

Forum: Nuclear Security Summit

Issue: Ensuring Protection Against Nuclear Power from Damage Caused by Natural and Unnatural Disasters

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Introduction

In today's day and age, [nuclear power](#) is a prominent fixture in discussion between nations and a notable establishment for the future of efficient and clean energy production. Nuclear power can be described as a method to produce electricity by turning turbines in nuclear power plants that use [low-enriched uranium](#) fuel through a process called fission, which is the outburst of uranium atoms in a nuclear reactor. This electricity can be used to power homes, hospitals, businesses and schools, proving to be crucial for society. The security of nuclear power is required as it is a rather important source of income and electricity to numerous nations, hence its misuse is looked down upon and measures such as guards are implemented to ensure its appropriate usage by the registered personnel.

The [nuclear security summit initiative](#) was first announced by the U.S. President Barack Obama in 2009 through a speech where he pledged to commence a global summit regarding nuclear security in 2010 as an endeavor to "secure all vulnerable nuclear material around the world within 4 years." ("Nuclear S security Summit at a Glance | Arms Control Association") As an organization, the NSS vowed to minimize the threat of [nuclear terrorism](#) and harm by securing civilian nuclear materials that could be turned into weapons and improving international cooperation to prevent the illegal trafficking of nuclear materials by nonstate nations.

As previously mentioned, nuclear energy is a large portion of numerous countries such as the USA's and Russia's overall income, hence its indulgence in security

measures is necessary. It is pivotal to continue in production since it is very instrumental in the development of the world due to its application as a semi-nonrenewable source. It allows governments to use environmentally safe materials to produce futuristic inventions, proving its reliable utility in different industries.

Since nuclear power is obtained through nuclear power plants and hence Uranium, the supply of the material is short-handed, therefore, there are [treaties](#) implemented to ensure these materials are directed towards the 31 nations that are allowed nuclear power, 24 that are only permitted nuclear power as well as 7 that are permitted nuclear weapons and power. An example of such, is the Treaty on the Non-Proliferation of Nuclear Weapons, created in 1968 and entered into force in 1970. With this in mind however, there are still occurrences of damages caused such as the Fukushima Daiichi Disaster, the Chernobyl disaster, and cases of [tornadoes](#), [floods](#) and more as a consequence of the usage of nuclear power.

Definition of Key Terms

Floods

A temporary water influx on typically dry land, generally caused by heavy rainfall when natural watercourses cannot bear the excess water.

Hurricanes

A large, high-speed, rotating storm forming over warm water over tropical areas. They are usually tropical cyclones in the Caribbean due to the warm climate in the region.

International Atomic Energy Agency (IAEA)

The IAEA was set up by the United Nations in July and held its first conference in Vienna in October on the proliferation of nuclear energy for peaceful purposes, the promotion of nuclear safety and the maintenance of a network of international nuclear safeguards to avoid the export of nuclear material.

International Nuclear Events Scale

A system used to communicate the safety significance of nuclear and radioactive events to the public. It is a 7-point scale with 1 being the least significant and 7, the most.

Low-enriched Uranium

Uranium with 3.5-5% concentration and enriched to less than 20% U-235, is used for fuel production targeted at commercial nuclear power plants.

Nuclear Power

The power generated by chain nuclear reactions and can be converted into electricity. Energy is produced at a nuclear power plant by the splitting of the uranium atom nucleus.

Nuclear Security Summit Initiative

An international forum addressing the global challenges faced by nuclear extremism and the importance of collaboration to protect nuclear resources and deter illegal trade of nuclear resources and terrorism. It was first established in 2010 in Washington, D.C.

Nuclear Non-State Actor Activity

Refers to an individual or individuals who detonate nuclear weapons as a non-state actor activity, usually for an unlawful or unethical use of violence with a political or religious agenda. This may happen by an assault on a nuclear power plant and facilities, or the detonation of a nuclear bomb in a populated area.

P5 +1 Countries

The group of world powers that work on the Iran Nuclear Deal and are permanent members of the United Nations Security Council with an addition of Germany. The U.N. SC consists of China, France, Russia, The United Kingdom, and The United States of America.

Sanctions

A threatened penalty used while disobeying a law. This is used in the UN on multiple occasions in the case nations do not abide by previously signed treaties or regulations imposed by the UN or other organizations.

