Assessment of Environmental quality and Environmental Damage due to oil spill accident at Oil India, Tinsukia, Assam and Scope for Environmental Compensation

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Abstract

This paper addresses an Oil blowout accident occurred in Oil India Baghjan site at Tinsukia, Assam. An assessment of environmental quality deterioration in terms of air, water and soil quality has been carried out on the basis of available baseline environmental data. Impact on ecosystem and environmental damage resulting from this oil blowout has been discussed. This oil blow out site is in proximity to wetland "Maguri Motapung Beel" which was the most impacted ecosystem, the next nearest biodiversity hotspot is the Dibru-Saikhowa National Park and Biosphere Reserve and the Bherjan-Borajan-Podumoni Wildlife Sanctuary. Habitat Destruction in terms of damage to plant and animal life has been assessed from the environmental data. As a number of such blowouts have been reported during the history of oil drilling activities, it is the responsibility of oil industry to understand the risks of accidents and taking appropriate measures to prevent accidents and minimize their impacts. Provisions of environmental compensation and restoration of environmental damage has also been discussed in purview of existing government policies and legal remedies available. This paper also highlights the need for strengthening of existing environmental laws for adequately compensating environmental damages and restoration on the basis of polluter's pay principle.

Key Words: Baghjan Oil blowout, Tinsukia, Assam, Legal Remedies, Environmental Damage, Compensation.

1. INTRODUCTION

Industrial development has played a significant role in improving the standard of living for people around the world. Industrialization has the potential to help achieve a variety of social objectives such as employment, poverty eradication, gender equality, labour standards, and greater access to education and healthcare. Advances in technology and manufacturing have made it possible to produce goods and services more efficiently, leading to increased productivity and economic growth. However, these benefits have come at a cost to the environment. Industrial activities can generate pollution, waste, and greenhouse gas emissions that can have negative impacts on air, water, and soil quality, as well as on human health and wildlife populations. These threaten the global environment as well as economic and social welfare.

To balance the benefits of industrial development with environmental protection, it is necessary to implement policies and regulations that encourage sustainable practices. To address the environmental impacts of industrial accidents, governments may impose regulations on industrial operations, require environmental impact assessments, and establish penalties for noncompliance. Industries may also take steps to reduce the risk of accidents, such as implementing safety protocols, conducting regular inspections and maintenance, and investing in equipment and infrastructure upgrades. In the event of an accident, industries may be held liable for damages and required to pay for environmental remediation efforts.

The focus is mainly on Industrial Disaster/accidents under the categories of man-made disasters, with special reference to the Industrial Fire. An industrial fire is a type of industrial disaster involving a conflagration which occurs in an industrial setting. Industrial fires often, but not always, occur together with explosions. They are most likely to occur in facilities where there is alot of flammable material present. Such material can include petroleum,

petroleum products suchas petrochemicals, or natural gas. Processing flammable materials such as hydrocarbons in units at high temperature and/or high pressure makes the hazards more severe. Facilities with such combustible material include oil refineries, tank farms (oil depots), natural gas processing plants, and chemical plants, particularly petrochemical plants. Such facilities often have their own fire departments for firefighting. Severe industrial fires have involved multiple injuries, loss of life, costly financial loss, and/or damage to the surrounding community or environment.

This study will explore the relationship between the environmental safety and industrial development and the importance of balancing economic growth with environmental protection. Since the starting of industrial age and development of large scale manufacturing industries such scenarios have arisen where huge environmental damage has been caused by the uncontrolled industrial operations or release to toxic chemicals due to industrial accidents. In such cases often the affected (environment including its inhabitants) are not aware of legal remedies to be exercised.A case study based on an industrial accidental case that happened in Baghjan Oil blowout site, Tinsukia, Assam on 27th May 2020 will be discussed in detail in this project.

1.1 Background:

Case Description: An accident occurred in Baghjan Oil blowout site, Tinsukia, Assam on 27th May 2020. The oil spill caused by the explosion of well No. 5 in Baghjan Oil Field, resulting in aleak of natural gas, subsequently caught fire on 9 June 2020, and was finally doused on 15th of November after burning for 159 days, becoming India's longest Oil well fire. The disaster has resulted in three deaths (officially), large-scale local evacuations, and environmental damage andthe locals losing their homes, belongings and livelihoods and separated families. The fire destroyedaround 60-70 hectares around the site. (Swapnali Gogoi, April-May 2022)

The fire at and around the Baghjan oil explosion site were unprecedented in their destruction. Thisaccident has had a significant impact on the physical and economic wellbeing of the surrounding community. As biodiversity of the nearby area of the concern well is very rich, it had a very destructive effect on the area. Traces of Chemical concentration on air, water and soil could be seen easily in nearby area. (Naqvi, 30 May 2020)

The poisonous substances produced due to the oil spillage and blow out will have a tremendous impact on the soils and sediments, affecting not only present life circumstances but also posing a major long-term health danger due to their continued release over time. Petrochemicals are complex chemical compounds with both lethal and sub-lethal impacts on the environment's flora and fauna. A blowout from an oil well releases a variety of pollutants into the air, water, and ground, damaging the impact zone and its surrounds. The hydrocarbon component contains a vast number of chemical molecules, many of which are dangerous to the environment when discharged, such as polycyclic aromatic hydrocarbons (PAHs). These carcinogenic chemicals are widely distributed in water, soil, sediment, and air, and their accumulation in these systems is quite high since they are not photo chemically or biologically oxidized or destroyed.

