

Nuclear Waste Can Be Managed Vitrification Process

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Abstract- Now-a-days we are more concentrating on using natural resources for production of electricity, for example – Solar energy, Wind energy and more efficient is Nuclear Energy. Nuclear Energy is more efficient because, where 2 million grams of coal or 3 million grams of oil produces electricity which equal to 1 gram of Uranium fuel, the process is also recyclable. Nuclear Fission is the process where nucleus gets splits into smaller nuclei releasing energy in the process. The elements used in process are Uranium-235 or Uranium-238, Thus, these splitting of nucleus leads to formation of electricity, by Nuclear Reactor process. Nuclear Reactor process will definitely the more efficient way of generating electricity without carbon emission. Now, we also got an alternative to handle nuclear waste which is harmful for living beings, may be we can make glass out of nuclear waste by using sugar. But we can power more through nuclear fusion reaction as well, because of which our sun and many of the stars are glowing, indeed produces most effective way for production of electricity but too much costly. Therefore nuclear power really reduces carbon emission problems and is highly efficient. But still nuclear waste is the most harmful waste in the world, though the uranium is used in the process 95% is still radioactive. Hence to decompose it properly scientists have found two methods which are much more effective as compared to others, verification and plutonium-contaminated waste is mixed with blast furnace to produce glass. This process will indeed reduce the hazards from nuclear waste.

Index Terms- Nuclear Energy, Nuclear Fission, Nuclear Fusion, Nuclear waste

1. INTRODUCTION

According to United Nations, there is an ample rise in energy due to increasing population in world. Nuclear reactor process is really a boon for our world to produce large amount of electricity without carbon emission. A nuclear reactor is the source of intense heat which is in turn used for generation of power in nuclear power plant. In the Nuclear reactor process, the splitting of nucleus into smaller nuclei which is nuclear fission. When the same principle used in

nuclear reactor the energy released is in the form of steam which indeed leads turbines to rotate and produces electricity, but the more successful part of it is, the water which produces steam can again be recycled in the process.

Though the process is recyclable, after a period of time Uranium can't do fission so the Uranium rods present in the fuel elements of nuclear reactor are of no use. Those waste rods still has 95 percent of radioactivity, which is most hazards for every living creature on Earth. There are many ways humans decompose it, like decomposing it far from habitual zone, under cement containers or directly thrown them into the sea, this methods are used but have various drawbacks and even the cement gets cracked after a period of time, throwing into sea is a major risk for aquatic animals. And also this will also raise to major problem when the demand for electrical energy rise due to increasing population. Burying the nuclear waste underground is not a good idea because when earthquake will occur these radioactive waste will penetrate the vault and have the capability to destroy the environment. Nuclear waste epitomizes the double-edged sword of modern technology, it's a toxic and radioactive waste of nuclear medicine power stations. The nuclear waste also reflects the humankind's biggest leaps in technology, but it also illustrates our inability to deal with our own advancements.

Scientist found out the two most significant methods which will lead the nuclear waste as recyclable. The process of vitrification is mixing the nuclear waste with sugar at higher temperatures and then converting those liquid into glass, which is indeed radioactive but not much effective to cause any harm for living beings. Another process which is still the same, production of glass, but the plutonium– contaminated waste mixing with blast furnace slag and turning it into glass reduces it's volume by 85-95 percent. It also effectively locks in the radiative plutonium or uranium becoming it a stable end product.

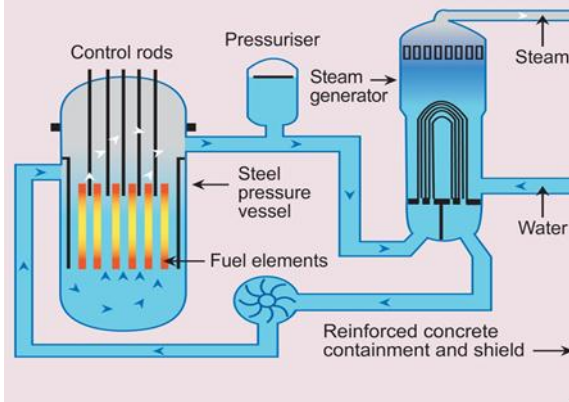
3. RELATED WORK

The Uranium present in the nuclear power reactors which is in the form of ceramic Uranium dioxide pellets that are sealed within the metal rods. But after some period of time the Uranium which is the main constituent loses from the rods, hence it is necessary to dispose them off. Though the rod loses uranium but still has 95 percent of radioactivity in those rods, which is the biggest hazard for world. But still the rods are often processed with chemicals to draw any unused uranium; this results in high-level-waste, which is liquid waste. Due to this reason the rods are usually stored in pools of water near reactor until a permanent location is prepared.

