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Review Article

Explosion disaster at a pharmaceutical facility in Visakhapatnam, India

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ABSTRACT

An industrial accident at a red category Escientia Advanced Sciences Pharmaceutical Company at Anakapalli district on 21st August claimed 17 lives due to blast injuries and 36 others sustained various degrees of thermal injuries. A Methyl-tert butyl ether (MTBE) heavy solvent leak while transiting from the second floor to the storage tank on the ground floor resulted in a vapour cloud around the power panel located there and ignited. The fire then spread through the ducts of the air handling unit to four other modules in the production block. Thick smoke and flames engulfed the facility, hampering rescue operations. 14 fire tenders and 50 fire personnel fought the blaze for an hour before arresting the blaze and preventing it from reaching the higher floors. Skylift, boom lifts and cranes were deployed by firefighters to break the plate glass windows and extricate 13 trapped workers. Around 380 employees work two shifts at the plant and most of them escaped because they were on lunch break when the explosion started the conflagration. The injured were treated at the NTR and private hospital at Anakapalli and the evacuated to tertiary hospital in the city and the Government Medical College at Visakhapatnam. No trauma or burns centre are available at the special economic zone housing the pharma city where 120 industrial accidents and equivalent number of deaths have been reported over the past five years. A detailed enquiry has been ordered into the incident by the State Government.

Keywords: Explosion, Industrial accident, Methyl-tert butyl ether solvent

INTRODUCTION

A blast injury is a complex physical trauma resulting from direct or indirect exposure to an explosion. They are caused by the detonation of high-order explosives and incendiary chemicals, vapours or gases, with injuries being compounded when the event takes place a confined space.[1]

The Escientia Advanced Sciences Private Limited was established in 2019 with a 200 crore investment and spread over 40 acres at The Andhra Pradesh Special Economic Zone at Gurajapalem, Rambilli Mandal of Anakapalli District. The company manufactures Active Pharmaceutical Ingredients (APIs) and bulk drugs. It is a global contract research, development, and manufacturing organization serving pharmaceutical and biotech companies in the discovery, development, and launch of small-molecule drugs. The company has two R&D centers in Connecticut (US) and Hyderabad.

Methyl tert-butyl ether (MTBE), also known as tert-butyl methyl ether with molecular formula C5H12O and minty odour is a volatile, flammable, and colorless liquid that is sparingly soluble in water. It is a popular oxygenate that blends well, has a low tendency to form explosive organic peroxides and cheaper than most available solvents. High purity MTBE is extensively used as a dissolution agent in pharmaceutical applications, for analytical purposes due to its high purity and as a solvent to isolate and purify active pharmaceutical ingredients. Environmental aspects of MTBE shows that it is a recalcitrant pollutant, but

biodegradable. MTBE is frequently detected in groundwater and the maximum permissible concentration is 5 µg/L in drinking water. Oral, inhalation, and skin are the routes of human exposure to MTBE, with inhalation exposure representing the predominant occupational exposure source. MTBE is rapidly absorbed through the respiratory and digestive systems, efficiently distributed to various tissues through blood circulation, and metabolized within hours The calculated cancer risks (CRs) is 0.170 to 0.240 per 106 for operating workers, and 0.026 to 0.049 per 106 for support staff.[2-4]

REVIEW

On 21 August at 14:30 hours, an explosion occurred at the Escientia Pharma at Anakapalli. MTBE is being used in the eight-stage process of manufacturing a pharmaceutical ingredient for export. Its boiling point is 55.5℃, flash point is -32.78'C. As the solvent was being transferred from the receiver on the second floor via PD lab to the storage tank located on the ground floor, it sprung a leak and triggered an alarm in the PD lab. The workers at this level initiated a drill to plug the leak and ordered a mass evacuation. However, being heavier than air, the vapour cloud settled down and came in contact with air and electrical panels, and exploded. Fire then spread through the air handling ducts to four other modules in the production block.

Figure 1: Dense smoke in the Escientia campus following a blast.

The blast was so severe that body parts of victims got strewn all over the place and 12 bodies were trapped within a collapsed wall and charred beyond recognition. Thick smoke and flames engulfed the area. The blast in the reactor resulted in the collapse of the slab of the first floor of the factory.

Around 380 employees work two shifts at the plant. Many escaped because they were on lunch break when the explosion started the fire.

In-house firefighting equipment were in working condition and used by the staff to contain the blaze.14 fire tenders and 50 fire personnel then arrived and fought the blaze for an hour before quenching it before it reached the higher floors However, a total of 17 workers perished due to fatal blast injuries and 36 others sustained thermal injuries. Of the latter, 10 received 57% body surface area (BSA) burns, 9 sustained 24% burns and 17 sustained 10% burns. They were given emergency first aid at local hospitals and transferred to tertiary care Government and private hospitals in Visakhapatnam city.[5]

Figure 2: A) Fire sighting, B) Casualty evacuation in progress.

DEFICIENCIES AND REMEDIES

Safety inspections and internal audits were lacking. Self certification introduced in 2015 for ease of doing business led to a decrease in external visits. A dispute between the two owners of the company led to negligence in complying with safety rules. Chemicals were being stored in the Human Resources offices. The factory had no emergency response or liaison team. There is no trauma and burns hospital in the entire 5600 acre SEEZ with 208 industries.

Generous financial compensation for the next of kin of the dead workers and for those who were injured was announced by the Centre and State Governments. The Chief Minister AP suggested bringing the Pollution Control Board, Labour and Legal Metrology under one roof. A High level enquiry launched into the incident by Home Minister, legal action initiated for negligence not amo1unting to culpable homicide under sections 106(1), 125 (a) and (b) of Bharatiya Nyaya Sanhita.

DISCUSSSION

Explosions are unique in their ability to inflict acute injuries on many people at the same time, resulting in high levels of mortality and morbidity. The type and severity of the impact depends on many factors though the principle mechanism driving the extent of injuries is the amount of kinetic energy released over a short period of time. Other factors involved include when and where the event took place, the number of people in the area, the material in the area, whether the explosion was nuclear, mechanical, or chemical, how far the victim was from the explosion, and what protection was available, if any. Chemical explosions cause injuries in four categories (primary, secondary, tertiary, and quaternary). The four

categories are based on the impact on the human body due to the blast wave, blast wind, environmental/material factors present in the area of the blast.[6,7]

CONCLUSION

Most of today's industrial processes have the potential for devastating accidents. A reliable and well-engineered industrial safety system is required to protect workers from accidents and loss of life. Operations and industrial procedures must protect employees and assets by minimizing hazards, risks, accidents, and near misses. All industrial personnel must be trained in safety aspects of man, machines, material and also in fire fighting and first-responder actions in cardiopulmonary resuscitation. Environmental aspects of MTBE is low and may not require long term follow up in exposed subjects.

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