSTATIC HAZARDS, ICHEME, SAFETY TRAINING PACKAGE, 016, 4.35.

Location : ,

Injured : 2 Dead : 0

Abstract

A polymer powder was separated from its solvent, butane, by a flash tank. On the day of the incident, the flash tank had become plugged with powder and various attempts were made to clear it. The system was inerted with nitrogen and the manhole on the sixth floor was opened. Two operators started taking the powder out onto the floor and shovelling it down the chute, which ran down the side of the building.

Gas detectors started registering low level alarms, but after an initial withdrawal of personnel, the work resumed. As the powder was being shovelled down the chute the fire started. Flames rose up the chute and out onto the floor. One of the operators received second degree burns and both were treated for smoke inhalation.

The fire burnt for about one hour. It was supported by two sources of fuel, butane evaporating from the powder in the tank cone and from the gas reaching the tank by back flow through a safety valve. The valve had been tied open during the nitrogen flushing of the tank.

[fire - consequence, separation]

Lessons

The following conclusions were made:

The fire was caused by the electrostatic ignition of the powder as it fell down the chute to ground level. The charge was probably generated by friction with the sides of the metal chute. The insulating rubber sleeve did not result in charge building up on the chute.

Source : LOSS PREVENTION BULLETIN, 133, 17-18.

Location : ,

Injured : 0 Dead : 0

Abstract

An incident involved a crane performing a task on an ethylene unit when a flexible hydraulic line inside the engine compartment ruptured.

As the air filter was missing, some of this oil entered the open air inlet causing loss of normal control over the engine. The latter could not be stopped until all the oil had been lost, meanwhile some of the oil came into contact with the hot exhaust manifold and ignited. The resulting fire was quickly extinguished, the whole incident lasting approximately 5 minutes.

After investigation it was decided that the probable cause of the hose failure was one or both of the following:

1. The hose was incorrectly fitted to the vehicle.
2. The process of 'swaging' the coupling onto the hose could, if overdone, have weakened it.

The following points support either of the above possibilities:

1. The hose was not hanging vertically, but was bent towards the front of the vehicle, which suggests there was very little slack.
2. When the fractured hose had been removed, it was noticed that the rubber sheathing had been damaged about 60 cm from the actual point of failure, and was caused by wearing against the casing of the torque converter.
3. When it was suggested that the new hose be fitted taking a slightly different route, not only did it hang free of the torque converter, but there was also more slack in it, such that it did hang vertically from the coupling.
4. This particular hose had failed previously and had been replaced, with the precise nature of the initial failure had not be established.
5. The process of swaging the coupling onto the hose i.e., squeezing the cylindrical portion of the coupling, so that its reducing diameter enables it to grip the hose, can, if overdone introduce internal stresses into the hose which could have either caused or contributed to the failure.

[fire - consequence]

Lessons

The following recommendations were made:

1. More care should be taken over the fitting of hoses to hydraulic equipment. If necessary an appropriate fitting course should be attended when new equipment is purchased.
 2. Equipment items regarded as important but not essential to the operation of the machine, should be attached in such a way as to make their removal difficult. In this case the air filter could be attached by bolting to a flange.
 3. All vehicles entering areas controlled by a permit to work should be checked visually by their drivers to ensure as far as is practicable the presence and correct fitting of equipment.
-

Source : LOSS PREVENTION BULLETIN, 091, 19-21.

Location : ,

Injured : 0 Dead : 1

Abstract

Two workers in a construction company were going to continue repairing the roof of a compressor hall. A refinery employee showed in the two workers, gave them the works labour pass and moved the bridge crane into the correct position for the work to be carried out. The oxygen and nitrogen compressors had already been shut down two days previously. One of the workers from the outside company climbed up onto the crane. Later the man working on the floor of the hall saw that his colleague had collapsed and was hanging motionless with his hands on the handrail of the travelling platform of the crane. He called to alert the works fire brigade who arrived at the place of the accident four minutes later. High levels of carbon monoxide were found close to.

An investigation was carried out to try and identify the cause of this accident.

As there were no process gas pipes (synthesis gas containing CO) in the compressor hall, the first question was how could the carbon monoxide have entered the compressor hall? Opposite the compressor hall are several plant units in which synthesis gas containing 28% CO and 70% H₂ is produced by oil vaporisation. On the day of the accident, all plants were shut down with the exception of the adjacent unit.

The only pipe connection to the adjacent synthesis gas plant was via the two-sided cooling water outlet. The connections ended in a DN 300 pipe.

