

CASE STUDY ON BHOPAL GAS TRAGEDY

Submitted By:

Aman Chauhan(1805158)

Aryan Maheshwari(1805163)

Gurjeet Singh Tatla(1805174)

Jagjit Singh(1805185)

INTRODUCTION

- Bhopal gas tragedy, a disaster that happened by a Gas leak is considered as one of the world's worst Industrial catastrophes that occurred on the night of December 2–3, 1984 at the Union carbide India Limited (UCIL) Pesticide plant in Bhopal, Madhya Pradesh, India.

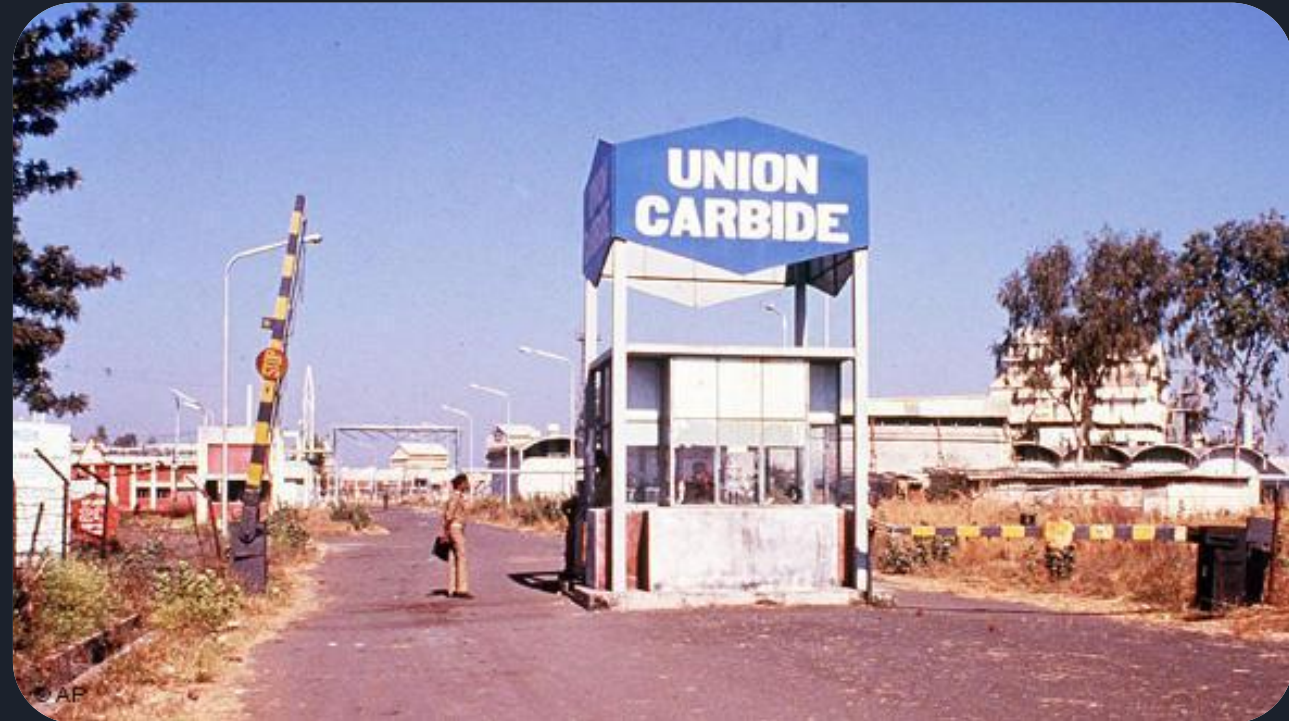
- A leak of Methyl Isocyanate (MIC) gas and other chemicals from the plant resulted in the exposure of thousands of people. The toxic substance spread its way in and around the neighborhood located near the plant. That Resulted in a very high death toll. The official immediate death toll was 2,259 and the government of Madhya Pradesh has confirmed a total of 3,787 deaths related to the gas release .



Where it Happened ?

