RENMUN VI

Finding Solace in Solidarity

March 6 - 7, 2021

CHAIR REPORT

International Atomic Energy Agency

Introduction

Dear delegates,

Welcome to the International Atomic Energy Agency (IAEA) of RENMUN 2021! We are Jacqueline Sin and Amelia Lau, your Head and Deputy Chairs, and we are delighted to have you in our council.

The IAEA is an intergovernmental organization under the United Nations, established to oversee the peaceful and sustainable use of atomic energy globally. IAEA promotes the use of atomic energy for peaceful purposes, such as assisting member states in the generation of electricity as well as facilitating the exchange of nuclear technology between states. IAEA serves the important function of ensuring nuclear safety. Throughout the years, IAEA has developed nuclear safety standards and implemented various programmes to safeguard human health, food safety and environmental sustainability, in the increasingly popular use of nuclear energy.

We hope to see everyone fully immersing themselves in these two days of debate, representing your countries' stances well, as well as compromising to make all-rounded resolutions. As chairs, we expect you to do prior research and demonstrate your understanding of the topic. You are encouraged to step out of your comfort zone, and take one more step further in your MUN career, in order to make the best out of your experiences. We are more than happy to answer any and all queries you may have. If you have any such questions, feel free to contact us at sinjacqueline121@gmail.com or sp20166121@spcc.edu.hk! We look forward to sharing an amazing experience with you at RENMUN 2021!

Best wishes,

Jacqueline Sin and Amelia Lau

Chairs of IAEA, RENMUN VI

Discussion on Safe Disposal of Radioactive Nuclear Waste

Disposing radioactive nuclear waste safely is of paramount importance in view of the consequences of a high level of radiation from nuclear waste to both the environment and humans. There have been multiple nuclear accidents in history, resulting in unregulated and disastrous releases of radioactive nuclear waste into the environment. One impact was the contamination of water sources, such as rivers or the sea, which harmed aquatic life, marine animals as well as threatened food safety and human health. Another consequence are the different health problems stemming from the exposure to radiation, such as an increased risk of cancer like thyroid cancer.

Radioactive waste is generated from nuclear energy, and the most highly radioactive portion comes from spent nuclear fuel (SNF). As SNF is being recycled, materials including fission products that are transformed to glass and plutonium are produced. Besides nuclear power generation, radioactive waste can come from the medical field, as radioactive materials are used to sterilize equipment, help diagnose and treat medical illnesses. Moreover, industrial radioactive waste is produced, for instance, gamma rays are used to test the quality of welds or the thickness of products like paper. Radioactive waste is also generated from military uses, including the operation of active nuclear-powered submarines and the decommissioning of retired submarines. From nuclear fusion technology, to developing new radiotherapy treatments, to testing novel solid materials for encapsulating liquid radioactive wastes, waste contaminated with radiation are produced for research and development purposes.

Used fuel from energy production is either reprocessed or disposed of directly. In both ways, used fuel is usually disposed of 40-50 years after removal, when its heat and radioactivity would have decreased by over 99%. As a result, HLW is usually in interim storage before permanent disposal.

There is currently about 250 000 tonnes of used fuel in storage. Storage options include storage pools in reactors and dry storage in casks. Used fuel is usually stored in pools in reactors for at least five years first, where circulating water both shields and cools the fuel. After that, some fuel is placed into sealed steel casks or multi-purpose canisters (MPCs) for storage in concrete buildings. On the other hand, reprocessed waste is vitrified into borosilicate (Pyrex) glass. Pyrex glass is perceived to have no future use, and is sealed into stainless steel cylinders to await permanent deep underground disposal. The most supported permanent disposal method is deep geological disposal. The aim is to isolate HLW from the biosphere by storing immobilised waste deep underground in corrosion-resistant containers with an impermeable backfill.