It was likely that the synthesis gas from the outlet valve of a standing cylindrical condensate separator entered the funnel-shaped outlet lying beneath it. The synthesis gas therefore penetrated the cooling water pipe system with injector action as a gas-air mixture and was able to leave from the funnel-shaped outlets in the compressor hall because no cooling water was flowing against it and because it had natural lift from the high hydrogen content.

The company separated the cooling water systems of the plants to prevent outbreaks of gas from the adjacent plant.

When the plant was being built a roof ventilator was provided to ventilate the compressor hall. However, it only stretched across the middle section of the hall.

The air vents were covered with a layer of insulation, which allowed the air through, to dampen the noise and prevent it from extending over the works boundaries. The rows of windows provided for ventilation were bricked up some years previously for reasons of noise protection. Fatality.

[repair, carbon monoxide]

Lessons

[None Reported]

12815Date Unknown

Source : QUARTERLY SAFETY SUMMARY, 1970, VOL.41, NO. 161.

Location : ,

Injured : 0 Dead : 0

Abstract

An explosion occurred during routine start-up of a nylon intermediates plant when an accidental release of hot cyclohexane occurred, which formed a vapour cloud and ignited.

It is believed that the source of ignition was due to a diesel engine platform lift truck and mobile crane that was in the area at the time of the incident. When the vapour cloud reached the two vehicles, the engines began to race. The drivers were unable to stop them by shutting off the diesel fuel and the engines were racing too violently to allow a gear to be engaged to stall them. The engines were running on cyclohexane sucked in through the air inlet over which there was no control.

The drivers immediately abandoned their vehicles and within a minute a flash back occurred in the engine of the platform truck and ignited the vapour cloud.

An examination of the engines found that the air filter on the platform truck was found to show signs of internal heating and pressure.

[gas / vapour release, leak, hot surface]

Lessons

A combustible gas detector must be in continuous use on the vehicle and the vehicle must not be left unattended with the engine running.

If gas is detected the engine must be stopped immediately.

Diesel vehicles must be avoided wherever possible in these areas.

9779 Date Unknown

Source : LOSS PREVENTION, VOL. 3.

Location : ,

Injured : 0 Dead : 0

Abstract

A malfunction of the control equipment allowed raw gas to accumulate in a direct fired textile fibre dryer. The dryer exploded when circulating fans were turned on.

[mechanical equipment failure, explosion]

Lessons

[None Reported]

13001Date Unknown

Source : LOSS PREVENTION BULLETIN, 148, 9.; CHEMICAL SUMMARY, 1978, 49 (193).

Location : ,

Injured : 1 Dead : 0

Abstract

The driver of a crane punctured a drum with the crane wheel as he passed through a production area.

He failed to report the incident and some eight hours later, a night shift operator moved the drum and in doing so received a splash of thiophene in his mouth.

[drums, driver error, design or procedure error, injury]

Lessons

The following lessons were learnt:

Personnel must always be present to direct a vehicle to manoeuvre safely.

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A lifting rope supporting a butane loading hose from a fixed crane at a river jetty failed without warning, allowing the hose and attachments to fall about 20 feet onto the jetty head, narrowly missing an operator.

The rope was used to raise and lower the hose on a single masted two jibbed fixed crane located at the jetty head specifically for handling hoses. A ship tied up at the jetty had just finished loading another hydrocarbon product (using another hose/crane combination) and the jetty operator was disconnecting the water supply hose which was suspended from the other jib of the single mast crane. The two crane jibs and hoses are totally independent of each other and there was no connection between the hoses.

Initial inspection of the rope revealed that extensive corrosion had occurred in the area of the failure which was at the block sheave. Approximately 60% of the 95 individual wires making up the rope had corroded through and the remaining wires had failed in tension. It was concluded that the corrosion resulted from a general lack of lubrication on the section of rope between the winding drum and the attachment to the hose fitting under the jib.

The section of rope within the winding drum was, however, well lubricated. The failure point was found to be in the region where, in the normal at rest position, the rope would have been around the trolley or block sheave. When a wire rope is left around a sheave the strands tend to open out allowing ingress of moisture. In the marine environment of the jetty, and with the lack of lubrication, corrosion rapidly occurred.

[near miss]

Lessons

The enquiry into this incident recommended that the entire rope be lubricated on a routine basis, the periods between thorough crane and rope inspections, currently 12 months, be reviewed and that full scaffolded access to the crane jib be provided at every thorough inspection. A review of material and construction of the ropes was also recommended to identify the availability of more corrosion resistant ropes for this particular duty.

11288Date Unknown

Source : INSTITUTE OF GAS ENGINEERS, COMMUNICATION 451, UNUSUAL INCIDENTS AT GAS WORKS AND THEIR LESSONS, PART 2, 28/9/1954.

