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Addressing Environmental Impact of Mining: Prioritizing SDG Goals 12 (Ensure Sustainable Consumption and Production Patterns), 13 (Climate Action) and 15 (Life on Land) and Emphasis on the Prominence of Strategic Environmental Impact Assessment (EIA)

Nida Tabassum khan[1]*

Department of Biotechnology, Faculty of Life Sciences & Informatics, Baluchistan University of Information Technology, Engineering and Management Sciences, Takatu Campus, Airport Road, Quetta, Baluchistan, Pakistan

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***Corresponding author:** Nida Tabassum khan, Department of Biotechnology, Faculty of Life Sciences & Informatics, Baluchistan University of Information Technology, Engineering and Management Sciences, Takatu Campus, Airport Road, Quetta, Baluchistan, Pakistan

Abstract

Mining, because of its critical environmental impacts such as land degradation, soil erosion, water contamination, pollution, climate change, loss of biodiversity etc raises global concerns. Therefore, it is crucial to address its devastating effects on the ecosystem in order to comprehend and achieve the targets of SDG Goal 12 (Ensure sustainable consumption and production patterns), 13 (Climate action) and 15 (Life on land). Environmental Impact Assessment (EIA) serves as an essential strategic tool to assess the likely natural outcomes of a mining project before it commences, ensuring that both short-term and long-term impacts are understood and mitigated to attain sustainability for future generation.

Keywords: Mining; SGD goals; Sustainability; Mitigation; Heavy metals

Abbreviations: EIA: Environmental Impact Assessment; FDI: Foreign Direct Investment; GDP: Gross Domestic Product; AMD: Acid Mine Drainage; GHG: Greenhouse Gases; COPD: Chronic Obstructive Pulmonary Disease; EMP: Environmental Management Plan; NEPA: National Environmental Policy Act; EPBCA: Environmental Protection and Biodiversity Conservation Act; MPRDA: Mineral and Petroleum Resources Development Act; CBD: Convention on Biological Diversity; PV: Photovoltaic; CSP: Concentrated Solar Power; FPIC: Free Prior and Informed Consent; SDG: Sustainability Development Goals

Introduction

The method of extraction or removal of valuable minerals, metals or other geological materials from Earth or underground, including the seas is termed as mining [1]. Materials like manganese, tantalum, cassiterite, copper, tin, nickel, bauxite (aluminium ore), iron ore, gold, silver, and diamond are typically obtained from the underground mineral deposits [2,3].

Methods of Mining

Surface Mining: It refers to extracting minerals that are near the Earth's surface. It is usually a more cost-effective mining method including the extraction of common coal, iron and bauxite [4]. It includes techniques like strip mining, open pit mining and mountaintop removal mining [5].

Underground Mining: It refers to extracting minerals that are positioned deep beneath the Earth's surface and the commonly extracted minerals through this method include gold, lead and silver [6]. This involves digging tunnels or shafting to reach the mineral deposit. An underground mine could be as shallow as 300 meters or as deep as 3 kilometres. For example, Mponeng Gold Mine, in South Africa, earth's deepest underground mine, has a functional depth beyond 3.1 km [7] and the deepest diamond mine is Mir in Yakutia, Russia, with the depth ranges 525 meters and the diameter is about 1.2 km [8]. (Figure 1)

Figure 1: Mponeng Gold Mine, located in South Africa and Mir Kimberlite Mine in Yakutia, Russia.

Importance of mining in economic development

Boost to economic growth and infrastructure development: Economic growth by means of Foreign Direct Investment (FDI) and Gross Domestic Product (GDP) growth and the development of schools, clinics, and rehabilitation canters in mining communities is supported by mining [9].

Employment opportunities: Mining offers employment opportunities by providing jobs to many people.

Capacity building for farmers: Training programs may be offered by mining companies for farmers which help farmers to enhance their skills.

Extension services: By providing services and farm inputs to farmers mining contributes to agricultural development [10,11].

Negative impacts of mining

Economic impact

Economic dependency: Overdependence on mining can make economies weak to instabilities in goods prices, leading to economic instability. Issues like the "resource curse," are faced by countries that depend heavily on mining which means that other sectors remain underdeveloped [12].

