

CHAPTER TWO

LITERATURE REVIEW

A. The proliferation of Nuclear Weapons

A nuclear weapon is an explosive weapon which destructive force could result from nuclear fission¹¹ chain reactions or combine nuclear fission or fusion¹² reactions. Nuclear weapons' explosions that result from fission reaction are commonly referred to atomic bombs, while nuclear weapons that result from a nuclear fusion reaction are referred to as thermonuclear weapons or a hydrogen bomb.

1. Fission weapon is defined as fissile material which is made of enriched plutonium or uranium which could produce an explosive output that is ranging from one to five hundred kilotons of TNT. A blast of radiation follows the detonation of any nuclear weapon. Fission weapons also create radioactive debris, more commonly known as fallout.
2. Thermonuclear weapon is defined as a weapon that uses the heat generated by a fission bomb to compress and ignite a nuclear fusion stage. Thermonuclear weapons particularly have a far higher explosive output than fission weapons that are ranging in megatons rather than kilotons. Fusion reactions could create fission products and

¹¹ Oxford Dictionaries define fission as “division or splitting into two or more parts; (Biology) Reproduction by means of a cell or organism dividing into two or more new cells or organisms.”

¹² Oxford Dictionaries define fusion as “the process or result of joining two or more things together to form a single entity.”

because of the thermonuclear weapon contained inside it, it could generate nuclear fallout as much as nuclear fallout produced by fission-only weapons.

3. A neutron bomb is a thermonuclear weapon that provides a smaller explosion but a large amount of neutron radiation. A neutron bomb can be used to create massive casualties while leaving infrastructure mostly undamaged and creating a small amount of fallout, in contrast.¹³

Uranium is the main ingredient of a nuclear reactor or nuclear weapons.

Uranium is the radioactive element with atomic number 92 and the appearance is in the form of silvery grey metallic. Its fuel is used for the nuclear power plant which produces electricity. Besides being used as a nuclear power plant, it is also used as military nuclear weapons. In order for uranium to be useful, it needs to be processed from its ore. Uranium needs to be enriched to produce fuel for the reactors. There are two classifications of enriched uranium, low enriched uranium (LEU) and highly enriched uranium (HEU).

Low enriched uranium (LEU) is an essential ingredient to produce nuclear fuel for the light-water reactor, the most common reactor, which has concentration lower than 20% of uranium-235.¹⁴ The heat produced is used to generate electricity. Meanwhile, highly enriched uranium (HEU) has more than 20% concentration of uranium-235. Usually, HEU used in weapon-grade

¹³ Gro Nystuen, 2014, *Nuclear Weapons under International Law – An Overview*, Cambridge, Cambridge University Press, p. 235.

¹⁴ International Atomic Energy Agency, “Low Enriched Uranium (LEU)”, taken from <https://www.iaea.org/topics/leubank/what-is-leu>, accessed on April 12th, 2019, at 12:26 am.

contains 85% or more of uranium concentration. Nuclear weapon containing HEU could produce a massive explosion.

The proliferation of nuclear weapons has three significant aspects:

1. Horizontal Proliferation: The development of the capability to produce or acquire nuclear weapons by countries that currently do not possess any nuclear weapons.
2. Vertical Proliferation: The increase of weapon inventory by countries that currently possess nuclear weapons and the increase of technical sophistication or reliability of these weapons, and the development of new weapons in the form of mini-nukes or known as battlefield nuclear weapons.
3. Another Form of Horizontal Proliferation: When individuals or non-state entities acquired nuclear weapons or the materials and also the knowledge to develop nuclear. They are often termed as a terrorist to produce nuclear weapons.¹⁵

At the beginning of the development of nuclear technology, it was aimed for military purposes, which was done during World War II. Two nuclear bombs made from enriched uranium and plutonium were dropped on Japan's Hiroshima and Nagasaki back in August 1945. The power of the atom

¹⁵ Victor W. Sidel, 2007, "Proliferation of Nuclear Weapons: Opportunities for Control and Abolition", *Am. J. Public Health*, Vol. 97, No. 9, United States, American Public Health Association, p. 2.

that was very massive and was not imagined before had been exposed and demonstrated.

Afterward, the proliferation of nuclear spread to public uses. Half century after nuclear energy become useful, nuclear technology has allowed access to energy sources which is almost unlimited when obstacles arise in the use of fossil fuels.¹⁶ Nuclear energy produced by nuclear fission with the control of human is a very new method.

