Forum: General Assembly Second Committee

Issue: Measures to recover radiation contaminated zones

Student Officer: Jingyi (Elina) Du

Position: Chair of General Assembly Second Committee

Introduction

As the world develops, humans are able to create more advanced, efficient, and inexpensive methods of using nuclear energy. Nuclear energy, a recently discovered type of energy, is mainly used to generate electricity and to create weapons. Nuclear energy was first harnessed by humans to generate electricity in 1948. Since then, it has become steeped in controversy due to its high efficiency and risk. The radioactive uranium isotopes used for nuclear energy generation are extremely unstable. Thus, if these substances go out of control, they would cause infrastructure-damaging explosions and great damage to the surrounding environment such as radiation poisoning to humans and animals. Several nuclear accidents have taken place around the world, with the most recent and well known one being the accident of the Fukushima nuclear power plant in Japan. The Fukushima Daiichi Accident caused three of six on-site nuclear reactors to melt down and contaminated a large area both on land and sea, as far as 200 miles from the source. Regardless of the risk, multiple more economically developed countries have constructed nuclear power plants.

Apart from power plants radiation leaks, another major cause of radiation contamination is the testing of nuclear weapons. Ever since the first nuclear test in July 1945 in the United States, numerous nuclear weapon tests have been carried out in different environments. These tests take place on Earth's surface, in the atmosphere, underground and underwater. According to the National Resources Defense Council, the total yield of all nuclear tests conducted between 1945 and 1980 was estimated to be 510 megatons (Mt). Atmospheric tests alone accounted for 428 mt, equivalent to over 29,000 Hiroshima-size bombs. The amount of radioactive pollutants that these tests generate varies by the size of the weapon, the location and the weather conditions. Generally, atmospheric tests contribute more to the exposure of the world's population to radiation. Multiple countries have conducted nuclear test explosions. The countries are listed according to the number of tests conducted, from the most to the least: United Sates, Soviet

Union, France, United Kingdom, China, India, Pakistan and North Korea. Major tests took place between 1945 and 1980 by the P5 nations. After the Partial Test Ban Treaty (PTBT) was signed by the five nations in 1980, the number of nuclear tests has decreased significantly. Nowadays, North Korea is the only country actively carrying out nuclear tests. However, the previous tests have already created radiation contaminated zones such as the Hanford Site and Sellafield.

Definition of Key Terms

International Nuclear Event Scale (INES)

The International Nuclear Event Scale is a tool used for measuring the severity of a nuclear and radiological event (could be incident or accident). The INES is a global standardized system to inform the public about the events and the threats to the safety of the citizens dwelling in nearby areas. There are 7 possible levels that a nuclear event could be classified as using the INES, with levels 1 to 3 classified as “incidents” and levels 4 to 7 classified as “accidents”. The difference of severity between each level is approximately 10 times of the previous level. When an event is not influential to be classified on the scale, it is a “deviation” and will be marked as “below scale” or “level 0”.

Ionizing radiation

Ionizing radiation is radiation that carries sufficient energy to cause the formation of ions by interacting directly or indirectly with atoms or molecules. It appears in radiation contaminated zones. Ionizing radiation is proven to be one of the carcinogens to human beings.

Radioactive material

Radioactive material is a physical substance that contains radioactive atoms, which release radiation as they decay. Radioactive material is measured in units representing the number of radioactive atoms. This unit is known as “Disintegrations per Minute” or DPM.

Dispersible radioactive material

Dispersible radioactive material is radioactive material that can be spread easily. Such as gas, liquid, or powder. These forms of radioactive materials are commonly used for scientific research and power plants.

Radioactive contamination

Radioactive contamination is undesired dispersible radioactive material in places that will affect the health and safety of the dwellers. The unit DPM/100 cm2 is the unit used to measure the amount of movable radioactive material on the surface of contaminated sites.

Airborne radioactivity

Airborne radioactivity is the measure of the amount of radioactive materials present in the air. The unit used for airborne radioactivity is μCi/cc, with μCi representing the amount of radioactivity and cc being the specified volume of air.

General Overview

Historic Development

Nuclear Weapons

On July 16, 1945, the world's first nuclear weapon was tested in New Mexico, United States. The nuclear weapon was the result of American-led research code named "the Manhattan Project." Less than a month later, nuclear weapons were put into actual use, as two atomic bombs, "Fat Man" and "Little Boy", were dropped onto the Japanese cities of Hiroshima and Nagasaki on August 6 and 9 of 1945 respectively. The two nuclear bombs played a crucial role in causing Japan's unconditional surrender, resulting in the end of WWII.