Hypothermia, skin and eye irritation, dyspepsia, dehydration, reduced reproduction, and/or pneumonia have all been recorded as side consequences of this sort of contamination in various taxa. These hazardous chemicals linger in the environment as particulate matter and sediments, and when the environment changes, they are released into water again, resulting in secondary pollution and long-term toxicity in these places, which is a troubling scenario for all living forms,including people. Also, in such a biodiversity-rich habitat and vital wetland area for water birds, adeep concern has been identified about the long-term effects of the oil leak. There has been a significant decline in the area's biodiversity, resulting in an inadequate habitat for aquatic and terrestrial life, as evidenced by the observed mortalities. To recover the decline in diversity seen in mammals, birds, insects, flora and fauna, it will take time and significant restorative efforts.

1.2 Objectives:

- To assess environmental conditions associated with blow out.
- To assess the detrimental effect on health condition of people in surrounding area.
- To assess the future illness due to hazardous contaminants in air, water, and soil
- To quantify the pollution level w.r.t air, water and soil in and around
- legal remedies for environmental damage – discussion on Public Liability Insurance

1.3 Methodology:

- Literature review
- Baseline data collection
- Identification of change caused to environment.
- Impact on socio environmental parameter and Damage assessment
- Scope for compensation within the ambit of existing policies.

2. REVIEW LITERATURE

The Baghjan oil well blowout occurred on May 27, 2020, and fire in June 2020 significantly impacted the physical and economic wellbeing of the surrounding community. Contaminants from the spill will have long-term effects, necessitating appropriate mitigating measures. The Maguri- Motapung beel was significantly affected, with dissolved oxygen and total petroleum hydrocarbons polluted. The oil leak also posed a long-term health threat to soils and sediments, affecting life circumstances and livelihoods. The oil spill has caused a decline in biodiversity in mammals, birds, insects, and herpes, affecting wildlife and the environment. The spillover has led to mass mortality, toxic gases, and oil coatings, causing widespread damage. Rapid action was needed to prevent further harm.

2.1 Study area:

The Baghjan Oil Field is located in Tinsukia district in the State of Assam, near Baghjan village. The total geographical area of village is 533.84 hectares. Baghjan Gaon has a total population of 4,488 people, consisting of 2,244 male and 2,244 female population. There are about 872 houses in Baghjan Gaon. The study area is covered by residential, forest, vegetation and swampy area. Baghjan Gaon, village comprised of native population is situated adjacent to the blowout site. (Swapnali Gogoi, April-May 2022)

Dibru-Saikhowa National Park, Bherjan Wildlife Sanctuary, Padumani Wildlife Sanctuary, and Borajan Wildlife Sanctuary are among the many protected places and key biodiversity hotspots in the area. Poba Reserve Forest, Kobo Chapori Proposed Reserve Forest, Amarpur Chapori, Maguriand Motapung beel are all Important Bird Areas (IBA). The blow out site is close to the Dibru- Saikhowa National Park and Maguri-Motapung Beel. During the winter, the wetland attracts a large number of migratory birds.The Maguri-Motapung beel, which covers a 10 km2 area in Assam's Tinsukia District, has been seriously harmed by the oil spill.Among the animals found in the area are the tiger, elephant, wild buffalo, leopard, hoolock gibbon, capped langur, slow loris, and Gangetic river dolphin. Bengal Florican and White Winged Duck are two endangered birds. Baer's Pochard, Slender-billed vulture, White-rumped vulture Adjutant storks, White-bellied Heron are some of the birds found in the area. This area is home to Yellow-breasted Buntings, Harriers, Swamp Francolins, Pale-capped Pigeons, Bristled Grassbirds, Marsh Babblers, Jerdon'sBabblers, Black-breasted Parrotbills, Yellow Weaver, Oriental Darter, Black-necked Stork, Ferruginous Duck, Red-breasted Parakeets, Blyth's Kingfisher.Ganges river dolphins can be found in large numbers in the rivers around Dibru-Saikhowa National Park, particularly in the Lohit and Siang rivers. (Choudhury, 1998)

2.2 Environmental damage reported:

State Pollution Control Board officials stated that the leaked gas condensate had affected local agricultural crops and plants, including bamboo, tea, bananas and betel nuts. Wind conditions had carried the leaked gas towards the Dibru-Saikhowa National Park as well. On 29 May 2020, the carcass of a Gangetic dolphin covered in condensate oil was found in the Maguri Motapung Beel, a local wetland, and sent for a post-mortem by the Tinsukia Wildlife Division, to establish the cause of death. Wildlife Division officials noted that because of rain immediately following the leak, local waterbodies had been contaminated by condensate from the leak. On 31 May 2020, Assam Government officials confirmed that the StatePollution Control Board was investigating environmental damage as a result of the leak. Followingthe leak, the State Forest Department had also asked Oil India Limited to account for its actions after reports of dead fish in local waterbodies. On 5 June 2020, local residents protested near the Maguri Motapung Beel wetland, calling for the protection of the ecologically sensitive Dibru- Saikhowa National Park, to mark World Environment Day, and called for compensation for their loss of livelihoods as a result of the leak (Swapnali Gogoi, April-May 2022).