The location do matter for decomposing nuclear waste, since we cannot dig and put all the waste near the vicinity, this will surely cause genetical disorders.

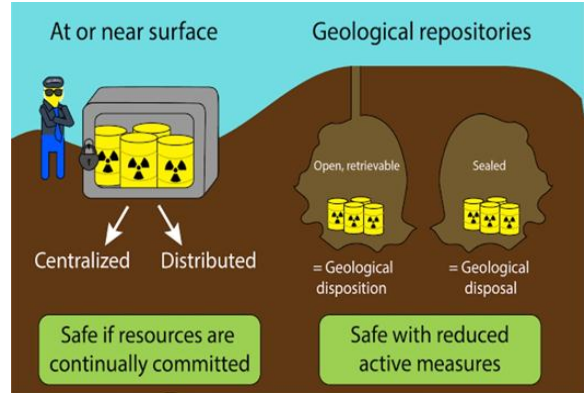


1: Nuclear Fission Process (separation of nucleus)



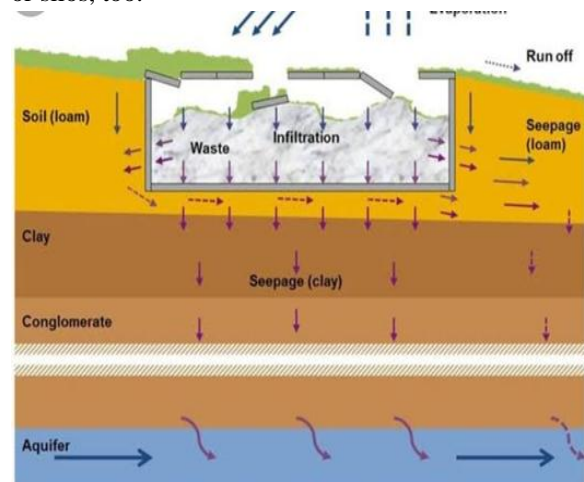
2: Nuclear Reactor

There can be various form of nuclear waste in different states of matter, including gas, solid and liquids. The radioactivity can last long for a few hours to thousands of years, depending upon the waste's source. If we don't take appropriate measures to handle nuclear waste it can devastate the whole ecosystem of world, which indeed ruins the air, water, and soil quality. What's more destroying, these materials can have long-term side effects on human health, can even fatal.



3: Decomposition of nuclear waste.

The low-level-waste, which is collected from hospitals or labs can often be compacted or incinerated in a container which gets buried in the landfill. Intermediate-level-waste from reactor components, chemicals and similar waste which is indeed called as high-level-waste it is the most radioactive, which is decomposed in concrete or and then the waste is buried deep underground. This High-level-waste is small in amount but holds 95 percent of radioactivity produced by nuclear waste. It is also stored far below the Earth's surface at government approved sites, and even stored in tanks or silos, too.



4: Decomposition of nuclear waste in soil.

Thus, finding a suitable place for radioactive elements and there waste is not an easy task. Indeed no one wants nuclear waste near their communities, even if we buried them in the desert as well. The Yucca Mountain storage facility, located in Nevada about 160.9 kilometers Northwest of Las Vegas, is a better example connected with nuclear waste disposal.

Really a tough part of burying nuclear waste underground, the earthquakes and groundwater level would get penetrate the vault and let the radioactive waste to escape, which would cause more harm to the environment, since two big disasters are occurred at a time. Therefore there's a need of another effective methods to solve these harmful side effects of nuclear waste.

