

The Safety of Uranium-based Energy Sources in and around the Maryland Area

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“I pledge on my honor that I have not given or received any unauthorized assistance in the completion of this assignment. All work contained herein is my own. All referenced work is cited correctly.

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Abstract

This paper will evaluate the effects of nuclear energy, while addressing whether or not certain benefits provided by the use of nuclear energy are efficient enough to outweigh any negative side effects that can and do occur from the proliferation of this material. There was a general focus in the Maryland area, with some reference material coming from other locales. I have used research questions as guidelines for my investigation. I will organize the presentation of my research findings by questions, using each source to answer that specific question. I have included one primary and two secondary questions to help steer my research in a direction that would be beneficial in terms of testing my hypothesis. My primary research question is “do the benefits of nuclear energy outweigh its moral or ethical cost?” My secondary questions are “given the effects of the earthquake in Japan, how safe are plants like *Calvert Cliffs* (MD)” and “can these plants operate at a safe (low) level of environmental impact while being cost effective and providing an alternative to fossil fuels?” My hypothesis is if the effects caused by nuclear energy are not detrimental to the population that surrounds the plant and if the Chesapeake Bay ecosystem as a whole is not harmed, then nuclear energy is a viable and beneficial form of alternate energy. I find that many of my sources agree with this hypothesis, while there are others that are not so welcoming of it. I will use a host of different media of sources including but not limited to scholarly articles, journalistic pieces, books, and online sources.

Key Terms: *Calvert Cliffs*

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Nuclear energy is one of the most utilized ways of creating energy on a large scale. In recent years, it has become popular as a replacement to fossil fuels and petroleum, yet it has also come under fire due to its suspected negative environmental effects. I have narrowed the scope of my research to findings directly pertaining to the operation of nuclear power plants in and around the Maryland area. I have chosen to evaluate the effectiveness of nuclear energy through the lenses of a few research questions. I chose one primary research question and two secondary ones. The primary question is “do the benefits of uranium-based energy outweigh their moral or ethical costs?” The secondary questions are “given the effects of the earthquake in Japan how safe are plants like Calvert Cliffs (MD)” and “can these plants operate at safe (low) levels of environmental impact while being cost effective and providing an alternative to fossil fuels?” My hypothesis is that if the effects caused by nuclear energy are not detrimental to the population that surrounds the plant and the Chesapeake Bay ecosystem as a whole is not harmed, then nuclear energy is a viable and beneficial form of alternative energy. Those affected by this issue are populations surrounding the plants, people who are part of the adjacent water systems, the Chesapeake Bay wildlife population, and possibly locales that are significant distances away (say, in the event of a severe nuclear meltdown).

Primary Research Question

In her “‘Clean’ Nuclear Energy? Global Warming, Public Health and Justice,” Virginia Sharpe writes about the impact that nuclear energy has on the energy discussion. She begins her article by quoting the governor’s attitude toward adding another nuclear power plant along the Chesapeake Bay shoreline. Sharpe writes “‘it is a huge moral challenge and it is a moral imperative . . . given what massive new burning of coal will do to the planet if we don’t develop

better and cleaner technology including safer and cleaner nuclear” (2008, p. 16). The issue of developing energy is considered the moral challenge, a challenge in preserving our planet for future generations. In a way, my question is flipped. Here, the development of nuclear power is considered a moral response, almost a moral obligation in the process of developing better and cleaner energy. This answers my primary question by posing the expansion of nuclear energy as a moral obligation. She later goes on to say that “policy deliberation about the proposed renaissance of nuclear power must take in to considerations the disproportionate health risks associated with uranium extraction, processing, enrichment, waste storage and nuclear accidents” (Sharpe, 2008, p. 16). This statement echoes my initial question of the maintenance of ethical principles in the exploration of nuclear energy. Ms. Sharpe talks of incorporating a human rights component to the process of awarding uranium-mining claims in this country if this “nuclear renaissance” is to continue by saying “if we go forward with nuclear power, any morally tenable nuclear energy policy must incorporate enforceable human rights protections into the uranium extraction process” (2008, p. 18). I agree with all of these statements and also believe that if these suggestions were to be imposed, a possible negative effect of nuclear power can be negated.

