BRATISLAVA MODEL UNITED NATIONS 2013

International Atomic Energy Agency

The Question of Permanent Disposal of Spent Nuclear Fuel

Study Guide

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Letter from the Chair

Distinguished Delegates,

My name is Anna Mária Urbanová and I will be chairing International Atomic Energy Agency (IAEA) committee at BratMUN 2013. To introduce myself, I am in my final year of IB Diploma Program at Gymnázium Jura Hronca. Having participated in previous BratMUN 2012, I know that it is an intriguing experience, and I believe that you will gain new and useful knowledge from this year´s BratMUN. I hope that IAEA committee will contribute to it.

By registering to BratMUN 2013 you have shown that you are active and that you seek new experiences and knowledge. I would like to thank you for your courage and zeal and I assure you that with right attitude each one of you has potential and right qualities to be a good contributory member of this committee.

As this year´s IAEA topic, I have chosen the question of disposal of spent nuclear fuel. As IAEA is not usual committee for BratMUN I have chosen this topic as it has more importance than it seems at the first glance. The main objective in managing and disposing of spent nuclear fuel is to protect both people and environment. Problem rests in the question how it should be done and in the public acceptance of known methods of disposal. This study guide will provide you with necessary information about this topic, but I strongly recommend you to investigate this topic thoroughly using other sources and I hope that you will prepare with responsibility.

I hope that you will have enjoyable time discussing this important global issue and that it will be beneficial to all of us.

I am looking forward to meeting you all at BratMUN 2013. In case of any questions or concerns feel free to contact me at mariaaurbanova@gmail.com.

Anna Mária Urbanová,

Chairperson of the International Atomic Energy Agency Committee

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Table of Contents

Letter from the Chair……1

1. Introduction to the International Atomic Energy Agency……..3
    1.1 IAEA´s role in radioactive waste management……3
2. Radioactive Waste……...4
    2.1 What is radioactive waste……4
    2.2 Categorisation of radioactive waste……..4
3. Disposal and Management of HLW……5
    3.1 Methods of dealing with HLW……5
    3.2 What is actually being done……..6
4. Conclusion……...7
5. Resolution……7
6. Position Paper……..8
7. Closing Word……..8
8. Useful Links……9

1. Introduction to the International Atomic Energy Agency

IAEA is the International organisation that advises its Member States from all over the world on the safe and peaceful uses of nuclear technology. It is one of the agencies of the United Nations. IAEA is based in Vienna and it is Austria founded in 1957 and currently has 159 Member States from countries both with and without nuclear energy programmes. International Atomic Energy Agency develops safety standards, recommendations and guidelines and provides technical guidance to its Member States on radioactive waste principles.

Member States use these guidelines and standards to develop their own legislation, regulatory documents and guidelines. It also verifies through a safeguards inspection programme compliance with Nuclear Non-Proliferation Treaty (NPT).

Section of IAEA, namely Waste and Environmental Safety Section, works to develop internationally agreed standards of radioactive waste. The Radioactive Waste Safety Standards Programme (RADWASS) provides guidance to member states in producing their own regulations and policies for the safe management of radioactive waste, including disposal of spent nuclear fuel.

Moreover, the IAEA aids Member States by providing technical assistance with services, equipment and training by conducting radiological assessments.

1.1. IAEA´s role in radioactive waste management

The IAEA has fostered international cooperation in the waste management field since its establishment in 1957. To reflect diverse range of interests among its Member States the IAEA´s waste management programme includes activities benefiting Member States regardless of their degree of sophistication in the uses of nuclear energy.

This waste management programme provides direct services particularly to developing Member States and newly independent states of the former Soviet Union. Such services include technical assistance training and necessary activities to strengthen national infrastructure. This programme also fosters and coordinates research and development through common research programmes to which it's Member States contribute as well. Moreover RADWASS is to establish safety standards for the management and disposal of wastes by building international consensus.

