CHAPTER 4

THE EFFECT AND THE CONSEQUENCE OF NUCLEAR WEAPON USE
CHAPTER 4: THE EFFECTS AND THE CONSEQUENCES OF NUCLEAR WEAPON USE

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"Mechanized civilization has just reached the ultimate stage of barbarism. In a near future, we will have to choose between mass suicide and intelligent use of scientific conquests. This can no longer be simply a prayer; it must become an order which goes upward from the peoples to the governments, an order to make a definitive choice between hell and reason."

Albert Camus in Combat newspaper, 8 August 1945,

Preliminary

The international law does not outlaw most class of conventional weaponry, even though some of them are capable of producing very devastating effects. Entire cities have been fire bombed or flattened, and large numbers of non combatants are killed by non nuclear bombs, but such weapon has not been treated as illegal. Nuclear weapon is illegal weapon because of its distinctive characteristic which set it apart from the other weapon. It is true that various other weapons are declared illegal in the past such as the Dum Dum bullet; they are condemned by treaty or otherwise as inflicting unnecessary suffering. The nuclear weapon however combines within itself more principle of illegality than any other weapon, which is demonstrated by its consequential effect in this chapter. History reveals out the most shocking experience to mankind with the end of Second World War. Any country indulging in warfare has a better option of re-establishing their relationship either by bilateral or mutual agreement or by mutual consent but the only assurance that are far to be trusted are the use of technological weapons in any future war by the states. The worst thing yet to be said about the war crises is the period after war, the consequential effect of war though is direct upon the economy of a country the incalculable damage is upon the human being, environment and civilization as whole. The study of law of war require a pre examination of the rules that are violated by states during war and requires an in dept enquire into its effect on general lives of human, nature and environment, thus making it necessary to conduct meticulous study on the effect and the consequence of use of nuclear weapon. Much debated issue among the international law jurist and the experts are on the status of nuclear weapon, this was drawn after study conducted by
ban the bomb movement which had highlighted the hazardous consequence of its effect upon the victims of radiological ray. War is never an isolated act; its impact is equally on all the aspect of ecology. In any nuclear warfare the danger inflicted would be incalculable, thus making the nuclear weapon a subject matter of enquiry under both law and fact. To understand the illegality of nuclear weapon chapter 4th conducts postmortem study of nuclear warfare and its effect upon the ecology as a whole. The object of the present chapter is to examine the physical effect of nuclear radiation on the living species and the ecology, thus to identify the status of nuclear weapon under the IHL.
4.1. Introduction

“Warfare is inherently destructive of sustainable development. States shall therefore respect international law providing protection for the environment in times of armed conflict and cooperate in its further as necessary.”

This statement was vowed by state’s party to the Rio declaration of 1992. Though there are several causes for environmental degradation, the impact of war is long lasting and rampant on the ecology. In term of environmental impact, Word War was most damaging, because of landscape changes caused by trench warfare. Digging trenches caused trampling of grassland, crushing of plant and animals, and churning of soil erosion resulted from forest logging to expand the network of trenches. Soil structures were already and severely damaged and if the war was never fought, in all likelihood the landscape would have looked very differently today. Another damaging impact was the application of poison gas. Gases were spread throughout the trenches to kill soldiers of the opposite front. Examples of gases applied during WWI are tear gas (aerosols causing eye irritation), mustard gas (cell toxic gas causing blistering and bleeding), and carbonyl chloride (carcinogenic gas). The gases caused a total of 100,000 deaths, most caused by carbonyl chloride (phosgene). Battlefields were polluted, and most of the gas evaporates into the atmosphere. After the war, unexploded ammunition caused major problems in former battle areas.

In 1925, most WWI participants signed a treaty banning the application of gaseous chemical weapons. However the treaties were severely violated during II WW. The effect of Second World War on ecology created history, causing massive human disastrous leaving no limit to human panic. Mid 19th witnessed a change in the political scenario of nuclear politics the beginning of the Cold War, nuclear weapons have played a crucial role in the international community, shaping the behavior of states and their actions in relationship to one another. Throughout the 20th century, nuclear weapons got deadlier; their range and power are both increased, bringing the potential for greater devastation to the globe. To limit the spread of nuclear weapons,

2 Angelo M. Codevilla, ‘No Victory, No Peace’, (Rowman and Littlefield, 2005), pp 28-78
the international community adopted the Non-Proliferation Treaty (NPT),\(^4\) which calls for the secession of the nuclear arms race and abandonment of nuclear weapons. A recent American attempt to start research in the field of the low-yield nuclear bunker buster bombs brings important issues of legality of the proposed research in light of Article VI of Non-Proliferation Treaty. Because the 2002 National Security Strategy does not prohibit this grade of weapons, the proposed research by the US military violates international law because it contradicts to the Article VI of the NPT.\(^5\)

The Non-Proliferation Treaty is one of the most important binding legal documents that curtails the spread of nuclear weapons and targets the future abandonment of the nuclear weapons.\(^6\) A recent proposal in US to start appropriate research in the field of nuclear earth-penetrating weapons is a strong challenge to the treaty, because it contradicts the main provisions of the treaty, namely Article VI, which reads:

“Each of the Parties to the Treaty undertakes to pursue negotiations in good faith on effective measures relating to cessation of the nuclear arms race at an early date and to nuclear disarmament, and on a Treaty on general and complete disarmament under strict and effective international control.”

The issue here is that if the states perpetuate the ongoing nuclear arms race the problem would be unending. If the U.S. successfully develops a weapon of such kind, then other nuclear and non-nuclear bearing states would feel the necessity to have such weapons in their arsenal for better protection of their national interests and sovereignty. The goal of NPT and, especially Article VI, is to stop such races for the good of the humanity, because nuclear weapons are dangerous and pose threat to the population of the globe. Even though the proposed research would create low-yield nuclear weapons, the crux of the problem is that it would be a step in the direction of the continuance of the nuclear arms race between the international actors, in violation of the NPT.

\(^5\)Proliferation Control Regimes: Background and Status Congressional Research Service Report, 26 December 2006/www.proliferation/nuke/org, accessed @ 7.30 pm on 28/3/2009
\(^6\) Ibid
Having experienced a number of local conflicts and two major world wars, the international community adopted the Geneva Convention in 1949 as a legal guideline for the appropriate measures of the conduct of the military conflict. The Geneva Convention is the base and the source of the international humanitarian law that deals with the conduct of war, usage of weapons during wartime, and treatment of civilians and military personnel. Bunker buster weapons are nuclear weapons the United States has access to in times of conflict, which brings the same question: would the United States use regular nuclear bombs in the process of conducting military warfare? The fallout from nuclear weapons can reach civilians in the area of the conflict, and innocent populations would be exposed to deadly radiation that leads to immediate death or severe diseases of internal human organs.\(^7\) Section I of the Additional Protocol I, Part IV, of the Geneva Convention, relative to the protection of civilian persons in time of war, states:

“The second, in order to ensure respect and protection for the civilian population and civilian property, obliges the Parties to the conflict to distinguish at all times between the civilian population and combatants, as well as between civilian property and military objectives and to direct their operations only against military objective.”

When nuclear weapons are unleashed against a particular target, it becomes very difficult to achieve a mission without affecting the civilian population in the targeted area.\(^8\) The problem with nuclear weapons is that radiation can travel for thousands of miles and have a very significant humanitarian effect as well as deep ecological effects. Thus, the use of nuclear bunker busters would violate International Law, because it would breach one of the articles of the Geneva Convention on the matter of military warfare and treatment of the civilian population. In an advisory opinion of July 8, 1996 the International Court of Justice concluded that principles of humanitarian law do apply to nuclear weapons.\(^9\)

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\(^7\) Gat, Azar ‘War in Human Civilization’, (Oxford University Press, 2006), p.45  
Legal Regime on the Use of Nuclear Weapon and its Impact on Humanity

The opposite conclusion "would be incompatible with the intrinsically humanitarian character of the legal principles in question which permeates the entire law of armed conflict and applies to all forms of warfare and to all kinds of weapons, those of the past, those of the present and those of the future." According to the Court's opinion, any weapon that has the potential to harm must be limited in usage, due to the established practices and treaties of international humanitarian law. Nuclear bunker buster weapons are just another step in the future race of the creation of more powerful weapons in order to effectively protect the interests of the state and its national integrity and sovereignty.\textsuperscript{10}

Living in an international community which has a number of nuclear possessing states and a wide range of nuclear capable states, it becomes crucial to control the spread of such weapons, due to the fact that they could get into the hands of terrorists or into the hands of a dictator, whose goal is the elimination of a particular group or a state by any means possible.\textsuperscript{11} Today the world is under the threat of the uncontrollable spread of nuclear weapons and nuclear material.\textsuperscript{12} The goal should be the abandonment of nuclear weapons and secession of research in the scope of usage of nuclear material for the benefit of mankind.

Another concern for today's generation should be the nuclear energy impact on the ecology. Although ecological disturbances brought on by war have been occurring for thousands of years, modern day warfare has made its impact increasingly severe. One of the most striking examples of military disregard for environmental and human health is the use of chemical and biological agents in warfare.\textsuperscript{13} The American military's use of Agent Orange during the Vietnam War is one of the most widely known examples of using environmental destruction as a military tactic. A key ingredient of Agent Orange is dioxin, the most potent carcinogen ever tested. It is therefore not surprising that Agent Orange has been linked to an array of health problems in Vietnam including birth defects, spontaneous abortions, chloracne, skin and lung cancers, lower IQ and emotional problems for

\textsuperscript{10}J.J. Mearsheimer , 'Back to the future: Instability in Europe after the Cold War' in International Security', Vol. 15,990, pp. 5–56

\textsuperscript{11} Small, Melvin & Singer, David J.'Resort to Arms: International and Civil Wars',(Sage Publications,1982), p.190

\textsuperscript{12} Wade, Nicholas. 'Before the Dawn, (Penguin': New York 2006), p.89

\textsuperscript{13} Rafael Karsten, Blood revenge, war, and victory feasts among the Jibaro Indians of eastern Ecuador,( New York,1923), p.78
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children. Agent Orange is an herbicide that was sprayed in millions of liters over approximately 10% of Vietnam between 1962 and 1971. It was used to defoliate tropical forests to expose combatants, and destroy crops to deprive peasants of their food supply. The environmental and health effects were devastating. The spraying destroyed 14% of South Vietnam’s forests, including 50% of the mangrove forests. Similar to toxic chemical spills, Agent Orange continues to threaten the health of Vietnamese. In 2001, scientists documented extremely high levels of dioxin in blood samples taken from residents born years after the end of the Vietnam War. Studies attribute such high levels to food chain contamination. Soil contaminated with dioxin becomes river sediment, which is then passed to fish, a staple of the Vietnamese diet.\(^{14}\) This is a clear reminder that poisoning our environments is akin to poisoning ourselves. The advanced technologies have a massive impact on warfare, the strategical methods of use of nuclear weapon have really added to the problems. Just as it was seen in the protest by the Japanese government against the US government immediate following the first dropping of the atomic bombs n Hiroshima and Nagasaki in August 1945, the dominant academic thinking for several years after 1945 held that nuclear weapon per se should be considered illegal by virtue of their inhumanness.\(^{15}\) There was always an opposing opinion however that because there is no positive international law regarding use of nuclear weapon per se, their use or non use is a matter of state discretion. There is at present no rule of international law expressly prohibiting the state from the use of nuclear weapon in warfare. In the absence of such prohibition, the use of weapon against enemy combatants and other military object is permitted. The two opinions co-exist. Are nuclear weapons truly weapons which causes cruel and unnecessary suffering thereby making their use illegal? Whether it is categorically a weapon falling under the status of WMD?

As mentioned in the earlier chapter the nuclear weapon is necessarily different from the other conventional weapon and what makes it different from the other weapons is a question of law and fact, as ruled out by International court of Justice in its opinion on the status of Nuclear weapon case of 1996, the court held that the weapon causes cruel and unnecessary suffering. The term suffering is a state of acute pain, indeed in war time suffering is just the excruciation but then, should the

\(^{14}\) S. A. LeBlanc, Prehistoric ‘Warfare in the American Southwest’, (University of Utah Press 1999).p.56

\(^{15}\) Duane M. Capulla, War Wolf, (University of Pili,2008).pp49-57
process of excruciation be ongoing affecting the very gene of living species, resulting into vulnerable state of destruction? The ICJ recognized two cardinals principles contained in the text constituting the fabric of the humanitarian law. First is the principle of distinction between combatants and civilians from which the court deduced:

1. *The state must never make civilian the object of attack and must consequently never use the weapons that are incapable of distinguishing between the civilian and the military targets.*

   In any given international armed conflict, some weapons can be employed in the manner breaching the principle of distinction by being the instrument of direct or indiscriminate attack against civilians. The facts that this happens in particular military action does not stain the weapon themselves with an indelible mark of illegitimacy, since I other operation the same weapon may be used within the frame work of LOIAC. The issue however, is whether certain weapon is designed in such a way, that intrinsically it is incapable of distinguish between civilian and military targets. If so the weapon is illegitimate regardless of circumstances. Putting it somewhat differently, ‘a weapon will be unlawful *per se* if it is incapable of being targeted at a military objective only, even if collateral harm occurs. More often than not, the problem would relate to an inability to aim the weapon exclusively at the military objects. But with the biological and nuclear weapon the crux of the matters is that, when unchecked they can spread contagious disease far and wide without sparing civilian.

   The second cardinal principle adverted by the court relates to unnecessary suffering by combatants. The court said:

2. *According to the second principle, it is prohibited to cause unnecessary suffering to combatants; it is according prohibited to use weapons causing them such harm or uselessly aggravating their suffering. In application of that second principle states do not have unlimited freedom of choice of means in weapon they use.*

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As pointed out by the court:

*In conformity with the aforementioned principles, humanitarian law, at a very early stage, prohibited certain type of weapon either because of their indiscriminate attack on combatants and civilian or because of unnecessary suffering caused to combatants that is to say a harm greater than that unavoidable to achieve legitimate military objective.*\(^{18}\)

In context of the two cardinal principles, the court cited the Martens Clause.\(^{19}\) This Clause the brainchild of M. de Martens was incorporated first in Preamble of the Hague Convention (II) of 1899 and Hague Convention (IV) of 1907 Respecting the Laws and Customs of war on Land. A modern version of that clause- as the curt puts it- is to be found in Article 1(2) of Additional Protocol I of 1977:

*In case not covered by this Protocol or by other international agreements, civilians and the combatants remain under the protection and authority of the principles of international law derived from the principles of humanity and from the dictates of public conscience.*

The reference to customary law is self-evident. But the thrust of the Martens Clause is the additional allusion to the principle of humanity and to the dictates of public conscience’. In the Corfu Channel case of 1949, the international court of justice used the phrase ‘elementary consideration of humanity, which has overtones of Martens Clause that its ‘continuing existence and applicability is not to be doubted.\(^{20}\)

While the principles of humanity and the dictates of public conscience may explain the evolution of LOIAC, it must be taken into account that they do not directly affect the legality of the weapons. It is obvious that the yardstick used by the court were the principle of distinction and prohibition of unnecessary suffering, rather than principles of humanity and dictates of public conscience. General revulsion in face of certain conducts during hostilities does not create an independent legal criterion regulating weaponry.

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\(^{19}\) Advisory opinion on the Legality of the Threat or Use of Nuclear Weapons, 1996, ICJ Rep, pp.226-257

\(^{20}\) Corfu Channel Case (merit) 1949,ICJ Rep, pp 4-22
Together with the two cardinal principles applicable in the armed conflicts, the court identified a third fundamental principle: the principle of neutrality, whereby the effects of the weapon must be contained within the territories of the belligerents states. This principle would strengthen objections to weapon of mass destruction like nuclear weapon including the biological weapon, were in the effect could spread everywhere, showing no respect for the frontiers of neutral countries.  

The theoretical interpretations of legal principles of law of war turn out to be extremely challenging when the same principle is to be applied in practical perspective, indeed the factual side of nuclear warfare demands an urgent necessity of legal intervention from humanitarian perspective. However there is no first hand solution to the problem, as mentioned earlier this is a serious issue with admixture of political facts among the nuclear surmount. The myth that might has the right preoccupies the nuclear proliferation practice The states indulging in the proliferation of nuclear weapon are more confident about the national security since they have the nuclear weapon as an arsenal. The state presumption of security may be true to an extent, but not as a whole because today the knowledge of nuclear science is not limited to any state or organization, and thereby challenging the existence of whole humanity. Such haphazard situation poses several questions. Do men have future? How does it affect the ecological balance challenging the right of future generation and the rule of sustainable development? Do moral responsibilities towards future generations require that we regulate the use of environment and natural resources in an appropriate manner? Can law tackle the unforeseen problem which encounters human future? How does it affect the environment? How does the international legal text proclaim the unconventional war, to protect the environment?

4.2 The Theory of Nuclear Winter

The human future is greatly influenced by the international policy makers, may for the economic prosperity is concern or the national security.  

\[22\] Birks, John W., ‘The Atmosphere After a Nuclear War: Twilight at Noon’ (Boster,1982), p.56
\[23\] Ibid
of mass destruction. Until then the future of mankind is at stake. The possibility of such danger was predicted by the environment scientist when the study revealed the endangering possibility of nuclear radiation on environment. The study developed with the coining term of nuclear winter. This theory promulgates the urgent necessity of nuclear disarmament in wake of ultimate right to existence.

