The Shift in Thinking Ethically about Nuclear Accidents: A Comparative Ethical and Historical Case Study

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Abstract

Between 1952 and 2011, many nuclear accidents transformed the public's perception of nuclear power, yet there continues to be a disconnected relationship between the public's perception of nuclear accidents and the governmental perception of nuclear accidents. In the 1950s, nuclear accidents were quite unknown and people did not understand the negative consequences associated with such events. By 2011, nuclear accidents had become more known, and people understood the negative consequences and other implications that were associated with such events; this is also the time period where the disconnected relationship becomes more evident. The literature on nuclear accidents seems to focus largely on social, psychological and environmental scientific perspectives, but what is missing is the ethical perspective of this change in public perception. Study of the ethical perspective of this change in public perception can add to the current literature on nuclear accidents by showing that ethical thought is influenced and shaped through learning from the negative consequences of historical events. Drawing on the works of Roderick Nash and Gordon Graham, this thesis explores the ethical and historical perspectives of this change in public perception of nuclear accidents and how this change will contribute to future energy use policies. I argue that this change in the public perception of nuclear accidents stemmed from lessons learned from multiple nuclear accidents that occurred from 1952 to 2011. As the public perception of nuclear accidents changes, the disconnected relationship between the public perception and the governmental perception becomes more evident.

Introduction

Nuclear energy has been of use since its discovery in the early 20th century. It is widely used, yet it is also a controversial subject in the sense that it is both convenient but dangerous because when nuclear materials are released into the natural environment, dangerous consequences can ensue. Two examples of such problems are: the 1952 Chalk River Laboratories nuclear meltdown and the 2011 Fukushima Daichii nuclear accident. The 1952 Chalk River Laboratories nuclear meltdown in Chalk River, Ontario, was the result of the reactor overheating which caused an explosion. The explosion released significant nuclear materials into the natural environment. As a result, the Canadian Federal Government and the Atomic Energy Control Limited (AECL) decided to bury the nuclear waste in shallow trenches near the reactor. From 1952 to 2011, the nuclear waste continued to accumulate from this method of disposal and the ongoing production of nuclear energy. In 2011, however, the Chalk River residents and residents of the city of Ottawa became aware of the accumulated nuclear waste at Chalk River Laboratories, yet the Canadian Federal Government and the AECL continued to ignore the issue about the nuclear accidents that occurred at the reactor. In addition to the inaction of the Canadian Federal Government and the AECL, the Canadian media failed to report the issue of the accumulation of nuclear waste at Chalk River Laboratories until December 17, 2011 in a local newspaper. The newspaper reported that "past behaviours have led to general outrage among citizens, multiple lawsuits and clean-up plans that total billions of dollars." (McCleod, 2011) Although the general public's perception of nuclear accidents changed in the period from 1952 to 2011, the Canadian Federal Government and its subsidiary organizations continued their inactions in three ways: ignoring the public's

concern, allowing nuclear waste to be accumulated, and harming the physical health of both the Chalk River residents and the Ottawa residents.

The 2011 Fukushima Daiichi nuclear accident was a result of a tsunami colliding with the Fukushima Daiichi nuclear reactor in Okuma, Fukushima, Japan. As a result, the collision caused the Fukushima Daiichi nuclear reactor to explode and release large amounts of nuclear materials into the atmosphere and into the Pacific Ocean. The release of materials spread over Okuma and caused many deaths. When the international public heard the news of the 2011 Case of Fukushima Daiichi, their ethical perceptions of nuclear accidents shifted from being aware about the dangers of nuclear accidents to questioning nuclear energy use itself.

Methodology of the Thesis

In order to indicate the existence of this shift in the two previously mentioned case studies, I consider two key texts: Roderick Nash's book *The Rights of Nature: a History of Environmental Ethics* and Gordon Graham's book *Theories of Ethics: an Introduction to Moral Philosophy with a Selection of Classic Readings*. Nash's book fits in this thesis because it shows how learning from past consequences makes a difference in ethical thought. In conjunction with Nash's theory of environmental ethics, there is also a need to look at the intricate details and the ethical implications that take place regarding the two nuclear accidents. To do this, I used Gordon Graham's book on normative ethics. Graham's book helps simplify the complicated ethical issues that pertain to governmental responses, media coverage and the involvement of government affiliated organizations (in the Chalk River nuclear accident). Graham's book achieves

this task by singling out certain actions / inaction that are important in an ethical analysis – for example, the duty of the governments in both nuclear incidents; the consequences that resulted from inaction from media, private organizations and government; and the character traits that need to be adopted in order to prevent future negative consequences. Both texts will be combined and used as an analytical framework in a comparative ethical and historical case study. The study will discuss four ethical theories: three normative ethical theories (specifically, consequentialism, deontology and virtue ethics) and Roderick Nash's theory of environmental ethics. Normative ethical theories are used to show different perspectives on the ethical implications in both case studies. Roderick Nash's theory of environmental ethics will be used to explain how ethical thought has changed over time by encompassing each normative ethical theory. Together, the ethical theories have been shown to have an interrelationship which will provide the underlying reasons for the difference in the public perceptions of nuclear accidents from 1952 to 2011. At the same time, this ethical interrelationship will indicate that there has been little to no shift in the government's perception of nuclear accidents.

The 1952 Chalk River Laboratories nuclear accident and the 2011 Fukushima Daiichi nuclear accident have shown that there was a shift in the general public's ethical perception of nuclear accidents from being totally unaware of the dangers of nuclear accidents to questioning the use of nuclear energy itself. This shift in the ethical perception is influenced by a combination of two factors: scientific knowledge acquired over time, and the increase in media coverage.

Unlike the general public's perception of nuclear accidents, the government's inaction when dealing with nuclear accidents shows to have changed very little. Thus,

one can see that there is a disconnect between the (concerned) general public and government (and its lack of involvement). Discussing both issues is commonly regarded as a social or scientific matter. However what is missing in both the sociological and psychological perspective when looking at environmental issues is the ethical perspective.

Ethics can play a role in the control of nuclear materials because it helps show how human attitudes change over time from being ignorant to being increasingly concerned. The relationship between ethics and human attitudes and treatment of the natural environment is necessary when it comes to analyzing and comparing cases such as the 1952 Case of Chalk River Laboratories and the 2011 Case of Fukushima Daiichi. This relationship will be used as an analytical tool to explain the shift in the general public's ethical perception of nuclear accidents from 1952 to 2011. In order to illustrate the shift in the general public's attitudes – for example, about the natural environment as an entity that should to be taken into account in ethical thought – the application of an ethical theory that encompasses environmental ethics and historical background is necessary. One particular theory that fits this criterion is Roderick Nash's historical perspective of environmental ethics. Nash's approach meets this criterion by indicating that ethical thought shows an evolution of natural rights from a limited human group to the natural environment. According to Nash, this evolution occurred through a recognition that oppressed minority groups and the natural environment needed to be accounted for in ethical analyses. Natural rights are defined as "rights [that are] not contingent upon the laws, customs, or beliefs of any particular culture or government and therefore universal and inalienable." (Rothbard, 1982) In other words, human beings are

created with certain rights that are guaranteed, regardless of political regime, culture or beliefs. In order to gain a better understanding of Nash's account, the first chapter of this thesis will further examine Nash's historical theory of environmental ethics. Accordingly, there are three purposes to this thesis. First, this thesis will demonstrate that there has been a shift in the general public's opinion of nuclear accidents and that this shift went from being aware of the dangers of nuclear accidents to questioning the use of nuclear energy itself. Second, it explores the disconnection between the government's inactions and the general public's opinion of nuclear accidents. Third, it discusses whether this shift in thinking will lead to an incentive to invest in alternative renewable energy sources.

Researching the shift in the popular view of nuclear accidents has two main challenges. The first challenge concerns the ambiguity in key terms – something that will be discussed throughout the thesis. The ambiguity in such terms is due to different interpretations in philosophy and in the social sciences. When ambiguity in key terms occur in a thesis, it is difficult for the reader to understand the main argument. One example of a key term that is ambiguous yet crucial to the argumentation of this thesis is the term 'public.' The term public usually refers to a group of individuals who are involved or affected by a particular event. However the term public varies depending on the discipline at hand. In this thesis, the term public will be clearly defined and discussed in the first chapter.

The second challenge concerns the question of moral responsibility and moral culpability – a question that was explored in an article titled "Moral Responsibility for Environmental Problems - Individuals or Institutional?" This article's central question is

on the "extent [where it is reasonable] to hold individuals and institutions responsible for environmental problems." (Fahlquist, 2008) Using the article's central question as a research question will highlight and explain how public concern changed regarding nuclear waste management. This thesis does this by showing that ethical thought in the 1950s extended only to human beings but, by 2011, extended to the natural environment; this shift in ethical thought is useful in order to debate the future use of nuclear energy. .

In order to achieve the three purposes, this thesis is divided into five chapters. The first chapter will establish definitions of environmental ethics (Roderick Nash's view), normative ethical theories, libertarian philosophy, environmental harm, and public indifference. Each definition will also include an explanation of its relevance to the 'ethical shift' – that is, to the shift in thinking about ethics – concerning the release of nuclear materials into the natural environment. At the same time, it will explore how this ethical shift moved away from mere awareness and towards questions of nuclear energy use. The second chapter will discuss the importance of addressing and discussing the relationship between the release of nuclear materials into the natural environment and the ethics of public indifference. The third chapter will introduce the 1952 Case of the Chalk River Laboratories, and demonstrate its significance in the ethical shift in concern about the release of nuclear materials into the natural environment. The fourth chapter will introduce the 2011 Fukushima Daiichi case, where there is a clear indication that public concern about the release of nuclear materials has greatly increased. The fifth chapter will proceed to compare both cases. Comparing these two cases will indicate the existence of an ethical shift in this area of public concern, and that this shift reflects a difference in the way people now think about the release of nuclear materials into the

natural environment. Finally, this thesis will conclude with a brief discussion about putting this ethical shift into practice in the area of long-term nuclear energy use risk management.

