Major Industrial Disasters in India

During the last several decades there has been a growing awareness of the expanding risks and consequences of major industrial disasters. This is reflected in official statistics, mass media reports, and the appearance of new public institutions that address the problem. The growth of industrial accident prevention companies and the blossoming of literature on industrial risk assessment are other expressions of the same trend.

Industrial disasters are not simply safety problems that need to be resolved: they also have wider significance because they offer important opportunities to learn about the "goodness of fit" between society, technology, and environment and about how that fit can be strengthened or weakened by unexpected events. This is the kind of information that will be invaluable to humanity during an era of deep and far-reaching societal and environmental change. However, if we are to make optimal use of such opportunities it may be necessary to modify the way we think about industrial disasters.

It is customary to view industrial disasters as "extreme events" that are different mainly in degree from more mundane disruptions to which industries and society have become adjusted. It is time to make a clear distinction between two types of industrial disasters - "routine" disasters and "surprises". Routine disasters are well understood by experts and susceptible to management using long-established principles and practices. They constitute the great majority of threats to human populations.

Successful management of routine disasters mainly requires that society put into practice the ample stocks of knowledge and experience about them that already exist. Surprises, which confound both expert and lay expectations, are quite different and much less understood. They include disasters like Bhopal and Chernobyl and Minamata events or their consequences or both - that lie outside the realm of previous experience. Because surprises are unprecedented events, it is difficult to design specific anticipatory measures of the kind that have proved successful in reducing routine hazards.

Industrial hazards are threats to people and life-support systems that arise from the mass production of goods and services. When these threats exceed human coping capabilities or the absorptive capacities of environmental systems they give rise to industrial disasters. Industrial hazards can occur at any stage in the production process, including extraction, processing, manufacture, transportation, storage, use, and disposal. Losses generally involve the release of damaging substances (e.g. chemicals, radioactivity, genetic materials) or damaging levels of energy from industrial facilities or equipment into surrounding environments. This usually occurs in the form of explosions, fires, spills, leaks, or wastes.

http://archive.unu.edu/unupress/unupbooks/uu21le/uu21le03.htm
The Bhopal disaster, also referred to as the Bhopal gas tragedy, was a gas leak incident in India, considered the world's worst industrial disaster. It occurred on the night of 2–3 December 1984 at the Union Carbide India Limited (UCIL) pesticide plant in Bhopal, Madhya Pradesh. Over 500,000 people were exposed to methyl isocyanate (MIC) gas and other chemicals. The toxic substance made its way in and around the shanty towns located near the plant.

Estimates vary on the death toll. The official immediate death toll was 2,259. The government of Madhya Pradesh confirmed a total of 3,787 deaths related to the gas release. A government affidavit in 2006 stated the leak caused 558,125 injuries including 38,478 temporary paral injuries and approximately 3,900 severely and permanently disabling injuries.

The cause of the disaster remains under debate. The Indian government and local activists argue slack management and deferred maintenance created a situation where routine pipe maintenance caused a backflow of water into a MIC tank triggering the disaster. Union Carbide Corporation (UCC) contends water entered the tank through an act of sabotage.

Overview of events that led to the Bhopal disaster

In November 1984, most of the safety systems were not functioning and many valves and lines were in poor condition. In addition, several vent gas scrubbers had been out of service as well as the steam boiler, intended to clean the pipes. Another issue was that Tank 610 contained 42 tons of MIC, more than safety rules allowed for. During the night of 2–3 December 1984, water entered a side pipe that was missing its slip-blind plate and entered Tank E610 which contained 42 tons of MIC. A runaway reaction started, which was accelerated by contaminants, high temperatures and other factors. The reaction was sped up by the presence of iron from corroding non-stainless steel pipelines.[7] The resulting exothermic reaction increased the temperature inside the tank to over 200 °C (392 °F) and raised the pressure. This forced the emergency venting of pressure from the MIC holding tank, releasing a large volume of toxic gases. About 30 metric tons of methyl isocyanate (MIC) escaped from the tank into the atmosphere in 45 to 60 minutes. The gases were blown in southeastern direction over Bhopal.

