1276902 October 2000

Source : CHEMICAL SAFETY AND HAZARD INVESTIGATION BOARD, OCTOBER 2, 2000, (http://www.chemsafety.gov).
Disclaimer: The Chemical Incident Reports Center (CIRC) is an information service provided by the U.S. Chemical Safety and Hazard Investigation Board (CSB). Users of this service should note that the contents of the CIRC are not intended to be a comprehensive listing of all incidents that have occurred; many incidents go unreported or are not entered into the database. Therefore, it is not appropriate to use the CIRC database to perfrom statistical analysis that extends conclusions beyond the content of the CIRC. Also, although the CSB never knowingly posts inaccurate information, the CSB is unable to independently verify all information that it receives from its various sources, much of which is based on initial reports. CIRC users should also note that the CSB receives more comprehensive reports about incidents that occur in the U.S.; comparisons made between U.S. incidents and those in other nations should take this fact into consideration.

Location : Manchester, USA

Injured : 0 **Dead :** 1

Abstract

An explosion occurred at a manufacturing plant killing a worker. The worker was working alone on a machine grinding magnesium when the explosion occurred.
An investigation into the cause of the incident is being carried out.
[fatality, grinder]

Lessons

[None Reported]

1221118 February 2000

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

Injured : 5 **Dead :** 0

Abstract

An explosion occurred when a construction worker accidentally cut through a gas pipe carrying an unspecified substance.
A spark from the disk cutter triggered the explosion injuring the construction worker and four other workers.
[hot work, injury]

Lessons

[None Reported]

1220414 February 2000

Source : CHEMICAL SAFETY AND HAZARD INVESTIGATION BOARD, FEBRUARY 15, 2000. (http://www.chemsafety.gov).
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CHEMICAL HAZARDS IN INDUSTRY, APRIL 2000.

Location : Santee, USA

Injured : 3 **Dead :** 0

Abstract

An explosion and fire occurred in an extruder at a plastics manufacturing plant.
The explosion occurred when three workers were mixing polyethylene granules, raw sulphur powder and potassium nitrate granules to produce a semisold.
The explosion occurred after the materials were heated, before any material had emerged from the extruder barrel. The building was evacuated.
The workers suffered third-degree burns and shrapnel injuries.
The cause of the explosion is under investigation.
[fire - consequence, injury]

Lessons

[None Reported]

5679 14 June 1992

Source : ICHEME

Location : ,

Injured : 0 **Dead :** 0

Abstract

A fire occurred at the continuous mixer extruder feed throat which extended to the fume vent system. A greasy wax coating was found in the vent duct.
[fire - consequence, extrusion]

Lessons

[None Reported]

5013 11 June 1990

Source : THE CHEMICAL ENGINEER, 1990, 28 JUN.
Location : Carrington, UK

Injured : 0 **Dead :** 0

Abstract

A fire started in the extraction ducting in the extruder area of this polypropylene plant. The likely cause was a dust explosion.
[fire - consequence, extrusion]

Lessons

[None Reported]

4748 17 October 1989

Source : REUTERS
Location : Botlek; Rotterdam, NETHERLANDS

Injured : 2 **Dead :** 3

Abstract

An explosion occurred in a storage tank containing acrylonitrile where maintenance crew where carrying out isolation work and a grinding machine was being used. Fatality.
[grinder, storage tanks]

Lessons

[None Reported]

4155 May 1988

Source : HSE NEWS RELEASE, 1989, 1 DEC.
Location : Haslingdon; Lancashire, UK

Injured : 0 **Dead :** 1

Abstract

Director convicted of manslaughter and sentenced to 1 year imprisonment suspended for 2 years and fined £47,000 (1988) regarding an accident when an employee was killed in a plastics crumbling machine. Fatality.
[processing].

Lessons

[None Reported]

7931 03 June 1987

Source : ICHEME

Location : ,

Injured : 0 **Dead :** 0

Abstract

A contractor pipe-fitter partially cut through a pipeline containing butane. The area was evacuated but fortunately the incident did not escalate.
Work was being carried out by the contractors on a number of specified tasks. A supervisor from the contractors was in charge and a Permit-to-Work was in force for the specified tasks.
The supervisor decided to prepare for a further task and explained to the pipe-fitter the extent of the work. The intention of the supervisor was that he would then obtain a hot work permit from the assigned authority. However other work distracted him from doing this immediately, during which time the pipe-fitter commenced work. He started cutting through a butane rundown line with an electrically operated angle grinder. He had partially cut through the line when he noticed a leak which he immediately reported to the Permit Control Supervisor. All hot work was stopped and the area evacuated. Fortunately a large system of downstream piping had been depressured for the installation of battery limit blinds and only a fraction of the rundown pressure had been established via a passing valve.
Near miss.
[maintenance, evacuation]

Lessons

The importance of contractors being made fully aware of the hazards associated with maintenance work in hazardous areas is borne out by this incident. When contractors are brought on site they should receive good induction training followed by periodic monitoring to ensure that the safety standards are observed.