Boom-and-bust cycles: Mining-driven economies can experience boom periods when goods prices are high, followed by busts when prices fall, leading to economic declines, discharges, and reduced government incomes [13].

Environmental Costs: The cost of rehabilitating land after mining activities, managing pollution, and negotiating health impacts can consider deeply on the economy. The short-term economic benefits of mining activities can sometimes be denied by these environmental expenditures [14].

Social impact

Dislocation and loss of living: For the purpose of land purchase for mining project the communities near mining sites may face dislocation. In some cases, traditional livings like agriculture or fishing are disturbed due to environmental destruction [15].

Health risks: Mining processes can lead to air and water pollution, exposing local residents to hazardous substances like heavy metals, which can cause long-term health issues [16].

Social inequality: Though mining can bring wealth, it may also develop social differences. The benefits of mining often go to a small elite or foreign investors, leaving local communities with environmental degradation and few long-term economic prospects [17].

Cultural erosion: The migration of workers and the expansion of mining towns can disturb local cultures and traditions, leading to the destruction of local does and lifestyles [18].

Environmental Concerns Related to Mining

The environmental concerns related to mining are wide, affecting air, water, land, and ecosystems and can lead to long-term ecological damage if not managed properly. These include:

Impacts on wildlife

- Habitat loss
- Destruction
- Species diversity decline etc [19]

Water pollution

- Acid Mine Drainage (AMD)

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- Contamination of Water Sources
- Sedimentation etc [20]

Air pollution

- Particulate Matter
- Acid rain
- Toxic Emissions (carbon dioxide (CO_2) and methane (CH_4)) etc [21]

Land pollution

- Erosion of soils
- Effect soil fertility etc [22]

Tailing impoundments, heap leach and waste rock

Groundwater and surface water contamination [23]

Construction of access roads

Leads to substantial environmental impacts, especially when cutting through ecologically significant areas [24].

Noise and light pollution

Mining operations involve blasting, drilling, and heavy machinery, generating noise and disturb wildlife and local communities.

Light pollution from mining operations can also dissturb nocturnal species and ecosystems [25]. (Figure 2)