Location : ,

Injured : 1 Dead : 0

Abstract

During a coal offloading operation from rail wagons and operator was injured by a crane grab. The man was standing on the wagon guiding the grab into collect the coal. The coal had been unloaded from one end and the grab was being relocated. As the grab was lowered the coal slid moved from the full to the empty end of the wagon. The grab pinned the operator the wall of the wagon.

[unloading, rail transport, people, operation inadequate, injury]

Lessons

This incident illustrates the risks of an operator working in a confined space with a large piece of machinery.

10541Date Unknown

Source : FIRE PREVENTION 214, NOV 1988.

Location : Illinois, USA

Injured : 3 **Dead** : 2

Abstract

Two explosions occurred at a riverside grain elevator complex, killing at least two people and injuring three.

It is believed that grain dust may have caused the explosion, which ruptured a natural gas main and touched off a second blast moments later.

The explosions levelled the complex's six foot tall concrete silos, which held a total of 100,000 bushel(s) (a dry measure of eight gallons).

[fatality, injury]

Lessons

[None Reported]

Source : LOSS PREVENTION BULLETIN, 088, 23.

Location : ,

Injured : 0 Dead : 0

Abstract

A product was recrystallised out of a mixture of cyclohexane and methylene chloride, filtered and then fed to a drier. During the latter process the solvent vapours ignited. It is probable that high electrostatic charging occurred on a polyethylene bag which was used as a coupling piece for charging the solvent-wet filter cake into the drier.

The fire was quickly extinguished.

[charging reactor, fire - consequence, plastic bags, lack of earthing, screw conveyor]

Lessons

The following should be considered:

Avoid flammable atmospheres:

1. Ensure the temperature of the flammable liquid is below the flash point. A margin of 15 degrees C below the flash point is usually required to obtain a sufficiently lean mixture.
2. Use an inert gas blanket in the top of the vessel.
3. Charge through a rotary lock screw conveyor or similar. The atmosphere in the vessel outside the flammable region by being too rich, inert blanketed, or too lean by using ventilation.

Avoid static electricity as a source of ignition:

A charge transfer in excess of 75×10^{-9} Coulombs should be considered hazardous.

1. Use a damp powder and add via an earthed tundish or better still, an earthed screw feed.
 2. The operator should wear anti-static shoes and gloves when handling powders to avoid being a collector of any static electricity. The powder should also be purchased in conducting bags to avoid the bags being a collector of static electricity.
 3. All metal equipment should be earthed.
-

10575Date Unknown

Source : THE ROSPA BULLETIN, JUL 1987.

Location : , UK

Injured : 1 Dead : 0

Abstract

An operator almost lost his life when he became trapped between a conveyor belt and a roller.

His life was saved by the quick thinking action of a workmate, when he saw what was happening he immediately hit an emergency safety button to cut the power.

For failing to fence dangerous machinery securely the factory owners were fined £1,200 (1987).

The operator who was injured had been bagging pulped materials when the incident occurred.

One of the sacks became stuck on the production line and when he could not knock it out of the way by hand he climbed onto the conveyor belt to free it.

However, he lost his balance and his foot went down into a gap between the belt and the roller. His leg had been drawn in as far as the knee when a nearby operator noticed and pressed the stop button. If he had not done so the consequences could have been fatal.

A fitter had to dismantle part of the equipment to release the operator.

[design or procedure error, operator error, near miss, injury]

Lessons

[None Reported]

Source : CONTROLLING ELECTROSTATIC HAZARDS, ICHEME, SAFETY TRAINING PACKAGE, 016, 4.15.

Location : ,

Injured : 1 Dead : 0

Abstract

A fine powder was being loaded into a stainless steel reaction vessel from propylene lined cardboard containers by tipping the powder down a GRP (glass reinforced plastic) chute. The vessel was 70% filled with a mixture of 2000 litres of methanol and 500 litres of toluene.

The GRP chute contained a metal tube cross at the bottom of its opening. The flammable vapour and possibly dust ignited, causing burns to the operator. [charging reactor, fire - consequence, lack of earthing]

Lessons

The following recommendations were made:

1. The GRP chute could be replaced with an earthed metal chute.
 2. The chute could be redesigned to incorporate a device for keeping nitrogen in the reactor (e.g. rotary valve, self closing flap valve etc.).
 3. Conductive liners should be used in the cardboard box and an earthed clip used on them when emptied.
 4. Oxygen levels could be monitored in the reactor to ensure a non-flammable atmosphere before reactor charging begins. (A pre-purge and top-up flow of N2 could be incorporated into operating procedures).
-

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A refinery crane was unloading containers which weighed approximately 4.25 tonnes gross. The crane was being operated by a shift rigger and assisted by grade four operative. During the unloading of the first container, the crane became overloaded and turned over coming to rest against a lorry which was positioned alongside.