1201416 January 1987

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

Abstract

A polyethylene extruder used for making plastic bags was taken out of service for a routine die strip and clean. This was carried out and start-up of the unit commenced. For the next 12 hours production was interrupted on a number of occasions to correct machine faults not associated with the extruder or the die. Heat was left on the extruder during these periods. Following a downtime of 1 hour to correct bubble sizing faults, the shift supervisor restarted the extruder and stood over the die to prepare to take the bubble up. About 10 seconds after starting the extruder he was hit in the face by a stream of hot wax shooting from the die. The supervisor was wearing safety spectacles but was burnt on his face and a small amount of wax got into his eye. Analysis of undegraded material from the die confirmed that the composition of the material being extruded was correct. Analysis of the greyish wax material responsible for the burns indicated a polymer chain scission formed by a chemical reaction in the extruder involving depolymerisation at high temperature (300 - 400 degress C) in the absence of oxygen. A sample of polyethylene was subjected to a temperature of 380 degrees C for 70 minutes under an atmosphere of nitrogen. A wax-like material was produced identical in appearance and infra red absorption to that found on the die after the incident.
[polyethylene, start-up, extruder, people, unwanted chemical reaction, burns]

Lessons

Polyethylene exposed to a temperature of 380 degrees C for 70 minutes in the absence of oxygen will decompose and produce a wax like material. Shorter time at a higher temperature or longer time at a higher temperature will also produce a similar wax.

3644 16 June 1986

Source : ICHEME

Location : ,

Injured : 0 **Dead :** 0

Abstract

The flow of polyethylene powder from a bin to an extruder slowed down and pellet was added to the silo to assist the flow. Shortly after starting the airflow taking in the pellets to the bin there was a small explosion which caused damage to the vent bag filter of the silo. It was concluded that a dust explosion had occurred in the vent bag filter ignited by static. The system was not fitted with explosion venting. Design inadequate.
[silo/hopper, design or procedure error, damage to equipment]

Lessons

Recommendations.
With respect to this particular incident:
1. The powder should be conveyed and stored under nitrogen.
2. Air transfers into powder storage bins or storage bins contaminated by powder should be via inlet cyclones or other means designed to minimise internal dust creation.
3. Pellets should not be added to powder bins which contain or are contaminated with powder.
4. Redundant vent bag filter housings on powder bins should be removed.
5. Routine monitoring of earth continuity of equipment attached to powder bins should be instituted.
In general
1. Bins or other equipment which may contain High Density Polyethylene (HDPE) powder should be provided with adequate safeguards against dust explosion risks (e.g. inerting or suppression or relief devices).
2. A systematic programme of work to assess the dust explosion hazards of different grades should be undertaken to supplement data available. Urgent attention should be paid to new or recently introduced grades to confirm, as soon as possible, that they may continue to be conveyed and stored in air. Acquisition of in-house explosion testing facilities should be considered.
3. Electrical equipment contained in powder bins should be checked for its suitability for operation in flammable dust clouds.

8021 13 August 1985

Source : ICHEME
Location : , UK

Injured : 0 **Dead :** 0

Abstract

A fire developed in a crude oil tank whilst demolition was in progress.
This fire was extinguished after two hours, fortunately there were no injuries to personnel.
Over the years, settlement of the tank base had taken place with the south side being approximately 2ft lower than the north side.
To facilitate cleaning about 8 to 10 feet of crude oil sludge in the tank was heated with hot water.
On pumping out the tank, the roof grounded unevenly because of the sloping floor. The north support legs landed first on the base and then collapsed. When legs in the central area landed, several punctured the roof plates. Pumping continued until the roof had landed in an irregular fashion and it was seen that oil had leaked through the ruptured plates on to the well-deck area. To facilitate entry two 5ft square holes were cut in the north and south sides of the tank shell about 6ft above ground level. This was done under work permit using an angled grinder with asbestos blankets laid and with water sprayed on the inner plates when cutting was taking place.
A decision was made to cut a hole in the well-deck at one of the low points to facilitate hot washing of crude oil on the roof back into the tank contents.
Unfortunately, the contract fitter, in the mistaken belief that the permit for cutting holes in the tank wall was valid for cutting the hole in the well-deck began to cut the roof plates using an angled grinder without waiting for the process supervisor.
Sparks ignited the oil on the tank roof and the subsequent fire spread into the tank itself.
The fire was successfully extinguished by site personnel with assistance from the local fire brigade within two hours.
It is clear that the incident resulted from a lack of understanding on the part of the contractor and inadequate supervision by the supervisory staff. On the day in question it would seem that there were some 60 work permits valid for demolition work and it was not possible to give the necessary level of supervision in view of the small number of project staff.
[fire - consequence]

