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HEALTH, SAFETY, AND ENVIRONMENTAL CHALLENGES IN CRUDE OIL TRANSPORT: LESSONS FROM THE EXXON VALDEZ SPILL

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ABSTRACT: Workplace accidents, especially in high-risk work environments, are inevitable at times. However, inadequate attention to health, safety, and environmental management (HSEM) in the workplace can lead to accidents that can significantly harm humans and the natural environment. The study examined Health, Safety and Environmental complexities resulting from the 1989 Exxon Valdez oil spill (EVOS) shipping accident in Alaska. The methodology adopted for the study involved secondary data collection using an exploratory approach. Study results show that EVOS led to serious environmental degradation and also caused significant sociocultural, psychological, economic and health impacts. The main complexity and interaction of HSEM resulting from EVOS is the dilemma of balancing HSE goals with economic goals. Even though the prevalence of shipping tanker accidents resulting in oil spills has significantly reduced, accidents attributable to human inadequacies still occur. Also, post-traumatic stress disorders caused by the social, economic and environmental effects of EVOS are still felt in the areas affected. In addition, the remediation techniques applied have not been very effective in mitigating the spill's environmental effects despite repeated applications. Therefore, the study recommends that International Oil Companies (IOCs) should strive to maintain a balance between economic and HSEM goals, thereby fostering sustainability in the shipping sector.

Keywords: Health and Safety, Workplace, Exxon Valdez, Oil Spill, Risks

INTRODUCTION

Workplace accidents are unplanned events that typically lead to fatalities, property damage, or environmental contamination (Emetumah, 2016; Osei-Asibey et al., 2021). Although effective health, safety, and environmental management (HSEM) procedures are in place, accidents will nevertheless happen from time to time. Thus, to the extent that it is practically possible, HSEM seeks to lower the frequency of workplace accidents (Emetumah et al., 2017). Oil and gas resources are essential to meeting energy needs worldwide because they currently supply more than 75% of the world's energy needs (Martins et al., 2019). Oil and gas deposits, however, are not always available where they are needed and must be transported from the extraction site to a processing facility where they can be separated into their parts before being used. Therefore, massive shipping tankers called barges, which can transport more than one million tons of crude oil at a time, are typically used to transport vast volumes of oil and gas resources (Abdussamie et al., 2018).

In the United States, the average oil spill from shipping tankers was about 26,000 metric tons in the mid-1970s and dropped to about 10,000 metric tons just before the Exxon Valdez oil spill (EVOS) disaster took place in the late 1980s (Ramseur, 2010). The EVOS shipping accident is considered a prime example of how inadequate HSEM in the oil and gas sector can become environmentally pernicious in the long term. Since then, efforts have been made to prevent reoccurrence. Due to the profound environmental impact of the EVOS, it has served as a point of reference for how HSEM can affect human and environmental well-being. Therefore, it is necessary to examine health, safety, and environmental complexities that resulted from the 1989 EVOS shipping accident in Alaska, United States. On that note, this paper explores the health, safety, and environmental complexities associated with oil tanker operations, with a specific focus on lessons learned from the Exxon Valdez spill

METHODOLOGY

The study centered on environmental, health, and safety concerns in the workplace by examining the 1989 Exxon Valdez shipping tanker tragedy. An exploratory research design was used to collect secondary data from the body of literature on the 1989 Exxon Valdez shipping tanker accident from the standpoint of health, safety, and environmental management (HSEM). Figure 1 shows the location where the EVOS accident occurred off the Alaskan coast.