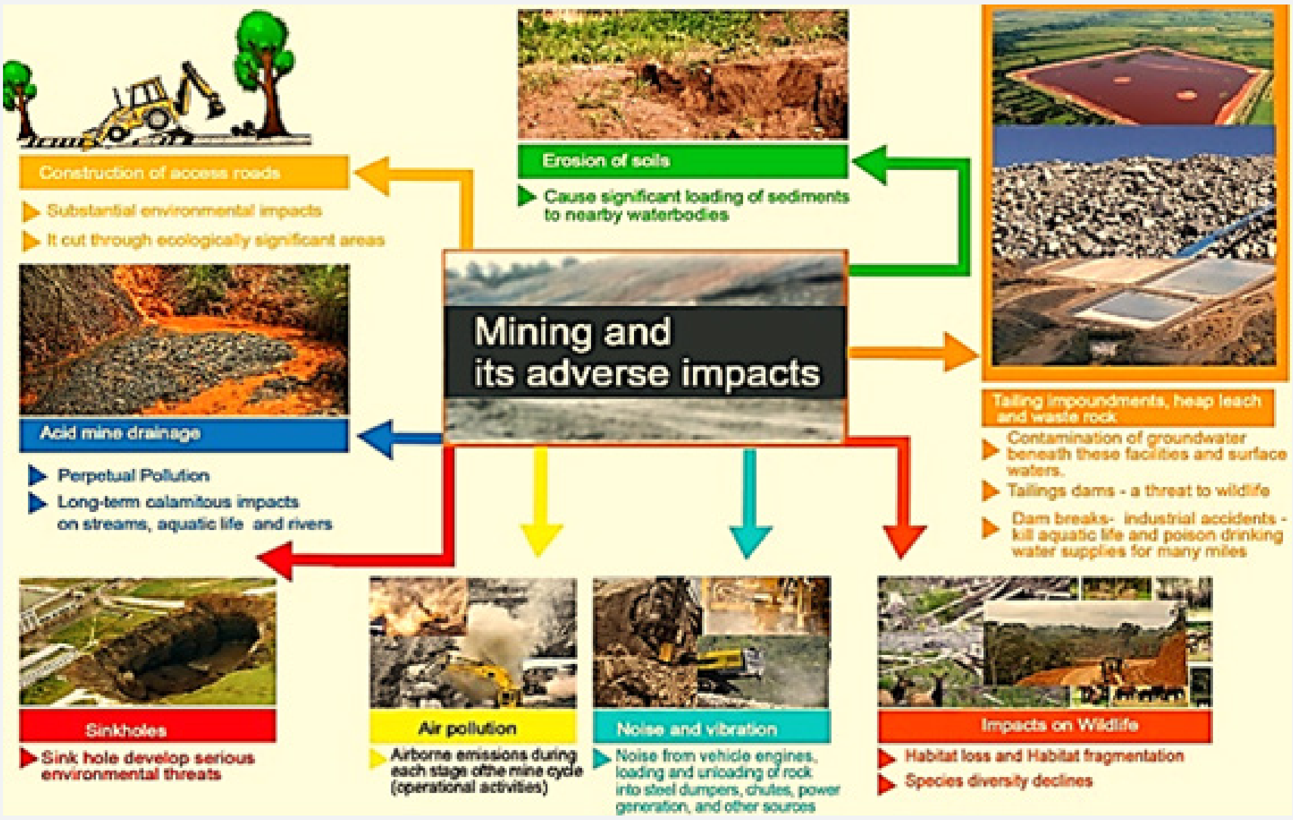

Figure 2: Mining and its adverse impacts.

Environmental Impact of Mining

Mining actions lead to considerable environmental impacts that are often challenging to improve.

Land degradation

The decline in the quality and efficiency of the land is referred to as Land Degradation, which is caused due to human activities such as mining, deforestation, agriculture, and urbanization. A variety of environmental problems are involved in it such as surface disruption, deforestation, habitat destruction, erosion, and the loss of topsoil [26]. (Figure 3)

Water pollution in mining

Mining processes cause significant water pollution through Acid Mine Drainage (AMD), heavy metal contamination, and chemical runoff [27].

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Figure 3: Impact of Mining causing Land degradation.

Acid mine drainage (Amd)

When sulphide minerals like pyrite are exposed to air and water during mining, producing sulfuric acid causes AMD. The acid leaches heavy metals into water bodies, dropping pH and harming aquatic life. It disturbs ecosystems and causing sedimentation that damages habitats [28]. (Figure 4)

Figure 4: Acid Mine Drainage.

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Heavy metal contamination

Heavy metals such as lead, mercury, and arsenic are released from mining waste and runoff. These metals are toxic to aquatic organisms, bioaccumulation in the food chain, and pose serious health hazards to humans [29]. (Figure 5)

