A Care Ethics Analysis of the Piper Alpha Oil Platform Disaster

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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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Introduction

On July 6, 1988, a sequence of explosions and failures across the Piper Alpha oil platform, owned by Occidental Petroleum, resulted in the death of 167 workers in the world's deadliest offshore oil industry disaster, in terms of human fatalities. This case has become a landmark in industry safety, as it helped to establish industrial safety standards, has pushed safety research forwards, and has served as a crucial example of safety in engineering practice (Nasa Safety Center, 2013). Currently, several scholars agree upon the lack of organizational integrity and technical redundancies that ultimately resulted in the Piper Alpha disaster. Scholars are especially focused on placing the blame on the technological failures and regulatory insufficiencies that allowed such a tragic sequence of events to unfold (Cullen, 2018). However, despite being such a famous landmark of engineering safety, virtually no literature exists evaluating the morality of those who should be held responsible. A failure to recognize the ethical stake engineers play in their design will allow engineers to continue blindly following rules and regulations, rather than understanding their obligation to act ethically for the good of the greater whole.

I will employ the ethical framework of care ethics to demonstrate that the Occidental Petroleum company did not act ethically in the events leading up to and during the Piper Alpha oil rig disaster, and should therefore be held accountable not only for the events that night, but also for the aftermath that continues to this very day. This paper will specifically examine Occidental's morality using the three of the four elements of care ethics, which explores how it did not exercise proper responsibility, competence, or responsiveness to its employees, thus resulting in the deaths of 167 workers and a lasting toll on the 59 survivors (Hull, Alexander, & Klein, 2002).

Background

The Piper oilfield, located 120 miles northeast of Aberdeen, Scotland, was discovered in 1973, and began oil production in 1976. The Piper Alpha oil platform was the primary oil production platform operating in the Piper oilfield. It was owned by the Occidental Petroleum Corporation, which is owned by the larger McDermott International Incorporated. Claymore and Tartan, two of the nearby oil platforms, were located 18 and 12 miles from Piper Alpha, respectively, and were connected to Piper Alpha by oil and gas pipelines (Rosenthal, Boin, & Comfort, 2001). See *Figure 1* at the end of this section.

When oil is extracted from beneath the ocean floor, the well extracts a mixture of oil, natural gas, and sea water to the platform. At the platform, the oil is separated away, and the gas must be condensed and pumped back into the oil before export to the shore refinery (Nasa Safety Center, 2013). On the Piper Alpha platform, Pump A and Pump B, of which only one was needed to continue oil production, were responsible for pumping gas condensate into the oil for export. On the day in question, Pump A was disabled by the day crew for routine maintenance and equipment overhaul, and a blind flange was hand-tightened to seal off the open pipe. The night crew was not aware of this, and when Pump B malfunctioned, they mistakenly began operating Pump A. The blind flange of Pump A was not able to sustain the high pressure of the gas, resulting in the first of the many fatal explosions that night. This was followed by rupture of the main oil line, which further fed the fire, and caused rupture of all other pipelines. Because Piper Alpha was connected to four gas and oil pipelines, the failure of the other oil platforms to shut down production caused additional hydrocarbons to take the easier route of backflowing into ruptured pipelines on Piper Alpha, thus drastically exacerbating the fire and smoke (Rosenthal, Boin, & Comfort, 2001). Following the disaster, Lord William Cullen of White kirk

carried out a Public Inquiry, which resulted in 106 recommendations for changes to North Sea safety procedures, all of which were adapted by the offshore oil industry (Nasa Safety Center, 2013).

