Managing Hazardous Waste

For Prelims: Hazardous Waste, Incineration, Methyl Isocyanate, Phosgene, Bhopal Gas Leak Disaster. (Processing of Claims) Act, 1985, Pesticides, Small and Medium Enterprises (SMEs), Wastewater Treatment, Hazardous Waste Management Rules, 2016, Environment Protection Act, 1986, Basel Convention, 1992, Pyrolysis.

For Mains: Management of hazardous waste.

Source: DTE

Why in News?

Four decades after the **Bhopal gas tragedy (1984)**, **hazardous waste** (toxic waste) from the abandoned **Union Carbide India Ltd (UCIL)** factory in Madhya Pradesh was finally removed for **incineration**.

What was the Bhopal Gas Tragedy?

- **About:** On the night of **2nd December 1984**, a catastrophic **chemical leak** occurred at the **UCIL pesticide plant in Bhopal.**
  - The leak involved **methyl isocyanate (MIC) gas** that **killed over 5000 people and poisoned** more than **half a million** others in the city of Bhopal**,** making it the world's worst industrial disaster.
  - Reports of chemical leaks, including **phosgene and methyl isocyanate**, were documented in the years **prior to 1984.**
- **Cause of the Leak**: A failed maintenance attempt on 1st December 1984, coupled with **malfunctioning safety systems**, triggered a **chemical reaction** in a MIC filled tank leading to release of at least **30 tonnes of MIC** gas into the atmosphere by **midnight on 2nd December 1984.**
- **Health Effects**:
  - **Immediate**: Respiratory problems, **abdominal pain, eye issues**, and neurological impairments were common among the exposed individuals.
  - **Long-Term**: Chronic health issues such as **decreased lung function, genetic abnormalities, pregnancy loss,** and infant mortality rates increased dramatically in affected populations.
- **Government and Legal Response**: The Indian government passed the **Bhopal Gas Leak Disaster. (Processing of Claims) Act, 1985** to act as the **legal representative** for the victims.
  - UCIL initially offered **USD 5 million in relief**, but the Indian government demanded **USD 3.3 billion**. The case was eventually settled out of court in 1989 for **USD 470 million.**
  - In **2010**, seven Indian nationals employed by UCIL were **convicted for causing death by negligence** but were released on bail.
- **Aftermath and Legacy**: Despite the passage of time, survivors still lack health care and **face**

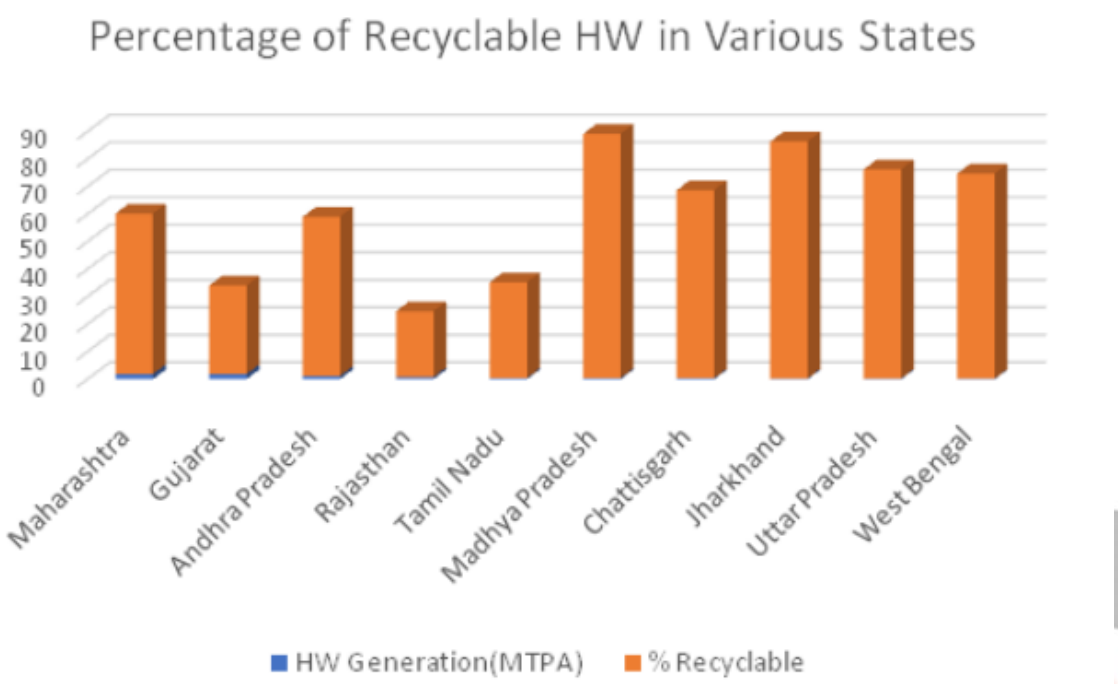
lingering toxic materials at the factory site.
    - Welfare organizations demand the **removal of hazardous waste** from the closed factory site.