2.3 National Green Tribunal (NGT) case:

The Hon'ble National Green Tribunal imposed an interim penalty of Rs 25 crore on M/s Oil India,Assam over its failure to stop fire in Assam's Baghjan oil well resulting in damage to the environment. The Hon'ble NGT passed an Order dated 24.06.2020, constituting the Committee of Experts was passed in O.A No.43/2020/EZ titled Bonani Kakkar -Vs- Oil India Limited & Ors. (Bonani Kakkar -Vs- Oil India Limited & Ors. , 2020) and O.A No.44/2020/EZ titled Wild Life and Environment Conservation Organisations -Vs- Union of India & Ors. The Applications inter-alia raise allegations of failure and negligence on part of Respondent Authorities including OIL in preventing the blowout and mitigating its impact.

In both these applications, the Hon'ble NGT was satisfied that substantial questions relating to theenvironment were involved and therefore, called for consideration by the Hon'ble NGT under Sections 14 and 15 of the National Green Tribunal (NGT) Act, 2010. The order had come on a plea filed by activist Bonani Kakkar and others alleging failure of the authorities in preventing theblowout of Baghjan oil well.

The National Green Tribunal (NGT) formed a seven-member joint committee comprising MoEF (Ministry of Environment and Forest), CPCB (Central Pollution Control Board), State Pollution Control Board, State Environment Impact Assessment Authority (SEIAA) Assam, Chief Wildlife Warden, Assam, Member Secretary, Biodiversity Board, Assam and Member Secretary, State Wetland Authority Assam. The committee formed to assessing the damage to the environment andremedial restoration plan, including Dibru-Saikhowa National Park, the Maguri-Motapung Wetland. (Express, 2021).

2.4 Litigation and compensation:

On 25 June 2020, the National Green Tribunal found a prima facie case had been made out against Oil India Limited for damage to the environment and local livelihoods because of the leak. The Tribunal ordered Oil India Limited to deposit a sum of ₹250 million with the District Magistrate of Tinsukia towards compensation, and constituted an expert committee to investigate the disaster and recommend how much compensation was payable to affected persons. The expert committee constituted by the National Green Tribunal recommendedthat completely damaged houses would result in compensation of 2,500,000, while those that wereseverely and moderately damaged would receive ₹1,000,000 and ₹250,000 each. From 24 August 2020 onwards, local residents staged a peaceful protest, establishing a camp in front of the office of the local Deputy Commissioner, to ensure that all persons whose homes were damaged in the fire and leak received more compensation. The Assam Government confirmed to the Assam Legislative Assembly that some families had been issued compensation. Oil India Limited had filed objections to these orders for compensation in the National Green Tribunal, but the Tribunal dismissed their objections on 8 August 2020. OIL announced that they will give ₹30,000 as compensation to all those families who are affected. On 1 October 2020, the Gauhati High Court agreed to hear a public interest litigation petition filed by

two local residents, and ordered OIL as well as a number of government authorities, including the Assam Government, the National Board for Wildlife, the State Board for Wildlife, and the State and Central Boards for Pollution Control,to respond to concerns raised about drilling inside the Dibru-Saikhowa National Park. (Swapnali Gogoi, April-May 2022).

2.5 Environmental conditions associated with blow out:

Industrial accidents can have a significant impact on the environment, causing environmental damage and potentially harming human health. The blowout and fire claimed three human lives, including that of a young engineer and two firemen of OIL. Three animals listed under Schedule Iof the Wildlife (Protection) Act, 1972, and more than 29,000 scheduled and unscheduled wild animals and organisms also perished in it. Most of the families in and around the blowout site havelost their primary sources of livelihood. Nearly 95 per cent of the 12,000 people that inhabit the 10 adjoining villages of the wetland are directly dependent on its bio resources for their livelihood. Nearly 3,000 families were displaced and around 11,000 residents were housed in shelters set up in schools amidst the COVID-19 pandemic.

The area is biodiversity rich having several protected areas and important biodiversity hotspots in its surrounding, Dibru-Saikhowa National Park, Bherjan Wildlife Sanctuary, Padumani Wildlife Sanctuary and Borajan Wildlife Sanctuary. Dibru- Saikhowa National Park comprising an area of340 square km is the core of the larger Dibru-Saikhowa Biosphere reserve (DSBR) which spans over 425 square km. This is located in the Tinsukia and Dibrugarh districts of Assam. This area has recorded at least 40 mammals, 500 species of birds, 104 fish species (Pollobi Kalita, 2016), 105 butterfly species and 680plant species), 11 species of chelonians, 18 species of lizards and 23 species of snakes (Dibru Saikhowa Management Plan). It harbours tiger, elephant, wild buffalo, leopard, hoolock gibbon, capped langur, slow loris, Gangetic dolphin, besides critically endangered bird species such as the Bengal Florican, White Winged Wood Duck, Greater Adjutantstork, White rumped vulture, slender-billed vultures, white rumped vulture, as well as the very rare and endemic, Black-breasted parrotbill. Among herpetofauna, it is home to the critically endangered Black Soft-shell Turtle as well as several endangered species (e.g. Narrow headed Soft-shell Turtle, Assam Roofed Turtle) and Schedule I species (e.g. Indian Flapshell Turtle, Water Monitor lizard, Indian Roofed Turtle, Burmese Rock Python) and several species of range- restricted frogs . During February 2020, 35 endangered Ganges River Dolphins were estimated to inhabit in this sector. Maguri-Motapung beel is one of the major wetlands in Tinsukia District of Assam, which cover ~ 5 km2 and is also severely impacted by the oil spill. While the species foundin this area largely overlaps with Dibru Saikhowa, until date 294 species of birds have been recorded from this area and is declared as an Important Bird Area. Thousands of migratory birds visit the wetland in winter. Critically endangered species like Baer's Pochard, White-bellied Heron are also found in this wetland. The first record of species like Baikal Bush Warbler and White- browed Crane are also from this area. (Choudhury, 1998)