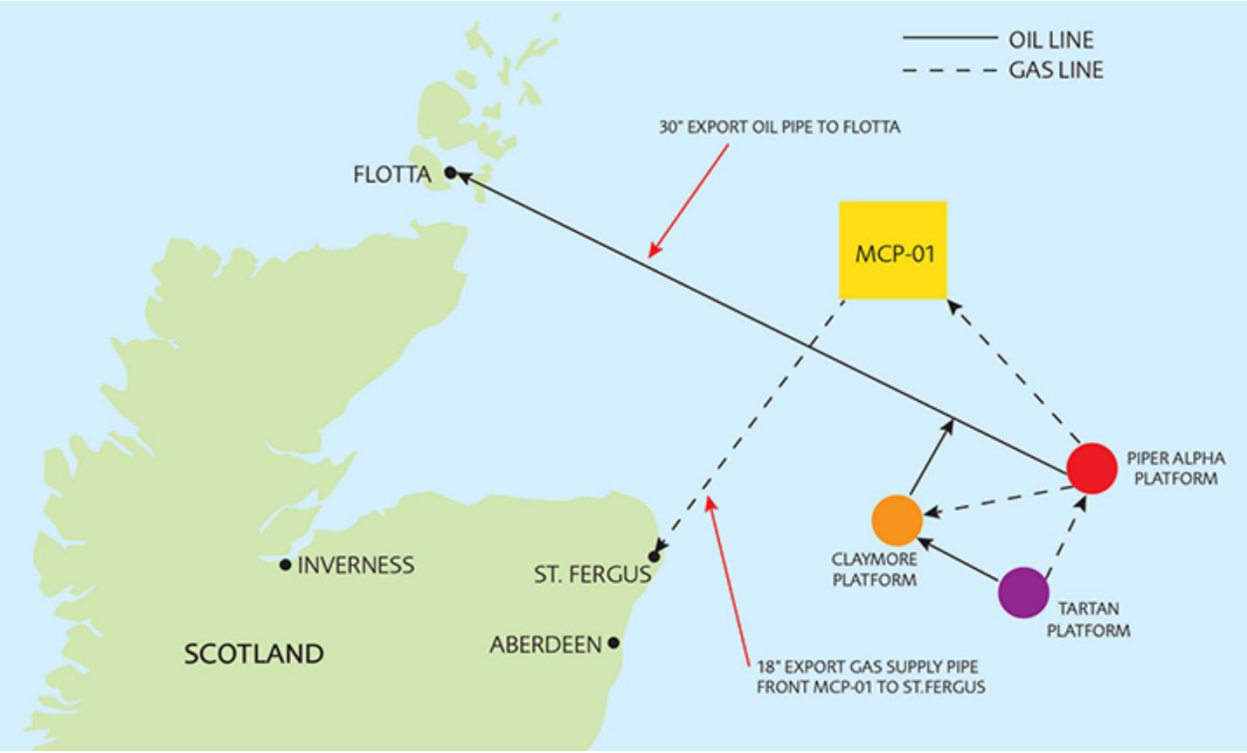

Figure 1. Locations of Piper Alpha, associated platforms, oil terminals, and gas terminals (Macleod & Richardson, 2018)

Literature Review

The Piper Alpha disaster has been analyzed by countless scholars due to its prominence in the discussion of engineering safety. Although many scholars have scrutinized the several errors contributing to the accident, there has been no work done to analyze the ethics behind it. The current analyses available focus on risk analysis frameworks, and highlight issues such as organizational breakdown, poor control dynamics, and poor design choices.

Lord Cullen, the investigator of the Piper Alpha disaster, is a strong advocate for process safety. He has given 106 recommendations following the accident, all of which have been accepted and implemented into the offshore oil industries, in addition to other engineering applications. He especially emphasizes the necessity of executing deeper, in-depth investigations in order to drive home the results of each accident. He believes that if this does not occur, then history is doomed to repeat itself. Although he does argue for the necessity of instilling responsibility in others for identifying and resolving safety issues, he never specifically mentions the morality that must come to mind when approaching engineering decisions (Cullen, 1993). Additionally, the 106 recommendations that he does make do not pertain to a change in code of ethics or morality, but are rather technical in nature. For example, he recommends changing the responsibility of offshore oil safety from one organization to another (Nasa Safety Center, 2013).