Much older forms of manufactured energy such as oil, gas, and coal have been quite damaging aftermath for the environment and have caused the early death of a significant number of human beings and also causing environmental damage known as global warming. The global warming is caused by the burning of fossil fuels which is likely to give more significant damage to the environment that has ever been caused by the generation of power from controlled nuclear fission.¹⁷

Nuclear does not only causing damage to the environment, but the nuclear energy facility used for civilian purposes have also been causing some quite troubling nuclear accidents. The civilian nuclear accident which is fatal has mostly caused by nuclear power plant accidents. In most cases, the accident generally occurred as the result of nuclear leaks or meltdowns where dangerous

¹⁶ World Nuclear Association, 2018, "Safeguards to Prevent Nuclear Proliferation", taken from <http://www.world-nuclear.org/information-library/safety-and-security/non-proliferation/safeguards-to-prevent-nuclear-proliferation.aspx>, accessed on March 14th, 2019 at 10 pm.

¹⁷ Pushker Kharecha and James Hansen, 2013, "Coal and Gas are Far More Harmful than Nuclear Power", NASA, taken from <https://climate.nasa.gov/news/903/coal-and-gas-are-far-more-harmful-than-nuclear-power/>, accessed on March 12th, 2019 at 9 am.

nuclear material escapes into the environment. The fatal accident that was caused by nuclear power plant accidents occurred at Three Mile Island in Pennsylvania; Chernobyl in Soviet Ukraine and the most recent one in 2011 incident at Fukushima Daiichi, Japan.¹⁸ Radiation poisoning can be regarded as the same with the ingestion of other forms of poison, but it is often causing more severe damage than other poisons because it can also cause long-lasting aftermath which is genetic damage that later could affect the future generation.

B. Treaty on the Non-Proliferation of Nuclear Weapons (NPT)

Non-Proliferation of Nuclear Weapons Treaty (NPT) is the highlight of global efforts in order to prevent further spread on nuclear weapons and to make sure that states use the nuclear energy for peaceful purposes only with another object for nuclear disarmament. NPT opened for signatures in 1968 and entered into force in 1970. NPT is considered as a milestone of nuclear treaties for both its content and its scope with over 190 parties have signed it.¹⁹ NPT rests on three pillars: prevention of proliferation on the nuclear weapon; encouragement of a peaceful use of atomic energy; and disarmament of existing stock of nuclear.²⁰

1. Prevention of proliferation on nuclear weapons: Under Article I of NPT, Nuclear Weapons States (NWS) promise not to transfer in any

¹⁸ Danielle Demetriou, 2011, "Japan Earthquake, Tsunami and Fukushima Nuclear Disaster: 2011 Review", the Telegraph, taken from <https://www.telegraph.co.uk/news/worldnews/asia/japan/8953574/Japan-earthquake-tsunami-and-Fukushima-nuclear-disaster-2011-review.html>, accessed on March 12th, 2019 at 11 am.

¹⁹ Zach Long, 2016, "Overview of U.S. Nuclear Treaties", Stanford, Stanford University, taken from <http://large.stanford.edu/courses/2016/ph241/long2/>, accessed on March 12th, 2019 at 11 pm.

²⁰ Treaty on the Non-Proliferation of Nuclear Weapons 1968, p. 4.

way possible a nuclear weapons or any nuclear technology to any recipient in any way and not to encourage any Non-Nuclear-Weapon State to manufacture or achieve nuclear weapon. Under Article II of the NPT, Non-Nuclear-Weapon States (NNWS) promise not to achieve or implement control of nuclear weapons or other nuclear explosive technology and not to seek or receive assistance in making such devices. Under Article III of the Treaty, non-nuclear-weapon states pledge to accept IAEA safeguards to verify that their nuclear activities serve only peaceful purposes.

2. Encouragement of peaceful uses of atomic energy: Article IV recognizes the right of all parties to achieve or improve nuclear energy for peaceful purposes only and to the benefit from international cooperation, but it has to be in conformity with their non-proliferation obligations.
3. Disarmament of existing stock of nuclear: Under Article VI of NPT, all parties to the treaty pledge to pursue good faith negotiations on practical calculations related to the termination of the nuclear arms race, to nuclear disarmament, and to make progress on complete disarmament regime.²¹

²¹ *Ibid*, p. 9

a. Disarmament Regime

The central part of the disarmament regime relating to nuclear weapons is the 1968 Nuclear Non-Proliferation Treaty (NPT) that has since been obtaining universal obedience. The Treaty has been termed a ‘big bargain’ in which the non-nuclear-weapon states (NNWS) leave the nuclear option but in exchange for a legal obligation on the nuclear weapon states (NWS) to refrain themselves from transferring the weapons to any other states and to disarm and eventually eliminate their nuclear contained in Article I and Article II. In addition to the non-proliferation elements in Article I and Article II, the Treaty guarantees all parties the ‘inalienable right’ to peaceful uses of nuclear technology for the benefit of their countries in Article IV. Article VI also requires the NWS to ‘pursue negotiations in good faith’ towards the reduction and eventual elimination of nuclear technology.

