Ageing dams

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Manifest Pedagogy:

The report, titled '**Ageing water infrastructure: An emerging global risk**' , by United Nations University's Canadian-based Institute for Water, Environment and Health, aims to attract global attention to the creeping issue of ageing water storage infrastructure and stimulate international efforts to deal with this emerging, rising water risk. India must analyse the costs versus benefits of its ageing dams, and conduct timely safety reviews in order to ensure safety of the structures, and the safety of those who inhabit the areas downstream.

In News: Ageing dams in India, U.S., other nations pose a growing threat: UN report.
Placing it in Syllabus: Economy- Infrastructure, Environment.
Static Dimensions

- Findings of the report about the ageing dam.

Current Dimensions

- Dam Scenario In India
- Issues with ageing of Dams

Content

Dams play a significant role in water supply, energy production, flood control, and irrigation.

The report says most of the 58,700 large dams worldwide were constructed between 1930 and 1970 with a design life of 50 to 100 years.The analysis includes dam decommissioning or ageing case studies from the U.S., France, Canada, India, Japan, and Zambia and Zimbabwe.

Findings of the report about the aging dam

- All over the world, many large dams built in the 20th century may start to show signs of ageing, and many may already be operating at or beyond their design life.
    - **50** is roughly the age when a dam may begin to show signs of ageing. In some cases, dam components such as gates and motors may need to be replaced after **30 to 50 years.**
- At 50 years, a large concrete dam would most probably begin to express signs of ageing.
    - Ageing signs include increasing cases of dam failures, progressively increasing costs of dam repair and maintenance, increasing reservoir sedimentation, and loss of a dam's functionality and effectiveness, strongly interconnected manifestations.
- By 2050, most people on Earth will live downstream of tens of thousands of large dams built in the 20th century, many of them already operating at or beyond their design life.
- The report said that **32,716 large dams (55% of the world's total) are found in just four Asian countries: China, India, Japan, and South Korea,** a majority of which will reach the 50-year threshold relatively soon.
- The same is true of many large dams in Africa, South America, and Eastern Europe.

- **USA**
    - More than **85% of U.S. dams** operating beyond life expectancy
    - More than **85% of U.S. dams in 2020** were operating at or beyond their life expectancy and 75% of U.S. Dam failures occurred after 50 years of age.
    - The estimated cost to refurbish U.S. dams is about $64 billion. Nearly 1,275 dams were removed in 21 U.S states in the last 30

years 80 removed in 2017 alone.

- **Ageing water storage infrastructure**
    - Worldwide, the huge volume of water stored behind large dams is estimated at 7,000 to 8,300 cubic kilometres, enough to cover about 80% of Canada's landmass under a metre of water.
    - Underlined is the fact that the rising frequency and severity of flooding and other extreme environmental events can overwhelm a dam's design limits and accelerate a dam's ageing process.
        - Decisions about decommissioning, therefore, need to be taken in the context of a changing climate.

- **Dam development**
    - Large dam construction surged in the mid-20th century and peaked in the 1960s – 70s especially in Asia, Europe and North America, while in Africa the peak occurred in the 1980s.
    - The number of newly-constructed large dams after that continuously and progressively declined.
    - According to the report, the world is unlikely to witness another large dam-building revolution as in the mid-20th century, but dams constructed then will inevitably be showing their age.
    - The pace of large dam construction has dropped dramatically in the last four decades and continues to decline in part.
    - The best locations for such dams globally have been progressively diminishing as

nearly **50% of global river volume** is already fragmented or regulated by dams," the report says.

- **Dam decommissioning.**
    - The report added that dams that are well designed, constructed and maintained can easily reach 100 years of service but predicts an increase in decommissioning, a phenomenon gaining pace in the U.S. and Europe as economic and practical limitations prevent ageing dams from being upgraded or if their original use is now obsolete.
    - Public safety, escalating maintenance costs, reservoir sedimentation, and restoration of a natural river ecosystem are among the reasons driving dam decommissioning.

Dam Scenario In India

- India has **4,407 large** dams of which more than **1,000 would be 50 years** or older by 2025.
- **Nature of built**-India's dams are **more vulnerable to deterioration** because a large proportion of them are earthen built by compacting successive layers of earth, and not concrete and are hence more prone to ageing.
- **Monsoon**-The country gets concentrated rainfall every year for a designated time period as opposed to distributed rainfall, which contributes to the dams' vulnerability.
- **Siltation**, which is the accumulation of silt and debris behind the reservoir, leads to a reduction in the storage capacity of the dams. The actual siltation rate of the dams is higher than what is estimated in the proposals.
    - The Central Water Commission's recent study on the Srisailam project on the Krishna river also found that the dam's storage capacity was reduced as a

result of siltation.