Chapter 1: Definitions and Key Terms

1.1 What is environmental ethics?

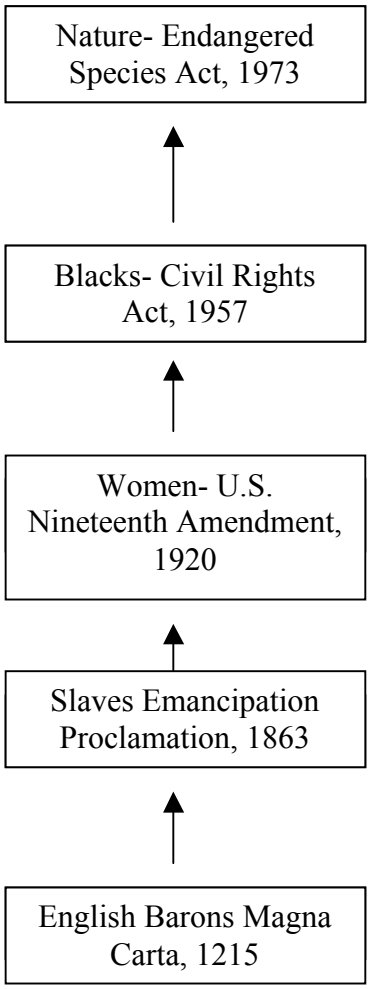
The aim of this chapter is to define the key terms that will be discussed throughout this thesis. First, it will provide a brief definition of environmental ethics and explain its significance. Then, it will highlight the importance of the discussion of environmental harm and define related terms. Third, it will explore the underlying reasons for the 'ethical shift' in public concern – that is, the shift in thinking ethically – toward the natural environment, which will be the main focus of this thesis. Finally, it will conclude with an introduction to the case studies that will be discussed in later chapters. The concept of environmental ethics that will be used in this thesis is based on Roderick Nash's book *The Rights of Nature: A History of Environmental Ethics*.

1.2 Roderick Nash's Perspective

Roderick Nash's book *The Rights of Nature: A History of Environmental Ethics* argues that environmental ethics "[concern] the history and implications of the idea that morality ought to include the relationship of humans to nature." (Nash, 1989, p. 3) The moral relationship between nature and human beings stems from an open-mindedness learned from historical events – in particular, historical actions that had negative consequences. Nash classifies this moral relationship as an "evolution of ethics from the natural rights of a limited group of humans to the rights of parts of all of nature." (Nash, 1989, p. 5) Before looking further into Nash's 'evolution of natural rights', one must also know that there are many interpretations of natural rights. For the purpose of this thesis, however, a natural right will be defined as "rights [that are] not contingent upon the laws,

customs or beliefs of any particular culture or government and therefore universal and inalienable." (Nash, 1989, p. 5) In order to show that environmental ethics is a rights-based theory, he takes a chronological approach to natural rights and its ethical relevancy. A rights-based theory is defined as "a set of statements or principles devised to explain a group of facts or phenomena." (Kymlicka, 2002, p. 3) In order to illustrate his point Nash creates a historical continuum showing how natural rights have evolved over time. Below is an illustration of this historical continuum.

Figure 1: Natural Rights Historical Continuum



As indicated in Figure 1, the historical continuum shows that before the 1800s in the United States, the wealthy class was considered the group that was usually accounted for in normative ethical considerations. Although this had been the case for many years, people continuously pushed natural rights and its ethical relevancy outward to include oppressed minority groups and eventually the natural environment. This push resulted in a series of legal acts, wars, protests, which stemmed from the recognition that the natural environment should be accounted for in normative ethical analyses. The push for the natural environment as having a natural right and being ethically relevant emerged into what we today call environmental ethics.

The emergence of environmental ethics is "explained in part by the rise of the science of ecology and its diffusion into a widespread popular enthusiasm." (Nash, 1989, p. 10) The rise of environmental ethics stems from the idea that "it is right to protect and wrong to abuse nature." (Nash, 1989, p. 11) This understanding emerged as human beings learned from past mistakes. As human beings learn from the past, they come to the realization that the natural environment is needed for survival, and therefore should be accounted for in ethical analyses.

The relevance of Nash's historical perspective of environmental ethics in this thesis serves as an explanation of, and identifies, the causes and effects of the shift in public perception concerning nuclear accidents. Furthermore, this historical perspective helps to determine whether this shift in perception is for the better or for the worse of the natural environment. This thesis answers these questions by exploring the historical background of two nuclear accidents, and looking at the involved parties' reactions to it.

Although the cases have a 59 year difference, the different reaction to the two cases has shown that there has been a shift in the popular view of nuclear accidents.

The lack of concern about the release of nuclear materials into the natural environment in the 1952 Case of Chalk River Laboratories was an example of human beings not giving the natural environment an ethical right, which is needed in order to be ethically relevant and therefore accounted for in normative ethical analysis. Unlike the 1952 Case of Chalk River Laboratories, the increase in public concern in the 2011 Case of Fukushima Daiichi was an example of human beings recognizing the natural environment as an ethically relevant entity that must be considered in ethical analysis.

Nash's theory of environmental ethics is related to normative ethical theories (consequentialism, deontology and virtue ethics) by encompassing and explaining how public concern changed in how people thought about the release of nuclear materials into the natural environment. Before examining how Nash's theory incorporates normative ethical theories, one must define the normative ethical theories being used in this thesis.

1.3 Application of Normative Ethical Theories

The three normative ethical theories that will be used throughout this thesis are: consequentialism, deontology, and virtue ethics. Consequentialism is a branch of ethics that focuses on the results of a given action. If an action produces positive results, then it is considered morally permissible. (Graham, 2011, p. 52) On the other hand, if an action produces negative results, then the action is considered morally impermissible. In the example of the release of nuclear materials into the natural environment, ignoring the release of nuclear materials will ultimately lead to perpetuating dangerous and deadly

consequences, which is morally impermissible. Consequentialism is the normative ethical theory that plays the main role in the ethical shift in thinking about the release of nuclear materials, and how this shift made a difference in the way people thought about the future use of nuclear energy. This is done by learning from past consequences of similar events dealing with the release of nuclear materials into the environment.

Unlike consequentialism, deontological ethics (or duty ethics) maintains that "whether an action is right or wrong is for the most part independent of whether its consequences are good or bad." (Graham, 2011, p. 77) Deontological ethics focuses on the duties of a moral agent. If the agent is committing an action for duty's sake, then the action is deemed morally permissible. On the other hand, if the agent commits an action not for duty's sake but for self-gratification, then the action is morally impermissible. In the example of governments dealing with nuclear accidents, finding solutions to mitigate the negative effects from the moment the nuclear accident occurred is morally permissible. This action is morally permissible because it demonstrates that governments are fulfilling their duties, and that duty is to serve their citizens.

In order to fulfill duties and to achieve positive consequences, there are also desirable character traits to be considered. The ethical theory that fits this criterion is virtue ethics. Virtue ethics is a normative ethical theory that assesses the moral permissibility of an action by the exhibition of a desired character trait of the moral agent. When character is the criterion that determines ethical behaviour, the context of the situation also needs to be taken into account as well. Characteristics play a role in the duties and actions of a moral agent by highlighting behavioural patterns which are desirable in a particular situation.

1.4 Nash's Historical Theory of Environmental Ethics and Normative Ethical Theories

Nash's theory of environmental ethics incorporates consequentialism, deontology and virtue ethics. Nash's theory of environmental ethics "concerns the history and implications of the idea that morality ought to include the relationship of humans to nature." (Nash, 1989, p. 3) What this statement also implies is that normative ethical theories also play an influential role in the relationship between historical attitudes and ethics. Consequentialism, for example, plays a role in Nash's theory of environmental ethics because people learn from past negative consequences, which causes them to realize their immoral behaviour. This realization motivates people to extend natural rights to accommodate oppressed minorities and, eventually, the natural environment. When this occurs, human beings will likely avoid dealing with nuclear materials that can result in negative consequences. Deontology plays a role in Nash's theory because, as human beings learn from past consequences, they are able to identify and define their future duties to the natural environment to avoid repeating mistakes. Virtue ethics plays a role in Nash's theory because it identifies what characteristic is needed to fulfill a duty and to make sure one has the ability to produce positive consequences. It is clear that these theories are interrelated. The interrelationship between Nash's historical theory of environmental ethics and normative ethical theories helps to illustrate and explain the changes in ethical attitudes toward the natural environment. In order to demonstrate this, this thesis will discuss this interrelationship in the fifth chapter.

1.5 What is Environmental Harm?

For the purpose of this thesis, environmental harm will specifically be that harm resulting from nuclear accidents. The shift in thinking ethically about nuclear accidents stems from the fact that the natural environment is a necessary entity for human survival. The 1952 Case of Chalk River Laboratories is an example that demonstrates environmental harm when the Canadian Federal Government and the Atomic Energy Control Limited (AECL) buried nuclear wastes into shallow trenches which "seeped into groundwater and the river upstream into the nation's capital." (Buckthought, 1989, p. 19) Despite clear evidence that nuclear materials were released into the environment (such as the increasing illness rate in Ottawa and Chalk River), the Canadian Federal Government and the AECL continue to deny their actions.