Tornadoes

A violent rotating column of air extending from a thunderstorm to the ground with the ability to destroy large buildings, remove trees and pull apart vehicles.

Treaties

A legally binding agreement/contract or other written instrument that confirms obligations between two or more parties regarding international law. If broken, there are severe consequences to the act.

Key Issues

Previous Nuclear Disasters

Over the course of time, the involvement of nuclear reactions, weapons and powers have caused a few accidents due to its lack of safekeeping or general faults in the machine. This has inexplicably affected numerous nations and has had lasting impacts till date, resulting in its caution to various extents. Marked in history as one of the major causes for disaster, nuclear power is often shunned as a weapon and without its appropriate usage, there will be further disasters as well.

Chernobyl Accident

Chernobyl is a well-known disaster that occurred due to the shortcomings and faults of the nuclear reactor; the product of lack of safety. On 26th April 1986, the fourth RBMK reactor at the Chernobyl nuclear plant lost control while conducting a test at low power which resulted in an explosion and fire that destroyed the reactor building, exposing the atmosphere to large amounts of radiation. Due to the lack of safety measures, the uranium fuel in the reactor overheated and melted through the protective barriers, causing radioactive elements such as plutonium, iodine, strontium and caesium to scatter across a wide area. This killed 2 workers and 28 firemen due to sudden casualties and radiation sickness, while the entire town of Pripyat was evacuated from the land in under 36 hours. This radiation also caused illnesses such as cancer, resulting in around 5,000 cancer-related deaths and increased the cancer rates from 0.1-2.2.

This proves to be an issue as it was one of the first instances that caused commotion regarding nuclear power and eventually required input from the United Nations in order to justify its leakage as there were long-term social and medical implications across the country and other surrounding nations. The [IAEA](#) began to assist Central and Eastern Europe along with the former Soviet Union to identify the weaknesses and design faults to prevent such events from happening in the future.

Fukushima Daiichi Disaster

The Fukushima Daiichi nuclear accident occurred in 2011 at the Fukushima Daiichi plant in northern Japan and is noted as the “second worst nuclear accident in the history of nuclear power generation”. This tragedy was triggered by a massive earthquake and a 15-meter tsunami crippling 3 Fukushima Daiichi reactors' power supply and cooling, causing a nuclear accident on March 11, 2011. Though the earthquake was the primary cause of the disaster, it would be considered unnatural than natural as a majority of its responsibility is due to the lack of safety measures

implemented by the nuclear regulators. This radiation caused global chaos as the nuclear waste crossed the Pacific Ocean and eventually affected more nations.

The site is on Japan's coast; hence its impact was significant on many countries near the Pacific Ocean. Its reported cause was the Japan earthquake on March 11th, 2011 that led to a tsunami and damaged the backup generators of the plant. The power cooling systems failed and the residual heat within each reactor's core caused a few fuel rods to overheat and melt down, releasing radiation. This radiation has affected numerous nations to different extents, eventually leading the Japanese and other international ambassadors to mark this a nuclear disaster and order warnings of the consumption of food and water as radiation had spread to ordinary goods. This poses as an issue in this topic as it was one of the biggest nuclear accidents and has since resulted in the IAEA to half their estimate of the additional nuclear generating capacity to 2035.

Natural Disasters

As the topic portrays, nuclear power accidents are equally a result of natural disasters. This is very prominent and can be seen on various instances such as the aforementioned Chernobyl. There are specific aspects of natural disasters, however, that cause the most harm such as floods, [hurricanes](#) and tornadoes, resulting in catastrophic impacts towards society and other aspects. Specifically, in the U.S.A., the nuclear power plants receive their electricity from the off-site electrical grid system, but by the course of natural happenings, this is often the cause for a lot of issues in nuclear reactors.

Tornadoes

On June 24, 1998, the Davis-Besse nuclear power station was hit by a powerful tornado, resulting in lightning strikes to the station's switchyard and an off-site power loss that shut the reactor down. This natural disaster was an issue for the nuclear power plant, but due to its halt, it caused the work to stop as well, hence Toledo was

unable to regain the nuclear power it lost that day. Tornadoes are proven to be dangerous as it causes numerous casualties, killing 41 people in 2019, which was an increased rate of death as compared to 2018 with 10 deaths. Scientifically, they kill 60-80 people per year and as the wind speeds exceed 200mph, causing debris being forced into the eyes, resulting in injury. Also, as proven in this instance, tornadoes also impact nuclear plants and industrialized areas, showing its danger to the environment, infrastructure and society.