Elisabeth Pate-Cornell is a Stanford University Professor in the Department of Management Science and Engineering. She has published two papers regarding the Piper Alpha accident, both of which utilize risk analysis frameworks to identify the complex root causes of the incident. Specifically, she uses the probabilistic risk analysis framework to identify the accident sequence of the Piper Alpha incident. This analysis ultimately isolates several causing factors, such as technical design flaws, misguided priorities in management, tradeoff between productivity and safety, mistakes of personnel onboard the platform, and errors in judgment due to management pressures (Pate-Cornell, 1993). This analysis effectively explores risk management measures that reach past the purely technical, however it still does not root back to the morality of the engineers or management when making preliminary decisions.

In both of these papers, the scholars direct the cause of the Piper Alpha disaster towards organizational insufficiencies and technical failures. However, although there were clearly

questionable ethical concerns at play, there has been little analysis done regarding the morality of the company itself. The scholarly papers that have been published thus far has made tremendous progress in determining the root causes of the disaster in order to ensure that future technologies do not fall victim to the same mistakes. While it is crucial to analyze the actions and technical errors that led to a certain failure, it is perhaps equally as important to understand how and why Occidental Petroleum did not behave ethically during this time. By doing so, we can better understand how to ask ourselves ethical questions and therefore design with those we design for in mind.

Conceptual Framework

When considering the relationship between Occidental Petroleum and its employees, and the care that they owe each other, we can see that this relationship fits nicely into the care ethics framework. Care ethics was developed by Carol Gilligan and Nel Noddings in the 1980s. It is unique from other frameworks because it stresses the relationships between two parties, the context in which the relationship lies, and how the different parties must show empathy and care for one another. Other ethical frameworks, such as utilitarian and duty ethics, do not consider how ethics may change within different contexts, which may not be logical given that certain decisions may be ethical in one situation, but unethical in another. Care ethics specifically focuses on the notion that we owe a duty of care to those we have any sort of relationship with (Poel & Royakkers, 2011). In this paper, I am focusing on the relationship between Occidental Petroleum as a company, and the duty of care they owe to their personnel as their employers. Duty of care is especially more prominent if one party is superior to the other, which in this case,

Occidental Petroleum clearly holds more power and therefore has a greater obligation to care for its personnel.

Care generally refers to the attitudes or actions we enact in order to repair ourselves and our surroundings so we can live as well as possible. This can be broken down into four stages of care, which are attentiveness, responsibility, competence, and responsiveness (Poel & Royakkers, 2011). Attentiveness refers to becoming aware of a need, such as looking for cracks in a cup before pouring a drink rather than simply pouring the drink and watching to see if it leaks. Responsibility can be thought of as a group or individual owning a mistake and proposing a solution for that fault. Competence is the act of providing good and successful care. For example, engineers are competent if they are able to design a technology that performs the requested safety features. Responsiveness is how a group or individual reacts by considering the position of the "other" in the relationship, especially when attending to power differences in asymmetrical relationships. For example, a company would be responsive if they issued an immediate recall after discovering that their product causes health hazards, rather than waiting to see if anyone encounters such a health hazard.

Carol Gilligan emphasizes that by "recognizing the vulnerability of the other by placing yourself in his or her shoes to understand his or her emotions, you can learn what is good or bad at that particular time" (Poel & Royakkers, 2011, p.102). Therefore, in order to appropriately care for someone, you must enact all four stages of care, listed above. It then follows that someone who does not fulfill all four stages of care can be deemed morally irresponsible in terms of care ethics, since they were not able to fully shift their perspective and thus cannot make ethical decisions with that perspective in mind.

In this paper, I will use the care ethics framework to analyze the morality of Occidental Petroleum in the events leading up to the Piper Alpha disaster. Because failure to deliver just one stage of care can be deemed immoral, I will provide evidence to show how Occidental Petroleum was immoral by failing to provide care through responsibility, competence, and responsiveness. By doing so, I will be able to prove that this company did not act morally and should therefore be held accountable for the disaster. Use of this framework will also allow future engineers to understand the moral basis of their actions.

