

Remediation of the Rocky Flats Plant:
An Ethical Analysis

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Abstract

This project investigated the ethicality of the remediation of the Rocky Flats Plant, a former plutonium weapons production facility located northwest of Denver, Colorado. Often times governmental institutions such as the Department of Energy are not held to an ethical standard for their remediation projects either before or after completion. Without the constant evaluation and appraisal of the Department of Energy's remediation projects we could end up in a situation where the DOE cuts corners and lowers their standard of operation. In order to combat this issue, I have analyzed the numerous aspects of the Rocky Flats remediation project, and compared the actions performed with the stated ethics of the Department of Energy, the organization responsible for remediation. This paper seeks to answer the question: How does the determination of the Rocky Flats Plant site as "safe" align with the stated ethics, or mission statements, of the organizations responsible for the cleanup and management of the site? After conducting the necessary research, I have concluded that the Department of Energy's remediation project did in fact align with the stated ethics of the organization.

Table of Contents:

<u>Abstract</u>	ii
<u>Preface</u>	1
<u>Introduction</u>	2
<u>Methodology</u>	3
<u>Background</u>	4
Safe Levels of Plutonium	12
Secrecy at Rocky Flats	13
<u>Ethical Background</u>	14
Deontology, Consequentialism, and Virtue Ethics	15
Environmental Ethics	16
Restoration Ethics	19
Looking at the DOE and USFWS	25
<u>Discussion</u>	28
Previous Work	39
<u>Recommendations</u>	39
<u>Bibliography</u>	42

Preface

This project is the result of a merge between my personal interests, my area of study, and the need for a project of this type. I found interest in the Rocky Flats Site due to its close proximity to my area of residence, combined with my strong interest in the Cold War and nuclear weapons production. I knew that remediation of nuclear waste can be a tricky process, and thus decided that an analysis of the remediation project aligned with the content discussed in the Environmental Studies program at the University of Colorado at Boulder. I chose to take the route of an ethics-style analysis after discovering how little work had been completed on this subject, as well as the need for an effective, action-based ethic upon which policy can be implemented. I would not have been able to complete this project alone, and would like to thank all of my committee members: Patty Limerick, Alex Lee, Sarah Rogers, and Dale Miller.

Introduction

Throughout the 20th century, the United States progressed economically and militarily, eventually reaching its current position as the dominant superpower of the globe. This transition was neither an easy nor clean process, and it has become clear that we will, as global citizens, be witnessing the lasting consequences of this transition for generations to come. One of the most notorious paths for the United States' transition to global superpower is the development of the U.S. nuclear arms program. This program has led to our securement of global military dominance, but also created a myriad of extreme cases of environmental degradation. One such case, the former Rocky Flats Plant near Denver, Colorado, is the primary focus of this paper. Nuclear production sites such as Rocky Flats have resulted in large quantities of pollution which pose health risks for humans, plant and animal species, and the ecosystem as a whole for thousands of years, if the contaminated land is left in a state of incomplete remediation. In the case of Rocky Flats, the site was cleaned by the contractor Kaiser-Hill under supervision of the Department of Energy to a level determined to be officially “safe”, and consequently the research question that this thesis attempts to answer is: How does the determination of the Rocky Flats Plant site as “safe” align with the stated ethics, or mission statements, of the organizations responsible for the cleanup and management of the site?

As a country that has situated itself as the dominant world power, the United States holds an inherent ethical obligation to lead the world by example. In addition to this, the very nature of western governments is to protect the needs of its future residents, including protecting them from domestic health risks. Therefore, the United States is responsible for remediating the damages done to the environment in its quest for global domination. This paper looks at how the United States has fulfilled this responsibility, in the case of the Rocky Flats site, and how that

fulfilment compares to the stated ethical guidelines of the organizations responsible for conducting the remediation.

Methodology

This paper, while centering around the ethics of remediation at the Rocky Flats Plant site, necessarily contains a discussion of the factors that contributed to the determination of the level of cleanup. For this section I assessed numerous documents written up by government institutions, independent contractors, activists publications, and other sources of interest. Using these sources I determined what factors influenced the level of cleanup conducted at the Rocky Flats Plant site, and in my discussion section I have made statements on the implications of these determining factors.

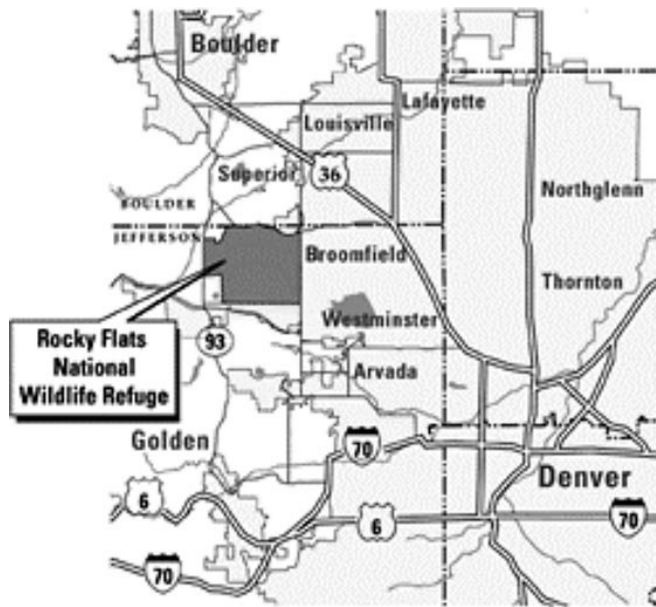
In addressing the ethical portion of this study, the methods are relatively simple. I begin with a basic overview of the three primary forms of ethical theory; deontology, consequentialism, and virtue ethics. Next I take a look at the general background of environmental ethics, and then move into the more specific topic of restoration ethics. The literature review is an important aspect of the methods of my ethical analysis, as this is how I set the stage for my discussion. In addition to the literature review, I will use thought experiments to better convey the functionality of different ethical theories.

One difficulty of an ethical analysis of government institutions is that many of their ethics are implicit as opposed to explicit, causing difficulty due to a lack of concrete standards when evaluating their work on an ethical level. This means that government institutions are expected to hold themselves to general ethical standards by the public, even if these ethics are not written in stone. An example would be not to purposely mislead the public, or take advantage of the public purposefully. In order to have a baseline of ethical standards self-prescribed by the institutions, I

looked at their mission statements. I visited the website of the Department of Energy and the United States Fish and Wildlife Service to look at the ethical obligations to which they chose to hold themselves to; I decided that these standards, posted on the institutions' website, are a sufficient baseline of ethical standards to use in my analysis. In addition to evaluating the Rocky Flats remediation project according to the responsible parties' mission statements, I will compare these processes to writings by numerous environmental restoration ethicists. This provides a broader look at the ethics behind the Rocky Flats remediation, and how that compares to the environmental and restoration ethics communities' opinions on the topic.

Background

After World War II, the two superpowers remaining, the Allies headed by the United States of America (USA) and the Soviet Union (USSR), disagreed on their goals for global development. This disagreement resulted in what is referred to as the Cold War, where these two superpowers conducted a massive arms race of both the traditional and nuclear nature. As a result, the United States erected multiple nuclear weapons production facilities across the country in order to keep up in the arms race with the Soviet Union, who developed nuclear facilities in a similar fashion. The Atomic Energy Commission managed one such site, the Rocky Flats Plant, and they broke ground on the site roughly 16 miles northwest of the city of Denver, Colorado in 1951 (Dreyer, 2005). The residents in the area at the time knew that this facility was being developed by the Atomic Energy Commission, but due to the top-secret nature of the project transparency was practically non-existent.