Floods

A situation called "Station Blackout" occurred in mid-July 1993 when an imminent flood on the plains threatened a nuclear power plant. It caused extensive leaking with rising water levels, hence the water was contaminated radiologically and pushed onto clean areas. This caused issues as a form of radioactive waste adversely affected the entire nuclear plant. Flooding is known as one of the most dangerous weather events as it causes an increasing rate of deaths over the last few years such as the death of 86 people every year for the past 30 years. Scientifically, it also affects other implications such as the environment, the industry due to the harm made, and the society due to the deaths.

Hurricanes

On August 24th, 1992, Hurricane Andrew with a wind speed of about 145mph and gusts of at least 175mph passed over the 2-unit Turkey Point nuclear power station near Miami, Florida. This caused the plant to lose all of its offsite power during the storm and the next 5 days with the loss of communication and access to the site. The plant's fire protection system was destroyed and fell on a water tank, declaring the fire suppression system inoperable, declaring the "Alert" for the station. Hurricanes are truly dangerous as they include storm surge, inland flooding, high winds and tornadoes that inflict sufficient damage on infrastructures as well as the environment. This affects the environment due to the storm surges, the infrastructure through the flood damage, and the society due to the numerous deaths caused per year.

Impacts of Nuclear Power

Nuclear power is often connotated with weapons or with the idea of warfare, hence it is not very encouraged amongst countries. However, as more nations prove, this power is greatly beneficial to development as it continues to help industries, while unfortunately, causing negative implications towards other aspects.

Environmental

As the main issue surrounds the change caused by natural and unnatural disasters, it is important to also note the impact nuclear power holds for the environment. Nuclear power is unlike power plants using fossil fuel as they do not produce air pollution or carbon dioxide while being used. This is beneficial for the environment as it eliminates a primary cause for air pollution and air-borne diseases.

On the other hand, it requires large amounts of Uranium ore mining and refining to make the reactor fuel, hence using a lot of electricity. The mining of Uranium for weapons is also hazardous as it involves radon gas, radiation and toxicity hazards. Natural Uranium does not have many radioactive side effects or consequences, however, the application of chemicals to create Uranium-235, which is necessary for nuclear power, proves threatening towards the ecosystems and habitats of land and water animals. The radiation released by the reactor can cause a range of illnesses, hurting untamed life as well as cause unnecessary transformations in creatures such as extra appendages. Another major concern is the creation of radioactive waste as it can cause lasting impacts for many years. This poses a threat to the environment as its inappropriate usage and disposal can result in danger to the environment surrounding it through the flora, terminating the soil and plants growing on it. An example of improper radioactive disposal is the illegal dumping of nuclear waste by the 'Ndrangheta mafia clan in Italy, where radioactive waste from Italy, Switzerland and France was buried in Somalia.

Economic

As a relatively newer industry, the production of nuclear energy allows exponential growth economically as it greatly benefits the countries with such power plants. It increases the jobs and prosperity of a country since there are more jobs to offer in these plants, reducing unemployment rates. Additionally, around 400-700 new permanent jobs are granted on average however, it can increase to 1,000 during its construction. Furthermore, it generates around \$500,000,000 by its goods and services, improving the GDP. This is primarily due to its various applications especially in developed countries since it is very well used in such. The initial construction cost of nuclear weapons is large however, its generation of electricity is cheaper than oil, gas and coal, proving to be a long-term benefit. Overall, nuclear power improves the employment rates and income of the country, showing its benefits.

However, as mentioned, the construction and production of nuclear power is very expensive, and the cost continues to rise. As an example, from 2002-2008, the average cost to construct a power plant grew from \$2-\$4 billion and that is just as an estimate. This initial cost is exponentially high and the maintenance cost only increases further, causing a possible debt to the nation for a few months or years, depending on the rate of the power plant development. Usually, the plant must also separate the funds to protect the radioactive waste produced and cooled structures in the case of a leak. Due to its expense and lack of accessibility, less developed nations would find it difficult to fund such production, resulting in its limited use globally.

