International Atomic Energy Agency (IAEA) Background Guide

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The International Atomic Energy Agency was created in 1956 to legislate nuclear technology in response to growing fear and expectations as a result of the rapid development of it. First addressed in 1953 by then president of the United States, Dwight D Eisenhower, the ratification of the statute of the IAEA happened later and was an implementation of the president's "Atoms for Peace" speech. Composed of 178 member states, the IAEA is tasked with cooperation amongst each other to 'promote and control the Atom'.[1] In other words, they are expected to develop safe, peaceful and secure methods of improving and harnessing nuclear energy. This convention acts as a platform for each delegate to engage in important rhetoric, share varying opinions and address the challenges posed by nuclear energy. With the rate at which new technology is being developed, it is evident that regulation is necessary to prevent the proliferation of malicious usage of nuclear energy, the consequences of which are catastrophic.

I. Nuclear Safety and Natural Disasters

Statement of the Issue:

The IAEA has observed that many countries are considering the introduction of nuclear power in order to boost reliable and clean energy production. They estimate world nuclear generating capacity to double from 369 gigawatts in 2023 to 890 GW (net electrical) by 2050. This projection has increased from 715 GW(e). For this to be realized, an accelerated implementation

[1] ("History | IAEA", n.d.)

of innovative technologies would be required. A lowercase prediction has also been made, indicating that the capacity may slightly increase to 458 GW(e).[2] As global electric generation is expected to increase over the next few years, nuclear power generating capacity will have to double to maintain its status as a viable source of power generation.

For this to happen, it is necessary for nuclear energy development and utilization to be considered 'safe'. The IAEA defines nuclear safety as "the achievement of proper operating conditions, prevention of accidents or mitigation of accident consequences, resulting in protection of workers, the public and the environment from radiation hazards."[3] Establishing nuclear safety is one of the fundamental cornerstones of an organization that handles radioactive material. It is essential that every individual at all levels in the organization is cognizant of the importance that nuclear safety has in its development. This helps in preventing any accidents from happening.

Yet, there have been many nuclear meltdowns and disasters stemming from a lack of safety maintenance. One such incident is the Chernobyl disaster, which occurred at the Chernobyl Nuclear Power Plant in the former Soviet Union (now Ukraine) in 1986. The unit 4 reactor was to undergo routine maintenance of the 25th of April 1986, which provided an opportunity to test the durability of the steam turbines in providing power to the main core in the event of a loss of power. This test was run the previous year, but results were not satisfactory, and thus new voltage regulators were installed. However, the next year, the test was run with improper procedure, most notably the disabling of the emergency core cooling system during the test, reflecting the general attitude of negligence By the time an operator moved to shutdown, realizing that they were losing

[2] ("IAEA Annual Projections Rise Again as Countries Turn to Nuclear for Energy Security and Climate Action | IAEA" 2023)
[3] ("Establishing a safety and security culture in nuclear | IAEA", n.d.)

control, the reactor became extremely unstable, and due to quirks in the fundamental design of the reactor, a dramatic power surged ensued causing the explosion.[4]

Not all nuclear disasters stem from human error, however. One of the most devastating nuclear meltdowns in recent times occurred due to a natural disaster that disrupted the stability of the nuclear reactor. The Fukushima Daiichi Nuclear accident occurred on the 11th of March 2011 in Japan, just after the country had witnessed a 9.0 magnitude earthquake. While the earthquake itself inflicted considerable damage, it was the resulting tsunami that dealt the fatal blow on the nuclear reactors. The double quake yielded a 150 meter tsunami which destroyed the infrastructure of the plant, melting all three cores in the span of 3 days. This disaster was rated a 7 on the Nuclear and Radiological Event Scale, the same as the Chernobyl Nuclear disaster, due to the high radioactive release over the next few days. The disaster itself caused the dislocation of over 100,000 people from northwestern Japan, and an inability to return due to the sensitivity of the area. Officials documented 2,313 deaths related to evacuees from the disaster area, however there have been no documented deaths from radiation poisoning, and an uncertainty with regards to the effect this may have on cancer rates[5].