No injuries were sustained by personnel and damage to the crane was superficial but it was purely fortuitous that no pipework in the area was damaged or fractured and that a fire/explosion did not occur. The automatic safe load indicator/audible alarm was switched off at the time of the incident.

[refining]

Lessons

Following a detailed investigation, a number of recommendations were made which included the following:

1. Discussions will be held with the crane manufacturer to see if the on/off switch on the automatic safe load indicator/alarm can be removed so that the safe load indicator is always in commission when the crane is operating.
 2. The automatic safe load indicator will be checked by means of a known weight at six monthly intervals.
 3. A bar will be fitted to the pulley system of the dynamometer (measuring device for the safe load indicator) to ensure that the hoist rope cannot jump off.
-

10428Date Unknown

Source : LOSS PREVENTION BULLETIN, 135, 10.

Location : ,

Injured : 1 Dead : 0

Abstract

An electrician was injured when a portable battery was used in an attempt to start an offshore pedestal crane.

The electrician connected the jump leads in reverse polarity, causing one of the batteries to explode, which emitted shards of material, resulting in injuries to the electricians face.

The ensuing investigation into the incident highlighted that the jump leads were both the same colour, and that the electrician probably did not check this before connecting up the battery, rather that the electrician had made an assumption that was proved later to be incorrect.

[explosion, operation inadequate, injury]

Lessons

[None Reported]

Source : LOSS PREVENTION BULLETIN, 091, 11.

Location : ,

Injured : 0 Dead : 1

Abstract

Ethyleneamine was being dispensed under nitrogen from a storage cylinder into a jug from which it was poured into bottles placed on scales on the work bench. A canopy was situated 1.2 m above the bench and a fan was mounted in the wall below the canopy. For such highly toxic, volatile chemicals an air velocity of at least 0.75 m/s is necessary to ensure adequate control. However, the actual air velocity at bench level proved to be only 0.1 to 0.15 m/s and, although the operator wore a full-face respirator this failed to provide sufficient protection and his exposure proved fatal. Fatality.

[material transfer, personal protective equipment, storage equipment]

Lessons

[None Reported]

Source : LOSS PREVENTION BULLETIN, 092, 21.

Location : ,

Injured : 1 Dead : 0

Abstract

A fitter and craft assistant reported to the plant control room and asked if a permit had been made out for a particular job. They were told that it had and had been accepted by their supervisor. Without reading it, they proceeded to the stirrer to start work. Whilst the fitter was on the staging, which had been erected around the vessel, and was checking the coupling between the gearbox and the motor, he was struck on the helmet by the overhead travelling crane. This caused a pain in his neck for which treatment was sought. The craft assistant, also on the staging was bending at the time, to pick up some bolts and escaped injury.

After the investigation it was found that the cause of the accident:

1. The rigger operating the crane was unaware of anyone in the area of the vessel.
2. The fitter said he had not read the permit to work fully before starting work.
3. The supervisor did not inform the fitter of the necessary precautions because he was elsewhere on the plant at the time.
4. The process supervisor who made out the permit was also out of the control room when the fitter made his enquiries.
5. No one informed the rigger that people would be working that close to the clearance of the overhead crane.
6. The site operating instruction, "Operation of overhead cranes", states that crane stops have to be placed on the tracks to limit the use of the crane 6 m away from where any work near to the crane might be taking place, or that the crane must be electrically isolated. This was not done.

[maintenance, operator error, injury]

Lessons

[None Reported]

Source : LOSS PREVENTION BULLETIN, 093, 35.

Location : ,

Injured : 0 Dead : 0

Abstract

An electrical contractor was carrying out preparatory work for running a cable to a new fan. The work was being done under the supervision of a Support Group Electrician with a permit to work (PTW) covering the relevant aspects of the job. Whilst working on a portable staging on the ground floor, he was sprayed by hot condensate from a vent pipe on a blow down header.

The precautions stated on the PTW were satisfactory for the work that was being carried out, and there was no reason to suspect that there was risk from the vent pipe close by.

The pipe, approximately three metres above ground level, is from a blow-down header which in turn carries a number of aqueous process streams, including an automatic blow-down from steam drums, discharging directly to drain.

It was not possible to carry out a modification to this venting arrangement safely without serious process disruption, so the area was fenced off until the vent could be made safe.

[spill, maintenance]

Lessons

The following recommendations were made:

Some of the actions to prevent a recurrence include:

1. A more detailed job specification to be prepared.
 2. Block the jacking stud holes off with small bolts.
 3. Look at alternative ways of lowering the sparger.
-

Source : LOSS PREVENTION BULLETIN, 088, 23.