Social

There is a definitive social attribute to the construction of a nuclear power plant and the production of nuclear power since there are catastrophes on both scales. In developing nations such as India, nuclear power is used in the medicinal, agricultural and research industries to help the betterment of humanity. This is through X-rays and injections to cure diseases and are used internationally. It is also a viable replacement for generating electricity using renewable sources. In the U.S., nuclear energy is used to

produce around 20% of its electricity and is now commonly used in other nations as well since it is no longer a taboo.

Unfortunately, nuclear power has also caused a lot of casualties through events such as the Chernobyl and Fukushima, hence is proved as dangerous. This is one of the most significant impacts since it results in the deaths of many. Along with this, the perception of nuclear technology by citizens is debatably negative as there are known tragedies caused by it as well as movements such as the “Anti-nuclear movement”. Specifically, this movement occurred in the USA and its goal was to oppose the production of nuclear weapons and the generation of electricity by nuclear power plants with the aim of promoting environmentalism and political activism. This negative social view of nuclear power has also caused a halt in possible nuclear energy production, regardless of its economic and technological profit.

Major Parties Involved and Their Views

International Atomic Energy Agency (IAEA)

The organization has been very helpful to many nations as they have encouraged the usage of the approach provided in the IAEA Safety Guide on Periodic Safety Review of Nuclear Power Plants. This is very reliable as it was published by the IAEA, while also encouraging nations to adopt measures such as releasing the external hazards and its influence on the licenses of nations periodically. Fukushima was the main framework that drove the IAEA to include such packets and safety measures in the hopes of preventing such disasters in the future. At the meetings, there have also been offers to bring up the design faults in such nuclear plants and improve the analytical molding abilities by further developing tools to do so. As mentioned, a majority of the disasters were due to faulty designs or the leakage of radiation which caused such long-term impacts. Additionally, it is also understood to develop methods and tools to marginalize the safety zones and implement enough protection against harsh natural disasters.

United States of America (USA)

The USA is responsible for many of the decisions made in the United Nations as it is one of the [P5 nations](#), hence gets large amounts of jurisdiction of matters. With this in mind, the USA also uses large amounts of nuclear power as it generates almost 20% of the country's electricity as well as their nuclear plants. As its stance, the USA reaffirmed its position on the power source and wishes to continue to invest into its safety improvements to avoid incidents such as Fukushima and Chernobyl. The USA also has an organization named the Nuclear Regulatory Commission (NRC) that handles the supervision of nuclear power and its safety measures; hence the USA has already implemented plenty measures to ensure their generation of nuclear energy is safe.

As discussed by Congressman Ed Markey in 2011, an American nuclear plant would not survive a disaster as it would damage the vessel or the equipment that is used to control the Uranium. Such an example is the 1998 tornado that caused a power loss in the Davis-Besse plant outside Toledo, Ohio, causing the plant to shut down, however, the plant's emergency diesel generators kept the plant running until the power lines were fixed. Additionally, a senior scientist with the Union of Concerned Scientists, Edwin Lyman, mentioned the lack of backup power held by the generator, claiming it was not ample to protect the public.

As a nuclear power state under the NPT, the USA is free to utilize and develop nuclear power as well as a plethora of nuclear weapons for any use. Currently, the US arsenal contains numerous nuclear weapons, with an estimate of 1,750 nuclear weapons to be deployed and delivered. A common thought regarding this ammunition is its destructive abilities, which is appropriate since the B-83 is more than 80 times more powerful than the bomb dropped on Hiroshima, hypothetically causing much more catastrophic results to enemy nations, yet remains in the US arsenal. Additionally, the USA looks to further its development and usage of nuclear power to develop their arsenal, spending a trillion dollars and with the intention to beat China and Russia in the

nuclear arms race since they are also enhancing their arsenal respectively. Regardless of the social discouragement against nuclear weapons in the USA, according to the Trump administration, their plans to build nuclear weapons and tests capabilities will continue.