Major impacts on the environment due to accident:

Damage to ecosystem- The wetland "Maguri Motapung Beel" was the most impacted of all the ecosystems. Almost 70 per cent of the earthworms in the Maguri grasslands and condensate affected areas are estimated to be dead. The waterbodies and impinging grasslands are home to several flora and fauna, including the wild buffalo, the barking deer, and a variety of avifauna. Birdlife International, a global partnership of non-governmental organizations, has recognized the wetland as an Important Bird Area. The blowout, explosion and fire directly impacted 40 animalsbelonging to different classes/order, genera, families and species listed in different Schedules of the Wildlife (Protection) Act, 1972. Habitats of these animals and their young ones were disturbed,and larvae, eggs and nests were damaged.

The next nearest biodiversity hotspot is the **Dibru-Saikhowa National Park and Biosphere Reserve** spread over 350 to 650 km to the north, northeast and northwest of the blowout. The nearest point of the park lies within 900 m of the blowout ground zero. In between the park and the blowout area lies the Lohit branch of the mighty Brahmaputra that has a confluence with Dangori river and later Dibru river, largely known as Dibru or even

Dangori river. The river starting from Sadia Dhola bridge on the upper reaches to the Bogiebeel on the downstream formsa rich habitat of the Gangetic River dolphins.

"These three unique ecosystems put together account for 36 mammalian species, 500. avifauna, including migratory birds, 11 species of turtles, 9 species of lizards, including two species of monitor lizards, 18 species of amphibia, 104 species of fish and 23 species of snakes, 104 speciesof butterflies, and 26 species of molluscs besides supporting astonishingly rich flora, including 28tree species, 26 species of shrubs, 2 species of parasitic plants, 17 species of grasses, 16 species ofaquatic plants, 3 species of marshy plants, 4 species of climbers and scandents, 5 species of canes,13 species of orchids and 6 threatened medicinal plant species. The Dibru-Saikhowa National Parkis also famous for feral horses. (Choudhury, 1998).

"The next important conservation regime is the **Bherjan-Borajan and Podumoni Wildlife Sanctuary.** While Bherjan, being closest, is at a distance of 6 km from the ground zero and lies tothe south of the Motapung Maguri Beel, Podumoni is at a distance of 8 km to the west of the blowout site. These areas are rich habitats of butterflies and there were resident troops of hoolockgibbons (the only ape found in India) in the past. The gibbons also have now a broken habitat, anda few [were] found outside the sanctuary areas (other than Borajan). While Borajan still supports hoolock gibbon populations, one such known location outside the protected area, but very close to the blowout site, where troops of hoolock gibbons, numbering 19 individuals, have been residing for long is Barekuri Gaon panchayat falling within 2-3 km south of the blowout site."

Air Pollution: Industrial accidents can release pollutants into the air, which can cause respiratoryproblems and other health issues for nearby populations. Pollutants such as sulfur dioxide, nitrogenoxides, and particulate matter can also contribute to acid rain and smog. As per Wildlife Institute of India (WII), Several representations received from the local communities in and around the siteof incident have revealed complaints of difficulty in breathing and the ambient air being laden within toxic and heavy fumes. The WII has measured the Nitrogen, Sulphur Dioxide, Carbon Monoxide and HCOH (formaldehyde) in the environment surrounding the site of incident. NO2 has shown 16 % increase on May 27. It has been widely reported in the representations available that several residents of villages close to the site of incident who have not been accommodated inthe relief camps for various reasons were suffering from breathing difficulties. (Preliminary report on oil well blowout and explosion at an OIL well in Baghjan, Tinsukia, Assam, 24/07/2020).

Particulate Matter and Gaseous emission:

PM can be defined or classified in a number of ways, aerodynamic diameter is one of the main criteria to describe its transportability in the atmosphere and/or inhaling ability through a respiratory organism. Environmental Protection Agency (EPA) has been regulating particles mainly in two size categories based on their predicted penetration capacity into the lung as either (i) coarse particulate matter (PM10) with an aerodynamic diameter of 10 µm (ii) fine particulate matter (PM2.5) with an aerodynamic diameter of 2.5µm. (Esworthy, 2014).

Exposure to PM has been identified as the cause of numerous health effects including increased hospital admissions, respiratory symptoms, exacerbation of chronic respiratory and cardiovascular diseases, decreased lung function, and premature mortality etc. (Esworthy, 2014).

