

Manufacturing Chemists' Association, Inc.

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TO THE EXECUTIVE CONTACTS OF MEMBER FIRMS

SUBJECT: Case Histories of Accidents (including Fires and Explosions).

Member firms are urged to send the MCA Washington Office an account of accidents (or near accidents) which they believe should be included in this report. Factual information on such occurrences is desired whether or not occupational injuries are actually involved, and regardless of the exact nature of their results.

CASE HISTORY NO. 953

Cylinder Refilling

Description: In the set-up in the safety department for refilling Pneolator Oxygen cylinders, (21 cubic ft. capacity cylinders) the larger Oxygen cylinders from the supplier are used. Such cylinders are located on the outside of the building and connected by a 3000 lb. tested stainless steel tubing running through the wall and to directly over a work bench, a distance of approximately 15 feet to the valve. The regulator is attached to the valve at this point and the regulator that had previously been used was approximately 6½ years old. The gauges were not operating properly and it was decided that a new regulator would replace the older one.

A new regulator was ordered from the manufacturer locally and when the same arrived was taken directly from the packing box in which it arrived and placed on the valve. One hour previous to installation of the new regulator, the entire line leading from the large cylinder located outside the building was blown out as a precaution and to eliminate any foreign materials. This was done by opening the valve on the large Oxygen cylinder and blowing out same.

When the new regulator was tightened and in place, the gauge on the outside cylinder was opened slowly and Oxygen was permitted to flow through the line and into the valve located inside the building which was closed. The inside valve was opened slowly and the gauge on the high pressure side of the regulator showed a pressure of between 2000 and 2100 lbs. on the gauge. This was permitted to stand this way for approximately 1 minute at which time the screw valve was turned to permit Oxygen to flow to the low pressure side of the regulator. When the screw valve had been turned clockwise about ¼ turn, a terrific explosion occurred and belching flames and molten metal spewed over the immediate area. Molten metal from three holes in the regulator was found

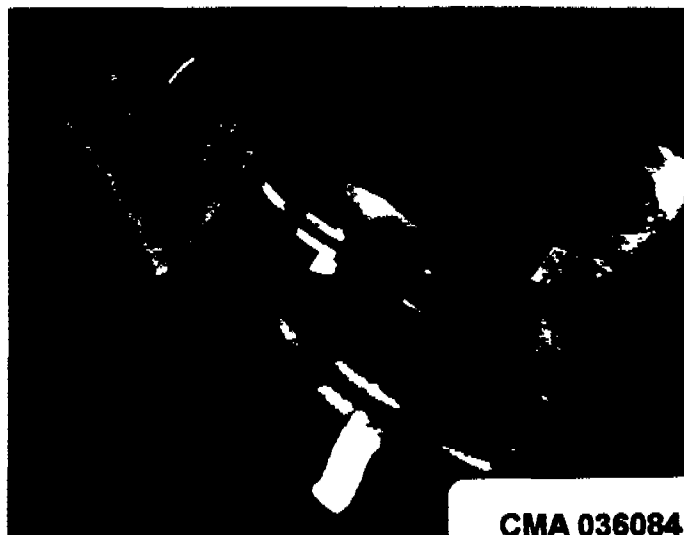
as far away as twenty feet.

A pad of unused matches with the cover closed was lying on a table approximately 8 feet from the explosion. Investigation revealed that all had been ignited within the pad and the cover was not even scorched.

The safety director was turning the screw valve on the regulator and standing approximately 5 degrees to the left of center of the regulator. The explosion blew one hole on the left side of the bell housing, another on the right and downward and another in the rear at the bottom of the flange. He received second and third degree burns on the right thumb and index fingers as this was the hand being used to turn the screw valve. His clothing was burned from hot metal.

A safety inspector who had been outside to turn the valve on the large Oxygen cylinder had just walked in the door approximately fifteen feet away from the regulator when the explosion occurred. He was blown back out the door approximately 8 feet.

(It might be well to note that nothing was attached to the outlet line of the regulator at the time of the incident inasmuch as they were only checking to see if the regulator was satisfactory.)



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Cause: It is probable that either grease or oil had been permitted to enter the inside of the regulator accounting for the explosion.

Preventive Measures: A testing program has been introduced for all regulators, new or old. They will be placed in position on the line and Oxygen will be fed from outside the building with no personnel permitted inside while the test is occurring.

CASE HISTORY NO. 954

Gas Explosion

Description: The desired temperature of a sulfuric burner in a sulfuric acid plant had been reached (1800°F) by burning of a propane gas mixture. The gas burning equipment then was shut down by pushing two electrical control buttons which closed two 2½" and two ½" electrically operated valves. Following the closing of the gas valves, the main air blower that supplied combustion air for the gas was shut down.