-image used from (Abbotts, 2011)

This site would become the home of a nuclear weapons production facility, which manufactured plutonium pits, or triggers, used to detonate larger nuclear or hydrogen bombs. The production complex was built upon a 385-acre piece of land, surrounded by an undeveloped buffer zone which increased in size as more surrounding land was purchased by the Atomic Energy Commission, eventually totaling about 5000 additional acres. Production at the facility began in 1952 and ended in 1989. Throughout the facility's operation, around 70,000 plutonium pits were produced there. These plutonium pits were small scale atomic bombs that triggered the detonation of larger scale hydrogen bombs, and therefore their production had the associated risks of producing any nuclear weapons, such as radiation exposure and a propensity for flammable materials to combust. Each pit is said to have the explosive power of 15,000 tons of TNT, and the larger warheads that they are used to detonate are said to be 600 times more powerful than the atomic bomb dropped on Hiroshima in World War II. The most common radioactive ingredients that were in use on the site were plutonium, uranium, and americium.

Other non-radioactive but still toxic materials used on site were beryllium, sulfuric acid, and carbon tetrachloride (Dreyer, 2005).

Before reviewing the history of the Rocky Flats plant, I must first discuss the issue of facelessness in policy implementation throughout this process. Often times in my paper, I refer to institutions such as the Department of Energy and Federal Government with terms such as “they” or “their.” This is largely a result of the lack of individual names associated with any decision surrounding the remediation of the Rocky Flats plant. I suspect this is due to an attempt at escaping direct liability for any consequences stemming from policy implementation; however, I cannot be certain. This facelessness of government institutions can be seen in almost every department of the U.S. Federal Government, and has been increasing over the past few centuries. I felt the need to address this topic at the beginning of the paper in order to alleviate any confusion around the use of anonymous terms such as “they” when discussing the DOE and Federal Government. I will return to this point to a greater extent in the discussion section.

The Rocky Flats Plant operated for almost 40 years, employing around 7000 workers, with these worker’s wages and benefits supporting another 19,000 jobs in the surrounding area (Anonymous, 1991). During the site’s operation, it experienced numerous malfunctions that both harmed human health and caused environmental damage. The first major accident took place on September 11, 1957, and while this was the first large scale accident, other environmentally destructive incidents occurred on site prior to this one. In building 71 (later termed building 771) a glovebox containing highly reactive alpha-phase plutonium caught on fire. Due to worker safety protocol, the fire was not attended to for over 10 minutes. By the time the fire was extinguished, combustible gases, which had not yet ignited, made their way into the ventilation system and eventually ignited, causing the exhaust system to explode. This released into the

atmosphere dangerous agents such as plutonium, which dispersed at an unknown rate into the surrounding community (Anonymous, 1995). Another glovebox fire took place on May 11, 1969, damaging the ventilation system and releasing dangerous and radioactive chemicals into the nearby environment. One more gradual occurrence of environmental degradation took place at the 901 pad where plutonium waste products were being stored. These barrels were placed outside and eventually corroded, resulting in the release of plutonium into the soil and surface water (Dreyer, 2005).

After another 20 years of operation, the environmental damage finally posed enough of a health issue to warrant a response. On June 6, 1989, a joint effort headed by the FBI and EPA orchestrated a raid on the Rocky Flats Plant, halting production immediately until the future of the plant could be determined. Fierce debate ensued over the fate of the site, which continues today, with many groups advocating for permanent closure of the plant while the Federal Government refused to come to that decision immediately. During the time period after the raid, the fate of the Rocky Flats Plant was unclear and up for debate, with many of those who were employed there advocating for a reopening of the site, and environmentalists pushing for a permanent closure of the site (Abbotts, 2011).

After three years, in 1992 the Federal Government announced its decision to close the Rocky Flats Site permanently. Although no formal plans for remediation were initially in place, remediation did become the site's new mission (Abbotts, 2011). This was largely due to the winding down of the Cold War, and subsequent loss of a rationale for nuclear arms development. After this announcement, Colorado's Governor at the time, Roy Romer, directed his lieutenant governor Gail Schoettler to get the remediation project into operation. By 1995 she had organized a negotiating table of stakeholders and interest groups, through meeting with all

stakeholders and assigning them specific responsibilities, who discussed suggested cleanup levels with the Department of Energy (Dreyer, 2005). These stakeholders included the Rocky Flats Citizen Advisory Board, a non-profit formed in 1993 by the Department of Energy. This group was made up solely of volunteer citizens concerned with the closure and cleanup of Rocky Flats. This group also coined the term “Make it safe. Clean it up. Close it down,” which they hoped would help rally the public around the remediation project. In 1995 the Department of Energy (DOE) hired contractor Kaiser-Hill to conduct the cleanup operation with a monetary incentive to complete the project by December 15, 2006 that was originally concealed from the public (Moore, 2005).

In 1996 the Department of Energy released its outline of the Rocky Flats cleanup called “Final Rocky Flats Cleanup Agreement.” Here the DOE set a maximum of 651 picocuries of plutonium per gram of soil after the cleanup had been completed. This caused a great deal of public outcry due to the proportion of plutonium that would be allowed to remain in the soil. This was higher than other similar sites; in comparison the Nevada Test Site maximum level was set at 200 picocuries per gram of soil and the Hanford site was set at 34 picocuries per gram of soil. As a result of public resistance from advocacy networks such as the Rocky Mountain Peace and Justice Center, the DOE and EPA agreed to begin revising the cleanup agreement with public input being taken into account, although the DOE was unclear on to what extent public input would be integrated into the agreement. The goal was to reach a “risk-based end state,” meaning an end-state with a level of risk corresponding to the proposed future use of the site, with collaboration between the government agencies and the public (Moore, 2005). However, in 2002 a revised form of the agreement was published which included a price cap and deadline for cleanup that were previously not public knowledge. The price cap, set at \$8 billion, (U.S.

Environmental Protection Agency, 2006) was decided upon by the DOE before they had sampled and categorized the extent of contamination. Due to this factor as well as the new levels of plutonium allowed to remain after cleanup (detailed below), 86% of individuals and organizations who commented on the revised agreement rejected it. The new standard for allowable residual levels of plutonium in the soil was varied based on soil depth: 50 pic/g for the top 3 feet of soil, 1000 pic/g for soil from 3-6 feet, and no limit of residual levels of plutonium for soil below 6 feet (Moore, 2005).

This new revision raised many concerns for activists such as the Rocky Mountain Peace and Justice Center and local residents hoping for a thorough cleanup of the site. The \$8 billion price cap was certainly cause for concern, not only because the full extent of contamination was not understood before the determination of the cap, but also because the budget was set to be used for the demolition of the site's buildings and relocation of hazardous material, not just remediation of the natural environment of the site. After allocation of funds for building demolition and relocation of hazardous waste materials, a mere 7% (or \$473 million) was left for soil and water contamination remediation, according to LeRoy Moore with the Rocky Mountain Peace and Justice Center (Moore, 2005).

During the first year of cleanup, Kaiser-Hill transported most of the hazardous and radioactive waste to off-site facilities. They shipped 21.6 tons of weapons grade plutonium and uranium to the Savannah River site in South Carolina, and transported almost 20,000 cubic yards of transuranic waste to the Waste Isolation Project in New Mexico. Also sites in Tennessee, Texas, Utah, California, Nevada, Idaho, and Washington all received shipments of either radioactive or hazardous waste materials (Dreyer, 2005). Next, Kaiser-Hill oversaw the deconstruction of the nearly 800 structures located on the site, as well as the dismantling of the

1500 gloveboxes located on site. Materials that were contaminated by radioactive agents were transported to multiple off-site waste storage facilities. Kaiser-Hill completed the proposed cleanup about a year ahead of schedule by October 2005, and around a billion dollars under budget. None of the remaining money would be allocated to cleanup, while about half of this was given to Kaiser-Hill as part of the incentivizing program for a quick and cost effective cleanup (Moore, 2005) (U.S. Cong., 2006). The final amounts of waste removed from the site are as follows:

- 14.2 tons of weapons grade plutonium
 - 7.4 tons of weapons grade uranium
 - 292 tons of depleted uranium
 - 20,000 cubic yards of highly radioactive transuranic waste
 - 337,450 cubic yards of low-level radioactive waste
- (Dreyer, 2005)

The DOE adopted multiple innovative techniques for the cleanup process. One example is the use of cerium nitrate to wipe down equipment that would, before this treatment, have been described as transuranic waste; after the wipe-down, the equipment could usually be classified as low-level radioactive waste, and therefore easier and cheaper to ship and store (Abbotts, 2011). Another technique used to reduce cost and effort in disposal was to spray equipment with InstaCote™, which trapped the radiation within the coating, making leaks less likely. However, some areas of high contamination, such as building 771, were polluted to such a degree that the only possible way to effectively contain the radiation was to cut the building and foundation into pieces and ship as transuranic waste (Abbotts 2011). Transuranic waste, as defined by the United States Nuclear Regulatory Commission, is “material contaminated by transuranic elements,” which are “artificially made radioactive elements such as neptunium, plutonium, americium, and other- that have atomic numbers higher than uranium in the periodic table of elements.” (Transuranic Waste, n.d.)