As per the analysis of Particulate Matter (PM10 and PM2.5), it has been evident that theconcentration level is found to be higher than the National Ambient Air Quality Standards (NAAQ) standard. Gaseous emission like NO2, SO2 are also found exceeds to the NAAQ standard.

Water Pollution:

Accidental spills of chemicals or hazardous waste can contaminate water sources, making them unsafe for consumption by humans and wildlife. This can also harm aquatic ecosystems, including fish and other aquatic species. The blowout had severe consequences for the water bodies in the vicinity, including the Dibru River and its tributaries. The released oil and condensate contaminated the water, leading to extensive water pollution. The

polluted water posed risks to aquatic life, affected ecosystems, and impacted the livelihoods of local communities dependent onfishing and agriculture.

Impact on Aquatic Life: Water pollution from the blowout had a detrimental effect on fish, aquatic plants, and other organisms in the affected rivers and wetlands. The oil and toxic chemicals presentin the water can suffocate fish and other aquatic species, disrupt the food chain, and cause long- term damage to the ecosystem.

Ecological Consequences: The contaminated water negatively impacted the diverse flora and faunaof the region, including endangered and endemic species. The wetlands and marshes in the area, known for their rich biodiversity, suffered from the spill, with potential long-term ecological consequences.

Human Health Risks: Water pollution resulting from the oil blowout can also pose health risks to local communities. Exposure to polluted water can lead to various health issues, including skin problems, respiratory ailments, and other complications.

Cleanup Efforts: Following the blowout, extensive cleanup efforts were undertaken by Oil India Limited and other agencies to mitigate the damage caused by the water pollution. These efforts involved containment, recovery, and treatment of the spilled oil and condensate, as well as the remediation of affected water bodies.

Biodiversity loss: The area affected by the oil spill due to blow out of well in Baghjan, is biodiversity rich, and one of the important remaining refuge for several endangered and range restricted species. The oil spillage in entire nearby area destroyed around 60–70 hectares around the site. The Oil blow-out incident caused widespread harm to local communities and theenvironment due to chemical contaminants in air, water, and soil. The incident occurred during themonsoon season, causing widespread damage to natural wetlands, rivers, and forests. Locals havereported headaches, nausea, eye irritations, and respiratory issues. The fire caused air and noise pollution, damaging houses and causing oil spills on water bodies, tea plantations, and agriculturalland. The incident has left agricultural land uncultivable and contaminated water bodies, financially affecting fishermen and farmers. The incident also led to significant loss of livestock, with many stalled animals dying and others missing.

Soil Pollution: Industrial accidents can also contaminate soil, making it unsuitable for agricultureand other uses. This can have long-term impacts on soil fertility and the ability of land to supportplant life.

Noise pollution:

The sound of the blowout impacted the whole of the national park and the Bherjan and Podumoni parts of the wildlife sanctuary. The people affected from the noise are spread within a radius of 40 km of the blast site; those within a five-km radius were acutely affected by noise levels that were more than 55 decibels (dBA) on 24x7 basis. “Similarly, all those who worked or lived within 700m of the blowout site were exposed to extreme noise of more than 75 dBA. These are all breachesof the permissible limits under the EPA [Environment (Protection) Act], 1986 (Talukdar, July 2021).

Damage to plant and animal life (Habitat Destruction):

Industrial accidents can destroy habitats for wildlife, including wetlands, forests, and other ecosystems. This can have long-term impacts on biodiversity and ecosystem health. It was estimated that about 64,000 kg of condensate oil containing heavy hydrocarbons may have fallenin a three-km radius of a blowout on the south side of the site, affecting an estimated 589 ha of area. The area has been severely burned, with 24 ha around the flame severely burned and 102 hapartially burned. High levels of polycyclic aromatic hydrocarbons (PAH) and organic substances have been found in the area. The plant community, particularly agricultural and horticultural crops, has been negatively impacted, with flowering and fruiting affecting several species. The livestockalso shows impacts of PAH contamination, with stillbirths in domestic animals. The open bill stork population may be at risk due to high molluscs death, while moths and butterflies have suffered severely. The flame has also negatively impacted herpetofauna, reptiles, and amphibians in the area. Bird richness has declined by 59% and that of the wetland by 85%. A systematic study is needed to evaluate the loss and work on a long-term basis (Talukdar, July 2021).

Climate Change:

Industrial accidents that release large amounts of greenhouse gases can contribute to climate change, leading to more severe weather patterns, rising sea levels, and other environmental impacts. The following impacts are given below:

Greenhouse Gas Emissions: Oil extraction and subsequent burning contribute to greenhouse gas emissions, primarily carbon dioxide (CO2) and methane (CH4). These emissions are major contributors to climate change and global warming. However, the immediate blowout incident itself is not a significant source of greenhouse gas emissions.

Methane Leaks: Methane is a potent greenhouse gas with a significantly higher global warming potential than carbon dioxide over shorter timeframes. Oil blowouts, especially those involving natural gas releases, can result in methane leaks. Methane emissions from such incidents can contribute to climate change.

Infrastructure and Operational Practices: The Baghjan blowout highlighted the importance of robust infrastructure and proper operational practices in the oil and gas industry. Poorly maintained equipment and inadequate safety measures increase the risk of accidents and potential environmental harm. Addressing these issues and ensuring industry best practices can helpmitigate climate change-related risks.