Analysis

Occidental Petroleum demonstrated a lack of morality when 167 personnel lost their lives, and 59 survivors were left to agonize with post-traumatic stress and guilt (Nasa Safety Center, 2013). The core values of McDermott International include "responsibility to act safely and look out for others," "take ownership and accountability," "provide certainty on schedule, quality, cost, and safety through clear and realistic plans," and "address problems head on," to name a few (McDermott, n.d.). As a subgroup of McDermott International, by default, Occidental Petroleum must align with these values (Nasa Safety Center, 2013). These values directly reflect the responsibility, competence, and responsiveness stages of care ethics. Furthermore, they reflect the relationship of care between the company and the personnel, as these values coincide with keeping their employees safe. However, these values were clearly not adhered to during the Piper Alpha disaster (Rosenthal, Boin, & Comfort, 2001). As previously mentioned, failing just one stage of care can be deemed immoral. Therefore, I will demonstrate that Occidental was immoral by failing to provide responsibility, competence, and responsiveness. In this analysis, I will be using quotes from the Cullen Investigation in order to

prove that Occidental was immoral to its personnel. Shortly after the disaster, the Secretary of State for Energy appointed Lord Cullen to hold a public inquiry to elucidate the cause of the Piper Alpha disaster. The inquiry lasted 180 days, with evidence from 260 witnesses, survivors, and experts. Although the dialogue from the inquiry is not available, Cullen used this investigation to produce the *Public Inquiry into the Piper Alpha Disaster*, also known as the Cullen Report, in 1990, which serves as excellent evidence into the events leading up to and during the Piper Alpha disaster (Drysdale & Sylvester-Evans, 1998).

Responsibility

Occidental Petroleum was inadvertently irresponsible by hiring offshore installation managers (OIMs) who were not able to adequately respond to such emergency scenarios. As OIMs are the highest level of control level on the oil platforms, and there is only one OIM per platform, it is crucial that they must be able to tend to emergencies in a methodical way such that the correct and safest operations are carried out. Responsibility directly aligns with the company values of "responsibility to act safely and look out for others" and "take ownership and accountability." Therefore, a company or individual can be deemed irresponsible if they do not appropriately respond to the emergency at hand. The poor performance of the OIM on Piper Alpha on the night of the accident was outlined in the Cullen (1990) investigation:

> The OIM made no specific attempt to call in helicopters from the Tharos or elsewhere; or to communicate with vessels around the installation; or with the shore or other installations; or with personnel on the Piper. It appeared that the OIM did not have a portable radio with which to communicate with senior personnel who had such radios. (p.153)

This detailed account of the OIMs response to the initial explosion demonstrates that he was not prepared for any kind of emergency. He "made no specific attempt" to reach out and notify the personnel on the platform, despite it being evident that all members of the platform must have heard such a massive explosion. Especially after a widely-observed incident, it should be the operating manager's responsibility to report the current status of the incident to all personnel who may be affected. Not only did the OIM neglect to keep the Piper Alpha personnel updated on what was occurring on the platform, but he also failed to reach out to any outside support vessels, which may have been able to provide help early on and therefore prevent exacerbation of the disaster. This failure to reach out to possible support vessels exhibits that the OIM did not take the appropriate responsibility in handling the situation. The OIM additionally did not report the initial explosion to other installations or platforms. Piper Alpha, being the main oil platform, had the most oil and gas pipeline connections to the other platforms and onshore installations, indicating that any tragedy aboard Piper Alpha would be directly affected by the operation of these other platforms and installations. Therefore, the OIM also demonstrated irresponsibility by not contacting those who had a stake in the disaster. Furthermore, the OIM "did not have a portable radio". Even if the OIM even wanted to reach out to those who may have been able to provide assistance, he did not even have the means to do so. The above quote was also the OIM's response to just the initial explosion, before the disaster had significantly escalated. At this point, there was no commotion or stress, and therefore the OIM should have had even more reason to appropriately take the steps to notify all personnel, associated platforms, and support vessels. Occidental did not ensure that the head operating manager on the Piper Alpha platform was qualified for this demanding position, and therefore should be deemed irresponsible for not providing their personnel with someone who could lead them properly.