Union Carbide India Limited

- UCIL was the Indian subsidiary of Union Carbide Corporation (UCC), with Indian Government controlled banks and the Indian public holding a 49.1 percent stake.
- It started in 1969 at the northern state of India.
- Phosgene, Monomethlyamine, Methyl Isocyanate (MIC) and the pesticide Carbaryl, also known as Sevin were manufactured here.



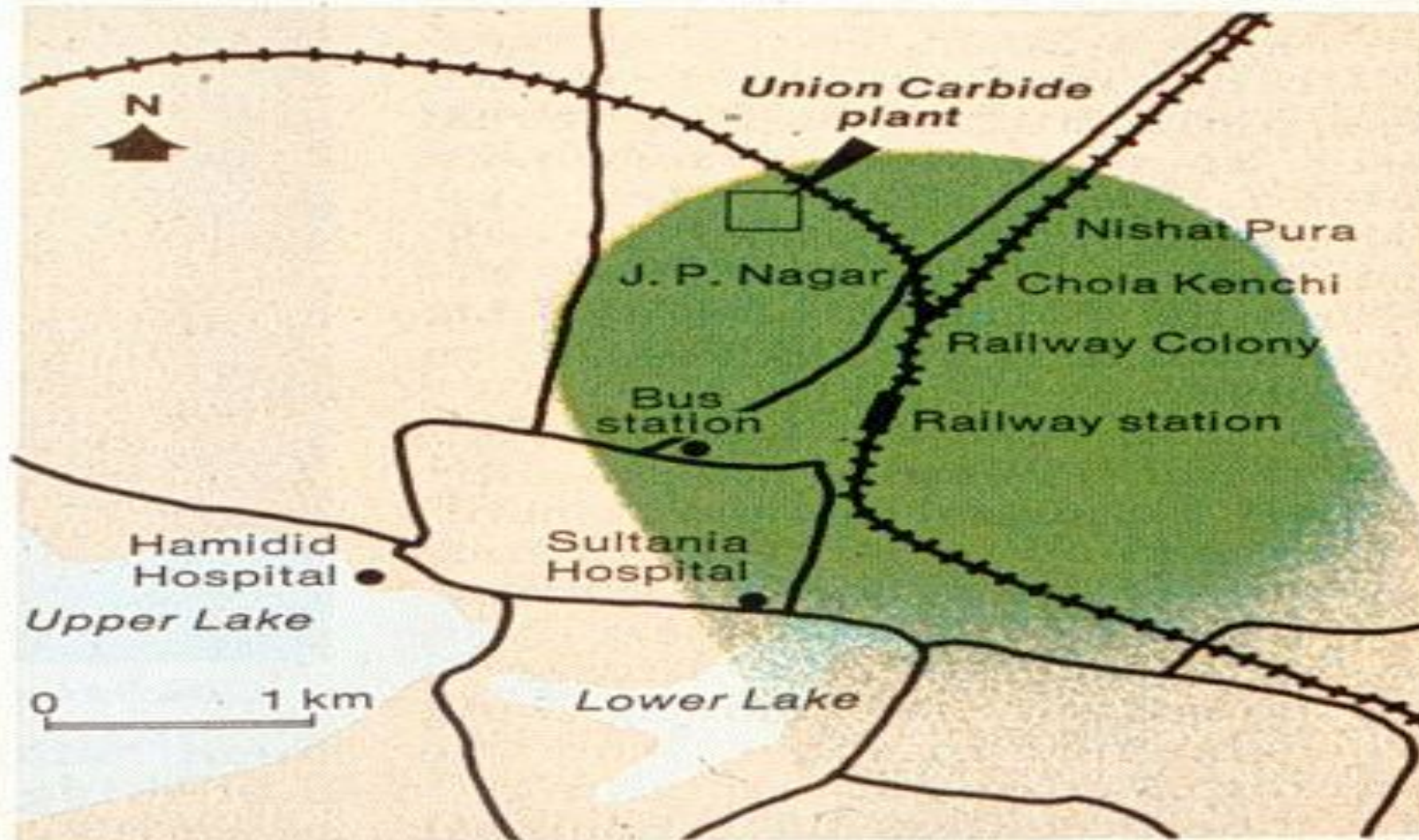
HOW DID IT START?