Nuclear winter is a meteorological theory estimating the global climatic consequences of a nuclear war, the environmental devastation that certain scientists contend would probably result from the hundreds of nuclear explosions in a nuclear war. The damaging effects of the light, heat, blast, and radiation caused by nuclear explosions had long been known to scientists, but such explosions’ indirect effects on the environment remained largely ignored for decades.

During a nuclear war, the exploding nuclear warheads would create huge fires, resulting in smoke and soot from burning cities and forests being emitted into the troposphere in vast amounts. According to nuclear winter theory, this would block the Sun's incoming radiation from reaching the surface of Earth, causing cooling of the surface temperatures. The smoke and soot soon would rise to high altitude because of their high temperature and drift there for weeks without being washed out. Finally, the particles would settle in the Northern Hemisphere mid-latitudes as a black particle cloud belt, blocking sunshine for several weeks. The ensuing darkness and cold, combined with nuclear fallout radiation, would kill most of Earth's vegetation and animal life, which would lead to starvation and diseases for the human

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24 Ibid
27 The Effects of Nuclear Weapons Glasstone, Samuel ; Dolan, Philip J. Department of Defense,1977, p.67
31 A. Barrie Pittock, Harwell and Thomas Hutchinson, (et al.),‘The Environmental Consequences of Nuclear War’ (Oxford University press, 1985),pp123-129
population surviving the nuclear war itself.\textsuperscript{33} At the same time, because the smoke would absorb sunlight, the upper troposphere temperatures would rise and create a temperature inversion causing further retention of smog at the lower levels.\textsuperscript{34} Another predicted consequence is that nuclear explosions would produce nitrogen oxides that would damage the protective ozone layer in the stratosphere and allow more ultraviolet radiation to reach Earth's surface.\textsuperscript{35}

In contrast to nuclear winter models, some climate models actually postulate a "nuclear summer," resulting from a worldwide warming caused by many small contributions to the greenhouse effect from carbon dioxide, water vapor, ozone, and various aerosols entering the troposphere and stratosphere.\textsuperscript{36}

What all scenarios and models forecast, the fact is that a nuclear war would have a significant effect on the atmosphere and climate of Earth. This in turn would drastically and negatively affect many aspects of life such as food production and energy consumption.\textsuperscript{37}

4.3 Distinctiveness of its Effects

The potential consequences to the global environment of nuclear war were the focus of studies in four decade since the first detonations of nuclear weapon in Japan. During this time the potential consequence that would ensue from a modern nuclear war have increased dramatically, and the combination of the much larger yields and mush greater number of nuclear warheads could now result in large scale nuclear war having little in common with the relatively limited experience of Hiroshima and Nagasaki.\textsuperscript{38} The SCOPE ENUWAR project had as one of its objectives the development of comprehensive understanding of the nature of a post nuclear war world, based on full range of available information and models. Volume 1 of the ENUWAR report presented the bases for estimating potential effects on the physical

\textsuperscript{35} Ibid
\textsuperscript{37} Paul R, The Effects on the Atmosphere of a Major Nuclear Exchange,( National Academy of Sciences, 1985), pp76-81
\textsuperscript{38} London & White (eds), (The Environmental Effects of Nuclear War, West view Press 1984), p67
environment, including possible climatic disturbances as well as fallout, UV-B, air pollutants and other effects. The present volumes take up where the first left off, by specifically considering the potential consequence of such physical and chemical stress on biological systems and on the ultimate endpoint of concern, i.e. effect of the global human population.\textsuperscript{39}

The approach taken in the biological analyses was to synthesize the current understanding of responses of ecological and agricultural system to perturbations, relying on the expertise of over 200 scientists from over countries around the Earth.\textsuperscript{40} Much of the synthesis took place in the context of series of workshops that addressed specific issues; other work included conducting simultaneous modeling and performing detail calculation of potential effects on the human population of representative countries. The range of possible nuclear war scenario is great; the estimate from the physical scientist of potential climatic consequence are not yet certain and continues to evolve with time. Those estimates are complex in their spatial and temporal distribution over the Earth the global landscape is covered by extremely complex ecological, agricultural and human system that react to perturbation in complex manner. For this reason the Volume 1 investigates the vulnerability of these systems to the type of perturbation possible after the nuclear war.

According to ENUWAR study the energy released from a nuclear weapon detonated in the troposphere can be divided into four basic categories:

- **Blast**—40-50% of total energy
- **Thermal radiation**—30-50% of total energy
- **Ionizing radiation**—5% of total energy
- **Residual radiation**—5-10% of total energy

However, depending on the design of the weapon and the environment in which it is detonated the energy distributed to these categories can be increased or decreased.\textsuperscript{41} The blast effect is created by the coupling of immense amounts of

\textsuperscript{39} SCOPE, Environmental Consequence of Nuclear War, published on behalf of the Scientific Committee on problems of the Environment(SCOPE) of the International Council of Scientific Union(ICSU), (Jhon Wiley&sons 1956),pp123-145

\textsuperscript{40} A. Gibson  Environmental Consequence of Nuclear Wa r, (oxford university press,1991),p 72

\textsuperscript{41} National Council on Radiation Protection and Measurements, NCRP (1984)  Radiological assessment; predicting the transport, bioaccumulation, and uptake by man of radio nuclides
energy, spanning the electromagnetic spectrum, with the surroundings. Locations such as submarine, surface, airburst, or exo-atmospheric determine how much energy is produced at blast and how much as radiation. In general, denser media around the bomb, like water, absorb more energy, and create more powerful shockwaves while at the same time limiting the area of its effect.42 The dominant effects of a nuclear weapon where people are likely to be affected (blast and thermal radiation) are identical physical damage mechanisms to conventional explosives.43

In 2006, U.S. researchers used a NASA computer model (Model 1E, also used for the Intergovernmental Panel on Climate Change to predict global warming) to evaluate the effects of a regional nuclear war fought in the sub-tropics 50 Hiroshima-size nuclear weapons (15 kilotons per weapon) were detonated in the largest cities of each combatant nation (100 total detonations). The studies predicted the nuclear explosions would kill 20 million people in the war zone, the equivalent to half of all the people who died during World War II. The conflict would also significantly disrupt global climate. Up to 5 million tons of smoke from burning cities would quickly rise above cloud level into the stratosphere, and within 2 weeks would form a global stratospheric smoke layer which would remain in place for about 10 years. The computer models estimated this smoke layer would block 7–10% of warming sunlight from reaching the surface of the Earth.44 Average surface temperatures beneath the smoke would become colder than any experienced during the last 1000 years. There would be a corresponding shortening of growing seasons by up to 30 days and significant reductions in average rainfall in many areas, with a 40% decrease of precipitation in the Asian monsoon region.

Such rapid and drastic climate change would have major impacts on global grain reserves, which already are at 50 year lows. Grain exports would likely cease for several years from large exporting nations like Canada. The 700 million people now living on the edge of starvation, along with those populations heavily dependent upon grain imports, would face mass starvation as grain reserves disappeared, prices

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skyrocketed and hoarding occurred. Global nuclear famine is the predicted result of this scenario. As many as one billion people could die during the years subsequent to the deadly climate change created by this level of nuclear conflict.\textsuperscript{45}

Energy from a nuclear explosive is initially released in several forms of penetrating radiation. When there is a surrounding material such as air, rock, or water, this radiation interacts with and rapidly heats it to an equilibrium temperature (i.e. so that the matter is at the same temperature as the atomic bombs matter). This causes vaporization of surrounding material resulting in its rapid expansion. Kinetic energy created by this expansion contributes to the formation of a shockwave. When a nuclear detonation occurs in air near sea level, much of the released energy interacts with the atmosphere and creates a shockwave which expands spherically from the hypocenter. Intense thermal radiation at the hypocenter forms a fireball and if the burst is low enough, it’s often associated mushroom cloud. The major effect is analyzed from two perspectives which may be classified as direct and indirect effect.\textsuperscript{46}

1. Direct effect

The direct effect of nuclear radiation causes a sudden and acute damage to the environment and living species. Direct effect includes

a) Blast Damage:

The high temperatures and radiation cause gas to move outward radically in a thin, dense shell called "the hydrodynamic front." The front acts like a piston that pushes against and compresses the surrounding medium to make a spherically expanding shock wave. At first, this shock wave is inside the surface of the developing fireball, which is created in a volume of air by the X-rays. However, within a fraction of a second the dense shock front obscures the fireball, causing the characteristic double pulse of light seen from a nuclear detonation.\textsuperscript{47} Much of the destruction caused by a nuclear explosion is due to blast effects. Most buildings,

\textsuperscript{45} ibid at 53
\textsuperscript{47} Brodine, Virginia, Radioactive contamination. (New York: Harcourt Brace Jovanovich, 1975) pp 76-87
except reinforced or blast-resistant structures, will suffer moderate to severe damage when subjected to overpressures of only 35.5 kilopascals (5.15 pounds-forces per square). The blast wind may exceed one thousand km/h. The range for blast effects increases with the explosive yield of the weapon and also depends on the burst altitude.\textsuperscript{48} Two distinct, simultaneous phenomena are associated with the blast wave in air:

i. Static overpressure, i.e., the sharp increase in pressure exerted by the shock wave. The overpressure at any given point is directly proportional to the density of the air in the wave.

ii. Dynamic pressures, i.e., drag exerted by the blast winds required to form the blast wave. These winds push, tumble and tear objects.\textsuperscript{49}

Most of the material damage caused by a nuclear air burst is caused by a combination of the high static overpressures and the blast winds. The long compression of the blast wave weakens structures, which are then torn apart by the blast winds. The compression, vacuum and drag phases together may last several seconds or longer, and exert forces many times greater than the strongest hurricane. Acting on the human body, the shock waves cause pressure waves through the tissues. These waves mostly damage junctions between tissues of different densities (bone and muscle) or the interface between tissue and air. Lungs and the abdominal cavity, which contain air, are particularly injured. The damage causes severe hemorrhaging or air embolisms, either of which can be rapidly fatal. The overpressure estimated to damage lungs is about 70 kPa. Some eardrums would probably rupture around 22 kPa (0.2 atm) and half would rupture between 90 and 130 kPa

iii Blast Winds: The drag energies of the blast winds are proportional to the cubes of their velocities multiplied by the durations. These winds may reach several hundred kilometers per hour.\textsuperscript{50}

\textsuperscript{49} Eisenbud, E. and Gessell, T. Environmental Radioactivity from Natural, Industrial, and Military Sources, (4\textsuperscript{th} Ed, Academic Press, San Diego,1997), p.134
b) Thermal radiation

Nuclear weapons emit large amounts of thermal radiation as visible, infrared, and ultraviolet light. The chief hazards are burns and eye injuries. On clear days, these injuries can occur well beyond blast ranges. The light is so powerful that it can start fires that spread rapidly in the debris left by a blast. However, the high winds following the blast wave will put out almost all such fires, unless the yield is very high. This is because the intensity of the blast effects drops off with the third power of distance from the explosion, while the intensity of radiation effects drops off with the second power of distance. However, in urban areas, the extinguishing of fires ignited by thermal radiation matters little, as fires will be started anyway by electrical shorts, gas pilot lights, overturned stoves, and other ignition sources. The range of thermal effects increases markedly with weapon yield. Thermal radiation accounts for between 35-45% of the energy released in the explosion, depending on the yield of the device.\textsuperscript{51} There are two types of eye injuries from the thermal radiation of a weapon:

Flash blindness is caused by the initial brilliant flash of light produced by the nuclear detonation. More light energy is received on the retina than can be tolerated, but less than is required for irreversible injury.\textsuperscript{52} The retina is particularly susceptible to visible and short wavelength infrared light, since this part of the electromagnetic spectrum is focused by the lens on the retina. The result is bleaching of the visual pigments and temporary blindness for up to 40 minutes. A retinal burn resulting in permanent damage from scarring is also caused by the concentration of direct thermal energy on the retina by the lens. It will occur only when the fireball is actually in the individual's field of vision and would be a relatively uncommon injury. Retinal burns, however, may be sustained at considerable distances from the explosion. The apparent size of the fireball, a function of yield and range will determine the degree and extent of retinal scarring. A scar in the central visual field would be more debilitating.\textsuperscript{53}

In Hiroshima a tremendous firestorm developed within 20 minutes after detonation and destroyed many more buildings and homes. A firestorm has gale force winds blowing towards the center of the fire from all points of the compass. It is not, however, a phenomenon in peculiar to nuclear explosions, having been observed frequently in large forest fires and following incendiary raids during World War II. Because thermal radiation travels more or less in a straight line from the fireball (unless scattered) any opaque object will produce a protective shadow. If fog or haze scatters the light, it will heat things from all directions and shielding will be less effective, but fog or haze would also diminish the range of these effects.54

2. Indirect effect:

The indirect effects are caused due to electromagnetic pulse. The term electromagnetic pulse (sometimes abbreviated EMP) is a burst of electromagnet radiation that results from an explosion (usually from the detonation of a nuclear weapon) and/or a suddenly fluctuating magnetic field. The resulting rapidly changing electric fields or magnetic fields may couple with electrical/electronic systems to produce damaging current and voltage surges. In military terminology, a nuclear bomb detonated hundreds of kilometers above the Earth's surface is known as a high-altitude electromagnetic pulse (HEMP) device. Nuclear electromagnetic pulse has three distinct time components that result from different physical phenomena. Effects of a HEMP device depend on a very large number of factors, including the altitude of the detonation, energy yield, gamma ray output, interactions with the Earth's magnetic field, and electromagnetic shielding of targets.55

Gamma rays from a nuclear explosion produce high energy electrons through Compton scattering.56 These electrons are captured in the Earth's magnetic field, at altitudes between twenty and forty kilometers, where they resonate. The oscillating electric current produces a coherent electromagnetic pulse (EMP) which lasts about one millisecond. Secondary effects may last for more than a second.57 The pulse is powerful enough to cause long metal objects (such as cables) to act as

56Ibid.
57Lawrence M. Krauss. The Doomsday Clock Still Ticks, Scientific American, January 2010, p. 26
antennas and generate high voltages when the pulse passes these voltages, and the associated high currents, can destroy unshielded electronics and even many wires. There are no known biological effects of EMP. The ionized air also disrupts radio traffic that would normally bounce off the ionosphere.\textsuperscript{58}

a) Ionizing radiation

About 5\% of the energy released in a nuclear air burst is in the form of ionizing radiation, neutrons, gamma rays, alpha particles, and electrons moving at speeds up to the speed of light. Gamma rays are high energy electromagnetic radiation; the others are particles that move slower than light. The neutrons result almost exclusively from the fission and fusion reactions, while the initial gamma radiation includes that arising from these reactions as well as that resulting from the decay of short-lived fission products.\textsuperscript{59} The intensity of initial nuclear radiation decreases rapidly with distance from the point of burst because the radiation spreads over a larger area as it travels away from the explosion. It is also reduced by atmospheric absorption and scattering.\textsuperscript{60}

The neutron radiation serves to transmute the surrounding matter, often rendering it radioactive. When added to the dust of radioactive material released by the bomb itself, a large amount of radioactive material is released into the environment. This form of radioactive contamination is known as nuclear fallout and poses the primary risk of exposure to ionizing radiation. Some of the harmful effects of ionizing radiation were apparent from the outset. Too much x-radiation caused recurrent reddening of the skin or loss of hair, hours or days later, often followed by painful radiation burns, which results in damage of tissues and ultimately leads to cancer.\textsuperscript{61}

b) Earthquake

The pressure wave from an underground explosion will propagate through the ground and cause a minor earthquake theory suggests that a nuclear explosion could

\textsuperscript{58} Nuclear Physics by Irving Kaplan (2\textsuperscript{nd} Ed, Addison-Wesley, 1962), p.117
\textsuperscript{60} Ibid
\textsuperscript{61} Ibid at p. 119
trigger fault rupture and cause a major quake at distances within a few tens of kilometers from the shot point. The intense research of nuclear radiation effect as showed above has been calculated by TTAPS group, the TTAPS scenario of nuclear winter has been tested, confirmed and refined by later studies, such as SCOPE and ICSU which have used three dimension in place of one-dimension one used by TTAPS. Through its scientific committee on problems of the Environment (SCOPE), the International Council of Scientific Unions (ICSU) has conducted a major review of the entire issue of the environmental consequence of the nuclear war. This is the SCOPE-ENUWAR (Environment Consequences of Nuclear War) projects, which was commissioned to study “biological, medical and physical effect of the large-scale use of nuclear weapons” and to prepare a report for wide dissemination that would be an ‘unemotional, non-political, authoritative and readily understandable statement of the effect of nuclear war, even a limited one, on human being and on other part of the biosphere. ENUWER was strictly enjoined by the Secretary General of ICSU “to restrict the examination to scientific issues and eschew policy question or matters of advocacy”.