Some may argue that the OIM aboard Piper Alpha was subjected to several unexpected psychological factors, thus explaining his poor leadership and decision making that night. It is understandable that, as the highest power level on the entire oil platform, the OIM was under immense stress as the responsible person for an atrocious disaster for which he had never been properly trained. Additionally, smoke inhalation has been found to be detrimental to cognitive function, thus further weakening the OIM's ability to take decisive action and command of the situation (Rosenthal, Boin, & Comfort, 2001). Therefore, it may not seem fair to deem the OIM irresponsible of the disaster at hand, as he had no expectations for the events that unfolded that night.

While these were no doubt factors taking effect that night, it is suspicious that the two other OIMs on duty on the Tartan and Claymore platforms also failed to make appropriate decisions that night. Cullen (1990) demonstrates the poor response on Claymore:

> At 22.20 and 22.30 hours Mr Davidson again raised the shutting down of production with the OIM. At the latter time he had heard from the *Tharos* of fire spreading and people being in the water. From the helideck he could then see a glow coming from the direction of Piper. The OIM continued to maintain production as he did not think the position on Piper would be beyond the control of its fire pumps. (p.140)

Here, the report states that James Davidson, the Operations Superintendent, who is the direct report of the OIM, had to "again" suggest shutting down production, indicating several previous efforts to stop oil production. Failure to shut down production on an adjacent oil platform causes the large hydrocarbon inventory to backflow into Piper Alpha, thus escalating the explosions and fires there (Drysdale & Sylvester-Evans, 1998). Despite being able to see "a glow" of the Piper Alpha fire, located 18 miles away, the OIM still thought that the fire "would be beyond the

control of its fire pumps." It is unacceptable that the Claymore OIM did not take the disaster seriously, even when the fire was visible from such a massive distance. The Claymore OIM failure to shut down production is irresponsible of the state of emergency visible on Piper Alpha. Likewise, Cullen (1990) also outlines the Tartan platform response to the Piper Alpha explosion:

> It should be added that the OIM was unable to explain why, if the decision to close ECV 54 was taken prior to the explosion on Piper at 22.20 hours, it took as long as until 22.25 hours for ECV 54 to be closed. (p.142)

The ECV is the emergency control valve that the OIM closed in order to halt production on the Tartan platform. However, as the OIM was "unable to explain why" the closing of the ECV took over 5 minutes, demonstrating that he did not recognize his responsibility in closing the valve as soon as possible in order to minimize disaster on Piper Alpha. Although 5 minutes may not seem significant, a 1988 memorandum between Occidental executives states that "structural integrity could be lost within 10-15 minutes if a fire was fed from a large pressurized hydrocarbon inventory," in reference to the oil platforms (Cullen, 1990, p.201). Delaying action for just 5 minutes in this critical situation contributed to fatal results, and should therefore be deemed irresponsible.

The inability for all OIMs to act responsibly that night reveals that weakness in the Piper Alpha OIM leadership was not solely a function of the psychological and physical conditions of Piper Alpha that night, but a pattern in Occidental management to not hire the appropriate personnel to run an entire oil platform. Not only that, but this demonstrates a potential hazard in having one sole position as the most powerful on the entire oil platform. Not only was there failure in layers of control, but there were failures in Occidental's ability to recognize that

leadership styles of on scene commanders have strong impacts on effectiveness of crisis management operations. Ultimately, Occidental was not responsibly able to hire appropriate OIMs, and therefore did not show responsibility for their personnel.

Competence

Occidental Petroleum demonstrated gross incompetence in providing safety to their personnel. Competence can be described as the ability to complete a task successfully and efficiently, which indicates the ability to provide effective safety for company personnel. This layer of care is reflected in the company value to "provide certainty on schedule, quality, cost, and safety through clear and realistic plans."