A study was conducted by the Maryland Department of Natural Resources in the *Calvert Cliffs* area. Their findings show that particles released from the plant called radionuclides are in healthy levels. They say

the concentrations of radionuclides found during this monitoring period do not represent a risk to the ecological health of Chesapeake Bay or Susquehanna River. The concentrations of radionuclide in sediments and biota would increase the radiological dose to humans by no more than 0.3% above the dose received from natural and other

man-made sources.” (Hood & Jones, 2010, p. v)

This study shows that the Bay and the area surrounding the power plant are not affected by radionuclide. This research, at least in part, confirms my hypothesis of the safety of this type of energy.

Several years ago, marine biology labs from several universities participated in an examination of the biological ecosystem of the Chesapeake Bay in the vicinity of *Calvert Cliffs*. While these studies are outside of the range of contemporary data, they are still helpful in understanding the how these reactors affected their area of the Bay. They concluded from their studies that, “there has been no demonstrable effect in phytoplankton standing stock or metabolism in the vicinity of the *Calvert Cliffs* nuclear power plant” (Kachur & Sellner. ed. Heck, 1987, p. 238). The study says that the “detectable impacts from plant operation are surprisingly small” (Heck. ed. Heck, 1987, p. 280). This analysis answers my question by laying out that, back at the time of this study, there was little impact from this nuclear facility. This evidence confirms my hypothesis because it states there were only insignificant harm to the plant and animal life.

One other thing to think about is the possible effects on the health of people that work at this plant. Several years ago a study was done that looked at the causes of death of plant employees. The study found that “although these studies have failed to link convincingly the adverse health factors with radiation exposure, elevation in diverse tumors have been reported” (Jablon and Boice, 1993, p. 430). This is an important piece because it shows the possible adverse effects of nuclear radiation caused by this plant. This source really does not answer my research question because it does not give a definitive answer. The statement above, however, does help to affirm my hypothesis.

Secondary Research Questions

SQ1. Can Nuclear Energy be Safe and Cost Effective?

As one might guess, the operation and maintenance of nuclear power stations is certainly expensive. This concept leads into my question; can nuclear energy be safe and cost effective? I found that the answer to the preceding question sometimes is no. My research has informed me that here are times that plant owners try to “cut corners” to save on operation expenditures. Many plants (like *Calvert Cliffs*) try to be thrifty with the resources they have, not to imply that the owners of these plants do not have enough capital to operate at peak performance. In fact, there was an incident that occurred where Constellation Energy decided that in order same money that would overuse some parts,

to save money, the company decided to test the performance of the devices rather than replacing them automatically. . . .The company stopped the routine replacement program before instituting the new regime for testing actual conditions. As a result, a worn-out device failed to prevent electrical problems.” (Lockbaum, 2011, p. 11-12)

Because this source allows me to answer this question in a negative way, it impedes the crux of my hypothesis.

The construction of new reactors or the refurbishing of old reactors around the country is very expensive and can take years to complete. A study written by Mark Cooper was published in the *Bulletin of the Atomic Scientists*,t reasserting the fact that the production of nuclear power is very expensive. Cooper says “severe accidents like Three Mile Island, Chernobyl, and Fukushima shine a spotlight on safety issues, which creates a major challenge for nuclear economics because safety can be extremely expensive” (2012, p. 62). Many regulations enforced by the Nuclear Regulatory Commission have indirectly caused the early shutdown of parts and

components. These components have “been shuttered before their licenses expired or kept offline for lengthy periods of time . . . They are not worth repairing or keeping online when new safety requirements are imposed, or when the reactors are in need of significant repair” (Cooper, 2012, p. 65). While these regulations may be helpful in stopping a possible disaster, they only aid in jacking up the price of the nuclear market. This source agrees with the previous one in playing a role in refuting my hypothesis; nuclear energy can be safe or it can be inexpensive, but it cannot be both.

SQ2. Given the effects of the earthquake in Japan, how safe is a plant like *Calvert Cliffs* (MD)?