SCOPE-ENUWAR conducted a series of meeting over period of two years in Europe, Asia, North and South America, and Australia. Scientist from 16 countries, including the Soviet Union, Japan and India, participated in these studies, and centers of research included the Computing Center of the USSR Academy of sciences in Moscow, the National Center for Atmospheric Research at Boulder, Colorado, and the Lawrence Livermore Laboratory. Nongovernmental channels as well as governmental ones were used to marshal this great mass of scientific information.

The report of this study, The Environment Consequence of Nuclear War (SCOPE Publication 28), was released at the Royal Society, London, on January 6, 1986. This 2- volume study perhaps the most comprehensive on the subject, deals with the physical and atmospheric effect and the ecological and agricultural effect, and represent in main consensuses in the distinguished scientists from many nations

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63 Budyko, M. I.; Golitsyn, G. S.; Izrael, Y. A. Global Climatic Catastrophes. (Springer,988), p.45
who were involved in the research. Great weight attached to it as the first attempt by an international scientific group to bring together what is known about the possible global environmental effect of nuclear war, the ensuing discussion hence drawn upon this study. It draws the following general conclusions.

1. Multiple nuclear detonations would result in considerable direct physical effect from blast, thermal radiation, and local fallout. The later would be particular important if substantial number of surface burst were to occur, since the lethal level of radiation from local fallout would extend hundreds of kilometers downwind of detonations.

2. There is substantial reason to believe that the nuclear war could lead to large scale climatic perturbations involving drastic reduction in the light level and the temperature in the large region within days and changes in precipitation pattern for period of days, weeks, months or longer. Episode of short term sharply depressed temperature could also produce serious impact particularly if they occur during critical period within the growing season. There is no reason to assert confidently that together would be no effects of this character and despite uncertainties’ in our understanding. It would be a grave error to ignore these potential environmental effects. Any consideration of a world after a nuclear war would have to consider the consequence of the totality of physical effects. The biological effect then follows.

3. The system currently support the vast majority of humans on earth (specifically agricultural production and distribution systems) are exceedingly vulnerable to the types of perturbations associated with climatic effects and social disruptions, should those system be disrupted on a regional or global scale, large number of human fatalities associated with insufficient food supplies would be inevitable. Damage to the food distribution and agricultural infrastructure alone (without any climatic perturbations) would put a large portion of the earth’s populations in jeopardy of drastic reduction in food availability.

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66 Freemantle, Michael, Ten Years after Chernobyl Consequences Are Still Emerging, by Chemical and Engineering News, April 29, (USA, 1996), pp.12-16
4. Other indirect effect from the nuclear war could be serious individually and in combination. These include disruption on an unprecedented scale of communications, power distribution and societal system. In addition, potential physical effects include reduction in stratospheric ozone and, after any smoke had cleared associated enhancement of ultraviolet radiations, significant global scale radioactive fallout; and localized areas of toxic levels of air and water pollution.

5. Therefore, the indirect effect on population of large scale nuclear war, particularly the climatic effects caused by smoke, could be potentially more consequential globally than the direct effects, and the risk of unprecedented consequence are greater for noncombatant’s countries also.68

TTAPS study has greatly contributed to the findings of nuclear warfare tragedy. Nuclear winter theory has stimulated “a surge of research activity now embraces a much larger range of concerns.”69 Undertaking a wider perspective of enquiry into the effect and the consequence of nuclear weapon use research falls into four broad groups: Atmospheric, Agriculture, Medical and social impact. A word about each of them assists in providing the factual basis for the legal proposition which is discussed in the next chapter.

4.3.1 Atmospheric Effects

A nuclear detonation creates a severe environment effect including blast, thermal pulse, neutrons, x- and gamma-rays, radiation, electromagnetic pulse (EMP), and ionization of the upper atmosphere. Depending upon the environment in which the nuclear de-vice is detonated; blast effects are manifested as ground shock, water shock and large amounts of dust and radioactive fallout. All pose problems for the survival of friendly systems and can lead to the destruction or neutralization of hostile assets.70

The energy of a nuclear explosion is transferred to the surrounding medium in three distinct forms: blast; thermal radiation; and nuclear radiation. The distribution of

70 Reinig, William C., ed. Environmental surveillance in the vicinity of nuclear facilities. Springfield, Ill.: (Charles C. Thomas, Publisher1970), p. 50
energy among these three forms will depend on the yield of the weapon, the location of the burst, and the characteristics of the environment.\textsuperscript{71} For a low altitude atmospheric detonation of a moderate sized weapon in the kiloton range, the energy is distributed roughly as follows:

50% as blast; and 35% as thermal radiation; made up of a wide range of the electromagnetic spectrum, including infrared, visible, and ultraviolet light and some soft x-ray emitted at the time of the explosion; and 15% as nuclear radiation; including 5% as initial ionizing radiation consisting chiefly of neutrons and gamma rays emitted within the first minute after detonation, and 10% as residual nuclear radiation. Residual nuclear radiation is the hazard in fallout. Considerable variation from this distribution will occur with changes in yield or location of the detonation. Because of the tremendous amounts of energy liberated per unit mass in a nuclear detonation, temperatures of several tens of millions degrees centigrade develop in the immediate area of the detonation. This is in marked contrast to the few thousand degrees of a conventional explosion. At these very high temperatures the non-fissionable parts of the nuclear weapon are vaporized. The atoms do not release the energy as kinetic energy but release it in the form of large amounts of electromagnetic radiation. In an atmospheric detonation, this electromagnetic radiation, consisting chiefly of soft x-ray, is absorbed within a few meters of the point of detonation by the surrounding atmosphere, heating it to extremely high temperatures and forming a brilliantly hot sphere of air and gaseous weapon residues, the so-called fireball. Immediately upon formation, the fireball begins to grow rapidly and rise like a hot air balloon. Within a millisecond after detonation, the diameter of the fireball from a 1 megaton (Mt) air burst is 150 m. This increases to a maximum of 2200 m within 10 seconds, at which time the fireball is also rising at the rate of 100 m/sec. The initial rapid expansion of the fireball severely compresses the surrounding atmosphere, producing a powerful blast wave and following an air burst, condensed droplets of water give it a typical white cloudlike appearance.\textsuperscript{72} In the case of a surface burst, this cloud will also contain large quantities of dirt and other debris which are vaporized when the fireball touches the earth's surface or are sucked up by the strong updrafts afterwards, giving the cloud a dirty brown appearance. The dirt and debris become contaminated with

\textsuperscript{71} Freeman J. Dyson, Disturbing the Universe. (New York: Harper and Row, 1979), p.78
the radioisotopes generated by the explosion or activated by neutron radiation and fall to earth as fallout. The relative effects of blast, heat, and nuclear radiation will largely be determined by the altitude at which the weapon is detonated. Nuclear explosions are generally classified as air bursts, surface bursts, subsurface bursts, or high altitude bursts. 73

a) Air Bursts

An air burst is an explosion in which a weapon is detonated in air at an altitude below 30 km but at sufficient height. After such a burst, blast may cause considerable damage and injury. 74 The altitude of an air burst can be varied to obtain maximum blast effects, maximum thermal effects, desired radiation effects, or a balanced combination of these effects. Burns to exposed skin may be produced over many square kilometers and eye injuries over a still larger area. Tactically, air bursts are the most likely to be used against ground forces. 75

b) Surface Burst

A surface burst is an explosion in which a weapon is detonated on or slightly above the surface of the earth so that the fireball actually touches the land or water surface. Under these conditions, the area affected by blast, thermal radiation, and initial nuclear radiation will be less extensive than for an air burst of similar yield, except in the region of ground zero where destruction is concentrated. In contrast with air bursts, local fallout can be a hazard over a much larger downwind area than that which is affected by blast and thermal radiation.

c) Subsurface Burst

A subsurface burst is an explosion in which the point of the detonation is beneath the surface of land or water. Cratering will generally result from an underground burst, just as for a surface burst. If the burst does not penetrate the surface, the only other hazard will be from ground or water shock. If the burst is shallow enough to penetrate the surface, blast, thermal, and initial nuclear radiation

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effects will be present, but will be less than for a surface burst of comparable yield. Local fallout will be very heavy if penetration occurs.\(^76\)

d) High Altitude Burst.

A high altitude burst is one in which the weapon is exploded at such an altitude (above 30 km) that initial soft x-rays generated by the detonation dissipate energy as heat in a much larger volume of air molecules.\(^77\) There the fireball is much larger and expands much more rapidly. The ionizing radiation from the high altitude burst can travel for hundreds of miles before being absorbed. Significant ionization of the upper atmosphere (ionosphere) can occur. Severe disruption in communications can occur following high altitude bursts. They also lead to generation of an intense electromagnetic pulse (EMP) which can significantly degrade performance or destroy sophisticated electronic equipment. There are no known biological effects of EMP; however, indirect effects may result from failure of critical medical equipment. Although some nuclear weapons effects (NWE) such as blast and cratering have analogs in the effects of conventional weapons, many NWE are unique to nuclear use. In addition, blast and other common weapons effects are likely to be much more powerful in the nuclear case than in the realm of conventional weapons. NWE are so severe that combinations of two or more simultaneously (as in a real event) may not add linearly, complicating the design and construction of physical simulators or the writing and validation of computer simulation codes.\(^78\)

Nuclear effects on electromagnetic signal propagation, which affects command, control, communications, computers, and intelligence (C 4 I), are of concern to countries expected to use nuclear weapons,\(^79\) particularly those which intend to explode a weapon at great altitudes or those which expect to have to defend against such a nuclear attack. C3I technology is primarily affected by high-altitude nuclear effects that could interrupt satellite-to-satellite communications, satellite-to-aircraft links, or satellite-to-ground links. Most nations will hope that signals from


\(^{78}\) ibid

\(^{79}\) Raymond LeRoy Murray,Nuclear energy: an introduction to the concepts, systems,and applications of nuclear processes, (Butterworth-Heinemann, 2009), p.67
Global Positioning System (GPS) satellites and ground-based differential GPS transmitters will be usable shortly after a nuclear explosion, as well as traditional communications channels which must be protected.\(^8^0\) The electromagnetic pulse generated by the detonation of a single nuclear weapon at high altitudes can be a threat to military systems located as much as a thousand miles away.\(^8^1\) HEMP can disable communications systems and even power grids at enormous distances from the burst.\(^8^2\).

### 4.3.2 Environmental Effect of Soot

The assessed soot emission of nuclear conflict is well illustrated through the two diagrams. Figure 1 (a) illustrates the changes in global average precipitation and temperature as a function of soot emission, 2. Figure 1 (b) illustrates shows how nuclear soot changes the radioactive forcing at Earth’s surface.

![Figure 1 (a)](image)

Figure 1 (a)\(^8^3\) indicates changes in global average precipitation and temperature as a function of soot emission, as calculated with the help of a modern version of a major United States climate model. A relatively modest 5 Tg of soot, which could be generated in an exchange between India and Pakistan, would be sufficient to produce the lowest temperatures Earth has experienced in the past 1000 years lower than

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\(^8^0\) [http://www.nukestrat.com/pubs.htm/](http://www.nukestrat.com/pubs.htm/) accessed on 12/3/2009@3.15.pm

\(^8^1\) Troon Harrison Adams, Nuclear Energy: Power from the Atom, (Crabtree Publishing Company, 2010), p.90


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during the post-medieval Little Ice Age or in 1816, the so-called year without a summer. With 75 Tg of soot, less than half of what we project in a hypothetical SORT war, temperatures would correspond to the last full Ice Age, and precipitation would decline by more than 25% globally. Calculations in the 1980s had already predicted the cooling from a 150-Tg soot injection to be quite large. New results, however, show that soot would rise to much higher altitudes than previously believed indeed, to well above the tops of the models used in the 1980s. As a result, the time required for the soot mass to be reduced by a factor of e is about five years in our simulations, as opposed to about one year as assumed in the 1980s. That increased lifetime causes a more dramatic and longer-lasting climate response.\textsuperscript{84}

2. Figure 1(b)

Complementary to temperature change is radioactive forcing, the change in energy flux. Figure 3b shows how nuclear soot changes the radioactive forcing at Earth’s surface and compares its effect to those of two well-known phenomena: warming associated with greenhouse gases and the 1991 Mount Pinatubo volcanic eruption, the largest in the 20th century. Since the Industrial Revolution, greenhouse gases have increased the energy flux by 2.5 W/m\textsuperscript{2}. The transient forcing from the Pinatubo eruption peaked at about $-4$ W/m\textsuperscript{2} (the minus sign means the flux decreased). One implication of the figure is that even a regional war between India and Pakistan can force the climate to a far greater degree than the greenhouse gases that may fear will alter the climate in the foreseeable future. Of course, the durations of the forcing are different: The radioactive forcing by nuclear-weapons-generated soot might persist for a decade, but that from greenhouse gases is expected to last for a century or more, allowing time for the climate system to respond to the forcing. Accordingly, while the Ice Age–like temperatures in figure 3a could lead to an expansion of sea ice and terrestrial snowpack, they probably would not be persistent enough to cause the buildup of global ice.

\textsuperscript{84} Owen, B.Toon. Alan Robock, Article on Environmental Consequence of nuclear war, American Institute of Physics,1978, p.41
Agriculture responds to length of growing season, temperature during the growing season, light levels, precipitation, and other factors. The 1980s saw systematic studies of the agricultural changes expected from a nuclear war, but no such studies have been conducted using modern climate models. Figure presents our calculations of the decrease in length of the growing season the time between freezing temperatures for the second summer after the release of soot in a nuclear attack. Even a 5-Tg soot injection reduces the growing season length toward the shortest average range observed in the mid western US corn-growing states. Earlier studies concluded that for a full-scale nuclear conflict, “What can be said with assurance is that the Earth’s human population has a much greater vulnerability to the indirect effects of nuclear war [including damage to the world’s agricultural, transportation, energy, medical, political, and social infrastructure], especially mediated through impacts on food productivity and food availability, than to the direct effects of nuclear war itself.” As a result, “The indirect effects could result in the loss of one to several billions of humans.”

Because the soot associated with a nuclear exchange is injected into the upper atmosphere, the stratosphere is heated and stratospheric circulation is perturbed. For the 5-Tg injection associated with a regional conflict, stratospheric temperatures would remain elevated by 30 °C after four years. The resulting temperature and circulation anomalies would reduce ozone columns by 20% globally, by 25–45% at

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85 Ibid, at p.42
middle latitudes, and by 50–70% at northern high latitudes for perhaps as much as five years, with substantial losses persisting for an additional five years.\(^{87}\)

### 4.3.3 Agricultural Effect

The ENUWAR Agriculture Effect Workshop held at Essex University on January 16-18, 1985, added to scientific understanding of the effect of nuclear war upon the climate and the impact of resulting climatic changes on agriculture. The workshop concluded that large temperature changes were needed for crop damage to result. A mere drop of 2°C during the growing season in Canada, for example, would eliminate wheat production in that country because of changes in the length of the frost-free growing season and the time required for wheat maturation.\(^{88}\)

Changes in the rate of precipitation would also affect productivity. Plants are far more dependent upon general precipitation than they are on rainfall alone, which is not always available. The tentative conclusions of the Agriculture Effects Workshop were as follows:\(^{89}\)

1. Agricultural production in the Northern Hemisphere during the first growing season after a nuclear winter would be largely or totally eliminated because of climatic stress alone.
2. Agricultural production in the Southern Hemisphere could be significantly depressed in the first growing season, depending on the extent of climatic stress there.
3. Agricultural production would be significantly reduced by average growing season temperature reductions of 1-5°C. The most sensitive crops would be affected by temperature reduction even at the lower end of that range.
4. Even in the absence of changes of climate, agricultural production would be significantly reduced because of the loss of fossil energy subsidies and human labor for agricultural systems. This kind of productivity reduction would be most important for non-combatant countries that have advanced agricultural systems.

\(^{87}\) Ibid, at p.87
\(^{88}\) supra, 85, p.34
5. Even assuming optimal distribution of food resources within a given country, lack of food would become a severe problem for many non-combatant countries, especially those with large population such as India and China.

6. Recovery of agriculture production would take a very long time compared to the duration of food stores in most location in the world.

7. Precipitation changes following a nuclear war may be as important for agricultural productivity as changes of few degrees in temperature. For adequate analyses of the effects of nuclear war on natural systems, however more work needs to be done in estimating the precise amount of precipitation likely in the first few years after a war.

Natural ecosystem is vulnerable to extreme climatic disturbance with differential vulnerability depending on the ecosystem type, location and the season of the effects. Temperature effect would be dominated for terrestrial ecosystem in the Northern Hemisphere and in the tropic and the sub-tropic; light reduction would be the most important one for the oceanic ecosystems; precipitation effect would be more important to grasslands and many Southern Hemisphere system. Other agricultural effects include acid rain, which could multiply several folds the acidity of the soil and the destruction of the ozone layer. Changes in the ozone layer would hamper photosynthesis and harm the bacterial flora of the surface layer of the soil.\(^{90}\)

It is to be remembered that the human casualties from the direct effect of nuclear blast, thermal radiation and radiation are projected to be in the range of several hundred millions. The indirect effect could thus result in the loss of one to several billions of human”.\(^{91}\)

4.3.4 Medical Effect

The report of the WHO International Committee of expert on the effects of nuclear war on health services points out that in addition to the effects of blast and heat, the radioactivity from a nuclear explosion would have devastating medical effect, both immediately and in long term. The medical effects of a nuclear blast upon humans can be put into four categories:

\(^{90}\) Ibid at p.199

\(^{91}\) Ibid at p.209
1) **Initial stage** -- the first 1–2 weeks, in which are the greatest number of deaths, with 90% due to thermal injury and/or blast effects and 10% due to super-lethal radiation exposure

2) **Intermediate stage** -- from 3–8 weeks. The deaths in this period are from ionization radiation in the median lethal range

3) **Late period** -- lasting from 8–20 weeks. This period has some improvement in survivors' condition.