- To produce Pesticide Sevin with an intermediate methyl isocyanate (MIC). It necessitated the start up of MIC production plant in 1979.
- Following production continued ,ironically during the night of December 2–3, 1984, water entered Tank E610 containing 40 tons of MIC.

- The resulting in exothermic reaction which increased the temperature inside the tank to over 200 °C(392 °F) and raised the pressure. About 30 metric tons of methyl isocyanate (MIC) escaped from the tank into the atmosphere, which got added to a weak wind which frequently changed direction, which in turn helped the gas to cover more area in a shorter period of time (about one hour).
- This weak wind and the weak vertical turbulence caused a slow dilution of gas and thus allowed the poisonous gas to spread over considerable distances.

AFFECTED AREA

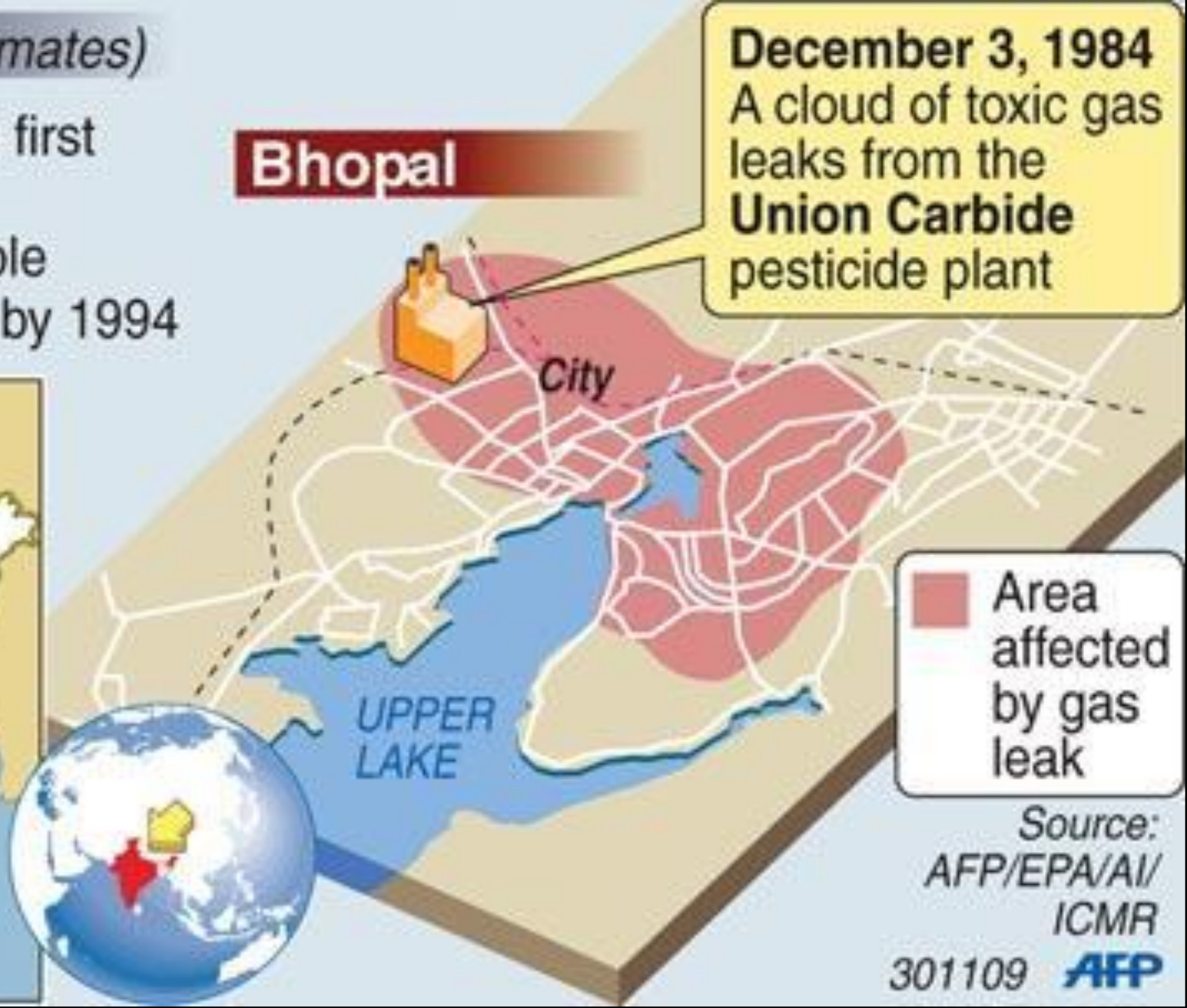
Escaping gas blanketed much of Bhopal



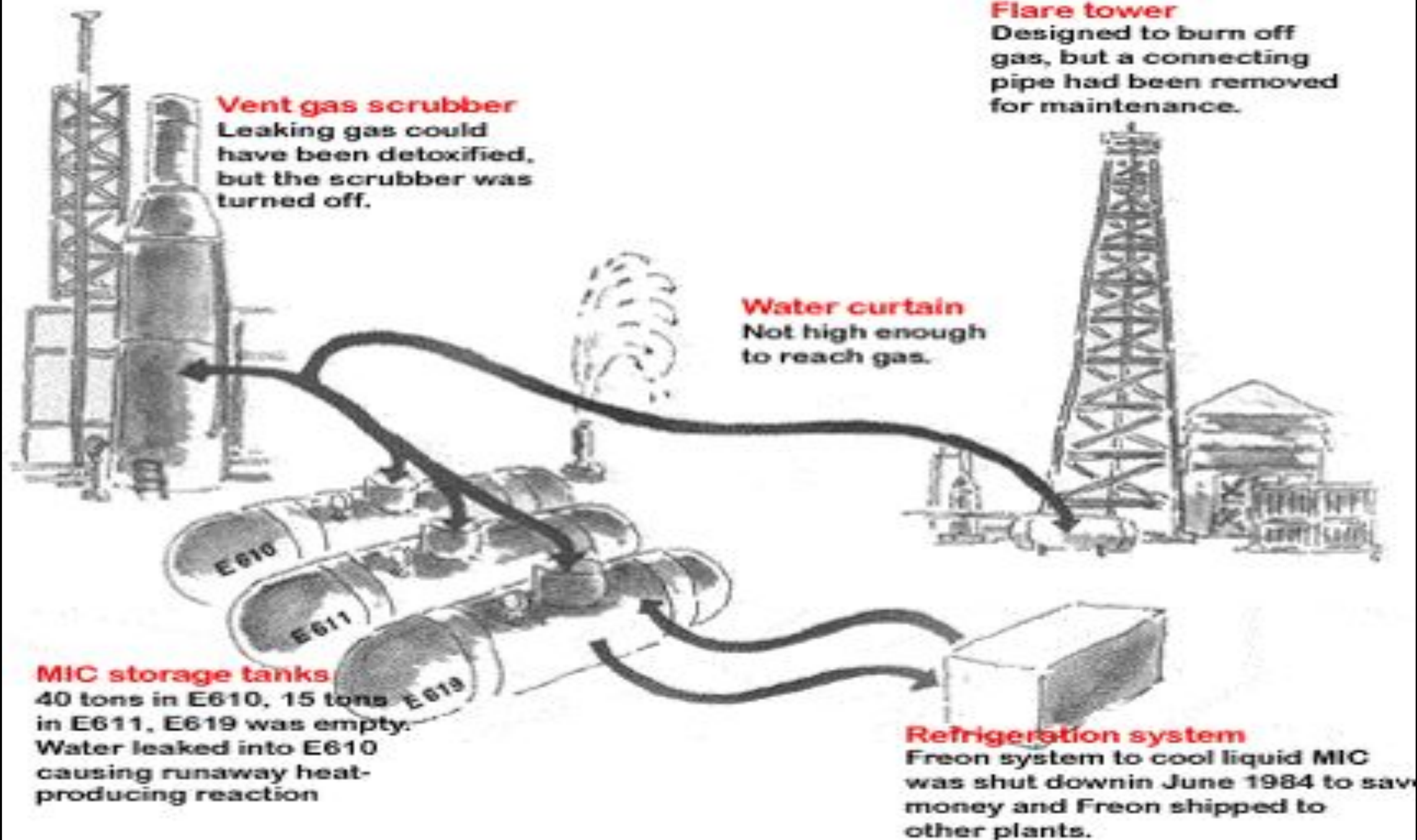
Heavily affected area

The human cost *(estimates)*

- ▶ Up to 10,000 deaths in first three days
- ▶ Additional 25,000 people died of related injuries by 1994



December 3, 1984
A cloud of toxic gas leaks from the **Union Carbide** pesticide plant



WHAT FACTORS LEAD TO THE MAGNITUDE OF GAS LEAK??

- Storing MIC in large tanks and filling beyond recommended levels.
- The flare tower and several vent gas scrubbers had been out of service for five months before the disaster.
- Failure of several safety systems .
