Mini Review

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A brief overview of radiation waste management and nuclear safety

Abstract

This paper focuses on how the radioactive waste is generated, classified, processed, stored, treated and eventually disposed. Understanding and management of these very important processes in nuclear technology result in compliance with nuclear safety regulations. The major public concern over nuclear energy is safety due to a history characterized with disasters and loss of human life. Radiation on one hand sends fear in the population when it comes to accepting the benefits of nuclear energy as a result of radioactive waste. This is the waste after usage of radioactive materials in nuclear power plants reactors. If care is note taken, radioactive waste has a potential of causing serious damages to the environment as well as threatening human life.

Keywords: Nuclear energy, radiation waste, nuclear safety

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Introduction

Power plants just like any manufacturing plant produce by-products in form of radioactive waste which is sometimes referred to as nuclear waste.[1] Not only does nuclear power plants produce such waste but also fission processes in research institutions and usage of radioactive samples in hospitals. Nuclear power plants do not only produce radioactive waste during operations but also in the process of decommissioning and dismantling of nuclear reactors.[2] Radioactive waste can be classified into high and low level waste. Mostly, power plants are responsible for the high level radioactive waste while other industrial and medical use of radioactive materials produce low levels.[3] Thus, where and how to store radioactive waste must be done with careful analysis of nuclear waste classification. Depending on the hazardous levels, suitable technologies can be employed to ensure protection of both the environment and humans.

Nuclear waste management

It is worldly understood that each nation has a responsibility to manage and deposit radioactive waste in the quest to protect not only human beings but the environment at large. In order to attain this, the International Atomic Energy Agency (IAEA) came up with principles and obligations that nations have to abide to.[4] In addition, the IAEA monitors that nations operating power plants ensure reduced amounts of radioactive waste.[5] This is done by encouraging nations to utilize new technologies and latest plant designs in the quest to reduce radioactive waste production. Radioactive waste does not only come in one form. Thus, liquids, for example, must be compacted into smaller volumes. In order to better manage this waste, liquids are transformed into solids for improved storing and disposal thereafter.[6] This is done by packaging this nuclear waste into specialized containers designed to keep radioactive samples for many years while protecting the environment.

On one hand, storage may be interim or final disposal. Interim storage refers to that storage that shall be revisited in the near future and retrieve the radioactive materials and then transfer them to the final disposal place.[7] In achieving this, there has to be constant monitoring and maintenance of facilities to ensure nuclear safety. On the other hand, in nuclear waste management, the final part is the disposal stage. Here, nuclear waste is disposed of without any future intentions to retrieve it unless in an event of an accident or environmental and life threatening disasters.

Geological disposal

The technology of geological disposal of radioactive waste involves the process of burying waste deep underground for a very long period of time in order to ensure nuclear safety and security.[8] This must be done to ensure long lasting safety for humans and the environment as well as not letting the burden to fall on future generations. This ensures that no radioactivity that can pose a danger returns to the Earth's surface. However, the biggest threat to this method is water table that can easily provide a fastest channel to human beings and the environment.[9] Thus, extra care must be ensured as to locate not only further places away from habitable areas but also places with extremely low water table.

Performance assurance

Determining whether a geological disposal site will endure to give positive results on why it was constructed is not very easy.[10] This is because most of these sites outlive the timeframe for human experiences. The biggest challenges are data collection and appropriate modeling to assess performances of geological nuclear waste disposal sites. Nevertheless, geological disposal has been proved through studies that it is capable of preventing nuclear waste from damaging the environment for a good period of time.

Transportation of radioactive materials

On one hand, radioactive waste produced from power plants is not disposed in same areas where these facilities are built. As a result, this nuclear waste must be transported to other isolated places to ensure nuclear safety and security. Safety measures in transporting such hazardous materials must be put in place to avoid contamination. On the other hand, to ensure usage of radioactive materials in industrials and medical facilities, transport is cardinal to facilitate for end users' accessibility. Provision of safety transportation mechanisms are entirely a national responsibility according to the IAEA.[11]

Societal perspective and policy considerations

The fact that radioactive waste is still being disposed on the same planet we are living in despite isolations still raises concerns not only for human beings living today but also future generations to come. Perhaps if we could have had another 'empty' planet where we could dispose nuclear waste, these concerns about radioactive waste was going to be a story of the past. This is because it has proved to be very difficult to convince society on radioactive disposal safety measures. This is the greatest set back that nuclear energy faces especially after historical accidents and its use in wars that left human beings devastated for so many years.

Furthermore, even with the presence of new technologies concerning radioactive waste management, a good section of society today still fills that nuclear energy is not safe. This is because it poses burden to future generations who are not enjoying its products today. This is viewed as being selfish move and being unethical to our future generations. As a result, the conflict between these two philosophies is posing a huge hindrance for nations to adopt radioactive waste management disposal solutions obtaining on the market.

Conclusion

Radiation waste management remains a huge active topic of discussion and research. This is so because some radionuclides have half-lives of more than a quarter of a million years posing a serious threat and fears for future generations that are to deal with such long lasting nuclear waste. For example, the half-life of Plutonium (Pu-239) is estimated at twenty-four thousand four hundred years making it dangerous to human beings and the environment for a long period of time. Managing nuclear waste entails that as more waste is produced and stored, modern-day scientists must explore more viable methods of storing such radioactive materials for so many years. Special consideration of these new technologies must be to ensure that storage of radioactive waste does not harm people and the environment for so many years to come.

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None.

Conflicts of Interest

None.

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