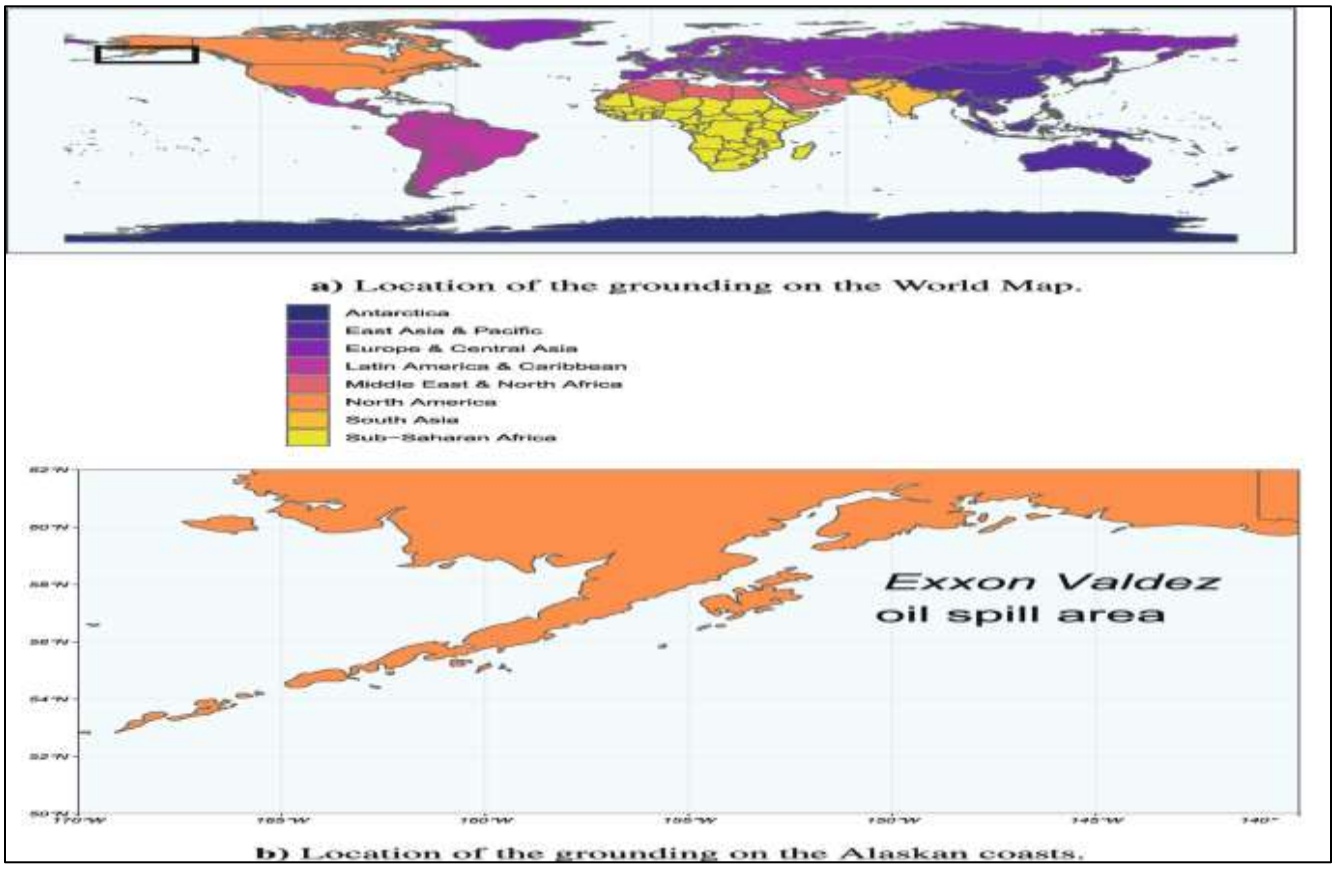

Figure 1: Map showing the location of the EVOS shipping accident. Adapted from Martín-Cervantes and del Carmen Valls Martínez (2020).

This was accomplished by applying the study's primary themes, which encompassed environmental, health, and safety concerns in the shipping industry. The HSEM and the Exxon Valdez maritime accident were also analysed using a simplified exploratory technique. An exploratory research strategy is appropriate when the goal is to investigate a subject that has not been thoroughly hypothesized; in this case, the exploration aims to provide fresh insight into the study problem to gain a deeper comprehension of the challenges it raises (Anderson & Lightfoot, 2022). Given the lack of clarity surrounding the HSEM concerns about the Exxon Valdez shipping tragedy, an exploratory research approach appears to be appropriate for this study. Three primary areas were the focus of the exploratory study approach: (1) the intricacies of HSEM risks in oil and gas shipping, (2) the pertinent regulatory framework, and (3) compliance difficulties stemming from the 1989 EVOS catastrophe.

RESULTS AND DISCUSSION

On March 24, 1989, an approximately 1000-foot shipping tanker carrying over 1.3 million barrels of crude oil (bbl) grounded in the Bligh Reef area of Prince William Sound (PWS), Alaska, causing the EVOS shipping catastrophe. Following its 1999 merger with Mobil Producing to create ExxonMobil, the company's present name, Exxon Corporation, one of the biggest international oil firms (IOCs) in the US and the globe, owned and operated the shipping vessel involved in the Alaskan oil disaster (Kumar, 2019). Paine et al. (1996) found out that human error caused the vessel to the ground and the ensuing oil spill catastrophe; there have been claims that the skipper of the ship may have been drunk at the time of the incident because he was a known alcoholic. Furthermore, according to Leveson (2005), the EVOS shipping accident might have been brought on by a lack of commitment on the part of Exxon and local authorities at the time of the incident; Exxon neglected to install a contemporary iceberg monitoring device despite having insufficient crew on board, and the radar station in Valdez City was not properly equipped. Conflicting claims between Exxon and the government on who was primarily to blame for the oil leak also caused delays in repair and reclamation efforts. As a result, during the three days following the ship's grounding, the EVOS oil leak extended over an area of more than 1200 kilometers, killing over 300,000 aquatic and avian animals and leaving the area's ecological health seriously damaged (Cheremisinoff & Rosenfeld, 2009).