While there have not been any nuclear accidents on the same level as the two above, incidents compromising the safety of nuclear generators and their surroundings still occur. In 2019, 5 people died and 3-6 people were injured in Nyonska Russia, due to the explosion of a failed isotope power source from an alleged nuclear weapons test. In November 2022, 400,000 gallons of water laced with tritium leaked from Xcel's Monticello Nuclear power plant in Minnesota, with only 25% of the water being recovered as of March 2023[6]. In the same month, the power plant was

[4] ("Chernobyl Accident 1986", n.d.)
[5] ("Fukushima Daiichi Accident", n.d.)
[6] (Karnowski 2023)

shut down to mitigate the specified leak. Finally, in 2024, a state of emergency was declared in Khabarovsk, Russia after elevated radiation levels were detected at a power pylon 2.5 km from residential buildings. Authorities reported no casualties with regards to the same.[7]

Nuclear safety is important in ensuring the security of the surrounding population. Due to meltdowns, they are exposed to ionizing radiation, which is detrimental to the body in minute doses, as it causes radiation poisoning. Alongside that, it causes problems such as cardiovascular disease, cataracts as well as cancer due to gene mutation, which need to be prevented.

History:

After the Chernobyl disaster, the IAEA drafted the Convention on Early Notification of a Nuclear accident in 1986. It was aimed at the creation of a notification system for nuclear accidents which had a high possibility of releasing radioactive material as well as the movement of such material between borders. Article 5 of the convention states the information which needs to be provided and is as follows:

- Time, location and nature of the nuclear accident
- Facility involved in the accident
- Assumed/Established cause and development of the accident with context to the transboundary release of radioactive materials.
- The characteristics of the radioactive release which include (if possible) nature, physical/chemical form, quantity, composition and effective height of the radioactive release.
- Information on current and forecast meteorological and hydrological conditions

[7] (Rodionov and Trevelyan 2024)

- Results of the environmental monitoring
- Off-site protective measures taken or planned
- Predicted behavior of the release.

The convention entered force on the 27th of October 1986 and, as of 2021, 115 states are full participants in the convention. 8 more states have signed the convention but have not ratified it. A technical implementation of the convention can be viewed on the IAEA's Unified System for Information Exchange in Incidents and Emergencies (USIE).[8]

Another convention that was released in 1986 is the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency. It is an international framework that is based on the co-operation among states and within the IAEA to provide support and assistance in the event of nuclear accidents or radiological emergencies. Article 2 of the convention specifically dictates that the country requiring assistance is expected to document the scope and type of assistance required, and provide the assisting party with information necessary to enact their strategy. In the event that the requesting party is unable to provide the specifics, the requesting state and assisting delegations will mutually agree on the optics. Article 3 of the convention delegates control of the assistance provided to the requesting party.[9]

The Convention on Nuclear Safety is focused on safety with regards to a civil context by committing contracting parties that operate land-based nuclear plants to maintain the highest level of safety through the establishment of safety principles which States are expected to adhere to. Adopted on 17 June 1994 and entered into force on the 24th of October 1996, the convention ensures safety through:

[8] ("INFCIRC/335 - Convention on Early Notification of a Nuclear Accident" 1986)
[9] ("INFCIRC/336 - Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency" 1986)

- The creation of regulatory and legislative framework, and a regulation body that is associated with the same framework
- Utilization of financial and human resources to ensure the highest order of safety
- Quality assurance tests such as safety assessments as well as verification of the physical state of the plant in accordance with its design.[10]

Alongside conventions, the IAEA is also reliant on non-legally binding codes of conduct. The Code of Conduct on the Safety and Security of Radioactive sources assists authorities to ensure radioactive sources are used appropriately. Similar to the Convention on Nuclear Safety, the code also calls for the creation of regulatory and legislative framework, as well as a body that oversees the implementation and the observation of such rules. It differs from the aforementioned convention in its focus on the import and export of radioactive material. The code calls for the states involved in the transfer of radioactive material to follow the safety guidelines dictated across the code, as well as in other conventions, and mandates that both countries should be consenting to the transportation of the material and only use authorized means of transportation to achieve the same.[11]

The IAEA has provided many tools that assist regulatory bodies in carrying out their functions and processes. Some of these include:

- Self-Assessment of Regulatory Infrastructure for Safety (SARIS): set of tools to facilitate states' self-compliance review with the IAEA safety standards.
- Regulatory Authority Information System (RAIS) - Software application that assists member states in managing regulatory activities in accordance with IAEA safety standards

[10] ("INFCIRC/449 - Convention on Nuclear Safety" 1994)
[11] (IAEA 2004)

- Control Sources Network (CSN): Platform designed for radiation safety managers, acting as a way to share knowledge and experience on the creation and maintenance of an effective system for controlling radiation sources done in conjunction with the Radiation Safety Advisory Mission Tool (RASAMT).
- Systematic Assessment of Regulatory Competence Needs (SARCoN) which assists states in their work in complying with IAEA safety standards.[12]