4) **Delayed period** -- from 20+ weeks. Characterized by “numerous complications, mostly related to healing of thermal and mechanical injuries coupled with infertility, sub-fertility and blood disorders caused by radiation.” Also, ionizing radiation from fallout can cause genetic effects, birth defects, cancer, cataracts and other effects in organs and tissue.

The initial stage includes immediate effect which causes death and disablement; the intermediated stage includes short term effect which starts within 6-8 weeks and the long term effects cover the consequence of both late period and delayed period.92

a) **Blast Effects - The Initial Stage [immediate effect]**

1 Immediate Post-attack Period: - The main causes of death and disablement in this state are thermal burns and the failure of structures resulting from the blast effect. Injury from the pressure wave is minimal in contrast because the human body can survive up to 2 bar (30 psi) while most buildings can only withstand a 0.8 bar (12 psi) blast. Therefore, the fate of humans is closely related to the survival of the buildings around them.93

2 Fate within certain peak overpressure

- over 0.8 bar (12 psi) - 98% dead 2% injured
- 0.3-0.8 bar (5-12 psi) - 50% dead 40% injured 10% safe
- 0.14-0.3 bar (2-5 psi) - 5% dead 45% injured 50% safe

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93 ibid at, p.199
The three types of Radioactive Exposure after a Nuclear Attack are stated below. In a nuclear explosion the human body can be irradiated by at least three processes.

- The Thermal burns from infrared heat radiation.
- Beta burns from shallow ionizing beta radiation (this would be from fallout particles; the largest particles in local fallout would be likely to have very high radioactivity because they would be deposited so soon after detonation; it is likely that one such particle upon the skin would be able to cause a localized burn). However, these decay particles are very weakly penetrating and have a short range.
- Gamma burns from highly penetrating gamma radiation. This would likely cause deep gamma penetration within the body, which would result in uniform whole body irradiation rather than only a surface burn. In cases of whole body gamma irradiation due to accidents involving medical product irradiators, some of the human subjects have developed injuries to their skin between the time of irradiation and death.\(^4\)

In the above picture the normal clothing that the woman was wearing would have been unable to attenuate the gamma radiation and it is likely that any such effect was evenly applied to her entire body.\(^5\) Beta burns would be likely all over the body due to contact with fallout, but thermal burns are often on one side of the body as heat theraputic treatment for medical issues.

\(^4\)Hiroshima and Nagasaki Nuclear Fact Sheet, http://www.vicpeace.org/victoria peace network /accessed @ 2.30pm//2/22009
radiation does not penetrate the human body. In addition, the pattern on her clothing has been burnt into the skin. This is because white fabric reflects more infra-red light than dark fabric. As a result, the skin underneath dark fabric is burned more than the skin covered by white clothing. There is also the risk of internal radiation poisoning by ingestion of fallout particles.\footnote{Ibid, at 312, also see W. R. Hendee and F. M. Edwards, Health Effects of Exposure to Low-level Ionizing Radiation, (Institute of Physics Publishing, Bristol, UK, 1996), pp.76-98}

4. Radiation poisoning: - Radiation poisoning, also called "radiation sickness" or a "creeping dose" is a form of damage to organ tissue due to excessive exposure to ionizing radiation. Many of the symptoms of radiation poisoning occur as ionizing radiation interferes with cell division. There are numerous lethal radiation syndromes including prodromal syndrome, bone marrow death, central nervous system death and gastrointestinal death.

5. Prodromal syndrome:- In prodromal (initial) syndrome, a dose of 1.5 gray or less is not lethal, but causes gastrointestinal distress such as anorexia, nausea, fatigue and possibly diarrhea.

6. Bone marrow death: - Bone marrow death is caused by a dose of radiation between 2 and 10 gray and is characterized by the part of the bone marrow that makes the blood being broken down. Therefore production of red and white blood cells and platelets is stopped by division of precursor stem cells ceasing (4.5 gray kills 95% of stem cells). The loss of platelets greatly increases the chance of fatal hemorrhage. While the lack of white blood cells causes septicemia infections, the fall in red blood cells is minimal and only causes mild anemia. The exposure to 4.5 gray of penetrating gamma rays has many effects that occur at different times. In 24 hours the victim could suffer from vomiting, diarrhea.\footnote{C.S. White, Effects of Ionizing Radiations on the Human Variations, (New York, 1970), p. 156} These will usually abate after 6–7 days. Within 3–4 weeks there is a period of extreme illness, which includes severe bloody diarrhea, indicating intestinal disorders causing fluid imbalance extensive internal bleeding septicemia infections. The peak incidence of acute BM death corresponds to the 30 day nadir in blood cell numbers. The number of deaths then falls progressively until it reaches 0 at 60 days after irradiation. The amount of radiation greatly affects
the probability of death. For example over the range of 2 to 6 gray the probability of
death in untreated adults goes from about 1% to 99%, but these figures are for healthy
adults. Therefore results may differ because of the thermal and mechanical injuries
and infectious conditions.

7. Gastrointestinal death: - Gastrointestinal death is caused by a dose of radiation
between 10 and 50 gray. Whole body doses cause damage to epithelial cells lining the
gastrointestinal tract and this combined with the bone marrow damage is fatal. All
symptoms become increasingly severe causing exhaustion and emaciation in a few
days and death within 7−14 days from loss of water and electrolytes. The symptoms
of gastrointestinal death are gastrointestinal pain, anorexia, nausea, vomiting and
diarrhea.\textsuperscript{98}

8. Central nervous system death: - Central nervous system death is the main cause of
death in 24−48 hours among those exposed to 50 gray. The symptoms are vomiting,
nausea, diarrhea, drowsiness, lethargy, tremors, delirium, frequent seizures,
convulsions prostration coma respiratory failure death

b) Short term effects (6-8 weeks) [intermediate stage]

1) Skin: - The skin is susceptible to beta-emitting radioactive fallout. The principal
site of damage is the germinal layer, and often the initial response is erythema
(reddening) due to blood vessels congestion and edema. Erythematic lasting more
than 10 days occurs in 50% of people exposed to 5-6 gray.\textsuperscript{99} Other effects with
exposure includes:-

- 2-3 gray--temporary hair loss
- 7 gray--permanent epilation occurs
- 10 gray--itching and flaking occurs
- 10-20 gray--weeping blistering and ulceration will occur

\textsuperscript{98} Jay H. Lubin and John D. Boice, Jr., “Lung Cancer Risk From Residential Radon:
Metaanalysis of Eight Epidemiological Studies,” Journal of the National Cancer Institute,
1997, pp.49-57
\textsuperscript{99} U.S. Atomic Energy Commission study on a volved in Estimating the Immediate
Casualties complete review with numerous references to From Nuclear Explosions,”
Civil Effects the biological effects of ionizing radiations in1972 whish showed the
consequence of radiation effect. Also see the Chernobyl case.
2) Lungs:- The lungs are the most radiosensitive organ, and radiation pneumonitis can occur leading to pulmonary insufficiency and death (100% after exposure to 50 gray of radiation), in a few months.

Radiation pneumonitis is characterized by:

- Loss of epithelial cells
- Edema
- Inflammation
- Occlusions of airways, air sacs and blood vessels
- Fibrosis

3) Ovaries :- A single dose of 1-2 gray will cause temporary damage and suppress menstruation for periods up to 3 years; a dose of 4 gray will cause permanent sterility.

4) Testicles:- A dose of 0.1 gray will cause low sperm count for up to a year; 2.5 gray will cause sterility for 2 to 3 years or more. 4 gray will cause permanent sterility.\textsuperscript{100}

c) Long Term Effects [late period and delayed period]

1) Cataract Induction:- The time span for developing this symptom ranges from 6 months to 30 years to develop but the median time for developing them is 2–3 years.2 gray of gamma rays cause opacities in a few percent 6-7 gray can seriously impair vision and cause cataracts.\textsuperscript{101}

2) Cancer induction:-Cancer induction is the most significant long term risk of exposure to a nuclear bomb. Approximately 1 out of every 80 people exposed to 1 gray will die from cancer and 1 in 40 people will get cancer. Different types of cancer take different times for them to appear.2 years for leukemia to appear, 20 or more years for skin cancer or lung cancer.

3) In Uterus Effects:-1 gray dose of radiation will cause between 0 and 20 extra cases of perinatal mortality, per 1,000 births and 0-20 cases of severe mental sub normality.

\textsuperscript{100} C.S.White The Effects on Populations of Exposure, (New York,1970), p. 85
\textsuperscript{101} H.B Gerstner,.. ‘Acute Radiation Syndrome in Man,’ U.S. Armed Forces Medical Journal,1974,pp78-89
0.05 gray will increase death due to cancer 10 times, to 5 per 1,000. An antenatal dose of 1 gray in the first trimester causes the risk of fatal cancer to increase to 100%.102

4) Infectious diseases resulting from nuclear attack:-The main long term effects of a nuclear blast are infectious diseases caused by contaminated water, untreated sewage, crowded living conditions, poor standard of living, and lack of vaccines in the aftermath. These diseases include.

- Dysentery
- Infectious hepatitis
- Salmonellosis
- Cholera
- Meningococcal meningitis
- Tuberculosis
- Diphtheria
- Whooping cough
- Polio
- Pneumonia

The WHO apart from the above illustrated fact, considered the three war scenario:

1 The detonation of a 1-megaton bomb over a large city, killing more than 1.5 million people and injuring as many other.

2 Limited nuclear war fought with small tactical weapons totaling 20 megatons, aimed at military targets in a relatively densely populated area, exacting to toll of about 9 million dead or seriously injured, of whom more than 8 million would be civilians

3 An all-out nuclear war, in which nuclear weapons totaling 10,000 megatons were used, resulting in more than a billions deaths and a billion injured.103

102 Ibid, at,p.75
The committee observed that it was obvious that no health services in any area of the world would be capable of dealing adequately with the hundreds of thousands of people seriously injured by blast, heat or radiation from even a single 1-megaton bomb. Even the death and disability that could result from accidental explosion of one bomb from among the enormous stockpiles of weapons would overwhelm national medical resources. There would be no enough doctors and nurses to look after the victim even after one attack.\textsuperscript{104} “It is difficult,” reported the committee, “to comprehend the catastrophic consequences and the human suffering that would result from the effect of nuclear explosion in the second and the third of the above scenarios. Whatever remained of the medical services in the world it will not be able to alleviate the disaster in any significant way. Immediate catastrophe must be added to the long term effect on the environment. Famine and disease would be widespread and social and economic systems around the world would be totally disrupted”\textsuperscript{105}

According to the committee Gamma-ray exposure from the fallout could reach the human body in variety of ways. Externally it could reach the body from the radioactivity deposited in the ground. It could enter the body internally through inhaled radioactivity from the air, from consumption of contaminated food and from inhalation of suspended radioactivity. The result of the exposure to the gamma ray would be radiation sickness which includes symptoms such as anorexia, nausea, vomiting, and diarrhea.\textsuperscript{106}

In case of all-out nuclear war the fallout would be on a global scale and would last for months and years. In case of smaller exchanges the period could range from few weeks to few days. Even in case of single local detonation the place of deposition would extend hundreds of kilometers downwind. The report of the committee of experts concludes as follows:

“As doctors and scientists, the member of the committee feels that they have both the right and the duty to draw attention in strongest possible terms to the catastrophic result that would follow any use of nuclear weapons. The immediate and

\textsuperscript{104} Cardis et al., “Effects of Low Doses and Low Dose Rates of External Ionizing Radiation: Cancer study, (Hiroshima 1956), pp23-45
\textsuperscript{105} Mortality among Nuclear Industry Workers in Three Countries,’(Radiation Research institute, 1995), pp.117-132
\textsuperscript{106} J. W Brooks, The Acute Radiation Syndrome,(California,1974), pp.112-145
delayed loss of human and animal life would be enormous, and the effect on the fabric of civilization would be either to impede its recovery or make recovery impossible. The plight of the survivors would be physically and psychologically appalling. The partial or complete disruption of the health service would deprive survivor of effective help. The committee is convinced that there is a sound professional basis for its conclusion that nuclear weapons constitute the greatest immediate threat to the health and welfare of mankind cannot be secure until this is done.\textsuperscript{107} World medical concern with nuclear warfare is manifested also through the activities of organizations such as International Physician for Prevention of Nuclear War (IPPNW).

**4.3.5 Social and Economic Effect**

Like other cataclysmic events, nuclear war might bring about radical social alterations. It is impossible to foretell what directions these changes will take. Behavioral norms might change and human life might be held in greater or lesser esteem. Pride in our humanity, in our rationality, in our superiority over the beasts, might decline. Scientists and politicians might be lynched. Books might be burned. Laws decreeing all free inquiries punishable by death might be enacted. Machines might be outlawed or confined to museums. On the other hand, war might come to an end and enlightened humanitarianism might surge at last.\textsuperscript{108}

Organized social systems will be replaced by anarchies, tribal groups, or small decentralized communities. Some of these communities might be open, like ancient Athens, and some closed, like Sparta. Perhaps the most ironic possibility is the emergence of totalitarianism from the ashes of the once-free world. This might happen, for instance, if the military or police are given broad powers to handle the crisis, and if they retain and expand those powers. At any rate, freedom in this new world might have few defenders. Would anyone think democracy worth defending if it contributed to such carnage? Alternatively, authoritarian political systems might become freer.\textsuperscript{109}

Social life as we know it would disappear after a nuclear war. The probability is that survivors, concerned only for their own survival, would revert to the law of

\textsuperscript{107} Ibid, at p.155
\textsuperscript{108} H. Sparrow, ‘The Effects of Radioactive Fallout on Food’, (Patterson,1968), p109
\textsuperscript{109} http://www.fas.org/nuke/intro/nuke/effects.htm@2.30pm,2/5/2010
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jungle, jealously guarding their meager foodstuffs and possession with their lives. The process of brutalization would be in operation, for central authority would have largely broken down and the will of the strongest in any local area would tend to be obeyed. Interlopers will be kept out of virtually closed local communities and intruders would be killed.\textsuperscript{110} The local head man or ruler would enforce his will arbitrarily. Courts and the legal procedure would have broken down. Iron discipline would be needed to regulate the distribution of meager food supplies, and in the initial days the distribution itself would be reduced due to inefficient transportation. Oversea sources would not initially be available, as sea transport, dependent on fuel, would not be available. Communication, which is essential to distribution as well as to linkage with the center, would have broken down. The electromagnetic pulse, one of the results of the nuclear explosion would initially destroy all communications. A surge of power in the power lines would destroy the administrative infrastructure based on power based communication. In the difficult initial days all central authority would have broken down. There would be political chaos.\textsuperscript{111} Today in complexity of modern industrial economies, each and every one of us are interdependent. Most of us depend on a highly complex web for sheer physical survival, let alone travel, leisure, education, and similar luxuries. Food, water, heating fuel, and other necessities often come from outside sources, and their continuous arrival depends on an intricate, finely tuned network. In the event of total war, this network would be blown to smithereens in minutes. The pool of workers and skilled professionals will be reduced by death and illness to a fraction of its pre-war levels. Oil refineries, power plants, factories, food production facilities, and other industrial and commercial facilities will be destroyed. Fallout will render immediate reconstruction impossible, for the survivors in the combatant countries will have to spend the first weeks or months indoors, underground, or in shelters.\textsuperscript{112}

Without enough fuel to run tractors, fertilizers and pesticides to grow crops, and people to work the fields; without adequate means of shipping raw materials to farms and factories and of shipping food and industrial products to consumers; and

\textsuperscript{112}ibid
without money or some other accepted standard of exchange; national economies may be in shambles. Some areas may be highly contaminated. Many regions may be frozen solid during the first growing season after the war. The survivors may be physically ill or sick at heart. They may not possess the necessary strength and courage, like Job, to start all over again. Why, they may wonder, should they work like slaves to rebuild a modern society that might end again in death?

The present complex system of international trade will almost certainly vanish. International aid, including grain and food exports, might cease. Millions of people in countries which depend on food imports or specialized exports will suffer a great deal. It is impossible to predict the long-term consequences of all this. Perhaps a modern economic system similar to our own could be re-created in 20 to 50 years, bringing much of the anguish and chaos to an end. Perhaps recovery would never take place, the world sinking instead to something like the decentralized economies of the Dark Ages. Public health and sanitary facilities would have broken down. Millions of unburied human and animal corps would make conditions macabre. Insect population and flies would proliferate. The food and water supplies existed would have been at least partially contaminated. Those who would still be able to move about would not be able to lead a normal life, for they would be disfigured by monstrous keloids with enormous ghastly growth on the skin surface. (Many of these keloids larger than saucers and more than an inch deep which have been surgically removed from Hiroshima survivors and are on display in Hiroshima museum. Commerce system would be destroyed and whatever exchange there might be would depend upon barter system.