One of the effects that natural disasters have man-made structures is that they help to point out structural problems and suggest new building and safety codes. Certainly no one wants a natural disaster, especially not ones that hit a nuclear power plant like in Fukushima, Japan. These events bring with them a reevaluation of the efficiency and effectiveness of building safety plans. The disaster in Japan meant “more people looking more carefully at a reactor’s track record, but even more importantly more people paying attention to the ongoing struggle with safety” (Cooper, 2012, p. 67). These rare freak-happenings in nature show the vulnerable these facilities. With that said, they are few and far between, but there is always that “what if.” Since the Japan incident, the “US, Japan and the EU have issued safety recommendations in response to the Fukushima accident” (Cooper, 2012, p. 67). He mentions that the group responsible for publishing the *Bulletin of the Atomic Scientists* has been tracking several instances of safety in US plants. Cooper states that the group “tracks ongoing safety issues at operating nuclear reactors in the US, [and have found that] leakage of radioactive material is a pervasive problem at almost 90% of all reactors, as are issue that pose a risk of accident” (2012, p. 67). As seen

above, there have been new measures taken by the US government to further the safety effort in nuclear power plants. This partially answers my second secondary research question; while natural disasters can be devastating, there are efforts to tighten safety regulation. While this article answers my question, it reveals information that does not support my hypothesis.

My research has now taken me to a document published by the Federal Register pertaining to the desired license renewal of *Calvert Cliffs* nuclear plant. The document tells of how the plant is seeking an exemption in a regulation by imposed by the Nuclear Regulatory Commission. It is an exemption that “would allow *Calvert Cliffs* to sequester sufficient individuals to staff two 12-hour shifts to maintain safe and secure operation during severe weather conditions” (Evans, 2012, p. 47122). This is a response to the events in Japan to help to have sufficiently safe emergency working conditions. It also says that the “exemption expands the allowance for tropical storms or hurricane force winds or severe winter precipitation that may or may not result in the declaration of emergency” (Evans, 2012, p. 47122). It then goes on to state that “such an allowance supports sequestering personnel to provide for shift relief, which is necessary to provide a safe and secure status of the units and ensure adequate protection of the health and safety of plant personnel and the public” (Evans, 2012, p. 47122). It shows the nuclear communities’ desire to make plants more safe and prepared for these disasters. These measures help to support my hypothesis and answer my research question.

I found an article in *The Baltimore Sun* that addresses the concern of a woman who lives just miles from a southern Pennsylvania power plant. The article gives her a response from a few spokespeople from the NRC, “the 104 nuclear plants in the US . . . are ‘safest in the world.’ Each has redundant safety systems and highly trained workers ready to respond to all manner of emergencies” (Wheeler, 2011, para. 5). Later it goes on to say “we don’t have any reason to

believe that the US plants are not safe . . . the Japanese reactors were confronted with a very unlikely set of circumstances” (Wheeler, 2011, para. 6). This source is important because it answers my question in a positive way. It affirms the thought that even with the geographical placement of *Calvert Cliffs*, it can be safe to operate. I believe this source helps to support my hypothesis.

I found another source from *The Baltimore Sun* that echoes the argument of several previous sources- that the plant at *Calvert Cliffs* is indeed safe. George Vanderheyden, vice president of *Calvert Cliffs* says that the plant “could withstand a catastrophe, like a plane crash or a 350 mile wind or a tornado or steam explosion out of one of the generators without any release of radioactive material. . . We have backups for our backups” (Mirabella, 2004, para. 3, 9). This information supports the fact that safety is a key component in the operation the *Calvert Cliffs* nuclear plant. It supports my hypothesis as well as answering my question.

Conclusion

I researched the “cause-effect” between several aspects of the nuclear market economy. These correlations can affect many people worldwide, but my focus was on *Calvert Cliffs*. I have found that nuclear energy is very expensive, can provide a cleaner alternate source of energy compared to fossil fuels, and *can* be harnessed in way to ensure public and environmental safety, all while being *potentially* very dangerous if used incorrectly. Some solutions to this tremendously dangerous aspect could be to try weaning our county off these uranium reactors in search of cleaner, greener energy sources. We could also try to find ways to develop safety measures and technologies to ensure that disaster effects are kept to a minimum while neither crushing the energy market, nor being too stifling to its activity. These fixes and solutions will be discussed in a later paper.