Outside of this, the IAEA also provides personalized assistance to member states through the Integrated Regulatory Review Service (IRRS), where they review the states' laws on radiation safety. The IAEA also created the International Regulatory Framework (RegNet), which enables various stakeholders to share their regulatory knowledge, practices and information and fosters collaboration through networks and forums.[13]

Analysis:

Current IAEA frameworks perceive the safety of nuclear power plants as more of a reactionary role. Thus is outlined in the many ways in which countries can report problems that have occurred with the powerplant. While knowledge is being shared on how to prevent such problems in the future, it is important to understand that countries can still be proactive in preventing the compromise of nuclear power plants. Firstly, there is a lack of regulation with regards to the protection of nuclear power plants in the event of a natural disaster. Such natural disasters can strike at any time and it is imperative that operating power plants, especially in key geographical areas that are prone to such natural disasters, discuss specific methods that help mitigate the damage and remain cautious. This will also be useful for new power plants that will

[12] (IAEA, n.d.)
[13] (IAEA, n.d.)

be constructed as nuclear energy starts to become a more viable and commercial source of energy.

Secondly, with the rise of technology and their integration into various fields, it is necessary to discuss action plans in case there is a glitch or bug in the technology that can be harmful to the system. Artificial intelligence is the latest technology being implemented for development and maintenance of nuclear energy, and thus there is a chance that the AI can go awry, negatively affecting the plant and possibly its surrounding environment, thus making it imperative to get ahead of it and discuss fail-safe mechanisms to prevent further damage.

Conclusion:

Nuclear energy is being rapidly developed and becoming more viable as an energy source everyday. To ensure maximum viability as an energy source, it is prudent to safeguard for the future. History has shown that there are many natural and structural threats to nuclear energy, and as the complexity of the technology used increases, so does the risk of a meltdown. Therefore the IAEA has been tasked with developing newer frameworks in order to treat if not counter nuclear meltdowns from natural or threats within the system.

Questions to Consider:

1. Is the protection of power plants a reactionary or proactionary role?
2. Can the IAEA advise on optimal locations to build new power plants to minimize the risk of compromise from natural disasters?
3. How does the committee plan on ensuring high levels of safety during the rise of integrated technology in the power plants?

4. Is artificial intelligence safe enough to be integrated into nuclear energy development and usage? If so, is there an action plan in place to prevent the AI compromising the power plant?

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II. Preventing Nuclear Terrorism

Statement of the Issue:

There is a risk that nuclear/radioactive material can be seized by criminal/international unauthorized actors for malicious purposes which can pose a threat to international security. Fortunately there have not been any documented acts of instances where nuclear technology was seized. Yet, at the turn of the century, terrorists were able to seize weapons of mass destruction (mainly of chemical nature) with instances such as the Sarin incident in Tokyo as well as anthrax cases in 2001. The smuggling of radioactive material is also a concern. Many large scale attacks show that bad actors contain considerable financial and human resources and the will to inflict maximum damage possible. This especially does not rule out the scenario that nuclear terrorism is a possibility in the future. [14]

The IAEA defines nuclear terrorism as the act of violence and destruction where the means applied are nuclear devices, or threats of using such means, to create a condition of fear, to get attention or to blackmail to have wider effects on other targets than the victim's directly affected. Nuclear terrorism can be categorized under radiological terrorism, where radioactive substances are the means to propagate terror. There are differences in the technical approach and potential of damage between radiological and nuclear terrorism, characteristics such as causes and actors are shared between the two.[15]

While there hasn't been any concrete takeover of fissile material by terrorist organizations, there has been interest/desire to either purchase the weapons from states that possess it, or purchase the means to construct the same in a separate base. There are three instances of this: Aum Shinrikyo

[14] (Maerli, n.d.)
[15] (Maerli, n.d.)

(Japan), Al-Qaeda (Pakistan) and Uranium Smuggling in Kinshasa (Democratic Republic of Congo).

Aum Shinrikyo is a religious movement and new age doomsday cult that notoriously conducted the aforementioned sarin attack in the Tokyo subway. These were a culmination of their biological and chemical programs. However they also contained the nuclear weapons wing. Their leader Shoko Asahara fantasized about an armageddon catalyzed by a nuclear war between Japan and the US in which only the followers of Aum Shinrikyo would survive. Other motives involved paranoia about the cold war as well as revenge from Hiroshima and Nagasaki. Fear catalyzed the recruitment conducted by Aum of scientists from various backgrounds ironically excluding nuclear physics. Many of the scientists were considered to be second rate and were instead lured by the opportunity of unlimited resources to further their research. While intelligence is incomplete, it was documented that Aum was present in Russia to purchase nuclear weapons from the government, with senior leader Kiyohide's notebook hypothesizing a fifteen million dollar sale. This connection was furthered by Asahara's delegation in 1992 to meet Russian ministers, who granted the cult access to the black market and enabled them to maximize the research that they did.