Around the world, there is increasing debate on the need to permanently dispose of the large amount of highly radioactive nuclear waste in temporary storage. In the US, senators even sued the Federal Government for not building a permanent disposal facility, which caused used nuclear fuel to build up in dry casks in temporary storage. The topic aims to discuss ways to dispose of radioactive waste safely in the long term.

Key Terms

Term	**Definition**
Radioactive Waste	Radioactive waste is any waste which is radioactive or contaminated by radiation at concentrations or activities greater than clearance levels as established by IAEA, and has no more foreseeable use.
Very low -level waste	Very Low-level waste (VLLW) or Exempt waste refers to radioactive materials, which are not considered harmful to humans or the environment, that is suitable for authorized disposal with ordinary waste in facilities not specifically designed for radioactive waste disposal.
Low-level waste	Low-level waste (LLW) means waste which contains small amounts of mostly short-lived radiation. Examples include paper, tools, clothing generated from hospitals, industry or energy production. After packaging for long-term management, LLW can be disposed of in bins and bags without shielding in near surface

	facilities. LLW makes up 90% of the volume but only 1% of the radiation of radioactive waste. Satisfactory disposal methods have been developed and are being adopted around the world.
Intermediate - level waste	Intermediate-level waste (ILW) contains enough long-lived radiation to require shielding. ILW usually includes resins, chemical sludges, metal fuel cladding and contaminated materials from energy production. ILW is usually stored in silos in shielded above-ground or in-ground storage facilities. ILW comprises 7% of the volume but 4% of the radiation of radioactive waste.
High-level waste	High-level waste (HLW) refers to materials radioactive enough for its decay heat to be capable of increasing the temperature of itself and its surroundings. HLW thus requires shielding and cooling. It is usually generated from the burning of uranium fuel in energy production. There are two kinds of HLW, mainly used fuel considered as waste and waste from the reprocessing of used fuel. HLW is usually stored in water or dry casks before final management, such as deep geological disposal. HLW accounts for 3% of the volume but 95% of the radiation of radioactive waste. It is the centre of debate surrounding the safe disposal of radioactive nuclear waste.
Near Surface disposal	Near surface disposal refers to the disposal of radioactive waste in ground level or below ground level with a depth of tens of metres. LLW and Short-lived ILW are disposed of here.
Deep geological disposal	Deep geological disposal means the disposal of radioactive waste at depths from 25m to 1000m for mined repositories (tunnels and caverns) or 2000m to 5000m for boreholes. It is used for the disposal of Long-lived ILW and HLW. Other than the place for storage, other complementary facilities also have to be developed, such as interim waste storage and casks for transport and deep storage. Many countries have conducted

	research on this method of waste disposal. The United States is currently using this method to dispose of defense- generated transuranic waste in an underground salt bed layer over 600 m below surface at WIPP. Sites have been selected in various countries, such as the site in Olkiluoto, Finland.

Background Information

Most of the radioactive waste generated around the world is currently stored in temporary storage facilities, awaiting permanent disposal with or without reprocessing. Many call for the quick development of permanent disposal facilities fueled by the following problems associated with temporary storage.

Overcrowding at temporary storage

HLW, usually used fuel from energy production, is currently stored at pools at nuclear power plants, since water can cool down waste and block radiation. These pools are intended to be temporary storage for HLW until it is cool enough to be transferred to permanent storage. However, many permanent disposal sites are only in the development stage, resulting in over-crowing at pools in many nuclear facilities. In fact, the US is running out of temporary storage facilities and the government estimates that it will pay private companies $35.5 billion to treat radioactive waste in the future.

Safety and health risks associated with temporary storage

Accidents and spills resulting in an unforeseen release of radioactive waste from nuclear energy facilities threaten human health. In the US in 1979, large amounts of tailings, a radioactive sludge, was released into the Puerco River. The locals were not informed of the leak and they continued to use the water for a few days. As a result, many of them were exposed to harmful radiation and developed neoplasms, leading to premature deaths.

