The Need for Nuclear Energy and Ensuring Accountability

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

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Introduction

Fossil fuels such as coal, oil, and gas play a dominant role in energy systems throughout the world. The Industrial Revolution that began in the 1760s expanded the overall use of coal when the English determined that it could produce fuel that burned hotter and cleaner than wood charcoal which was commonly used at the time (Ritchie, 2020). Through the expanded use of coal and other fossil fuels during the Industrial Revolution, multiple developments were made in technology which led to improving the economic status of the workforce. Having influenced human development and advancement for the past several centuries, it has become increasingly apparent that carbon dioxide, produced when fossil fuels are burned, is the largest contributor to climate change across the globe. As lower carbon dioxide emitting sources of energy become readily available such as nuclear or renewable energy, the world must transition away from the fossil fuels that have supported the development of humankind for hundreds of years.

Fossil fuel use is unsustainable in the long term which is why humans must identify an alternative renewable or pseudo-renewable energy source as quickly as possible. Nuclear power has a high energetic potential in the world to be a main source of energy due to the enormous supply of uranium on Earth. The importance of moving away from fossil fuels is essential for the survival of the United States of America in addition to the rest of the world. There are multiple reasons for why it has been slow to transition into a greater supply of nuclear power plants including public perception of safety issues. For the United States to have success with an increase in nuclear power plants, they have to get the residents of the country to believe that no disaster such as Chernobyl and Fukushima will occur on our soil. As nuclear energy use is expanding throughout the country and technology is deemed safer than ever before, it is important to present a compelling argument for transitioning to a more sustainable primary

source of energy in the world. This has to begin from the technical side first with the scientists and engineers talking about the work they have done to ensure that, if followed closely, all the safety protocols and emergency procedures will be able to prevent any explosion or disaster from occurring in our country. Nuclear has to be handled incredibly closely and listening to reputable researchers that are great speakers will be the first step in gaining the trust of the American people.

As current research and development are progressing towards a safer environment within a nuclear power plant, there is a question that has yet to be explored. If a tragic incident were to occur such as in Fukushima or Chernobyl, who will be responsible? Should the blame be placed on the contractors and researchers that produced the parts for the nuclear reactor or the Department of Energy (DOE) that truly implements the research that was conducted? Knowing that nuclear energy, if not done one-hundred-percent correctly, can be deadly and forever alter the lives of those that live in the proximity of the nuclear site which would soon become a radioactive zone. The aftermath of past nuclear disasters has only had negative impacts on the wellbeing of children and adults. Given the various relationships between each responsible party in deploying safe nuclear energy practices, the actor-network relationships will be explored to determine accountability in the nuclear industry when incidents occur. It will be shown that the Soviet Union was incompetent to handle the situation in Chernobyl following the explosion in 1986 where they only declared a need for international help four years later while people were suffering from radiation exposure on day one.

Background and Significance

A main project that is ongoing within the DOE is to upgrade the nuclear fuel storage tubes. They are currently made of zirconium alloys and work very well in standard operating

conditions. However, as soon as these tubes are exposed to salt water, like in the Fukushima disaster, the ends of the tube corrode allowing the active uranium fuel pellets to escape and cause mass destruction. As nuclear energy is constantly increasing in demand, it is essential that all the science and engineering over done correctly. Research in safer nuclear energy operation is essential because society cannot afford any mistakes or else lives will be lost. In addition to the social construction of how technology is operating to protect lives and help the environment, major attention should be focused on the management chosen to operate the power plants. They should be experienced in the field of nuclear energy, preferably on the science and engineering side. In order for everything to be operating smoothly and safely at all times, everyone in the plant should have immense knowledge about how every single piece in the plant functions and ways to mitigate failures if there are any. Many companies have failed in the past because of inadequate leadership and always focusing on trying to save a few cents on operation costs. It is vital that the management not only have the technical expertise in the field but that their mindsets are checked by the higher levels of management in the Department of Energy to ensure everyone's goals are the same throughout all branches of the government. Safety regulations must be followed through one hundred percent of the time with no corners cut because of the need for public trust in how the government is handling safety and avoiding disasters.