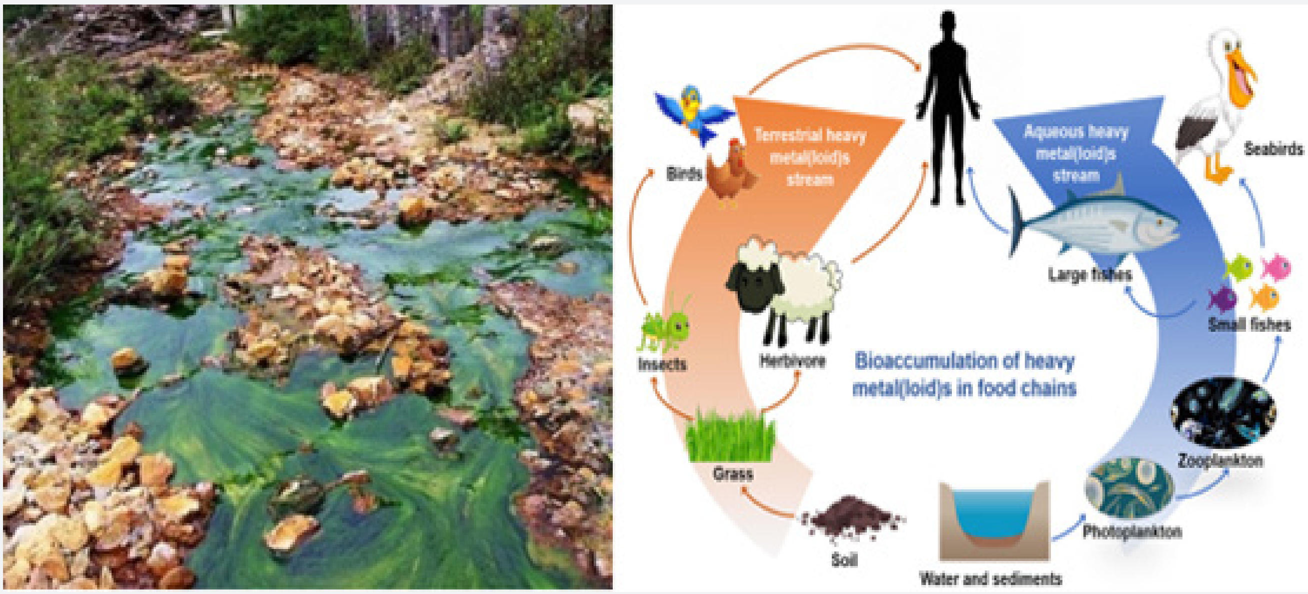

Figure 5: Heavy Metal Contamination and its Bioaccumulation in food chains.

Chemical runoff: Chemicals used in mining, like cyanide and mercury, are wash away into water bodies via surface runoff, which causes toxicity to aquatic life, degrades water quality, and can have long-term environmental and health impacts [30].

Air pollution: Mining is primary cause of air pollution which is due to the release of dust, particulate matter, and greenhouse gases (GHGs) [31]. Activities like blasting, drilling, excavation, transportation, and processing of minerals, cause the release of dust and particulate matter which contribute to respiratory health issues and environmental degradation [32]. These fine particles, with toxic substances like silica, reduce air quality and harm ecosystems. Mining also produces significant amounts of GHGs, mainly from fossil fuel combustion in machinery, mineral processing, and coal mining, which releases methane. These cause global warming and climate change [33].

Biodiversity loss: It occurs as ecosystems and wildlife habitats are brutally disturbed by actions like deforestation, habitat destruction, and pollution [34]. Large-scale deforestation, habitat destruction, and fragmentation isolate species, reducing genetic diversity and hindering migration and survival [35]. Pollution from mining, including water contamination and air pollution, further damages aquatic and terrestrial ecosystems. Soil degradation and erosion from mining activities also lead to the loss of plant life, disrupting the whole food chain reliant on these ecosystems [36]. Endangered species are particularly vulnerable, as mining destroys habitats, breeding grounds, and food sources [37]. Mining activities also accelerate climate change, further stressing species already affected by habitat loss [38]. Poaching and illegal wildlife trade also increase due to the influx of human activity in remote areas. Examples include jaguars in the Amazon, orangutans in Borneo and Sumatra, and coral reefs impacted by seabed mining [39].

Soil contamination: Occurs when harmful chemicals, heavy metals, and pollutants infiltrate the soil, often through chemical leaching and modifications in soil composition. Chemical leaching occurs when minerals exposed during mining react with water and air, producing acid mine drainage (AMD) that dissolves toxic metals like arsenic and lead, which contaminate soil and groundwater [40]. The removal of topsoil and deposition of mining waste also modify soil composition, reducing fertility and increasing erosion [41]. This contamination makes the soil toxic, disrupts ecosystems, and poses health risks, which lead to long-term environmental damage, loss of agricultural land, and biodiversity decline [42].

Noise and vibration from mining operations: Mining processes generate significant noise and vibration from blasting, heavy machinery, drilling, processing plants, and material transportation, impacting nearby communities and wildlife [43]. For communities, prolonged exposure to noise can cause hearing damage, stress, sleep disruption, and reduce the overall quality of life, while vibrations from blasting can damage buildings. These disturbances often lead to social conflict between mining

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companies and residents [44]. Wildlife is similarly affected, with noise disrupting communication, natural behaviours, and leading to habitat abandonment. Prolonged exposure can cause hearing loss and increased stress in animals, potentially disrupting ecosystems by altering food chains and biodiversity [45].

