The Impact of Nuclear Power Plant Accidents on the Health of Individuals Over Generations

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Abstract

Nuclear energy is an energy source that is more friendlier to the environment. However, nuclear power plants have a lot of negative impacts associated with them. Nuclear power plant accidents can lead to physical health impacts such as thyroid cancer, acute radiation syndrome, and deaths. In addition, premature deaths like heart attack and asthma are also a result from nuclear power plant accidents. Unpredictably, most nuclear power plant accidents cause more psychological impacts rather than physical impacts. For example, the Three Mile Island accident tends to not observe any physical impacts but psychological stresses. Mental impacts such as depression, anxiety, hostility, and the fear that one will develop cancer are high amongst the victims of nuclear power plant accidents.

Introduction

In the modern world, individuals are increasingly looking for energy sources that can replace fossil fuels. This energy source should be able to provide as much or more energy than fossil fuels while being more environmentally friendly. Nuclear energy is one of the alternatives that comes to mind. However, the negative health impacts of nuclear power plant accidents outweigh the benefits it brings to the environment.

Generally, nuclear power plants are found near rivers, lakes, or seacoasts. This location choice has a strong connection to how nuclear power plants operate. Nuclear power plants use radioactive elements, mainly Uranium-235, to generate heat through nuclear fission. The generated heat is used to heat up water that is obtained from the nearby water source. The heated water forms steam that turns the turbines which helps power the generator, creating energy. The heated water is then stored in cooling towers to cool down and then return to the water body nearby.

The main component of nuclear power plants, elements like Uranium-235, are the reason behind nuclear energy not being widely promoted. Uranium-235 is usually extracted through mining. Uranium-235 are separated from uranium ore at uranium mills or from a slurry at in-site leaching facilities to produce uranium concentrate. The process of mining for these elements can lead to possible contaminations and often not correctly cleaned up. These elements are highly radioactive and can cause multiple health issues upon exposure. This research paper will investigate different health impacts of individuals upon nuclear power plant accidents over generations.

Literature Review

Health Effects

According to Rashad (1998), the 1984 Bhopal accident caused 3000 deaths and hundred thousand severe health effects, which shows how nuclear accidents lead to complex health issues. Furthermore the U.S. Environmental Protection Agency data reports, " up to 17,000 of premature deaths; 11,000 heart attacks; 120,000 asthma attacks; 4,500 cases of chronic bronchitis and other illnesses" were found as a result of nuclear accidents (Vujić et al., 2011, page 41) This expanded on the claim that nuclear power plant accidents perform a diverse health impact rather than simply radiation and cancer. The Belarus National Academy of Sciences estimates 270,000 people in the region around the accident site will develop cancer as a result of Chernobyl radiation and that 93, 000 of those cases are likely to be fatal. In another report the Russian Academy of Sciences found a dramatic increase in mortality since 1990—60,000 deaths in Russia and an estimated 140,000 deaths in Ukraine and Belarus— probably due to Chernobyl radiation. (Pedraza, 2013, p 157-158).

Impacts to Ecosystems

Nuclear accidents impact not only humans, but other organisms as well. In addition, data collected by the ARGOS DSS shows that decisions regarding the contamination of aquatic ecosystems and other ecosystems should be made within 1-2 days after an accident has taken place. (Liland et al., 2019) Contaminations of these ecosystems can create an impact towards food production. According to GreenFacts, after the Chernobyl Nuclear Accident, radioactive cesium has continued to biomagnify in organisms and is moving up the food chain. The ecosystem has been highly contaminated where Forest food products such as mushrooms and

berries have recorded the highest levels of cesium-137. According to Liland et al., (2019), under the circumstance that all food were produced locally, the internal dose of contaminated diet in Vindafjord would be up to 9.1 mSv for adults and 3.8-7.0 mSv for children in Rogaland over 5 years if there were not any agricultural implementation after a nuclear accident.