The fact set out in this chapter has been elaborated upon in many volumes. The SCOPE-ENUWAR report provides the most detailed and objective scientific assessment thus far. The first military evaluation of the nuclear winter theory appeared on February 28, 1985, when the pentagon delivered to Congress a report entitled, “The potential Effect of Nuclear War on the Climate”. The report accepted as valid the theory that a nuclear war could create a cloud of smoke and dust thick

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enough to block out the sun and the cause a devastating nuclear winter.  
While the study acknowledge that the effect of nuclear winter could be equal to or even worse than the more direct damage caused by the explosion of nuclear weapons, it said that there was insufficient evidence to determine the length and severity of such a cataclysm.

In Nuclear Winter, Dr. Carl Sagan has summarized the position in this terms; “Nuclear War is a problem that can be treated only theoretically. It is not amendable to experimentation. Conceivably we have left something important out of our analysis and the effects are more modest then we calculate. On the other hand it is also possible and from previous experience even likely that there are further adverse affects that no one has yet been wise enough to recognize. With billions of life at stake were does conservatism lie, in assuming that the result would be better than we calculate, or worse.

The following recent development will also help to place it in perspective:

1) The U.S. National Academy of Science issued its long awaited report in December 1984 on “the effect on the atmosphere on the major nuclear exchange”. This was the result of two year study and concluded that “nuclear winter is a clear possibility and nuclear war could result in long term climatic effects with sever implication for the biosphere.” It said that nuclear winter would be included in any analysis of the consequence of nuclear war. The report was prepared by the NAS committee of eminent scientists which was chaired by George F. Carrier of Harvard University.

2) On March 1, 1985, the U.S secretary of Defense submitted a report to congress called “the Potential Effect of Nuclear War on the Climate”. The 17 page report said that the climatic effect of the nuclear exchange may endanger human survival on “a scale similar to other horrors of nuclear war”. The report did not address the biological and environmental aspects of nuclear winter.

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3) Following the request by the Canadian Minister of the Environment, the Royal Society of Canada completed a comprehensive 309 page report on the nuclear winter. The Royal Society found the nuclear winter hypothesis to be “plausible and results credible.” It stressed that a drop in summer time temperatures of even 1-4 C could sharply reduce or eliminate Canadian grain production and exports. Nuclear war could destroy Canada’s forest and expose a large portion of Canadian population to fall out.

4) The U.S. Office of Science and Technology Policy at the White House now has under consideration an American program for scientific research on the climatic effect of the nuclear war.

5) On December 17th 1984, the United Nations General Assembly adopted Resolution 39/148 F, which recognized that the prospect of nuclear winter poses a significant new peril to all nations, even those far removed from the nuclear war zone. The resolution requested the Secretary General to compile documentation on recent national and international scientific studies on the climatic effects of nuclear war; this documentation was to be submitted to the General Assembly in the Autumn of 1985.

   It is fair to say, then that we now posses enough knowledge concerning nuclear winter for it to be a factor in our attitude toward these weapons including question of their legality. As Dr. Carl Sagan observed at the 1985 Bellerive Colloquium, we now realize that even in the early 1950s the arsenals of the United States were capable of triggering a nuclear winter. The Soviet Union reached that status also without knowing it at the time in the 1960s. At present France Britain and Chain have, each of them, sufficient weapons to cause a nuclear winter. We do not know the exact point at which the nuclear winter would come about, but we do know with certainty that the arsenal of the world long ago passed that point.117 “It is simply not safe”, said Sagan, to have a planet in which nuclear winter can be triggered. We are vulnerable to computer malfunction, to misunderstood orders, to madness in high office, and it is fundamentally foolish to permit the world arsenal to be at this level. If there is no planetary safety at this level, the only course for survival is to turn the ascending

curve steeply downward. Every additional nuclear weapon which scientist helps to produce only delays the day we set foot upon the road to planetary safety.  

In all, over a dozen worldwide studies, including two in the Soviet Union, have confirmed the results of the TTAPS studies. It has become clear, from the evidence cited in this chapter that there is a scientific and factual basis for the contention that the nuclear war can result in destruction of the civilization and perhaps of man himself along the various other creatures that exist on this planet the possibility is sufficient to sustain this thesis. Certainty is neither claimed nor required. While all forms of conventional warfare leave open the prospect of post war recovery and continuance of human civilization and the human species, nuclear war has the potential to eliminate recovery, shatter civilization beyond restoration, and destroy the human species and the human habitat.  

The expressive words of president jimmy carter in his farewell speech of January 14th, 1981 bear repetition: “in an all-out nuclear war, more destructive war then in all World War II would be unleashed, every second for the long afternoon it would take for all the bombs to fall. A World War II every second-more people killed in the first few hours then in all the wars of history put together.” It is important to know that all discussions prior to 1983 concerning the legal implication of nuclear war were conducted without any reference to the nuclear winter scenario. Even without reference to it, the legal evidence was strong enough. The dramatic new scientific fact now available must necessarily make a significant further impact upon discussion of the legal questions involved.

4.3.6 Psychological Effect

Within the first two to four months of the bombings, the acute effects killed 90,000–166,000 people in Hiroshima and 60,000–80,000 in Nagasaki, with roughly half of the deaths in each city occurring on the first day. The Hiroshima prefectural health department estimates that, of the people who died on the day of the explosion, 60% died from flash or flame burns, 30% from falling debris and 10% from other causes. During the following months, large numbers died from the effect of burns, radiation sickness, and other injuries, compounded by illness. In a US

118 Robock, Alan, Climate effects of a regional nuclear conflict. (IPRC Climate, 2007), pp. 16-18.
119 Robock, Alan, Time to bury a dangerous legacy: Part II: Climatic catastrophe would follow regional nuclear conflict. (Yale Global Online, 2008), pp-12-16
estimate of the total immediate and short term cause of death, 15–20% died from radiation sickness, 20–30% from flash burns, and 50–60% from other injuries, compounded by illness. In both cities, most of the dead were civilians. Many more people suffered for several years before dying or died in the following years due to radiation exposure from the bombs. It is estimated that by 1950,200,000 more people had died from atomic bomb related disease or injuries. Many more lived with permanent disabilities. Among the disease infected were the cancer the most common radiation caused disease although other diseases, such as liver failure and respiratory diseases occurred in atomic bomb survivors. 120

This agonizing incident is a mark of remembrance in every Japanese life, these stories of nightmare truth is well explained by the survivors of atomic bomb. The survivors of the bombings are called hibakusha in Japanese word that literally translates to "explosion-affected people. Surviving hibakusha was recognized by the Japanese government, most living in Japan. The government of Japan recognizes about 1% of these as having illnesses caused by radiation. The memorials in Hiroshima and Nagasaki contain lists of the names of the hibakusha who are known to have died since the bombings. Updated annually on the anniversaries of the bombings, as of August 2010, the memorials record the names of more than 420,000 deceased hibakusha; 269,446 in Hiroshima and 152,276 in Nagasaki.121

a) Double survivor:- People who suffered the effects of both bombings are known as nijū hibakusha in Japan. On March 24, 2009, the Japanese government officially recognized Tsutomu Yamaguchi as a double hibakusha. He was confirmed to be 3 kilometers from ground zero in Hiroshima on a business trip when Little Boy was detonated. He was seriously burnt on his left side and spent the night in Hiroshima. He arrived at his home city of Nagasaki on August 8, a day before Fat Man was dropped, and he was exposed to residual radiation while searching for his relatives. He was the first officially recognized survivor of both bombings. Tsutomu Yamaguchi died on January 4, 2010, after a battle with stomach cancer at the age of 93. The 2006 documentary Twice Survived: The Doubly Atomic Bombed of Hiroshima

120 Kimmel ME. The age of anxiety: general societal impact and particular effects on criminality. J Psychiatr Nurs (Ment Health Serv,1977), pp.27–30
and Nagasaki documented 165 nijū hibakusha, and was screened at the United Nations.122

b) Korean survivors:- During the war, Japan brought many Korean conscripts to both Hiroshima and Nagasaki to work as forced labor. According to recent estimates, about 20,000 Koreans were killed in Hiroshima and about 2,000 died in Nagasaki. It is estimated that one in seven of the Hiroshima victims was of Korean ancestry. A Korean prince of the José on Dynasty, Yi Wu, also died from the Hiroshima bombing. For many years, Koreans had a difficult time fighting for recognition as atomic bomb victims and were denied health benefits. However, most issues have been addressed in recent years through lawsuits.123

c) Testimony of Kinue Tomoyasu a Hiroshima survivor: - The traumatic conditions of Hiroshima and Nagasaki survivors are expressed in several documentary study conducted by the UN peace study program. Among the most afflictive one is the testimony of Kinue Tomoyasu a Hiroshima survivor.124

Kinue was in her home the day of bombing. Kinue suffered from weakness and illness due to exposure to the radiation during the bombing and lived in the Hiroshima Atomic Bombing Victim Nursing Home for 13 years. Kinue’s daughter was killed in the bombing. Her daughter had been on her way to the train station, closer to where the bomb hit, years later Kinue recited the story of search for her daughter and her own radiation caused illnesses.

“Mr. Ishido [a neighbor] came up to me and said, “Quick…..Your daughter is at the bank of the Ota River….She is alive”…..around Hiroshima Station, I saw more people lying dead…. I couldn’t t tell who was who. I kept wandering were my daughter was. But then she cried for me, “Mother” I recognized her voice. I found her in a horrible condition. Her face looked terrible. And she still appears in my dream like that sometime. When I met her she said, “There should not any war”……... And after nine hour she died….. I held her in my arms…. She said… “I do not want to

123 Escalona SK. Growing up with the threat of nuclear war: some indirect effects on personality development. Am J Orthopsychiatry. 1982, pp.600–607
die”….. on August 15th I held her funeral. And around early October my hair started to come out. I wondered what was happening to me… In November I became bald, then purple spot started to appear on my neck, my arms and my body…a lot of them all over. I had a high fever of forty degree [Celsius]…. I still had fever when I was admitted here[HABV] Nursing home for a while. But now I don’t have fever so often….My son [served in the Japanese army]….. Suffered a lot. I don’t know why but he killed himself… I was left alone. I had to go through hardship living alone. I have no family. I pledge to donate my body after my death to the medical education and research. My registration number is 1200. I am ready, I am ready to be summoned by the God at any moments. But God does not allow me to come by his side yet. If it were not for the war my two children would not have died. If it was not for war I wouldn’t have to stay at a institution like this. I suppose three of us would have been living together in happiness. Ah, it’s so hard on me.125

This is just the story of single survivor of Hiroshima incident, there are many number of them and many more untold stories. The facts is the truth, if such could be the horror of single nuclear war with the least potential radiation, just imagine the horror of present nuclear strategy and if the war is waged there would be utter collapse of humanity.126

4.4. Case Study on Hiroshima and Nagasaki

There can never be better reliable sources as an evidence for the effect of nuclear warfare then the story of Hiroshima and Nagasaki. The nuclear winter theory is an outcome of post war study of II World War. The agonizing and painful incident of Hiroshima and Nagasaki has become a part of the Japanese cultural song. Many philosophers and dramatist have expressed the incident in their style. Charles Wolfe in his book ‘Classic Country’ “By the end of war, the duo was starting to experience the changes in the taste that was altering all of country music. The record companies were now concentrating more on the Jukebox market than on home sales, and they encouraged Karl Davis and Harty Taylor to do more upon topical songs…like the ‘Training Camp Blues’ and ‘when the Atom Bomb Fell”(Wolfe 122-123). Certainly

the plight of the Japanese are not alone, the one which they suffered is yet to be suffered by the whole mankind. 127

a) The test

At 5:29:45 a.m., July 16, 1945, a blinding flash and unbelievable heat seared the New Mexico desert the world's first nuclear explosion. Code-named Trinity, the Manhattan Project's test of the plutonium implosion bomb was a stunning success. The explosion almost equaled 20,000 tons of TNT, many times what some had expected. General Groves and his Project leaders were jubilant and relieved. But for some, the spectacle also cast an ominous shadow. 128 Los Alamos scientific director Dr. Robert Oppenheimer later said he thought of the lines from the Hindu scripture, the Bhagavad Gita, I am become Death, Destroyer of Worlds.

b) Design of the bomb

The Manhattan Project produced two different types of atomic bombs, code-named Fat Man and Little Boy. Fat Man, which was dropped on Nagasaki, was the more complex of the two. A bulbous, 10-ft. bomb containing a sphere of the metal plutonium 239, it was surrounded by blocks of high explosives that were designed to produce a highly accurate and symmetrical implosion. 129 The Little Boy type of bomb, which was dropped on Hiroshima, had a much simpler design than the Fat Man model that had been tested at Trinity. Little Boy triggered a nuclear explosion, rather than implosion, by firing one piece of uranium 235 into another. When enough U235 is brought together, the resulting fission chain reaction can produce a nuclear explosion. 130

c) Why Hiroshima

Hiroshima was chosen as the primary target since it had remained largely untouched by bombing raids, and the bomb's effects could be clearly measured. While President Truman had hoped for a purely military target, some advisers believed that

bombed an urban area might break the fighting will of the Japanese people.\textsuperscript{131} Hiroshima was a major port and a military headquarters, and therefore a strategic target. Also, visual bombing, rather than radar, would be used so that photographs of the damage could be taken. Since Hiroshima had not been seriously harmed by bombing raids, these photographs could present a fairly clear picture of damage.\textsuperscript{132}

d) Unexpected opposition

Before Little Boy was dropped on Hiroshima, Leo Szilard at Met Lab in Chicago tried to stop its use. Ironically, Szilard had led atomic bomb research in 1939, but since the threat of a German bomb was over, he started a petition to President Truman against bombing Japan. With 88 signatures on the petition, Szilard circulated copies in Chicago and Oak Ridge, only to have the petition quashed at Los Alamos by theoretical physicist J. Robert Oppenheimer.\textsuperscript{133} When General Leslie Groves learned of the petition, he polled the Met Lab scientists and learned that only 15 percent wanted the bomb used "in the most effective military manner." While 46 percent voted for "military demonstration in Japan to be followed by a new opportunity for surrender before full use of the weapon is employed," somehow the figures were manipulated to suggest that 87 percent of the Met Lab scientists favored some sort of military use. Ultimately, Groves sat on Szilard's petition and the poll until August 1, and then had them filed away. President Truman never saw them.\textsuperscript{134}

e) Delivering little boy

At approximately 2:00 a.m. on August 6, 1945, a modified American B-29 Super fortress bomber named the Enola Gay left the island of Tinian for Hiroshima, Japan.\textsuperscript{135} The Enola Gay weaponers, Navy Capt. Deak Parsons, were concerned about taking off with Little Boy fully assembled and live.\textsuperscript{136} After 6:00, the bomb was fully armed on board the Enola Gay. Tibbets announced to the crew that the plane was carrying the world's first atomic bomb. By 7:00, the Japanese radar net detected

\textsuperscript{132}ibid
\textsuperscript{134}Ibid
\textsuperscript{135}Ibid at p.102
\textsuperscript{136}Rachel Fermi and Esther Samra, Picturing the Bomb: Photographs from the Secret World of the Manhattan Project. (New York: Harry N. Abrams, Inc.,1995), p56
a aircraft heading toward Japan, and the alert was broadcast throughout the Hiroshima area. Soon afterward, a weather plane circled over the city, but there was no sign of bombers. The people began their daily work and thought the danger had passed. At 7:25, the Enola Gay was cruising over Hiroshima at 26,000 feet. By 8:00, Japanese radar again detected B-29s heading toward the city. Radio stations broadcast another warning for people to take shelter, but many ignored it. At 8:09, the crew of the Enola Gay could see the city appear below and received a message indicating that the weather was good over Hiroshima.

f) The bomb exploded

A T-shaped bridge at the junction of the Honkawa and Motoyasu rivers near downtown Hiroshima was the target. At 8:15 a.m., Little Boy exploded, instantly killing 80,000 to 140,000 people and seriously injuring 100,000 more. The bomb exploded some 1,900 feet above the center of the city, over Shima Surgical Hospital, some 70 yards southeast of the Industrial Promotional Hall (now known as the Atomic Bomb Dome). Crewmembers of the Enola Gay saw a column of smoke rising fast and intense fires springing up. The burst temperature was estimated to reach over a million degrees Celsius, which ignited the surrounding air, forming a fireball some 840 feet in diameter. Eyewitnesses more than 5 miles away said its brightness exceeded the sun tenfold.

g) Immediate aftermath

In less than one second, the fireball had expanded to 900 feet. The blast wave shattered windows for a distance of ten miles and was felt as far away as 37 miles. Over two-thirds of Hiroshima's buildings were demolished. The hundreds of fires, ignited by the thermal pulse, combined to produce a firestorm that had incinerated everything within about 4.4 miles of ground zero. To the crew of the Enola Gay, Hiroshima had disappeared under thick, churning foam of flames and smoke. The co-pilot, Captain Robert Lewis, commented, "My God, what have we done?"