The first step in providing safety in a competent manner is to provide a comprehensive safety training program to ensure that all personnel can carry out operations safely and respond adequately in case of an emergency. However, this was not accomplished by Occidental, as outlined by Cullen (1990):

> 26 of the survivors (all contractors' personnel) were asked whether they had received a safety induction. Six of them said that they had never done so. One thought he had not; and one could not recall. The remaining 18 said that they had received an induction. But 4 said that it had lasted for 5-10 minutes. (...) Four others also said that they had not been shown their lifeboats. Of the 18 to whom I have referred 9 had visited Piper for the first time prior to 1988. Three had received no repeat of the induction since their initial one. (p.213)

Out of the 26 survivors, 8 did not receive any form of safety training. Although 2 seemed unsure, safety training should be an essential part of employee onboarding, and therefore it can be

concluded that these 2 survivors did not receive any form of safety training due to their failure to even recall if such a session had occurred. Not only that, but 4 survivors who had received safety training "said it had lasted for 5-10 minutes," which is clearly insufficient, especially for such a dangerous work environment. Additionally, 4 more survivors had not been shown their lifeboats, which is a crucial component of the evacuation protocol. This detail is especially important, because on the night of the disaster, personnel were unable to locate their lifeboats and were forced to wait in their accommodation, where the majority of personnel eventually lost their lives due to fatal smoke inhalation (Rosenthal, Boin, & Comfort, 2001). Finally, Occidental Petroleum assumed that personnel did not have to repeat safety induction training if they had been previously exposed to Piper Alpha in the past, and "three received no repeat of the induction since their initial one." With such alarming proportions of survivors reporting little to no safety induction training, it is hard to believe that the remaining survivors, or any of the other employees for that matter, received comprehensive safety training. This gross lack of safety training is especially alarming when considering that the personnel work in direct contact with and extremely dangerous pieces of equipment, in addition to several hazardous chemicals, such as oil and gas. Not only do these suggest direct harm to the personnel working in a dangerous setting, but failure of one operator to follow safety protocols in such an interconnected platform could result in consequences across the entire platform, which is precisely what caused the Piper Alpha disaster. Occidental's failure to provide a thorough and complete safety training for all onboarding employees demonstrate that they were severely incompetent in providing safety for their personnel and preparing them in the event of danger.

Responsiveness

Occidental Petroleum did not take action to respond to known hazards, and therefore should be deemed unresponsive. Responsiveness is a group or individual's ability to utilize information about possible hazards and propose feasible solutions. The McDermott International values demonstrate a desire to adhere to this level of care through commitment to "address problems head on."

Prior to the Piper Alpha disaster, Occidental was clearly aware of several safety problems, yet did not take any action to propose or follow through with a solution. On September 7th, 1987, a contract rigger, referred to as Mr. Sutherland was killed in an accident on Piper Alpha. Below, Cullen (1990) describes the incident:

> Occidental's mechanical technicians on the night-shift decided to depart from the method of lifting which had been proposed by the day-shift and decided that clamps should be attached to overhead beams for the purpose of assisting in the lift. (...) In order to attach a shackle and sling to the beams Mr Sutherland climbed on to a panel which formed part of a canopy over the pump. The panel shifted from its support on one side and Mr Sutherland fell off sustaining injuries from which he later died. (p.197)

In this case, the day-workers had developed a method of lifting due to a mechanical issue that prevented them from using the routine method of lifting. However, there is a clear discrepancy between what was communicated between the day and night-shift workers, as the first sentence of the above quote states that the night-shift workers decided to deviate from what the day-shift workers had been doing. Although there was a safety reason for why the day-shift workers were using a certain method of lifting, it seems that this was never communicated to the night-

workers. Had the night-workers known of why this change occurred, they likely would have followed suit. Cullen (1990) then outlines the response to this accident in the Public Inquiry:

> A number of witnesses from the production and maintenance sides on Piper said in evidence to the Inquiry that no changes were made to handover practice after the fatality or Occidental's plea of guilty. There was no awareness of any weakness in or criticism of communication at handover. (p.198)

Despite the loss of an employee, Occidental still did not enact any change in the communication at handover between the day and the night shift. Although Occidental may have not been aware of this communication problem beforehand, the death of an employee as a result of poor communication is obvious evidence that the shift handover protocol must be updated. However, there was still no action to mitigate this problem in the future, and as a result of Occidental being completely unresponsive to this incident, another communication failure at shift handover a year later resulted in the historic Piper Alpha disaster.