In the 2011 Case of Fukushima Daiichi, the reaction by the Japanese government and the international community were completely the opposite of Chalk River Laboratories. This can be attributed to the death toll, and fear about the vast amount of nuclear materials being leaked into the Pacific Ocean and nearby lakes.

Both cases have shown that humans do not notice environmental harm until they have learned from past accidents. The 1952 Case of Chalk River Laboratories is an example where the ignorance of the Canadian Federal Government and the AECL stemmed from a lack of knowledge about safely disposing of nuclear waste, which led them to bury the waste in shallow trenches. Since 1952, there have been many nuclear accidents around the world, and this has shaped the international community's concern about the environmentally harmful effects of the release of nuclear waste. The most recent nuclear accident was the 2011 Case of Fukushima Daiichi; here, the thinking of

the international community changed from a mere awareness of harm to questioning nuclear energy use itself. This change in thinking shows that environmental harm is sometimes not fully realized, until human beings learn from the past. This phenomenon will be discussed in further detail in the fourth chapter.

1.6 Libertarian Philosophy

Libertarian philosophy emphasises the value of individual, their freedoms, and rights. The derivative principle of libertarian philosophy refers to considerations such as human limitations, incentive effects, administrative costs, and the intrinsic value of liberty for the good life. Although the derivative principle is a key area of libertarian philosophy, the moral aspect of the individual agent is the main focus in this thesis. Libertarian moral philosophy, on an individual level, is defined as the "moral view that agents initially fully own themselves and have certain moral powers to acquire property rights in external things." (Vallentyne, 2004, p. 33) Although there are various interpretations of libertarian moral philosophy, this thesis specifically looks at Jan Narveson's theory of blameworthy vs. non-blameworthy action. Narveson's theory will be discussed after I define the term 'public,' as libertarianism relies on notions of individual ethical choice.

1.7 What is Public Indifference?

Public indifference is commonly defined as "human beings choosing to ignore a situation known to exist." (Oxford English Dictionary, 2007) Academics define indifference as lack of interest. According to Charles E. Scott, author of *Living with*

Indifference, indifference means lack of interest or the absence of care or intention. (Scott, 2007, p. 3) When it comes to the discussion about the causes and effects of public indifference and moral permissibility, one has to establish a clear yet less straight-forward definition of public indifference. Simply defining public indifference as negligence or lack of interest is too vague because it does not take into account the moral permissibility or the consequences of the action. In order to fully understand the meaning of public indifference, it is appropriate to define the words 'public' and 'indifference' separately.

1.71 Definition of Public

The public refers to a general population of a given community. The word public originates from the Latin word 'populus' or 'publicus' meaning people in association with a common interest. The definition is dependent on the situation at hand. Two philosophers who discuss the meaning of the term 'public' are John Dewey and James E. Grunig. Dewey defines public as "a group of people who, when facing a similar problem, recognize it and organize themselves to address it." (Dewey, 1927, p. 27) Grunig elaborates on Dewey's definition by making four distinctions: "non-publics, latent publics, aware publics, and active publics." (Grunig, 1983, p. 25) Non-publics are people who do not encounter a problem nor are affected by a problem. Latent publics are people who encounter a potential problem but there is no direct impact yet. Aware publics are people who recognize that they have a problem but do not necessarily take action. Finally, active publics are people who are both aware and take action to mitigate or to solve the problem. After defining each of the four types of publics, one can draw

the conclusion that the word public involves not only the general population but also the social aspect of the general population. Both definitions of the meaning of the word public are important because the notion of public plays a key role in understanding the morality of the release of nuclear materials into the natural environment. However, Grunig's definition of the different types of public is pertinent to the question of moral responsibility as he makes convincing distinctions between people who are active and people who are not active when dealing with a problem.

When applying Grunig's definition of public to both the 1952 Case of the Chalk River Laboratories and the 2011 Case of Fukushima Daiichi, it is necessary to understand who the involved parties are in each case. In the case of the Chalk River Laboratories, the aware public refers to the Canadian federal government (specifically, today, Natural Resources Canada – although that department did not exist in 1952), the Canadian news media, and the AECL, because they all knew that there was a problem of nuclear accidents at Chalk River Laboratories, yet they did not take proper actions to mitigate or solve the problem. The latent public is the Ottawa residents and the Chalk River residents because they encountered a problem only when the Canadian federal government, the AECL and the Canadian news media did not properly deal with the nuclear accidents.

In the 2011 Case of Fukushima Daiichi, the latent public refers to the global population because, in many countries, nuclear energy is the main energy source. Since the Fukushima Daiichi accident had extremely dangerous consequences, the global population feared that a similar event could occur in their own countries. The active public is the Japanese government and the global media because they had done their jobs.

Despite the Japanese government's inadequate actions to solve the dangerous effects of the nuclear accident, it is still considered an active public because it at least took measures to mitigate the effects by: evacuating many people from the affected areas, built new homes for the newly homeless, and tried to find a new way to properly clean up the accident. The global media is also considered as an active public because they had done their job properly by informing the global population about the nuclear accident.

1.72 Narveson's Definition of Indifference

Though public indifference does exist, there must be a reason to explain to how this phenomenon occurs. Some libertarian philosophers such as Jan Narveson say that "there is a difference between the cases where we do nothing because we do not realize that there is anything we could be doing and those where we face the question of whether to do it or deliberately decline." (Narveson, 2001, p. 52) Here, Narveson takes a libertarian perspective indicating that either a human being is unsure of what action to take, or human beings simply do not care. (Narveson, 2001, p. 52) Libertarian philosophy sees individuals as the main decision-makers of moral conduct. When individuals are the main moral decision makers, individual ethical choice must be taken into account. There are two types of ethical choices individuals make: blameworthy choices and not blameworthy choices. Blameworthy choice is when an individual chooses to set a priority of tasks based only on what is more important to oneself.

Narveson's argument is convincing in the sense that it appeals to ethical choice and makes a distinction between blameworthy choice and not blameworthy choice. When it comes to analyzing Narveson's argument about moral culpability, one must also

question the extent to which it is reasonable to hold individuals and institutions responsible for environmental problems. The reasonable extent of moral culpability is dependent on the situation and time period at hand. For example, the 1952 Case of the Chalk River Laboratories consisted of an ineffective clean up method from a nuclear accident. The clean-up method consisted of burying nuclear waste into shallow trenches not far from the reactor. In 2011, there are an increasing number of people contracting serious illnesses. From Narveson's standpoint, who is blameworthy in this case is suspect. One can argue that the actions by people involved in the 1952 clean up are blameworthy because they caused the devastating consequences of today. At the same time, one could also argue that the actions by people working at Chalk River Laboratories in 2011 are blameworthy because they have the ability to fix the ongoing consequences of past events.

1.73 Definition of Public Indifference

After the examination of both the definitions of the word public and the word indifference, one can see that the definition of public indifference is complicated. This definition is complicated because there are two obstacles to overcome: a risk of generalizing about a population of a given state, and 'finger-pointing' indifferent people as behaving in an unethical manner. Since these obstacles exist, one must understand the difference between the case of the Chalk River Laboratories and the case of Fukushima Daiichi. The case of the Chalk River Laboratories was an example where public indifference allowed the accumulation of nuclear waste and the illness rate to increase. On the other hand, the case of Fukushima Daiichi was an example where the power of

less public indifference and the acknowledgement of the release of nuclear materials into the natural environment indicated a global re-thinking of environmental policy. In the context of this thesis, public indifference is defined as a deliberately ignoring action that is developed over time by human beings that ultimately results in ongoing, culpable, and dangerous consequences.

Chapter 2: Release of Radioactive Contaminants and Ethics

This chapter has two goals. The first goal is to explore the disconnection between the public perception and the organizational perception of nuclear accidents. The second goal is the discussion of the ethical implications of this disconnection.

2.1 Relationship between Nuclear Policies and Ethics

Rachel Carson, author of *Silent Spring*, describes the relationship between nuclear energy use policies and ethical thought by noting that "actions performed by individuals, as consumers and citizens have aggregate negative consequences on the natural environment." (Carson, 1962, p. 5) Carson's description states that this relationship stems from various actions done by the general public and by political nuclear energy use policies. These actions can either directly or gradually contribute to a series of negative consequences over time. This means that historical issues play a role in the relationship between nuclear energy use policies and ethics. The primary historical issue is the change in the public perception of nuclear accidents as distinct from the organizational perception of nuclear accidents. This relationship needs to be explored.

2.12 Change in the Public Perception of Nuclear Accidents

The public perception of nuclear accidents in the 1950s differed greatly from the public perception of such accidents in 2011. This difference in thinking changed through a combination of factors: environmental scientific knowledge acquired over time, increased media coverage, and environmental legislation.

In the 1950s, the public perception of nuclear energy use was positive, because it had been recently discovered and was promoted as a "cheap, less polluting source of virtually limitless energy." (Martin, 2002, p. 43) Governments, nuclear scientists and engineers supported nuclear power, which led to the construction of nuclear plants and programmes in countries around the world. Because of its recent discovery and its extensive promotion at the time, people did not know how to properly deal with nuclear materials in terms of disposal, use, and so on.

By the late 1960s, however, opponents of nuclear energy began to voice their views against nuclear energy. Opponents raised a number of objections – that "nuclear energy is expensive because of the clean up from accidents and that the release of radioactive waste will remain dangerous for hundreds of thousands of years." (Martin, 2002, p.43) People saw the dangerous effects of nuclear accidents and this probably triggered the shift in thinking ethically about nuclear accidents by the general population and the somewhat increased governmental responses to such accidents.

2.13 Organizational Perception

The organizational perception of nuclear accidents is shown by the inaction of governments when dealing with nuclear accidents. Despite the change in the public perception of nuclear accidents, there is still a problem of the inaction of governments and their subsidiary organizations when dealing with nuclear accidents.