138 Ibid 131, at,p.98
About 30 minutes after the explosion, a heavy rain began falling in areas to the northwest of the city. This "black rain" was full of dirt, dust, soot and highly radioactive particles that were sucked up into the air at the time of the explosion and during the fire. It caused contamination even in areas that were remote from the explosion.\textsuperscript{141}

h) Instant confusion

Radio stations went off the air, and the main line telegraph had stopped working just north of Hiroshima.\textsuperscript{142} Chaotic reports of a horrific explosion came from several railway stops close to the city and were transmitted to the Headquarters of the Japanese General Staff. Military headquarters personnel tried to contact the Army Control Station in Hiroshima and were met with complete silence. The Japanese were puzzled. They knew that no large enemy raid could have occurred, and no sizeable store of explosives was in Hiroshima at that time, yet terrible rumors were starting.\textsuperscript{143}

A young officer of the Japanese General Staff was instructed to fly immediately to Hiroshima, to land, survey the damage and return to Tokyo with reliable information for the staff. Headquarters doubted that anything serious had occurred, but the rumors were building. When the staff officer in his plane was nearly 100 miles (160 km) from Hiroshima, he and his pilot noticed a huge cloud of smoke from the bomb. In the bright afternoon, the remains of Hiroshima were burning. The plane soon reached the city and circled it. A great scar on the land was still burning, covered by a heavy cloud of smoke.\textsuperscript{144} They landed south of Hiroshima, and the staff officer immediately began to organize relief measures, after reporting to Tokyo. Since communications between the Hiroshima and higher military and naval headquarters had been severed, initial news that something frightful had occurred at Hiroshima came into Tokyo from nearby towns. People reported to the navy's underground headquarters in Tokyo a "sinister cloud," an "enormous explosion," a "terrible flash," a "heavy roar." Reports were vague and created more puzzlement than alarm. Finally,

\textsuperscript{141} Paul S. Boyer, By the Bomb's Early Light: American Thought and Culture at the Dawn of the Atomic Age. (New York: Pantheon, 1985), p.45
\textsuperscript{144} Ibid
from descriptions of the city's destruction, Japanese military began to realize that what happened may have been the result of an atomic bomb—a shock to them, since most thought the Americans' progress in nuclear bomb development to be still in the "scientific investigation" stage.

Truman's public announcement in Washington, D.C., 16 hours after the attack, was Tokyo's first knowledge of what had really happened to Hiroshima. "Sixteen hours ago an American airplane dropped one bomb on Hiroshima. It is an atomic bomb. We are now prepared to obliterate more rapidly and completely every productive enterprise the Japanese have above ground in any city. If they do not now accept our terms they may expect a rain of ruin from the air the like of which has never been seen on this earth." \(^{145}\)

The Japanese immediately formed the "Atomic Bomb Countermeasure Committee," which was made up of members of the War, Navy, and Home ministries, and included Technical Board representatives. The committee's first meeting was held on August 7, at which time the latter group "strongly insisted that the bomb was not an atomic bomb." They maintained that even if the Americans had gone so far as to develop an atomic bomb, they wouldn't have brought "such unstable weapons as atomic devices to Japan, across the Pacific." They added, "We do not know what will happen in the future, but to date American technique is not that highly developed." Rather, they claimed, the explosion was the result of a "new type [of] bomb with special equipment, but its content is unknown." Japan's initial public announcement of the bomb did not include the word "atomic." In the meantime, army and navy personnel had been sent to investigate Hiroshima. Initially, there was disbelief that the destruction was caused by an atomic bomb, but after viewing the degree and nature of the devastation and noting that it was different from that caused by conventional bombs; they knew that the United States had indeed perfected and used the atomic bomb. Japan was quite a bit behind in its own nuclear-bomb development. \(^{146}\)


\(^{146}\) ibid
i) Blast effect on Hiroshima and Nagasaki\textsuperscript{147}

a) Physical effect of atomic bombing on Hiroshima.

The atomic bomb, nicknamed "Little Boy", which was dropped on Hiroshima City, exploded at an altitude of 580 meters above Shima Hospital close to the present A-bomb Dome (the former Hiroshima Prefectural Industrial Promotion Hall) at 8:15 am on 6 August 1945. The atomic bomb employed uranium-235 and was equivalent in power to approximately 15 kilotons of TNT gunpowder.

The dissipation of energy is believed to have been in the following ratio: bomb blast - 50%, thermal rays - 35% and radiation - 15%. It was estimated that the bomb blast had traveled a distance of approximately 3.7 km from the burst point after 10 seconds and a distance of about 11 km after 30 seconds from the detonation. The thermal rays traveled as far as 3.5 km, which inflicted burns on human skins not covered with clothes. It was also estimated that radiation had traveled a distance of about 2 km. Physical effect of atomic bombing on Nagasaki\textsuperscript{148}


j) Infrastructure damage

At the time of its bombing, Hiroshima was a city of some industrial and military significance. A number of military camps were located nearby, including the headquarters of the Fifth Division and Field Marshal Shunroku Hata’s 2nd General Army Headquarters, which commanded the defense of all of southern Japan. Hiroshima was a minor supply and logistics base for the Japanese military. The city was a communications center, a storage point, and an assembly area for troops. It was one of several Japanese cities left deliberately untouched by American bombing, allowing a pristine environment to measure the damage caused by the atomic bomb.149 Hiroshima was in ruins. The T-bridge’s barriers had been knocked away, utility poles stood at odd angles and familiar landmark were gone or unrecognizable. Building even strong modern structure had suffered significant damage. Cemeteries had uprooted and churches had become rubble. The center of the city contained several reinforced concrete buildings and lighter structures. Outside the center, the area was congested by a dense collection of small wooden workshops set among Japanese houses. A few larger industrial plants lay near the outskirts of the city. The houses were constructed of wood with tile roofs, and many of the industrial buildings were also built around wood frames. The city as a whole was highly susceptible to fire damage.150

k) Fight for justice: Ryuichi Shimoda v. The State

*Ryuichi Shimoda et al. v. The State* was a case brought before the District Court of Tokyo by a group of five survivors of the atomic attacks on Hiroshima and Nagasaki, who claimed the action was illegal under the laws of war and demanded reparations from the Japanese government on the ground that it waived the right for reparations from the US government under the Treaty of San Francisco.

a) Background

Ever since the atomic bombings of Hiroshima and Nagasaki, there has been legal debate over the action. On August 10, 1945, the Japanese government addressed a communication to the International Committee of the Red Cross, asking it to denounce the US government as performing a crime under international law. Following surrender and the landing of US occupation troops in Japan, the Prime Minister Naruhiko Higashikuni offered not to make any complaints in the media or in legal institutions about the use of the nuclear weapons if the United States Government agreed to drop its demand to try Japanese war criminals. During the Tokyo War Crimes Trial, some of the defense lawyers tried to convince the International Military Tribunal of the Far East to launch a legal investigation into the matter of the legality of the first use of nuclear weapons, but their motions were ignored. One of these defense lawyers, Shoichi Okamoto, continued to deal with the issue after the trial was concluded. In February 1953, he published a booklet titled "Genbaku Minso Wakumon (Questions and Answers on the Civil Lawsuit over the Atomic Bombings)", in which he called upon individuals in Hiroshima and Nagasaki to take legal action against the US government within the US legal system.¹⁵¹

Okamoto's plan met great deal of opposition within Japanese society and even in Hiroshima and Nagasaki. Shinzo Hamai, the mayor of Hiroshima at the time, opposed the plan on grounds that the US legal system was not favorable to such actions. As a result, Okamoto gave up the notion of trying the case in a US court and decided to seek action in the Japanese legal system. In co-operation with local organizations in Hiroshima and Nagasaki, a group of five people were selected for the purpose of making the motion in a Japanese court. Shimoda, the leader of the group,

¹⁵¹ Shimoda et al. v. The State, Tokyo District Court, 7 December 1963 ICJ General list 50.
came from Hiroshima and was 57 years old.\textsuperscript{152} He lost four daughters and one son in the atomic attack on Hiroshima, and he, his wife and surviving son suffered from persistent health problems. A lawyer named Yasuhiro Matsui joined the legal team.\textsuperscript{153} Proceedings at the District Court in Tokyo began in April 1955, and they lasted for eight and a half years until the final ruling was rendered on December 8, 1963. Okamoto died of a stroke in April 1958 and did not live to see the final ruling.\textsuperscript{154}

b) The ruling

On 7 December 1963, in Ryuichi Shimoda et al. v/s. The State, the atomic bombings of Hiroshima and Nagasaki were the subject of a Japanese judicial review. On the 22nd anniversary of the attack on Pearl Harbor, the District Court of Tokyo declined to rule on the legality of nuclear weapons in general, but found that "the attacks upon Hiroshima and Nagasaki caused such severe and indiscriminate suffering that they did violate the most basic legal principles governing the conduct of war". In the opinion of the court, the act of dropping an atomic bomb on cities was at the time governed by international law found in Hague Convention of 1907 IV. The Laws and Customs of War on Land, and IX - Bombardment by Naval Forces in Time of War, and the Hague Draft Rules of Air Warfare of 1922–1923, and was therefore illegal.\textsuperscript{155}

The facts were that the plaintiffs, Japanese nationals, were all residents either of Hiroshima or of Nagasaki when atomic bombs were dropped on these cities by bombers of the United States [Army] Air Force in August 1945. Most of the members of their families were killed and many, including some of the plaintiffs themselves, were seriously wounded as a result of these bombings. The plaintiffs jointly brought the present action against the defendant, the State, for damages on the following grounds: (a) that they suffered injury through the dropping of atomic bombs by

\textsuperscript{152} Boyle, Francis A. The Criminality of Nuclear Deterrence. (Atlanta: Clarity Press, 2002), p. 58.
\textsuperscript{153} Ibid
\textsuperscript{155} Judge T. Koseki (Toshimasa Koseki), Judge Y. Mibuchi (Yoshiiko Mibuchi), Judge A. Takakuwa (Akira Takakuwa) (Civil Affairs Division No. 24, Tokyo District Court). Shimoda et al Hanrei Jiho, vol. 355, p. 17; translated in The Japanese Annual of International Law, vol. 8, 1964, p. 231
members of the [Army] Air Force of the United States of America; (b) that the dropping of atomic bombs as an act of hostilities was illegal under the rules of positive international law (taking both treaty law and customary law into consideration) then in force, for which the plaintiffs had a claim for damages; (c) that the dropping of atomic bombs also constituted a wrongful act on the plane of municipal law, ascribable to the United States and its President, Mr. Harry S. Truman; (d) that Japan had waived, by virtue of the provisions of Article 19 (a) of the Treaty of Peace with Japan of 1951, the claims of the plaintiffs under international law and municipal law, with the result that the plaintiffs had lost their claims for damages against the United States and its President; and (e) that this waiver of the plaintiffs' claims by the defendant, the State, gave rise to an obligation on the part of the defendant to pay damages to the plaintiffs.\footnote{Falk, "The Claimants of Hiroshima", (Oxford university press,1965), p.308}

The plaintiffs' cause of action was based, more specifically, on the provisions of Article I of the State Redress Law, which was applicable to the case of injury to a private person through an unlawful act of a government official; on the provisions of Article 29 of the Constitution, which provided for the obligation to pay just compensation in every case of expropriation of private property by the State for public use; and, finally, on unlawful infringement of the rights of the plaintiffs through the omission of the defendant to take appropriate measures for recovery of compensation.\footnote{Falk, Richard A. (15 February 1965). "The Claimants of Hiroshima", The Nation. reprinted in Richard A. Falk, Saul H. Mendlovitz eds., (1966). 'The Shimoda Case: Challenge and Response'. The Strategy of World Order. Volume: 1. New York: World Law Fund. pp. 307–13} It was held that the action must fail on the merits.\footnote{Supra 150} The aerial bombardment with atomic bombs of the cities of Hiroshima and Nagasaki was an illegal act of hostilities according to the rules of international law. It must be regarded as indiscriminate aerial bombardment of undefended cities, even if it were directed at military objectives only, inasmuch as it resulted in damage comparable to that caused by indiscriminate bombardment. Nevertheless, the claimant as an individual was not entitled to claim damages on the plane of international law, nor was he able, as a result of the doctrine of sovereign immunity, to pursue a claim on the plane of municipal law. In these circumstances, the plaintiffs had no rights to lose as a result of the waiver contained in Article 19 (a) of the Treaty of Peace with Japan.
Legal Regime on the Use of Nuclear Weapon and its Impact on Humanity

c) Aerial bombardment

The judgment draws several distinctions which are pertinent to both conventional and atomic aerial bombardment. On the basis of international law found in Hague Convention of 1907 IV - The Laws and Customs of War on Land, and IX - Bombardment by Naval Forces in Time of War, and the Hague Draft Rules of Air Warfare of 1922–1923, the Court drew a distinction between "Targeted Aerial Bombardment" and indiscriminate area bombardment, that the court called "Blind Aerial Bombardment" and a distinction between a defended and an undefended city.\(^{159}\) "In principle, a defended city is a city which resists an attempt at occupation by land forces. A city even with defense installations and armed forces cannot be said to be a defended city if it is far away from the battlefield and is not in immediate danger of occupation by the enemy."\(^{159}\)

The court ruled that blind aerial bombardment is permitted only in the immediate vicinity of the operations of land forces and that only targeted aerial bombardment of military installations is permitted further from the front. It also ruled that the incidental death of civilians and the destruction of civilian property during targeted aerial bombardment were not unlawful. The court acknowledged that the concept of a military objective was enlarged under conditions of total war, but stated that the distinction between the two did not disappear.\(^{160}\)

The court also ruled that when military targets were concentrated in a comparatively small area, and where defense installations against air raids were very strong, that when the destruction of non-military objectives is small in proportion to the large military interests, or necessity, such destruction is lawful. Thus, in the judgment of the Court, because of the immense power of the atom bombs and the distance from enemy (Allied) land forces, the atomic bombings of both Hiroshima

\(^{159}\) Supra 149

and Nagasaki "was an illegal act of hostilities under international law as it existed at that time, as an indiscriminate bombardment of undefended cities".¹⁶¹

d) Aftermath

One of the main arguments of the court in the Shimoda case, that the waiver of claims in the San Francisco peace treaty precluded any actions for damages by Japanese citizens against the US government was also used in the US legal system.¹⁶²

In the case of Mitsubishi Materials Corporation "et al". v. Frank H. Dillman "et al.", dealing with a lawsuit by a former US prisoner of war against the Mitsubishi company for its part in forced labor that he performed during the Second World War, the Superior Court of Orange County rejected the motion after referring to the Shimoda case as follows:¹⁶³

The Japanese court found against the plaintiffs because even though the Shimoda court was willing to say that the United States had in fact violated international law, it also said that Japan had waived the right of its nationals to recover against the United States because of the 1951 treaty. Without a waiver of all war crime claims that could have been brought by either side, Japan and the United States might have wrangled endlessly about liabilities arising out of the war”.¹⁶⁴

4.5. Nuclear Weapon and Sustainable Development

The concept of sustainable development has a unique role to perform in social economical, cultural and political life of human civilization. Indeed sustainable development appears have replaced such vulnerable concept as growth modernization, progress and even accelerated development as unifying concept for worldwide development activities. Only the concept human development that currently is being promulgated by the UNDP represent a serious challenge to the primacy of sustainable

¹⁶³ Joan T. Phillips. List of documents and web links relating to the law of armed conflict in air and space operations., Bibliographer, Muir S. Fairchild Research Information Center Maxwell (United States) Air Force Base, (Alabama.2006), pp12-78
in the newly hierarchy of development concepts. The applications of sustainable development have become an integral part of human right.

To view sustainable development movement as a passing fad or yet another feeble efforts to capture the imagination of development policy makers, however is to miss both the power of the concept. The fact is that sustainable development has succeeded in uniting widely divergent theoretical and ideological perspective into a single conceptual frame work, the concept has also succeed in exciting the imagination of development specialist and lay person alike, especially regard to the positive outcome that can be achieved of careful implemented plan of local and global action.

And the concept has succeed, even more remarkably in animating governmental leaders, development policy makers and other to enter into formal agreements that seek to promote both socioeconomic development and protect the environment. The theory of sustainable development was coined by Brunt land commission; report called for emboldened and dramatically new concept of development that advanced the material wants of the present generations without depriving future generation of their resource required to satisfy their needs. Thus the commission conceptualized sustainable development simply as,\(^\text{165}\)

“Paths of human progress which meets the needs and aspiration of present generation without compromising the ability of future generation to meet their need”

If we analysis the problem of nuclear weapon from the point of sustainable development theory matter would be of serious concern for research and enquiry, such as the problem of nuclear warfare, nuclear proliferation and illicit nuke weapon transaction so much so that it is seriously co-ordinate to social, economic and political issues. WCED had taken a practical approach to analysis the problems working against the sustainable development; whereby the commission emphasized the need for new conception of global development and took the cognizance of the fact that;

1 Social and environmental problem are interconnected

Recognized that environmental stresses are not restricted to particular locals or geographical boundaries

Recognized that environmental catastrophes experienced in one world region in the end effect the well being of the people everywhere and

Recognized that only through the sustainable approach to the development to the planet’s fragile eco-system be protected and the aim of human development be furthered.