-retrieved from Colorado Department of Public Health and Environment
(<https://www.colorado.gov/pacific/cdphe/rocky-flats>)

After the completion of the cleanup project, the site was formally divided into two post-remediation operable units: this consisted of a core operational unit which required continued monitoring, and a peripheral operational unit which consisted of the previous buffer zone (Abbotts 2011). These units were determined based on the previous use of the land; the core operational unit was the area of plutonium production during the site's operation, while the peripheral operational unit did not host plutonium production and therefore required less monitoring, according to the DOE. In 2007 the DOE issued the Rocky Flats Legacy Management Agreement, which stated that the central OU was to be monitored, regulated, and maintained by the DOE into perpetuity. Shortly prior to this agreement's release, the DOE created the Rocky Flats Stewardship Council, which became the stakeholder organization for the site, replacing the Rocky Flats Citizen Advisory Board. Also in 2007, the peripheral OU was separated and given to the US Fish and Wildlife Service for stewardship and facilitating the creation of a national wildlife refuge. This refuge, now named Rocky Flats National Wildlife Refuge, is currently restricted from the public, and can only be accessed by the public on guided tours hosted by the US Fish and Wildlife Service (USFWS) once a month. The USFWS declares on their website a projected opening date of Spring 2018, although this is certainly tentative as the projected opening date was December 2017 when I began this project. The core operable unit will remain under the control of the DOE for monitoring, with no plans for any transition of control or future

Post Remediation Site Division:

The map illustrates the Lindsay Ranch and Doe Retained Area. Key features include:

- Lindsay Ranch:** Located on the left, containing a "stabilize barn only".
- Doe Retained Area:** The central shaded region.
- Trails:**
 - Multiple Use Trail (hiking & biking):** Solid line with cross-ticks.
 - Multiple Use Trail (equestrian, hiking & biking):** Dashed line with cross-ticks.
 - Pedestrian Trail:** Dotted line.
- Off-Trail Use:** Indicated by a star symbol, with seasonal restrictions in the southern half of the refuge.
- Service Refuge Lands:** Shaded gray areas.
- Area Retained by DOE:** The central Doe Retained Area.
- Public Use Facilities:**
 - Interpretation & Environmental Education Facility (star in a circle).
 - Photography Facility (camera icon).
 - Observation Facility (telescope icon).
 - Regional Trail Connection (arrow icon).
 - Visitor Contact Station (house icon).
 - Developed Area (dotted line).
 - Overlook (star icon).
- Other Facilities:**
 - Refuge Entrance (star icon).
 - Maintenance (M in a circle).
 - Gravel Road (dashed line).
 - Trailhead (H in a circle).
 - Parking* (P in a circle).
 - Restrooms (R in a circle).
- Future Developments:**
 - Future Great Western Trail (dashed line with cross-ticks).
 - Future Westminister Trail System (dashed line with cross-ticks).
 - Future Aravada Trail System (dashed line with cross-ticks).
 - Future Aravada Trail System (dashed line with cross-ticks).
- Other Features:**
 - To Potential Future Trail Connection (dashed line with cross-ticks).
 - To Potential Future Road Connection (dashed line with cross-ticks).
 - To Future Great Western Trail (dashed line with cross-ticks).
 - To Future Westminister Trail System (dashed line with cross-ticks).
 - To Future Aravada Trail System (dashed line with cross-ticks).

Legend:

- Public Uses**
 - Multiple Use Trail (hiking & biking)
 - Multiple Use Trail (equestrian, hiking & biking)
 - Pedestrian Trail
 - ADA Accessible Trail
 - Off Trail Use (seasonally, in southern half of site only)
 - Service Refuge Lands
 - Area Retained by DOE
- Public Use Facilities**
 - Interpretation & Environmental Education Facility
 - Photography Facility
 - Observation Facility
 - Regional Trail Connection
 - Visitor Contact Station
 - Developed Area
 - Overlook
- Other Facilities**
 - Refuge Entrance
 - Maintenance
 - Gravel Road
 - Trailhead
 - Parking *
 - Restrooms

**Main parking area by Rock Creek/Lindsay Ranch trailhead will accommodate horse trailers.*

Safe Levels of Plutonium

the DOE decided on a significant amount of radiation to be left in the soil. The DOE claimed that those levels would be “safe” for a wildlife refuge worker, one who does not bring his or her children to the refuge and drinks little to no water from the refuge. In fact, numerous scientists have made the claim that there is no “safe” level of ionizing radiation, and that even a single particle of plutonium that is ingested into the body has the potential to cause cancer (Anonymous, 2005). In addition to these issues of “safe” levels of exposure, plutonium 239 has a half-life of 24,400 years, meaning that any molecules of plutonium 239 which were left at Rocky Flats will remain there for thousands of years, long after anyone alive today has left this earth (Strumenska 2013). The long half-life of plutonium forces us to consider the consequences of leaving a higher level of contamination after cleanup. Will this area still be a wildlife refuge 1000 years from now? What about 10,000 years from now? I would venture to say that developmental pressures paired with the forgetful nature of the human mind, will lead to this land being developed long before even a single half-life of plutonium has taken place.

Secrecy at Rocky Flats

Rocky Flats was the production site of plutonium triggers for nuclear weapons, and every nuclear weapon in the United States’ arsenal contained a trigger produced there. As a result, the site was subject to high levels of secrecy, and all workers employed there were required to have “Q-clearance,” the highest level of clearance for workers of nuclear facilities (Ciarlo 2009). In addition to the high level of clearance required of the workers, all areas of the site were compartmentalized, meaning that workers only knew what was going on in their specific sector and nothing else. Also, many of the facilities lacked reliable blueprint records as a way of protecting that information from a possible leak or spy infiltration into the facility. Another consequence of this was that the lack of blueprints for the facilities, including air ducts and ventilation units, made it difficult for those responsible for the cleanup to identify areas of high

contamination. The large degree of secrecy practiced at Rocky Flats had multiple implications for the closure and cleanup of the site. Firstly, the DOE believed its actions to be fully authorized and allowed under the Atomic Energy Act of 1954, meaning that they could not be held liable for these actions. In the initial stages of closure and cleanup after the 1989 raid, the DOE released little to no information on their operations.

Another detrimental consequence of this culture of secrecy, in reference to public relations, was the creation of a separation and substantial amount of resentment and distrust between the public and the Department of Energy. This has caused a great deal of friction in the implementation of remediation policy because environmental activists and concerned citizens are largely skeptical of any study or research that is conducted by the DOE or any government agency. Often times this culture of distrust creates a high-pressure situation for politicians who have not had much experience with the subject of Rocky Flats. This pressure can result in politicians being hyper-sensitive and cautious in their decision making which might manifest itself in a public perception of indecisiveness. This leads to a cycle where the public distrust leads to government officials refraining from action, which results in more public distrust. It is important to understand that the distrust of government officials by environmental activists and concerned citizens is ingrained in all community meeting and discussions hosted on the topic of Rocky Flats.