The initial effects of exposure were coughing, severe eye irritation and a feeling of suffocation, burning in the respiratory tract, blepharospasm, breathlessness, stomach pains and vomiting. People awakened by these symptoms fled away from the plant. Those who ran inhaled more than those who had a vehicle to ride. Owing to their height, children and other people of shorter stature inhaled higher concentrations. Thousands of people had died by the following morning.

Primary causes of deaths were choking, reflexogenic circulatory collapse and pulmonary oedema. Findings during autopsies revealed changes not only in the lungs but also cerebral oedema, tubular necrosis of the kidneys, fatty degeneration of the liver and necrotizing enteritis. The stillbirth rate increased by up to 300% and neonatal mortality rate by around 200%.

http://www.hrdp-idrm.in/e5783/e17327/e24075/ e27316/

Chasnala Mining Disaster 1975

The Chasnala Mine Disaster occurred on the evening of 27 December 1975, and killed 372 miners in Dhanbad, India. On 27 December 1975, an explosion rocked the Chasnala Colliery in Dhanbad, India. The explosion was most likely caused by sparks from equipment igniting a pocket of flammable methane gas. Even a small spark can ignite the surges of gas that may suddenly fill a mine. Clouds of coal dust raised by the explosion and accompanying shock wave contribute to these sorts of mine explosions, making the flames self-sustaining.

The Chasnala Colliery explosion was so severe that the mine collapsed, and millions of gallons of water from a nearby reservoir rushed into the pits at a rate of seven million gallons per minute. Those miners who weren't killed in the blast now found themselves trapped under debris, or drowned as the water quickly filled the mine. Rescue workers continued their efforts to dig out bodies and survivors until 19 January 1976. Sadly, there were no survivors, and most of the bodies were never recovered.

The local workers' union claimed a total death toll of almost 700 people. The government's official death toll, however, is 372. The Chasnala Colliery's records were poorly kept, and many bodies were never recovered, so there is no way of knowing how many miners actually perished in the Chasnala Mine Disaster.

The lake that sank and killed 372 miners at Chasnala

[Image of a lake and miners]

In the immediate aftermath, the plant was closed to outsiders (including UCC) by the Indian government. The initial investigation was conducted entirely by the Council of Scientific and Industrial Research (CSIR) and the Central Bureau of Investigation. Union Carbide organized a team of international medical experts, as well as supplies and equipment, to work with the local Bhopal medical community, and the UCC technical team began assessing the cause of the gas leak.

The health care system immediately became overloaded. Medical staffs were unprepared for the thousands of casualties. Doctors and hospitals were not aware of proper treatment methods for MIC gas inhalation.

Long-term health effects

Some data about the health effects are still not available. A total of 36 wards were marked by the authorities as being "gas affected," affecting a population of 520,000. Of these, 200,000 were below 15 years of age, and 3,000 were pregnant women. The official immediate death toll was 2,259, and in 1991, 3,928 deaths had been officially certified. The government of Madhya Pradesh confirmed a total of 3,787 deaths related to the gas release. Later, the affected area was expanded to include 700,000 citizens. A government affidavit in 2006 stated the leak caused 558,125 injuries including 38,478 temporary partial injuries and approximately 3,900 severely and permanently disabling injuries.

A number of clinical studies are performed. The quality varies, but the different reports support each others. Studied and reported long term health effects are:

Eyes: Chronic conjunctivitis, scars on cornea, corneal opacities, early cataracts
Respiratory tracts: Obstructive and/or restrictive disease, pulmonary fibrosis, aggravation of TB and chronic bronchitis
Neurological system: Impairment of memory, finer motor skills, numbness etc.
Psychological problems: Post traumatic stress disorder (PTSD)
Children's health: Peri- and neonatal death rates increased. Failure to grow, intellectual impairment etc.

Missing or insufficient fields for research are female reproduction, chromosomal aberrations, cancer, immune deficiency, neurological sequelae, post traumatic stress disorder (PTSD) and children born after the disaster. Late cases that might never be highlighted are respiratory insufficiency, cardiac insufficiency (cor pulmonale), cancer and tuberculosis.

http://en.wikipedia.org/wiki/Bhopal_disaster

The Chasnala Disaster inspired the 1979 film Kaala Patthar, directed by Yash Chopra.