Other more famous examples include the Chernobyl Accident in 1986 and the Fukushima Accident in 2011. In Chernobyl, a flawed reactor design utilized by untrained staff resulted in steam explosion and fires, leading to the release of radioactive reactor cores into the environment. In Fukushima, an earthquake followed by a tsunami disabled the power supply and cooling of three reactors, resulting in high radioactive releases. Inside reactor buildings, there is a massive volume of waste which is mostly contaminated with radiation on the surface.

The most common health concern is the increased risk of getting thyroid cancer from the release of radioactive iodine-131. If breathed in or ingested, iodine-131 concentrates in thyroid glands and increases the chances of thyroid cancer, placing children at especially high risks. There is a high number of cases of thyroid cancer after Chernobyl, yet people at Fukushima only had a little uptake of iodine-131 since less radioactive iodine was released and most of it was released out to the sea, and also due to quick removal of contaminated food and the distribution of iodine tablets. It was actually more common for people to suffer from stress and depression resulting from the relocation following the accident.

Nevertheless, storing radioactive waste temporarily in pools in energy production facilities does induce the risks of an accident and raises safety and health concerns. However, it can be seen from the Fukushima incident that swift government response in disseminating information, organizing relocation and handling out iodine tablets makes a big difference.

Economic burdens from temporary storage

Temporary storage requires human monitoring and regular inspection, which makes it costly. For example, in the United Kingdom alone, it costs taxpayers £3 billion per year to keep nuclear waste in safe yet high-maintenance conditions. In the US, many nuclear power plants are not in operation since they cannot compete with cheaper natural gas and renewables, yet they still have a price. In the US, the Maine Yankee power plant had a cost of $35 million in 2019 without producing any electricity for more than 20 years. A total cost of $7.5 billion is estimated as the total cost for storing radioactive waste all these years. The high cost of temporary storage is certainly an incentive for policy makers to come up with permanent solutions to the waste problem.

Potential Clashes

Despite the many problems in temporary storage, there is still vigorous debate on whether permanent disposal should be adopted at all. Even if a consensus is reached on the need for the development of permanent disposal facilities, many countries still struggle to actually construct these facilities due to the difficulties listed below.

Environmental concerns

Environmentalists are likely to object to the construction of permanent disposal sites, as it is feared that a better storage facility will only lead to more nuclear power stations and an increase of nuclear energy in the gross energy mix. Others are also concerned about the potential environmental impacts and safety risks involved, since this method is not widely adopted yet. In Sweden, the court has rejected the construction licence for a disposal facility near Forsmark due to concerns over the corrosion resistance of copper canisters. Some anti-nuclear activists in France also claim that deep geological storage involves risks of radiation leakage in groundwater and advocate for storage in underground facilities which are just a few metres deep with better monitoring instead.

Failure to find a suitable site

During the siting process, it is difficult to obtain consent from different stakeholders. There are many geological, socio-economic, health and safety concerns involved. Oftentimes, development plans are met with strong opposition from regional organizations, resulting in the ultimate failure in securing a site. For example, the UK launched a course, Managing Radioactive Waste Safely (MRWS), committing by the authorities that only communities that "voluntarily expressed an interest in taking part in the process will ultimately provide a site for a geological disposal facility". Plans including detailed geological investigations and discussions over the social and economic implications had been made to search for a site in Cumbria, but the Cumbria County Council vetoed the stage, which ends Cumbria County Council's four-year formal involvement in the process to find an underground repository for HLW. The Cabinet believed that Cumbria was not the best place geologically in the UK and "the government's efforts need to be focused on disposing of the waste underground in the safest place, not the easiest".

Lack of public support

Following various nuclear disasters, the public has many doubts and worries surrounding nuclear energy and its impacts on radiation and health. Many of them are especially opposed to the idea of the construction of any facility involving nuclear energy near their homes, a display of the Not In My Backyard mentality. In France, there were protests surrounding the disposal facility at Bure. Citizens may perceive permanent storage as fallible and dangerous without recognizing the danger of overcrowding in temporary storage in the status quo. The lack of public support poses challenges to processes such as site selection.