Japan

Japan is best known for the Fukushima Daiichi Disaster, hence its return to the world of nuclear energy was doubtful. As a result of the disaster, the Japanese government halted all 54 of its nuclear power plants; however, started to run 5 plants in 2018. At the time, the then Prime Minister, Naoto Kan took an anti-nuclear stance as he ordered the old Hamaoka Nuclear Power Plant to be closed due to fears of impending earthquakes or tsunamis, freezing plans to build new reactors. He claimed that, *“Japan should reduce and eventually eliminate its dependence on nuclear energy...Fukushima accident demonstrated the dangers of nuclear technology”*. The current Prime Minister, Shinzo Abe, claims their return is for the country’s benefit as they aim to reduce their fossil fuel usage with the assistance of carbon-free nuclear power in order to reach its climate objectives. Also, all the country’s nuclear reactors are undergoing tests to ensure their survival against similar events to Fukushima, with scientists saying that incident led to bettered reactors. As of May 2019, there are currently 39 operable reactors in Japan out of which 9 reactors in 5 power plants have started working. Overall, it can be seen that Japan is making amends for the past disasters and has multiple measures and reasons that keep the nuclear plant safe as well as its surroundings.

Nuclear Regulatory Commission (NRC)

The NRC is an American body that oversees the civilian use of nuclear materials to ensure public health in the event of threats and to promote the general protection and safety of the environment. They have been very outspoken in the establishment of new regulations and tests to ensure the US does not face a natural nuclear disaster since it is not prepared to do so. In March 2012, the NRC ordered for immediate

safety-enhancements that cost around \$100 million after the Fukushima accident. This included ordering additional material and equipment to help the loss of electricity and cooling. Another addition was the improved water level and temperature instrumentation, while the third being harder containment vents that could work under any potential situation. These containment vents are said to be able to endure “anything and everything”, showing the NRC’s dedication to ensure these tests are viable and useful for the USA since a part of their lifestyle runs on nuclear energy.

India

India stands as one of the non-NPT nations, a country that has not signed the Non-Proliferation Treaty, hence it has access to both nuclear energy and nuclear weapons. It uses nuclear power for a lot of industries such as the medical, agricultural and research industries. This includes x-rays and injections, and newer technology for hospitals through the isotopes used to make weapons. Hence, there are a lot of nuclear power plants in India and are all designed to endure natural disasters such as earthquakes. This has been proven to be true since lower intensity earthquakes have not affected the Kakrapar Atomic Power Station, Rajasthan Atomic Power Station and the Tarapur Atomic Power Station/ However, the plants could not withstand the tsunami in 2004 as the campus got flooded and hit the coast. India is home to the Bhabha Atomic Research Centre (BARC) that has also done influential work to sustain India’s prosperity in this field, showing appropriate findings from such. Unfortunately, there have not been a lot of safety precautions implemented to ensure a natural disaster does not occur, affecting the nuclear power plants yet.

Currently, India continues to modernize its nuclear arsenal, similar to other nations, with more than 5 weapons under development to alter or replicate in different forms, still depending on the conventional methods while fielding its first nuclear weapon in 2003. India’s missile force is still in process, however is in possession of 4 types of land-ballistic missiles and 2 other types that are in development. Though nuclear energy is being used to develop weapons, it is also used for aforementioned benefits and continues to preside with the doctrine of “No First”, ensuring the use of

nuclear weapons only when required. They are also using nuclear power to develop dosimetric instruments capable of detecting different types of radiation, as well as, an advanced water theorem, completely run on nuclear energy.

The Russian Federation

Russia is one of the pioneers of nuclear power, aiming to expand its neutron reactor technology and nuclear energy. Formerly part of the Soviet Union, Russia has also continued to keep experiments hidden from the public regarding their involvement with dangerous nuclear power as late as 2017, found by the Ring of Fire. Due to Chernobyl especially, Russia has prepared for further accidents as proven by the IAEA Operational Safety Review Team assessing the programs and efficiency of such precautions and presenting it as viable. Overall, Russia could potentially be conducting experiments in secret, however, with their standardized and approved precautions and programs, no harm has been done to any habitats.

Development of Issue/Timeline

Date	Event	Outcome
December 20, 1951	Nuclear energy was first formed by Enrico Fermi.	The nuclear plant, EBR-1 was the world's first to produce nuclear power through fission reaction. This was done as scientists were commencing the first self-sustaining nuclear chain reaction.
September 29, 1957	The Mayak nuclear complex occurred and categorized as a Level 6 on the International Events Scale .	Near Chelyabinsk, a fault in the cooling system occurred, resulting in a chemical explosion that released 70-80 tonnes of radioactive material into the air.