Human health impacts of mining: Mining activities, particularly in large-scale operations, often expose workers and nearby communities to various health hazards, primarily through exposure to hazardous chemicals, dust, and water contamination. These factors can lead to acute and long-term health issues, with respiratory problems being among the most common [45].

Exposure to hazardous chemicals and dust: Mining processes release harmful chemicals and dust that pose serious health risks to miners and nearby communities. Toxic chemicals like cyanide, mercury, and sulfuric acid are used in extracting metals, leading to severe poisoning, respiratory issues, and environmental contamination [46]. Exposure to heavy metals such as lead and arsenic can cause neurological damage, developmental issues, and cancer [47]. Dust from mining, including silica, coal, and asbestos dust, results in severe lung diseases like silicosis, pneumoconiosis, and asbestosis, often leading to fatal respiratory and organ damage [48].

Long-term health issues: Mining activities pose significant health risks through various environmental and chemical exposures. Respiratory problems such as Chronic Obstructive Pulmonary Disease (COPD), asthma, bronchitis, and lung cancer can arise from inhaling dust and carcinogens [49]. Neurological disorders, including mercury and lead poisoning, can impair cognitive functions and cause developmental issues in children [50]. Acid Mine Drainage (AMD) and chemical runoff from mining can contaminate drinking water with heavy metals like arsenic, lead, and cadmium, leading to cancer, liver and kidney damage, and neurological problems [51]. Additionally, groundwater contamination from mining can result in gastrointestinal disorders, reproductive harm, and cancer from consuming tainted water [52].

Regulatory Framework and Environmental Impact Assessment (Eia) In Mining

Mining, due to its significant environmental and social impacts, is subject to stringent regulatory frameworks. An Environmental Impact Assessment (EIA) is a crucial tool used to evaluate the potential environmental consequences of a mining project before it begins, ensuring that both short-term and long-term impacts are understood and mitigated [53]. The regulatory framework surrounding mining, including EIAs, varies by country but generally follows global standards and best practices to protect the environment and communities [54].

Overview of Eia Procedures for Mining Projects

An Environmental Impact Assessment (EIA) is a systematic process used to evaluate the environmental consequences of a proposed mining project. The main goal is to ensure that decision-makers consider the environmental impacts and incorporate them into the planning and approval stages of the project [55].

Key steps in eia procedures for mining projects

Screening

Determines whether a full EIA is required based on the size, location, and nature of the mining project.

Large-scale mining operations typically require a comprehensive EIA due to their significant environmental impacts [56].

Scoping

Identifies the key environmental issues that need to be studied in detail. This phase involves consulting with stakeholders, including local communities, environmental experts, and government bodies.

Scoping helps define the scope and extent of the environmental studies that need to be carried out [57].

Baseline data collection

Detailed data is collected on the current state of the environment in the area of the proposed mining project. This includes data on air and water quality, biodiversity, land use, and socio-economic conditions [58].

This baseline data serves as a reference for comparing future environmental changes during and after mining activities [59].

Impact assessment

Analyses the potential impacts of the proposed mining activities on the environment, including water quality, soil erosion, deforestation, biodiversity loss, and impacts on local communities [60].

Both positive and negative impacts are considered, with special attention given to cumulative and long-term effects [61].

Mitigation measures

Proposes measures to minimize, reduce, or offset the negative impacts identified during the assessment. These might include pollution control technologies, habitat restoration plans, or measures to reduce dust and noise pollution [62].

Environmental management plan (EMP)

A comprehensive plan that outlines how the mining company will manage the environmental impacts throughout the life of the mine (including closure and post-mining rehabilitation) [63].

The EMP often includes monitoring and compliance mechanisms to ensure that environmental standards are maintained [64].

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Public consultation and participation

In many jurisdictions, public consultation is a legal requirement. Communities that will be affected by the mining project are given the opportunity to provide input and voice their concerns.

Public hearings and feedback are incorporated into the EIA report [65].

