## **Daily News Juice**

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#### **1. Paste Fill Technology for Mining**

#### Why now?

South Eastern Coalfields Limited (SECL) is set to become the first coal PSU in India to adopt paste fill technology for coal mining—marking a major step toward sustainable and environmentally friendly mining practices.

To implement this innovative underground mining technology, SECL has signed a ₹7040 crore agreement with TMC Mineral Resources Private Limited.

Under this agreement, large-scale coal production will be undertaken using paste fill technology in the Singhali underground coal mine located in SECL's Korba area. Over a period of 25 years, the project is expected to produce approximately 8.4 million tonnes (84.5 lakh tonnes) of coal.



#### What is Paste Fill Technology?

Paste filling is a modern underground mining method that eliminates the need to acquire surface land. After coal extraction, the mined-out voids are filled with a specially prepared paste made from fly ash, crushed overburden from opencast mines, cement, water, and

binding chemicals. This process prevents land subsidence and ensures the structural stability of the mine.

Importantly, the paste utilizes industrial waste materials, making the process environmentally sustainable and promoting waste recycling.

#### **Background of Singhali Mine**

The Singhali underground mine was approved in 1989 for a production capacity of 0.24 million tonnes per year and commenced operations in 1993. Presently, the mine has 8.45 million tonnes of extractable reserves of G-7 grade non-coking coal.

However, the surface area above the mine is densely occupied—with villages, high-tension electricity lines, and a Public Works Department (PWD) road—rendering traditional caving methods unfeasible due to safety and environmental concerns.

#### New Opportunity for Singhali Mine

With the introduction of paste fill technology, mining activities in this area can now proceed without disturbing the surface infrastructure.

The successful implementation of this technology in Singhali is expected to pave the way for resuming operations in other underground mines where similar land constraints exist.

#### A Step Towards Green Mining

With a total investment of ₹7040 crore, the project is a major initiative to promote green mining technologies in India. It aims to enhance coal production while significantly reducing environmental impact.

Relevance: GS Prelims & Mains Paper III; Science & Technology Source: PIB

#### 2. Does the planet K2-18b show signs of life?

#### Why in News?

On April 16, an international research team uploaded a paper in which it reported that the distant exoplanet K2-18b may be habitable. The claim was met with cautious excitement by astronomers. While finding places in the universe that could harbour life is a vital quest in the field, experts — including the team that made the finding — are cautious because many similar claims in the past have had to be retracted after closer inspection.

#### What is K2-18b?

K2-18b is an exoplanet — a planet outside the solar system. It's located 124 lightyears away from the earth in the constellation Leo, orbiting the star K2-18. It is 5.2-times wider and roughly nine-times more massive than the earth, dimensions that suggest it likely possesses a hydrogen-rich atmosphere. The amount of stellar radiation it receives from its star is comparable to what the earth receives from the sun. It was discovered by the Kepler telescope in 2015.

In 2019, the Hubble Space Telescope found that its atmosphere contains signs of water vapour. Four years later, the James Webb Space Telescope (JWST) also detected signs of carbon dioxide and methane. Scientists had previously shown in modelling studies that it's possible to find methane and carbon dioxide and no ammonia in a hydrogen-rich atmosphere if (but not only if) there is a liquid water ocean on a planet's surface.



#### What kind of planet might K2-18b be?

According to the new work, K2-18b might be a Hycean world: covered with an ocean overlaid by a hydrogen-rich atmosphere. The JWST is designed to study such planets better than other telescopes can, although K2-18b itself isn't confirmed to be Hycean. Some computer models suggest it may also have a stratosphere and some carbon oxides and cyanide in the middle atmosphere. Researchers have also said its surface conditions may be close to the runaway greenhouse threshold — when the concentration of greenhouse gases in the atmosphere prevents any heat from escaping the surface. This is why Venus is a hellscape.

In the new paper, the team reported the presence of two compounds — either dimethyl sulphide (DMS) or dimethyl disulphide (DMDS) — in K2-18b's atmosphere. Scientists have suggested that DMS could be a biomarker, a sign of life, on exoplanets. DMS on earth is made mostly in the oceans. Phytoplankton produce a molecule called dimethylsulphoniopropionate. When they die, enzymes break up the molecule to release DMS. It's also emitted when bacteria break up plant matter. In 2015, researchers reported that 76% of soil bacteria contain a gene that allows them to produce DMS.

#### Is K2-18b really habitable?

Experts have said the only way to find extraterrestrial life is for them to directly detect it. This is why NASA launched its Clipper mission in 2024 to study Jupiter's moon Europa. Attempts to look for conditions suitable for life (that too only life as we know it) and the presence of specific molecules from a distance can only be suggestive of habitable conditions.

Relevance: GS Prelims & Mains Paper III; Science & Technology

#### Source: The Hindu

3. Ramban rain causes destruction: Understanding the weather events affecting the region

#### Why in News?



Jammu Kashmir rainfall impact: Three people were killed after torrential rainfall and hail in the Ramban tehsil of Jammu and Kashmir recently. Buildings collapsed, transport was disrupted and hundreds of people had to be relocated due to the heavy rain.

According to the India Meteorological Department (IMD), in the 24 hours

ending 8:30 am on April 20, Jammu and Kashmir received 16.9 mm of rainfall, which is a 575% departure from the normal of 2.5 mm.

The Ramban district administration, Udhampur MP and Union Minister Jitendra Singh, and the J&K Office of Chief Minister all posted information about the events on social media, using terms like flash flood, landslide, and cloudburst. What are these events, what causes them, and what impact can they have?

#### What is a cloudburst?

While episodes of heavy rain are often termed "cloudburst", a cloudburst has a specific technical definition — rainfall of 10 cm or more in an hour, over a roughly 10 km x 10 km area. Cloudbursts are more common in hilly areas because of a phenomenon called 'orographic lift', which basically means warm air rising up the side of a mountain. As warm air 'climbs' a mountain, it expands because of the low pressure above. The expanding air cools, releasing the moisture it was holding as rain. But if more and more warm air keeps rising, it prevents that rain, till a large amount of rain builds up and bursts out in a massive shower all at once. Because cloudbursts happen in localised areas (over a roughly 10 km x 10 km area), they are difficult to capture accurately.

The sudden rain released by a cloudburst can quickly overwhelm drainage systems and lead to flash floods and landslides.

#### What is a flash flood?

As the name suggests, a flash flood happens quickly, when a lot of rain suddenly enters into the drainage systems (waterbodies, drains), and water overflows. Flash floods are again more common in hills, because rocky terrain does not absorb water very well.

While river floods, the kind normally seen in plains, last longer and cause more damage to property, the sudden flash floods are more likely to lead to loss of life.

#### What is a landslide?

Landslide is a portion of 'land' coming loose and sliding — rocks and soil slipping down a mountain, for example. As the British Geological Survey's website says, "When the force of gravity acting on a slope exceeds the resisting forces of a slope, the slope will fail and a landslide occurs...adding water to the material on a slope makes a landslide more likely to happen. This is because water adds weight, lowers the strength of the material and reduces friction, making it easier for material to move downslope."

A lot of water gushing down just speeds up this process. Landslides can crush people and animals under the debris, make roads unmotorable, and a lot of debris falling into a water body can cause floods.

Relevance: GS Prelims & Mains Paper III; Environment Source: Indian Express

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