Location : ,

Injured : 0 Dead : 0

Abstract

Static electrical discharges were seen when an organic powder was tipped into a vessel from plastic bags. No fire occurred as the vessel contained non-flammable material but flammable solvents were handled nearby.

Measurement of static showed voltages of up to 12 kV.

[charging reactor, near miss, screw conveyor, shoes]

Lessons

The following should be considered:

Avoid flammable atmospheres:

1. Ensure the temperature of the flammable liquid is below the flash point. A margin of 15 degrees C below the flash point is usually required to obtain a sufficiently lean mixture.
2. Use an inert gas blanket in the top of the vessel.
3. Charge through a rotary lock screw conveyor or similar. The atmosphere in the vessel outside the flammable region by being too rich, inert blanketed, or too lean by using ventilation.

Avoid static electricity as a source of ignition:

A charge transfer in excess of 75×10^{-9} Coulombs should be considered hazardous.

1. Use a damp powder and add via an earthed tundish or better still, an earthed screw feed.
 2. The operator should wear anti-static shoes and gloves when handling powders to avoid being a collector of any static electricity. The powder should also be purchased in conducting bags to avoid the bags being a collector of static electricity.
 3. All metal equipment should be earthed.
-

Source : ICHEME

Location : ,

Injured : 0 Dead : 0

Abstract

A 65-tonne crane was lifting a 508 lb pallet of material for an aluminium dome roof onto the top of a tank floating roof. The crane's first lift, of 1,178 lbs, had been successfully completed in the same location. However, one of the crane outriggers sunk into the ground, causing the crane to tilt and the extended boom to strike the top edge of the tank shell. Although the ground appeared very solid, there was a void below the surface which allowed the outrigger and support pad to sink. A false assumption had been made the ground would support the loading without either testing the conditions or using load spread equipment because it was impractical to test in the existing conditions. There was minor damage to the top of the tank shell, there was no evidence of equipment, rigging or mechanical failure or negligence. Proper contracts and insurance were in place. The dome contractor and his crane subcontractor assumed full responsibility and cooperated completely.

[floating roof tank, damage to equipment, mechanical equipment failure, maintenance, operation inadequate]

Lessons

When setting up crane operations in an area where the soil is not compacted from use or where it is impractical to test the soil, the use of load spreading equipment should be used.

The incident stresses the importance of using reputable contractors with good contract documents and insurance in place before work begins.

Source : LOSS PREVENTION BULLETIN, 088, 23.

Location : ,

Injured : 0 Dead : 0

Abstract

Explosion in vessel after a distillation operation. Methanol and acetone were distilled off from mother-liquors in a vessel. Without cooling or using nitrogen, the vessel was opened and an organic powder charged by hand from a plastic bag. After about ten shovels of the powder had been added, an explosion occurred inside the vessel causing a small fire which broke a glass coil condenser. The incident was caused by static electricity being generated by the flow of the powder across the plastic.

[charging reactor, plastic bags, fire - consequence, screw conveyor, shoes]

Lessons

The following should be considered:

Avoid flammable atmospheres:

1. Ensure the temperature of the flammable liquid is below the flash point. A margin of 15 degrees C below the flash point is usually required to obtain a sufficiently lean mixture.
2. Use an inert gas blanket in the top of the vessel.
3. Charge through a rotary lock screw conveyor or similar. The atmosphere in the vessel outside the flammable region by being too rich, inert blanketed, or too lean by using ventilation.

Avoid static electricity as a source of ignition:

A charge transfer in excess of 75×10^{-9} Coulombs should be considered hazardous.

1. Use a damp powder and add via an earthed tundish or better still, an earthed screw feed.
 2. The operator should wear anti-static shoes and gloves when handling powders to avoid being a collector of any static electricity. The powder should also be purchased in conducting bags to avoid the bags being a collector of static electricity.
 3. All metal equipment should be earthed.
-

Source : UNUSUAL INCIDENTS AT GAS WORKS AND THEIR LESSONS (PART III), COMMUNICATION NO. 564; TRANS. INST. GAS ENG.**Location** : , UK**Injured** : 0 **Dead** : 0**Abstract**

A gas works lift was located in the retort house with the winding gear at ground level. The car was suspended by two ropes that passed over pulleys at the top of the lift well. Safety dogs were provided and were actuated by means of a separate rope, connected from the gear on top of the car to the balance weight. The car crashed from a considerable height, due to the failure of both main ropes, these were well worn and approaching the end of their useful life. Inspection found one broken in two places and the other in one place. The safety gear was found to have operated, evidenced by marks of the dogs on the guides, and the rope operating the safety gear was found to be broken. The safety gear was not fitted with an electrical cut-off switch, and the car was empty at the time. The following explanation is offered:

