



Heavy Metal Pollution

For Prelims: Heavy Metals, Heavy Metal Pollution, Namami Gange Mission, Central Water Commission

For Mains: Contribution of heavy metals to river pollution, Wastewater treatment plants

Why in News?

Recently, the **Center for Science and Environment** has reported that rivers of India are facing severe metal pollution.

- **Three out of every four** river monitoring stations in India have observed alarming levels of **heavy toxic metals** such as **lead, iron, nickel, cadmium, arsenic, chromium** and copper.

What is Heavy Metal Pollution?

- **Heavy Metals:**
 - **Heavy metals** may be defined as elements with an **atomic number** larger than **20** and an **atomic density greater than 5 g cm^{-3}** that must possess metal-like characteristics. **Example: arsenic, cadmium, chromium, copper, lead, manganese, mercury, nickel, uranium etc.**
- **Heavy Metal Pollution:**
 - Heavy metal pollution has been caused in our **rivers, soils, and environment** as a result of rapidly growing **agriculture** and **metal industries**, **improper waste management**, **heavy use of fertilizers**, and **pesticides**.
 - **Agricultural and industrial operations**, **landfilling**, **mining**, and **transportation** are the primary sources of heavy metals in **groundwater**.
 - Through the **agricultural water runoff heavy metals** reach upto river.
 - **Discharge of wastewater** from industries (like the tannery industry which is a big source of chromium heavy metals) directly into **river bodies** intensified the severity of the **heavy metal pollution**.
 - Heavy metals have the property of long persistent in plants, animals and environment.

What are the Sources of Heavy Metals?

- There are two kinds of sources through which the heavy metals enter into the environment.
 - **Natural Source:**
 - Heavy Metals are naturally present in the **earth's crust**. Rocks are the natural source of heavy metals. Heavy Metals are present in the **rocks** in the form **minerals**. Examples: arsenic, copper, lead etc.
 - **Anthropogenic Source:**
 - **Mining, industrial, and agricultural operations** are all anthropogenic sources of **heavy metals** in the environment.
 - These heavy metals are produced during the **mining** and **extraction** of various elements from their respective **ores**.

- **Heavy metals emitted** into the atmosphere during **mining, smelting**, and other industrial activities are deposited on land by **dry and wet deposition**.
- Discharge of **wastewaters** such as **industrial effluents** and **domestic sewage** add heavy metals to the environment.
- Application of **chemical fertilizers** and **combustion of fossil fuels** also contribute to the **anthropogenic input of heavy metals** in the environment.

What has been Observed in Monitoring of Heavy Metal Pollution?

- There are **764 river quality monitoring stations** in India, spread over **28 states**.
- Out of the **33 monitoring stations in Ganga**, **10 had high levels of heavy metals contaminants**.
- The **Central Water Commission** examined water samples from 688 sites for heavy metals between August 2018 and December 2020.
- **Total coliform** and **biochemical oxygen demand** were high in **239 and 88** of the **588 water quality stations** examined for pollution throughout **21 states**.
- It indicates that **wastewater treatment** from **industry, agricultural, and domestic households** is inadequate.
- According to the **Center for Science and Environment's State of the Environment Report 2022**, the river, which is the focus of the **Namami Gange mission**, contains high levels of lead, iron, nickel, cadmium, and arsenic (CSE).
- The report is a yearly compilation of data on environmental development obtained from public sources.
- According to the **Central Pollution Control Board**, **ten states** do not treat their sewage at all.
- In India, 72% of sewage waste is dumped untreated.

What are the Consequences of the Heavy Metal Pollution?

- These toxic heavy metals entering the environment may lead to **bioaccumulation and biomagnifications**.
 - **Bioaccumulation:**
 - The net **accumulation of a pollutant in an organism** from all sources, including water, air, and food, is known as bioaccumulation.'
 - **Biomagnifications:**
 - Biomagnification is the **accumulation of a chemical by an organism** as a result of water and food exposure, **resulting in an increase in concentration** that is higher than would have been expected from equilibrium.
- Some heavy metals have an effect on **biological activities** and **growth**, while others accumulate in one or more organs, resulting in a variety of **severe diseases** such as **cancers, skin diseases, nervous system disorders** etc.
 - **Metal toxicity** results in the production of **free radicals**, which **damages DNA**.
- These heavy metals are not readily **degradable** in nature and accumulate in the animal as well as human bodies to a **very high toxic** amount.
 - Heavy metal intake has been related to **developmental retardation, renal damage, a variety of cancers**, and **even death** in extreme cases.

What is Namami Gange Mission?

- Namami Gange mission is an **Integrated Conservation Mission**, approved as a **'Flagship Programme'** by the **Union Government** in June 2014 to accomplish the twin objectives of effective **abatement of pollution and conservation** and rejuvenation of **National River Ganga**.
- It is being operated under the **Department of Water Resources, River Development and Ganga Rejuvenation, Ministry of Jal Shakti**.
- The program is being implemented by the **National Mission for Clean Ganga (NMCG)**, and its state counterpart organizations i.e **State Program Management Groups (SPMGs)**.
- **NMCG** is the implementation wing of **National Ganga Council** (set in 2016; which replaced the **National Ganga River Basin Authority - NGRBA**).

▪ **The main pillars of the programme are:**

- Sewage Treatment Infrastructure
- River-Front Development
- River-Surface Cleaning
- Biodiversity
- Afforestation
- Public Awareness
- Industrial Effluent Monitoring
- Ganga Gram

What is the Central Water Commission?

- The Central Water Commission is the apex technical organization in the country for development of water resources and is an attached organization of the **Ministry of Jal Shakti**.
- The Commission is responsible for **initiating, coordinating** and **furthering**, in consultation with the **State Governments**, the schemes for **control, conservation, development** and **utilization of water resources** throughout the country for the purpose of **irrigation, flood management, power generation, navigation** etc.

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