The major purpose of the Treaty was to prevent further proliferation of nuclear weapon and the NPT has played and continue to play an important role in limiting nuclear, also limiting the access of states to a nuclear weapon. Even though there was a breach of the non-proliferation pillar, such as the fact that India, Israel, and Pakistan never acceded to the Treaty, and North Korea withdrew from the Treaty (declared that it had the

right to do so under Article X of the NPT), the overall purpose of preventing proliferation of nuclear weapons to NNWS has mostly been achieved. However, the NPT comes under increasing pressure mainly because of the lack of implementation on the disarmament elements of the treaty. Indeed, Article VI remains a constant source of debate (and tension) between NWS and NNWS that are states parties to the Treaty.

The International Court of Justice (ICJ) has stated its opinion on the interpretation of Article IV in the Advisory Opinion on the Legality of the Threat or Use of Nuclear Weapons [1996]. The ICJ point on how important is Article VI of NPT to be recognized. The obligation of each Party of NPT contained in Article VI is beyond of a mere obligation of conduct; it involved an obligation to achieve a proper result with nuclear disarmament in all its aspects by adopting certain conduct that is pursuing negotiations on the matter with good faith.²²

In the dispositive F in the Advisory Opinion, the judges of the ICJ stated that:

“There exists an obligation to pursue in good faith and bring to a conclusion negotiations leading to nuclear disarmament in all its aspects under strict and effective international control.”

²² International Court of Justice, 1996, “Legality of Threat or Use of Nuclear Weapons”, Advisory Opinion of July 8th, 1996, p. 42.

Therefore, Article VI is not a mere goal but a binding obligation. In addition, the obligation to continue negotiations in good faith - a legal term with established content and bodies of jurisprudence - shows that efforts to simply provide false services to the negotiation idea are not sufficient.

NPT classified States into two classifications, Non-Nuclear-Weapon States (NNWS) and Nuclear-Weapon States (NWS). NNWS devote themselves not to manufacture or acquire nuclear weapons or any applicable nuclear technology or other nuclear explosive devices while NWS devote themselves to not in any way help, encourage, or transfer any NNWS to manufacture or acquire nuclear weapons or any other nuclear applicable technology. Nuclear-Weapon States consist of five States, USA, UK, France, the Russian Federation, and the People's Republic of China, and they are the permanent member of the United Nations Security Council.²³ The other States are called the Non-Nuclear-Weapon States (NNWS).

The fundamental obligation of non-proliferation expected from NNWS party conferred by the NPT is not to acquire or even manufacture nuclear weapons. This obligation could be found in Article II of NPT, which stated:

“Each non-nuclear-weapon State Party to the Treaty undertakes not to receive the transfer from any transferor whatsoever of nuclear weapons or other nuclear explosive devices or of control over such weapons or explosive devices directly, or indirectly; not to manufacture or otherwise acquire nuclear weapons or other nuclear explosive devices; and not to

²³ Jozef Goldblat, 2005, “Nuclear Non-Proliferation: A Guide to the Debate”, *Stockholm International Peace Research Institute*, London, Taylor & Francis, p 2.

seek or receive any assistance in the manufacture of nuclear weapons or other nuclear explosive devices.”

The first clause in Article II was implicated toward the transfer of nuclear explosive device. Besides that, Article II stated that NNWS party could not control over a weapon. Control used in this context applicable to states that have the independent capability in using nuclear weapons. On the contrary, the obligation “not to receive the transfer” of nuclear is prohibited based on national territory provisions of the NNWS and in other territories of other states.

The maintenance of a strong nonproliferation regime grounded in the NPT helped create a secure and stable security environment conducive to progress in nuclear disarmament. The NPT facilitates cooperation on peaceful uses of nuclear energy that diagnose and fight diseases, develop new crops, manage scarce water resources, and broadly apply nuclear science and technology that meet UN Sustainable Development Goals.