When there is a change in public perception of nuclear accidents and no change in the organization perception, one can see that there is a disconnection between the two. This disconnection is compelling, as it highlights the social and political tensions

between the general population and the government. These tensions are evident when the general public's interest is directly opposed to the government's interest. In other words, these tensions occur when the general population is interested in finding ways to prevent a nuclear accident by finding new alternative energy sources or lobbying the government to listen to their concerns. On the other hand, the government is more interested in profiting from the products that are manufactured at the nuclear reactors than dealing with the nuclear accidents and the well-being of the general population. Here, we see that the social and political tensions are caused by the different interests of both parties. When this occurs there are also ethical implications to be considered.

2.2 How Media Secrecy and Lack of Action by Politicians are Unethical

When it comes to the question of moral culpability in dealing with nuclear accidents, one must first establish the extent to which it is reasonable to hold individuals and institutions (governments, media and corporations) responsible for their actions. Some authors such as Jessica Fahlquist argue that "individuals are not appropriate targets to blame when acting in environmentally destructive ways unless they have reasonable alternatives. On the other hand, institutions are responsible because they have it in their power to make it easier and less expensive for individuals to choose environmentally friendly options and they can provide information that is easily accessible and as straight-forward as possible." (Fahlquist, 2008, p. 52) Here, Fahlquist argues that responsibility lies with those who have the power to change their actions. A reasonable alternative for individuals is defined as another option for an individual to commit an action that is more environmentally friendly. Governments have the power to make it easier and less

expensive for individual citizens to do what is environmentally friendly, but if they do not exercise their ability to do so, they are held morally culpable.

Although Fahlquist makes an interesting argument, she does neglect to take into account the historical implications of moral culpability. For something to be moral culpable, it must have ethical status or relevance. In order for something to be ethically relevant, it must have natural rights. If the entity being badly treated at the time is not considered morally relevant, then the actions by the perpetrators are not considered to be morally culpable at the time. However, if the entity being badly treated is considered morally relevant, then the action is considered to be morally culpable. When this argument is applied to the case of environmental harm, one must again consider the historical implications. In the 1950s, the natural environment was not considered to be an entity that was morally relevant, so when governments caused harm to the natural environment, they are not to be held morally accountable.

2.3 Moral Culpability

Since the disconnection raises social and political tensions, there are normative ethical implications that should be considered. The normative ethical implications are relevant to the discussion of the disconnection, because they help simplify the complex social and ethical problems that occur as a result of nuclear accidents. The implications that should be considered are: the consequences that result from the government's lack of involvement when dealing with nuclear accidents, the government's duties, and the character traits that are to be adopted when carrying out such actions. The consequences that result from a nuclear accident are key factors that should be taken into account in

ethical discussion, because they show how government inaction has a detrimental impact on the general population. The question of the ethical duties of governments is also a factor in this discussion because it helps show how their inaction in dealing with nuclear accidents uses the general population as a means to an end. This means that the government can use the general population as a way to profit from the products of nuclear reactors. The virtue ethical discussion of government is also needed because it identifies the characteristics involved in acting that will contribute to the well-being of the general population. In the next two chapters, I present two case studies that clearly show the shift in thinking ethically about nuclear accidents between 1952 and 2011.

Chapter 3: The 1952 Case of Chalk River Laboratories and its Aftermath

The 1952 Case of the Chalk River Laboratories is an example where continuous inaction by the Canadian Federal Government, the Canadian news media and the Atomic Energy Control Limited about the release of nuclear materials into the natural environment led to continuous dangerous and deadly consequences. Before proceeding to the ethical discussion about the Chalk River case, there are three factors that need to be taken into account: the historical background, the significance of the case, and the ethical discussion. The historical background provides information about the Chalk River Laboratories from 1952 to today. The significance section will cover the sociological and ethical issues that occurred in the case. The ethical discussion will consist of normative ethical theories which are involved in a critical ethical analysis of the issues discussed in the significance section. Finally, this chapter will conclude with a discussion of the ethics of continuing public inaction.

3.1 Historical Background

The Chalk River Laboratories was a nuclear reactor that opened in 1944 for "neutron research and to produce plutonium for U.S. nuclear weapons." (McCleod, 2011) It is located in Chalk River, Ontario, in Renfrew County, and regulated by the Atomic Energy Control Limited (AECL). The AECL is an organization that was created by the Canadian Federal Government in 1952 to ensure that "Canadians and the world receive energy, health, environmental and economic benefits from nuclear science and

technology – with confidence that nuclear safety and security is assured." ("About AECL- Introduction", 2012)

On December 12, 1952, the Chalk River Laboratories became the location of one of the world's first major nuclear accidents. It was caused by a partial nuclear meltdown of the Nuclear Research Experimental Reactor (NRX). The partial nuclear meltdown started when the NRX reactor "underwent a violent power excursion that destroyed the core of the reactor [which caused] some fuel [to] melt." (McCleod, 2011) When this occurred, "a series of hydrogen gas explosions hurled the four-ton gasholder dome four feet through the air where it jammed in[to] the super structure. Thousands of curies of fission products were released into the atmosphere, and a million gallons of radioactively-contaminated water had to be pumped out of the basement and disposed of in shallow trenches near the Ottawa River." (McCleod, 2011) Following the accident, the Atomic Energy Control Limited (AECL) and Canadian Federal Government were called to assist with the cleanup efforts. The clean up method consisted of the reactor core and liquid waste being buried in shallow trenches. After the clean up, the nuclear reactor was then closed for two years.

The nuclear reactor opened again in 1954. Four years later, Chalk River Laboratories had another nuclear accident that was identical to the 1952 accident, and was cleaned up using the same method. Despite having two nuclear accidents, "the management methods adopted there have often set a pattern for waste management in Canada." (Charlesworth & Carter, 20) In 2011, the Chalk River Laboratories nuclear reactor produced half of the world's medical isotopes. Though Laboratories' production of medical isotopes is needed for treating serious illnesses, the disposal management

methods are identical to the one used in 1952. This causes serious problems because nuclear waste is accumulated over time. The accumulation increases the likelihood of the waste to be released into the Ottawa River due to its close proximity to it. Mike Buckthought states that "several radioactive plumes are making their way from Chalk River Laboratories to the Ottawa River. Radioactive contaminants trickle down into the groundwater and the river upstream to the nation's capital… The deliberate release of radioactive contaminants into the river must stop because it threatens our health and the environment." (Buckthought, 2009, p. 25) The amount of leaking radioactive waste was confirmed in a 2005 report titled *Ecological Effects Review of Chalk River Laboratories*. According to this report, "contaminated ground water plumes occur at several locations on the CRL property. These include plumes arising from the Waste Management Areas (WMA) and the plant site along the Ottawa River shoreline." (Hart &McKee, 2005, p. 15) Although there have been radioactive contaminants found on the CRL property, "the levels of [radioactivity intake] in the Canadian environment, even close to nuclear facilities, and the resulting intakes of radioactivity by the public are too low to have any observable health consequences." (Osbourne, 2002) However, the claim that the amount of radiation is not dangerous is contested by a medical report which states that "even levels of exposure below 1 milisievert a year is harmful. Thousands of people will face early death as a result. Worst of all, the small doses of radiation that millions habitually receive will poison the human gene pool, [thereby] wreaking damage on future generations." (Cardis, 2005) Cardis' article is relevant to the 1952 Case of Chalk River Laboratories as the articles helps refute Osbourne's claim that small intakes of radioactivity by the public do not have observable health consequences.

We see that the above-mentioned reports contradict one another. These contradictions stem from the different funding organizations who published these articles. The first article by Donald Hart and Paul McKee was funded by Ecometrix Inc, an independent environmental consulting firm. The second article by Richard Osbourne was funded by the Canadian federal government. The last article was funded by an Ontario medical organization. The disagreements among the three articles are compelling because they illustrate the tensions between the independent environmental consulting firm, the Canadian federal government, and an Ontario medical organization. Based on the arguments previously outlined, there is a clear indication that the Canadian federal government continues to deny the harmful accumulated nuclear waste flowing into the Ottawa River, by simply stating that there are no obvious health consequences, whereas the provincial medical organization and the independent environmental consulting firm attempt to reveal the hidden information the federal government continuously ignores. This hidden information is the increasing illness rate in Ottawa and Chalk River, and the accumulated nuclear waste in the Ottawa River. As these tensions occur, there is a need for a normative ethical analysis. Before proceeding to the normative ethical analysis, there are four sociological problems that must be addressed.

3.2 Social Problems in the 1952 Case of the Chalk River Laboratories

Although the 1952 Chalk River nuclear accident occurred more than 50 years ago, it was one of the world's first nuclear accidents. Due to lack of experience, people were unsure of a proper disposal method and of its health impact on human beings. As we have seen, the federal government and the Atomic Energy Control Limited (AECL)

decided to bury the nuclear materials in shallow trenches near the reactor. In 2011, the 1950s cleanup method is still used, and so it is appropriate to examine the ethical implications and the social problems associated with this method.

Before proceeding to the ethical discussion, there are four social and ethical issues relevant to this case. The areas that will be taken into ethical consideration are the following:

i) Ignorance of the Accumulation of Nuclear Waste

ii) Increasing Illness Rate

iii) Lack of Media Attention

iv) Public Perception

The sections that follow will proceed with an examination in all four areas. Exploring the four sociological problem areas will not only provide background information but also show the ethical implications of each social problem. When ethically analyzing the four areas, normative ethical theories are appropriate to employ because they are more feasible to apply to practical examples. This will show the reader different ethical perspectives that will be useful when identifying and explaining the change in human attitudes toward the use of nuclear energy from 1952 to 2011, which will be discussed in a later chapter.