- Also some safety systems being switched off to save money, including the MIC tank refrigeration the MIC was kept at 20 degrees Celsius, not the 4.5 degrees advised by the manual.
- There was only one manual back-up system, compared to a four-stage system used by union carbide plant of USA.
- Lack of skilled operators-No proper training was given to them.

OVERALL VIEW OF THE GAS LEAK

- The scientific reason that caused the accident was that water entered the tank where about 40 cubic meters of MIC was stored.
- As a result, the safety valve of the tank burst because of the increase in pressure.
- It is presumed that between 20 and 30 tonnes of MIC were released during the hour that the leak took place.
- The gas leaked from a 30 m high chimney and this height was not enough to reduce the effects of the discharge.

OTHER CAUSES

- Use of more dangerous pesticide manufacturing method for decreasing the generation cost.
- Plant located very close to a densely populated area.
- Lack of skilled operators.
- Reduction of safety management.

HEALTH EFFECTS

Instant effects:

- Air : Burning like chili, cough, suffocation, etc.
- Eyes: Severe irritation , inability to open eyes, corneal ulcers etc.
- Upon autopsy: Edema of brain, kidney swollen, necrotic flesh.

Long term effects:

Damage to :-

- Eyes.
- Respiratory system.
- Lungs.
- Immune system.
- Neurological system.
- Psychology.
- Genetics etc.

UNION CARBIDE PLANT AFTER DISASTER









CONTRIBUTION TO NEGLIGENCE

- **Union Carbide did not maintain safety rules.**
- If a pipe leaked, union carbide did not replace it.
- MIC workers needed more training to handle poisonous gases.