		Thousands of people were exposed to the radiation and was one of the biggest reactions at the time.
October 7, 1957	The Windscale nuclear reactor was infiltrated by a fire and released a limited amount of radioactivity.	This radioactivity leakage caused a social impact as the sale of dairy products was banned for a month. Also, the reactor could not be saved and buried in the concrete. This site is now where new nuclear plants are constructed.
June 12, 1968	The Non-Proliferation Treaty was established and was under the IAEA	It is an internationally recognized treaty that covers disarmament, nonproliferation and peaceful uses of nuclear energy. This is a very important treaty as it serves as the pillar for all the countries since 191 of them have signed it and are held up to the treaty.
March 29, 1979	The Three Mile Island power plant in Pennsylvania is now considered one of the worst nuclear accidents in the USA.	This occurred due to a cooling malfunction causing a meltdown in one reactor and releasing radioactivity. The first reactor was on the Susquehanna river and released radioactive water and gas on the perimeter.

<p>April 26, 1986</p>	<p>Chernobyl Power Plant explosion by the former Soviet Union country.</p>	<p>Known as one of the most dangerous nuclear reactions, it is the starting trigger for many of the future precautions and treaties signed. 1 of the 4 reactors exploded after an experiment resulting in fire burns and 100X more radiation than Nagasaki. There was a total of 30 deaths due to acute radiation and currently, a cover called the New Safe Confinement is being built over it. Currently, Chernobyl continues to have a psychological impact on the survivors and also led to suicides and alcohol abuse. Also, there have been multiple health issues noted in the population as of 2008. However, at the present moment, there are no negative impacts, rather the site has become a popular tourist spot, regardless the remaining radiation.</p>
<p>April 6, 1993</p>	<p>Severesk</p>	<p>At a uranium and plutonium factory, a tank exploded and caused the dispersal of radioactivity into the atmosphere. This contaminated 120spm and the village was left completely vacant.</p>

<p>July 16, 2007</p>	<p>An Earthquake hit the Kashiwazaki-Kariwa nuclear power plant</p>	<p>It was the largest electricity generating station and was built to endure earthquakes and more in Japan. An earthquake near the plant caused the plant to leak radioactive substances and was hence closed to prevent further harm.</p>
<p>April 12, 2010</p>	<p>The Nuclear Security Summit was formed</p>	<p>The first summit was held in Washington D.C. with attendance from the IAEA, heads of the UN and the European Union. This later became very significant to preventing the misuse of nuclear materials and energy.</p>
<p>March 11, 2011</p>	<p>Fukushima Daiichi Disaster</p>	<p>A very powerful tsunami caused by a 9.0 magnitude earthquake slammed water onto the power plant and damaged 4 of the 6 reactors. It set a series of fires into motion and the lack of cooling systems led to explosions. This is said to be less harmful than Chernobyl since there was minimal harm to the public.</p>

Previous Attempts to Solve the Issue

[Nuclear Non-Proliferation Treaty \(NPT\)](#)

The NPT is a treaty aimed at reducing the spread of nuclear weapons through disarmament, non-proliferation and peaceful use of nuclear energy. Collecting 191 signatures from States Parties, it was signed on 1st July 1968. The treaty defines nuclear weapon states as those who manufactured and exploded a nuclear device before January 1st 1967, hence all others are called non-nuclear weapon states. The 5 nuclear weapons states are: China, France, Russia, The U.K. and the U.S. These states look to move forward towards disarmament and all the countries are permitted to use nuclear energy for peaceful purposes.

This treaty played an important part in the dispersal of nuclear energy since it ensures that only countries who are stable can use the energy and also takes special assistance from the NRC. The NRC helps countries use the benefit of peaceful nuclear energy. Overall, this treaty has been greatly beneficial as it stands as the foundation of nuclear energy, weapons and warfare, hence all further treaties were made in respect to this one. However, since it does not have direct correlation, it does not impact the nuclear-enhanced nations greatly.