Within nuclear plants, a large network of actors is present at all times. The network is comprised of engineers, technicians, the population that requires the energy produced at the nuclear plant, the people that live near nuclear power plants, the DOE and the material components from a technical standpoint. Actor-network theory (ANT) attempts to understand how "humans and nonhumans…form alliances…in order to produce and stabilize a particular state of affairs" (Crawford, 2020). In nuclear plants, ANT focuses on the actors within the

network mentioned previously that contribute to developing, operating, and managing the facilities. A simple way to think about how different actors within this nuclear network interact with each other would be to look at the design and construction of a nuclear power plant. Collaboration between engineers, technicians, and the DOE will be required to maintain safety and technical guidelines in addition to deciding which technologies and materials will be used throughout the construction process. Once a nuclear power plant is constructed and is ready to be used to produce energy for people, management will be needed to continuously operate the plant safely and efficiently. Managers and supervisors will be at the higher ends of the hierarchy while technicians, operators, and engineers exist to follow management's orders. In addition to the employee hierarchy in place, there will also be the social construction of technology (SCOT) in place. SCOT argues that "technology does not determine human action, but that rather, human action shapes technology" (Klett, 2018). Certain technologies have been introduced as safeguards that take the place of required human actions such as various control systems, emergency responses, and safety protocols. Technicians and engineers constantly check the technological systems that monitor the health of the power plant as well as the emergency systems that activate upon a disaster warning. The network of actors in a nuclear power plant is a combination of a hierarchy of people and technology that is required to maintain safe operation of a nuclear energy production site.

Research Methods

Who should be responsible for nuclear disasters in the future as we are transition more to it and away from fossil fuel use? One of the main methods in which I am collecting evidence is by finding papers on specific cases. Many papers have researched the aftermath of various incidents/tragedies including the effects on people's health and who was at fault for the

incidents. I chose this method because I thought it would be easier to explore the reactions and aftermaths of incidents that have previously occurred in the world rather than trying to forge my own opinions on "make-believe" incidents. Exploring case studies is also a data analysis method that I have used to explore various situations that have occurred in history. Case studies are great to learn more about a past event and the impacts that it had. They are also a great way to gather evidence and data analysis because they tend to cover everything that I need to cover what I discussed previously. This paper will discuss important Science, Technology, and Society (STS) themes like the social construction of technology and actor-network theory and their roles in the nuclear power industry. These two STS themes are vital when discussing nuclear tragedies since there is always more than one party involved in the incident and aftermath of the incident which will be discussed in depth in a later section regarding the Soviet Union and the residents that were affected by the Chernobyl disaster.

Discussion

Nuclear reactors have numerous safety concerns which can be seen in Chernobyl, Three Mile Island, and Fukushima. On April 26, 1986, a block of the nuclear power plant in Chernobyl exploded which ended up as the "biggest civil nuclear accident ever recorded" (Danzer, 2011). The explosion caused immediate deaths and injuries among employees at the power plant and firefighters that arrived at the scene. "After the initial explosion, a nuclear cloud formed and contaminated…areas…with radioactive fallout" (Danzer, 2011). There is evidence that the Chernobyl incident has led to long-term changes in levels of well-being, health, and personal safety among citizens of Ukraine (Danzer, 2011). According to the United Nations, more than eight million people from Belarus, Ukraine, and Russia were affected (United Nations, 2001). Thyroid cancer among children became more prevalent due to the release of radioactive iodine

into the air following the incident (Demidchik, Mrochek, Demidchik, Vorontsova, Cherstvoy, Kenigsberg, Rebeko and Sugenoya 1999). In addition to countless disastrous health effects that the tragedy has on numerous people, the surrounding environment was also impacted negatively. As estimation of approximately 4,000 square kilometers of land have been contaminated with radioactive materials as well as the surrounding sources of surface and ground water which has posed significant challenges for the environment to recover (IAEA, 2019). Currently, the river waters, open lakes, and reservoirs that contain fish have low levels of lingering radiation from the incident but "some 'closed' lakes with no outflowing streams in Belarus, Russia, and Ukraine…water and fish will remain contaminated with caesium-137 for decades to come" (Greenfacts, n.d.). Almost 40 years have passed since the incident at the Chernobyl plant and many facets of the environment are still polluted with radiation, even though the levels are much lower than they were in the 1980s.

In addition to the deterioration of people's mental and physical health and the environment, there was a large exodus of people in the surrounding area of the Chernobyl power plant. According to the World Health Organization, an estimate of 116,000 people evacuated their homes from within a 30-kilometer radius zone from the power plant and many more followed that soon after (WHO, 2006). Due to the relocation and forced closures of businesses, people lost their jobs and livelihoods, especially those that worked in the agriculture industry. Relocation costs were expensive for families and costs increased when health care was needed to combat the sicknesses that developed among people shortly after exposure to the radiation.

The Chernobyl incident is one that will be forever remembered for the harmful exposure to radiation that impacted millions of people which resulted in an increase in thyroid cancer among children, leukemia, tumors, and cataracts. People evacuated from their homes for the rest

of their lives and had to virtually restart their lives elsewhere costing them a fortune, especially ones with large families. However, some positives can be taken away from this entire incident. A greater emphasis was placed on safety measures and protocols in the nuclear industry in addition to giving scientists an opportunity to study and explore what radiation exposure does to humans and other natural surroundings.