[Ethical Background](#)

Ethics, or moral philosophy, have been debated and developed for millennia, and therefore contain many distinctions and frameworks. In a general sense, ethics is a branch of philosophy that focuses on the determination of actions as right or wrong, and defending that determination with systemized concepts of moral obligation. Ethics are important because they

hold humans to a standard of action. Ethical theory attempts to give a basis for why, at the most basic level, one human should treat another with respect. As ethical theory has been further developed, this notion of respect has extended to numerous other aspects of human interactions with non-human entities such as plants, animals, and even inanimate objects such as rivers and mountains.

Deontology, Consequentialism, and Virtue Ethics

Before discussing the more specific disciplines of ethical theory, it is important to look at the broader distinctions in normative ethics. The first ethical approach to introduce is that of deontology. Deontology is the ethical position that views an action as moral if it adheres to moral rules or duties. A person's interests and duty should be the driving factor of his or her moral compass, assuming that one's interests line up with his or her duty (Bentham, 1983).

Additionally, at times a person's duty is at odds with the forces of his or her vices. The determining factor of a person's action as morally right or wrong is whether that action was in compliance with the laws of that time and place; that is the assumption of the Deontological ethical position. One condition that accompanies this viewpoint for many deontologists is that the laws must adhere to universalizable moral laws, and if they do not adhere, breaking that law is not necessarily wrong.

Consequentialism offers an alternative ethical theory to deontology. This position states that an action is morally right if it is the action which produces the best or most beneficial consequences of all the possible actions. Someone has made the "right" decision if his or her action results in the largest amount of positive benefits for the most people possible (Mulgan, 2005). This can often create a moral dilemma where a person is judged as acting in the wrong when they make a decision to support their own wellbeing over supporting the wellbeing of many others.

Finally, we must look at the approach of virtue ethics. This ethical approach values a person's virtues or moral character as a basis for assessing whether an action is right or wrong. An example of this would be if a person gives \$50 to a particular charity, the action would be judged as right according to the person's motivation of being charitable or benevolent, in contrast with deontology that would say it is right because the person is following the moral code of "treat others as you would like to be treated," or with consequentialism which would say that the action is right if it produced the most beneficial consequences. The morality of a person's actions is judged based on their motivating characteristics instead of physical consequences or stated rules (Hursthouse, 2013). It is necessary to understand these three frameworks of ethical theory in order to look at environmental and restoration ethics as both of these frameworks build upon ideas developed in deontology, consequentialism, and virtue ethics.

Environmental Ethics

Deontology, consequentialism, and virtue ethics set the stage for ethical theory with respect to how a human's actions affect other humans. Environmental ethics takes this framework to another level, and develops an ethical theory with respect to how humans interact with the natural world. There are multiple forms of environmental ethics that have developed throughout history. One of the most widespread and prevalent environmental ethic to emerge is one referred to as *anthropocentric* ethics, which means a human-centered ethical approach, and this form of environmental ethics has been at least touched on since the days of the earliest western philosophers. In anthropocentric environmental ethics, the natural world is valued or given moral consideration only to the point of which it provides benefits or services to other humans. Another way of explaining this is that we as humans have moral responsibilities regarding the natural world, however, we do not have responsibilities to the natural world (DesJardins, 2006). In this example, "regarding" means that we have moral responsibilities

which involve not destroying the environment because that causes harm to other humans, while “to” means moral responsibilities to the natural world itself, and not because of the value it provides to humans. Anthropocentrism likely was one of the first frameworks of environmental ethics to emerge because it is a rather linear extension of ethics and morals regarding interaction between humans, and actually just includes the natural world as another factor to be considered that might affect humans in terms of the services and benefits ecosystems provide. We can see an anthropocentric ethic expressed as early as writings by Aristotle, saying “it must be that nature has made all things specifically for the sake of man” (Aristotle, 1941). This ethical viewpoint has resulted in engraining human’s perceived dominance over the natural world for over two millennia.

Another form of environmental ethics to emerge more recently is referred to as *non-anthropocentric* ethics. This ethical standpoint developed as the culmination of multiple extensions of moral consideration, specifically to the non-human natural world. Previous ethical views made clear that one should not poison the environment lest his neighbors be poisoned as a result. As more complex environmental issues arose which took a longer period of time to have detrimental effects on human populations, such as increasing CO₂ levels in the atmosphere, moral consideration had to be extended to humans who do not yet exist, but will exist sometime in the future. This extension of moral consideration is still an anthropocentric extension. Eventually environmental degradation forced philosophers to further extend these moral considerations. The new extensions of moral consideration came to include non-human beings, and even non-living natural objects: plants, animals, insects, rivers, oceans, mountains, etc. This marks a shift in philosophy where humans no longer simply have responsibilities regarding the natural world, and now have responsibilities to the natural world (DesJardins, 2004). Different

philosophers disagreed on which specific aspects of the natural world moral consideration should be extended to and why.

One philosopher who has discussed non-anthropocentric ethics in detail is Joel Feinberg in his writing, “The Rights of Animals and Unborn Generations.” In this paper, Feinberg discusses the extension of moral consideration to animals on the basis that they have interests that can be disrupted, either negatively or positively, by human action. In this case he is speaking of extending ‘rights’ to animals, but this can be understood as an extension of moral consideration. When looking at the rights of plants, Feinberg says that they should not be given rights due to the fact that they do not have the “rudimentary cognitive equipment” that is crucial in having interests (Feinberg, 1974). Since plants cannot develop their own interests, they should not be extended rights or moral consideration. Although non-anthropocentric ethics can extend moral consideration to all animals, plants and natural objects, it is an extension on the individual level as opposed to the community level (DesJardins, 2004). Another non-anthropocentric ethical framework that differs from Feinberg’s view is biocentrism or life-centered ethics. Biocentrism goes one step further than Feinberg, and states that all living things should be extended moral consideration due to the inherent value of all living organisms (Derr, 2003). This framework extends moral consideration not only to animals, but to plants and bacteria as well. It is important to understand that this framework does not require that all living organisms be treated exactly the same, but rather that all living organisms have value in and of themselves.

The final view in environmental ethics that needs to be discussed is *holistic* ethics. In the holistic ethical view, moral consideration is extended to the natural world, but in contrast to non-anthropocentric ethics, holistic ethics extend this consideration to ecosystems and communities as opposed to individuals. This ethical view prioritizes the good of a species over the good of an

individual. An action is “right” when it results in the best possible outcome for an entire species or ecosystem. An example is that if there is a species of rat introduced to an island that is killing off large amounts of endemic species, then it is morally acceptable to eradicate the rat species, because that is what is best for the ecosystem as a whole, and because that species of rat exists elsewhere on the planet.

A prominent ethicist who has focused on this ethical view is Aldo Leopold, specifically in his book A Sand County Almanac. In the final chapter of his book, titled “The Land Ethic,” Leopold advocates for extending moral consideration to all natural organisms as well as natural objects, which he encompasses with the term the “the land” (Leopold, 1949). Leopold chooses to be rather simplistic when discussing the implications of this new ethic for what is right or wrong, but he does leave us with one statement that conveys his sentiment on the matter: “A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise.” (Leopold 1949). This quote reveals Leopold’s acceptance of the holistic ethical view; he values the good of the community over the good of an individual organism. Expanding upon this, the decision to have annual hunting seasons for white-tailed deer is considered to be morally acceptable because white-tailed deer are overpopulated and result in increased competition for other herbivores in the area. This decision to kill off a certain number of deer every year is one that prioritizes the good of the biotic community as opposed to individual organisms in the community, and therefore is considered morally correct under the holistic framework.