3.21 Ignorance of the Accumulation of Nuclear Waste

The accumulation of waste was "the result of Cold War activities in the [United States during the] 1940s, 50s and 60s, when the risks of atomic waste were not known. The rest is from research and development for nuclear reactor technology, medical

isotope production and national science programs." (McCleod, 2011) As shown in the media, nuclear waste has accumulated over time. As this occurred, people have become exposed to the effects of nuclear radiation, which in turn results in serious consequences that affect both human health and the natural environment. The accumulation of nuclear waste is explained through a historical lens. Nuclear energy was discovered not long before 1952, so people did not fully understand its effects on human beings or how to safely dispose of nuclear waste. For these reasons, people believed that the best way to dispose of nuclear waste was to bury it in the ground. This method is still ongoing because "in the last fifty years no one has been able to devise a truly safe way to dispose nuclear waste." ("Renewable Energy Options for Canada", 1997) So, "nuclear waste remains deadly for thousands or millions of years and the nuclear industry cannot guarantee a disposal site to last as long as nuclear waste." ("Renewable Energy Options for Canada", 1997)

Another reason for the accumulation of nuclear waste is flawed disposal management by the Atomic Energy Control Limited (AECL). The AECL's responsibility is to develop peaceful and safe uses of nuclear energy. The disposal method used by the AECL is problematic because "radioactive liquid waste from the Chalk River is seeping slowly into the Ottawa River." (Spears, 1996) Despite this problematic method, the AECL continues to say that: "the amount of contamination is 'mild' and poses no threat to the health of workers or the public." (Spears, 1996) At the same time, Natural Resources Canada is "planning an underground dump at Chalk River, 350 metres from the Ottawa River, for thousands of trainloads of low-level radioactive waste from other parts of Ontario." (Mcleod, 2011) Here, the AECL and Natural

Resources Canada (a Canadian federal government department whose mandate is to promote sustainable development and responsible use of Canada's mineral, energy and forestry resources) ignore the issue that perpetuating this flawed method will result in the buried liquid waste leaking into the Ottawa River, thereby likely causing an increasing illness rate in both the Chalk River area and the Ottawa area.

3.22 Increasing Illness Rate

As pointed out in the previous section, the ignorance of the accumulation of nuclear waste is problematic because it causes an increase in illness rate. Studies in 1989 and 1991 found a prevalence of leukemia in children living near nuclear facilities and cities near the nuclear facilities. (Vakil & Harvey, 2009, p.150) Among the 8000 people living in both Chalk River and the Ottawa area, "a total of 4260 men [and women], 47% of the [subjects], were exposed to low doses of external ionizing radiation at low dose rates, with a mean cumulative equivalent dose of 52.1 mSv. For cancers as a whole the excess relative risk, based on 227 deaths, was 0.36% per 10 mSv (90% confidence bounds -0.46, 2.45), [which means that even at low doses, serious illnesses can ensue]". (Gribbin, Weekes & Howe, 1993, p. 32) Based on the medical reports, one can see that there is an increasing number of human beings contracting serious diseases, and this number to be expected to steadily increase.

3.23 Lack of Media Coverage

When discussing the lack of news media coverage of the 1952 Chalk River nuclear accident, one must also take into account the difference in the amount of news

coverage between 1952 and 2011. Nuclear energy was used since its discovery and development during the Second World War. Much of the media saw the use of nuclear power was positive, and there were hardly any negative remarks about nuclear energy. (Hurst, 1997, p. 33) This was the case until multiple nuclear accidents occurred around the world. Despite the continued nuclear accidents at Chalk River Laboratories, there is still a lack of media coverage in 2011. (Hurst, 1997, p. 33) The lack of news media coverage of the 1952 case at Chalk River poses a question about the news media's responsibility to the public to report the news in a truthful manner.

3.24 Public Perception

In the 1950s, nuclear power was viewed favourably by the general population of Canada. It became especially well known at the time because the nuclear power industry uses the media as a vehicle to spread its propaganda. As people bought into the propaganda, so did the Canadian federal government and the AECL.

Around 2008, however, certain individuals tried to blow the whistle on the Canadian government's inaction in dealing with the 1952 nuclear accident. Unfortunately, they have been dismissed from their jobs or have been completely ignored. According to an article published on the CBC news website, "Linda Keen, a former president of the Canadian Nuclear Safety Commission (CNSC), was fired for trying to shut down the Chalk River nuclear reactor because of the unsafe production of radioactive medical isotopes." ("Nuclear Safety Watchdog Head Fired for 'Lack of Leadership': Minister", 2008) Since Keen was fired from her occupation, the Natural Resources Minister Gary Lunn "refused to cite one example of what Linda Keen had

done wrong in her job, only that she has lost confidence in the government." ("Nuclear Safety Watchdog Head Fired for 'Lack of Leadership': Minister", 2008) This example highlights that there is a disconnection between the public perception of nuclear accidents and the organizational perception of such accidents. This disconnection is compelling, as it illustrates the social and political tensions between the general public's concern about nuclear accidents and the government's interest in profiting from the manufacturing of medical isotopes. As these tensions occur, the disconnection also raises ethical issues. Since this nuclear accident took place in the 1950s and the natural environment was not considered as a morally ethically relevant entity and humans were, the normative ethical analysis in this case will be more human-focused. Prior to proceeding to this analysis of three social problems, one should also note that the public perception during the 1950s cannot be added into the normative ethical analysis as the natural environment was not considered to be a morally relevant entity at that time.

3.3 Normative Ethical Analysis of the Three Social Problems

3.31 Consequentialist Perspective

In 1952, public perceptions and the government's perceptions of nuclear accidents were identical because they did not know the dangerous consequences that can occur from an accident. However, over time, as the general public became educated about the dangers of nuclear accidents, their perceptions and ethical thinking have shifted from being completely unaware to being increasingly concerned.

Despite the changed public perceptions of nuclear accidents by 2011, the inaction of the Canadian Federal Government is unethical and morally culpable as it has had many

negative consequences since 1952. As we have seen, Natural Resources Canada wants to build an underground dump at Chalk River which will contain waste from other Ontario nuclear reactors. (McCleod, 2011) The reasons underlying the plan for an underground dump at Chalk River was to concentrate all the radioactive waste in one area. However, if all the radioactive waste is concentrated in one area, it will only contribute to the problem of the accumulation of nuclear waste in underground trenches. When all of Ontario's radioactive waste is concentrated in one area, the waste will find its way to seep into the groundwater and flow into the Ottawa River, damage the water supply in Chalk River and, at the same time, will flow upstream to Ottawa. This will cause continuous increases in cancer rates in Chalk River and in Ottawa, which are unethical from a consequentialist perspective. (Buckthought, 2011)

3.32 Deontology Perspective

In 1952, the government did not believe that it was its duty to protect the natural environment, and did not know the dangerous effects nuclear accidents have on the general public. Due to this mindset, one can argue that the actions by the Canadian Federal Government and the AECL at the time were morally permissible because the natural environment was not considered to be morally relevant and that nuclear energy was believed to be a safe and efficient energy source for the general public.

From a deontological perspective, however, by 2011, Natural Resources Canada and the AECL failed in their duties to address the dangerous effects from the 1952 Chalk River nuclear accident and are therefore unethical. The mandates of Natural Resources Canada and of the AECL have not been met; their inaction in dealing with the 1952

Chalk River nuclear accident is unethical because it treats the people who reside in Ottawa and Chalk River areas as a means rather than an end. These residents were treated as a means by Natural Resources Canada and the AECL; it is as if their lives matter less than the lives of other Ontario residents. This treatment is shown when Natural Resources Canada intends to use Chalk River Laboratories as a 'scapegoat' disposal site rather than as a town inhabited by hundreds of residents. (McCleod, 2011) On the other hand, if Natural Resources and the AECL did consider the Ottawa and Chalk River residents as ends, then they would find new ways to properly dispose of nuclear waste, or consider using alternative renewable energy sources.

The duty of the Canadian media stems from their responsibility to report events in a truthful manner. However in the 1952 Case of the Chalk River Laboratories, the media did not fulfill this task. This is shown by the lack of news media coverage on the case. When there is a lack of news media coverage on the nuclear accident, it is deceiving the public who live around Chalk River nuclear reactor area.

3.33 Virtue Ethics Perspective

When examining the 1952 Chalk River nuclear accident from an ethical perspective, it is useful employ traditional virtue ethical theory, where the character of the moral agent is the driving force for ethical analysis. There are two characteristics that are essential in virtue ethics: honesty and conscientiousness.

Conscientiousness is defined as "acting according to the dictates of one's conscience and being attentive to human needs" (Oxford English Dictionary, 2007) It is a characteristic that is desirable in the actions of Natural Resources Canada and the Atomic

Energy Control Limited in cleaning up nuclear materials released into the natural environment from the Chalk River Laboratories. If conscientiousness had been characteristic of Natural Resources Canada and the AECL, they could have quickly dealt with the issue since they had control over it. One example that shows a lack of conscientiousness on the government's part – one mentioned already above – is when the government chose to dismiss Linda Keen, an individual who 'blew the whistle' on the unsafe production of medical isotopes from the Chalk River nuclear reactor. The government was irresponsible here because it simply 'brushed off' the issue by saying that she had shown a 'lack of leadership' because she did not do what she was told to do – and that was to restart the nuclear reactor so the government could profit from the production of medical isotopes.

