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Impacts of Methane Emission

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Why is in news? Scientists release findings of second biggest man-made methane leak: What happened; impact on the environment

Recently, scientists revealed that a drilling incident, which took place last year, at an exploration well in the **Mangistau region, southwestern Kazakhstan**, led to one of the worst methane leaks in history. It was **possibly the second biggest man-made methane leak ever**.

Kazakhstan incident:

The **drilling incident at the exploration well** caused a fire that raged between June and December 2023 and released 127,000 tonnes of methane into the atmosphere.

Plumes of gas could be seen from space, which is how scientists behind five satellite instruments detected the leak 115 times during the six months. The leak has now been stopped and the well is currently being sealed with cement.

The UN's International Methane Emissions Observatory, said that the magnitude and the duration of the leak were "unusual" and "extremely big", according to the BBC, which first reported the incident.

The Kazakhstan methane leak is the latest addition to the long list of such leaks from the oil and gas sector.

The **UN Environment Programme** said that "massive methane leaks, known as **super-emitter events**, have been taking place at oil and gas fields all over the world, from the US to Turkmenistan". Most of these leaks are due to equipment failure.

Notably, **2023 witnessed the highest levels of greenhouse gas concentrations** ever in the atmosphere. Methane concentrations increased by 11 parts per billion (ppb).

Methane:

Methane (CH₄) is a hydrocarbon that is a **primary component of natural gas**.

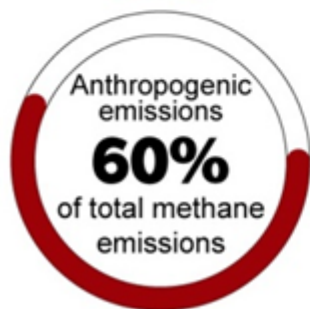
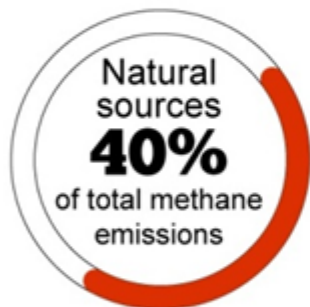
Methane is **also a greenhouse gas** (GHG), so its presence in the atmosphere affects the earth's temperature and climate system.

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Second-most abundant greenhouse gas



Global Methane Emission

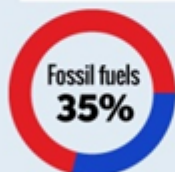


Anthropogenic emissions



Livestock emissions **32%**

Rice Cultivation **8%**

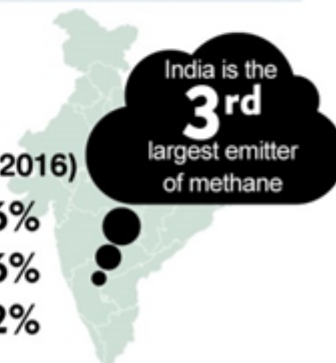


Oil & Gas Extraction **23%**

Rice Cultivation **12%**

Waste Sector: **20%**

India's methane emissions (2016)



Methane (CH₄) is a colourless, odourless and highly flammable gas.

Leaks from fossil fuel operations are the biggest source of methane emissions. About **40% of human-caused methane emissions** come from such operations.

Methane is the **second most abundant anthropogenic GHG** after carbon dioxide (CO₂), accounting for about 20 percent of global emissions.

China, the United States, Russia, India, Brazil, Indonesia, Nigeria, and Mexico are estimated to be responsible for **nearly half of all anthropogenic methane emissions**.

Because methane is both a powerful **greenhouse gas and short-lived** compared to carbon dioxide, achieving significant reductions would have a rapid and significant effect on atmospheric warming potential.

Sources of Methane:

Globally, 50 to 65% of total methane emissions come from the following human-caused activities:

Raising livestock: Ruminants such as cows, sheep, goats, and buffaloes have a special type of digestive system that allows them to break down and digest food that non-ruminant species would be unable to digest.

Livestock emissions (from manure and gastroenteric releases) account for roughly 32 per cent of human-caused methane emissions.

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Energy sector and Gas leak: Leaks from natural gas systems

Decomposition of Waste: Landfills and waste from homes and businesses

Agriculture is the predominant source.

Paddy cultivation in which flooded fields prevents oxygen from penetrating the soil, creating ideal conditions for methane-emitting bacteria – accounts for another 8 per cent of human-linked emission.

Environmental impact of the leak:

Methane is the **primary contributor to the formation of ground-level ozone**, a hazardous **air pollutant** and greenhouse gas, exposure to which causes 1 million premature deaths every year.

Over a 20-year period, methane is **80 times more potent at warming** than carbon dioxide.

Methane has accounted for **roughly 30 percent of global warming** since pre-industrial times and is proliferating faster than at any other time since record keeping began in the 1980s.

The environmental impact of such a methane leak is comparable to that of driving more than 717,000 petrol cars for a year.

According to the **International Energy Agency (IEA)**, rapid and sustained reductions in methane emissions are needed to limit near-term warming and improve air quality.

The average global temperature has already risen at least 1.2 degree Celsius above pre-industrial times.

To ensure that the planet doesn't breach the 1.5 degree and 2 degree Celsius thresholds set by the 2015 Paris Agreement, countries urgently need to implement certain steps, including curbing greenhouse gases like methane and carbon dioxide.

Initiatives to tackle Methane emissions:

India:

'Harit Dhara' (HD): Indian Council of Agricultural Research (ICAR) has developed an anti-methanogenic feed supplement 'Harit Dhara' (HD), which can cut down cattle methane emissions by 17-20% and can also result in higher milk production.

India Greenhouse Gas Program: The India GHG Program led by WRI India (non-profit organization), Confederation of Indian Industry (CII) and The Energy and Resources Institute (TERI) is an industry-led voluntary framework to measure and manage greenhouse gas emissions.

The programme builds comprehensive measurement and management strategies to reduce emissions and drive more profitable, competitive and sustainable businesses and organisations in India.

National Action Plan on Climate Change (NAPCC): NAPCC was launched in 2008 which aims at creating awareness among the representatives of the public, different agencies of the government, scientists, industry and the communities on the threat posed by climate change and the steps to counter it.

Bharat Stage-VI Norms: India shifted from Bharat Stage-IV (BS-IV) to Bharat Stage-VI (BS-VI) emission norms.

Global:

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Methane Alert and Response System (MARS): MARS will integrate data from a large number of existing and future satellites that have the ability to detect methane emission events anywhere in the world, and send out notifications to the relevant stakeholders to act on it.

Global Methane Pledge: At the Glasgow climate conference (UNFCCC COP 26) in 2021, nearly 100 countries had come together in a voluntary pledge, referred to as the Global Methane Pledge, to cut methane emissions by at least 30% by 2030 from the 2020 levels.

Global Methane Initiative (GMI): It is an international public-private partnership focused on reducing barriers to the recovery and use of methane as a clean energy source.

Way Ahead:

Farmers can provide animals with more nutritious feed so that they are larger, healthier and more productive, effectively producing more with less.

Scientists are also **experimenting with alternative types of feed to reduce the methane** produced by cows and looking at ways to manage manure more efficiently by covering it, composting it, or using it to produce biogas.

When it comes to **staple crops** like paddy rice, experts recommend **alternate wetting and drying approaches** that could halve emissions.

Rather than allowing the continuous flooding of fields, paddies could be irrigated and drained two to three times throughout the growing season, limiting methane production without impacting yield. That process would also require one-third less water, making it more economical.