Lessons

[None Reported]

1110712 February 1985

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

Injured : 0 **Dead :** 0

Abstract

Thirty five employers 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.

3129 26 October 1984

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

Abstract

An operator lost his finger when operating a masson cutter being used to grind fused resin. When starting it up he found material coming out of a port which should have had a cover. He pressed the stop button and climbed onto the machine to push a polythene bag into the hole and in doing so his finger was cut off by the still rotating cutter.
[operator error, solids processing]

Lessons

The following recommendations were made.
1. Masson Cutter inspection port cover plate to be fitted.
2. All machinery on plant to be inspected to ensure that access to running moving parts is impossible.
3. All operators to be informed that, upon any failure or malfunction of plant equipment, the correct procedure is to isolate the power to that piece of equipment and to report to the shift supervisor.
4. All operators to be reminded that plant machinery can continue to run-on mechanically, after disconnection of electrical drive.

3041 July 1984

Source : SEDGWICK LOSS CONTROL NEWSLETTER
Location : , UK

Injured : 0 **Dead :** 0

Abstract

Fire in polyethylene extruder switchgear.
[fire - consequence, solids processing]

Lessons

[None Reported]

2549 28 March 1983

Source : CHIMIE ACT, 1983, 11 APR.; LE JOURNAL, 1983, 19 APR.
Location : Balan; Lyon, FRANCE

Injured : 0 **Dead :** 2

Abstract

Explosion in workshop following escape of ethylene from an extruder. The ethylene escaped via a drain valve which had been left open while the venting chimney was plugged up. Watch found near incident and tested for being source of ignition and concluded that it was not.
[fire - consequence, fatality, leak]

Lessons

[None Reported]

4058 14 November 1980

Source : ICHEME

Location : ,

Injured : 0 **Dead :** 0

Abstract

A fabric connection between a feed hopper and an extruder became disconnected releasing fine polyethylene polymer powder into the air. After about 10 seconds this caught fire when it came into contact with hot surfaces on the extruder. Preliminary fire fighting was with dry powder fire extinguisher while water hoses were being laid out, the dry powder extinguishers were seen to agitate the dust.
[leak, fire - consequence, fire protection equipment, processing]

Lessons

Flexible fabric connectors to be improved. Fire fighting facilities to be reviewed, dry powder extinguishers are not suitable for dust fires.

9406 14 November 1980

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

Abstract

An extruder was in commission to empty the feed bin. Two machine operators observed that the extruder was producing oversized pellets which had blocked the scalping screen. This was brought to the attention of the senior operator who came to alter the operating settings on the extruder to improve the pellet quality. Shortly after completing this a cloud of polymer was released from sock connecting the feed pipe to the entrance section of the extruder barrel, forcing the personnel to leave the area. Almost immediately the polymer ignited and a flame spread causing damage to the facing of the extruder control panel and starting several small fires on the floors above the extruder. The fire at the extruder was quickly extinguished. The fire in the weighfeeder room was extinguished. The fire in the weighfeeder room was extinguished after a slight delay. There were no injuries to personnel arising from the incident. It was concluded that the polymer was released as a result of the sock becoming detached. The source of ignition has not been identified but it is considered that either static discharge or a hot spot on the equipment are the most probable causes.
[commissioning, gas / vapour release, explosion, fire - consequence]

Lessons

The following recommendations were made:
1. Modifications to be made to improve the weighfeeder floor and the floors below should be sealed.
2. An investigation to be made into the requirement for the fitting of an on line hydrocarbon analyser and alarms to the power extruder feed bin.
3. The methods used to clear blockages in the feed pipes to extruders to be reviewed to minimise the amount of polymer spilled during the operation.