Methyl Isocyanate (MIC)

- **About:** Methyl Isocyanate is a **colourless liquid** used for making **pesticides.**
- **Reactivity:** The chemical is **highly reactive to heat**.
    - When exposed to **water**, the compounds in MIC react with each other causing a **heat reaction.**
- **Storage:** It is **no longer in production**, although it is still used in pesticides.
    - The **Bayer CropScience plant in Institute,** West Virginia, US is currently the **only storage location** of MIC left across the globe.

What is Hazardous Waste?

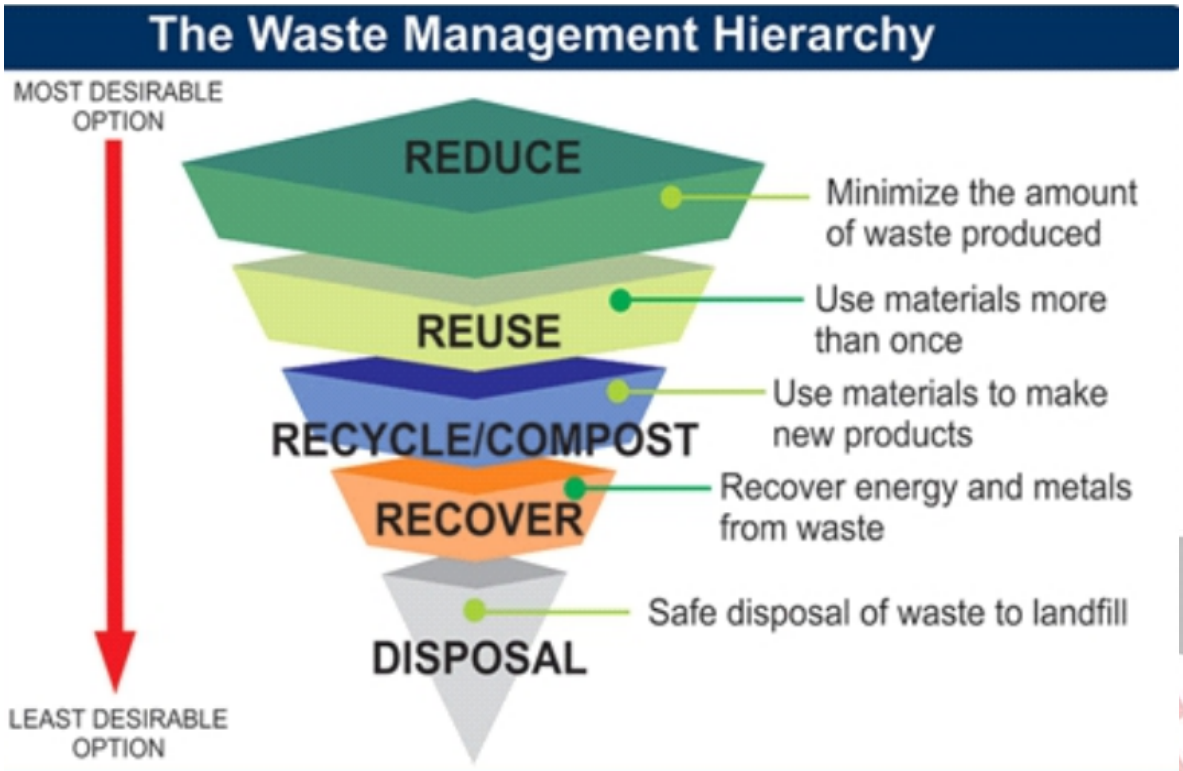
- **About:** Hazardous waste refers to waste that poses a **danger to health or the environment** due to characteristics like **toxicity, flammability, reactivity, or corrosiveness**, either alone or when combined with other substances.
- **Sources:**
    - **Use of Hazardous Substances**: Most hazardous waste is produced during **chemical production and consumption**, increasing with rising demand for consumer goods.
    - **Inappropriate Technologies**: Outdated technologies used by **small and medium enterprises (SMEs)** result in inefficient resource conversion, leading to higher and more toxic hazardous waste.
    - **Post-Treatment**: **Wastewater treatment and gaseous emissions** result in residues containing hazardous substances.
- **Hazardous Waste Regulations**:
    - **Environment Protection Act, 1986:** The **Hazardous Waste (Management and Handling) Rules, 1989** were introduced under the **Environment Protection Act, 1986 .**
        - These rules were amended in **2008**, **2009**, **2010, and 2016** to include other waste types (e.g., used electronics, paper waste, metal scrap, and waste tires).
    - **Basel Convention, 1992:** India is a signatory to the **Basel Convention, 1992,** which aims to reduce the movement of hazardous waste across countries.
- **Waste Generation**: India generates about **7.66 million tonnes per year** of hazardous waste from **industries**.
    - The breakdown of hazardous waste shows that **44.3% is landfillable, 47.2% is recyclable, and 8.5% is incinerable**.
    - **83% of hazardous waste** is generated in seven states i.e., **Gujarat, Maharashtra, Tamil Nadu, Andhra Pradesh, West Bengal, and Chhattisgarh**.