Restoration Ethics

The ethics section of this paper outlines numerous distinctions in ethical theory, beginning with the broadest, and narrowing down to more a specific ethical framework, environmental ethics. Environmental ethics are a set of principles that look at the interactions

between humans and nature in general, but for the purpose of this paper it is important to look at an even more specific ethical framework. Restoration ethics is an ethical framework encompassed within environmental ethics; however, it looks more specifically at the morality in the cleanup of damage done to the natural world by human activity.

To discuss the ethics surrounding environmental degradation and the possible restoration thereafter, we must first look at the writing by Robert Elliott, Faking Nature. In this book, Elliott introduces the concept of the “Restoration Thesis.” The restoration thesis states that restoration (re)creates something of equal value to that which was degraded. Elliott has two objections to the restoration thesis. First, he says that if restoration can create something that is equally valuable, then it justifies or even promotes degradation in the first place. Second, this concept diminishes the value of conservation, meaning that if we assume an ecosystem can be restored to its former value there is no reason to avoid the destruction of that ecosystem. Elliott goes on to layout his major arguments against the restoration thesis. (Elliott, 1997)

Elliott’s Arguments Against the Restoration Thesis:

- 1) Value comes partially from origin and history—and not just function and composition as ecology might assume.
- 2) Restored nature is a forgery of its predecessor—it’s not the ‘real’ thing.
- 3) In order for something to be natural, it requires that something to have no human disturbance—restored nature is of a different kind, it is artificial.

Essentially Elliott is saying that restoration is impossible, and even entertaining the notion that it is possible is simply an extension of anthropocentric ideals (Elliott, 1997).

In order to explain his second argument against the restoration thesis more thoroughly, Elliott utilizes a thought experiment centering around art forgeries. In this thought experiment

someone has forged a work of art. The forgery is exactly the same as the original in every possible aesthetic aspect, yet when viewers are told it is a forgery they value the work substantially less. This is due to the fact, according to Elliott, that value comes in part from origin. Works of art are valued partially because of who created them, when they created them, and why they were motivated to create the art in the first place. He then compares this to a restored ecosystem which is exactly the same as the previously degraded ecosystem as far as composition. Even though the ecosystem looks and functions the same as its degraded predecessor, it lacks equal value because of the difference in origin. The new ecosystem is a product of human intervention and perceived dominance over nature, while the original ecosystem is a product of natural processes (Elliott, 1997). This comparison, Elliott argues, shows how it is impossible to restore the value of a degraded natural habitat as a result of the shift in origin. This writing has set the stage for ethicists to either agree, refute, or expand upon Elliott's claims, and has led to numerous works centering around these premises.

One such ethicist who has taken the side of Robert Elliott is Eric Katz. Katz agrees with Elliott that a degraded environment cannot be restored to the standard laid out in the restoration thesis. Katz says that the assumption that human technology can fix or repair a degraded environment is not only incorrect, it is a dangerous assumption as well. He explains that this viewpoint takes an anthropocentric stance on environmental restoration, which is a stance that assumes a human domination over the natural world. Katz believes that this way of thinking has propagated the environmental degradation in the first place. Katz also makes a strong distinction between something that is "natural" and something that is an artifact. He says that the two labels contradict each other, and something which is an artifact cannot also be natural. The ecosystems which humans claim to be "restored" are in fact mere artifacts of human intervention, and

therefore lack all of the value that the previously natural ecosystem possessed. An artifact, Katz claims, is built with an intended purpose, while something that is “natural” does not have a specific purpose, and simply is. Although Katz agrees with many of Elliott’s assertions, Katz shows his skepticism for Elliott’s art forgery thought experiment by saying that just as we do not understand enough about the natural world to create adequate replicas of ecosystems, we also do not understand enough about art or art forgeries to make an accurate comparison (Katz, 1992). Basically Katz is saying that this comparison is rather arbitrary due to the unknown factors contained within the comparison. One important aspect to note about both Elliott’s and Katz’s stance on restoration is that they still believe that efforts should be made to mitigate damages done to the natural world, but they object to the assumption that this mitigation leads to restoration of the value of the ecosystem.

Andrew Light writes an essay responding specifically to Katz’s claims. He chooses to view restoration not as a way of restoring nature’s original value, but instead as a way of restoring the human relationship with non-human nature. Light lays out four different goals of environmental ethics, but asserts that the most important goal is to convince policy makers to implement policy that is in the best interest of the environment. This is a non-anthropocentric approach as it values the environment in itself, and not simply what the environment provides for humans. He then differentiates between two different types of restoration. Malicious restoration, Light says, is what is referred to in the restoration thesis that Elliott and Katz have critiqued, and is restoration that is used to justify the initial degradation. The other form of restoration is benevolent restoration, which is restoration that attempts to compensate for past harm, but is not used as a justification for degradation. Light explains that benevolent restoration is not addressed

by the restoration thesis, and therefore can be seen as beneficial without implying that it has completely fixed the initial degradation (Light, 2003).

Andrew Light and Eric Katz may have disagreed on restoration ethics, however they were able to come together to write a book outlining a relatively recent ethical theory, environmental pragmatism. Before looking at the more specific theory of environmental pragmatism it is important to understand pragmatism in the broader sense. Pragmatism is an ethical theory that breaks away from the three major forms of ethical theory described above: deontology, consequentialism, and virtue ethics. In contrast to these three theories, pragmatism does not require an absolute truth, innate belief, or indubitable “given” upon which to prescribe ethical guidelines. One aspect of pragmatism which all pragmatists agree on is the rejection of foundationalist epistemology (Light, 2005). An early pragmatist, William James, asserts that the statement that a certain belief is true, “is to say that the belief succeeds in making sense of the world, and is not contradicted in experience” (Light, 2005, pg.22). This central position in pragmatism creates an environment of a more practical ethical theory. Instead of spending countless hours debating the undeniable and irrefutable “truth” upon which the ethic is based, pragmatism allows for ethical standards to be created on a case by case basis in order to deal with problems that arise in society. In pragmatism, ethics are created in reference to human experience. The only “truth” that anyone knows for certain is the way in which they experience the world around them. Obviously there are countless different human experiences on the planet at any given time, and pragmatism says that each of these experiences creates a standard upon which ethical standards can be created on a case by case basis. As stated above, pragmatism is an attempt to have a more effective ethical theory that has the ability to be implemented in societal

problems rather than condemned to debate into eternity over whether the undeniable “truth” upon which the ethic is based is valid.

Environmental pragmatism is simply an extension of the ethical theory explained above to the natural world. As I have explained, there is often a large amount of debate over what form of value to use in creating an environmental ethic. The approach of environmental pragmatism says that the universal value of the environment is not as important as understanding that the natural world does have value, both to humans and to the natural world itself (Light, 2005). This approach is important with respect to the natural world because the environment is being destroyed on a massive scale every single day. Action is required now to combat these issues, and so it is not practical to debate over what attribute the natural world contains that allows us to give it value. Instead what is needed is an agreement on a set of ethics surrounding the environment that can be agreed upon due to shared experience, and that can be used in the production of protective policy.

Another ethicist who discusses his own idea of environmental restoration is John Basl. He asserts that there are two components to restoration, a reparative component and a remediative component. The reparative component to restoration requires that the responsible party fix or repair whatever was degraded to the greatest possible extent. He says that, “at a minimum an act of restoration must remove the traces of degradation” (Basl, 2010). For this component of restoration, Basl partially agrees with Elliott that a natural environment can never be fully restored to its former value. The second component of restoration, remediation, involves taking steps to make sure the wrongdoing does not occur again. This refers to actions such as shifting personal character or public policy to prevent a similar event from taking place in the future. This, Basl claims, is the important part of restoration, and the part which is fully

achievable in the case of environmental degradation. He comes to define a different type of restoration, termed restitutive restoration, where the remediative component of restoration is met, but it does not necessarily meet the reparative component of restoration. The reason why Basl says that it is important to develop this new type of restoration for environmental degradation is because it is often difficult to identify who or what is harmed by the initial degradation, and therefore difficult to prescribe remediation. However, if we are able to make steps in the direction of insuring that the degradation does not occur in the first place, then we can make amends for the damage by protecting against future damage (Basl 2010).