In the following years, other countries also successfully developed and tested their own nuclear weapons, including the rest of the Security Council P5 members, as well as India, Pakistan, Israel, and North Korea. The Nuclear Arms Race during the Cold War saw thousands of nuclear detonations around the world as the United States and Russia fought for nuclear supremacy. Despite several close calls, notably the Cuban Missile Crisis, nuclear weapons were never used against other nations after the two bombs dropped on Japan. Nations around the world had begun to realize the dangers of nuclear weapons, and a deterrent system was realized in the form of "Mutually Assured Destruction," the concept that if any nuclear strikes against other nations will result in the destruction of both nations.

As the potential extinction of human civilization due to nuclear weapons became increasingly likely, the international community convened in an effort to achieve the goal of nuclear disarmament. As a result, the Treaty on the Non-Proliferation of Nuclear Weapons was signed on July 1, 1968. It entered into force in 1970, and was extended indefinitely and unconditionally on May 11, 1995. As of today, all United Nations member states have either signed or ratified the treaty, except for India, Israel, Pakistan, South Sudan, and North Korea.

Past nuclear testing sites such as The Polygon, Kazakhstan (previously part of the USSR), as well as nuclear/chemical production sites of nuclear weapons such as Hanford in the United States, the Fangatuafa Atoll in the Pacific Ocean, Sellafield in the United Kingdom, and Siberian Chemical Combine in Russia still possess strong radioactive contamination.

Nuclear Energy

Scientific research into atomic radiation, atomic change and nuclear fission started in 1895, when ionizing radiation was discovered by Wilhelm Rontgen. This research was continued by different scientists until the end of 1938, when nuclear fission was demonstrated by Otto Hahn and Fritz Strassmann. They calculated the energy released from the fission to be 200 million electron volts, showing nuclear fission as a promising energy source.

The discovery and confirmation of nuclear fission sparked research in many laboratories around the world. The experiment demonstrated by Hahn and Strassmann showed that nuclear fission not only released massive amounts of energy, but also additional free neutrons that could possibly be used to sustain a chain fission reaction. It was then proposed by Niels Bohr that the Uranium-235 isotope was much more likely to sustain a chain reaction than Uranium-238, due to its slower moving neutrons. This was later confirmed, and along with previous discoveries acted as precursors to the eventual realization of a nuclear bomb.

The first commercial nuclear power plant “Yankee Rowe” entered into use in 1960 and operated for more than 30 years until its retirement in 1992. Following it, many more emerged, some with different methods of controlling the fission. The most notable are the Pressure Water Reactor, Boiling Water Reactor, and RBMK (Russian for “High Power Channel-type Reactor).

Nuclear Accidents

Perhaps the most notorious nuclear accidents are the Chernobyl and the Fukushima Daiichi Accidents. Both released massive amounts of nuclear contamination into the surrounding environment and rendered the area uninhabitable for many years.

Chernobyl

On April 25, 1986, the No.4 reactor of the Chernobyl nuclear plant critically failed as a result of flawed design and operation by inadequately trained personnel. The resulting explosions and fires released more than 5% of the reactor core's radioactive material into the atmosphere and surrounding areas. Two workers died on site, and later on 28 more people died as a result of acute radiation poisoning. The three classic acute radiation syndromes are bone marrow syndrome, gastrointestinal (GI) syndrome, cardiovascular (CV)/ central nervous system (CNS) syndrome, from the least harmful syndrome to the most harmful. The causes of deaths of the three syndromes include infection, hemorrhage, dehydration, electrolyte imbalance, edema, vasculitis, and meningitis. The radiation level at Chernobyl has dropped to an acceptable level as of today, and the remaining reactors at the Chernobyl power plant remain operative. Chernobyl Unit 4 was enclosed in a large concrete shelter, however about 200 tons of highly radioactive material (famously known as the “Elephant’s Foot”,) remain a risk to the surrounding environment until it is better contained.

Fukushima Daiichi

Following a major earthquake on March 11, 2011, a massive 15-meter-tall tsunami swept the Fukushima Daiichi reactors, disabling their power supplies and cooling systems. The cores of 3 reactors melted within three days. The accident was marked 7 on the INES scale due to the massive amount of radioactive releases. The Japanese government quickly evacuated the surrounding area, relocating over 100,000 people. No deaths or radiation sickness were reported in civilians, however an estimated 1000 deaths was reported to have occurred during the evacuation. The treatment of the accident generated massive amounts of radioactively contained water, some of which was dumped into the ocean. In October 2018, an estimated 80% of the 900,000 cubic meters of stored water from the reactors remain at radiation levels above legal limits to release into the ocean.