Unequal groove wear on the traction pulley suggests that the ropes were unequally tensioned, and it is thought that whilst the lift was travelling upwards the more highly stressed rope failed. If it is now assumed that the safety gear rope was shorter than the one remaining rope, then the safety dogs would engage and the safety rope would also fail. Since the dogs were not fitted with an electrical cut-off switch, the lift would continue upwards and thus re-set the safety dogs in their normal "off" position. If the broken rope fouled the one remaining rope of the main sheave, when the lift was next called down both ropes would be jammed together on the sheave and would break. This would give the second failure, which had been observed on the first rope. With no safety gear in action, the cage and balance-weight would crash to the ground.

[lifting equipment, normal operation, design inadequate, damage to equipment]

Lessons

The following lessons were learnt:

Periodical inspection of lifts is a legal requirement. At the time of the incident Safety Recommendations of the Institute of Gas Engineers dealt with desirable features for Gas Works applications. Attention is directed to the use of repeat action safety gear that remains in the "on" position when the car is raised, and which also incorporates an electrical cut-off switch.

Source : LOSS PREVENTION BULLETIN, 088, 23.

Location : ,

Injured : 2 Dead : 0

Abstract

A crystalline product was being shovelled out of a plastic bag through a manhole into a 1000 litre steel reaction vessel containing methanol. A fire occurred when the remaining crystals were shaken from the bag. Ignition was caused by discharge of static electricity from the bag.

Two operators were severely burned.

[fire - consequence, charging reactor, plastic bags, reactors and reaction equipment, screw conveyor, lack of earthing, screw conveyor, shoes, burns]

Lessons

The following should be considered:

Avoid flammable atmospheres:

1. Ensure the temperature of the flammable liquid is below the flash point. A margin of 15 degrees C below the flash point is usually required to obtain a sufficiently lean mixture.

2. Use an inert gas blanket in the top of the vessel.

3. Charge through a rotary lock screw conveyor or similar. The atmosphere in the vessel outside the flammable region by being too rich, inert blanketed, or too lean by using ventilation.

Avoid static electricity as a source of ignition:

A charge transfer in excess of 75×10^{-9} Coulombs should be considered hazardous.

1. Use a damp powder and add via an earthed tundish or better still, an earthed screw feed.

2. The operator should wear anti-static shoes and gloves when handling powders to avoid being a collector of any static electricity. The powder should also be purchased in conducting bags to avoid the bags being a collector of static electricity.

3. All metal equipment should be earthed.

10427Date Unknown

Source : LOSS PREVENTION BULLETIN, 135, 10.

Location : ,

Injured : 0 Dead : 0

Abstract

Transportation incident. This incident involved the movement of a 2 m³ open topped container from one part of a site to another. The container had previously been on site for several weeks prior to the incident. The straps used originally were fitted at the corner lugs and the crane lifted the container approximately 2 m off the ground the straps snapped and the container fell to the ground. No personnel were injured and no equipment was damaged.

When the container was inspected it was found to contain water to a depth of approximately 0.3 m. This would have increased the container weight by over 1 tonne and exceeded the safe load on the straps by over 0.5 tonne.

It was assumed because the container had not been used that it still weighed the same. It was not inspected before lifting and the effects of the weather had been ignored.

[design or procedure error, weather effects]

Lessons

[None Reported]

10162Date Unknown

Source : ICHEME

Location : , UK

Injured : Dead :

Abstract

A trainee dumper driver crawled under a conveyor belt instead of going down the steps to get safe access. His arm and head were pulled into the machinery crushing him to death. The accident happened after the worker was asked to clean debris from under the conveyor. He used a long-handled shovel which was caught between the belt and the rollers and he lost his life in trying to stop it. Since the accident, the company has spent £20,000 on guarding every gap in its machinery.

[maintenance, conveyor belt, fatality, inadequate guarding]

Lessons

[None Reported]

11274Date Unknown

Source : INSTITUTE OF GAS ENGINEERS, COMMUNICATION 451, UNUSUAL INCIDENTS AT GAS WORKS AND THEIR LESSONS, PART 2, 28 SEP, 1954.

Location :

Injured : 2 Dead : 0

Abstract

Spent oxide from a gas purifier in a gas production works ignited causing an explosion in an elevator. Damage was caused to the elevator housing and two personnel sustained minor injuries. No clear cause for the explosion was identified. It may have been due to foreign material in the oxide or local hot spots in the material when air contacted finely divided dust. Tests on spent oxides indicate that the material is liable to explode if small sources of heat are available, when the dust forms an explosive mixture with air.