Overall, Carbon Footprint: While the immediate blowout incident can have localized environmental impacts, the broader issue of climate change is tied to the extraction, production, and consumption of oil and gas. This includes the cumulative effect of various extraction sites, transportation, refining, and end-use combustion of fossil fuels. It is the collective impact of theseactivities that contributes to climate change.

Transition to Renewable Energy: Addressing climate change requires a shift away from fossil fuels towards renewable energy sources. The Baghjan blowout incident serves as a reminder of theenvironmental risks associated with oil extraction and underscores the importance of transitioningto cleaner and sustainable energy alternatives.

3. SCOPE FOR COMPENSATION WITHIN THE AMBIT OF EXISTING POLICIES

Environmental awareness has increased intensely over the last three decades. However, environmental degradation is not a new issue, it has been cumulated over centuries of intensive industrialization, which left the world's environment endangered by a long series of predicamentssuch as the depletion of the Ozone layer, global warming, acid rain, deforestation, hazardous wastedumping and pollution of all elements of the environment, air water, soil. In all above cited formsof environmental degradations cause is human activities, which, should in principle be functionedto the prosperity and wellbeing of the mankind.

Many environmental disasters happened all over the world causing terrible consequences: loss oflives, several injuries, huge financial loss and ecological damage infecting natural recourses as well as damages to the environment. Seveso disaster in Italy, Chernobyl nuclear disaster in formerSoviet Union, the Sea Empress crude oil spill disaster at the United Kingdom coast, Bhopal gas tragedy in India, are some examples of environmental tragedies that received extensive media coverage with huge public uproar, and shown environmental accidents can be highly devastating. Such major accidents pose extra threats to the environment with its complex broad and transboundary effects. Since it was understandable that environmental threats are in an increasingtrend, it becomes critical to act and react on serious note to find out how environment can be bestprotected. Public around the globe become aware of what environmental degradation may cause to their survival and health.

3.1 Environmental compensation: Environmental compensation is a policy tool for the environment protection which works on the Polluter Pay Principal. Environmental compensation has been implemented in different countries. Experiences from these implementations are mixed and tend to stress the importance of certain principles in order to achieve the overall objective of the environment protection.

The concept of environmental compensation acknowledges that development projects often resultin the loss or degradation of natural habitats, biodiversity, or ecosystem services. To counterbalance these negative impacts, compensation measures are undertaken to achieve a net gain in environmental quality or biodiversity.

Here are a few key points related to environmental compensation:

1. Purpose: Environmental compensation aims to achieve no net loss or even a net gain in environmental value. It recognizes the importance of conserving and restoring ecosystemsand biodiversity to maintain ecological balance and sustain human well-being.
2. Types of Compensation: There are different types of compensation measures, including habitat restoration, reforestation, creation of new habitats, biodiversity enhancements, and protection of ecologically valuable areas. The choice of compensation measures depends on the specific project and the ecological context.
3. Regulatory Framework: Many countries and regions have developed regulatory frameworks or guidelines to govern environmental compensation. These frameworks typically outline the principles, methodologies, and requirements for compensatory actions and may involve public authorities, environmental agencies, and stakeholders in thedecision-making process.
4. Stakeholder Engagement: Environmental compensation often involves collaboration and consultation with various stakeholders, including government agencies, project developers, local communities, and environmental organizations. It is important to engage these stakeholders to ensure transparency, fairness, and accountability in the compensation process.
5. Monitoring and Reporting: Monitoring and reporting mechanisms are essential to evaluate the effectiveness of environmental compensation measures. Regular assessments help determine whether the desired environmental outcomes are being achieved and identify any necessary adjustments or additional actions.
6. Challenges and Criticisms: Environmental compensation can face challenges related to thecomplexity of ecological systems, the difficulty of accurately measuring and valuing environmental impacts, and ensuring the long-term sustainability of compensation measures. Critics argue that compensation should not be seen as a substitute for avoiding or minimizing environmental harm in the first place.

Overall, environmental compensation provides a framework to address the environmental impacts of development activities and promote sustainable practices. By integrating compensation measures into development plans, it is possible to safeguard biodiversity, protect ecosystems, andensure the long-term health of our planet.

3.2 Legal Remedies for Environmental Damage:

There are several legal remedies for environmental damage due to accidental cases, including:

1. **The Polluter Pays Principle:** The principle basically means that, those who cause environmental damage shall accept the costs of avoiding it or paying the victims of damage.The polluter pays principle can be acceptable from different viewpoints; namely economic efficiency and fairness, from an economic viewpoint, as those industries responsible for environmental damage are profiting from their polluting activities, then they should be paid for any environmental damage caused. Polluter pays principle is a pecuniary principle in the sense that polluter himself will bear cost of pollution and not the society at large. As mentioned above, polluter pays principle is a liability principle, which means it forms the basis of environmental compensation liability, this liability can be civil or criminal.
2. **Civil Liability**: The polluter can be held liable for damages caused by their actions or omissions. This can include compensation for loss or damage to property, economic loss, and loss of enjoyment of natural resources. Civil liability can be sought through civil lawsuits, which may be initiated by the government or by private individuals.
3. **Criminal Liability:** In some cases, environmental damage may be so severe that it constitutes a criminal offense. Criminal liability may result in fines, imprisonment, or otherpenalties.
4. **Administrative Penalties:** Government agencies may impose administrative penalties onindividuals or companies responsible for environmental damage. These penalties can include fines, orders to cease or

limit activities, and revocation of permits or licenses.