Other Sources of Radioactive Contamination

Nuclear power isn’t the only source of radioactive wastes. Others include medical, particle and space research, oil and gas, and mining.

A notable incident is the Goiânia accident which occurred on September 13, 1987 at Goiânia, Brazil. A radiotherapy source was taken from an abandoned hospital, and subsequently handled by many people, crated a radioactively contaminated zone, resulting in four deaths and 249 others who received significant doses of radiation. It is named by the IAEA as “one of the world’s worst radiological incidents.”

UN Involvement, Relevant Resolutions, Treaties and Events

The United Nations has been closely involved in matters concerning nuclear energy since its establishment. The aforementioned International Atomic Energy Agency (IAEA) was established on July 29, 1957 in response to the deep fears and expectations generated by the discoveries and diverse uses of nuclear technology. Although it as an autonomous organization operating under its own international treaty, the IAEA Statute, it reports to both the UN General Assembly and Security Council. The IAEA operates under three main missions: Peaceful Uses, promoting the peaceful uses of nuclear energy by its member states; Safeguards, implementing safeguards to verify that nuclear energy is not used for military purposes; and Nuclear Safety, promoting high standards for nuclear safety.

The aforementioned Treaty on the Non-Proliferation of Nuclear Weapons (NPT) was signed on July 1st, 1968, and defined nuclear weapon states as those who have built and tested a nuclear device prior to January 1, 1967. These are the permanent five members of the United Nations Security Council (United States, Russia, China, United Kingdom, France). Later on, further measures were adopted to strengthen the NPT, rendering it highly difficult for states to acquire the necessary resources or technology to produce nuclear weapons. The treaty also establishes a safeguarding system under the responsibility of the IAEA. The treaty consists of a preamble and eleven articles. However, its structure is often referred to as the "Three Pillar System," with the pillars being: 1. Non-proliferation, 2. Disarmament, 3. The right to peaceful use of nuclear technology.

Relevant UN resolutions:

-A/RES/56/24 (2001)

-A/RES/61/70 (2006)

-A/RES/61/70 (2006)

-A/RES/66/33 (2011)

-General Assembly Resolution 2373

Timeline of Events

Date	Description of event
1895	Discovery of ionizing radiation.
1938	Discovery and confirmation of nuclear fission.

July 16 1945	First nuclear weapon ever detonated in New Mexico, United States, as the product of the Manhattan Project.
August 6/9 1945	The only two nuclear weapons ever used in warfare were dropped on Hiroshima and Nagasaki, Japan.
July 29 1957	The establishment of IAEA.
1960	First commercial nuclear power plant entered use in the United States.
July 1 1968	The Treaty on the Non-Proliferation of Nuclear Weapons was signed.
April 25 1986	Chernobyl’s No.4 reactor critically failed, releasing radioactive material into the surrounding area.
September 13 1987	The Goiânia accident where an abandoned radiotherapy cell caused four deaths and 249 cases of acute radiation poisoning.
May 11 1995	The NPT was unconditionally and indefinitely extended during the Review Conference in New York City.
March 11 2011	The Fukeshima accident where three reactor cores of the Fukeshima Daiichi reactors melt down and release hazardous radioactive material into the surrounding area and ocean.

Possible Solutions

The current solution to recover radiation contaminated zones is decided into three phase, short-term recovery, intermediate-term recovery and long-term recovery. Short-term recovery refers to actions for recovery taken at the first few days to even hours for a nuclear event that would cause contamination. Short-term recovery mainly focuses on the evacuation of civilians and the medical stabilization and decontamination of the exposed individuals. After a few days or weeks, the intermediate phase of recovery begins. During this phase, conduction of more detailed characterization monitoring, agricultural embargo, and relocation of residents is necessary. However, since the currently existing contaminated zones passed the first two phases, the last phase should be the main focus. In this case, long-term recovery would be more suitable. The objective of the long-term phase is to revitalize, rebuild, and repopulate affected areas.

The major concerns in achieving long-term recovery of nuclear contaminated zones can be categorized as economic and social. Rebuilding contaminated zones is a huge financial burden to both more and less economically developed countries, especially when the nuclear event took place in or near populated residential districts. Different from rebuilding, the obstacle in the way of repopulating is the willingness of citizens.