Approximately ten minutes after the burner had been shut down, two men were requested to remove a blind flange from a 4" nozzle on the vaporizer cover. The vaporizer is a tank 6'-0" in diameter x 8' high located adjacent to the sulfur burner and connected by an 8" pipe. One employee was standing on top of the vaporizer and the other employee (injured) was standing on a stepladder alongside of the tank. His face was about level with the 4" nozzle. There was a sudden explosion and a flash of flame came out of the nozzle burning the injured on the face, neck and upper chest. In trying to get away, he fell and lacerated his knee.

Cause: Investigation revealed that failure to close the primary gas cocks was the cause of the accident. The Investigation Committee believes the explosion was caused by gas leaking past one or more of the electrically operated shut-off valves. A hot brick surface was present and when sufficient gas accumulated to produce a combustible mixture, it exploded.

Preventive Measures: A thorough review of operating techniques with all operators, particularly infrequent start-up and shutdown practices.

CASE HISTORY NO. 955

Inhalation of Chlorine Gas

Description: An employee was engaged in charging chlorine cylinders. This involves the connecting of a full one ton cylinder to the distribution system, and disconnecting the empty cylinder. Present practice has been to

have cannister type gas masks at the job location, but not to wear them. In this case, the gas masks were present, but were not being worn.

The chlorine cylinder station is located outside. The employee, who had performed this job many times, had checked the isolating valve to see that it was closed tight and then proceeded to remove the 3/4" steel pipe plug from the free end of a three foot length of 5/16" copper tubing. When the plug became loose, a quantity of chlorine gas was released and inhaled by the employee.

Cause: Investigation revealed that a procedure was written several years ago that required the wearing of a gas mask while performing this operation, but the short cut of having it present but not wearing it has been substituted.

Preventive Measures: The procedure will be reviewed with supervision and a gas mask will be worn by persons performing this operation.

CASE HISTORY NO. 956

Acid Sprayed While Thawing Line

Description: An employee was heating a cast iron acid line containing 99% sulfuric acid to thaw the line. While trying to establish flow by heating the line, the acid sprayed out from a crack in the line into the employee's face. The employee's injuries consisted of second degree acid burns about the face and hairline, neck, and forehead. In addition, he sustained severe corneal burns to both eyes.

Cause: Investigation revealed that the cast iron pipe cracked from heating the line. The employee was wearing safety glasses but should have been wearing safety goggles or a face shield.

Preventive Measures: Acid line will be steam traced and insulated to prevent freezing. Employees have been instructed in the use of protective clothing, face shields and safety goggles.

CASE HISTORY NO. 957

Beaker Containing Lead Styphnate Exploded

Description: An employee was removing a beaker of lead styphnate (lead 2,4,6-trinitroresorcinate) from a laboratory oven. He grasped the beaker with his left hand and, as he turned, he apparently bumped the beaker on the side or bottom of the oven opening and a detonation occurred. The detonation propagated to the other two beakers in the oven and all three detonated. The man's injuries consisted of perforated colon, lacerations to arms, abdomen and hands and perforated ear.

Cause: The causes of the accident were:

1. Inadvertent mishandling of explosives.
2. Drying explosives in glass beakers.
3. Possibility of detonation from impact during handling while hot and dry.
4. Flaw in beaker from thermo effects.

Preventive Measures:

1. All ovens shall be equipped with upper limit temperature control and grounded.
2. Drying lead styphnate for the purpose of determining the average granulation size weight will be accomplished by weighing in water using a pycnometer.
3. Handling of dry explosives will be eliminated whenever possible and use of glassware will be minimized.

CASE HISTORY NO. 958

Possible Static Electricity Flashes Flammable Vapors

Description: An employee was renewing the filter "heel" on the screen of a centrifuge. The old "heel" powder had been scraped off and the screen flushed with a vehicle. The fresh powder was stored in a leverpak with a polyethylene drum liner. Because the drum was nearly empty, the employee dumped the powder directly from the liner into the centrifuge. It was at this time that a flash occurred. The employee received minor and moderate burns to both arms, face, ears, and neck. Two maintenance employees who were standing by to close up the centrifuge received moderate burns on their arms as they assisted the employee from the area.

Cause:

1. High level of fumes inherent in process.
2. Possible static charge created by powder flowing from the polyethylene bag.

Preventive Measures:

1. Operator to wear aluminized jacket and hood with air supply.
2. Flushing with vehicle will be discontinued.
3. A grounded aluminum scoop will be used to apply fresh powder.
4. Additional grounding of centrifuge to be provided.
5. Use of polyethylene drum liners will be discontinued.
6. Block valves to be installed on centrifuge to limit vehicle fumes.

CASE HISTORY NO. 959

Ammonia - Leaking Control Valve

Description: Employees were starting up a

granulation operation after a four hour shutdown. They were in the plant control room. As the granulator started rotating, liquid ammonia, which had leaked past the closed valves, vaporized rapidly, overtaking the fume collecting system and billowed out. The doors at the discharge end of the granulator were open for observation, and the ammonia vapors flowed out and into the control room just as the employees were leaving to inspect the granulator product exit. The employees were forced to retreat and leave the room through an exit behind the control panel, which exposed them again to heavy ammonia concentrations. One employee was hospitalized.