Looking at the DOE and USFWS

When looking at the ethics of remediation and cleanup of sites of environmental degradation, simply discussing what someone should or should not do according to an ethical standard often proves fruitless. What is necessary is holding those responsible for the cleanup to these ethical standards, especially since the actors almost never agree to or even know about these standards. What I have chosen to do in the case of the Rocky Flats cleanup project is to look at the posted mission statements and guidelines of the government institutions responsible for overlooking the cleanup and managing the post-cleanup site and appraise their work based on an ethical standard outlined in the discussion section.

I will start with the Department of Energy, the organization responsible for overseeing remediation of the site after its time operating as a plutonium trigger production facility and monitoring the inner operable unit after remediation. The Department of Energy does not generally have to declare their intent or purpose on any specific project to the general public, however those in charge have chosen to post a broad mission statement on their website which we can use to retroactively assess how the remediation project lines up with the DOE's mission. It reads as follows:

“The mission of the Energy Department is to ensure America’s security and prosperity by addressing its energy, environmental and nuclear challenges through transformative science and technology solutions.” (<http://www.energy.gov/mission>)

Even though this mission statement does not hold the DOE to much as far as an ethical standard, it does express the organization’s obligation to consider the environment in their operations. The Department of Energy also has a page under their mission statement section titled “Environmental Cleanup.” This outlines the Department of Energy’s mission for remediation projects stating,

“The Energy Department is committed to a safe, complete cleanup of the environmental legacy of five decades of government-sponsored nuclear weapons development and nuclear energy research. As part of this mission, we safely and cost-effectively transport and dispose of low-level wastes; decommission and decontaminate old facilities; remediate contaminated soil and groundwater; and secure and store nuclear material in stable, secure locations to protect national security.”

(<https://energy.gov/environmental-cleanup>)

The fact that this statement directly references the Department of Energy’s obligation to mitigate the environmental damage resulting from the nuclear weapons program provides a more specific standard of operation. This statement also details exactly what factors the DOE is responsible for cleaning up; transporting low-level waste, remediating groundwater and soil, decommission and decontaminate facilities, and safe storage of nuclear material.

The next governmental organization which I will address is the US Fish and Wildlife Service. The USFWS has had no responsibility for the remediation of the Rocky Flats site; however, they are responsible for the stewardship of the exterior operable unit that was

previously the buffer zone. The USFWS has significantly more standards of operations posted on their website as opposed to the DOE. Their official mission statement reads as follows:

“The mission of the U.S. Fish and Wildlife Service is working with others to conserve, protect, and enhance fish, wildlife, plants, and their habitats for the continuing benefit of the American people.” (<https://www.fws.gov/info/pocketguide/fundamentals.html>)

They also have a set of “Conservation Principles” posted on their website which lay out their ethical position in reference to conservation. Some of these conservation principles are listed below:

- **“Our ethic is to conserve natural resources for future generations**
- **“Our work is grounded in thorough, objective science.”**
- **“We hold ourselves to the highest ethical standards, strive for excellence and respect others.”** (<https://www.fws.gov/info/pocketguide/fundamentals.html>)

The final institution that I wanted to try to find a mission statement to hold to a self-prescribed ethical standard is Kaiser-Hill, the private company responsible for executing the remediation. Unfortunately, I could not find a posted statement, or even a website for the company. This is a result of the temporary nature of Kaiser-Hill, which was a joint venture formed between CH2M Hill and ICF Kaiser specifically for the Rocky Flats cleanup job. I will discuss the implications of the posted mission statements of the organizations above in further detail in the discussion section.

A short note on this section: I decided to use the mission statements of these organizations as a basis for an ethical evaluation of their actions. Unfortunately the mission statements of these organizations are not necessarily legally binding, but the lack of any other concrete ethical standard led me to utilize this standard in my analysis.

Discussion

The cleanup and remediation of the Rocky Flats Plant Site is a complex story, with a vast array of information published concerning this topic. The question that this paper addresses is how does the determination of the Rocky Flats Plant site as “safe” align with the stated ethics, or mission statements, of the organizations responsible for the cleanup and management of the site? After analyzing the information available on this subject I conclude that the Rocky Flats Site remediation project was completed in an ethical manner. I have reached this conclusion as a result of my choice to use the ethical approach of environmental pragmatism.

To begin, it is important to note the “exceptional” project management of the Rocky Flats Plant remediation project (Cameron & Lavine, 2006). Before remediation began, as well as during the project, many believed that this was an impossible task with no real solution available. The Department of Energy’s contractor for the project, Kaiser-Hill, took on this burden, and completed the project in less time than was allocated to them by the DOE. Those who work in the remediation industry hail this project as a milestone for remediation project management. Kaiser-Hill, encouraged by the incentive structure implemented by the DOE, utilized innovative techniques to both reduce cost and time required for the completion of the project. I chose to address this at the beginning of my discussion section because it is important to realize that while there are many who denounce the Rocky Flats remediation project as a failure, those who work in the industry view this project as a success. A testament to this can be gathered by simply reading the title of the book: Making the Impossible Possible: Leading Extraordinary Performance: The Rocky Flats Story. An important note to make on this subject is that those in the remediation industry who hail the success of this project are largely assessing the project on terms of process of completion rather than level of remediation. The level of remediation in this case was predetermined by the DOE, and therefore Kaiser-Hill, according to those in the

industry, should not be assessed on the degree of remediation, but rather the efficiency and effectiveness of their remediation project.

Before discussing the ethics surrounding the remediation of Rocky Flats, I must first look at the factors that went into the determination of the site as “safe” by the Department of Energy and the contractor Kaiser-Hill. I have isolated three primary factors that influenced and contributed to the determination of the site as “safe”: economic factors, setting a deadline, and scientific assessment. These factors were crucial in determining the speed, level, and scope of the remediation project.

The economic factor, which I referenced in the background section, set the parameters for the scope and level of remediation completed at Rocky Flats. The DOE decided, initially behind closed doors, to set a monetary price cap at \$8 billion in 1995, before the remediation project began (Moore, 2005)(U.S. Environmental Protection Agency, 2006). Many activist groups, such as the Rocky Mountain Peace and Justice Center, expressed outrage at this price cap, which they claim was determined without fully understanding the extent of plutonium contamination on site. The DOE refutes this claim, and in response to public demands from local activists and institutions such as the Rocky Mountain Peace and Justice Center, the DOE set a new level of allowable levels of plutonium radiation to remain in the soil. This 3-part standard of radiation levels based on soil depth was laid out in 1996 in the Final Rocky Flats Cleanup agreement, and even though this agreement lowered the allowable levels of residual plutonium in the soil many activists did not support this new level. There is no denying that the monetary price cap set by the DOE for Kaiser-Hill impacted the degree of cleanup, primarily because the possible level of soil cleanup is a direct function of the funds available for the project. Even though many state that this price cap determined the level of cleanup at a premature time, the fact that every project

needs a plan of action supports this price cap decision. The price cap of \$8 billion is no meager sum, and some say that simply throwing money at a problem does little to solve the issue. One aspect of the budgeting that raises some concern is that only a fraction of this monetary sum was used for actual soil and water remediation. Large portions of the budget were required for demolition of existing structures, as well as transport and storage of the radioactive waste on site. Roughly \$500 million of the budget was given to Kaiser-Hill as an incentive to finish the project by the deadline determined by the DOE (U.S. Environmental Protection Agency, 2006). While this large incentive payment raises the question of why this money could not be used for further cleanup, I have found that the incentive structure greatly increased the efficiency and speed of the project by encouraging Kaiser-Hill to plan out the project before execution.