4. METHODOLOGY

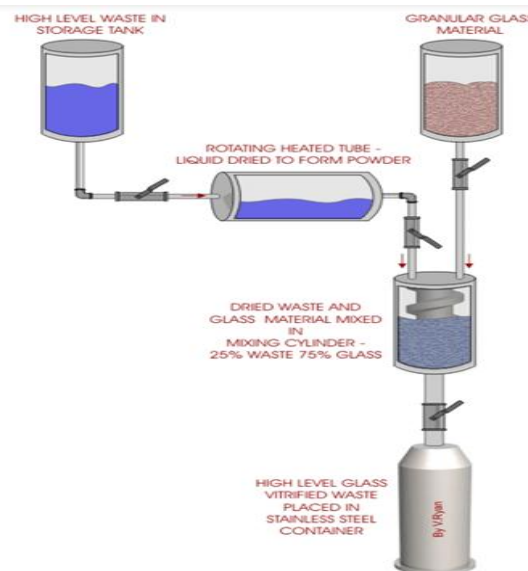
The process as mentioned, Vitrification deals with converting liquid nuclear waste from Nuclear reactor of uranium. Major elements in the nuclear reactor are fuel which consists of thin rods of Uranium around 1 centimeter in diameter, the rods placed is equal to the size of the moderator. Moderator triggers the thermal neutrons of 0.04 eV in the fission reaction. New neutrons produced during fission reaction produces 1MeV of energy, in the heavy water. Control Rods are the most important part of moderator, they are made up of Boron and Cadmium. These rods controls the excess of energy being released during the reaction and thereby reducing the probability of explosions.

But after period of time the Uranium rods gets melted and it gets in liquid form which is having 95 % radioactivity, very much hazardous for health. There are many ways to decompose nuclear waste but it isn't permanent set-back.

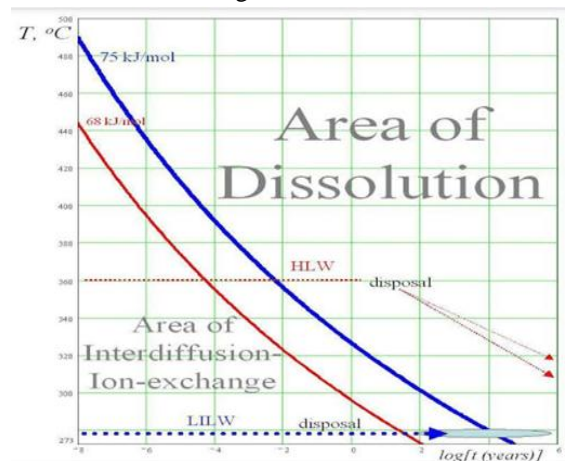
Hence, the Vitrification process combines the liquid uranium or plutonium waste and liquid sugar, burning at a very high temperature, moulding this mixture results into glass. The glass is still radioactivity but can't cause much harm to the world. One of the biggest applications of vitrification process are in pottery, glass, and some other types such as the vitrification of an antifreeze-like liquid cryopreservation. Hence, the Vitrification process we could say is the most efficient process.

There is another process similar to vitrification but the plutonium which is also a radioactive element is mixed with glass furnace slag which indeed produces molten glass and reduces the volume of the nuclear waste up to 85-90 percent, it more effectively stores the radioactive radiations and end up as a stable product. The main substituent is cerium which is a common by product for steel, used to convert nuclear waste into glass, leads to an eco-friendly

environment. This is also known as Vitrification but the method to obtain the result is different.



4: Conversion of High-level-waste into molten glass. The Vitrification process is frequently used in glassy waste forms to build glass structures.



5: Corrosion of Nuclear waste glasses as a function of Environment temperature and time.

Therefore, the vitrification process is most suitable for the future of Nuclear waste, it reduces Carbon Emission, provides greater amount of electricity as compared to fossil fuels, and even makes a different field for humans to earn in, by producing glass, sugar is indeed available in ample amount so there's no problem for sugar scarcity.

5. RESULT

The main aim of the entire human race and other living beings also do think that we should be free

from all types of pollutions, so that we can save our mother nature from being extinct of green lands, ecosystems, climate, and even the other species of animals from being extinct. Hence apply such type of life, according to this article, Nuclear energy is the most effective way to produce electrical energy, though it has radioactive wastes products we have found out one of the best process to decompose these nuclear waste and even reducing it's volume by 85-90 percent, thereby converting the waste into molten glass, which can also be used as a structural artifacts or in various applications.

Hence one of the best way is Vitrification process to control nuclear waste.

6. CONCLUSION

This we can conclude that the Vitrification process is the most effective way to handle Nuclear waste and to put a setback to fossil fuels, to reduce the carbon emission for production of electricity.

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