Controversy regarding whether waste should be retrievable

Unprocessed waste mainly consists of uranium. While some believe that this potentially valuable resource should not be disposed of irretrievably, others argue that permanent closure is the key to long-term security. France, Switzerland, Canada, Japan and the US all include the element retrievability in their disposal policy. For example, the Bura site in France is designed so that waste can be retrieved for the first 100 years if a better disposal method is developed in the future.

Key Stakeholders and Past Actions

Stakeholder	Involvement with the Issue
United States	The United States currently has 56 commercially operating nuclear power plants with 94 nuclear power reactors scattered around the 28 states, with around 20% of its electricity coming from nuclear power. As the US runs out of temporary storage facilities (imposing high costs as discussed in the section of economic burdens), many call for the development of permanent facilities. However, the US was unable to reach a consensus on the construction of permanent facilities. Yucca Mountain, which is located in an arid desert 100 miles from Las Vegas, Nevada, was directed to be studied by the Department of Energy (DOE) in order to become the main site for storing the US's accumulated nuclear waste. Under the strong opposition of the State of Nevada, the DOE withdrew its application to the Nuclear Regulatory Commission (NRC) in 2010. The Blue Ribbon Commission on America's Nuclear Future (BRC)

	was formed to find new strategies for managing the back end of the nuclear fuel cycle. The BRC conducted a comprehensive review and issued a framework for moving toward a sustainable program for managing the country's radioactive wastes, called the Strategy for the Management and Disposal of Used Nuclear Fuel and High-Level Radioactive Waste. A new siting process, labelled "consent-based siting," was being developed by the DOE. However, this was cancelled by the current Administration, and attempts are being made to revive the Yucca Mountain project.
United Kingdom	Nuclear energy plays an important role in the United Kingdom's generation of electricity. The UK currently has 15 nuclear power plants, with around 20% of its electricity coming from nuclear power. In January 2018, the UK Department for Business, Energy and Industrial Strategy launched a new siting process, beginning with community consultations to explore views on the approach to planning and selecting a site for a geological disposal facility in partnership with potential willing host communities.
Russia	The National Operator for Radioactive Waste Management (NORWM) is the specified national operator for the Russian nuclear waste management program. Long-term storage of nuclear waste and postponed decision of its final disposal was a general practice. During the past few years Russia has been putting a lot of effort in handling implementation of principles, investing in technologies and control systems for the ultimate disposal stage. In 2016, the Nizhnekansky Rock Massif at Zheleznogorsk in Krasnoyarsk Territory was approved to be the location of the deep geological repository for high level waste and used nuclear fuel. An underground research laboratory, which will be used for research before the construction of the repository, is currently under construction at the site.
China	The China National Nuclear Corporation (CNNC) is responsible for the development of a deep geological repository for used CANDU fuel, and for high-level waste from the reprocessing of

	used light water reactor fuel. China's site selection process, which is technically-driven, began in 1986 and focused on three candidate locations in the Beishan region of Gansu province in northwest China. In 2016, one of the siting regions was selected to host an Underground Research Laboratory. The site for the Underground Research Laboratory has a strong potential to become the eventual site of the repository. Site selection is expected in 2020.
Germany	Germany's Federal Office for Radiation Protection (BfS) is responsible for the safety and protection of people and the environment against damages due to ionizing and non-ionizing radiation. This includes radiation from sources such as medical diagnostics, mobile communications, and nuclear technology. Germany is investigating a site for a deep geological repository, with the project still in its early stages. A new siting law was passed in 2013, and between 2014 and 2016, a commission was established for discussing the basics of how to manage high-level waste and site selection criteria. Germany is now proceeding to the second step in its stepwise process, which is to establish actual siting criteria. A new government agency – BGE (Bundesgesellschaft für Endlagerung) – was established as the implementing organization. The site selection process will be accompanied by extensive public participation.
Japan	It is witnessed that there are great changes in Japan's power sector, especially with the collapse of nuclear power. After mass protests, Japan announced plans to make a shift to renewable energy, instead of rebuilding new reactors. Despite enormous investments in nuclear power plants, its share in the country's gross electricity generation had a drastic decrease. After the great Tohoku earthquake and Fukushima Daiichi accident, a range of discussions were held to reconstruct the geological disposal program at the government level. The Nuclear Waste Management Organization of Japan (NUMO) has been promoting a siting process since its establishment in 2000. This included a sitting strategy, in which the Government of Japan