The distant location of PWS, hundreds of nautical miles from the US mainland, where the majority of the equipment and technical personnel for the remediation exercise originated, complicated rescue and spill mitigation efforts. Significant long-term environmental damage was caused by the shipping tanker's grounding in PWS, which caused the ship to dump over 260,000 barrels of crude oil onto nearby land and water systems (Payne et al., 2008). Given that the area is an essential habitat for a variety of shoreline creatures, including pink salmon, Pacific herring, sea otters, and birds, among others, the EVOS had a considerable environmental impact (Maki, 1991). Furthermore, even after 15 years, the EVOS pointedly impacted the vegetation surrounding the spilt regions, making it more difficult for many organisms in the biological area to locate food and suitable shelter (Harwell & Gentile, 2006).

Estimates suggest that the total cost of EVOS is around $10 billion because of the long-term nature of its effects on the environment, society, and economy, which makes cost estimation challenging

(Carson et al., 1992). According to Cakir et al. (2021), the EVOS accident is regarded as the biggest oil leak involving a cargo tanker in US territorial waters. When compared to other oil spills, it comes in second place because the Deepwater Horizon oil leak in 2010 spilt more than 4.8 million barrels of crude oil into the Gulf of Mexico (Lacina et al., 2023).

Intricacies of Health, Safety and Environment (HSE) issues resulting from EVOS

There are basic obstacles to achieving effective HSEM in oil and gas shipping that avoid workplace accidents. Many organisations engaged in high-risk operations view the implementation of effective HSEM as a barrier that raises operating expenses rather than as a beneficial element that boosts business earnings (Hughes & Ferrett, 2013). This means that many organisations are faced with the challenge of finding a balance between decreasing operating expenses by cutting organisational budgets without making extra HSEM investments or making investments that can improve HSEM and prevent accidents. Accordingly, anthropological deficiencies that come from human error and inconsistency are typically the cause of HSEM problems in the workplace (Almazrouei et al., 2019).

Since exporting such large quantities of oil and gas resources is thought to carry some HSE hazards, efforts have been made over the years at both the national and international levels to lessen the possibility of mishaps during this process. Figure 1 shows the quantity and volume of oil spills from cargo tankers worldwide from 1970 to 2021. According to the data, fewer than seven oil tanker mishaps occurred in 2013, a dramatic decrease from the average of over 78 spills in the mid-1970s. However, whether this decrease in oil shipping tanker spills is equivalent to the environmental harm caused by previous oil spills is still up in the air.

