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1. Can Bhopal gas tragedy waste be safely disposed of?

Introduction

On January 2, Madhya Pradesh government authorities moved 358 tonnes of hazardous waste from the defunct Union Carbide facility in Bhopal to the Pithampur industrial area in Dhar district. On December 3 last year, the Madhya Pradesh High Court had set a four-week deadline for authorities to dispose of this waste, nearly 40 years after the gas disaster that killed more than 4,000 people and injured or debilitated thousands more.



What is the waste's status?

The disaster on the intervening night of December 2-3, 1984, was the result of poisonous gases leaking from the plant, which Union Carbide had set up to manufacture fertilizers. The waste at the facility is composed of the ingredients required to make these fertilizers.

After years of lying in Bhopal and multiple petitions from civil society groups, the Madhya Pradesh government was to incinerate the waste at a Treatment, Storage, and Disposal Facility (TSDF) in Pithampur more than 200 km away. Officials arranged for the waste to be packaged and transported in secure long-haul containers.

But protests in the industrial town by the local population fearing harmful emissions from the incineration have paused the State's plans.

On January 6, the Madhya Pradesh High Court gave the State government six weeks to safely dispose of the waste. The order came after State authorities had also sought time to spread awareness about the manner of disposal and measures to minimise its effects on health and the environment.

The Central government has allocated ₹126 crore to the State to incinerate the waste and deposit the residue in the TSDF landfill.

Why Pithampur?

In 2012, the Supreme Court selected the Pithampur facility as being the most suitable final destination for the waste. According to the Central Pollution Control Board (CPCB), it is the sole TSDF in the State and includes a landfill and an incinerator. The CPCB submitted an affidavit to the apex court in 2013 attesting to the TSDF's ability to 'handle' the waste.

In 2015, Madhya Pradesh organised a 'trial run' in which it incinerated 10.1 tonnes of the waste at the TSDF. The CPCB monitored the process with help from experts from private laboratories in Chennai and Hyderabad. Notably, the State had secretly advanced the incineration date by a few days to sidestep local resistance.

According to Bhopal Gas Tragedy Relief and Rehabilitation Department director Swatantra Kumar Singh, the emissions from the trial were under stipulated limits. The State's public relations office also reported no adverse effects on the environment or on public health.

Is the waste harmful?

The 'trial' waste consisted of 4.8 tonnes of excavated waste, 1.6 tonnes of semi-processed residue, 1.3 tonnes of naphthol waste, 1.3 tonnes of carbaryl residue, and 0.8 tonnes of reactor residue. According to a December 2024 press release from the State's public relations office, the Regional Director (Central) of CPCB Bhopal had collected and tested five water samples from around the Pithampur TSDF. The report (numbered WW24.25-188.189) indicated the water colour, chloride, sulphate, and fluoride concentrations, hardness, and the amount of total dissolved solids "exceeded permissible limits" specified in the IS 10500 standard in two open wells near the landfill.

However, the release said according to "scientists involved in the analysis" the higher values "reflect groundwater quality and don't appear to be linked to the TSDF operations".

The release also said experts from the All India Institute of Medical Sciences (AIIMS) Bhopal and the Indian Council of Medical Research reportedly surveyed 12 villages and found the prevalence of skin and respiratory ailments to be lower than the national average.

Credible media reports in 2015 had said around four-times as much ash and residue as the waste combusted (by mass) had been generated and which the CPCB had said it would dispose of in the landfill, including protections to contain leachates.

The U.S. Environmental Protection Agency (EPA) has said these protections can degrade and need to be reinstalled at periodic intervals.

What next?

Madhya Pradesh has temporarily put off incinerating the waste. Authorities have said the local protests, including two attempts at self-immolation, mean they would first like to improve public confidence in the safety of the disposal process.

There will also be another trial run: a 90-kg batch will be incinerated at 1,200° C. According to the EPA, most organic compounds (like naphthol) are destroyed when subjected to 590° to 650° C. Operating hazardous waste incinerators at 980-1,200° C would thus strip the waste of organics.