Annotated Bibliography

Boice, J. & D., Jablon, S. (1993). Mortality among Workers at Nuclear Power Plant in the United States. *Cancer Causes and Control*, 4(5), 427-230. Retrieved from <http://www.jstor/stable/3553219>.

This source gave some background on the effects that radiation could lead to the development of tumors, causing death. While radiation can cause the development of tumors, there was no evidence to support that the plants caused this exposure. This was helpful because it provided some studies to clarify the safety of radiation exposure in these plants.

Cooper, M. (2012). Nuclear safety and affordable reactors: Can we have both?. *Bulletin of the Atomic Scientists*, 68(4), 61-72. doi:10.1177/0096340212451627

This source provided information about the expenses necessary to keep safety measures in top condition. It also stated that disasters bring scrutiny, as well as new regulation. This information is very helpful in determining if a post-disaster evaluation of nuclear power is needed.

Evans, M. (2012). Calvert Cliffs Nuclear Power Plant, LLC; Calvert Cliffs Nuclear Power Plant, Units 1 and 2; Exemption. *Federal Register*, 77(152), 47121-47123. Retrieved from [http://www.lexisnexis.com/hottopics/lnacademic/?shr=t&csi=6013&sr=\(%22Calvert%20Cliffs%20Nuclear%20Power%20Plant,%20LLC;%20Calvert%20Cliffs%20Nuclear%20Power%20Plant,%20Units%201%20and%202;%20Exemption.%22\)+AND+DATE+IS+2012](http://www.lexisnexis.com/hottopics/lnacademic/?shr=t&csi=6013&sr=(%22Calvert%20Cliffs%20Nuclear%20Power%20Plant,%20LLC;%20Calvert%20Cliffs%20Nuclear%20Power%20Plant,%20Units%201%20and%202;%20Exemption.%22)+AND+DATE+IS+2012).

This source contained information about changed to the NRC rule code pertaining to disaster management. It states that Calvert Cliffs wants an exemption from a rule, so that

they may better handle a disaster or crisis should one arise. This was very helpful in identifying the measures that were taken in direct result of the Fukushima accident.

Heck, K. (1987). Summary and Conclusions. In K. Heck (Ed.), *Ecological Studies in the Middle Reach of the Chesapeake Bay* (pp. 276-284). Dolphin Island, AI: Springer.

This book presents a study done several years ago on the wildlife surrounding Calvert Cliffs. They concluded that there was a very small impact made by the power plant. This is helpful because it identifies that there were no significant damaged done by this plant on the Bay area.

Hood, B., Jones, T. (2010). Environmental Radionuclide Concentrations in the Vicinity of the Calvert Cliffs Nuclear Power Plant and the Peach Bottom Atomic Power Station: 2006-2007 [Abstract]. v. 1-141. Retrieved from <http://www.msa.md.gov/megafile/msa/speccol/sc5300/sc5339/000113/013000/013065/unrestricted/20100941e.pdf>.

This source talks about the releases of particulates from Calvert Cliffs. It finds they that there is a very low dose of radiation given to humans. This source was helpful because it gave some current scientific evidence of the safety of nuclear energy.

Kachur, M. & Sellner, K. (1987). Phytoplankton Entrainment. In Heck (Ed.), *Ecological Studies in the Middle Reach of the Chesapeake Bay* (226-253). Springer.

This source is a chapter in the same book as Heck's work. It points out that there were limited effects on the small organismal life of the Bay. This provides some good quotes to show the small effect of the power plant.

Lockbaum, D. (2011). The NRC and Nuclear Power Plant Safety in 2010. *Union of Concerned Scientists*. 11-12. Retrieved from http://www.ucsusa.org/assets/documents/nuclear_power/nrc-2010-full-report.pdf

This article provides some information about accidents that occurred in 2010 at nuclear facilities. It outlines a particular incident at Calvert Cliffs. This was helpful because it allowed me to give an example of a local incident.

