Case Study: Bhopal Gas Tragedy

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Abstract— Bhopal is known for one of the biggest industrial disaster, known as Bhopal Gas Tragedy. The disaster occurred in the capital of Madhya Pradesh, Bhopal at a pesticide plant, on 2-3 December 1984. The disaster is caused due to the leakage of excessive amount of MIC gas, that caused the huge amounts of death and severe injuries to the people being caught by the dangerous gas. Due to this, Bhopal Gas Tragedy is known to be the worlds most dangerous industrial disaster. In this case study, the author has explained about the happenings in the disaster, its reasons and has also suggested some points to avoid such kinds of major happenings in the future.

Keywords— Methyl Isocyanate, Phosgene, Carbaryl

I. INTRODUCTION

Bhopal Gas Tragedy occurred in Bhopal at a pesticide plant i.e. Union Carbide. The disaster is caused due to the leakage of excessive amount of MIC gas and some other dangerous chemicals on the night of 2-3 December, that caused the huge number of deaths and severe health injuries to the people being caught by the gas. Due to this, Bhopal Gas Tragedy is known to be the worlds most dangerous industrial disaster.

In the pesticide plant, the disaster caused due to the flow of water into the tank consisting Methyl Isocyanate that resulted in the formation of CO2 and some other products. Due to this reaction, the temperature of the tank increased to a greater extent and the pressure inside the tank was increased to the level that was unable for it to withstand. Therefore, the hazardous gases that were present in the huge amount, get exposed to the environment, effecting more than 5,00,000 people in different ways.

After so many attempts by the workers that were failed, they realised nothing can be done to prevent the leak. The people were badly injured from the gas, were screamingly running for escaping through the tragedy. But the another major problem was that, no one was aware about the treatment of the toxin. The treatment was a serious issue as people were suffering from various health injuries like burning sensation in the eyes, vomiting, fainting, etc and the most devastating, the new born children were also the sufferers.

There are many theories how the water flow entered the tank. That means the reason of what actually caused the disaster is still the matter of debate. It is claimed by the wokers and the govt. that due to the cheap maintinance, it was possible for the water to pass from the place where pipeline cleaning was done to the tank E610 containing MIC, that resulted in the disaster. On the other hand, the UCC wasn't agree with this. It was a sabotage act done by a worker, the UCC claimed.

II. LEAKS PHASES

A. Pre leak period

The UCIL factory was built to manufacture the carbaryl which is a pesticide by using MIC as an intermediate. The factory was set up in 1969. After 10 years, the production plant of MIC was built. The carbaryl was produced by the chemical reaction of methylamine with phosgene to give MIC, which acts as an intermediate. . MIC was then allowed to react with 1-naphthol to form the required product, that was carbaryl. After approximately one year(early 1980s), the need for the same had fallen, but production still continued which resulted in the large storage of unused MIC.

B. Earlier leaks

There was a larger no. of leaks of the toxic gases before the disaster happened in 1984. There was a complaint by two trade unions about the pollution within the plant in 1976. In 1981, a worker during his maintainence job, died due to inhalation of the phosgene gas that was highly toxic. Further in the year 1982, there were several number of leaks that caused many serious injuries to the workers. There was a phosgene leak in the first month of 1982, that affected 24 workers. After that there were 2-3 MIC leaks that also suffered the workers and supervisors badly.

III. LEAKS AND THE EFFECTS CAUSED BY IT

The UCC factory used 3 storage tanks for MIC which were 68 kiloeters each. It was under the safety regulations that no tank should be filled more than 50% of its volume and the pressure should not exceed the maximum pressure the tank could withstand. The tanks were pressurised with inert nitrogen gas that was suitable for the pumping of MIC.

In October 1984, the tank was unable to withstand the pressure by nitrogen causing the failure of the liquid MIC to be pumped out. Due to this failure, the production of MIC had been stopped at the respective pesticide plant. After the failure in re-introducing the system, the contained amount of liquid MIC (42 tons) was still unable to pump out.
On 2nd December 1984, at the time of evening, the water somehow managed to enter the tank E610 (via a connecting pipe) that contained the liquid MIC. The safety equipments of MIC were not working and some systems were in bad condition. The introduction of water into the tank containing MIC resulted into an exothermic reaction that was enough to cause a disaster. The pressure in the tank increased to the level that was unable for it to withstand. This caused the leakage of MIC and in a shorter duration, the toxic gas started effecting people by spreading over the city.

The effects caused by the leak were dreadful. Some on the spot effects were burning sensation in the eyes & respiratory tract, suffocation, vomiting and stomach ache. The people immediately started running from their respective places by realizing the situation. On the very next morning only, there was a huge no. of deaths, in several thousands. The major factors of deaths includes choking, problem in the lungs & kidneys, failure of circulatory system and the declination of the liver. It was an estimate that, more than 500,000 people were the sufferers.

IV. LACK OF PROPER KNOWLEDGE AND INSINCERITY SHOWN

The use of MIC for the production of carbaryl was the biggest mistake because maintaining this was not a simpler task. It was found that the MIC storage tanks were filled more than 50% which was against the safety norms. In addition to this, the use of MIC is considered to be risky because MIC itself comes under most hazardous chemicals.

There were several no. of MIC and phosgene leaks before the disaster in the year 1981-1984 too, which caused the serious health injuries to the workers, still the proper maintainance did not come into picture. The workers or operators were lacking skills and the proper training was not provided to the workers about the safety regulations.

The safety systems related to MIC were in poor maintainence. There was a safety system that was vent gas scrubber but it was not in the operational form. Then there was another safety system that was Flare tower, but it was also not in the working condition. The refrigeration system used to cool the liquid MIC was also not available as it was shut down earlier for the purpose of saving money.

Just few hours before the disaster, the workers informed the supervisor about the leakage of MIC causing pollution. But the supervisor delayed this for few minutes, that caused the toxic gas to spread over the city. They also failed to aware people about the situation as the alarming system was also failed to work well and the people came to know when they started observing the effects.

V. WHAT ABOUT THE CLOSURE?

More than 33 years passed since the disaster occurred in Bhopal. There is still not the exact cause of the happening. There are the people who still have some hope of having something to fulfil their lives, as they still are the sufferers of the happening. There are only a few percentage of people who have been given the compensation among which many people still have not been given the required amount. The victims fight for the justice is unstoppable and this fight seems to be one-sided. There is no one who rarely gives attention towards their need and their fight for the justice, including the state and central government. The govt. should understand their situation & the needs of the sufferers; should definitely take the necessary step for them to fulfil their wants for the justice and negotiate the impacts that has been caused on their lives.

VI. CONCLUSION

The author has studied the details and the happenings caused by the disaster. It has been concluded that the process disaster caused in Bhopal in 1984 was a serious and devastating incident which affected more than 5,00,000 people. The disaster is caused by the flow of water in the tank containing liquid MIC, that resulted in the leakage of hazardous gas (MIC) in the environment due to lack of proper functioning of the safety systems and the insincerity shown by the workers. While, the exact cause of HOW the water introduced in the tank is still the matter under debate. In this case study, the author has also given the measures so that to avoid such kinds of major happenings in the future.

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