The Chasnala Disaster was one of the worst in Indian history. The nationalization of Indian mining since then has contributed to a significant decrease in the incidence of mining accidents in that country.

http://en.atropedia.net/article:5b5017

**Jaipur Oil Depot Fire, 2009**

The Jaipur oil depot fire broke out on 29 October 2009 at 7:30 PM (IST) at the Indian Oil Corporation (IOC) oil depot's giant tank holding 8,000 kilolitres (280,000 cu ft) of oil, in Sitapura Industrial Area on the outskirts of Jaipur, Rajasthan, killing 12 people and injuring over 200. The blaze continued to rage out of control for over a week after it started and during the period half a million people were evacuated from the area. The oil depot is about 16 kilometres (9.9 mi) south of the city of Jaipur.

The incident occurred when petrol was being transferred from the Indian Oil Corporation's oil depot to a pipeline. There were at least 40 IOC employees at the terminal, situated close to the Jaipur International Airport) when it caught fire with an explosion. The Met department recorded a tremor measuring 2.3 on the Richter scale around the time the first explosion at 7:36 pm which resulted in shattering of glass windows nearly 3 kilometres (1.9 mi) from the accident site.

http://www.dailymail.co.uk/news/article-1224018/Five-killed-150-injured-massive-rages-Indian-oil-depot.html

The fire was a major disaster in terms of deaths, injury, loss of business, property and man-days, displacement of people, environmental impact in Jaipur. As per eyewitnesses having factories and hotels around Indian Oil's Sitapura (Jaipur) Oil Terminal they felt presence of petrol vapour in the atmosphere around 4:00 p.m. on 29 October 2009. Within the next few hours the concentration of petrol vapour intensified making it difficult to breathe. The Ayush Hotel in the vicinity of the terminal asked all its guests to vacate the Hotel to avert any tragedy. Adjacent to the Terminal wall was the workshop of Morani Motors (P) Limited whereas per eyewitnesses the Cars parked on the roof top were thrown up in Air to about 10 feet and 35 new Hyundai brand cars were completely damaged. The police, civil administration and fire emergency services were oblivious of the situation developing in Indian Oil Terminal.

Around half past six the staff in the terminal had contained the leak and flow of petrol panicked and reported the matter to nearby Sanganer Sadar Police Station. Within the next 30 minutes the local police chief and District Collector were on the spot along with Indian Oil general manager, but with no plan to deal with the situation. The nearby industries, which were running second shifts, were cautioned to vacate the area.

At 7:35 p.m. a huge ball of fire with loud explosion broke out engulfing the leaking petrol tank and other nearby petrol tanks with continuous fire with flames rising 30–35 m (98–115 ft) and visible from a 30 km (19 mi) radius. The traffic on adjacent National Highway No. 12 was stopped leading to a 20 km (12 mi) long traffic jam. The Jaipur International Airport is just 5 km (3.1 mi) away from the accident site.

Both the Army and experts from Mumbai were employed on 30 October 2009 to contain the fire, which started when an oil tanker caught fire at the depot in the Sitapura Industrial Area. The district administration disconnected electricity and evacuated nearby areas to limit the damage.

The fire still raged on 31 October 2009, in the Indian Oil Corporation Depot, at Jaipur, after a defective pipe line leak that set fire to 50,000 kilolitres (1,800,000 cu ft) of diesel and petrol out of the storage tanks at the IOC Depot. By then, the accident had already claimed 11 lives and seriously injured more than 150. The District Administration and Indian Oil Corporation had no disaster management plan to deal with this kind of calamity. The local fire officers were ill equipped to deal with fire accidents of this magnitude. They remained onlookers and no efforts were made to breach the terminal wall to get closer to kerosene and diesel tanks to cool them with water jets.