1018012 February 1980

Source : ICHEME
Location : , UK

Injured : 0 **Dead :** 0

Abstract

At approximately 01.15 hours, an explosion protection system on a No.1 unit detonated. A yellowish-blue flame was seen from the No.1 Pulsaire box vent and a dull explosion was heard by two operators. The site alarm was raised. An initial examination of the Pulsaire box showed that the supressant, chlorobromomethane, had coated the filter bags. No external damage to the unit was observed and no personnel were injured.
Damage to mill hammers, the mill cover ('washboard') and one mill feed screw flight was caused by extraneous material in the system. Although no metallic object was found, it was suggested that such material was present and provided the spark which caused the explosion. The explosion protection system activated as designed and no damage to the unit was sustained.
[metal, grinding/milling, grinder, vent, explosion, spark, solids processing equipment, dust, damage to equipment]

Lessons

The following was recommended:
1. The importance of magnet checks, currently carried out once per shift, should be re-emphasised to supervisory staff and all operating personnel.
2. Routine cleaning of the blender vent should be carried out weeklyrefitting after a recalibration exercise.

7461 1980

Source : ICHEME

Location : ,

Injured : 0 **Dead :** 0

Abstract

A sheet metal worker still has his sight because he was wearing a pair of safety spectacles. The man was using a portable grinder when a piece of metal suddenly broke away and struck the right lens of the glasses with considerable force. Although both lenses were shattered, they remained intact within the frames.
[personal protective equipment, near miss]

Lessons

[None Reported]

9978 28 September 1979

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

Abstract

During the maintenance of a strainer that separates oversized lumps from the output of a polyethylene pelletiser, injury occurred to a fitter by scalding from steam released when overheated water flash vaporised. The overheating was a result of the operating procedure not being followed.
[gas / vapour release, design inadequate, operation inadequate, injury]

Lessons

Procedure design inadequate was considered to be the fundamental lesson learnt. Soft resin produced at reactor start-up causes unusually large quantities of oversized, or agglomerated, particles, and these overload the "agglomerate remover"(strainer). The operating procedure was not designed to cover these start-up conditions.

1893 21 August 1979

Source : ICHEME
Location : , UK

Injured : 1 **Dead :** 0

Abstract

An operator was charging resol resin and cotton into a mixer grinder when there was an explosion which caused him facial injury. Spectacles prevented serious eye injury. The ignition source emanated from the grinder to ignite an explosive mixture in the mixer. There was no damage to equipment but the practice of passing cotton and resol resin through the grinder was unsatisfactory. Dust explosion.
[mixing, charging reactor, injury]

Lessons

The following recommendations were made:
1. It is essential that a reliable choke be inserted between mixer/grinder and charging hood(s).
2. Separate charging hoods for grinder and mixer would be advisable.
3. All controls should have clear indication of their position.
4. Work of contractors should be checked by a reliable engineer.
5. Resol/cotton mixture should not be ground.
6. Overhaul should always be considered when making a major modification or movement of equipment.
7. Grinding and mixing plant should be separated with a choke wherever possible to reduce the probability of an ignition source reaching an explosive mixture.
8. The extraction system should be restored to full operating standards.
9. Observation of the mixer should be maintained in order to prepare an adequate maintenance routine.
10. Whilst the vent had operated satisfactorily as far as could be ascertained the outlet should be increased if this is reasonably practicable.
11. The electrical cabling in front of the vent should be re-routed.
12. The safe operating procedure should be reviewed, re-written, understood and accepted, and followed by all operators.
13. Manufacturing procedures and records should be reviewed with a view to ensuring that management are aware of all operations within their area of responsibility.

1457 September 1977

Source : CHEMICAL AGE, 1977, 7 OCT.
Location : Paisley; Scotland, UK

Injured : 0 **Dead :** 0

Abstract

Dry grinding unit warehouse destroyed by fire.
[grinder, fire - consequence]

Lessons

[None Reported]

1265527 July 1977

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

Abstract

An angle disc grinder fractured into four pieces leaving the centre depressed piece flush with the disc clamp nut and backing plate.
An investigation into the incident found that the disc nut was tight and there was evidence of slight wear on the one edge of the disc's outer periphery. It appeared that the disc had not been subject to heavy abrasive wear.
The cause of the disc failure is not known, but it is thought that the disc had been damaged either by some heavy object or the machine had been dropped.
[mechanical equipment failure, material of construction failure, plant / property / equipment]

Lessons

Any defect found on a portable grinder, the operator must stop the machine, disconnect the air supply and report the incident.