In the area of news coverage, honesty is defined as a character trait that requires the media not to fake or ignore the facts about a particular event, and to report an event at the moment as it occurs. (Mahmoud, 2008, p.88) Honesty is a cornerstone of ethical behaviour in the media. When ethical behaviour is assessed, one must take into account both the intentions as well as the consequences that result. If the Canadian news media had exhibited the virtue of honesty in 1952 and in 2011, then people would have been aware of the problems with nuclear waste. However, its behaviour in both time periods is unethical – though for different reasons.

In the 1950's, people acquired knowledge about current events through newspapers and radio. (Hurst, 1997, p. 22) The role of Canadian newspapers and radio reports is extremely important; had they reported the nuclear accident, then the residents would have been able to take precautions. However, since the newspapers and radio

deliberately avoided reporting the accident, the affected residents had no idea how to protect themselves or how to take precautions should a similar incident happen.

In 2011, information is more accessible and people do not need to rely on newspapers or the radio for information. When there is a vast array of media, the ethical implications of reporting the news is expanded to other media. (Hurst, 1997, p. 22) However the media are more susceptibility to be dishonest in 2011, because information can be easily manipulated, skewed and distorted. When such actions occur, there is no way to identify whether a source is telling the truth. If the sources are being dishonest about reporting nuclear accidents, then people start to question the reliability of the news media.

3.34 Short Mention of Nash and Conclusion of the 1952 Case of the Chalk River Laboratories

What the preceding normative ethical analysis has shown is that the 1952 Case of Chalk River Laboratories is an example where the Canadian public did not consider the natural environment as an ethically relevant entity. Despite the change in the public perception of nuclear accidents in 2011, the AECL and Natural Resources Canada continue to deny that they need to find solutions to fix the problematic disposal method and address the increasing illness rate occurring in Chalk River and in Ottawa. (McCleod, 2011)

The Chalk River Laboratories case illustrates a situation where the lack of public concern allowed dangerous consequences to continue. Moral culpability stems from the inaction of the Canadian government and the AECL. They had the power to change the

situation but chose not to. This is dangerous in the sense that, as the amount of nuclear waste accumulates, the unhealthier the human population becomes. The next chapter will address a case where we see a shift in thinking ethically about nuclear accidents. Moreover, this shift in ethical thinking about nuclear accidents moved to human beings questioning the use of nuclear energy itself.

Chapter 4: The 2011 Case of Fukushima Daiichi

While the 1952 Chalk River case was one of the first nuclear accidents, the 2011 Case of Fukushima Daiichi is the most recent nuclear accident to date. Like Chalk River, it is a nuclear accident that occurred without warning. However, the 2011 Fukushima Daiichi case was caused by natural disasters rather than overheating. What makes this case stand out from other nuclear accidents that have occurred since 1952 is that the shift in the general population's ethical perception of nuclear accidents went further than the recognition of the dangerous effects of nuclear accidents. In the years after the 1952 Chalk River case, we see a shift in the public thinking about nuclear accidents – from being completely unaware to recognizing the dangerous effects from nuclear accidents. In the 2011 Fukushima Daiichi nuclear accident, the shift in the general population's ethical perception of nuclear accidents went from the recognizing the dangerous effects of nuclear accidents to the general population's questioning the use of nuclear energy itself. When humans question the use of nuclear energy, there is also a chance that nuclear energy may no longer be of use and therefore no further release of nuclear materials into the natural environment will occur. In order to show that there is a shift in thinking ethically about nuclear accidents, this chapter will first present the historical background of the 2011 case of Fukushima Daiichi. Second, it will look at the significance of this case, which will consist of a discussion of the debate about the future use of nuclear energy and the increase of news media coverage. Third, it will proceed with a normative ethical analysis of the stakeholders' behaviours in the 2011 case of Fukushima Daiichi. Finally it will conclude with a brief comparison of the 1952 case at Chalk River and the 2011 case of Fukushima Daiichi.

4.1 Historical Background

Fukushima Daiichi is a nuclear power plant that is located on a 3.5 square kilometre site in Okuma, Fukushima, Japan. The reactor was first commissioned by the Tokyo Electric Power Company in 1971 and consisted of six boiling water reactors. (McNeil and Adelstein, 2011) The reactor uses water for the following reasons: "it acts as a coolant, carrying heat away from the nuclear fuel, and as a "moderator," slowing down the release of neutrons during fission reactions." (McNeil & Adelstein, 2011) Following a magnitude 9.0 earthquake, "a 13 metre tsunami disabled the power supply and cooling of three Fukushima Daiichi reactors causing a nuclear accident on March 11, 2011." ("Fukushima Daiichi Accident 2011", 2012) On March 21, 2011, an article in the Guardian newspaper stated that: "the human and financial cost of tsunami continues to rise after police estimates showed more than 18000 people have died in the [tsunami] disaster and the World Bank said it may cost Japan as much as £145 billion to repair the damage." (McCurry, 2011)

Together, the nuclear accident and the tsunami "killed over 20,500 people and resulted in the evacuation of over 320,000 people from the devastated areas." (Butler, 2011, p. 27) Following this disaster, the Japanese government and the employees of the nuclear reactor worked to "minimize the effects of the damage to the plant and to protect the public, and the points at which the responses proved to be inadequate. However the Fukushima Daiichi case offers a lesson "that will be of value to those planning for and responding to future natural disasters and accidents in Japan and around the world." (Butler, 2011, p. 36)

When looking at how the Japanese government dealt with the Fukushima nuclear accident and how the Canadian government dealt with the Chalk River Laboratories nuclear accident, there is a clear shift in thinking, from deliberately ignoring the issue to proactively finding measures to mitigate the issue. In order to explore this phenomenon in greater depth, there is a need to look at the significance of this case.

4.2 Significance of this Case

When it comes to looking at the significance of the case of Fukushima Daiichi, there is a need to look at how the change in ethical thinking about nuclear accidents occurred. How did thinking move away from focusing on the dangerous effects of nuclear accidents, to human beings questioning the use of nuclear energy itself? The increase of media coverage caused people to 'tune in' to the event, which in turn caused people to become fearful. When people become fearful, they began to question whether Fukushima is a turning point or a temporary ethical phase. In order to further examine this issue, this section will be split into two main parts: the increase of media coverage and the debate about the future use of nuclear energy.

4.3 Increase of Media Coverage

Unlike the 1952 Case of the Chalk River Laboratories, the 2011 Case of Fukushima Daiichi attracted much news media coverage (Blowers, 2011) When there is more media coverage on a particular event, there is more public concern. When public concern is the result of hearing about a historical catastrophic event, it is debatable whether one should consider the increase in news media coverage to be a positive

influence or a media-distorted event. (Butler, 2011, p. 55) This debate stems from the importance of media framing of the Fukushima Daiichi case. Media framing is defined as the news media having "the task of constructing meaning over time" (Butler, 2011, p.43) As suggested by Eid Mahmoud, media framing is important in the case of Fukushima Daiichi because of its responsibility to the international community, which is to report events in a truthful manner. (Mahmoud, 2008, p.88) Since the international community relies on the news media for obtaining information about world events, the news media's framing particular events dealing with nuclear accidents must be accurate. In exploring the Fukushima Daiichi case, the media having a positive influence or as engaging in distortion is a matter of concern.

4.31 News Media Coverage Positive Impact

Due to the international news coverage of Fukushima Daiichi, some countries such as Canada began to debate whether to take action on making policy changes in nuclear energy use. According to Anna Mehler Paperny, "Fukushima's global impact has led some to argue nuclear regulations and solutions should be a global, rather than national, concern." (Paperny, 2011, p. 8) This statement shows that countries such as Canada can learn from Fukushima Daiichi, as a lesson to all countries that use nuclear power as an energy source.

The media serves as a powerful tool that influences people by allowing them to acquire knowledge. The media coverage of the 2011 Case of Fukushima Daiichi was vast in the sense that it was all over the internet, the television news, the radio, and the major newspapers and magazines. (Butler, 2011, p. 45) The more people are exposed to

looking at events in the media, the more they will develop an interest in the event. (Butler, 2011, p. 45) Because of the vast media coverage of Fukushima Daiichi, people not only became aware of the event but came to question whether the use of nuclear energy is safe and ethical. (Butler, 2011, p.45) When such a debate occurs, the consequences are positive consequence because it leads the international community to rethink its uses of nuclear energy. (Butler, 2011, p. 45) If there is a rethinking of nuclear energy, there is a chance that nuclear energy may no longer be of use (and therefore there will be no further releases of nuclear materials into the natural environment) or a chance that there will be a change in nuclear energy disposal policies. (Butler, 2011, p. 45)

4.32 Media Distortion

Despite the positive influence of the increase of news coverage of Fukushima Daiichi, the news media can always be manipulated or contextualized in such a way that the international public could misinterpret an event. According to Rama Hoetzlein, "our primary source for information in times of crisis is the news media. Yet, due to physical circumstances resulting from [this] crisis, information may be scarce or unreliable. Messages may be de-contextualized, translated across cultural boundaries or manipulated by the news media itself, leaving the public to wonder how to respond correctly." (Hoetzlein, 2011, p. 33) Hoetzlein indicates the importance of the framing carried out by the news media, and how distorted views about events dealing with release of nuclear materials into the natural environment have an impact not only on human concern but also on human behaviour. When distorted views about such events are broadcast, there is

a need to explore the issue whether it is the news media's responsibility to tell the truth about such cases. This debate is ongoing.