Despite such a close connection, Aum were unable to purchase a nuclear weapon, thus turning to the construction of a nuclear weapon, evidenced by the purchase of a ranch in Australia (who they believed to be unaffected by the hypothetical armageddon). However they weren't able to mine enough uranium to power nuclear weapons. Efforts of development continued into the new millennium, with the use of the internet, ultimately heralding their downfall as Japanese officials got a hold of the communications, shutting down the operation entirely.[16]

[16] (Maerli, n.d.)

Al-Qaeda, the perpetrators of the September 11 attacks also had nuclear intentions. Their bombings of US embassies in Nairobi and Tanzania revealed Bin Laden's intentions to acquire weapons of mass destruction. Dating back to the 1990s, the group attempted to purchase nuclear material as well as weapons, but were unable to do so. It was determined that the group did have the fiscal and human capacity to develop weapons, and first attempted to do so in Sudan from 1992 to 1996, by investing in the local economy and National Islamic front in return for sanctuaries and laboratory assistance. The results were unfruitful as low-grade reactor fuel was offered that could not be used for weapons design.

Al-Qaeda then moved to Afghanistan, by partnering with the Taliabn to use secure bases in the development of unconventional weapons as well as hide such activity from the outside world. This was boosted by disillusioned Pakistani scientists who were unhappy with their own nuclear establishment and sought to share classified information with their neighbors in return for reward. The "Superbomb" was a document discovered in Kabul which theorized the creation of a nuclear weapon, but could not act as an authoritative guide as it was missing steps as well as didn't enable creators to gain confidence. Other documents seized showed some knowledge of nuclear weapons although they contained mistakes such as references to "Saturium", a nonexistent chemical. Rumors continued to float that Al-Qaeda had purchased nuclear weapons from the Chechens and Russians, but ultimately nothing came to fruition.[17]

In 1998, smugglers were able to steal valuable material from the Kinshasa nuclear power plant in Zaire (now the DRC). This included uranium as well as reactor fuel rods. They then sold it to prospective buyers such as Carlo Monteiro, a Portuguese businessman who further traded it to the Italian mafia for seven billion Italian lira. Ultimately they were thwarted by Italian agents

[17] (Maerli, n.d.)

who posed as middle eastern buyers. The network was further unraveled with men being arrested in Belgium for selling 5 kg of uranium. At the same time, the DRC denied the smuggling of material in fear of looking compromised.[18]

The greatest modern threat with intention of purchasing nuclear weapons is the IS (Islamic State) or ISIL (Islamic State of Iraq and the Levant) who have expressed a desire to buy or develop nuclear weapons to threaten the status quo. The number of states with a nuclear arsenal as well as the demand for a piece of the same are increasing. The potential for destruction also increases as technology and nuclear energy develops, therefore it is of the utmost importance to ensure such delicate and potent material does not end up in the wrong hands.

History:

The IAEA has determined that responsibility for nuclear security rests entirely within the state. At the same time, the IAEA recognises that multiple states have not adhered or implemented the regulation properly. This has left gaps in the global system that can be exploited by terrorists or other bad actors. However, respecting and following the relevant regulation, harmonizing of national legal frameworks and an effective application of necessary measures contribute to the nonproliferation of nuclear terrorsim.

While there may be no explicit singular document on addressing nuclear security, the Convention of Physical Protection of Nuclear Material (CPPNM) and its amendment, the Code of Conduct on the Safety and Security of Radioactive Sources, the Safeguards Agreements and their protocols, the Nuclear Terrorism convention and the United Nations Security Council's Resolutions 1540 and 1373 act as the vanguard of protection from nuclear terrorism.

[18] (Maerli, n.d.)

Entered into force on February 8, 1987, the CPPNM establishes physical protection measures that are expected to be applied to nuclear material in transit. The CPPNM also outlines measures taken in the instance of criminal offenses related to nuclear materials, and acts as a blueprint for international cooperation amongst states. Article 7 of the CPPNM specifically targets the distribution of material to those parties with intent of threat or harm, stating that the intentional commission of unlawful acts with nuclear material (possession and distribution to those with malicious intent) must be punished at once, with states being expected to describe the offense in detail to the IAEA. Articles 8-12 describe the measures taken to counter the offense ranging from the extradition of the perpetrator to their trial if necessary while ensuring fairness in all aspects.[19]

The amendment of the convention helped strengthen it by increasing the scope to cover physical protection of power plants as well as their peaceful storage and transportation domestically. It further condemns any illicit trafficking of nuclear material and calls for even stronger collaboration in the event of any sabotages.[20]