1370 May 1977

Source : CHEMICAL AGE, 1977, 3 JUN.; CHEMICAL MARKETING REPORTER, 1977, 20 JUN.
Location : Lillebonne, FRANCE

Injured : 0 **Dead :** 0

Abstract

Fire in low density polyethylene complex destroyed granulation facilities.
[granulator, fire - consequence, processing]

Lessons

[None Reported]

1283 01 December 1976

Source : ICHEME

Location : ,

Injured : 0 **Dead :** 0

Abstract

Fire at a petrochemical polypropylene plant. Source of ignition was hot surface. Equipment involved: extruder. Cause: lubrication failure.
[fire - consequence, processing]

Lessons

[None Reported]

9356 04 November 1975

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

Abstract

A fire occurred on an extruder spin away duct. Polyethylene and cardboard deposited from filters ignited spontaneously during shut-down.
[fire - consequence]

Lessons

[None Reported]

964 01 December 1974

Source : NORTHERN ECHO, 1974, 2 DEC.
Location : Jarrow, UK

Injured : 1 **Dead :** 0

Abstract

Explosion in granulator in plastics factory.
[solids processing]

Lessons

[None Reported]

1259614 June 1974

Source : ICHEME

Location : ,

Injured : 0 **Dead :** 0

Abstract

An explosion occurred at a methocel plant. The explosion occurred in the discharge part of the grinder and propagated into a dust collector and blew the door off.
Flaming powder blew out of the opening causing a secondary explosion. No injuries were reported.

Lessons

[None Reported]

832 28 November 1973

Source : JOURNAL, 1973, 29 NOV.
Location : Felling; Co Durham, UK

Injured : 0 **Dead :** 0

Abstract

Explosion destroyed grinding machine.

Lessons

[None Reported]

1158519 November 1973

Source : ICHEME

Location : ,

Injured : 0 **Dead :** 0

Abstract

A clean water drain network at an oil refinery became contaminated with hydrocarbons from the drainings of vessels used for cleaning and degreasing equipment. Sparks from a grinding wheel being operated near to an open drain then ignited a series of flash fires at nine manholes along the network. The fires were quickly extinguished with dry powder and foam, and there were no injuries or serious damage to property.
[fire - consequence, grinder, contamination, design or procedure error, solids processing]

Lessons

The contamination of the drain was found to have been caused by contract maintenance personnel, highlighting the importance of proper training and supervision of such personnel.

536 March 1971

Source : EUROPEAN CHEMICAL NEWS, 1971, 12 MAR.
Location : , GERMANY

Injured : 0 **Dead :** 4

Abstract

Explosion and fire at plastics granulation plant. Fatality.
[processing, fire - consequence]

Lessons

[None Reported]

7 30 January 1967

Source : FIRE PREVENTION, 1967, 76, JUL., 182-183.
Location : Stroud; Gloucestershire,

Injured : 0 **Dead :** 0

Abstract

A fire at a plastics works occurred when expanded polystyrene was fed into a machine for chopping waste material. The machine's rotor blades struck a metal object and ignited pentane vapour released from the expanded material and quickly ignited other material. Normally, a curing period of about fourteen days is allowed for the pentane, which is used in the expansion process, to diffuse out of the expanded polystyrene. On this occasion it is thought that some newly manufactured expanded polystyrene was fed straight into the chopping machine. As it contained a higher percentage of pentane, an accumulation of flammable vapour built up in the chopping machine.
[solids processing, polystyrene expanded]

Lessons

[None Reported]

4398 Date Unknown

Source : LOSS PREVENTION BULLETIN, 023, 141.
Location : ,

Injured : 1 **Dead :** 0

Abstract

During operational activities. An apprentice plater connected a pneumatic hand grinder to the workshop piped oxygen supply instead of the compressed air supply. When he started to use the grinder, his clothing caught fire.
The error was possible because the connections used for air and oxygen were sufficiently similar to enable a connection to be made.
[fire - consequence, burns]

Lessons

[None Reported]

8236 Date Unknown

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

Abstract

A flexible fabric connection became disconnected releasing fine polymer powder into the air. This ignited when in contact with hot surfaces on an extruder. [fire - consequence, flexible coupling failure]

Lessons

Flexible fabric connectors to be improved. Fire fighting facilities to be reviewed, dry powder extinguishers are not suitable for dust fires.

9648 Date Unknown

Source : MANUFACTURING CHEMISTS ASSOCIATION 1966 VOL. 2, CASE HISTORY 618.; LOSS PREVENTION IN THE PROCESS INDUSTRIES, F. LEES.