Impacts to Mental Health

Studies show that there are still unseen anxieties within individuals that have experienced the suffering and even the second generation of people also felt anxiety (Naiki, 2020). Naiki's article studied the long term effect of the Chernobyl nuclear accident after 32 years finding that victims often suffer long term anxiety (Naiki, 2020). According to Bromet (2014), nuclear power plant disasters have emotional consequences such as depression, anxiety, post-traumatic stress disorder, and somatic symptoms that can not be explained. The victims of the disaster tend to experience these long term effects that are associated with the fear of developing cancer. According to the World Nuclear Association (2022), independent health studies showed no physical health effects like cancer to victims of the Three Mile Island but only psychological stress was detected as an effect.

Atmospheric Consequences

Nuclear power plant accidents lead to a lot of atmospheric consequences as it releases elements and compounds into the atmosphere. According to Pohl (1976), "During nuclear atmospheric explosions, a large fraction of the neutrons generated reacts with the nitrogen in the air to form carbon-14. By the end of 1962, a total of 405 Mton TNT equivalent of atmospheric and 105 Mton TNT equivalent of surface tests had introduced 6.2×10^6 Ci into the atmosphere (as CO2)."

According to Zhang and Ungar (2018), several volatile radionuclides such as, ^{137}Cs, ^{134}Cs, ^{131}I, and gaseous radioactive Xenon ^{133}Xe, were detected in stations after the Fukushima accident.

Results

Table 1

Chernobyl Nuclear Accident

Type of Physical Health Effect	Total of Victims
Thyroid Cancer (Iodine-131)	5,000 cases
Acute Radiation Syndrome (ARS)	134 plant staff
Death	28 people

*Note.*This data was obtained from Canadian Safety Nuclear Commission, 2022

Table 2

Chernobyl Nuclear Accident

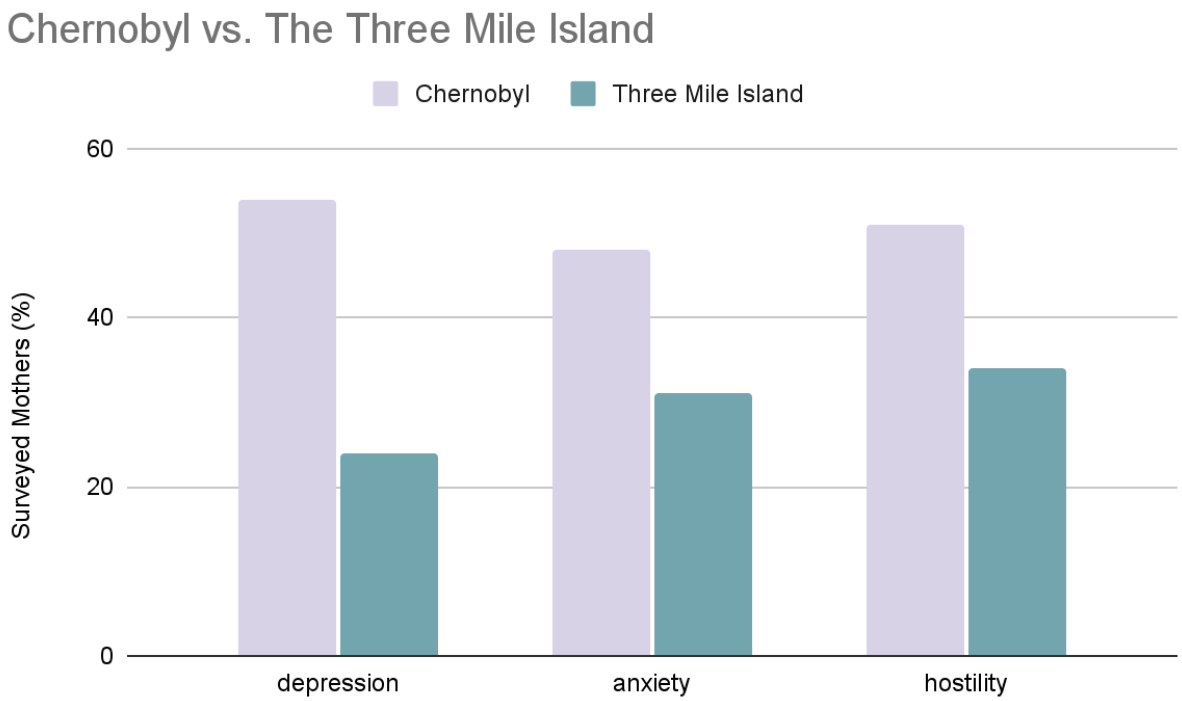
Type of Mental Health Effect	Percentage of Mothers Surveyed
Depression	54%
Anxiety	48%
Hostility	51%