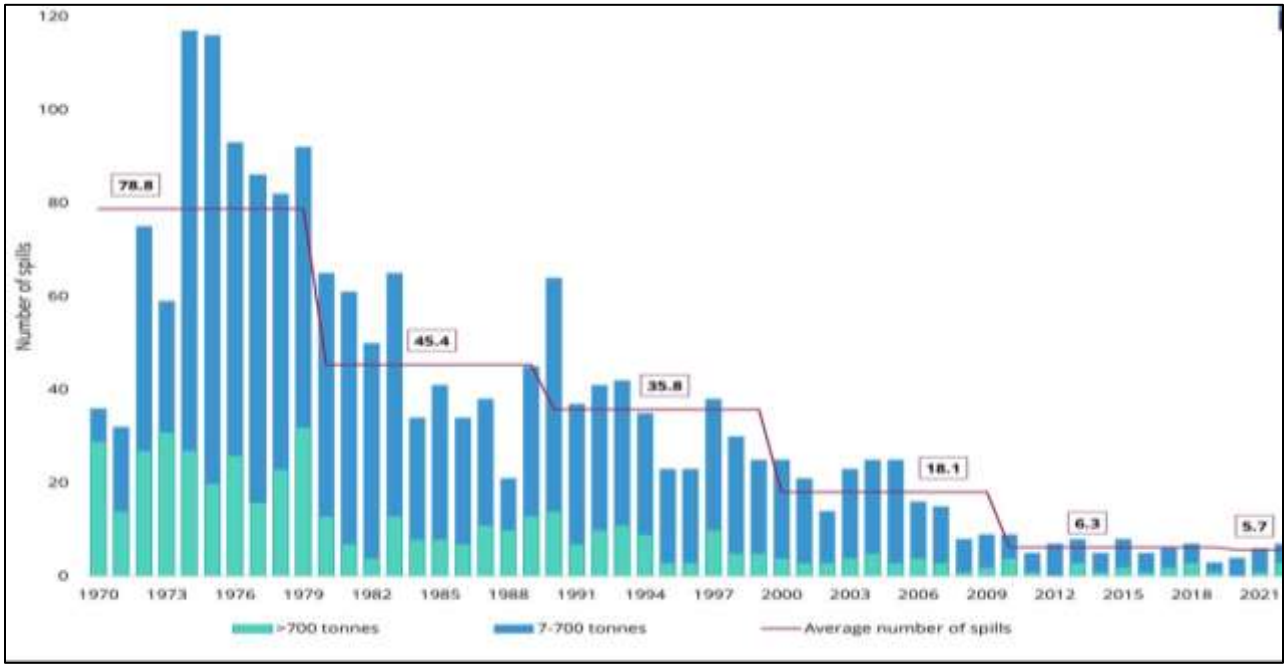

Figure 2: Oil spills from maritime tankers worldwide, 1970–2021. Adapted from ITOPF (2023).

As evidenced by the declining oil spill amounts in Figure 2, there is no question that major technological developments since the EVOS catastrophe have enhanced the management of marine oil spills. However, it is extremely difficult to limit the detrimental consequences of oil spills on aquatic life, valuable reef systems, and coastal beaches due to their long-term nature (National Geographic, 2019). Although the optimum way to prevent oil leaks from shipping accidents is to prevent them altogether, human behaviour inconsistencies suggest that shipping mishaps may only be minimized rather than eliminated (Nixon & Michel, 2018). Thus, one of the main challenges in managing oil spills is the complexity of human behaviour.

Unmitigated HSE risks from the Exxon Valdez oil spill

EVOS has been around for over 30 years, yet the effects of the leak continue to pose a number of HSE hazards. The location's vulnerability exacerbates these worries; PWS, the site of the oil leak, is near the arctic region, whose ecology is essential to preserving biodiversity and climate in other regions of the planet (Boufadel et al., 2016). The area where the leak happened still has unresolved HSE hazards years after EVOS. For example, despite a large recovery in the sea otter population in PWS following over 20 years of EVOS, Garshelis and Johnson (2013) found that animals continue to excavate for subterranean oil remnants, which negatively impact both their general well-being and the quality of the environment.

The fact that shipping accidents continue to occur after EVOS shows that there are still a lot of HSEM hazards associated with moving oil and gas. According to Eliopoulou, Papanikolaou, and Voulgarellis (2016), there are six types of shipping accidents: collision, contact, grounding, fire, explosion, and structural failure. As of 2016, the most common types of accidents were collision and contact. Approximately 15,000 tons of crude oil were spilt in seven medium-to-large oil tanker spills in 2022, despite improvements in maritime technology; the majority of these spills were brought on by either ship owners' poor management choices or unmitigated HSEM risks by seafarers on board (ITOPF, 2023).

Cheremisinoff and Rosenfeld (2009) claim that among Alaskans whose livelihoods were adversely impacted by the spill, post-traumatic stress disorder was common as a result of the environmental, social, and economic disturbances brought on by EVOS. This is because a large number of rural people impacted by EVOS depend on wildlife, forests, and water bodies for domestic water supplies and food, all of which were contaminated by the spill. In a similar vein, Palinkas et al. (1993) found that EVOS exacerbated sociocultural, physiological, and psychological disorders in many Alaskan communities, making drug and alcohol abuse, domestic violence, and other health conditions endemic and potentially widespread over time.

Even when used repeatedly in the years after the leak, many remediation strategies used to lessen the effects of EVOS, including burning, high-pressure washing with hot water, skimming, and bioremediation were ineffective (Peterson et al., 2003). The environment surrounding PWS may sustain long-term harm for many years to come due to the inefficiency of these remediations, even if oil residue may not be apparent at first glance.

According to Paine et al. (1996), Exxon has used litigation to contest the extent of its liability, claiming that the long-term impact of EVOS on Alaska is negligible, even though the Code of Federal Regulations holds oil companies accountable for the costs of environmental degradation brought on by their operations. Because it allows other IOCs to minimize their liability in the future, this poses a significant risk to HSEM. Since it may take years to resolve the issue, using a legal approach makes it difficult to achieve justice and exacerbates environmental degradation in the impacted areas (Neal, 2011).