- **Hazardous Waste Production:** As per the **Compendium of Environmental Statistics India, 2016**, most of the hazardous waste is being generated from **chemical production & metal processing industries** apart from the treatment of **wastewater and flue gases.**

How Hazardous Waste is Disposed?

- **Co-processing:** It involves using waste materials, like **industrial by-products or hazardous waste**, as alternative **raw materials or fuels** in industries, especially **cement manufacturing** or other high-temperature industries.
  - About **25 cement plants** have started co-processing in India.
- **Material and Energy Recovery:** Material recovery makes use of the material value **embedded in the waste** whereas energy recovery utilizes its **calorific value.**
  - E.g., recovering **copper from cable residues** and re-melting of the copper or recovery of **lead from used batteries.**
  - **Spent lube oil, solvents, solid and semi-solid grease,** and **wax** can be used as an alternative fuel for industrial processes that require **thermal energy input.**
- **Incineration:** Incineration is the process of **burning waste in big furnaces at high temperatures**. It converts waste materials into bottom **ash, flue gasses, particles, and heat** that can be utilized to produce electricity.
- **Pyrolysis:** **Pyrolysis** involves the thermal **decomposition of waste materials in the absence of oxygen** or with limited oxygen usually at temperatures ranging from **300°C to 900°C.**
  - It converts waste materials into useful products such as **bio-oil, synthesis gas (syngas) and char.**



Note:

- **Bio-oil** is a **liquid fuel** produced through the **pyrolysis** of organic materials such as **biomass (wood, agricultural residues, algae)**, and other plant matter.
- Syngas is a fuel gas mainly composed of **hydrogen (H_2), carbon monoxide (CO)**, and small amounts of **carbon dioxide (CO_2) and methane (CH_4).**
- **Char** is a solid, **carbon-rich byproduct** generated during the **thermal decomposition of organic materials** in processes such as **pyrolysis.**

Conclusion

- The **Bhopal Gas Tragedy** highlights the **catastrophic consequences of industrial safety negligence.** Despite regulatory advancements like the **Hazardous Waste Management Rules, 2016 and Basel Convention**, challenges persist in **safe waste disposal,** emphasizing the urgent need for stricter compliance, technological upgrades, and effective remediation of hazardous waste in India.

Drishti Mains Question:

What are the key regulatory frameworks governing hazardous waste in India?

UPSC Civil Services Examination, Previous Year Questions (PYQs)

Prelims

Q. In India, 'extend producer responsibility' was introduced as an important feature in which of the following? (2019)

(a) The Bio-medical Waste (Management and Handling) Rules, 1998

(b) The Recycled Plastic (Manufacturing and Usage) Rules, 1999

(c) The e-Waste (Management and Handling) Rules, 2011

(d) The Food Safety and Standard Regulations, 2011

Ans: (c)

Q. As per the Solid Waste Management Rules, 2016 in India, which one of the following statements is correct? (2019)

(a) Waste generator has to segregate waste into five categories.

(b) The Rules are applicable to notified urban local bodies, notified towns and all industrial townships only.

(c) The Rules provide for exact and elaborate criteria for the identification of sites for landfills and waste processing facilities.

(d) It is mandatory on the part of the waste generator that the waste generated in one district cannot be moved to another district.

Ans: (c)

Mains

Q. Enumerate the National Water Policy of India. Taking river Ganges as an example, discuss the strategies which may be adopted for river water pollution control and management. What are the legal provisions of management and handling of hazardous wastes in India? **(2013)**