4.4 Public Perception - International Impact

In the wake of the staggering cost of the disaster, "Japan has decided to raise its assessment of the accident at the crippled Fukushima Daiichi nuclear power plant to the worst rating on an international scale."(Tabuchi & Bradsher, 2011) After the occurrence of the Fukushima Daiichi disaster, there have been ethical debates about the future use of nuclear energy. These ethical debates were confirmed in an article which states that, "[the] ethical context that the Fukushima tragedy [moved away from the recognition of the dangerous effects of nuclear accidents to human beings questioning] the future [use] of nuclear energy." (Blowers, 2011) As each country acknowledged the events of Fukushima Daiichi, some began to take measures to attempt to mitigate the long-term effects of the release of nuclear materials into the natural environment. The German government, for example, immediately decided to shut down seven of their nuclear reactors after the 2011 Fukushima Daiichi disaster. According to the Howard L. Hall, "[The German government] took its 7 oldest nuclear reactors offline shortly after the Fukushima accident began and has just announced a significant reversal of the Merkel administration's opposition to shutting down all of Germany's other 10 reactors within 10 years." (Hall, 2011) In the past, "Germany produced approximately 29% of its electricity by means of nuclear power and was exporting a small amount of electricity to the rest of Europe." (Hall, 2011) When the Germans disengaged these reactors, it was due to their fear of having the risk of a similar event like Fukushima Daiichi. This example illustrates

that when people see and become concerned about the consequences from nuclear accidents, they take action immediately.

The 2011 Fukushima Daiichi nuclear accident demonstrated that there was positive government involvement and an abundance of media coverage, but there is a need to look at the normative ethical implications of these reactions. The ethical implications of these reactions will show that the organizational perception of nuclear accidents had shifted from government inaction to government action to mitigate the effects of nuclear accidents. For the media's case, however, the shift is more evident because it went from barely any media coverage on nuclear accidents to an abundance of coverage.

4.5 Normative Ethical Discussion

4.51 Consequentialist Perspective

The events of Fukushima Daiichi presented a case where the increase in media attention certainly had an impact on the amount of public concern about the release of nuclear materials into the natural environment. The increase of media coverage caused states to pay attention to the accident. This increase of media attention was a result of lessons learned from past events. Still, one must also consider whether this increase of coverage is ethical or unethical. On the one hand, the increased amount of public concern about the release of nuclear materials into the natural environment is ethical because this increase is seen by the international community as a positive consequence. (Blowers, 2011) That the increase of public concern is positive stems from the assumption that the more the public is concerned about the release of nuclear materials

into the natural environment, the more human beings will become determined to find solutions to the problem.

The debate about the future use of nuclear energy can be interpreted as a positive consequence because it caused countries around the world to rethink their position. (Butler, 2011, p. 50) The debate is morally permissible from a consequentialist perspective because it caused human beings to question the value of nuclear energy and the high risks that can potentially result from its use. (Butler, 2011, p. 50) As this rethinking occurs, there is a chance that nuclear energy will no longer be seen to be as valuable. Once nuclear energy is not in use, there will be no more nuclear accidents. Rethinking the use of nuclear energy results is ethical because, if nuclear reactors will no longer be in use, the international community will be free from the risk of contracting cancers from the release of nuclear materials into the natural environment. (Butler, 2011, p. 51)

Rethinking nuclear energy use can result in finding safer and more environmentally-friendly disposal methods to manage nuclear waste. However, there is still a risk of releasing nuclear materials into the natural environment even when there are safer and more environmentally friendly disposal methods to manage nuclear waste, because of human error and the usual locations of nuclear reactors (which are often located near water, which can easily flow into other areas, causing serious consequences).

Both sides of the debate about the future use of nuclear energy were influenced by the media coverage of the case of Fukushima Daiichi. The increase of media coverage reminded the international community about concern for the natural environment; we see this in the reactions of the Japanese government and the international community. After

the Fukushima nuclear accident, the international community became very concerned because it believed that a similar event could happen to any country that uses nuclear energy. (Butler, 2011, p. 50) As the international community's concern for the natural environment increases, there is an ethical shift that moves away from mere awareness of a problem to questioning nuclear energy use itself.

4.52 Deontologist Perspective

Unlike the consequentialist perspective where the outcome of actions is the criterion for ethical judgement, the deontologist perspective focuses on the duties of the moral agent. A deontologist perspective on the 2011 case of Fukushima Daiichi looks at the role of two parties: the international news media and the Japanese government. Examining the duties of both parties will illustrate the importance of the responsibilities the media have to the international community and the Japanese governments have to their citizens.

The Fukushima Daiichi events had more media coverage than those of the Chalk River Laboratories. (Butler, 2011, p. 50) Despite this, one must wonder whether more media coverage of a particular event is always a positive influence on the public. In order to look further into the issue of the duties of the international news media concerning Fukushima Daiichi, one must consider whether the effect of media coverage is positive or leads to distortion. In the case of Fukushima Daiichi, it seems that the media fulfilled their duty in reporting news in a truthful manner and allowed the international community to make an ethical assessment. This is ethical because the media demonstrated that their objective was to ensure the international community

acknowledged the events of Fukushima Daiichi and its impact on countries that also use nuclear energy.

On the other hand, if the media distorted the events of Fukushima Daiichi, then the action is unethical because the media did not fulfill their duty to report the news in a truthful manner. Perhaps the media is simply trying to sell a story in order to make a profit or gain publicity. Such action is unethical because it is for self-gain instead of duty. However there has been no evidence that the news media distorted the events of Fukushima Daiichi. (Butler, 2011, p. 50)

Despite their inadequacy, the actions taken by the Japanese government were ethical. Unlike the (in)action of the Canadian Federal Government and the AECL with the Chalk River Laboratories, the Japanese government did not deny that there was a problem about the release of nuclear materials from the Fukushima Daiichi nuclear reactor into the Pacific Ocean and into nearby lakes. (Paperny, 2011) Instead, they took responsibility by trying to find measures to mitigate the physical impact of the accident. (Hall, 2011) These measures included: evacuation, providing medical attention to those who were harmed by the tsunami, and building new homes for the newly homeless. (Hall, 2011) The actions taken by the Japanese government demonstrate that they were attempting to solve the problem, which is conducive to fulfilling their duty as officers of the state. In other words, these actions demonstrated that the well-being of the citizens was the main priority, unlike ignoring or marginalizing the issue, as in the Canadian government's response to the case of Chalk River Laboratories.

4.53 Virtue Ethical Perspective

A virtue ethical perspective is useful when ethically analyzing the case of Fukushima Daiichi, as it will identify possible ways for the media and the international governments to act to improve the living conditions for the public. When looking at the Fukushima Daiichi case from this perspective, the focus of the ethical analysis is on the individuals involved in the media and in government.

When looking at the media coverage of Fukushima Daiichi from a virtue ethical point of view, one may look at the characteristic of honesty. Honesty in the area of news media coverage is defined as the character trait that involves the media to not present a skewed view of events. Honesty plays a role in media coverage of the Fukushima Daiichi accident by serving as a criterion for an ethical assessment of how well the news media influences the international community's behaviour. If the media coverage is factual, then the action would be considered to be ethical from a virtue ethical perspective; the media did not distort their framing of the event. On the other hand, if the coverage were distorted, then it is unethical as it is dishonest. However in the case of Fukushima Daiichi, media coverage was robust; people were made aware of the dangers from the release of nuclear materials into the natural environment. Therefore in the 2011 case of Fukushima Daiichi, the news coverage was delivered in an ethical manner.

When looking at the Japanese government's handling of the events, there is a need to look at the characteristics of conscientiousness and attentiveness. Conscientiousness and attentiveness are needed because they are conducive to making decisions, such as showing care for those affected and rebuilding after the accident. Although the Japanese government's responses were somewhat inadequate (Butler,

2011), it did at least attempt to find ways to mitigate the effects of the accident rather than ignore them, and thereby contributing to the problem. Because of the actions attempted by the Japanese government to minimize these effects, the government behaved in an ethical manner.

4.6 Short Mention of Nash and Conclusion of the 2011 Case of Fukushima Daiichi

The 2011 Case of Fukushima Daiichi shows that Nash's historical theory of environmental ethics is plausible. This case shows that there has been a shift in thinking ethically about nuclear accidents, and this change in thinking moved from simply awareness of the event to human beings questioning the use of nuclear energy itself. This shift in thinking also stems from people learning from events similar to those of Fukushima Daiichi. In order to further explore how the mixture of Nash's theory and normative ethical theories helps to prove the existence of an 'ethical shift' in public concern about the release of nuclear materials into the natural environment, it is appropriate to apply this combined ethical theory to both cases used in this thesis. This comparison will be the main focus of the next chapter.

Chapter 5: Comparison of the Two Cases

The central aspect of the previously discussed two case studies is the shift in thinking ethically about nuclear accidents. This phenomenon reveals a difference in the way people think about nuclear power, to the extent of people debating about the future use of nuclear energy itself. When analyzing this phenomenon, it is appropriate to apply Roderick Nash's Historical Theory of Environmental Ethics. Applying his theory will show how ethics is rights-based and has developed over time. Nash's theory also incorporates the normative ethical analyses (specifically consequentialism, deontology and virtue ethics) used in both case studies, as it shows how each theory fits within his rights-based ethical theory. In order to demonstrate how normative ethical analyses play a role in Nash's theory, it is best to compare both case studies. One must ask, of course, whether this shift in thinking ethically is beneficial or not. In order to address these issues, this chapter will review Nash's theory and then compare both case studies by discussing the ethical shift. Finally, I will conclude with some comments about whether this ethical shift is beneficial for the international community.

