Rat-Hole Mining

For Prelims: Rat-Hole Mining, National Green Tribunal (NGT), Article 371A, Rat-Hole Mining, Coal

For Mains: Article 371A limitations and challenges, Sustainable mining practices, Rat-Hole Mining, Environmental pollution and degradation

Source: TH

Why in News?

The **rat-hole mining** tragedy in **Assam's Dima Hasao** district, where nine miners were trapped after a flood in an illegal coal mine, highlights the persistent dangers of unregulated mining despite existing bans.

- Also, **biomining** is being conducted at the **Koottupatha trenching ground** in **Palakkad**, Kerala.

What is Rat-hole Mining?

- **About:**
  - **Rat-hole mining** is a **primitive, crude, labor-intensive and hazardous** method of **coal mining.**
  - It involves **digging of very small tunnels**, usually only **3-4 feet deep and 2 to 3 feet wide** into the ground, in which workers, more often children, enter and extract coal.
  - It is typically practiced in **northeastern India,** particularly in **Meghalaya and Assam.**
- **Methods of Extraction:**
  - **Side-Cutting Procedure**: This involves **digging narrow tunnels into hill slopes** to access thin coal seams, usually less than 2 meters in height, found in the region's hilly terrain.
  - **Box-Cutting:** In this method, a **rectangular opening is first created,** followed by **digging a vertical pit.**
    - Horizontal tunnels, resembling rat holes, are then dug for coal extraction.
- **Reasons for Rat-Hole Mining:**
  - **Poverty:** Due to **limited livelihood options**, local tribal communities often turn to rat-hole mining as a means of survival.
    - The **immediate financial gain from selling extracted coal,** despite the high risks, is a significant pull for those struggling economically.
  - **Land Ownership Issues: Ambiguities in land titles and lack of proper regulation** create opportunities for illegal mining operations to **exploit gaps in governance** and persist without accountability.
  - **Coal Demand: Continuous demand for coal**, both legal and illegal, sustains the practice.
    - **Middlemen and illegal traders** further perpetuate this cycle by creating a

market for unlawfully mined coal.

What are the Challenges Associated with Rat-hole Mining?

- **Safety Hazards:** The narrow tunnels are **prone to collapses, often trapping miners**, while **poor ventilation leads to suffocation**. The **lack of safety measures** results in frequent **accidents, injuries, and life-threatening diseases.**
    - **Eg:** The 2024 Wokha mine explosion in **Nagaland claimed 6 lives,** while the 2018 **Ksan mine flooding in Meghalaya resulted** in the deaths of 17 miners.
- **Environmental Impact:** Rat-hole mining contributes to **deforestation, soil erosion,** and **water contamination**.
    - **Improper waste disposa**l from mining operations leads to **acidic runoff (Acid Mine Drainage, or AMD)**, which **degrades water quality** and **harms biodiversity** in surrounding ecosystems.
    - Eg: In Meghalaya, AMD turned rivers like **Lukha** acidic, while in Nagaland, mining degraded fertile lands and polluted water in **Wokha** and **Mon districts.**
- **Social Issues:** It causes **exploitation of child labor and poorly paid workers.** Also, leads to displacement of local communities.
    - Reports by **NGO Impulse** revealed that **70,000 child labor**, primarily from **Bangladesh and Nepal**, were employed in mines due to their **small size for navigating narrow tunnels.**

How is Rat Hole Mining Regulated?

- **Regulation in India:**
    - **Status in India:**
        - **Rat hole mining** is **illegal** and falls under the jurisdiction of the **State/District administration** to address as a **law and order issue**.
    - **Ban by the National Green Tribunal (NGT):**
        - In 2014, the **National Green Tribunal (NGT) banned rat-hole mining** due to numerous incidents of fatalities, particularly during the monsoon season.
        - The **Supreme Court of India**, in **July 2019**, upheld the ban on **rat hole mining** in **Meghalaya**, originally imposed by the **NGT** in 2014.
            - SC ruled that such mining is **illegal** under the **Mines and Minerals (Development and Regulation) Act, 1957.**
    - **Regulation of Rat-Hole Mining in Nagaland:** The **Nagaland Coal Policy, 2006** regulates rat-hole mining by granting **Small Pocket Deposit Licences** (SPDLs) to individual landowners under strict conditions.
        - **Article 371A** also provides **Nagaland** with **autonomy to protect land, resources, and customary laws,** creating legal hurdles in regulating mining practices.
    - **Sixth Schedule:** The Sixth Schedule grants **autonomy to tribal areas** in Meghalaya, Mizoram, Tripura, and Assam **through Autonomous District Councils (ADCs),** complicating mining regulation.
        - Local **tribal communities own both land and minerals**, limiting **central oversight** and enforcement of national mining and environmental laws.
        - **ADCs' authority to legislate on land and resources** often **conflicts with** central regulations under the **MMDR Act, 1957**, creating regulatory ambiguities.
- **International Context:** There's **no specific international law** directly addressing rat-hole mining.
    - However, international regulations promote **sustainable mining methods** and **prioritise worker safety**, indirectly influencing member states to adopt similar practices.