International codes of practice and safety conventions are implemented and provision of a forum for the dissemination and exchange of information at international conferences, symposia and seminars including the promotion of education, public information and training is part of this programme as well. Development and implementation of special projects, including assessment of the environmental and radiological impacts of waste disposal is another key focus of this programme.

2. Radioactive Waste

2.1. What is radioactive waste

Radioactivity is naturally occurring phenomenon and sources of radiation are natural features of the environment. Radioactive substances, or radiation itself, have numerous beneficial and profiting applications in several fields. Starting from power (electricity) generation to medicine or agriculture environment. Radiation risks to workers and environment and wide public from application in these fields have to be assessed, if need arises controlled, as to avoid any harm.

For over half a century implementation of nuclear technologies has been contributing to improved life quality in various fields:

- Close to one fifth of the world`s electricity is supplied by nuclear power plants and in some countries this power accounts for over 50% of the energy supply.
- Nuclear applications are enhancing the productivity of the industry and agriculture worldwide and thus contribute to scientific advancement in numerous areas.
- Nuclear technologies and techniques are used in the treatment and diagnosis of life-threatening diseases (for instance cancer).
- Improvement in the management of water resources and the biosphere.
- Help in controlling pollution.

However, like many human-induced and natural processes, applications of atomic energy produce waste-residue that needs to be managed and disposed of effectively and carefully to protect environment and human health.

IAEA`s definition of radioactive waste, which is mostly result of such processes, is that it is any material containing a concentration of radionuclides greater than those deemed safe by national authorities. Another fact that distinguishes it, is that it has no foreseen use.

Due to such a wide variety of nuclear applications, the types and amounts or, even physical forms, of radioactive waste considerably vary. Some waste can remain radioactive for hundreds of years, while other remains radioactive for much shorter time span.

2.2. Categorisation of radioactive waste

To facilitate communication and information exchange among its Member States, the IAEA instituted a revised waste classification system in 1994 that takes into account both qualitative and quantitative criteria, including activity levels and heat content. IAEA's three principal classes include exempt waste, low and intermediate level waste, and high level waste.

Exempt waste contains rather low concentration of radionuclides and is actually excluded from nuclear regulatory, for is radiological hazards are considered negligible.

Low and intermediate level waste (LILW) is most often a result of manipulation with object in the close vicinity of radioactive material, for instance manipulation with of near the reactor. LILW contains enough radiation that it is necessary to take action to protect

humans and environment for either short or extended period of time. It is possible to subdivide this category by the half-lives of the radionuclides contained in the material into short lived waste and long lived waste. Long lived waste has the half-life of radionuclides over 30 years.

Spent nuclear fuel is highly radioactive material, but is not truly a waste as it still contains usable parts. It is possible to reprocess it and extract plutonium and other usable components. Officially is the spent nuclear fuel, as well as the waste from reprocessing of it, considered and referred to as a high level waste (HLW). Such waste by standards contains such a high levels of radioactive materials that a high degree of isolation from biosphere, normally in geologic repository, is required for long periods of time.

To provide you with an idea of how much of a waste is produced, by electricity generation in nuclear plants, this information is rather useful:

- The generation of electricity from a 1000 MW (e) nuclear power station, which would supply the needs of a city the size of Amsterdam, produces approximately 300 m^3 of low and intermediate level waste per year and some 30 tonnes of high level waste per year.
  To compare it a 1000 MW (e) coal plant produces some 300,000 tonnes of ash alone per year that contains, among other things, radioactive material and heavy metals which end up in landfill sites and in the atmosphere.

- Nuclear power generation facilities produce about 200,000 m^3 of LILW and 10,000 m^3 of HLW (including spent fuel designated as waste) each year worldwide.

3. Disposal and Management of HLW

Countries operating nuclear plants mostly have, or are in a process of developing, facilities for managing HLW. Despite the fact that national strategies differ, the approach and basic strategies are mostly similar, thus creating a basis for information exchange and platform form cooperation.