Decision-making

Based on the EIA report, government authorities decide whether to approve the mining project. Approvals may come with conditions that require the company to follow specific environmental standards or implement certain mitigation measures [66].

Monitoring and post-eia audits

Continuous monitoring of the mining project is required to ensure compliance with the EIA recommendations and legal environmental standards [67].

Periodic environmental audits are conducted to assess the project's ongoing impacts and ensure that mitigation measures are effectively implemented [68].

Key Environmental Regulations and Laws Governing Mining Activities

Environmental regulations for mining are designed to manage the impacts of mining operations, guided by both international frameworks and national laws. Internationally, the Rio Declaration (1992) and the Equator Principles emphasize sustainable development and require environmental and social risk assessments [69]. National regulations vary in the United States, the National Environmental Policy Act (NEPA) and the Clean Water and Air Acts control environmental impacts, while Australia's Environmental Protection and Biodiversity Conservation Act (EPBC Act) and South Africa's Mineral and Petroleum Resources Development Act (MPRDA) oversee mining activities and require environmental impact assessments (EIAs) [67-69]. Mine closure and rehabilitation laws mandate that companies prepare plans for site restoration and provide financial assurances to cover rehabilitation costs [70].

Role of Government and Regulatory Bodies in Monitoring

Government bodies and regulatory authorities are vital in enforcing environmental regulations and ensuring compliance with Environmental Impact Assessments (EIA) for mining projects. Their roles include monitoring and inspecting mining operations to check for adherence to environmental standards, issuing licenses and permits with strict conditions, and facilitating public involvement in decision-making processes [71]. They also require periodic environmental audits and annual reports from mining companies to assess ongoing compliance. Sanctions for non-compliance can include fines, penalties, or permit revocation, and authorities oversee the implementation of mine closure plans, including environmental restoration efforts [72].

Mitigation Measures in Mining Projects

Mitigation measures in mining aim to minimize environmental degradation and social disruptions during and after mining operations. They play a crucial role in achieving sustainable mining practices thus prioritizing SDG Goals 12 (Ensure sustainable consumption and production patterns), 13 (Climate action) and 15 (Life on land) by ensuring the protection and restoration of ecosystems and communities [73]. Below is an in-depth explanation of various mitigation measures for land, water, air, biodiversity, and sustainability in mining, with references to academic resources. (Figure 6)

Figure 7: Mount Polley Mine Disaster.

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Land rehabilitation and reclamation

Post-mining land rehabilitation aims to restore ecological integrity by implementing several key strategies. Topsoil management involves removing and storing topsoil during mining, then reapplying it to support vegetation growth and land productivity [74]. Contour reshaping is crucial for stabilizing the land by mimicking natural contours to reduce erosion and manage water flow [75]. Revegetation focuses on planting native vegetation to restore ecosystems, prevent erosion, and stabilize soil [76]. Reforestation and afforestation are methods for planting trees to either restore previously forested areas or create new forested lands, respectively [77]. These strategies collectively help in rehabilitating disturbed land for future use.

Water management

Mining can significantly impact local water resources by affecting water quality and availability. To manage these effects, proper water management strategies are crucial. Acid Mine Drainage (AMD) results from sulphide minerals reacting with air and water, forming sulfuric acid and contaminating water [78]. Treatment of AMD involves neutralizing the acid with alkaline materials like lime to raise the pH and precipitate heavy metals [78]. Containment systems, such as tailings dams and impoundments, are employed to prevent contaminated water from runoff into local water bodies, supplemented by drainage channels and retention ponds for controlling water flow during heavy rains [79]. The International Council on Mining and Metals (ICMM) advocates for best practices in tailings management to mitigate water pollution [80].

Air quality management

Dust and emissions from mining significantly impact air quality and human health. Effective air quality management involves several strategies. Dust suppression techniques, such as spraying water or chemicals and employing vegetative covers and windbreaks, help reduce particulate matter from dust-generating sources [81]. For emission control, technologies like scrubbers, filters, and catalytic converters capture pollutants before they enter the atmosphere [82]. Additionally, switching to less polluting fuels, such as natural gas instead of coal, can further lower emissions [83].