Mirabella, L. (2004 August 25) Nuclear plant's owner says it's completely safe ; Nuclear power Reconsidered: [FINAL Edition]. *The Baltimore Sun*. Retrieved from <http://search.proquest.com/baltimoresun/docview/406625656/13A4CBA4AC04637FEF4/2?accountid=12164>

This article from *The Sun* describes how safe the plant is. This evidence helps to give the public some closure about the safeness of Calvert Cliffs. It is helpful because it allows me to include some local details about nuclear facilities. It also provides some worthwhile information.

Sharpe, V. (2008). "Clean" Nuclear Energy? Global Warming, Public Health, and Justice. *Hastings Report Center*, 38(4), 16-18. Retrieved from <http://ehis.ebscohost.com/eds/pdfviewer/pdfviewer?sid=60e55a3c-2f86-436c-89f6-94792c8632be%40sessionmgr14&vid=5&hid=2>

This article by Ms. Sharpe provides some thoughts about the ethicality of nuclear energy. She creates an idea that it is a moral obligation, and should be considered in terms of human rights.. it is helpful because it answers my primary research question.

Wheeler, T. (2011, March 20). Should we Worry About Nuclear Plants here?: Companies say Calvert Cliffs, Peach Bottom Safe. *The Baltimore Sun*. Retrieved from <http://search.proquest.com/baltimoresun/docview/857771874/13A4CCAB82162C52D55/1?accountid=12164>

This article from *The Baltimore Sun* was a great article to come across. It describes how a woman is worried about her home near a nuclear facility. The article tries to calm her nerves. This was a helpful article because I was able to find local detail as well as answer my research question.

Research Log

What I did	Time spent	Date
Class work time- narrowed down what topic to cover=safety of nuclear energy, health care or domestic abuse	35 minutes	10/11/12
Library research day-settled on topic= safety of nuclear energy, found “Clean Energy” by Sharpe	10 minutes	10/16/12
Library research day- stasis theory application. Found <i>Sun</i> article, eventually not used	25 minutes	10/18/12
Independent research-created research Q’s: PRQ-do benefits of nuclear energy outweigh the moral or ethical consequences?, SQ1-can nuclear energy be safe and affordable?, SQ2-given effects of earthquake in Japan, how safe are facilities here?	2 hour 40 minutes	10/18/12
Independent research- found “Nuclear safety and affordable reactors: can we have both” by Cooper. Findings: energy can be expensive, safe does not equal cheap. Also Fukushima disaster raises scrutiny about safety, measures to be taken to further prevent them. Found “NRC Plant Safety” by Lockbaum. Findings: incident that was caused by part neglect	1 hour 25 minutes	10/21/12
Independent research- found book source. Checked out from Hood library. Picked	20 minutes	10/21/12

up 10/22/12		
Went to see Dr. Brizee. We discussed possibly hypothesis/research questions	30 minutes	10/25/12
Independent research- found two <i>Baltimore Sun</i> articles. Article 1 by Wheeler Findings: talks about safety of Calvert Cliffs. Article 2 by Mirabella Findings: more safety about US plants. Found Federal Register piece. Findings: exemption to NRC rule in response to Fukushima. Found “Radionuclide” piece by Hood, Jones & Grey. Did not read yet.	4 hours	11/4/12
Independent research- read book source <i>Ecological Studies...</i> by Heck. Findings: study done by marine biologists, concluded that there were small impacts on Bay by CCNPP. Read “Radionuclide” piece by Hood, Jones & Grey. Findings: concentrations of radionuclide = minimal.	2 hour 30 minute	11/5/12
Independent research- Found third scholarly article- “Mortality” by Jablon and Boice. Findings: discussion about death and nuclear plant relation. Deaths not seen to link to exposure to radiation	2 hours	11/6/12

Final Tally of Hours: Time = 14 hours 35 minutes

Student permission from email, Monday, January 14, 2013 11:07 PM:

Dr. Brizee, attached is my Effective Writing project 3, fully revised and corrected. I am honored that you decided to use my essay. Sorry for it being so late. Thanks again for the great semester.

-Scott Lombardo