Location : ,

Injured : 0 **Dead :** 1

Abstract

An operator was in the process of unloading titanium carbide dust from 2ft conical ball mill. He had removed 95% of the material. The mill was being rotated in order to clean it when a dust cloud ignited. He received severe burns from which he later died. The product had been milled to a finer size than desired and thus rendering highly reactive.
[vapour cloud explosion, fatality, solids processing equipment, cleaning, titanium carbide]

Lessons

[None Reported]

10158Date Unknown

Source : ICHEME
Location : , UK

Injured : 1 **Dead :** 0

Abstract

While approaching a horizontal milling machine, a worker lost part of a finger after slipping on some oil. He reached out to save himself and cut his finger. The company pleaded guilty for not securely fencing the cutters on a spline milling machine with a strong guard and was fined for its safety lapse. Special guards have now been fitted to 15 similar machines.
[milling, cutter, inadequate guarding, solids processing equipment]

Lessons

[None Reported]

7860 Date Unknown

Source : DUST EXPLOSION HAZARDS, ICHEME, TRAINING PACKAGES, 022, 4.42.

Location : ,

Injured : 0 **Dead :** 0

Abstract

Explosion in metal pulverising plant. During cleaning with aluminium shovels, an explosion occurred resulting in a fireball and fine manganese dust being emitted from the ball mill return chute. Vent panels 3 and 4 opened at the top of the elevator with an expulsion of flames. Although the maintenance crew were enveloped in a cloud of dust, fortunately this did not ignite and nobody was injured in the incident.
Although the bucket elevator was protected by pressure relief panels, mechanical damage was sustained at the top section.
[solids processing equipment, damage to equipment]

Lessons

Test needed:
1. MIE (minimum ignition energy) to evaluate electrostatic risk.
2. MIT (minimum ignition temperature) to determine sensitivity of dust cloud.
3. 20 litter sphere test for explosion relief design.
4. Train firing tests is not necessary as finely divided materials are known to be pyrophoric when moist.
The potential for thermite sparking in the presence of MnO and MnO2 also needs to be considered.

7711 Date Unknown

Source : CONTROLLING ELECTROSTATIC HAZARDS, ICHEME, SAFETY TRAINING PACKAGE, 016, 4.9.
Location : ,

Injured : 0 **Dead :** 0

Abstract

A flaker explosion. An incident occurred during the production of solid biphenyl flake. A cooled drum rotated slowly through a trough of molten material. A thin layer of solid formed on the drum and was continually scraped off with a knife. The solid broke up into small pieces about 3 to 5 mm square which then fell into a packed out hopper to be bagged off.
The normal melt temperature was about 20 degrees C, below the flash point, but the vapour pressure, though small, was significant in relation to the lower flammable limit (LFL). In fact, at the operating temperature, vapour concentrations were of the order of 40% of the LFL.
The following conclusions were made:
The most likely cause of the incident is that the discharge of static electricity from the charged bulking phenolic resin. Electrostatic discharges would be expected to be commonplace during the flaking process, but the coincidence of a sufficiently high dust concentration, vapour energetic spark would have been relatively rare.
[fire - consequence, solids processing]

Lessons

[None Reported]

7624 Date Unknown

Source : LOSS PREVENTION BULLETIN, 130, 13-15.
Location : ,

Injured : 1 **Dead :** 0

Abstract

A mixer/grinder had been relocated and rebuilt, the only modification during the rebuild had been the positioning and length of the mixer discharge. After various checks and essential work being carried out the plant was declared ready for production and a dry run of 30 minutes duration was carried out.
The material to be produced was made from ground, bleached cotton linters (cotton fibres of length 0.36 mm and apparent density 0.23 g/ml) and resol (a low melting point resin). The manufacturing instructions called for the cotton linters to be charged into the mixer and the resol to be charged first into the grinder which sits ontop of the same mixer and discharges directly into it at a restricted rate. Both materials were charged from a common loading hood and an air operated flap valve was used to direct the material either straight into the mixer - the linters - or into the grinder - the resol. The mixture created was used in the production of a moulding material.
One batch had been completed satisfactorily. Due to operator error or plant malfunction the resol for the second batch was loaded directly into the mixer and the resultant mix of crushed resol and linters was removed for reworking. Batch 3 was produced by the operators who added two kegs of material from batch 2 through the grinder to the mix without incident. Batch 4 was then commenced, the linters being charged directly to the mixer and the resol added via the grinder. One keg of reworked material had been charged through the grinder and the operator was commencing to add the second keg of rework when an explosion occurred. The explosion vented to atmosphere via the explosion relief panels, but also flashed up the charging hood and the operator sustained superficial burns to his face and ears. The emergency procedures were implemented and worked according to plan.
[charging reactor, commissioning]