**Korba Chimney Collapse, 2009**

The 2009 Korba chimney collapse occurred in the town of Korba in the Indian state of Chhattisgarh on 23 September 2009. It was under construction when under contract for the Bharat Aluminium Co Ltd (BALCO). Construction had reached 240 m (790 ft) when the chimney collapsed on top of more than 100 workers who had been taking shelter from a thunderstorm. At least 45 deaths were recorded.

Plans specify a 275-metre (902 ft) chimney for the construction of a thermal power plant by BALCO, which is owned by Vedanta Resources. The incident happened during extreme weather conditions involving lightning and torrential rainfall. Workers sought shelter from the rain in a nearby store room, and a lightning strike at approximately 16:00 brought the chimney down on top of them.

A rescue attempt was initiated following the collapse. Ongoing rain obstructed efforts to retrieve the trapped workers. At least seven of the wounded were hospitalised.

An investigation is ongoing to determine the cause of the collapse. BALCO initially did not discuss the incident in full, stating only that "[t]here is an accident and some people are injured"; claiming to be too busy with the rescue effort to make a longer statement. The state government believes that BALCO had been "overlooking security aspects".

In November 2009, the project manager from GDCL was arrested, as well as three officials from Vedanta Resources which manages BALCO. Later the National Institute of Technology (NIT) Raipur observed that the materials were of substandard quality and technically faulty in design. NIT also concluded that there was improper water curing and that soil at the site was not up to code. Additionally, supervision and monitoring was found to be negligent.


**Mayapuri Radiological Incident, 2010**

In April 2010, the locality of Mayapuri was affected by a serious radiological accident. An AECL GammaCell 220 research irradiator owned by Delhi University since 1968, but unused since 1985, was sold at auction to a scrap metal dealer in Mayapuri on February 26, 2010. The orphan source arrived in scrap yard in Mayapuri during March, where it was dismantled by workers unaware of the hazardous nature of the device. The cobalt-60 source was cut into eleven pieces. The smallest of the fragments was taken by Ajay Jain who kept it in his wallet, two fragments were moved to a nearby shop, while the remaining eight remained in the scrap yard. All of the sources were recovered by mid-April and transported to the Narora Atomic Power Station, where it was claimed that all radioactive material originally contained within the device was accounted for. The material remains in the custody of the Department of Atomic Energy.

One of the main business at Mayapuri is the recycling of metal scraps and sale of salvage vehicle parts. It is, arguably, the biggest market for used automotive and industrial spare parts in India. Many traders from all over India come here to sell or purchase old auto parts. Many small workshops specialized in different metals are active in the Mayapuri area. The safety of the scrap yards became a concern after the radiological accident which occurred in April 2010. The area is not equipped with
radation detectors or porcs, despite being a common practice in steel recycling factories in the US and in most of the European countries. The presence of toxic heavy metals and of harmful chemicals in the waste generated by these activities presents a direct menace for the health of several ten thousands of people living in the area.

Eight people were hospitalized as a result of radiation exposure, where one later died. Five patients suffered from the haematological form of the acute radiation syndrome and local cutaneous radiation injury as well. While four patients exposed to doses between 0.6 and 2.8 Gy survived with intensive or supportive treatment, the patient with the highest exposure of 3.1 Gy died due to acute respiratory distress syndrome and multi-organ failure on Day 16 after hospitalization. The incident highlights the current gaps in the knowledge, infrastructure and legislation in handling radioactive materials. Medical institutions need to formulate individualized triage and management guidelines to immediately respond to future public radiological accidents.

The Bombay Docks Explosion (or Bombay Docks Explosion) occurred on 14 April 1944, in the Victoria Dock of Bombay (now Mumbai) when the freighter SS Fort Skine carrying a mixed cargo of cotton bales, gold, and ammunition including around 1,400 tons of explosives, caught fire and was destroyed in two giant blasts, scattering debris, sinking surrounding ships and setting fire to the area killing around 800 people. The SS Fort Skine was a 7,142 gross register ton freighter built in 1942 in Prince Rupert, British Columbia, under a lend-lease agreement, and was named after Fort Stikine, a former outpost of the Hudson's Bay Company. Sailing from Birkenhead on 24 February via Gibraltar, Port Said and Karachi, she arrived at Bombay on 12 April 1944. Her cargo included 1,395 tons of explosives including 238 tons of sensitive "A" explosives, torpedoes, mines, shells, munitions, Supermarine Spitfire fighter aircraft, raw cotton bales, barrels of oil, timber, scrap iron and approximately £890,000 of gold bullion in bars in 31 crates. The 87,000 bales of cotton and lubricating oil were loaded at Karachi and the ship's captain, Alexander James Naismith, recorded his protest about such a "mixture" of cargo. The transportation of cotton through sea route was inevitable for the merchants, as transporting cotton in rail from Punjab and Sindh to Bombay was banned at that time. The vessel had berthed and was still awaiting unloading on 14 April, after 48 hours of berthing.