Similar to the economic factors of determining the Rocky Flats Site as “safe,” the factor of time, or imposing a deadline on the project, contributed to setting the scope and level of cleanup. In addition, the deadline was the primary determining factor in the speed of the cleanup. Before this project, the DOE came under harsh criticism for its lengthy and often incomplete remediation projects. They made the decision to make the Rocky Flats remediation project an example of their ability to conduct a quick and effective cleanup. As a result, they set the timeline for the remediation project at 10 years. This deadline was also the motivation for the half a billion dollars in incentive fees paid to Kaiser-Hill for completing the project before the deadline. Many innovative techniques arose as a result of this monetary incentive, such as the InstaCote (TM) technique discussed above which not only reduced the time required for shipment and storage of transuranic waste products but also reduced the cost. Although many express concern that rushing a project can lead to mistakes, it appears that Kaiser-Hill was able to reach a happy medium in which they completed the remediation project quickly and safely, as

shown by the lack of accidents during the project. Additionally, critics of the cleanup project often cite the speed with which the project was completed as a downfall however, I would argue that extending a project over another few years would have done little to increase the thoroughness of the project, while also allowing contaminants that had not been reached yet to spread.

The final factor that contributed to the determination of the Rocky Flats Site as “safe” was the scientific aspects of radiation exposure. When setting the limits of residual levels of plutonium in the soil, the DOE needed to determine the future use of the site. The DOE eventually settled upon giving the peripheral operable unit to the US Fish and Wildlife Service for use as a National Wildlife Refuge. As a result of this decision, the DOE determined the “safe” levels of residual plutonium in the soil to be one that leaves the land “safe” for the person that would most frequently utilize the land, a USFWS refuge worker. This determination is what allowed the DOE to set the residual levels of plutonium at a level which would be unacceptable for the site if the future use was to be a residential or industrial complex. While those who oppose the project might say that this is an attempt to reduce the amount of work put into the project, I agree with the chosen future use of the site. I see no reason for an area that was previously utilized for the production of nuclear weapons to be used as land for residential or industrial use. Turning the site into a wildlife refuge gives at least something to the natural world from which we have already taken so much. This location provides a sanctuary to animals that reside in both mountainous and grassland ecosystems. All in all, the decision to designate this area as a wildlife refuge allowed the DOE to clean the site to a lower threshold than would be required for a more utilized future. This is not necessarily a bad decision, and as long as this less comprehensive cleanup project is accompanied with constant monitoring and as-needed

remediation into the future, as promised by the DOE, then this could be the best option, both financially and from a management standpoint.

Now, returning to the ethicality of this project, I will look first at Robert Elliott, who has provided a strong basis for my conclusion. He says that nature can never be fully restored, and compares the notion of ecosystem restoration to a forgery of a work of art. In this comparison, Elliott states that like a forged work of art, a degraded ecosystem that is restored can never hold the same value as the original ecosystem. At first glance, this seems to be an impassable road block to ever completing an ethical environmental restoration project however, this is not the case. Instead this ethical stance says that any attempt to pass off a restored ecosystem as equal in value to the original is misleading and unethical. So as long as the restoration or rather remediation project is not an attempt to restore the full value or perception of that value of the original ecosystem it can still be an ethical and effective project. Embracing this stance, it becomes clear that the Rocky Flats remediation project can never fully succeed in restoring the original value of the site, or even fully mitigating the damages done to this ecosystem. Once we accept this, the ethical evaluation of the project becomes based on the effectiveness of the remediation in comparison to the technology and finances available, as well as the mission of the project and mission statement of the overseeing agency, the Department of Energy.

As discussed in the previous section, “Restoration Ethics”, environmental pragmatism is an ethical stance that says one is not required to adhere to a single monistic ethical framework. Instead, an environmental pragmatist can put together multiple ethical principles that do not necessarily have the same theoretical basis, but that promote the health and stability of the environment and the natural world for each particular case. The case that I am addressing is the

remediation project for the Rocky Flats Plant site. The principles that I have adopted to evaluate the effectiveness of this project are as follows:

1. A responsibility to protect the health and wellbeing of current local residents in close proximity to the site.
2. A responsibility to protect future generations.
3. A responsibility to protect the natural world, including plants, animals and the ecosystem as a whole; this includes current and future generations.

The most immediately pressing responsibility of the Department of Energy in conducting the remediation project is to protect the health and wellbeing of current local residents living in close proximity to the Rocky Flats Site. During the plant's operation, and for years after its closure, workers who oversaw production at the plant were diagnosed with a variety of illnesses and cancers, with most medical professionals agreeing that radiation exposure was the cause. In the years following the closure and remediation of the Rocky Flats Site, there has not been a single case of cancer or illness linked to radiation exposure at the site post-closure. The fact that no one is currently being harmed as a result of radiation exposure from Rocky Flats (meaning there has been no reported cases of harm from Rocky Flats radiation exposure) leads me to conclude that the DOE and Kaiser-Hill have fulfilled this responsibility of protecting the health and wellbeing of local residents.

Next, the Department of Energy has a responsibility to protect future generations from radiation exposure emitted from the Rocky Flats Site. One issue that opponents to the cleanup project express is that erosion will eventually expose the deeper sections of soil that were left with higher levels of plutonium contamination. This poses a risk to the DOE's responsibility to

future generations, especially since plutonium has a half-life of around 24,000 years. The DOE asserts that it will continue to monitor levels of plutonium and other harmful toxins in the soil and water of the Rocky Flats Legacy Site, also known as the core operable unit where production occurred during the operation of the plant. This obligation is accompanied with the implication that the DOE will take steps to remediate any areas where they have noticed a rise in contaminants in the soil or water. As long as the DOE operates on the premise of this obligation, they will be fulfilling their responsibility to protect future generations against radiation exposure coming from the Rocky Flats site.

The final responsibility of the DOE is to protect the natural world, including plants, animals, and the ecosystem as a whole. This responsibility is in reference to current populations, as well as organisms that will reside in the Rocky Flats Wildlife Refuge in the future. As stated previously, the Rocky Flats Wildlife Refuge is home to numerous species of plants and animals, including a herd of hundreds of elk. During the operation of the Rocky Flats Plant, no elk herds resided on site, so the presence of this herd is a testament to the steps taken by the DOE and USFWS to restore the natural order of the natural ecosystem. I do have concerns for animals such as the prairie dog, which burrows deep into the ground, as the higher levels of plutonium in the deeper layers of soil might be exposed as a result of their burrowing. This factor creates a need for the DOE to monitor the health of burrowing animals such as prairie dogs into the future. As of yet, the DOE has no legal obligation to monitor animal health on the site. I recommend that this obligation be added to the DOE's list of priorities in the future, or that the USFWS take on this responsibility. The issue with burrowing animals aside, the Rocky Flats Site is now hosting healthy plant and animal life, and therefore the DOE has fulfilled this responsibility.

One method of analyzing the morality of remediation projects completed by the Department of Energy, which I have chosen to utilize in this paper, is to compare the results of the project to the DOE's mission statements and statements of intent. To start, the DOE says in its statement of intent on environmental cleanup that they are "committed to a safe, complete cleanup of the environmental legacy of five decades of government sponsored nuclear weapons development" (<https://energy.gov/environmental-cleanup>). The two keywords in this statement are "safe" and "complete". The Department of Energy held contractor Kaiser-Hill to strict safety standards while conducting the cleanup operation. While most of the remediation was completed without incident, there were a few occurrences of breaches in safety protocol (Anonymous, 2004). There was a fire in a glovebox during decommission as well as a reversal in airflow ventilation resulting in radioactive material spreading into rooms within the building, however no radioactive material was released outside of the Rocky Flats facilities (Anonymous, 2004). This cleanup operation spanned almost a decade, with multiple different types of facilities and areas being remediated. Any project of this size is bound to experience mistakes, and due to the low frequency of incidents during the project, I conclude that this project was conducted to the standard of "safe" self-prescribed by the DOE.