Lessons

The following recommendations were made:
1. A reliable choke be inserted between the mixer/grinder and charging hood.
2. Separate charging hoods for grinder and mixer should be considered.
3. Controls should have a clear indication of their position.
4. Grinding and mixing plant should be separated by a choke wherever possible to reduce the probability of an ignition source reaching an explosive mixture.
5. The explosion vent should be increased in size.

The following changes of procedure were also made:
1. Resol/cotton mixture should not be ground.
2. The operating procedure should be reviewed, rewritten, understood, accepted and followed by all operators.
3. When movement of equipment or major modification has occurred then an overhaul should be carried out.
4. An adequate maintenance procedure should be drawn up for the equipment.
5. Manufacturing procedures and records should be reviewed with a view to ensuring that management are aware of all operations within their area of responsibility.

7444 Date Unknown

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.

7251 Date Unknown

Source : LOSS PREVENTION BULLETIN, 071, 31.
Location : ,

Injured : 3 **Dead :** 0

Abstract

Three workers were given the task of repairing a fault on an extruder used in the production of polyethylene films; one of the extruder heating elements had failed. First they loosened three of the six flange bolts on the extruder head. As they began to unscrew the remaining bolts, the extruder housing suddenly burst with a loud bang. The work cylinder spun away with considerable force, with the flange cover and the section head.
Fortunately, while loosening the remaining bolts, all three were standing away from the direction of flight of the extruder head as it spun away.
On investigation the following was found:
The extruder is heated by several heating elements. When one heating element failed on the extruder outlet, the equipment became so tight that the extruder was immovable. At the same time, the other heater elements increased their output to compensate for the failure of the defective element. This probably caused a build-up of ethylene gas which was unable to escape, in spite of the presence of openings. This led to a considerable overpressure which, combined with the other forces which had built up during dismantling of the extruder, caused the explosion.
[overpressurisation, repair]

Lessons

The following recommendations were made:
1. New extruders should only be fitted with one locked temperature controller for each heating element (thermostat).
2. When rectifying defects on older extruders which have not been fitted with this type of control equipment, particular care is needed. During dismantling necessitated by faults, steps should be taken in the following order:
1. Workers carrying out the repair should be informed before work commences of the possible dangers caused by the pressure build-up inside the extruder.
2. Each worker must wear full facial protection together with gauntlets.
3. Allow the extruder to cool for at least one to two hours to minimise any pressure build-up.
4. When dismantling the extruder head, loosen all flange bolts equally, a few turns at a time. Do not completely loosen each bolt separately.

7037 Date Unknown

Source : LOSS PREVENTION BULLETIN, 018, 13.
Location : ,

Injured : 0 **Dead :** 0

Abstract

A grinder was being used near the open end of a new pipeline. Unknown to the plant management the contractors had connected up the other end of the pipeline to a live line. The connecting valve leaked, gas came out of the open end leading to an explosion.
[contractor error, construction]

Lessons

If a portable gas detector had been used it would probably of detected the leak.
It should be made clear to all contractors that new equipment must not be connected to existing plant without a special clearance certificate.

11 Date Unknown

Source : SICHERE CHEMIEARBEIT 1985, ISSUE 4 TRANSLATION T85/8/7.
Location : , GERMANY

Injured : 3 **Dead :** 0

Abstract

3 of 6 end bolts of a polyethylene extruder head had been loosened. When the remaining bolts were slackened, the extruder housing suddenly burst and the worm cylinder spun away. On investigation it was found that when a heating element on the extruder outlet failed, the equipment became so stiff that the extruder was no longer moving. At the same time, the other heater elements increased the temperature in order to compensate for the output of the defective component. A build up of ethylene gas occurred due to the decomposition of the polyethylene. This gas was unable to escape in spite of the presence of openings and this led to considerable overpressure which, together with the other forces which had built up during dismantling in the extruder (eg. bending stress with the unequal loosening of the remaining 3 flange bolts) caused the explosion.
[solids processing, overpressurisation]

Lessons

New extruders should only be fitted with one locked temperature controller for each heating element, and a separate temperature controller should be available for the section head.
When rectifying defects on older extruders which have not been fitted with this type of control equipment, particular care is recommended. During dismantling necessitated by faults, steps should be taken in the following order:
a) Workers carrying out the repair should be informed before work commences of the possible dangers caused by the pressure build-up inside the extruder.
b) Allow the extruder to cool down at least 1-2 hours so as to minimize any pressure present.
c) When dismantling the extruder head, loosen all flange bolts equally and do not first loosen one bolt completely.
d) Each worker involved must wear sufficient facial protection together with gauntlets.