In the mid-afternoon around 14:00, the crew were alerted to a fire onboard burning somewhere in the No. 2 hold. The crew, dockside fire teams and fireboats were unable to extinguish the conflagration, despite pumping over 900 tons of water into the ship, nor were they able to find the source due to the dense smoke. The water was boiling all over the ship, due to heat generated by the fire.

At 15:50 the order to abandon ship was given, and sixteen minutes later there was a great explosion, cutting the ship in two and breaking windows over 12 km (7.5 mi) away. The two explosions were powerful enough to be recorded by seismographs at the Colaba Observatory in the city. Sensors recorded that the earth trembled at Shimla, a city located at a distance of over 1700 km. The shower of burning material set fire to slums in the area. Around two square miles were set ablaze in an 800 m (870 yd) arc around the ship. Eleven neighbouring vessels had been sunk or were sinking, and the emergency personnel at the site suffered heavy losses. Attempts to fight the fire were dealt a further blow when a second explosion from the ship swept the area at 16:34. Burning cotton bales fell from the sky on docked ships, on the dock yard, and on slum areas outside the harbour. The sound of explosions was heard as far as 50 miles (80 km) away. Some of the most developed and economically important parts of Bombay were wiped out because of the blast and resulting fire.

The total number of lives lost in the explosion is estimated at more than 800, although some estimates put the figure around 1,300. The results of the explosion are summarized as follows:

- 231 people killed were attached to various dock services including fire brigade and dock employees.
- Of the above figure, 66 firemen were killed
- More than 500 civilians were killed
- Some estimates put total deaths up to 1300
- More than 2500 were injured, including civilians
- 13 ships were lost and some other ships heavily or partially damaged
- Out of above, three Royal Indian Navy ships lost
- 31 wooden crates, each containing four gold bars, each gold bar weighing 2 stones (actually 800 Troy...
EVENT

The educational visits of the nurses of BJ Medical College Ahmedabad and JG Nursing College Ahmedabad were held on 10th and 12th November respectively. They were informed about the activities of NIOH and ENVIS NIOH A presentation about ENVIS NIOH centre activities were given by Ms Annie Soju, Programme Officer and Ms. Prarthana Trivedi, Information Officer. Mr. Deepak Purohit, IT Assistant gave an overview about the ENVIS NIOH Website. Ms. Shru Patel helped in getting the questionnaire filled by the visitors.

For queries/feedback visit: www.niohenvis.nic.in/feedback OR write to
ENVIS Coordinator, National Institute of Occupational Health, Meghani Nagar, Ahmedabad-380016, Gujarat. Tel. 079-22682868; 22688838

Web links

- http://www.hrdp-idrm.in/e5783/e17327/e24075/e27316/
- http://en.atropedia.net/article:5b5017
- http://en.wikipedia.org/wiki/Mayapuri

The inquiry into the explosion identified the cotton bales as probably being the seat of the fire. It was critical of several errors: storing the cotton below the munitions, not displaying the red flag required to indicate a dangerous cargo on board, delaying unloading the explosives, not using steam injectors to contain the fire and a delay in alerting the local fire brigade.


An Awareness programme was held in the ceramic units of Ahmedabad on 8th November 2014 to impart awareness about the occupational health problem in them. They were also told about the health hazards due to exposure to heat, warning signs of heat strokes and the protective measures need to be taken. Mr. Joydeep Majumder, Scientist B was also invited for the awareness programme.