The next standard that the Department of Energy holds itself to with regards to environmental cleanup of nuclear facilities is that the cleanup is "complete." This standard creates some issues due to the subjectivity of the term "complete." Many stakeholders in the Rocky Flats remediation project, such as the Rocky Mountain Peace and Justice Center, argue that this project has not come anywhere close to "complete", and that this designation would require decades more of cleanup efforts. This notion expressed by the Rocky Mountain Peace and Justice Center is similar to views expressed by Robert Elliott and Eric Katz; a view that says

an ecosystem can never be fully remediated, and a defeatist view in my opinion. While I agree with this notion to a certain degree, radioactive contamination on the level seen at Rocky Flats can likely never be cleaned up to background levels. As a result, we are forced to accept a cleanup that results in “safe” levels of radiation for the current populations living near the site. The Department of Energy, through contractor Kaiser-Hill, has cleaned the Rocky Flats site to radiation levels that are “safe” for those living near the site for the time being. They have not cleaned the site to a level that allows them to claim safety for surrounding populations forever, but they have adopted a mandate of monitoring radiation levels into perpetuity in order to identify and mitigate any spikes in radiation that might result from natural events such as erosion. It would be inefficient to pour resources into this remediation project in an attempt to clean the site to a level that allows safety to all future generations. Not only would we be wasting taxpayer’s money on the immensely extensive cleanup, but also there is no way to tell for sure if all radioactive material was eradicated from the site. As a result, there would be a mandate for monitoring into perpetuity regardless of the perceived extensiveness of the remediation project. Due to these factors, I conclude that the cleanup operation was conducted to the DOE’s self-prescribed standard of “complete,” under the condition that they fulfil their obligation to monitor the site and mitigate any dangerous increases in surface radiation into perpetuity.

In their statement of intent on environmental cleanup, the Department of Energy goes on to say, “as part of this mission, we safely and cost effectively transport and dispose of low-level wastes; decommission and decontaminate old facilities; remediate contaminated soil and groundwater; and secure and store nuclear material in stable, secure locations to protect national security” (<https://energy.gov/environmental-cleanup>). I have already discussed the safety of the cleanup operation. The next important term used in this statement is “cost effectively.” Kaiser-

Hill has often been praised for their cost effective, quick, and efficient cleanup of the Rocky Flats site. A book was even written as a testament to this efficiency titled Making the Impossible Possible: Leading Extraordinary Performance—The Rocky Flats Story by Kim Cameron and Marc Lavine. Kaiser-Hill utilized numerous innovative techniques, both to speed up the cleanup process and reduce the costs of the project. One such technique was the use of InstaCote™ to allow transuranic waste to be classified as low level radioactive waste, greatly reducing the cost of shipment and storage of the waste (Abbotts, 2011). Another technique utilized to reduce the time and cost of the cleanup project was the use of explosives to demolish buildings that needed to be dismantled. This allowed for much less time, and consequently money, to be used in the dismantling of buildings deemed to be safe enough for explosive demolition. Due to these factors, I conclude that the DOE held up its self-prescribed mandate of completing the cleanup in a cost effective manner.

Wrapping up my thoughts from this paper, I conclude that the Department of Energy completed the remediation of the Rocky Flats Plant site in an ethical manner. I have come to this conclusion by adopting the principles of environmental pragmatists, and consequently using my own ethical framework upon which to evaluate the Department of Energy's remediation project. Additionally, I have compared the actions taken by the Department of Energy during the project with the organization's self-prescribed ethics in the form of mission statements. These factors, in conjunction with the reality of our technological on economic ability at this time, has led me to conclude that the Rocky Flats Plant site remediation project was completed to the ethical standard self-prescribed by the Department of Energy, as well as the ethical standard which I have developed in this paper.

A final note on this project is the nature of policy implementation practices used by the Department of Energy and the Federal Government in dealing with the remediation of the Rocky Flats Plant site. Whenever a new policy or agreement was proposed by the DOE or the Federal Government there was rarely, if ever, a name associated with the policy or agreement being presented. I have concluded that this is a result of a couple of factors; secrecy and liability. First of all, the inherent secrecy associated with a site responsible for national security and nuclear arms production leads to tremendous roadblocks for transparency. I have discussed numerous ramifications of this secrecy in the background section above, but another consequence of this secrecy is that individuals within the government were often not linked to policy concerning the site. This was likely a result of no single administrator or politician wanting to take responsibility for a site which has so much of its history shrouded in secrecy. This connects to the second reason for the faceless implementation of policy I am describing; liability. None of the administrators in the DOE or politicians in the Federal Government want to be held singularly responsible for any issues or unforeseen consequences that might arise from the Rocky Flats remediation project. An easy way to avoid this is to simply implement policy through the corridor of large institutions with numerous departments and employees, because it is more difficult to hold a large institution responsible than it is to hold an individual responsible for mistakes made. This has materialized in my paper through the constant use of terms such as “the Department of Energy” or “the Federal Government” when referring to the actors that proposed policy and agreements regarding the Rocky Flats Plant remediation project. I am noting this here to acknowledge the broad terms which I used in my paper when discussing actions of the governmental institutions responsible for remediation.

Previous Work

An immense amount of previous research exists around the subject of remediation of nuclear contamination in the environment. Governments across the globe have funded research to look at the damage done to the environment by both nuclear arms production waste and nuclear power waste, as well as research into techniques to clean up this damage. On the other hand, there has been almost no research looking specifically at the ethicality of these remediation projects. I have not found any research that focuses solely on the ethicality of remediation of nuclear weapons production facilities in general, but interestingly enough there is one piece of research that looks at ethics surrounding the Rocky Flats site. This article, *Transnatural Ethics: Revisiting the Nuclear Cleanup of Rocky Flats, CO, Through the Queer Ecology of Nuclia Waste*, takes a look at the cleanup of Rocky Flats and its relationship with waste, nature, and the queer community (Krupar, 2012). The paper looks at the ethics surrounding the binarisms that have developed around waste/nature and humans/nature. The author of this paper, Krupar, chooses to use the lens of a Denver-based drag queen comedian named “Nuclia Waste” to look at the binary relationship between the public and Rocky Flats, an interesting perspective to say the least (Krupar, 2012). While this paper does not look into the morality of the remediation actions conducted during the cleanup of Rocky Flats, it does show the public’s interest in the culture surrounding the Rocky Flats remediation project. My paper provides a different perspective because I focus specifically on the ethics surrounding the remediation project as a whole.

Recommendations

After completing this analysis, I have come to several recommendations for further research. First of all, for further work it is crucial that an independent party continue to watch the

Department of Energy to assure that they are holding up their obligation to the public in the case of monitoring and remediating the Rocky Flats site inner operable unit.

Due to the nature of government institutions as well as humans in general to forget the past quickly, I recommend a safety measure be implemented by law to hold the Department of Energy to its standard of monitoring the Rocky Flats site into perpetuity. This situation requires action by congress to pass legislation requiring the Department of Energy to survey the core operable unit every decade, and posting the information collected on a public forum. This should include average levels of plutonium contamination in the top three feet of soil, as well as a report on the status of erosion of the top soil. Not only would this legislation require the Department of Energy to monitor the levels of plutonium, but would also require the DOE to take remediative action if the residual levels are above the determined “safe” levels for the site for the original remediation project. The final aspect of this legislation would require that this action be completed by the Department of Energy, or any institution that replaces the Department of Energy, into perpetuity. The half-life of plutonium is over 24,000 years, therefore it is crucial that this obligation to monitor and remediate be in effect for at least that period of time. In addition to this, the US Fish and Wildlife Service has an obligation to monitor the health of plant and animal species living in the peripheral operable unit, or what is now known as the Rocky Flats Wildlife Refuge.

I believe what is needed for further research is a thorough assessment of the ethicality and effectiveness for all of the Department of Energy’s remediation projects for nuclear production facilities. In addition to this, I recommend further research on techniques to more effectively clean up plutonium contamination in soil and groundwater. If new and innovative

technique arises, there is the potential to clean the Rocky Flats site to a further extent in a cost effective manner.

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