Biodiversity conservation

Mining operations disrupt ecosystems and wildlife habitats, necessitating biodiversity conservation strategies to mitigate species and habitat loss. When mining is unavoidable, wildlife relocation programs help move species to protected areas or reserves, and endangered species are translocated with habitat reconstruction efforts [84]. Buffer zones around mining sites reduce environmental impacts such as noise and dust, while collaboration with conservation organizations helps establish protected areas where mining is prohibited [85]. The Convention on Biological Diversity (CBD) underscores the importance of integrating protected areas into mining project planning to preserve ecosystem health [86].

Sustainable mining practices

Sustainable mining aims to reduce the environmental impact of mining while maximizing resource efficiency [86]. Companies are increasingly adopting renewable energy sources, such as solar and wind, to power mining operations, thereby cutting dependence on fossil fuels and lowering greenhouse gas emissions [87]. For example, BHP Billiton has successfully integrated solar power in its Chilean operations, reducing its carbon footprint [88]. Additionally, the circular economy approach is being implemented to minimize waste through practices like reusing materials, recycling, and tailings reprocessing. This method recovers valuable minerals from waste, reducing the need for new extractions and mitigating environmental impact [89].

Case Studies

Following are the case studies illustrate both the challenges and potential solutions in the pursuit of environmentally responsible mining.

Mount polley mine disaster

The Mount Polley mine is an open-pit copper and gold mine located in British Columbia, Canada. On August 4, 2014, the mine's tailings storage facility failed, releasing approximately 25 million cubic meters of wastewater and tailings into the nearby Polley Lake, Hazeltine Creek, and Quesnel Lake [90,91].

Environmental impact

Water Pollution

The tailings contained various toxic metals, including arsenic, mercury, and lead, which contaminated local water bodies. This posed a significant risk to the aquatic ecosystems and drinking water sources. Quesnel Lake, one of the world's deepest lakes, faced severe long-term contamination concerns [92].

Habitat destruction

The flood of tailings and water destroyed entire ecosystems along Hazeltine Creek. Approximately 8.5 km of stream and riparian habitats were severely damaged [93].

Long-term consequences

The contamination raised concerns about fish populations, including salmon, which use Quesnel Lake as part of their spawning grounds. The long-term ecological recovery of the area is still uncertain [94].

Response and aftermath

Following the disaster, the government of British Columbia conducted investigations into the cause of the tailings dam failure. A report by an independent panel concluded that poor design, particularly related to the foundation materials, was a primary

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factor [95]. This disaster led to stricter regulations and reforms in mining practices in British Columbia and across Canada to ensure that such failures would not happen again [96]. (Figure 7)

BHP billiton's solar power integration

BHP Billiton, one of the world's largest mining companies, has been a key player in integrating renewable energy into its operations as part of its sustainability goals. In recent years, the company has made significant investments in using solar power to reduce the carbon footprint of its mining activities [97].

Key Projects

Cerro Dominador Solar Project (Chile): In Chile, BHP has incorporated solar power at its Escondida and Spence copper mines, two of the largest copper mines in the world [98]. A key project is the Cerro Dominador Solar Plant, which combines photovoltaic (PV) and concentrated solar power (CSP) technologies. This plant provides a significant portion of the energy required by these mines, reducing dependency on fossil fuels [99]. By integrating solar energy, BHP has been able to cut greenhouse gas (GHG) emissions and contribute to Chile's national goals of reducing carbon emissions [100].

Collaboration with TransAlta (Australia): In Australia, BHP partnered with TransAlta to build solar farms and battery storage systems at its Nickel West operations. These renewable energy sources help power the site's mining and refining processes while minimizing environmental impact [101]. The project is expected to reduce carbon emissions by around 50,000 metric tons annually, the equivalent of removing 17,000 cars from the road each year [102].

Sustainability Benefits

Greenhouse Gas Emissions Reduction: By utilizing renewable energy, BHP significantly reduces its reliance on coal and gas, helping to lower carbon dioxide emissions [103].

Cost Efficiency: Solar power has also proven to be cost-effective in the long term, reducing operational costs for energy-intensive mining processes [104].