5. **Injunctions:** In some cases, a court may issue an injunction ordering the polluter to stop the activity causing environmental damage. This can be a powerful tool for preventing further harm and protecting the environment.
6. **Restoration:** In addition to compensation for damages, courts may also order the polluterto take actions to restore the environment to its pre-damaged state. This can include actionssuch as habitat restoration, pollution cleanup, and reforestation.
7. **Environmental Regulations:** Many countries have environmental regulations in place that aim to prevent environmental damage and provide for penalties and remedies in case of accidents. These regulations may include requirements for environmental impact assessments, pollution prevention plans, and reporting requirements.

3.3 Existing Policies

The Public Liability Law notified in 1991 for regulating mandatory liability insurance. This act applies to all industries engaged in production and handling of any hazardous chemicals. It provides immediate relief to victims and persons (other than industry workers) in case of accidents happens during handling hazardous substances through the insurance amount paid by the owner of the hazardous substance.

One of the major trigger for the enactment of Public Liability law was Bhopal Gas Tragedy case in which thousands of people lost their lives. This was one of the worst industrial disaster in the world that happened on night in the early hours of December 3, 1984. Around midnight, in chemical plant of the Union Carbide (India) Limited, due to failure of process safety, deadly gas methyl isocyanate (MIC) released from one of the tanks. As a result, the lethal gas emitted from the factory enveloped the city within its deadly folds. Approximately 3,000 people died in the tragedy, and thousands more were physically injured and affected from this industrial mishap. The environment was polluted and ecology was disturbed. An estimated 40 tons of methyl isocyanate(MIC) gas was leaked from the Union Carbide Factory.

The government of India formulated a number of concrete legislative measures thereafter: -

1. **Environment Protection Act, 1986**– The Environment Protection Act, 1986 is a key environmental legislation in India. It was enacted by the Indian Parliament with the objective of providing the framework for the protection and improvement of the environment and the prevention of hazards to human beings, other living creatures, plants, and property. This is an umbrella act which provides framework for coordination of central and state governments to prevent air, water pollution. It also expands the central government's powers to enter, inspect, and close down polluting factories.

   Here are some important features and provisions of the Environment Protection Act, 1986:

   I. Objectives: The main objectives of the Act are to protect and improve the environment, promote sustainable development, and safeguard the health and well-being of people and other living beings.
   II. Central Pollution Control Board (CPCB): The Act establishes the Central Pollution Control Board as the apex regulatory authority responsible for coordinating and enforcing environmental laws and regulations at the national level.
   III. State Pollution Control Boards (SPCBs): The Act empowers the central government to authorize the establishment of State Pollution Control Boards in each state to implement and enforce environmental standards and regulations.
   IV. Environmental Impact Assessment (EIA): The Act provides for the mandatory Environmental Impact Assessment of certain projects and activities that are likely to have a significant impact on the environment. EIA is a process to assess the potential environmental consequences of proposed projects before they are approved.
   V. Hazardous Substances and Pollutants: The Act addresses the regulation and management of hazardous substances and pollutants. It empowers the central government to take necessary

measures to control, prevent, and abate the pollutioncaused by industrial and other activities.

VI. Penalties and Offences: The Act specifies penalties for various offenses, including non-compliance with environmental standards, unauthorized handling or disposal of hazardous substances, and failure to comply with the directions of the regulatoryauthorities. It provides for both monetary fines and imprisonment depending on theseverity of the offense.

VII. Public Participation: The Act emphasizes public participation in matters related to environmental protection. It allows individuals and organizations to file complaints and seek legal remedies for environmental damage or non-compliance with environmental laws.

VIII. Environmental Laboratories: The Act provides for the establishment and recognition of environmental laboratories to carry out testing and analysis of samples related to environmental quality and pollution control.

IX. Powers of the Central Government: The Act grants the central government the power to issue directions and guidelines on matters related to environmentalprotection and pollution control. It also enables the government to delegate certainpowers and functions to other authorities.

The Environment Protection Act, 1986 has played a significant role in shaping environmental governance in India. It has provided a legal framework for addressing environmental issues, promoting sustainable development, and ensuring accountability for environmental degradation.

The Act has been amended over the years to keep pace with emerging environmental challengesand strengthen environmental protection measures.

2. **The Factories Act, 1948-** The Factories Act, 1948 is a significant labor legislation in Indiathat sets out provisions for the regulation and welfare of workers employed in factories. Itwas enacted by the Indian Parliament to ensure the health, safety, welfare, and rights of workers in the industrial sector. Here are the key features and provisions of the Factories Act, 1948:

I. Scope: The Act applies to factories where specified manufacturing processes are carried out and employing ten or more workers with the use of power, or twenty or more workers without the use of power. It covers a wide range of industries, including manufacturing, processing, and production units.

II. Health and Safety: The Act emphasizes maintaining a safe and healthy working environment in factories. It mandates provisions such as ventilation, temperature control, lighting, cleanliness, and prevention of occupational hazards. It also covers aspects like machinery safety, fencing of machinery, handling of hazardous substances, and precautions against accidents and fire.