The Code of Conduct on the Safety and Security of Radioactive Sources and its Guidance on the Import and Export of Radioactive Sources helps States ensure radioactive sources are used safely and security. Accepted by over 130 countries, it is well accepted and not legally binding. It addresses nuclear terrorism specifically in clause 19 g) which requires security measures to be implemented to prevent the illegitimate distribution and handling of nuclear material.[21]

One of the cornerstones of nuclear security currently is the requirement for accounting and control of nuclear material and the establishment of such organizations outlined in the Safeguards Agreements. The safeguards help in preventing the transfer of nuclear material from peaceful

[19] (IAEA 2005)
[20] (IAEA 2005)
[21] (IAEA, n.d.)

energy production to the manufacture of nuclear weapons. This is alongside the expectation of states to create a protection system that minimizes the possibility for the unauthorized removal of nuclear material and/or for sabotage. Unlike the code of conduct, the Safeguard Agreements are legally binding with non-nuclear weapon state parties that also agreed to the Nuclear Non Proliferation treaty. Nuclear weapon states that are bound to the NPT have also signed safeguard agreements which allow the IAEA to protect select nuclear facilities offered by the state and selected by the Agency. The three states that are not party to the NPT (India, Pakistan and Israel) have agreed to specific safeguard agreements that prevent the existing nuclear material from being used to further military development.[22]

Outside the IAEA, the United Nations has developed legislation that tackles nuclear terrorism. One such document is the International Convention on the Suppression of Acts of Nuclear Terrorism. Inspired by Russian law, the Convention defines nuclear terrorism, and covers many aspects of possible targets, including nuclear power plants and reactors. It calls for the extradition or prosecution of perpetrators. It also encourages states to cooperate in preventing terrorist attacks by sharing information and aiding each other in criminal investigations and extradition processes. The treaty mandates that seized nuclear or radiological material is held in accordance with IAEA protocol. The United Nations Security Council has also addressed the threat of nuclear terrorism through its resolutions 1373 and 1540. Although these resolutions have much more broader ideas (resolution 1373 addresses general counterterrorism post the september 11 attacks while resolution 1540 handles the non-proliferation of weapons of mass destruction), they also call for international cooperation to prevent the unsanctioned seizure of nuclear material for hostile reasons.[23]

[22] (IAEA, n.d.)
[23] (IAEA 2005)

Analysis:

The most pressing issue is the lack of regulation from the IAEA with regards to countering nuclear terrorism. While the IAEA has acknowledged what the United Nations has done, it is clear that this is not the perfect solution. The aforementioned documents were written at the start of the millennium based on their technological considerations, and it is clear that nuclear energy, technology and the capabilities of non-state actors have increased. Therefore, it is prudent for the IAEA to come up with a document that addresses how to prevent counterterrorism as well as what to do in case such an event rises.

The committee must harmonize laws from the member states to create a set of rules that will be enforced effectively. It must take into consideration the capacity of non-state actors such as ISIL and look at the technology that is present which they could have access to. Ensuring that the organization and technology does not affect the proliferation of peaceful nuclear energy is of the utmost importance. Thus it is also important to consider the potential effect it has on physical nuclear facilities and ensure there are protection measures in place to prevent damage from occurring. The member states also need to discuss the future of the perpetrators, specifically their capture and extradition (if necessary), and what kind of trial/punishment they may deserve.

The committee needs to revisit the laws in place for the safe transportation (internationally and domestically) of nuclear material, as that is when it's most vulnerable. The committee must do its best to bolster the legislation in place to protect the nuclear material from being seized in the wrong hands, which can cause nuclear terrorism. Finally, the committee must also consider methods to squash aspiring terrorist groups that wish to use nuclear weapons to compromise the world.

Conclusion:

Nuclear terrorism has fortunately not struck the world, but the threat of nuclear terrorist persists, especially since proof exists of various organizations trying to either construct their own nuclear weapons on purchase from governments with access to it. While the IAEA expects nuclear security to be the job of the government, the IAEA can provide suggestions as well as regulation on how to prevent bad actors from gaining access to nuclear weapons.

Questions to Consider:

1. What aspects need to be considered when it comes to scoping prospective buyers of nuclear energy? How do we differentiate between good and bad actors?
2. How can we improve security when it comes to the transport and use of nuclear weapons, preventing them from being hacked?
3. What are some of the ways in which nuclear energy and nuclear weapons can be compromised? How can we handle them?
4. What happens if terrorist organizations do gain access to nuclear weapons? How do the governments react to that?

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