With the NPT being adhered by 190 countries, it is very close to world participation and remains unique as there is no other international agreement compromised by nuclear and non-nuclear weapon states. The NPT has so far failed to completely solve the issue as it is a major cause of opaque proliferation, which destabilizes and uses the transnational smuggling network, leading the proliferation of nuclear components to terrorists. With the abandonment of the NPT, a more realistic governing head will put transnational nuclear smuggling out of business and stabilize the inevitable proliferation of weapons as it will lead to further transparency amongst the nations. Additionally, without full compliance from countries like India, DPRK and Pakistan, the NPT is not as effective as proclaimed as there continue to be nations that have not signed the treaty yet, however are not penalized in any form.

[Convention on Nuclear Safety \(CNS\)](#)

This is a legally binding international treaty that calls upon 80 parties to maintain a high level of civilian, land-based nuclear power plants. This is done by setting international jurisdictions which surround the topics of its construction, design, operation, financial resources and its assessment of safety with emergency preparedness. Understanding the high risk factors applied by the natural disasters is a necessity for this topic, hence this treaty aims to abide by the expectations, ensuring a disaster does not occur in the future.

This has proven to be effective as the meetings occurring at the IAEA continue to happen, showing definitive progress. Additionally, nation-specific organizations take the lead in ensuring the treaty is abided by such as the NRC since it was also a principal lead in overseeing the USA meet the obligations within the CNS. It prepares a report for the U.S. every 3 years and reviews other parties' reports as well, showing complete and appropriate analysis of the work done. However, since the meeting happens only every 3 years, there is scope for error or lack of data, which could present itself as a problem. Additionally, since the independent nations present their information to the IAEA, there is a lack of efficient transparency which could affect the data and the results provided.

As a part of the CNS, review meetings are also held every 3 years, discussing the nuclear safety programs of participating countries, addressing common issues and proposals, and developing a summary report for each convention. This was implemented during the wake of the Chernobyl by Germany as technical principles were anchored to ensure the prevention of leaked radioactivity. This also enforced itself onto the European Union through national regulations and resulted in its triennial meetings. This treaty has had effects as more countries have signed onto the treaty such as Serbia in 2017, Thailand in 2018, and more as more signatories have resulted in less nuclear accidents. With this in mind, here have been no official statistics on the change of nuclear accidents, hence no permanent conclusion can be made.

Convention on Early Notification of a Nuclear Accident

This treaty was adopted in 1986 after the Chernobyl Accident in an attempt to prevent the repetition of history. It implements a notification system for nuclear accidents caused by natural or unnatural disasters that have the scope to pass through international borders and release radioactive waste or other harmful chemicals. It requires the place of the explosion to report on the time, location, radiation release and other information to analyze the data appropriately and find further methods to limit its release and protect the land it has exposed. This information is sent to the IAEA where information is channeled, and a response is provided.

This treaty is very impactful and beneficial as it limits the impacts and scope for exposure through this system. Since nations are required to provide exact data, the IAEA, which is the governing body, can create a decision and spread it onwards to prevent chaos or confusion. Since it aims at the transboundary release, other nations are permitted to aid which is crucial for countries that are landlocked or have large amounts of leaked radiation. However, since it is provided by the country itself, there are always possibilities of lack of transparency that can be solved by further analysis and a faster method. Furthermore, during the time of data recollection, the radioactive materials may spread further than intended and cause more harm to other societies and nations.

Possible Solutions

Establishing Areas for Industrialization

Currently, there are established areas for the construction for nuclear power plants, however, the reason there are numerous casualties is due to the close proximity at which cities or villages lie. Hence, an effective solution would be to construct and produce nuclear energy in a distant place, preferably remote, so energy is produced effectively while staying safe from disaster. In the case of an earthquake, if the design faults are apparent and leakage occurs, it would be safer since there would be no outward radiation to any habitats, harming the limited amount of people as possible.

Additionally, nations along the coast must allocate areas for radioactive waste away from the ocean as it spreads very quickly and has a possibility of passing through international borders, proving the aforementioned treaty useless. If the waste is let loose near the ocean, nations must provide monetary [sanctions](#) to the IAEA in the attempt of understanding repercussions

MEDCs

MEDCs are known for having developed architecture, plants and other means to enhance their lifestyles and encourage national evolution. With this in mind however, they also produce a lot of nuclear power since countries such as the USA rely on it for electricity and other such things. Fortunately, in an attempt to reduce the nuclear waste and harm brought into the environment, MEDCs can develop or invest in technology that converts this waste in energy. This will increase safety as even with isolated areas for industrialization, there is bound to be waste that must be contained, hence this solution will help MEDCs restrict the development areas while also managing to control another issue caused by nuclear power.