III. Working Hours: The Act regulates the working hours of adult workers and sets a maximumlimit of 48 hours per week. It also specifies guidelines for overtime work, rest intervals, spread-over (duration of work including intervals), and weekly holidays.

IV. Employment of Young Persons: The Act contains provisions for the employment of youngpersons (those between 15 and 18 years of age) in factories. It outlines restrictions on their working hours, types of work they can be engaged in, and measures to protect their health,safety, and welfare.

V. Welfare Provisions: The Act includes provisions for welfare amenities to be provided by factories, such as clean drinking water, adequate sanitary facilities, first aid provisions, canteens (in factories employing a certain number of workers), restrooms, and arrangements for the disposal of waste and effluents. It also includes provisions for the establishment of a creche facility for factories with a certain number of women workers.

VI. Inspections and Enforcement: The Act empowers the government to appoint factory inspectors who conduct regular inspections to ensure compliance with the Act's provisions. Factory inspectors have the authority to issue improvement notices, initiate legal proceedings, and take necessary actions to enforce compliance.

VII. Penalties and Offenses: The Act prescribes penalties for contraventions and non- compliance with its provisions. It includes monetary fines and, in some cases, imprisonment for offenses committed by factory owners, managers, or workers.

VIII. Amendments and Revisions: The Factories Act, 1948, has been amended multiple times to address

emerging needs, technological advancements, and changes in the industrial landscape. These amendments have introduced additional provisions and enhanced the overall effectiveness of the Act.

The Factories Act, 1948, aims to ensure the welfare and safety of workers in factories and promotea conducive working environment. It sets standards for health, safety, and working conditions while also addressing welfare measures that contribute to the overall well-being of workers.

3. **Public liability insurance act 1991**- This required factory owners to take insurance for potential personal injury and property damage in surrounding communities due to any unforeseen industrial accident.

The Public Liability Insurance Act came into action after the tragedy and aims to provide immediate relief to victims of such accidents caused by hazardous industries. According to Section 4 of this Act, owners of industries where hazardous chemicals are stored or used, take out insurancepolicies to cover liabilities from accidents that cause death, injury, or injury. In addition, Section 7 A, i) and (ii) regulate the establishment of a central government's environmental promotion fund to be used in accordance with the law to pay assistance to accident victims in industries which are hazardous in nature. The law also regulates factory owners to take insurance that cover obligationsnot less than the paid up capital of the industry and not more than Rupees Fifty crore.

4. CONCLUSION

Industrial accidents can have severe consequences, posing significant risks to both human health and the environment. These risks vary depending on the nature of the accident, the industry involved, and the substances or materials affected. Understanding and addressing these risks are crucial for ensuring the well-being of individuals and the preservation of our ecosystems. Prevention in industry before and during accidents is a crucial aspect of ensuring the safety and well-being of workers and minimizing the occurrence of accidents.

The Baghjan accident, brought attention to the devastating consequences of industrial accidents, particularly in the oil and gas sector. The incident serves as a sobering reminder of the urgent need for comprehensive safety measures, effective response protocols, and greater environmentalconsciousness within the industry. The Baghjan accident highlights several crucial lessons that must be learned and acted upon:

Stringent Safety Measures: Oil and gas companies must adhere to rigorous safety protocols, including regular inspections, maintenance of equipment, and thorough risk assessments, to minimize the risk of accidents.

Emergency Response Preparedness: Companies should have robust emergency response plans in place, focusing on prompt and effective actions to mitigate accidents and handle subsequent crises. Regular drills and training for employees and emergency responders are essential to ensurea swift and coordinated response.

Environmental Considerations: Companies should prioritize environmental consciousness and adopt sustainable practices to prevent and mitigate the environmental impacts of accidents. Strict adherence to environmental regulations, such as proper waste management and spill containmentmeasures, is vital.

Community Engagement and Compensation: Proactive engagement with local communities, transparent communication, and fair compensation for affected individuals are crucial to address the social and economic impacts of accidents.

Industrial accidents pose significant risks to human health and the environment. Understanding these risks and taking appropriate measures to prevent accidents and minimize their impacts are vital responsibilities. By prioritizing safety, following regulations, and implementing effective risk management strategies, industries can protect the well-being of workers, nearby communities, andthe environment. It is crucial for stakeholders to work together to ensure a safe and sustainable industrial landscape that minimizes the occurrence and consequences of industrial accidents.

In conclusion, the relationship between the environment and industrial development is complex and multifaceted. While industrial development has played an important role in driving economic growth and technological advancement, it is also important to recognize the negative impacts it can have on the environment. It is important for industries to take responsibility for their impact on the environment especially in the case of accident. By implementing policies and practices that balance economic growth with environmental protection, we can reduce the chances of such accidents and can ensure that future generations canenjoy the benefits of industrial development while preserving the natural resources and ecosystemsthat support our planet's health and wellbeing.

In such cases of industrial accidents which result in enormous environmental damage, it is observed that the environmental compensation is imposed only after the judicial interventions. However, our environmental acts can be amended to incorporate a calculation formula for imposing compensation for environmental damages and restoration. These amendments should be on the polluter's pay principle and shall strengthen the existing framework of legal remedies for such accidental cases by ensuring appropriate compensation towards environmental damages.

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