	will play a proactive role by nominating “scientifically favourable areas" to assist in resolving the issue of high-level radioactive and TRU waste disposal. A detailed geological map, including exclusion areas, was released in 2017 for public review and discussion. NUMO expects site selection about 2025, with repository operation from about 2035.
France	France has 59 operational nuclear power plants, with 78% of its electricity coming from nuclear power. Andra is responsible for identifying, implementing and guaranteeing safe management solutions for national radioactive waste, in order to protect the country from the danger of such substances. Siting studies of France began in 2007, outside the village of Bure in the Champagne-Ardenne region of eastern France. An application for a repository construction licence was submitted in 2019, with construction expected to start in 2022.
Nuclear Energy Agency	The Nuclear Energy Agency (NEA) is an intergovernmental agency which aims to facilitate international cooperation regarding the use of nuclear energy. Its objective is to assist member states in developing scientific, technological, legal, environmental and economical bases required for the safe and peaceful use of nuclear energy. More specifically, it provides assessments and conducts research to aid governments in decision making as well as facilitates the exchange of information between states on nuclear energy. The IAEA and the NEA have worked closely together throughout the years with complementary missions and roles. The NEA especially focuses on improving the safety and capability of current nuclear energy programmes. The NEA has contributed immensely to the research on the safe disposal of radioactive nuclear waste, publishing multiple reports on topics such as the safety of geological disposal in France, safety-related issues like gas generation and discussions on reversibility and retrievability in geological disposal.

Possible Solutions

A lot can be done to enhance safety in the disposal of radioactive waste. Other than deep geological disposal, there are many other disposal options suggested and implemented in history, such as sending waste into space or the sea after treatment. Many can be done to improve current methods as well, such as directing investment and facilitating international cooperation to the development of related technologies. Below are just brief discussions of the possible solutions to the issue.

Initiating public discussion on permanent disposal

It would be a big step on the road to a solution if public conversation is initiated. Many of the difficulties encountered in developing permanent disposal stem from public mistrust and worries towards nuclear energy and radiation, resulting in problems such as the inability to secure a site. The role of governments is crucial in defining the process, addressing public concerns, and negotiating acceptable solutions. Public dialogue has the potential to facilitate a better understanding of the current problem of temporary storage as well as clear common misconceptions about the dangers of permanent disposal. At the end, the aim is to enhance public support for permanent disposal. Various incentives can be provided to spark public dialogue. For example, the UK government proposed an incentive package which offers communities £1m per year just to have discussions about hosting the facility.

Better temporary storage

Other than looking for permanent ways to store radioactive waste, centralized dry cask storage can be used instead of cooling pools to improve safety.

Alternatives to Geological Disposition

Surface storage

Safe Storage in surface or near-surface facilities can be achieved by packaging SNF and HLW in suitably engineered structures or robust containers to make sure that radioactive waste will not be released. Security can be achieved by restricting access of the general public, so that there is no possibility of individuals or groups using radioactive material for acts of terrorism.

Partitioning and transmutation (P&T)

The P&T concept has been investigated by a number of countries. It is believed that such a method can only reduce the volume of HLW that would be sent to a repository, hence, instead of a substitute, it should be considered as a supplement to geological disposition.

Guiding Questions

- How should the IAEA react to member states that are not complying with current rules and regulations?
- What contributions can member states make to further develop new technologies regarding nuclear waste disposal?
- What role does new emerging technologies play while solving the issue?

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