If the resulting emissions don't breach legal thresholds, the rest will be incinerated in batches of 270 kg each over three months. If the emissions exceed, Mr. Singh had told The Hindu the batch size would be reduced and the duration extended to nine months.

Relevance: GS Prelims & Mains Paper III; Environment Source: The Hindu

2. Why are fertility levels declining in India?

Introduction

A comprehensive demographic analysis of global fertility in 204 countries and territories from 1950-2021 has found that fertility is declining globally and that future fertility rates will continue to decline worldwide, remaining low even under successful implementations of pronatal policies.

What has it noted about India?

INDIA'S TFR MAY FALL TO 1.04 BY 2100



The Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) 2021, noted that India has moved from a fertility rate of 6.18 in the 1950s to a Total Fertility Rate (TFR) of 1.9 in 2021. This, it pointed out, was below the replacement fertility level of 2.1 (which is the average number of children a woman should have to replace herself and her generation, for population stability). The GBD study projected that the TFR could fall further to 1.04 — barely one child per woman — by 2100.

The steep fall in fertility levels has triggered concerns about the political and socioeconomic fallout, especially in the southern States, which fear the loss of parliamentary seats post the delimitation exercise in 2026.

Why is fertility falling?

Even though the country has had one of the oldest birth control/family planning programmes, increased female literacy, workforce participation of women, women's empowerment and improved aspirations could have contributed more to the steady drop in fertility rates over the decades than the faithful adoption of family planning initiatives.

The decline in fertility rate has also a lot to do with changing societal attitudes towards marriage and reproduction, with women increasingly exercising their choice. They often prefer to marry late or not at all, often choosing career and financial independence over motherhood. Rising rates of infertility in both men and women and abortions are important factors which could be contributing to this decline in fertility though no absolute data is available. With an increasing number of young men and women opting to go abroad for higher studies and jobs and choosing to settle down and raise their families there, migration is another key factor that could be in play when one considers the decline in fertility levels.

What are the implications?

Declining fertility rates have resulted in a rapid demographic transition in many southern States. The consequences of this — an ageing population, a declining young workforce and increased demands on healthcare and social security measures for the care of an increasing population of the elderly — are being acutely felt in States such as Kerala. Migration of youngsters in search of better prospects is also an issue.

What is happening in the southern States?

There is concern over the irreversible fertility decline across the country, but more so in the southern States, where fertility rates had dropped below the replacement levels much earlier than the rest of India.

Kerala led the demographic transition in the South, achieving the replacement level fertility rate in 1988, with the other four States achieving this by mid-2000. Along with education and women's empowerment and development in the social and health sectors, which were the hallmark of Kerala's high human development index, the State has also seen low economic investments and growth. Educated youth are leaving the State; the proportion of the aged population is expected to surpass that of children (23% in 2036). Changed attitudes towards marriage and motherhood are beginning to reflect in the health of women, leading to an increasing proportion of older mothers and pregnancy-related morbidities.

Kerala's high labour wages and high quality of life index are attracting internal migration from other States to supplant a shrinking workforce. The State Planning Board reckons that by 2030, the proportion of migrant labour could be close to 60 lakh, about one-sixth of the State's population.

What is the way forward?

Fertility decline is almost always irreversible and the graph, once it starts going down, may never bounce back. Countries like South Korea, which tried to stem the demographic crisis by pumping in millions have failed and the fertility rate plunged from 0.78 in 2022 to 0.73 in 2023. Demographers suggest that socio-economic policies that propel the growth of the economy, improve job prospects for the youth and tap the potential of a growing population of senior citizens, can help in reducing the impact of a long spell of low, sub-replacement level fertility rates on countries.

Relevance: GS Prelims & Mains Paper I; Society Source: The Hindu

3. What is the SVAMITVA scheme to issue property cards in villages, who benefits from it and how

What is the SVAMITVA scheme?