The WCED project analysis the important factors as a cause for environmental degradation and hinder the human development, this hypothetical approach has become a strategical approach of several studies associated with the principal of sustainable development.\textsuperscript{166}

The present strategical approach of the states in nuclear weapon proliferation and the past incident of Hiroshima and Nagasaki have viably challenged the theory of sustainable development. There was a time when the weapon used by, were only two countries prior to the cold war and possible succeeded in managing the weapon from disastrous use, due to the theory of deterrence, which balances the power between the nuclear surmount. Today number of states possesses nuclear weapon and technically speaking they rely to greater extend on the theory of deterrence. However a sea change that has been seen in the use of nuclear power is with the establishment of nuclear power plants.\textsuperscript{167} The nuclear power plants constituted in many states are undertaking R&D in converting the energy for commercial purpose, however behind this veil of constructive use of nuclear energy much of the states are at their best to proliferate the nuclear weapon by increasing its strategical nuclear power. This generally leads the research to inquiry into the issues:-

1. What are the factors of sustainable development apprehended due to nuclear proliferation?
2. Whether the states nuclear power plants are safe enough to control the accidental nuclear disaster?
3. How far the unforeseen apprehension should be considered seriously violating standard of sustainable development?

\textsuperscript{166} Glasstone, Samuel, and Philip J. Dolan, eds., The Effects of Nuclear Weapons, (3\textsuperscript{rd} Ed U.S. GPO, Washington, DC,1977), pp67-89
\textsuperscript{167} Ibid
Categorically the nuclear energy disaster can be studied under two head:-

1. The disaster due to nuclear weapon use at the time of war
2. Secondly the disaster due to the nuclear fuel cycle operation and the effect of accident such as the Chernobyl disaster (1986) and Fukushima I nuclear accidents.

The bizarre rush run on nuclear proliferation resulting in illegal transfer of nuclear weapon and the experiment to use nuclear energy have serious impact on the theory of sustainable development. The radiation dispersed into the environment has a lasting effect on the ecology causing threat to future generation. Thus the environmentalist and the ecological scientist have warned the countries of nuclear surmount on apprehension possible to take place. It is an arguable issue that several factors are cause for ecological degradation then the nuclear war or nuclear power plant disaster and is only an untimely concern. But the truth is, once there is an outbreak of nuclear war the impact on ecology is double then the general factors. The whole life of the earth depends much upon the ecological system. This eco-system is largely apprehended and affected due the outbreak of war. One of the major factors of sustainable development, seriously under threat is the environment.

4.6. Disaster due to Out Break of War

Disaster due to outbreak of war is already witnessed in the above discussion headed in the consequence of use of nuclear weapon; this is no way delimiting the responsibility of the states toward the environmental disaster which seriously violates the purpose of sustainable development.

4.6.1 Disaster due to Nuclear Weapon Tests

Conventional international law contains various limitations on nuclear weapons, such as possession, testing, deployment use or threat to use. Both the customary and contemporary principles of international law prohibit the use of nuclear weapons. It is argued in given current threat in the nuclear proliferation, a comprehensive abolition of nuclear weapon through legal instruments is crucial.

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Since nuclear weapon is turning out to be the most important device of military arsenal, consequential act of proliferating the weapon and in advance to this testing of nuclear weapon has become ipso facto right of the states.\textsuperscript{170} The Nuclear non Proliferation Treaty clearly prohibits the testing of nuclear weapon and impedes the states party to abide to the environmental protection.\textsuperscript{171} These are the least concern of the member parties to the NPT. Of all the activities concerning nuclear weapons, testing has been the most destructive of human health and the environment. China, France, India, Pakistan, Russia, the US and UK have collectively conducted over 2000 nuclear explosions for testing purposes - approximately 500 above ground and the rest underground.

The story of Lijon Eknilang (box at right) is just one of the many from the test sites and adjacent areas in the Marshall Islands, Te Ao Maoi (French Polynesia), Maralinga, Nevada, Kazakhstan, Lop Nor, Novaya Zemlya, Kiribati and Pokhran. It has been estimated that global fallout from nuclear testing will lead to over 2 million cancer fatalities alone, not counting other health effects.\textsuperscript{172}

The Legality of Nuclear Test Explosion and the Role of ICJ

There were attempts made on two occasions with contentious cases to obtain a pronouncement from the ICJ on the legality of nuclear tests. In both cases the court avoided clear pronouncement on the substance of the subject-matter.\textsuperscript{173} In 1973 both Australia and New Zealand protested against announced forth coming French nuclear test to be held in the pacific and instituted proceeding before the ICJ, by unilateral application in accordance with General Act for pacific settlement of international dispute as well as Article 36 of the Courts Statute. Australia and New Zealand also requested the court to indicate interim measures of protection on the ground that radioactive fallout from any test held before the final judgement of the court on the legality of such tests would prejudice the interest of two countries concerned.\textsuperscript{174} In 1973 the court issued the requested order. France ignored the order and announced a

\textsuperscript{170} Journal of Conflict & Security (,Vol, 15 No. 1,New York, 2010), pp.65-87
\textsuperscript{171} Article I, II,III Non Proliferation Treaty 1968
\textsuperscript{172} Radioactive Heaven and Earth. IPPNW. (Apex Press. New York, 1991), p56
further series of tests. Australia and New Zealand asked the Court to declare such atmospheric tests illegal and to order France to abstain in the future.\textsuperscript{175}

Before the Court had an opportunity to hear in full the merit of the case, statement were made by French authorities indicating that the France would no longer conducts atmospherics nuclear tests. The court held by nine votes to six that, due to these statements by France the claim of Australia and New Zealand no longer had any grounds and so the courts did not have to decide the issues in the case, and accordingly there was no need to rule on the legality of the test that France had already conducted.\textsuperscript{176} However ICJ stated that if the basis of its decision were to be affected in the future, New Zealand could return to the ICJ and seek an examination of the situation. Several judges expressed a joint Dissenting opinion pointing out that the legal dispute between the parties still persisted since Australia and New Zealand sought a judgment from the ICJ stating that atmospheric nuclear test were contrary to international law. Judge ad hoc Sir Garfield Barwick appended a dissenting opinion to the judgment by the Court.\textsuperscript{177} It was argued that Partial Test Ban Treaty form the basis for an international legal custom that would prohibit the testing of nuclear weapons and that such a rule would be banning on all states both parties and non-parties. In the view of Sir Barwick, treaties, resolutions expression of opinion and international practice, may all combine to produce the evidence of that customary law.\textsuperscript{178}

France announced in June 1995 that it would resume nuclear testing after three year moratorium and conduct eight underground nuclear tests at Mururoa and Fangataufa atolls. New Zealand challenged France decision and argued that its intention to recommence nuclear testing in the south Pacific affected the basis of the ICJ decision in the Nuclear Test Cases. New Zealand requested the ICJ to examine the situation and grant provisional measures to prevent France from undertaking any further nuclear tests. The practice of the ICJ did not have precedent for reopening a case in the way New Zealand was attempting. The traditional application on the basis of the Statute and rules of the Court were not applicable since this would suggest that

\textsuperscript{175} ibid
\textsuperscript{176} Nuclear Tests (Australia v France) 1974, ICJ, General list 92, 1978, p 435.
\textsuperscript{177} Supra 155 at,p.367.
\textsuperscript{178} Nuclear tests (New Zealand v France) (Judgment) [1974] ICJ Rep ,pp. 472-3
New Zealand was attempting to open new proceedings.\textsuperscript{179} Therefore, New Zealand made reference to paragraph 63 of the 1974 judgment. The Court stated that it would hold hearing only on threshold issues whether New Zealand provision fell within the provision of the above paragraph.\textsuperscript{180}

In its judgement the Court stated that declarations made by way of unilateral acts, concerning legal or factual situations, may have the affects of creating legal obligations. By the issue order of 22 September 1995 the ICJ dismissed New Zealand’s application on the ground that the basis of its earlier decision was France undertaking not to conducts any further atmospheric test and that this did not extend to cover underground testing.\textsuperscript{181} However France did reduce the number of test carried out from eight to six and subsequently accepted a complete ban on all nuclear testing when it became party to the CTBT in 1998. Judge Weeramantry, Kororma and Judge \textit{ad hoc} Sir Geoffrey palmer each field dissenting opinion. Judge Weeramantry stated that New Zealand’s original complaint of 1973 did not make explicit reference to atmospheric nuclear testing, but to the various type of damage from radioactive fallout.\textsuperscript{182} It was asserted that New Zealand’s complaint of violation of international law was based on the final result, namely the damage from radioactive contamination not the specific cause of the injury. Judge Weeramantry discussed the importance of such environmental law, as the principle of intergenerational equity and precautionary. Intergenerational equity places a responsibility on states to protect and improve the environment for present and future generations. The judge pointed out that the precautionary principle allows the New Zealand to bring this case before the France has conducted the nuclear test. Judge Koroma underlined the proper standard that he believes the court should have applied to determine whether New Zealand had established the legal basis for its request. Judge Palmer pointed out that a risk benefit analysis should be performed which showed that a prime face case had been established. The judge compared this analysis to a law of tort calculation and

\textsuperscript{179} ICJ Rep (1995) p.288 325-
\textsuperscript{180} ICJ Rep (1995) 288 (n85) p.327.
\textsuperscript{181} Ibid
\textsuperscript{182} The most widely used description of the precautionary principle is found in Art 15 of the Rio Declaration of 1992, in order to protect the environment the precautionary approach shall be widely applied by states according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost effective measures to prevent environmental degradation.
underlined that the international law commission had supported this type of test in its
draft Article entitled risk of causing significant transboundary harm. In the view of
Judge Palmer the Court has a responsibility to declare, develop and uphold
international law.

4.6.2 Disaster due to Nuclear Fuel Cycle Operation and The effect of Accident

The environmental impact of nuclear power results from the nuclear fuel cycle,
operation, and the effects of accidents such as the Chernobyl disaster (1986)
and Fukushima I nuclear accidents.¹⁸³ The nuclear wastes emitted into the
environment are:-

1. Waste stream

   Nuclear power has at least four waste streams that contaminate and degrade land:
   1. they create spent nuclear fuel at the reactor site (including plutonium waste)
   2. they produce tailings at uranium mines and mills
   3. during operation they routinely release small amounts of radioactive isotopes
   4. during accidents they can release large quantities of radioactivity

   According to Benjamin K.Sovacool, the nuclear fuel cycle involves some of
the most dangerous elements known to humankind. He says "these elements include
more than 100 dangerous radionuclides and carcinogens such as strontium-90, iodine
131 and cesium 137, which are the same toxins found in the fall out of nuclear
weapons"¹⁸⁴

2. Radioactive waste

   Radioactive waste is a waste product containing radioactive material. It is
usually the product of a nuclear process such as nuclear fission, though industries not
directly connected to the nuclear power industry may also produce radioactive waste.

   Radioactivity diminishes over time so in principle the waste needs to be
isolated for a period of time until it no longer poses a hazard. This can mean hours to
years for some common medical or industrial radioactive wastes, or thousands of

¹⁸³ 'The Human Consequences of the Chernobyl Nuclear Accident’, UNDP and UNICEF. 22
January 2002. p.66
¹⁸⁴ Ibid
years for high-level wastes from nuclear power plants and nuclear weapons reprocessing.\textsuperscript{185}

a) High level waste

Around 20–30 tons of high-level wastes are produced per month per nuclear reactor. Currently most spent nuclear fuel outside the U.S. is reprocessed for the useful components, leaving only a much smaller volume of short half-life waste to be stored. In the U.S., reprocessing is currently prohibited by executive order, and the spent nuclear fuel is therefore stored in dry cask storage facilities (this has the disadvantage of keeping the long-lived isotopes with the other waste, thus greatly extending the half-life of the waste).

Several methods have been suggested for final disposal of high-level waste, including deep burial in stable geological structures, transmutation, and removal to space. So far, none of these methods have been implemented. Recognizing that long-term management options may require significant time to be achieved, interim storage is currently used.\textsuperscript{186}

Since the spent nuclear fuel has nowhere to go, some experimental nuclear reactors, such as the Integral Fast Reactor, have been proposed that use a different nuclear fuel cycle that avoids producing waste containing long-lived radioactive isotopes or actually "burns" those isotopes from other plants, via transmutation into elements with lower radioactivity.

According to anti-nuclear organizations and current public opinion in the US, rendering nuclear waste harmless is not being done satisfactorily and it remains a hazard for anywhere between a few years to many thousands of years, depending on the particular isotopes. The same organizations lobby against processing the waste to reduce its radioactivity and longevity, claiming that the method has proliferation concerns and is uneconomic.

The length of time waste has to be stored is controversial because there is a question of whether one should use the original ore or surrounding rock as a reference

\textsuperscript{185} Black, Richard, "Fukushima: As Bad as Chernoby?", (New York, 2001), p.67
\textsuperscript{186} Cheney, Glenn Alan, Journey to Chernobyl: Encounters in a Radioactive Zone.(Academy Chicago,1995), p189
for safe levels. Anti-nuclear organizations tend to favor using normal soil as a reference; in contrast to pro-nuclear organizations those tend to argue that geologically disposed waste can be considered safe once it is no more radioactive than the uranium ore it was produced from.

b) Other waste

Moderate amounts of low-level waste are produced through chemical and volume control system (CVCS). This includes gas, liquid, and solid waste produced through the process of purifying the water through evaporation. Liquid waste is reprocessed continuously, and gas waste is filtered, compressed, stored to allow decay, diluted, and then discharged. The rate at which this is allowed is regulated and studies must prove that such discharge does not violate dose limits to a member of the public. Solid waste can be disposed of simply by placing it where it will not be disturbed for a few years. There are three low-level waste disposal sites in the United States in South Carolina, Utah, and Washington. Solid waste from the CVCS is combined with solid waste that comes from handling materials before it is buried off-site.

3. Power plant Emission

a) Radioactive gases and effluents

Most commercial nuclear power plants release gaseous and liquid radiological effluents into the environment as a byproduct of the Chemical Volume Control System, which are monitored in the US by the EPA and the NRC. Civilians living within 50 miles (80 km) of a nuclear power plant typically receive about 0.1 μSv per year. For comparison, the average person living at or above sea level receives at least 260 μSv from cosmic radiation. The total amount of radioactivity released through this method depends on the power plant, the regulatory requirements, and the plant's performance.

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187 Dyatlov, Anatoly, 'Chernobyl. How did it happen, (Nauchtechlitizdat, Moscow, 2003), p.70
188 Ibid
Atmospheric dispersion models combined with pathway models are employed to accurately approximate the dose to a member of the public from the effluents emitted. Effluent monitoring is conducted continuously at the plant.

b) Boron letdown

Towards the end of each cycle of operation (typically 18 months to two years in length), each pressurized water reactor reduces the amount of boron in its primary coolant system (the water that flows past and cools the nuclear reactor core. As a consequence, some of this irradiated boron is discharged from the plant and into whatever body of water the plant's cooling water is drawn from. The maximum amount of radioactivity permitted in each volume of discharge is tightly regulated189.

c) Tritium

Tritium is a radioactive isotope of hydrogen that emits a low-energy beta particle and is usually measured in Becquerel’s (i.e. atoms decaying per second) per liter (Bq/L). Tritium becomes dissolved in ordinary water when released from a nuclear plant. The primary concern for tritium release is the presence in drinking water, in addition to biological magnification leading to tritium in crops and animals consumed for food. Legal concentration limits have differed greatly from place to place. For example, in June 2009 the Ontario Drinking Water Advisory Council recommended lowering the limit from 7,000 Bq/L to 20 Bq/L. According to the NRC, tritium is the least dangerous radionuclide because it emits very weak radiation and leaves the body relatively quickly. The typical human body contains roughly 3,700 Bq of potassium-40. The amount released by any given plant also varies greatly; the total release for plants in the United States in 2003 was at least counted to be 0 and at most 2,080 curies (77 TBq).190.

d) Uranium mining

There have been several epidemiological studies that claim to demonstrate increased risk of various diseases, especially cancers, among people who live near nuclear facilities. Among recent studies, a widely cited 2007 meta-analysis of 17 research papers was published in the *European Journal of Cancer Care*. It offered

190 *Industry Progress Since the Chernobyl Accident April 1986*, World Association of Nuclear Operators (WANO) April 1996

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evidence of elevated leukemia rates among children living near 136 nuclear facilities in the United Kingdom, Canada, France, United States, Germany, Japan, and Spain. Elevated leukemia rates among children were also found in a 2008 German study that examined residents living near 16 major nuclear power plants in Germany. These recent results are not consistent with many earlier studies that have tended not to show such associations. But no credible alternate explanations for the recent findings have so far emerged. The British Committee on Medical Aspects of Radiation in the Environment issued a study in 2011 of children under five living near 13 nuclear power plants in the UK during the period 1969-2004. The committee found that children living near power plants in Britain are no more likely to develop leukemia than those living elsewhere.\textsuperscript{191}

4.6.3 Contrast of Radioactive Accident Emissions with Industrial Emission

Proponents argue that the problems of nuclear waste "do not come anywhere close" to approaching the problems of fossil fuel waste. A 2004 article from the BBC states: "The World Health Organization (WHO) says 3 million people are killed worldwide by outdoor air pollution annually from vehicles and industrial emissions, and 1.6 million indoors through using solid fuel." In the U.S. alone, fossil fuel waste kills 20,000 people each year. A coal power plant releases 100 times as much radiation as a nuclear power plant of the same wattage. It is estimated that during 1982, US coal burning released 155 times as much radioactivity into the atmosphere as the Three Mile Island accident. The World Nuclear Association provides a comparison of deaths due to accidents among different forms of energy production. In their comparison, deaths per TW-yr of electricity produced from 1970 to 1992 are quoted as 885 for hydropower, 342 for coal, 85 for natural gas, and 8 for nuclear.\textsuperscript{192}

4.7. Environmental Effect of Accidents

The worst accidents at nuclear power plants have resulted in severe environmental contamination. However, the extent of the actual damage is still highly debated.