This failure of Occidental to respond to known hazards is simply indicative of several more risks that Occidental allowed on Piper Alpha. Just a few months prior to the disaster, 124 expired permits were found in the Safety Office, to which the safety staff acknowledged the need to update the system. However, no procedure was ever instated to bring about changes to this system (Cullen, 1990). Occidental was also aware that Piper had no structural fireproofing, while the other oil platforms did, which is unacceptable given that Piper had the greatest pipeline connections and product output. Furthermore, Occidental was aware that any significant explosions would cause structural integrity to disintegrate within 10-15 minutes without a powerful fire-fighting system, and yet, they allowed Piper Alpha to frequently and unnecessarily inactivate the automatic fire-fighting system (Cullen, 1990). When companies fail to be

responsive to known hazards, they are continuously putting all personnel in danger, which is clearly unethical given the opportunity for the company to mitigate such risks.

Conclusion

This case study of the Piper Alpha disaster not only serves as a landmark in establishing rules and regulations surrounding industrial technology, but it can and should additionally serve to represent how companies and individuals should act from an ethical standpoint. In this paper, I used the care ethics framework to demonstrate how Occidental Petroleum did not appropriately show a duty of care to its employees, which ultimately resulted in the death of 167 personnel, with lasting negative impacts on the 59 survivors. Although Occidental Petroleum was determined to be guilty for inadequate maintenance and safety procedures, no criminal charges were brought against the company, despite the clear hand it played in the disaster (Nasa Safety Center, 2013). By using care ethics, we were able to identify that Occidental Petroleum did not act morally and therefore should be held accountable for its actions. Examining case studies such as Piper Alpha and the ethics behind them ensures the future of engineering gets one step closer to designing with ethics in mind. Engineers should not wait for disaster to strike in order to follow the resulting rules and regulations, but rather, they must act in a way that is morally responsible such that these new disasters never arise.

References

Cullen, L.W.D. & Great Britain (1990). *The public inquiry into the Piper Alpha disaster*. London: H.M.S.O.

Cullen, L.W.D. (1993, July). The public inquiry into the Piper Alpha disaster. *Drilling Contractor (United States)*, *49*(4).

Cullen, L.W.D. (2018). Lord Cullen: Piper Alpha investigator. *The Chemical Engineer*, (925/26).

Drysdale, D. D., & Sylvester-Evans, R. D. (1998). The explosion and fire on the Piper Alpha platform, 6 July 1988. A case study. *The Royal Society*, *356*(1748). doi: https://doi.org/10.1098/rsta.1998.0304

Hull, A. M., Alexander, D. A., & Klein, S. (2002). Survivors of the Piper Alpha oil platform disaster: long-term follow-up study. *British Journal of Psychiatry*, *181*(5), 433–438. doi: 10.1192/bjp.181.5.433

Macleod, F., & Richardson, S. (2018). Piper Alpha: The disaster in detail. *The Chemical Engineer*, (925/26).

McDermott. (n.d.). Our vision is one. Retrieved March 1, 2020, from https://www.mcdermott.com/Who-We-Are/Our-Vision-is-One

Nasa Safety Center. (2013, May). The case for safety: The North Sea Piper Alpha disaster. Retrieved from https://sma.nasa.gov/docs/default-source/safety-messages/safetymessage-2013-05-06-piperalpha.pdf?sfvrsn=3daf1ef8_6

Pate-Cornell, M. E. (1993). Learning from the Piper Alpha accident: A postmortem analysis of technical and organizational factors. *Risk Analysis, 13*(2). doi: https://doi.org/10.1111/j.1539-6924.1993.tb01071.x

Poel, I. van de, & Royakkers Lambèr M. M. (2011). *Ethics, technology and engineering: an introduction*. Chichester, West Sussex: Wiley-Blackwell.

Rosenthal, U., Boin, A., & Comfort, L. K. (2001). *Managing crises: threats, dilemmas, opportunities*. Springfield, IL: Charles C Thomas.