HSEM legislation and regulations affecting oil and gas shipping

The main goals of HSE laws and rules on oil and gas shipping are to prevent accidents completely and to offer guidelines and response systems that lessen the overall impact of incidents on the health and safety of people and the environment.

The 1979 Occupational Safety and Health (Dock Work) Convention, the 1981 Occupational Safety and Health Convention (No. 155) and its 2002 protocol, the 1990 Chemicals Convention (No. 170), and other international instruments are among the many that the International Labour Organization that address HSEM and occupational safety and health issues in the workplace (ILO, 2023). These agreements have also given various nations around the world some direction, which they have utilised to create framework laws and rules that lessen the likelihood of shipping mishaps when transporting gas and oil resources. Article 4 (C134) of the ILO Convention on the Prevention of Accidents for Seafarers (ILO-C134, 1970) states that national and international water transportation laws and regulations should prioritise the prevention of accidents and the protection of the health and safety of employees by, among other things, maintaining ship order, implementing proper work procedures, managing fires, and ensuring the use of personal protective equipment (PPE).

The adoption of the Oil Pollution Act of 1990 (OPA-90), which includes provisions for preventative measures, liability for damages caused, and remediation costs, was the most significant impact on EVOS on HSEM legislation and regulations in oil and gas shipping (Talley et al., 2001). In addition to imposing severe penalties on owners of shipping vessels engaged in oil spills, OPA-90 requires that the responsible party prove that $150 million was spent on spill cleanup; if not, a $25,000 per day penalty would be accumulated (Bureau of Ocean Energy Management, 1990). Additionally, OPA-90 requires ships to be double-hulled, drastically reducing the impact of oil leaks by dividing the ship's hull into two layers of watertight segregation (Hamann et al., 2013). The majority of oil tankers in service today have two hull compartments since the double-hull design is so widely accepted. The National Oil and Hazardous Substances Pollution Contingency Plan (NCP), which also adheres to legislative directives in the Clean Water Act of 1972, provides the majority of the regulations for putting OPA-90 into practice (US EPA, 2023). Better laws and regulatory mechanisms have made it easier and faster to predict oil tanker movements in dangerous waters and to locate and contain oil spills when they occur. Among other things, the regulations establish a national, regional, or local response team with specific responsibilities, classify the oil spill, and specify how oil spill remediation is funded.

Conclusion

Accidents do occur, but they are less likely to occur when HSEM is used effectively. Additionally, HSEM guarantees that the impact of accidents on environmental and human health is minimal. Because crude oil is essential to the world's energy supply, it must be transported around the globe in massive cargo tankers, which occasionally have mishaps that result in oil spills. A substantial amount of crude oil leaked into the surrounding surroundings of PWS, Alaska, as a result of the 1989 EVOS catastrophe. In addition to causing major environmental damage, EVOS had a major negative influence on the sociocultural, psychological, economic, and health well-being of the local population near PWS. IOCs face the challenge of striking a balance between HSE and economic objectives, which is the primary complexity and interaction of HSEM brought on by EVOS. Accidents caused by human error still occur in various regions of the marine globe, even if the frequency of shipping tanker accidents that result in oil leaks has significantly decreased. When wildlife forages on the ground in the spill region, they continue to dig up oil residue, which poses an unmitigated HSEM risk from EVOS. Additionally, the social, economic, and environmental impacts of EVOS continue to produce post-traumatic stress disorders in the impacted communities. Furthermore, despite numerous applications, the remedial methods used have not been very successful in reducing the environmental effects of the spill. Among the international and national laws influencing oil and shipping in the United States are the Oil Pollution Act of 1990 (OPA-90), the Clean Water Act of 1972, the 1979 Occupational Safety and Health (Dock Work) Convention, the 1981 Occupational Safety and Health convention (No. 155), the ILO convention on the prevention of accidents for seafarers (ILO-C134, 1970), and the Code of Federal Regulations. The advent of the double-hull (DH) idea, which has been imitated globally, was a significant advance following the EVOS accident. This is quite important in terms of HSEM in oil and gas shipping.

In light of this, the report suggests that IOCs work to reconcile HSEM and economic objectives to promote sustainability. This can be accomplished by making certain that HSEM concerns are given top attention at the organisation's highest decision-making level. Additionally, it should be discouraged to use legal tools to suppress and postpone remediation efforts following oil spills. This not only demonstrates a lack of concern for environmental protection but also demonstrates that the associated IOCs prioritise profit-making over long-term environmental sustainability.

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