[damage to equipment, explosion, dust explosion, injury]

Lessons

The following recommendations were made:

1. Industry guidelines issued by the Institute of Gas Engineers indicate spent oxide should not be discharged into an enclosed area. The oxide should be damped down with water immediately.
 2. Minor dust explosions are highly hazardous as they may dislodge dust in the plant area, leading to a larger secondary dust cloud explosion.
 3. The provision of dust explosion panels may have mitigated this incident.
-

10160Date Unknown

Source : ICHEME

Location : , UK

Injured : 1 Dead : 0

Abstract

While rewinding steel rope onto a drum in a confined space unattended, a worker lost a leg and two of his fingers. The worker was too young to operate the machinery but had been allowed to train in using it due to his aptitude for the job. Although all employees had been warned that it was a two-man job, the worker was keen and wanted to get on with the work. An illegal unguarded clutch mechanism had compounded the accident because when he put the brake on the machine, the clutch kept on spinning until the engine stalled. The company was fined for allowing a young person to operate a powered lifting appliance and for not having a clutch fence.

[construction, drums, rope, inadequate guarding]

Lessons

[None Reported]

10159Date Unknown

Source : ICHEME

Location : , UK

Injured : 1 Dead : 0

Abstract

A worker's hand was damaged when a colleague accidentally guided the wheels of a travelling electric crane over it. The man who caused the injury knew workers were overhead inside the building but had forgotten the instructions. It was believed that necessary safety measures were taken as the area had been roped off where the men were working. The company admitted that it failed to take effective measures to ensure the overhead crane would not cause damage. Since the accident, the company has put blocks on tracks to guide the crane and protect workers.

[offshore, crane, safety procedures inadequate, injury]

Lessons

[None Reported]

Source : LOSS PREVENTION BULLETIN, 088, 23.

Location : ,

Injured : 2 Dead : 0

Abstract

To purify a faulty batch of a dry, powdery active drug ingredient, the latter had to be dissolved in ethanol in a 1000 litre stirred vessel. The product was sealed in 30 kg PVC sacks which were placed in suitably-sized plastic containers. At the time of the accident, two workers were carrying out the loading operation. To do this, they had cut open the PVC sack and placed it on the edge of the vessel opening. 25 kg of material from an open sack had already been poured into the 25 degrees C, hot vessel in which two solution mixtures of the same type had previously been carried out. During loading, one worker suddenly saw a flame at the bottom of the vessel, some 1.20 m below, followed immediately by an explosion. The workers were hit by the jets of flame which shot out. They suffered burns to face and hands. The building suffered a considerable amount of damage as the outer wall of the extraction building, was forced out by the pressure wave. The wall comprised glass panels and broke at ground level. The incident was caused by static electricity being generated by the flow of the powder across the plastic.

[charging reactor, reaction vessel, plastic bags, damage to equipment, fire - consequence, lack of earthing, shoes, screw conveyor]

Lessons

The following should be considered:

Avoid flammable atmospheres:

1. Ensure the temperature of the flammable liquid is below the flash point. A margin of 15 degrees C below the flash point is usually required to obtain a sufficiently lean mixture.
2. Use an inert gas blanket in the top of the vessel.
3. Charge through a rotary lock screw conveyor or similar. The atmosphere in the vessel outside the flammable region by being too rich, inert blanketed, or too lean by using ventilation.

Avoid static electricity as a source of ignition:

A charge transfer in excess of 75 nanocoulomb x 10⁻⁹ Coulombs should be considered hazardous.

1. Use a damp powder and add via an earthed tundish or better still, an earthed screw feed.
 2. The operator should wear anti-static shoes and gloves when handling powders to avoid being a collector of any static electricity. The powder should also be purchased in conducting bags to avoid the bags being a collector of static electricity.
 3. All metal equipment should be earthed.
-

Source : LOSS PREVENTION BULLETIN, 088, 22.

Location : ,

Injured : 1 Dead : 0

Abstract

A fire occurred in an ethanol esterification batch reactor whilst an operator was emptying the last contents of a bag of oxalic acid into the reactor. The reactor had been filled to about two-thirds full with recovered ethanol containing about 10% of cyclohexane and was at a temperature of 15-20 degrees C. The stirrer and dust extraction equipment were in operation. Crystalline oxalic acid was being added through a hood into the manhole from 50 kg plastic bags. About 40 bags had been added when an ignition occurred at the manhole opening just as the operator was shaking out an emptied bag. The operator sustained burns to the exposed parts of the body.

