Student 5: Low Achieved

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Nuclear Power

Nuclear power is a highly-debated topic in New Zealand, with our currently nuclear free stance, however the looming "power crisis", as it has been referred to, is nearing, so perhaps it would be a smart idea to consider a change to the nuclear free New Zealand.

Or perhaps a change wouldn't even be necessary.

A closer look at the "New Zealand Nuclear Free Zone, Disarmament, and Arms Control Act of 1987" has no mention that we 'must not have nuclear power stations' (cite 1), however many people claim that it is illegal for New Zealand to be nuclear powered. This is not true, though there are valid environmental, economic, and possible health implications to be wary of, but to gain the full picture of these, it is important to understand how a nuclear power station actually produces power.

Nuclear Power formation can be summed up as the fission (splitting) or fusion (combining) of nuclear elements to produce heat. Current technology has us limited to creating power via nuclear fission. Most nuclear power stations run by the splitting of a uranium-235 into two smaller atoms, usually barium (Br-144) and Krypton (Kr-89), by colliding a neutron into the Uranium-235 nucleus. This reaction also produces 3 more neutrons, and a significant amount of energy. This energy is then used to heat water to produce steam to spin a turbine, which then creates the electricity. All reactants and products of a nuclear fission reaction are highly dangerous due to the radioactive nature of those atoms; however, the risk is reduced dramatically if stored correctly. Generally radioactive products are stored in thick concrete vats, where the external concrete is approximately 7inches (18cm) thick. The other common option is to store the spent fuel rods underwater; however, the water is also usually surrounded with a thick layer of concrete as well. The spent fuel is then able to be disposed of, commonly at this time by being flushed into the ocean, however there are new deep geological repositories being built and used in France. There is very little evidence to see what would happen after a civil disaster currently. The only times when nuclear power is truly dangerous for humans is after a nuclear meltdown or other horrific event. (1)

The world knows the potential hazards of nuclear meltdown after the large scale nuclear fallout of the Chernobyl disaster in 1986, after a meltdown in the reactor released a large amount of radioactive material, all of which cause numerous serious aliments to tens of thousands of people, and makes the surrounding area uninhabitable and unusable for several more years to come. There is also the horrific tragedy of the Fukushima Daiichi nuclear disaster, where the nuclear power station was badly damaged during a large earthquake in 2011, causing large scale nuclear fallout over a country that was already crippled by the effects of the fore mentioned earthquake and the tsunami that followed. Japan's history of strong earthquakes is similar to ours, with multitudes of large earthquakes shaking both countries on a regular basis. The spent fuel vats, containing several radioactive compounds, were fractured in the earthquake leading to the major Fukushima disaster, the following tsunami made it extremely difficult and dangerous to fix the fracture. When the tsunami struck the reactor and fractured fuel vats, the nuclear waste was then washed far inland with the tidal wave, cause a large wide spread fallout of nuclear waste.

So, should we risk the earthquakes damaging a nuclear reactor in New Zealand? Well, the point could be taken that if we do, and it goes wrong, the radiation from the radioactive elements could have significant biological impacts on the general communities. The gamma radiation that is released from radioactive elements is enormous, and is known to cause several types of cancers, as well as skin burns from direct contact. In a nuclear disaster, the radioactive elements can be spread over a very large area, up to about a 30 kilometre radius from the plant, however other causes can spread the fallout a much larger distance, such as the tsunami at Fukushima. The radioactive elements are surrounded by thick concrete walls to provide protection from the radiation, especially in the form of gamma radiation, in normal circumstances, however during a nuclear disaster such as the oh-so-common New Zealand earthquake, these concrete structures could rupture, and causing gamma radiation to be emitted up to a huge 30km away from the reactor. The knowledge of how radioactive elements decay is also a major point to consider. Radioactive elements decay in what are known as half-lives, the time it takes for the amount to be reduced by half. Most radioactive elements only have half-lives of a few days to a couple of weeks, meaning it (2)

reduces to a safe amount very quickly. However, some, such as caesium-137, have a half live of 30 years, so it takes generations for the amount to reduce to a safe amount. There have been suggestions that the land surrounding Fukushima Dachii will not be safe again for "hundreds of thousands of years" (2), although it is more likely to be about 300 years, due to the half-lives of the spent fuel deposited on the ground. Combining those ideas, the area surrounding a nuclear accident is dangerous and seriously damaging to everyone for years. Is that really a mark we want on our "Clean, Green" image?

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However, nuclear power could be the answer we are looking for to our growing energy demands.

The rise of electrical appliances in everyone's homes is increasing the demand for power, if we continue to have an increasing demand, we will soon have a large deficit of energy, and After all we are already net importers of energy. A nuclear power plant, of an average size, produces approximately 12 million kilowatt hours, that's approximately 6% of the energy that New Zealanders use, in a year, as a whole. Nuclear power facilities also have a far greater amount of energy produced per kilogram of fuel than coal, 23,279,200 $KwhKg^{-1}$ to 6.27 $KwhKg^{-1}$ so perhaps it might just help the energy crisis.

I believe that although this magical idea of a nuclear power plant being able to solve the countries power crisis, it is not the best idea for New Zealand. This is due to the potential of a nuclear accident and the negative affects that that would have on every person in New Zealand. The cancers and skin burns from direct contact with the radioactive compounds, almost all requiring medical treatment, will cost taxpayers a lot of money in the long run.

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