- In India, the downstream areas are often exposed to flood disasters even without a dam breach, in which water creates an opening in a dam due to rapid erosion of a section of the embankment.
- **Water management in dams is poor**-Dams are filled up right at the beginning of the rainy season instead of at the end, which means that in case of heavy rainfall in the upstream as well as downstream areas, the dam would have to release water downstream causing heavy flooding in the downstream areas.
    - The safety performance of India's dams is much worse than what the UNU report state.
- **Flooding** caused 44% of dam failures in India, while the remaining were caused by other factors, including inadequate spillway capacity, piping and poor workmanship.
- **Vulnerable regions** -Some of the Himalayan dam systems, including the **Tehri Dam**, are in an active seismic area given that the Himalayan mountain system is constantly changing and growing giving rise to several tectonic movements.
    - The **Koyna Dam** in Maharashtra and the downstream **Warna Dam** on the Warna river, a tributary of Krishna, also lie in a highly sensitive area.
    - The report said that approximately **3.5 million people** are at risk if India's **Mullaperiyar dam** in Kerala, built over 100 years ago, were to fail.
        - The dam, in a seismically active area, shows significant structural flaws and its management is a contentious issue between Kerala and Tamil Nadu States.

Issues with ageing of Dams

- **Risks**-Older dams pose greater safety risks, cost higher in terms of maintenance and have declining functionality

due to sedimentation.

- **Environmental and social impacts-**There are also strong concerns regarding the environmental and social impacts of dams, and large dams in particular,
- **Lack of Information**-Information continues to be sporadically documented in India and serves as a blind spot in terms of understanding the true gravity of the water crisis in the country.
- **Storage capacity**-As dams age, soil replaces the water in the reservoirs. Therefore, the storage capacity cannot be claimed to be the same as in the 1900s and 1950s.
- **Climate change**-A study by the **Canada-based United Nations University Institute for Water, Environment and Health**, released in January- Climate change is also likely to accelerate the ageing of dams.
- **Age-related problems** can crop up, such as decay or deterioration of the structural materials used in construction, ageing of other components such as gates and spillways.

Steps taken by the government

- **Dam Safety Act 2021**
  - It provides for proper surveillance, inspection, operation and maintenance of all specified dams in the country to ensure their safe functioning.
  - It provides for the constitution of a **National Committee on Dam Safety** which shall evolve dam safety policies and recommend necessary regulations as may be required for the purpose.
  - It provides for the establishment of the **National Dam Safety Authority** as a regulatory body which shall discharge functions to implement the policy, guidelines and standards for dam safety in the country.
  - It provides for the constitution of a **State Committee on Dam Safety** by the State Government.

- **DRIP**
    - The Government of India, with financial assistance from the **World Bank initiated the Dam Rehabilitation and Improvement Project (DRIP)** in April 2012.
    - The objective was to improve the safety and operational performance of selected existing dams along with dam safety institutional strengthening with a system wide management approach.
    - The **budget outlay is Rs 10,211 Cr** (Phase II: Rs 5107 Cr; Phase III: Rs 5104 Cr) with rehabilitation provision of 736 dams

Way Forward

- **Case-by-case assessment** should be made by reviewing dams that have reached 50-60 years of age and an informed decision should be taken.
- **Dam decommissioning** should be seen as equally important as dam building in the overall planning process on water storage infrastructure developments.
    - Projects that pose serious safety risks should be listed and then decommissioned in a phased manner through a consensus of all the stakeholders.
    - A risk management decision such as decommissioning is also based on public safety and environment factors apart from economic factors.
- **Proper engineering, good construction and regular maintenance**, the dams that we design and build today can continue to serve many generations to come.
- **Existence of accountability and transparency** while taking into consideration the views of the real stakeholders,the people living downstream from the dams, who are the most at-risk group in case of a breach.
- **Need management committees** for every dam where fully independent voices and experts beyond the government agencies as well as those representing the vulnerable

downstream communities will have a say in the dam safety policy paradigm.

- **Operational safety**, **the rule curve**, that decides how a dam is supposed to be operated and is created when a dam is proposed, needs to be upgraded at regular intervals on the basis of environmental changes such as siltation and rainfall pattern since these would change the frequency and intensity of incoming flood into the dam as well as the spillway capacity.
    - The rule curve also needs to be in the public domain so that the people can keep a check on its correct functioning and can raise questions in its absence,
- **Cumulative assessment**-In India every river has multiple dams along its course, so a cumulative assessment of every upstream and downstream dam needs to be in place to ensure dam safety in terms of operations.

Mould your thoughts

1. Ageing dams might jeopardise water security, reduce farmer income, and worsen flooding. Discuss with special emphasis on the dam scenario in India. Also enumerate the steps taken by the government in this regard. (250 words).

Approach to the answer

- Introduction about gravity of situation
- Issue of Ageing Dam in India.
- Implications of ageing dam- water security, farmer income, flooding
- Steps taken by government
- Way Forward and conclusion.