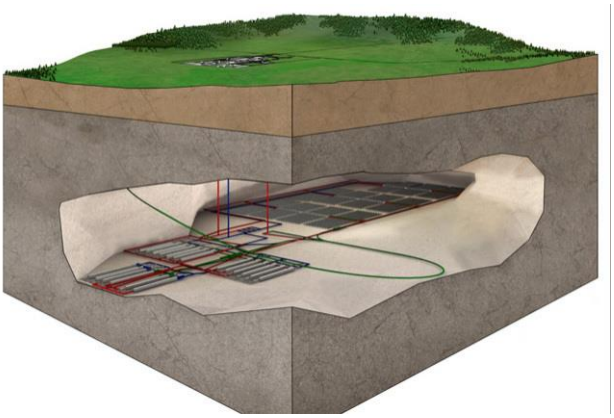
3.1. Methods of dealing with HLW

The moment the spent fuel has been removed from a nuclear reactor, it is placed in storage at the reactor site. Such a storage is only an interim solution and spent fuel is afterwards handled in two different manners:

- Spent fuel placed in storage facilities away from the reactor for 5 to 100 years. It is conditioned after an appropriate decay period and then stored before its final deposition in a geologic depository (see Addition A).

OR

- Spent fuel is reprocessed after the stage in the away-from-reactor-storage. Resulting product is liquid HLW that is soon immobilised in a stable matrix (for instance borosilicate glass). HLW is then stored before its final disposal in a geologic repository (again see Addition A)



[Addition A shows the design of geologic repository of spent nuclear fuel and HLW]

There is broad scientific agreement that deep geologic disposal using a system of engineered and natural barriers to isolate the waste is the best method. The principal features of such geological repository is to place packaged waste in a stable formation several hundred meters below the surface with engineered barriers around and/or between the waste packages and the surrounding rock.

Such geologic repository should be located deep underground and in stable region, one that is not prone to massive landslides or earthquakes. Granite, loam and crystalline rock are suitable environs for such repositories.

3.2. What is actually being done

There are no deep geologic repositories available. In America construction of one was almost initiated in Yucca Mountain, but the idea was abolished after the distress about the hazard of pollution of subterranean water. Belgium has plans for building repository in loam near Mole and England in crystalline rock around Sellafield.

It is estimated that with the amount of HLW in Europe only 2(3) deep geologic repositories are necessary and at least 2 are estimated to be necessary for USA. It is unthinkable that each country, which uses nuclear power to generate electricity, would operate their own repository, as fixed costs for building and planning are rather high for country to bear alone. Moreover there are countries that do not possess territory with necessary characters to fulfil the safety standards of HLW permanent disposal.

Countries thus seek easier reached solutions for HLW. Plutonium or americium extracted from spent nuclear fuel are quite usable materials, for example in fuel for space shuttles, thus countries try to reprocess the spent fuel and sell extracted material. If plutonium was proven to be useful for the above mentioned kind of fuel and demand for it would rise Great Britain, for instance, would have easier way out. Currently is the approximate sum for managing HLW in Britain 4 billion USD.

However, the problem does not arise only from spent fuel and HLW produced in recent years. Soviets deposited much of their HLW in Northern Sea and now Russia deals with the problem of cleaning the sea water of containers containing HLW, before it’s too late. If there was leak, consequences would be devastating world-wide.

4. Conclusion

Question of permanent disposal of spent nuclear fuel, or HLW for that matter, is one of major problems that came with modern age. It is challenge to find and execute the right solution for the problem, as the decision would affect several following generations. It is necessary to ensure safe environment for HLW to decompose, which takes at least 100 000 years. The solution to the problem nowadays is to store HLW in interim storages. This is not wrong solution, but such storages are above ground and they need to be monitored and controlled. *Is this world able to provide such safety and stability that these storages will be left untouched for at least 100 000 years?*

There is always lure of power and as HLW is dangerous enough (when released from its containers) that someone would dare to use it as a weapon. Deep geologic repository would contain HLW and would not require such control as above-ground-storage would.