5.1 Interrelationship: Nash's Historical Theory of Environmental Ethics incorporates Normative Ethical Theories

As stated in the first chapter, Nash's theory is a rights-based ethical theory, so that he argues that environmental ethics is an "evolution of ethics from the natural rights of a €limited group of humans to the rights of parts of all of nature." (Nash, 1989, p. 5) This means that the change in ethical thought about the relationship between the natural environment and human beings stems from an acquired open-mindedness learned from a

series of mistakes that had occurred over time. In order for Nash to illustrate this point, he introduces a historical continuum indicating that natural rights are ascribed to more and more 'ethically relevant' beings. Natural rights are, recall, "rights [that are] not contingent upon the laws, customs, or beliefs of any particular culture or government and therefore universal and inalienable." (Rothbard, 1982, p.1) By examining Nash's historical continuum, one is able to understand how the change in thinking ethically about nuclear accidents from 1952 to 2011 is manifest. Nash's theory of environmental ethics also incorporates the normative ethical analyses used in the third and fourth chapters, by showing how duties, consequences and character traits contribute to the change in human ethical thought about the abuse of nuclear energy and harming the natural environment. In order to demonstrate this, the next section will proceed with a comparison of the previously mentioned case studies.

5.2 Comparison of the Case Studies

Between the 1952 Case of the Chalk River Laboratories and the 2011 Case of Fukushima Daiichi there is a fifty-nine-year difference. This difference suggests that there have likely been many scientific advancements and social movements that have influenced how people think ethically about nuclear accidents. In the 1952 case of the Chalk River Laboratories, people were unaware of problems concerning the disposal and managing of nuclear energy. From the 1960s onward, the ecological movement, social movements, scientific research, environmental ethics and media advancement, influenced people to think differently about the natural environment. Due to lessons learned from events similar to the Chalk River nuclear accident, people became increasingly

concerned. (Paperny, 2011) This new knowledge led to the international community's concern about the release of nuclear materials into the natural environment. In order to illustrate this, it is useful to apply Nash's historical theory of environmental ethics and the normative ethical theories that were discussed in the first chapter.

5.21 Comparison - Consequentialism

Consequentialism plays a role in Nash's historical theory of environmental ethics because human beings learn from past negative consequences – and this has caused an extension in the application of natural rights. (Nash, 1989) The consequentialist perspective in the 1952 Case of the Chalk River Laboratories illustrates that the continuous ignoring by Natural Resources Canada (and its predecessor government departments) and the AECL contributed to the accumulation of nuclear waste at Chalk River and the increasing cancer rate in Chalk River and in Ottawa. Because of this increase in illness, the consequences are clearly negative and the inaction of Natural Resources Canada and the AECL are, in 2011, unethical. The Canadian media in the 1952 Case of the Chalk River Laboratories are also guilty of unethical behaviour because of their lack of attention in reporting the nuclear incidents occurring at the reactor from 1952 to 2011. To the extent that the Canadian media failed to report the various accidents occurring at the reactor, Chalk River and Ottawa residents were unaware of the accumulation of nuclear waste and the increasing rate of illness. (McCleod, 2011) This lack of awareness has, again, led to negative consequences, which makes the (in)action of the Canadian media unethical.

Since 1952, there have been many nuclear accidents around the world. Due to the negative consequences of past nuclear accidents, such as at Chernobyl in the Ukraine, people have become increasingly concerned about the matter. (Blowers, 2011) This increase in concern has led many in the international community to extend natural rights to include the natural environment. (Nash, 1989) This extension of natural rights allows the natural environment to be considered in normative ethical analysis. This new knowledge and extension of natural rights no doubt also led to the increase of news media coverage and the action taken by the Japanese government to mitigate the problem of the nuclear accident at Fukushima Daiichi.

5.22 Comparison - Deontology

Deontology plays a role in Nash's theory because human beings have duties to care for the natural environment. The comparison of the deontologist perspectives concerning the 1952 case of the Chalk River Laboratories and the 2011 case of Fukushima Daiichi will focus on the duties of the governments of the respective states. The Chalk River case will focus on the duties of Natural Resources Canada (and its predecessor departments) and the AECL; the Fukushima Daiichi case will focus on the duties of the Japanese government.

Although the 1952 incident at the Chalk River Laboratories was the first nuclear accident, environmental harm was not yet recognized, and the Canadian government initially did not see the natural environment as being ethically relevant. Because of this, in 1952 the Canadian government did not see it as their duty to protect the environment. However, when looking at the Chalk River case from a 2011 perspective, it is clear that

Natural Resources Canada and the AECL have not performed their duty, and instead found more ways to contribute to the problem. When the Canadian public begins to question the integrity of Natural Resources Canada and the AECL, there is a clear indication both did not act ethically.

In contrast to the failure of Natural Resources Canada and the AECL, the Japanese government at least attempted to find ways to fix the catastrophic impact of the Fukushima Daiichi accident. Although its actions were inadequate, the Japanese government still acted ethically because it was performing its duty to find ways to mitigate the impact from the accident rather than ignore it or add to the problem. (Hall, 2011) The actions taken by the Japanese government again was no doubt inspired by the consequences learned from past nuclear accidents, but also a greater sense of duty.

5.23 Comparison - Virtue Ethics

Virtue ethics plays a role in Nash's theory by identifying what characteristics are needed to fulfill duties and provide positive consequences. From the virtue ethical perspectives, in both case studies two especially desirable characteristics are relevant: honesty and conscientiousness. The ethical behaviour in the respective cases was, however, very different. For example, in the 1952 Chalk River case, the media did not act in an honest manner; they simply did not report the nuclear accident. As they did not report the nuclear accident, the media deceived the Chalk River and Ottawa residents - and were clearly unethical. Similarly, the Canada government and the AECL did not act in a conscientious manner at the time of the accident or afterwards; in fact, they contributed to the problem rather than mitigate it.

On the other hand, in the 2011 Case of Fukushima Daiichi, the media behaved ethically because of their truthful reporting - a reporting that influenced the international community to think long and hard about the release of nuclear materials into the natural environment. The same may be said for the difference in conscientiousness of the government in the respective case studies.

5.3 Major Shift in the Public Perception and Minor Shift in the Organizational Perception

The comparison in the previous section confirms two conclusions: there has been an evident shift in public ethical perception concerning nuclear accidents, and the shift in the organizational ethical perception has been minimal. The 1952 Chalk River nuclear accident showed that the public ethical perception of nuclear accidents had not yet extended to include concern for the natural environment. A shift in thinking did occur, but did not occur immediately; rather, there was a gradual shift in the sense that the general population too note of the dangerous effects of multiple nuclear accidents that had taken place around the world. During the 2011 Fukushima nuclear accident, this shift in thinking ethically about nuclear accidents seemed to change from merely being aware of the dangerous effects of nuclear accidents, to questioning the use of nuclear energy itself.

On the other hand, the organizational perception of nuclear accidents made a minor shift – from not taking nuclear accidents sufficiently seriously, to starting to find measures to mitigate the dangerous effects of nuclear accidents. The 1952 Chalk River nuclear accidents highlighted the disconnection between the Canadian federal

government and the Canadian public. This disconnection still persists, as the federal government continues to remain largely inactive in addressing the general public's concerns about the 1952 Chalk River nuclear accident. The 2011 Fukushima Daiichi nuclear accident shows that there has been a shift in government involvement in nuclear accidents from being completely inactive (as in the Chalk River case) to finding measures to mitigate the nuclear accident.

5.4 The Shift in Thinking Ethically - For Better or For Worse?

Drawing from the comparison of the two case studies, the question of whether the shift in public concern is beneficial has yet to be answered. On the one hand, one could argue that this ethical and historical analysis is a cornerstone in evaluating long-term nuclear energy use policies, as it will make people 'think twice' before abusing such a complex energy source. It could also cause states to consider alternative energy sources that are safer and ethical. On the other hand, one could argue that the public concern about the release of nuclear materials into the natural environment is inevitable, but nothing can be done to solve this issue because nuclear energy is a necessary evil that is cost-effective and has a powerful lobby. What both sides of the issue neglect, however, is that there is a middle ground, and that is that the ethical shift in public concern is for the better because it causes people to not only 'think twice' about nuclear energy, but also help governments to realize what their priorities ought to be, i.e., to the citizens whom they serve. This means that serving citizens is more important than nuclear power.

Conclusion and Future Considerations

I have argued in this thesis that there has been a shift in thinking ethically about nuclear accidents. This shift has caused human beings to move from simply being concerned about the dangerous effects of nuclear accidents to questioning the use of nuclear energy itself. In order to demonstrate this ethical shift, a comparative historical and philosophical analysis has been used. The philosophical theory that best fits this thesis is Nash's historical theory of environmental ethics which includes or takes account of normative ethical theories such as consequentialism, deontology and virtue ethics.

In chapters 1 and 2, I outlined several key issues or terms necessary to this thesis, such as the ethical approach of Nash, normative ethical theories, public indifference, environmental ethics, and environmental harm. The relations between Nash's theory and normative ethical theories demonstrate how to account for the existence of the ethical shift in public concern about the release of nuclear materials into the natural environment. The relations between Nash's theory and other ethical theories indicate an evolution in natural rights from a focus on human beings to extending these rights to the natural environment.

In chapter 3, I provided an example where there is a disconnection between the general public's perception and the organizational perception of nuclear accidents. In addition, I outlined the social and ethical implications that this disconnection raises.

In chapter 4, I provided an example of a case showing the major change in the general public's perception and the minor change in the organizational perceptions of nuclear accidents. Finally in chapter 5, I provided a comparison of both case studies.

Both studies indicated that historical differences in attitudes and moral culpability play a role in the way people thought – and think – about nuclear accidents.

It would be beneficial for the well-being of the international community if further research were done concerning the risk management of long-term nuclear energy use. This will help to determine what needs to be done to mitigate or solve the issue of the release of nuclear materials into the natural environment.

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