When discussing the relationship between the actors within this specific network, it is important to know that the top of the hierarchy was the Soviet Union. The Soviet authorities severely downplayed the scale of the incident and attempted to keep the disaster from being released to the public. Reports about the incident were not released until three days following the explosion when "Swedish authorities correlated a map of enhanced radiation levels in Europe" and were about to announce that there had been an incident somewhere in the Soviet Union (United Nations, n.d.). Questions that are essential for living such as "Is it safe to leave the house? Is it safe to drink water?" were ignored since there was no legitimate authority immediately available to answer them leaving local residents in the dark and scared for their lives (United Nations, n.d.). Science believes that "early evacuation would have helped people avoid the area…when iodine 131 is most dangerous, 8-16 days after release" (United Nations, n.d.). The Soviet Union solely dealt with the entire situation until 1990, four years after the explosion, when they finally "acknowledged the need for international assistance" (United Nations, n.d.).

The lead actor in the network, the Soviet Union, failed to address their constituents in a timely manner and never took accountability for their actions. As a result, dozens of innocent lives were lost immediately and thousands as of today from suspected sicknesses resulting from radiation exposure. In addition to lives lost, millions of lives have been impacted with forced

relocation, lower socio-economic standings, and diseases that are still being battled. It is hard to trust a government in this scenario since citizens were lied to about the disaster for years and were mostly neglected until 1990 when the United Nations adopted Resolution 45/190 which called for "international cooperation to address and mitigate the consequences at the Chernobyl nuclear power plant" (United Nations, n.d.). Following the collapse of the Soviet Union in 1991, the newly formed Ukrainian government took over the response to the Chernobyl incident and worked closely with international organizations to address the ongoing situations in the area (World Nuclear Association, 2022). They also established new safety frameworks for nuclear power and developed a plan to fully decommission the Chernobyl power plant. Financial assistance was provided to affected communities to help support relocation and economic losses for the few years prior. This incident taught the entire world an important lesson that the Soviet Union failed to experience. When the whole international community works together to help with a crisis rather than downplaying deaths and disease, it is much easier to find assistance for every single resident. If transparency was focused on from day one of the incident, people would have had more time to flee and not end up acquiring a disease from the radiation exposure. In the Chernobyl situation, the Soviet Union should be completely at fault since they developed the standards for nuclear safety as well as operated the facility on their own. Following the explosion, they poorly handled the situation and let people suffer without truly helping them. All the top leaders of the USSR should have been put on trial by the newly formed government of Ukraine after investigations have been complete relating to management and personnel.

In the event of a nuclear incident in the United States like in Chernobyl or Fukushima, responsibility should be shared by a few different actors within the established nuclear power plant network. The DOE should be the main actor responsible for a nuclear incident because it is

the main actor for overseeing all activity in the facility ensuring safety during operation. They enforce the regulations established by the federal government and have the power to hold anyone else accountable for non-compliance in the work area. If regulations were not stringent enough which helped cause an incident, then the DOE should work with the federal government to tighten the guidelines to ensure that something like that does not occur again. Accountability is important when it comes to the public perception on the idea of "safety" within the power plants. The DOE has the legal authority and technical expertise required to regulate the nuclear industry as well as ensuring that every operator in the facility is maintaining a high standard for safety while working. In order for a government to effectively govern for "we the people," people need to have faith in and trust the government to keep them safe. The Department of Energy should be advocating for safety and providing redress for all the harm that was caused following an incident that they took responsibility for. Compensating victims and their families, providing medical care, attempting to stabilize the environment, and improving safety and emergency protocols should be the bare minimum that the DOE should do following an incident. No matter the circumstance, the government should be proactive in assisting anyone in need as nuclear incidents are not known to be light in overall damage on the environment but most importantly, the people living in the affected areas.

Conclusion

The entire world must shift to a more sustainable primary source of energy such as that which nuclear offers and transition away from the use of fossil fuels. As vital components of the world are suffering from climate change, it is more important now than ever to transition to a nuclear primary source of energy. As research and development continues in these technical fields throughout the country, it should be known that there will be consequences for any

government responsible for any nuclear catastrophes that may occur. Accountability should fall on the DOE and their failure to accurately check the technical work of the contractors and researchers. Because the DOE is run by the United States' federal government that sets standards for energy in place, it is their responsibility to ensure that the engineering side of nuclear reactors is completely safe. At the end of the day, citizens of the country pay taxes that fund the federal government which should ensure the safety of all inventions put in place. When the hierarchy is structured this way, less pressure is mounted on the researchers to maximize the safety and potential of nuclear reactors. A rapid but safe change to nuclear as a primary source of energy is needed to keep civilization as we know it alive for as long as possible. However, to do this as efficiently and safely as possible, research needed to safely handle uranium and other nuclear devices must be as comprehensive as possible. Research has already demonstrated the need for a greater push towards nuclear energy which is where scientists and engineers come into the picture of addressing the environmental problems occurring globally due to fossil fuels.

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