Styrene gas

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***Source**: IE*

Manifest pedagogy: Disasters are not new to mankind. The below topic gives the picture of human negligence in dealing with one such man made disaster and aftermath of such incidents. This topic is important from prelims perspective.

In news: Styrene gas leaked recently in one of the storage tanks at the LG Polymer plant at Gopalapatnam, outskirts of Visakhapatnam.

Placing it in syllabus: Disasters

Static dimensions: Styrene products and utilisation

Current dimensions:

- Recent case of leakage
- Government efforts to contain the gas
- Criticisms
- Safeguards against chemical disasters

Content:

Styrene products and utilisation:

- Styrene is an organic compound with the **formula C8H8**, which is a derivative of benzene (C6H6).
- It is stored in factories as a liquid, but evaporates easily and hence **has to be kept at temperatures under 20°C.**
- It is the **main raw material for synthesis of polystyrene,** which is a versatile plastic that is used to make parts of various appliances such as refrigerators or micro-ovens, automotive parts and parts of computers and also to manufacture disposable cups and

in food packaging.
- Styrene is **also used as an intermediate to produce copolymers** (polymers derived from one or more species of monomers such as styrene) and **engineering plastics compounds.**

Consequences of styrene inhalation:

- It causes breathlessness, respiratory problems, irritation in eyes, indigestion, nausea, transient loss of consciousness and giddiness.
- It is the mucous membrane that is mainly affected by exposure to styrene gas.
- Exposure to styrene gas affects the central nervous system.
- Long-term effects include developing leukaemia and headaches.

Recent case of leakage:

- The gas leaked, **Styrene is also known as** *Vinylbenzene or Cinnamene or Ethenylbenzene or Phenylethylene*, which is a synthetic hazardous and toxic chemical.
- The **source of the gas leak was a styrene plant owned by South Korean LG Chem Polymers** located near Gopalapatnam, 15 km from Visakhapatnam.
- The factory was established in 1961, **originally as Hindustan Polymers,** to manufacture polystyrene.
- It was merged with McDowell & Co of the UB Group in 1978, then taken over in 1997 by South Korea-based LG Chem, which renamed it LG Polymers.
- The gas leaked from this tank when officials were preparing to reopen the factory that was shut for 44 days due to the lockdown.
- According to official sources, 1,800 tonnes of styrene was stored in a tank of capacity 2,400 tonnes.
- About half the gas leaked before it was contained.
- As the styrene was stagnant for 44 days some gas might

have accumulated at the ceiling of the storage tank and its temperature rose beyond the specified 20°C and the gas started vaporising and escaped.
- This phenomenon is called **auto-polymerisation**.

Other such cases in the past:

Government efforts to contain the gas:

- Police and **National Disaster Response Force (NDRF)** team evacuated people to nearby safer villages and those who complained of breathing difficulties were rushed to the hospitals.
- To neutralize the effects of styrene, the state government has airlifted around 500 tonnes of inhibitors like **Para-tertiary butyl catechol (PTBC).**
- Water sprinklers were used to dissipate gas emissions.
- A **criminal case has been registered** against the plant management and the National Green Tribunal (NGT) has taken cognisance of the case.
- Andhra Pradesh High Court has issued notices to both the State and Central governments.
- Andhra Pradesh Chief Minister announced an ex-gratia payment of 1 Crore rupees each to the families of those killed in the tragedy.
- About 10 lakhs and 25,000 has been announced each to those undergoing treatment on ventilator support and those treated as out-patients respectively.
- The India Air Force airlifted 1.1 tonnes of **Tertiary Butylcatechol (TBC)** and 7.2 tonnes of **Polymerization Inhibitors and Green Retarders** from Mundra, Gujarat that could reduce the toxicity of the gas leaked.
- All public spaces including open drains and sewage canals have been cleaned and sanitised.
- About 13,000 tonnes of Styrene from the LG Polymers plant is being sent back through a ship to the company's

headquarters in Seoul, South Korea.

Criticisms:

- Forensic experts have reported that the styrene leakage occurred due to **human error and negligence** in maintenance during lockdown.
- In addition, an auto polymerization inhibitor in the styrene storage tank and **failing to maintain the temperature below 20 degree centigrade during the lockdown** period led to the mishap.
- During the lockdown period the **TBC was not added to the styrene to prevent self-polymerization** and whatever was existing got inactive.
- The **cooling process was also not maintained** which led to the generation of enormous heat of 150 degrees centigrade (boiling point of styrene is 146 degree centigrade).

Safeguards against chemical disasters in India:

At the time of the Bhopal gas tragedy, the Indian Penal Code (IPC) was the only relevant law specifying criminal liability for such incidents –

- Section 304 (culpable homicide not amounting to murder) and
- Section 304A (deals with death due to negligence and imposes a maximum punishment of two years and a fine).

Later the below laws regulating the environment and prescribing and specifying safeguards and penalties came into force:

1. **Bhopal Gas Leak (Processing of Claims) Act, 1985**
2. **The Environment Protection Act, 1986**
3. **Public Liability Insurance Act, 1991,** which is an insurance meant to provide relief to persons affected by accidents that occur while handling hazardous

substances.

4. **The National Environment Appellate Authority Act, 1997**, under which the Appellate Authority can hear appeals regarding the restriction of areas in which any industries, operations or processes shall not be carried out or shall be carried out subject to certain safeguards under the Environment (Protection) Act, 1986.
5. **National Green Tribunal Act, 2010**, provides for the establishment of a National Green Tribunal for effective and expeditious disposal of cases related to environmental protection and conservation of forests.

Any incident similar to the Bhopal gas tragedy will be **tried in the National Green Tribunal and most likely under the provisions of the Environment (Protection) Act, 1986** if an offence is committed by a company and every person directly in charge and responsible will be deemed guilty.

Mould your thought: What is styrene and what are its harmful effects? Explain the safeguards available against chemical disasters in India.