Countries operating nuclear power plants design their own repositories, their own solutions to the problem. However, there is not as much time as to have indefinite time for when such repositories should be working. Over 20 proposals and designs for deep geologic repositories are made, yet none are ready for use.

Reprocessing of spent fuel provides useful materials and resultant waste needs less storage time than spent fuel does. However, during reprocessing higher risk of pollution and leak of radiation is present. *Are those materials and less storage time worth risking human health and environment?*

5. Resolution

As it was mentioned previously, permanent disposal of spent nuclear fuel is pressing issue and world-wide problem and should be brought forward to wider public. It is important to provide public with information about this problem, and to reach decisions cooperating not only on international scale, but it is also important to address this issue on national scale. A resolution of IAEA should not focus only on how to dispose of HLW as extensive scientific research was already conducted on the topic and each country has its own strategy, which is similar to strategies of other countries. Instead it should focus on addressing the issue of how to inform public and decide on certain time span to provide for firs repositories to be build. After-care mechanism after reprocessing and acceptance of safety guidelines provided by IAEA should be addressed in resolution. Furthermore extra care should be paid to countries that do not possess any means of dealing with HLW in the long run.

6. Position Paper

As delegates you are required to submit a position paper, where you clearly state the position of your country towards the issue and what measures your country condemns and endorses. Position of the country you represent should be based on extensive research about both the topic and background of country. I advise you to summarise this position, find solutions that the government would deem to be appropriate and what would be considered as steps against your country. Your Position Paper should not exceed the length of 1 page.

7. Closing Word

Disposal of spent nuclear fuel is a pressing topic in current world, though may not be such an outspoken one. Highly radioactive products are produced during electricity generation and as years pass large amounts of this nuclear waste are accumulated. Despite the fact that each country, which uses nuclear plants to produce electricity, has its own plan of disposal of such waste, collective world-wide cooperation is necessary to ensure safety of following generations.

I hope that you will make use of this study guide. However, you should not make it your only source of information. You should research beyond what is mentioned here. It is not truly necessary for you to research the processes of decomposition of HLW, but I suggest that you look into how countries deal with it (meaning: search for information on other countries as well).

8. Useful Links

-HLW

- http://www.iaea.org/Publications/Factsheets/English/manradwa.html
- http://www.world-nuclear.org/info/Nuclear-Fuel-Cycle/Nuclear-Wastes/Radioactive-Waste-Management/#.UlAx6IbwnkU
- http://www.nda.gov.uk/ukinventory/
- http://www.nda.gov.uk/ukinventory/waste/materials-management-regulated.cfm
- http://www.iaea.org/
- http://www.iaea.org/About/Policy/GC/
- http://www.whatisnuclear.com/articles/waste.html
- http://www.counterpunch.org/2013/07/15/nuclear-spent-fuel-a-ticking-timebomb/

-Solutions

- http://www.forbes.com/sites/kensilverstein/2013/08/29/where-on-earth-do-we-put-spent-nuclear-fuel/
- http://www.world-nuclear.org/info/Nuclear-Fuel-Cycle/Fuel-Recycling/Processing-of-Used-Nuclear-Fuel/#.UlLdlFDwnkU
- http://en.wikipedia.org/wiki/Deep_geological_repository
- http://www.oecd-nea.org/rwm/igsc/sc2013/
- http://bruce-nuclear-waste-burial.weebly.com/
- http://www.sjforum.sk/bulletin/06_02_07.htm

-Stands

- http://www.world-nuclear-news.org/newsarticle.aspx?id=24743
- http://www.world-nuclear.org/info/Nuclear-Fuel-Cycle/Nuclear-Wastes/International-Nuclear-Waste-Disposal-Concepts/#.UlLem1DwnkU
- http://www.wiseinternational.org/node/2018
- http://www.neimagazine.com/features/featurerock-solid-ambitions