Cause: Ammonia which leaked past two closed manual block valves, and a closed automatic control valve, did not vaporize because it was trapped by crusted material or because the sparger nozzles were plugged.

Also, the granulator fume collection duct and the duct entering the primary scrubber were partially blocked.

(Note: The vapors discharged so rapidly, employees did not have time to don protective masks and leave the control room which is in direct line with the granulator discharge. The door in front made it necessary for the employees to exit from the room via a door behind the control panel which opens alongside the granulator.)

Preventive Measures: The leaking control valve has been repaired and the two block valves are being replaced.

The granulator fume system will be cleaned regularly and the plant will not be operated unless there is sufficient draft on the fume collection system. Also, a spray has been installed in the duct entering the primary scrubber to prevent blockage at this point.

A door is being installed at one end of the control room to provide another emergency exit.

CASE HISTORY NO. 960

Explosion - Sight Glass Failure

Description: Trying to repair a leaky sight glass on a vessel under pressure was the primary cause for a chemical plant explosion and fire that resulted in 7 deaths, 2 critical injuries and property damage exceeding \$4 million.

The 85' x 85' building with drying and packaging area attached contained 20 - 2,000 gallon reactors used in the manufacture of polyvinyl chloride, (PVC). All electrical equipment was explosion-proof and the building was ventilated at 20 air changes an hour.

One reactor had trouble with the 6 inch

sight glass which had a light above it. The lead and asbestos gasket and sight glass were replaced and the vessel put on stream. The foreman noted that at 140°F. and 140 p.s.i.g., the system was tight, but while the maintenance men were in the building to repair a valve on another reactor, they were asked to check the sight glass. A small leak was observed and a maintenance man tightened the nuts with an open end wrench (not a torque wrench). On the second round of tightening, a one inch ribbon stream of water and vinyl chloride suddenly shot out and knocked the man down. He was bleeding from the face and escorted out of the building. Regular emergency procedures were started immediately, e.g., windows and doors were opened, steam to reactor shut, additions stopped, and the manual vent to the reactor opened.

An operator was overcome by vapors and carried out. Five minutes later a tremendous explosion occurred, ripping the building to pieces. The contents of 18 reactors were dumped but there was very little fire in the building. The explosion wrecked the sprinkler system and the Post Indicator Valve could not be reached. Pressure dropped to zero in critical locations. There evidently wasn't a sprinkler line loop on this area. A warehouse, laboratory and office building 150' x 800', was 60 feet south of the building. A wall was blown down, several small fires started and propagated along the roof. The roof caved in and the building burned several days, to complete destruction. The sprinkler pressure was zero in this area. The boiler and maintenance building 80 feet to the north, was extensively damaged and other surrounding buildings also were damaged to varying degrees. Windows in homes were shattered and some homes evacuated.

Of the dead, one was found in the dryer room attached to the building. Four bodies were found outside, between the building and the warehouse, indicating that conditions had changed from emergency to evacuation within a five minute period. One fatality occurred in the boiler room, 80 - 100 feet away.

Cause: The investigators feel that the 6 inch sight glass shattered completely, causing a sudden build-up of flammable vinyl vapors which found an unknown source of ignition. Possibly glass fragments broke the ceiling lights.

CASE HISTORY NO. 961

Plugged Transfer Line

Description: An operational difficulty, poor communications, and faulty judgment resulted

in a steam burn and 2 days of lost time. A section of transfer line between 4 stills became plugged with tars and could not be unplugged with solvent or nitrogen. A cap on a branch section of piping was removed and high pressure steam connected. At the sections of the line that were free, valves were set to permit condensate to bleed to the floor. The section leading in the other direction was plugged and valves to these stills opened wide. At shift change the outgoing supervisor informed the incoming supervisor of the conditions and explained in detail the positions of the valves on the transfer line. Without direction from either supervisor, and without notifying the supervisors, an incoming operator noticed the condensate coming from the end of a bonded hose and shut 3 valves on this system. The supervisor went to check about 10 minutes later, saw only drops of condensate coming from the bonded hose and opened a plug cock on this line to check steam conditions. As soon as the condensate drained out, a sudden gush of steam caused the unsecured hose to whip and steam contacted his legs. He applied cold water and was transported to Plant Health.

Preventive Measures: Use of high pressure steam for this purpose is very hazardous. A memo from the plant management has been issued, re-emphasizing to supervision that it should not be done. The operator obviously should not have touched the valves without finding out why the condensate was flowing. The department head has instructed his supervisors to transmit information on unusual conditions or procedures by personally visiting the site. Flexible hose should not be permitted to hang loose on any system that can be under pressure. Either detach it completely or secure it and direct it away from personnel. Plant management has re-emphasized this directive as well.

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