12846Date Unknown

Source : QUARTERLY SAFETY SUMMARY, 1973, VOL.44, NO. 175.

Location : ,

Injured : 2 **Dead :** 0

Abstract

An explosion occurred during the handling of dry silver oxalate. The incident occurred following the preparation of silver oxalate. The wet, filtered salt was oven dried for several days at 50 degrees C maximum. An operator was instructed to grind the material to a powder using an end runner grinder (a mechanical pestle and mortar), the quantity being approximately 1 kg. The grinder was set up with the material in the mortar and the weighted pestle inserted. The operator then turned on the motor.

Almost immediately an explosion occurred seriously injuring the operator and another nearby.

It is thought that the cause of the explosion may have been due to local overheating during grinding, though as the explosion was almost instantaneous, it is probable that impact detonation could have been the cause.

[solids processing, injury]

Lessons

Silver oxalate is explosive above 140 degrees C and the explosion hazard to moderate when exposed to heat.

12856Date Unknown

Source : QUARTERLY SAFETY SUMMARY, 1976, VOL.46, NO's. 183, 184.
Location : ,

Injured : 1 **Dead :** 0

Abstract

Hot polymer ejected from an extruder whilst an instrument artificer was removing a pressure transducer. The artificer was splashed in the face causing minor burns.
The correct procedure had been followed by the artificer in checking that no pressure was indicated but the extruder had been standing for five hours at an elevated temperature (275 degrees C). It is thought that polymer had degraded, although the reason for the eruption is not known.
[maintenance, gas / vapour release, overpressurisation, injury]

Lessons

The following recommendations were made:
It is essential that a check is made for any pressure existing and that anyone carrying out any work on the equipment wears a face shield.

12982Date Unknown

Source : LOSS PREVENTION BULLETIN 146, 3-4.
Location : ,

Injured : 0 **Dead :** 0

Abstract

An explosion occurred at a plastics manufacturing plant. The incident occurred when water accumulated in the bottom of the piping below the grinder and eventually reached a point where the water pressure was sufficient to activate the chlorofluorocarbon system. As the pipes and ducts were partially filled with water, and the plastic powder was wet and did not flow freely, the chlorofluorocarbon suppressing agent was unable to flow easily through the system. The pressure of the chlorofluorocarbon release into the grinder was sufficient to overpressurise it resulting in failure of the grinder the grinding door blew off. There was a view port, which operators used to inspect the grinder, in the door. Fortunately no one was in the area at the time of the incident.
The potential pressure build-up in the grinder was estimated. Some plant personel were surprised that the grinder door blew off at the calculated pressure since it looked like a strong piece of equipment. The door that blew off weighed several hundred pounds, and was made of thick metal. However, in fact the grinder would not only withstand an internal pressure of 15-20 psig, and the grinder drawings indicated that it was not rated for any internal pressure. The door was held on by four bolts, which were the weak point in the system. Equipment which looks strong may not really be very stong at all.
[overpressurisation, processing]

Lessons

The following lessons were learnt:
This is an example of the importance of identifying and evaluating all potential failure modes when designing a system. The explosion suppression system was designed and specified assuming that the grinder and its associated piping would be filled with dry, free-flowing powder it the system was triggered. The scenario in which water entered the system, triggered the suppression system and simultaneuosly restricting the ability of the chlorofluorocarbon suppressing agent to flow freely through the process resulting in overpressurising of the grinder, was not recognised.
The result of this incident was redesign of this particular system, and a thorough review of other similar hazards.
1. The area around the grinder was restricted from personnel access while the grinder was in operation, and barricades were installed.
2. the view ports for inspection of the grinding operation were relocated away from the grinder.
3. The number if chlorofluorocarbon suppressing agent bottles was reduced, still providing adequate explosion protection but reducing the amount of chlorofluorocarbon discharge into a potentially closed system.
4. Drain valves were added to prevent water build-up.
5. Alternative explosion detection and explosion suppression systems are being evaluated.