LEDCs

Developing nations and LEDCs view nuclear technology as a step into the first world as it proves development. This is especially true for nations such as India where nuclear technology is prominent however not as feared as the US arsenal. Since these nations do not always have a lot of government related land, they would be unable to delegate it to nuclear power plants. With this in mind, enclosing their present power plants with developed technology that presents itself as a shield to the outside world will be very beneficial. This technology is not developed yet, according to public knowledge, however will be pivotal in ensuring the power plants do not cause any harm. Since LEDCs may

not have the monetarism to find such technology, special funds could be received from organizations such as the UN or specifically the IAEA.

Improve the Filtration Systems

An effective alternative is to install filtered venting systems to minimize the risk of building explosions as radioactive gasses will be emitted into the environment via a large filter system. It is beneficial because it retains the radioactive particles but removes the gas and reduces the risk of explosions. It is already being applied in a few countries, but countries with an abundance of nuclear power plants will also benefit from it. Statistically, an operating plant produces very small amounts of radioactive gases and radioactivity and a location 50 miles from a nuclear power plant would receive an average amount of estimated, 0.01 millirem per year. However, in the event of an explosion, these rates increase as the pressure in radioactivity releases, hence implanting filtration systems will be beneficial since it will limit the outside exposure received by the population and prevent mass casualties.

Stabilizing the Electricity

A main cause for the faults in nuclear power plants during natural disasters is the loss of electricity since it is usually offsite. This causes the generators to potentially malfunction as well, resulting in the entire power plant being shut off. In order to restore this and save the electricity, plant operators should install various connections of electricity to the offsite power grid so a prospect hurricane can only shut one off instead of all of them. Emergency diesel generators should be on higher ground instead of on the ground to protect it from disasters such as floods or hurricanes and movable generators should also be available so there are different methods to obtain the electricity. With stable electricity, the cooling does not switch off, heating other factors and preventing an explosion or leakage. This would benefit the long-term nuclear plant as there would be less cause for renewing or changing the basic structure and formation of its architecture since there would be resistant to natural disasters affecting

their plants. However, this would also initially cost quite a lot and hence its utility may be different depending on the financial status of the nation at the time. Changing the electricity routers across one or more nuclear plants will also take a lot of time, which may prove detrimental for the production of nuclear energy.

Implementing Sanctions on Breaching Nations

Sanctioning breaching nations is an effective method to ensure they abide by the treaties and reduce nuclear power experiments. This would ensure that nations abide by treaties such as the CNS, NPT and more since there are nations that conduct nuclear experiments in secret or without the jurisdiction of the IAEA. This is beneficial since the sanctions implemented and taken by nations will be put into the restoration in the case of an explosion or disaster since Chernobyl. Once the IAEA is made aware of an explosion or experiment conducted, they may obtain sanctions as there are many regions in the world where nuclear testing is banned. Furthermore, this would encourage nations to restrict their testing of nuclear power for unsafe motives or move their stations to a deserted location, resulting in less harm and focusing towards the use of power for positive applications.

Sanctions are incredibly reliable and effective since it has been applied in the past and in the present. As known to many, Iran has been sanctioned by the USA, following its nuclear standout and that has significantly reduced the exports and economic growth in Iran. After the removal of the US from the 2015 agreement, Iran's GDP growth has increased, presiding at 2% in 2009, to a decrease, -6% in 2012. However, once the sanctions were lifted after the nuclear deal was implemented, the GDP grew again to 12%. This just proves that the sanctions of different types have great benefits and are especially applicable to other nuclear power related issues.

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Appendices

- I. IAEA Report - Measures to Protect Nuclear Power Plants Against Earthquakes and Tsunamis <https://www.iaea.org/sites/default/files/protection040912.pdf>
- II. IAEA Database - Records of the most dangerous nuclear power station incidents <https://www.theguardian.com/news/datablog/2011/mar/14/nuclear-power-plant-accidents-list-rank>