The investigation showed:

1. The resistance to earth of an operator wearing the shoes worn during the incident was $2 + 1 \times 10^7$ ohms. This is within the range 10^4 - 10^9 ohms specified for anti-static footwear.
2. The resistance to earth of an operator wearing a new pair of standard issue shoes was $3 + 1 \times 10^9$ ohms.
3. Tests carried out on an operator wearing PVC gloves, earthed footwear and vigorously shaking a woven polypropylene sack with an inner polyethylene liner (the type used) showed the bag was electrostatically charged. Discharges with a maximum charge transfer of -60×10^9 Coulombs were detected between the inner polyethylene liner and the spherical probe.
4. The oxalic acid used was noted to be of two types. One form of the acid comprised moist agglomerates of crystalline material, and other a much drier, free flowing crystalline material. At the time of the incident, a bag of the second type was being added.
5. Emptying a full bag of moist acid into an insulated drum produced lower charge levels than emptying a full bag of dry acid. Discharges with maximum charge transfer of $+40 \times 10^9$ Coulombs and -10×10^9 Coulombs could be measured from the bag and wet acid powder respectively when using a probe and electrometer. When emptying a full bag of dry powder into an insulated drum charge transfers of $+200 \times 10^9$ Coulombs and -120×10^9 Coulombs were measured respectively.
6. With the extraction system in operation the lower flammable limit boundary was 300 mm below the manhole lid. With the extraction system off, the boundary was 300 mm above the manhole lid. The extraction system was impaired by a partial collapse of the ducting. The flash point of ethanol is 12 degrees C and of cyclohexane -17 degrees C.

It was concluded that the most likely source of ignition was static discharge from the plastic bag. Modifications were put in hand to provide an earthed screw conveyor for the oxalic acid and alterations to the extractor systems.

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

Lessons

[None Reported]

Source : UNUSUAL INCIDENTS AT GAS WORKS AND THEIR LESSONS (PART III), COMMUNICATION NO. 564; TRANS. INST. GAS ENG.**Location :** , UK**Injured :** 0 **Dead :** 0

Abstract

Two fan-type boosters were installed in an exhauster house. One booster was working at full load when the casing split open and the building was enveloped in flames.

The gas supply was shut off at the holder outlet valves, which reduced the fire such that the building could be entered to shut the inlet and outlet valves on the boosters. Examination of the damaged machine revealed that the impeller blades had burst through the casing, causing sparks which ignited the gas. The blades and shroud were stripped from the backplates and the casing was split open for half of its circumference. The machine was about six years old, driven by an electric motor.

The impeller was of the overhung type. Bearings on the impeller shaft were found slack and considerable quantities of dust were discovered in the inlet pipe to the booster. The failure was caused by a combination of defects. The impeller probably became out of balance due to dust, the effect being exaggerated by the bearing slackness. Oscillating stresses such as this could cause failure of the shrouding with consequent disintegration of the whole assembly.

[material of construction failure, mechanical equipment failure, normal operations, damage to equipment]

Lessons

Incident highlights the need to have control valves outside any gas pumping house. If possible, connections should be such that supply can be maintained when boosting equipment is shut down. Particular attention must be paid to maintenance of bearings on overhung-type machines. Any vibration noted should be immediately investigated, and if necessary the shaft and impeller removed and rebalanced.

11507Date Unknown

Source : UNUSUAL INCIDENTS AT GAS WORKS AND THEIR LESSONS (PART III), COMMUNICATION NO. 564; TRANS. INST. GAS ENG.

Location : , UK

Injured : 0 Dead : 1

Abstract

A gang of men were emptying a purifier, during a weekend, at a time when the regular chargehand was on holiday.

There were also a number of conveyors and it became necessary to move one of them. Without authority, a sling was hitched around the conveyor and attached by its end links to the hook of the overhead travelling crane. The crane was for removing covers and was suitable for heavy lifting, the hook was massive and the end links of the sling chain were only wide enough to sit on its nose. The conveyor was lifted, but as soon as it started to move sideways one end of the chain slipped from its hold and the conveyor fell, crushing one man, who died from his injuries.

[fatality, safety procedures inadequate, competency lacking, operational activities]

Lessons

The following lessons were learnt:

The failure of lifting devices is a common cause of accidents. In most cases this is attributable to their misuse either by overloading, lack of maintenance, or use for purposes for which they were not intended. Whilst the chain was strong enough for the load, one with ring ends, which would fit on to the hook, should have been used. Often, accidents of this nature can be traced to lack of proper supervision. Being Sunday, supervisory staff were depleted, and the relief chargehand was elsewhere at the particular time.