What is Biomining?

- **About:**
    - Biomining refers to the **extraction of metals** from ores and other solid materials

using **microorganisms** such as **bacteria, archaea, fungi,** or plants.
    - It is an **eco-friendly technique** that can also be **applied to remediate sites** polluted by metal contaminants.
    - It **extracts metals by oxidising them**, making them **more soluble and easier to recover**. The two main processes are:
        - **Bioleaching:** Microorganisms **directly dissolve the target metal** from its ore for easier extraction.
        - **Biooxidation:** Microbes **break down surrounding minerals,** enriching the target metal and facilitating its extraction.
- **Metals Extracted via Biomining**
    - Biomining primarily extracts metals like **copper, uranium, nickel, and gold,** typically found in **sulfidic minerals**.
- **Advantages of Biomining:**
    - **Environmental Sustainability:** Minimal hazardous waste and **reduced carbon footprint** compared to traditional mining.
    - **Energy Efficiency: Requires less energy**, lowering **greenhouse gas emissions**.
    - **Reduced Water Usage:** Uses water more efficiently, beneficial in water-scarce areas.
- **Challenges of Biomining:**
    - **Slower Extraction Rates**: Biomining tends to be a **slower process** compared to conventional mining, making it **less suitable for large-scale operations.**
    - **Limited Scope**: **Not all ores are suitable for biomining,** particularly those that do **not contain metals** that are easily oxidized by microorganisms.
    - **Technical Challenges**: The process requires **specialized knowledge of microbiology** and may involve complex operational conditions, making it more **difficult to scale up.**

Electrokinetic Technology

- **About:**
    - **Electrokinetic Mining (EKM)** is an **innovative, eco-friendly technique** for extracting **rare earth elements.**
    - It uses an **electric field to mobilize ions** from in-adsorption rare earth deposits (IADs) and extract them efficiently.
- **Significance:**
    - It **reduces leaching agent usage by 80%** and **energy consumption by 60%,** achieving a **recovery rate of over 95%,** marking a significant breakthrough in sustainable mining.
    - This innovation simultaneously minimizes environmental impacts and **enhances the recovery of rare earth elements (REEs).**

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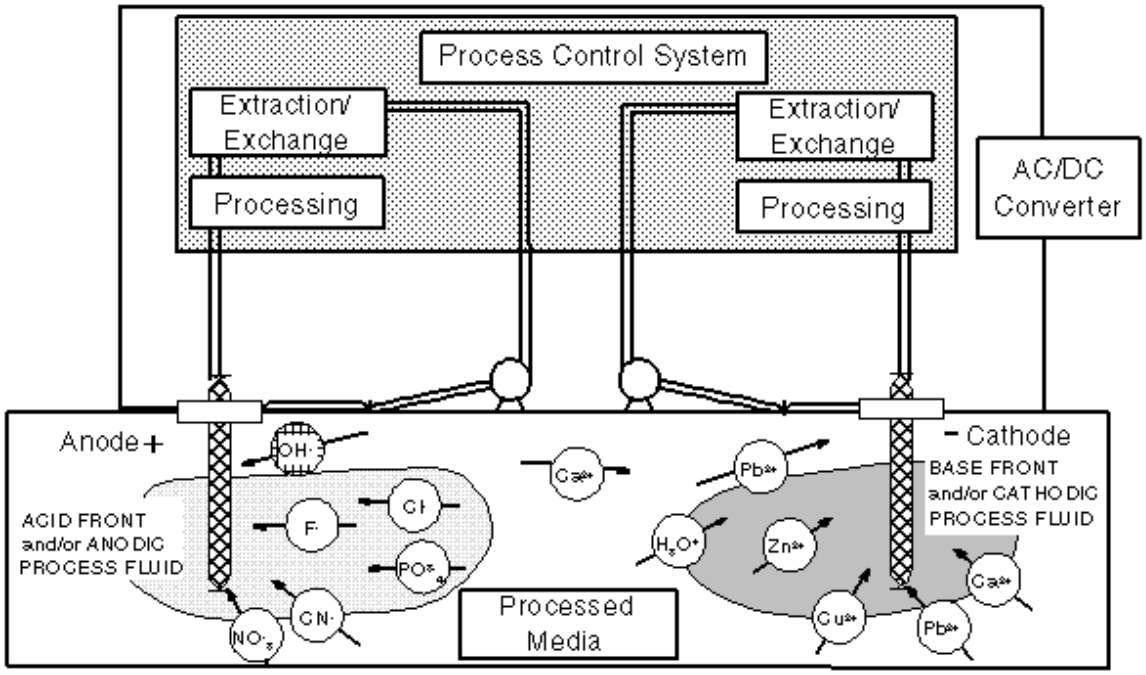

Electrokinetic Remediation Process

Drishti Mains Question:

Examine the environmental and safety challenges posed by rat-hole mining in India. Propose measures to mitigate these issues and promote sustainable mining practices.

UPSC Civil Services Examination, Previous Year Question (PYQ)

Q. "In spite of adverse environmental impact, coal mining is still inevitable for development". Discuss.(2017)