The acronym SVAMITVA stands for Survey of Villages and Mapping with Improvised Technology in Village Areas. It aims to provide a 'record of rights' to those having houses in villages, and issue them a property card.

The plan is to survey all rural properties using drones and prepare GIS -based maps for each village. The scheme was launched by PM Modi on National Panchayati Raj Day, on April 24, 2020.

What is the benefit of a SVAMITVA property card?

According to the Ministry of Panchayati Raj, the scheme benefits rural residents in many ways. First, it enables rural households to use their property as a financial asset for taking loans and other financial benefits.

Second, it helps in determination of property tax, which accrues to the Gram Panchayats directly in states where they are empowered to collect such taxes. The cards help increase liquidity of land parcels in the market and increase the financial credit availability to the village. The scheme also paves the way for creation of accurate land records for rural planning. All the property records and maps are available at the Gram Panchayat level, which helps in taxation of villages, construction permits, elimination of encroachments, etc.

How is the scheme being implemented?

The framework for implementation of SVAMITVA scheme provides a multi-stage process of generating a property card, which starts with signing of a memorandum of understanding between Survey of India (SoI) and respective state governments. The SoI is responsible for preparing the National Topographic database on all scales, using technology for topographical mapping at various scales including the use of airborne photography drones, satellite imageries, and Unmanned Air Vehicles (UAV) or drone platforms.

Once the MOU is done, a Continuously Operating Reference System (CORS) is established. It is a network of reference stations that provide a virtual base station that allows access to long-range high-accuracy Network RTK (Real-Time Kinematic) corrections. "The CORS network supports in establishing ground control points, which is an important activity for accurate Geo-referencing, ground truthing and demarcation of lands," says the framework.

The next step is the identification of villages to be surveyed, and make people aware of the process of mapping properties. The abadi area (inhabited area) of the village is demarcated

and each rural property is marked with limestone (chunna). Then, drones are used for large scale mapping of rural abadi areas.

Based on these images, a GIS database on 1:500 scale, and village maps — Gram Manchitra — are drawn. After creation of maps, a ground verification process by drone survey teams follows, on the basis of which corrections, if any, are made. At this stage, the inquiry/objection process – conflict/ dispute resolution is completed.

After this, final Property Cards/Title deeds or "Sampatti Patrak" are generated. These cards are made available on digital platforms or as hard copies to the village household owners.



How far has the scheme progressed?

Back in 2020, the scheme was implemented as a pilot project in about 1 lakh villages across 9 states– Haryana, Karnataka, Madhya Pradesh, Maharashtra, Uttar Pradesh, Uttarakhand, Punjab, Rajasthan and Andhra Pradesh. The aim was to cover all 6.62 lakh villages in the country by the end of financial year 2023-24.

Recently, an official statement said, "Drone survey has been completed in over 3.17 lakh villages, which covers 92% of the targeted villages... The scheme has reached full saturation in Puducherry, Andaman & Nicobar Islands, Tripura, Goa, Uttarakhand and Haryana. Drone survey has been completed in Madhya Pradesh, Uttar Pradesh, Chhattisgarh and several UTs," the statement said.

According to the ministry, A total of 67,000 sq.km of rural Abadi land has been surveyed, valued at Rs.132 lakh crore, emphasizing the economic significance of the initiative.

Now the government plans to showcase the success of the SVAMITVA scheme at global level. "Looking ahead, the Ministry plans to showcase the success of the SVAMITVA Scheme on global platforms. In March 2025, MoPR in collaboration with Ministry of External Affairs, has planned to host an International Workshop on Land Governance in India, with participation from nearly 40 representatives from Africa, Latin America, and Southeast Asia. This workshop aims to share best practices and advanced drone and GIS technologies, fostering collaboration for similar initiatives worldwide. In May 2025, the Ministry is also planning to participate in the World Bank Land Governance Conference in Washington to highlight India's achievements and encourage international adoption of the model," the ministry said in a statement on January 17.

Relevance: GS Prelims & Mains Paper II; Governance Source: Indian Express