C. International Atomic Energy Agency (IAEA)

To continue the goal of non-proliferation further and as a measure between States parties, NPT establishes a safeguards system under the responsibility of the [International Atomic Energy Agency](#) (IAEA). Safeguards are used to verify the compliance of every state with NPT through inspections conducted by the IAEA. NPT promotes cooperation in the field of peaceful uses of nuclear technology and access to this technology that is equal for all

States parties, while safeguards prevent the diversion of nuclear material for weapons use.²⁴

The IAEA is an international organization established under the United Nations in 1957 to help nations develop nuclear energy for peaceful purposes. Its office is located in Vienna, Austria. IAEA has 178 state members²⁵ and responsible directly to the UN General Assembly and Security Council. Allied to this role since 1970 is the administration of safeguards arrangements. The administration assures the international community that individual countries are honouring their treaty commitments to use nuclear materials and facilities exclusively for peaceful purposes.

In 1991, after the Gulf War, IAEA established a program named “Program 93+2” that later produced several additional regulations called “Additional Protocol” to complement the previous regulation. This program was divided into two parts; the first part is regulating the access that IAEA could get to the information regarding nuclear material in their state members; the second part is more emphasizing to complete physical access for IAEA when it performs an inspection in states member territory that covers access to unreported facilities.²⁶

²⁴ United Nations Office for Disarmament Affairs (UNODA), “Treaty on the Non-Proliferation of Nuclear Weapons (NPT)”, taken from <https://www.un.org/disarmament/wmd/nuclear/npt/>, accessed on March 14th, 2019 at 1 pm.

²⁵ International Atomic Energy Agency, “List of Member States”, taken from <https://www.iaea.org/about/governance/list-of-member-states>, accessed on March 14th, 2019 at 2 pm.

²⁶ Rodney W. Jones, *et al.* 1998, *Tracking Nuclear Proliferation: A Guide in Maps and Charts*, Washington, Carnegie Endowment for International Peace, p. 296-297.

1. IAEA Safeguards System

IAEA safeguards play a key role in stopping nuclear proliferation by independently verifying the compliance of states with nuclear non-proliferation undertakings. IAEA safeguards are incorporated into legally binding agreements with the IAEA. These agreements provide the legal foundation for safeguards application. There are a number of components in the legal framework for IAEA safeguards. These include the IAEA Statute; State obligations under the Treaty on the Non-Proliferation of Nuclear Weapons and treaties establishing nuclear-weapon-free zones; safeguards instruments such as safeguard agreements, protocols and subsidiary arrangements to those agreements; and decisions of the IAEA Board of Governors.

The IAEA concludes three kinds of safeguards agreements:

- a. Comprehensive Safeguards Agreements (CSA): an agreement concluded by all NNWS which is a party to the NPT as required in Article III of the NPT. A state has to accept IAEA safeguards to all nuclear material that it possessed within a peaceful nuclear activity. IAEA is granted with right and obligation to confirm that the safeguards are applied to all nuclear material and to verify that the material is not diverted to produce nuclear weapons or nuclear devices;

- b. Voluntary Offer Agreements (VOA): safeguards agreements concluded by the five NWS party to the NPT voluntarily that cover their peaceful nuclear activities. Their nuclear facilities will be reported to IAEA by the relating State and offer the application of safeguards. So IAEA will apply its safeguard to nuclear material that is selected by the State only;
- c. Item-Specific Safeguards Agreements: it is an agreement concluded between State and IAEA on specified item only. The safeguards would cover only to nuclear material, facilities, and any other subject related to nuclear activity. The state parties should not use the material, facilities, or another subject to produce any nuclear weapons or use it for military purposes.

Each of these agreements may be complemented with an Additional Protocol (AP) that includes provisions for information about, and access to, all parts of a State's nuclear fuel cycle, from mines to nuclear waste. A Small Quantities Protocol (SQP) may be concluded in conjunction with a comprehensive safeguards agreement. It is as a means to reduce the burden of safeguards activity. Small quantities protocols are currently available for States that have minimal or no nuclear material and no nuclear material in a facility.

The IAEA begin to do regular inspections on civilian nuclear facilities to verify the accuracy of documentation submitted to them by States. The Agency inspects inventories, takes sampling, and does the analysis of materials. Safeguards are designed to prevent any diversion of nuclear material by increasing the risk of early detection. They are accompanied by controls on the export activity of sensitive technology from countries such as the UK and the USA through voluntary bodies such as the Nuclear Suppliers Group. Safeguards are backed up with the threat of international sanctions.²⁷

²⁷ World Nuclear Association, 2018, “The International Atomic Energy Agency”, taken from <http://www.world-nuclear.org/information-library/safety-and-security/non-proliferation/safeguards-to-prevent-nuclear-proliferation.aspx>, accessed on March 14th, 2019 at 2 pm.