Commitment to Sustainable Mining: These initiatives are part of BHP's broader commitment to achieving net-zero emissions by 2050. The company has also focused on resource efficiency and circular economy strategies to further enhance sustainability in mining [105].

Impact on the Mining Industry

BHP's integration of solar power sets an important precedent for the mining industry, demonstrating that large-scale mining operations can shift towards renewable energy without sacrificing productivity [106]. It also supports the global shift toward green technologies and reinforces the mining sector's role in providing the raw materials necessary for renewable energy infrastructure, such as copper, nickel, and lithium [107]. (Figure 8)

Figure 8: BHP Billiton's Solar Power Integration.

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Recommendations for Sustainable Mining

For sustainable mining we can replace current technology with the following technologies and take following measures.

Green mining technologies

Green mining technologies aim to reduce the environmental impact of mining by lowering energy consumption, emissions, and promoting sustainability [108]. Key advancements include the following:

Electric vehicles (Evs) and automated equipment

Mining operations are shifting from diesel-powered machinery to electric vehicles, reducing carbon emissions and improving air quality [109]. Companies like Sandvik and Caterpillar are developing battery-operated trucks for underground mining [110]. Autonomous equipment also enhances efficiency and safety by reducing energy use and minimizing human exposure to hazardous areas [111].

Renewable energy integration

Solar and wind energy are being utilized in remote mining locations. Companies such as BHP Billiton and Rio Tinto have integrated solar power into their operations, cutting reliance on fossil fuels and reducing emission [112].

Waterless processing technologies

Innovations like dry stacking and waterless ore processing help conserve water, addressing water scarcity issues in mining regions [113]. Methods like hydrometallurgy reduce the need for traditional smelting, further lowering environmental impact [114].

Recycling and circular economy

The circular economy approach promotes recycling of mining waste and reprocessing tailings to recover valuable minerals, maximizing resource use and reducing waste [115].

Strengthened regulations

Strengthened regulations are vital to minimizing the environmental impacts of mining.

Key aspects include:

Environmental impact assessment (EIA): EIAs are mandatory evaluations of potential environmental risks (e.g., water pollution, land degradation) before a mining project starts. A thorough, transparent EIA process involves stakeholder participation and ensures mitigation measures are implemented [116].

Mine closure plans: Companies must submit plans for rehabilitating land post-mining, including reforestation and tailings management. Financial provisions ensure accountability even if operations cease [117].

Pollution control standards: Regulations on air and water quality control emissions, including dust suppression, water treatment, and GHG emissions. Some jurisdictions use carbon pricing to promote greener practices [118].

Monitoring and enforcement: Regular inspections and remote sensing technologies ensure compliance, with penalties for violations and responsibilities for remediation in cases of environmental damage [119].

Community involvement: Community involvement in mining projects is essential for addressing the social, environmental, and economic needs of local populations, particularly those living near mining sites [120].

Key elements include:

Stakeholder Engagement: Mining companies must engage local communities during project planning and operations through public consultations, workshops, and discussions. Indigenous peoples have the legal right to give or withhold consent through Free, Prior, and Informed Consent (FPIC) [121].

Social License to Operate (SLO): Mining companies must maintain the approval of local communities by acting responsibly, reducing environmental harm, and providing benefits such as jobs and infrastructure. Community participation in environmental monitoring fosters trust [122].

Benefit-Sharing: Communities should benefit from mining through agreements that ensure infrastructure development, employment, and royalty payments, especially where livelihoods depend on natural resources [123].

sAddressing Grievances: Mining companies should establish formal mechanisms to address community grievances related to land, compensation, and environmental impacts, promoting dialogue and long-term sustainability [124].

Conclusion

Thus, the implementation of Environmental impact assessment assists in understanding and achieving the sustainability development goals including SDG goal 12 by ensuring sustainable consumption of minerals and devising environmental friendly and save extraction methodologies, SDG goal 13 by identifying and minimizing the potential indicators such as emission of greenhouse gases, heavy metal leaching into soil and water etc that causes drastic climatic changes and eventually safeguarding the diverse terrestrial life forms i.e. SDG goal 15 (Life on land).

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