- The flare tower and the vent gas scrubber had been out of service for five months before the disaster.
- The steam boiler, intended to clean the pipes, was out of action for unknown reasons.

WHAT COULD HAD BEEN DONE TO AVOID THE DISASTER

- Supervisor could have been placed on night shifts and the readings and feedback of the Equipment could have been taken for every one hour.
- There should have been 4 stage back up system (union carbide plant of USA) instead of a one manual back up system.
- At regular intervals proper maintenance and servicing of Flare towers, pressure valves, gas scrubbers must have be made.
- Strict regulations and methods must have been used according to the manual.
- Proper pressure gauges should have been used.

LAW ENACTED AFTER BHOPAL GAS TRAGEDY

The government passed the Bhopal Gas Leak Act in March 1985, which allowed it to act as the legal representative for victims. While the UCC initially offered a \$5 million relief fund to India, the government turned down the offer and demanded \$3.3 billion

After Bhopal accident, several pieces of legislation came into force, the prime one being the Environment Protection Act (EPA), 1986. In 1987 a new chapter was added to the Factories Act, 1948, in the aftermath of Bhopal.

Conclusion

- Today, the Union Carbide plant in Bhopal is falling apart.
- Humanity has become completely dependent on pesticides, herbicides and synthetic chemicals.
- So to stop such industries and conserve the future, safety measures should be the priority.



THANK YOU