Although most radioactive materials would decay within a few years, the public still believes that the risk of living in the recovering zones is beyond their range of acceptance. One possible solution is to lower the tax in the recovering zones and possibly providing other additional welfare. This would attract residents who could not afford living in their current locations. The government might also consider to provide protection by law to the residents who decided to move to the recovering zones. This policy would attract refugees and internally displaces persons (IDPs). On the other hand, governments must establish and apply regulations to the refugees and IDPs to prevent chaos. Once the recovering zones are repopulated, further constructions could be carried out easily.

Bibliography

Lee, Jim. "Ten Most Radioactive Places on Earth Mapped Out [GRAPHIC] · ClimateViewer News." *Ten Most Radioactive Places on Earth Mapped Out [GRAPHIC] ·*, 24 Nov. 2013, https://climateviewer.com/2013/11/24/10-most-radioactive-places-on-earth/

"INES Scale - Nuclear Accidents." *Nuclear Energy*, https://nuclear-energy.net/nuclear-accidents/ines-scale.html

BNL TRAINING & QUALIFICATIONS OFFICE, BNL TRAINING & QUALIFICATIONS OFFICE. "CONTAMINATION, HIGH CONTAMINATION and AIRBORNE RADIOACTIVITY TRAINING STUDY GUIDE." *Training.bnl.org*, 22 Sept. 2015, http://training.bnl.gov/StudyGuides/RWT/rwt300.pdf

World Nuclear Association, World Nuclear Association. "Outline History of Nuclear Energy." *Safety of Nuclear Reactors - World Nuclear Association*, Aug. 2018, http://world-nuclear.org/information-library/current-and-future-generation/outline-history-of-nuclear-energy.aspx

CTBTO, CTBTO. "General Overview of the Effects of Nuclear Testing." *1 March 1954 - Castle Bravo: CTBTO Preparatory Commission*, 2012, https://www.ctbto.org/nuclear-testing/the-effects-of-nuclear-testing/general-overview-of-theeffects-of-nuclear-testing/

Boehmer, Dawna, and Cecil Adams. "If Nuclear Fallout Lasts Thousands of Years, How Did Hiroshima and Nagasaki Recover so Quickly?" *The Straight Dope*, 29 Nov. 2017, https://www.straightdope.com/columns/read/2466/if-nuclear-fallout-lasts-thousands-of-years-how-did-hiroshima-and-nagasaki-recover-so-quickly/

Society, Asia. "A Brief History of Nuclear Weapons States." *Asia Society*, 2018, https://asiasociety.org/education/brief-history-nuclear-weapons-states

Editors, History.com. "Manhattan Project." *History.com*, A&E Television Networks, 26 July 2017, https://www.history.com/topics/world-war-ii/the-manhattan-project

Vattenfall, Vattenfall. "History of Nuclear Power." *Vattenfall*, 2013, https://corporate.vattenfall.com/

about-energy/non-renewable-energy-sources/nuclear-power/history/

The editors. "Ten Most Radioactive Places on Earth." *Brainz*, 1 Aug. 2017, https://www.brainz.org/ten-most-radioactive-places-earth/

UN Office for Disarmament Affairs. "Treaty on the Non-Proliferation of Nuclear Weapons (NPT) – UNODA." *United Nations*, United Nations, 2015, https://www.un.org/disarmament/wmd/nuclear/npt/

World Nuclear Association, World Nuclear Association. "Fukushima Daiichi Accident." *Nuclear Power in Canada - World Nuclear Association*, 2018, http://www.world-nuclear.org/information-library/safety-and-security/safety-of-plants/fukushima-accident.aspx

World Nuclear Association, World Nuclear Association. "Chernobyl Accident 1986." *Nuclear Power in Canada - World Nuclear Association*, 2018, http://www.world-nuclear.org/information-library/safety-and-security/safety-of-plants/chernobyl-accident.aspx

World Nuclear Association, World Nuclear Association. "What are nuclear wastes and how are they managed?" *Nuclear Power in Canada - World Nuclear Association*, 2018, http://www.world-nuclear.org/nuclear-basics/what-are-nuclear-wastes.aspx

International Atomic Energy Agency. " THE RADIOLOGICAL ACCIDENT IN GOIANIA." *Pub.iaea.org*, 1988, https://www-pub.iaea.org/mtcd/publications/pdf/pub815_web.pdf

International Atomic Energy Agency. "History." *IAEA*, IAEA, 8 June 2016, https://www.iaea.org/about/overview/history