Note. This data was obtained from (Bromet, 2014)

After major nuclear power plant accidents, people tend to only focus on physical effects of radiation exposures. However, from the table, we can see that mental impacts are also at a high rate. The ones suffering from mental impacts like depression, anxiety, and hostility are often the family members of victims in the accidents. At the same time, the surveyed population also

claimed to believe their health had been affected by the accident. From the data we also see that physical health impacts focused on thyroid cancer and acute radiation syndromes (Table 1). Unexpectedly, there were not many deaths that occured but more long term health effects that could possibly lead to death.

Graph



Note. This data was obtained from (Bromet, 2014)

From the graph we can see the difference in impacts based on the severity of the nuclear power plant accident. Being one of the largest nuclear power plant accidents, Chernobyl outweighs the impacts of the Three Mile Island. The graph shows that in the three major mental impacts, Chernobyl's effect is almost twice the effect of Three Mile Island, this further proof how severe Chernobyl was. Both the Chernobyl nuclear accident and the Three Mile Island

nuclear accident resulted in more psychological effects rather than physical health impacts. Many victims developed mental impact due to fear of developing cancer.

Discussion

Strengths

The strengths of this paper includes the diversity in perspective to approach the impact of nuclear power plant explosions. Nuclear energy has always been an alternative energy plan that creates less pollution to the environment. However, it is not widely promoted as a result of how dangerous it is. This paper clearly shows the negatives of nuclear power plants if an accident happens. A nuclear power plant accident tends to result in more psychological impacts rather than physical health impacts like most of the society thinks. These accidents are also associated with an increase in radioactive elements in the atmosphere and in the ecosystem. These radioactive elements differentiate in half times, resulting in the place of accidents being abandoned for long periods of time.

Limitations

The limitation of this paper is the lack of actual experiment and real time data. Since this paper is completed based on other journal articles and studies, much information is not up to date. This can lead to understating or overstating the results of nuclear power plant accidents. In addition, many data used in this paper are collected through self-development systems or chains which one can question the accuracy of the collected numbers. The amount of surveyed mothers for the graphs was also not clearly stated which can make the percentages unable to represent the whole population.

Further Research

Further research can be done to further compare the different effects of the major nuclear power plant accidents such as Chernobyl, Fukushima, and the Three Mile Island. Then analyses regarding how differences in the destinations, time period, and size of the power plants might have possibly affected the effects. This can provide a better understanding to how nuclear power plant industries should improve to decrease the effects it can create when accidents happen.

Conclusion

A nuclear power plant accident causes various degrees of impacts, from atmospheric to ecosystem to human health. Impacts of accidents include the release of radioactive elements into the atmosphere and ecosystem which can be taken in by animals. This then becomes a major threat to the human population as these elements can end up in the human body through biomagnification. Radioactive elements including Xenon and Cesium. Despite these impacts that could affect humans, there are direct human health consequences. These consequences are both physical as victims are likely to develop thyroid cancer and acute radiation syndromes and psychological as victims are likely to associate with depression, anxiety, and other somatic symptoms. While most believe the impacts of nuclear power plant accidents are cancer and radiation, there are also a fair amount of premature deaths like heart attacks, asthma, chronic bronchitis, and other illnesses that are associated with these accidents.

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