\textsuperscript{191} BEIR Report, National Academy of Sciences, Washington, D.C. November, 1972 and 1979. The effects on populations of exposure to low levels of ionizing radiation
\textsuperscript{192} J.J. Mearsheimer, Case for a Ukrainian deterrent’ in Foreign Affairs, Vol. 72, 1993, pp. 50–66
a) Chernobyl disaster

The 1986 Chernobyl disaster in the Ukraine was the world's worst nuclear power plant accident. Estimates of its death toll are controversial and range from 4,056 to 985,000. Large amounts of radioactive contamination were spread across Europe, and cesium and strontium contaminated many agricultural products, livestock and soil. The accident necessitated the evacuation of 300,000 people from Kiev, rendering an area of land unusable to humans for an indeterminate period.\(^{193}\) The disaster began during a systems test on Saturday, 26 April 1986 at reactor number four of the Chernobyl plant, which is near the city of Prypiat and within a close proximity to the administrative border with Belarus and Dnieper River. There was a sudden power output surge, and when an emergency shutdown was attempted, a more extreme spike in power output occurred, which led to a reactor vessel rupture and a series of explosions. These events exposed the graphite moderator of the reactor to air, causing it to ignite. The resulting fire sent a plume of highly radioactive smoke fallout into the atmosphere and over an extensive geographical area, including Pripyat.\(^{194}\) The plume drifted over large parts of the western Soviet Union and Europe. From 1986 to 2000, 350,400 people were evacuated and resettled from the most severely contaminated areas of Belarus, Russia and Ukraine. According to official post-Soviet data, about 60% of the fallout landed in Belarus. Russia, Ukraine, and Belarus have been burdened with the continuing and substantial decontamination and health care costs of the Chernobyl accident. A report of the International Atomic Energy Agency, examines the environmental consequences of the accident. Estimates of the number of deaths potentially resulting from the accident vary enormously: Thirty one deaths are directly attributed to the accident, all among the reactor staff and emergency workers. A UNSCEAR report places the total confirmed deaths from radiation at 64 as of 2008. The World Health Organization (WHO) suggests it could reach 4,000. A 2006 report predicted 30,000 to 60,000


\(^{194}\) Pripyat is a ghost town near the Chernobyl Nuclear Power Plant in the Kiev Oblast (province) of northern Ukraine, near the border with Belarus. A town often becomes a ghost town because the economic activity that supported it has failed, or due to natural or human-caused disasters such as floods, government actions, uncontrolled lawlessness, or war.
cancer deaths as a result of Chernobyl fallout. A Greenpeace report puts this figure at 200,000 or more.

A Russian publication, Chernobyl, concludes that 985,000 excess deaths occurred between 1986 and 2004 as a result of radioactive contamination. The accident raised concerns about the safety of the Soviet nuclear power industry, as well as nuclear power in general, slowing its expansion for a number of years and forcing the Soviet government to become less secretive about its procedures. As radioactive materials decay, they release particles that can damage the body and lead to cancer, particularly cesium-137 and iodine-131. In the Chernobyl disaster, releases of cesium-137 contaminated land. Some communities were abandoned permanently. Thousands of people who drank milk contaminated with radioactive iodine developed thyroid cancer.

b) Fukushima disaster

In March 2011 an earthquake and tsunami caused damage that led to explosions and partial meltdowns at the Fukushima I Nuclear Power Plant in Japan. Radiation levels at the stricken Fukushima I power plant have varied up to 1,000 mSv/h (millisievert per hour), which is a level that can cause radiation sickness to occur at a later time following a one hour exposure. Significant release in emissions of radioactive particles took place following hydrogen explosions at three reactors, as technicians tried to pump in seawater to keep the uranium fuel rods cool, and bled radioactive gas from the reactors in order to make room for the seawater.

Concerns about the possibility of a large scale radiation leak resulted in 20 km exclusion zone being set up around the power plant and people within the 20-30km zone being advised to stay indoors. Later, the UK, France and some other countries told their nationals to consider leaving Tokyo, in response to fears of spreading

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196 T. Lindsey Bake, Ghost Towns of Texas, (University of Oklahoma Press, 1991), p.89
198 JoulesBurn, "The Fukushima disaster and other irreproducible (experiments, Oil Drum, Archived, 2011), p89
nuclear contamination. *New Scientist* has reported that emissions of radioactive iodine and cesium from the crippled Fukushima I nuclear plant have approached levels evident after the Chernobyl disaster in 1986, though most of it is being (comparatively) harmlessly discharged into the ocean.

As of April 2011, water is still being poured into the damaged reactors to cool melting fuel rods. John Price, a former member of the Safety Policy Unit at the UK's National Nuclear Corporation, has said that it "might be 100 years before melting fuel rods can be safely removed from Japan's Fukushima nuclear plant".\(^{199}\)

c) Water wastage

As with some thermal power stations, nuclear plants exchange 60 to 70% of their thermal energy by cycling with a body of water or by evaporating water through a cooling tower. This thermal efficiency is somewhat lower than that of coal fired power plants, thus creating more waste heat.

The cooling options are typically once-through cooling with river or sea water, pond cooling, or cooling towers. Many plants have an artificial lake like the Shearon Harris Nuclear Power Plant or the South Texas Nuclear Generating Station. Shearon Harris uses a cooling tower but South Texas does not and discharges back into the lake. The North Anna Nuclear Generating Station uses a cooling pond or artificial lake, which at the plant discharge canal is often about 30°F warmer than in the other parts of the lake or in normal lakes (this is cited as an attraction of the area by some residents). The environmental effects on the artificial lakes are often weighted in arguments against construction of new plants, and during droughts have drawn media attention.\(^{200}\)

The Turkey Point Nuclear Generating Station is credited with helping the conservation status of the American Crocodile, largely an effect of the waste heat produced. The Indian Point nuclear power plant in New York is in a hearing process to determine if a cooling system other than river water will be necessary (conditional upon the plants extending their operating licenses). During Europe's 2003 and 2006

\(^{199}\) Ibid
heat waves, French, Spanish and German utilities had to secure exemptions from regulations in order to discharge overheated water into the environment.\textsuperscript{201}

d) Greenhouse gas emission

Nuclear power plant operation emits no or negligible amounts of carbon dioxide. However, all other stages of the nuclear fuel chain mining, milling, transport, fuel fabrication, enrichment, reactor construction, decommissioning and waste management – use fossil fuels and hence emit carbon dioxide. There has been a debate on the quantity of greenhouse gas emissions from the complete nuclear fuel chain.\textsuperscript{202}

Many commentators have argued that an expansion of nuclear power would help combat climate change. Others have pointed out that it is one way to reduce emissions, but it comes with its own problems, such as risks related to severe nuclear accidents the challenges of more radioactive waste disposal. Other commentators have argued that there are better ways of dealing with climate change than investing in nuclear power, including the improved energy efficiency and greater reliance on decentralized and renewable energy sources.\textsuperscript{203} According to an analysis by Mark Z. Jacobson, nuclear power results in 9-25 times more carbon emissions than wind power, "in part due to emissions from uranium refining and transport and reactor construction, in part due to the longer time required to site, permit, and construct a nuclear plant compared with a wind farm (resulting in greater emissions from the fossil-fuel electricity sector during this period), and in part due to the greater loss of soil carbon due to the greater loss in vegetation resulting from covering the ground with nuclear facilities relative to wind turbine towers, which cover little ground".\textsuperscript{204}

4.7.1 The Fostering of Ecocide

It’s quite clear from the above study that the nuclear energy has the potentiality to destroy the who planet earth; no matter what form of use its is being

\textsuperscript{201} Ibid
made for. The situation is extremely challenging. Many environmentalists have termed the act as ECOCIDE, which refer to large scale destruction of natural environment or over consumption of critical non renewable sources. Recognizing the long-term and wide-spread impacts caused by such degradation, experts have coined the term ecocide, literally meaning the killing of the environment. The term was first used in the year 1969 to refer the murder of the environment. In fact the term was used in relation to environmental damage due to war such as the use of defoliants in the Vietnam War and the use of glyphosate in the Colombian civil war. Ecocide is also a term for a substance that kills enough species in an ecosystem to disrupt its structure and function. Another example would be a high concentration of pesticide due to a spillage. U.S. environmental theorist and activist Patrick Hossay, argues that the human species is committing ecocide, via industrial civilization's effects on the global environment. Much of the modern environmental movement stems from this belief as a precept. However there has been a serious debate on the literal sense of the term ecocide and many of the environmental jurists were not satisfied to use the term ecocide as the sole cause for environmental disaster, they believed that several factors contribute to ecological disturbance. According to this interpretation and because humankind well-being is directly related to numerous environmental factors such as rainforest, climate warming, chemistry of the air and water our negative impact on these factor can't be viewed as a part of the weaker definition, but really for what it is: a threatening unbalance in the environment and a symptom of fundamental errors in managing how many we are and how much we pollute per capita. At the heart of the ecocide issue are practical and moral questions: is human activity destroying the ecological support system necessary for our own survival? Is global ecocide actually happening? In 1996, Canadian/Australian lawyer Mark Gray proposed an international crime of ecocide, based on established international environmental and human rights law. He demonstrated that states, and arguably individuals and organizations, causing or permitting harm to the natural environment on a massive scale breach a duty of care owed to humanity in general. He proposed that such breaches, where deliberate, reckless or negligent, be identified as ecocide where they

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entail serious, and extensive or lasting, ecological damage; international consequences; and waste.\textsuperscript{206}

In April 2010 UK Lawyer Polly Higgins proposed to the United Nations that ecocide to be recognized as an international Crime against Peace alongside Genocide, Crimes of Humanity, War Crimes and Crimes of Aggression, trailed at the International Criminal Court.

The definition proposed is:

Ecocide: the extensive destruction, damage to or loss of ecosystem(s) of a given territory, whether by human agency or by other causes, to such an extent that peaceful enjoyment by the inhabitants of that territory has been severely diminished. To put in one word the use of nuclear for both the constructive and destructive purpose is turning out to be a nightmare for humanity. The term is quite adaptable to the present situation of nuclear era.\textsuperscript{207}

4.7.2 Sustainable Development and International Arms Control Procedure

The act of international arms transfer has both pros and cons within it. On one side it can provide the right environment for development by strengthening the capacity of military, security and police force to protect citizens from crime. On the other, huge investment in production, piling, and stocking of weapons can divert fund from public service, impair poverty reduction and socio-economic development and when they contribute armed crime conflict or serious violation of human rights. And if the act of transfer takes place without accountability and transparency it can aggravate corruption. The act of arms transfer is just, to an extent of transfer of conventional arms. Any act of transferring the unconventional weapon would be a serious offence. The major issue would also include illegal transfer of weapons and falling out into the hands of terrorist. Individually and cumulatively, these impacts undermine sustainable development and the achievement of internationally agreed targets such as the Millennium Development Goals (MDGs). That’s why more effective and responsible regulation of international armed trade is needed urgently to

\textsuperscript{207} Cherson, Adam ,Ecocide: Humanity’s Environmental Demons. (Greencore Books, 2009), p. 135.
ensure that arms transfer is intended to achieve security do not come out at the cost of undermining progress against development. The transfer must take place in accordance with states international legal obligation and global norms. The general principles of sustainable development are emphasized under international law, thus making the application of these rules in appropriate manner and in accordance.\footnote{Practical Guide: Applying Sustainable Development to Arms Transfer Decisions, Oxfam International Technical Brief, April 2009,p78}

1. Legal basis and international standard for sustainable development criteria

The legal obligation and other responsibilities of the state concerning sustainable socio-economic development are firmly grounded in the UN Charter and in international human rights and other international law, including the Universal Declaration of Human Rights and the International Covenants on Economic Social and Cultural Rights. They are also included in numerous other resolutions, declarations and universal commitments to poverty reductions and socio-economic development such as the MDGs.\footnote{The concept of ‘sustainable development’ here refers to socio-economic development and poverty reduction that is sustainable for future generations. In this report we have referred to this as sustainable socio-economic development. Reference to this concept is well established and can be found in numerous reports including: UN World Commission on Environment and Development (1987) ‘Our Common Future’, UN: New York.}

a) UN Charter obligations and international law

Article 51 of the UN Charter recognizes that every state has a right to individual and collective self-defense. However, this right must be balanced with other UN Charter obligations, including the promotion of higher standard of living, full employment and condition of economic and social progress and development and universal respect for and observance of human rights and fundamental freedom for all without distinction as to race, sex, language or religion\footnote{UN Charter VII: Action with Respect to Threat to Peace, Breach of the Peace and Act of Aggression.}.

The UN Charter also enshrined the requirement to promote the establishment and maintenance of international peace and security with least diversion for armament of the world’s human and economic resources, specifically making it requirement of the Security Council. The need to ensure appropriate level of spending on armament has since been reinforced and widely accepted by the member states in universal agreement such as the outcome document of the General Assembly First Special
Session devoted to disarmament as well as a number of regional and sub-regional arms export control instruments.\textsuperscript{211}

The Universal Declaration of Human Rights recognizes that ‘everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food, clothing housing and medical care and necessary social services, and the right to security in the event of unemployment, sickness, disability, widowhood, old age or other lack of livelihood in circumstance beyond his control. The International Covenant on Economic Social and Cultural rights recognizes the right of everyone to education and the right of everyone to the enjoyment of the highest attainable standard of physical and mental health. The rights contained in this Covenants are widely considered to be indivisible from those in the Covenant on Civil and Political Rights and respect for both sets of rights are necessary for the full enjoyment of sustainable development.\textsuperscript{212}

b) Development responsibilities in resolutions, summits and declarations

Human rights and obligations to promote ‘higher standard of living, full employment and conditions of economic and social progress and development, enshrined within the UN Charter, have been reinforced by numerous summits, resolution and declarations.\textsuperscript{213} For example, 1986 UN General Assembly Declaration on the Right to Development reaffirmed that development is an inalienable human right and committed states to strengthening peace and security and ensuring that the resources released by the effective disarmament measures were used for development. The MDGs universally agreed in September 2000 by all UN member states enshrined rights and obligations to socio-economic development and the poverty reduction. The 2005 World Summit reaffirmed that development is the central goal in itself and that development, peace, security and human rights are the pillars of the United Nations and are interlinked and mutually reinforcing. Under UN programme of Action to Prevent, Combat and Eradicate the Illicit Trade in Small Arms and Light Weapons in

\textsuperscript{211} AC Trinidad, the right to live: the illegality under contemporary international law of all weapon of mass destruction. Study presented in the form of lecture delivered at the university of Hiroshima, in Hiroshima, Japan 20 December 2004


all its aspects, states are committed to making greater efforts to address problem related to human and sustainable development, taking into account existing and future social and developmental activities.214

c) Additional state responsibilities on corruption and transnational crime

Obligations of the states to address corruption, corrupt practices, and transnational organized crime are enshrined in a range of different conventions and treaties containing provisions that can help guide states when considering development in international arms transfer. The UN Conventions Against Transnational Organized Crime (CATOC), agreed in 2000 and the UN Convention Against Corruption agreed in 2003, requires states to improve accountable and transparent government spending, tackle corruption, and investigate and prosecute corrupt activities. The additional firearms protocol 55/255 to UN CATOC requires states to address illicit manufacture and trafficking in firearms, their parts and components, and ammunition.215

2. Existing criteria on sustainable development in international arms-transfer decision making.

The UN Guideline for International Arms Transfer (1996) endorsed by the UN General Assembly commit states to avoiding international transfer that aggravate conflict, that will not be used for legitimate security needs, or seriously undermine a state’s economy. In addition, specific commitments by states to consider development when making decision about international transfer of arms are already including in most regional and multilateral arms-transfer instruments. Currently this instrument covers a total of 89 countries, including nine of the top 11 arms exporter and 14 of the 20 least developed countries. Thus according to regional multilateral and global agreements on international arms transfers that states recognize their responsibility to carefully consider the impact of international arms transfer on sustainable development before authorizing an arms transfer.216

214 Programme of Action to Prevent, Combat and Eradicate the Illicit Trade in Small Arms and Light Weapons in All Its Aspect, UN Document A/CONF.192/15


3. Essential elements of sustainable development criteria

Given the legal basis and international standard as described earlier, and its translation into many regional and global agreements’ it’s clear that significant global norm is emerging. It is thus essential that steps be taken to standardize how these criteria are to be applied in practice.\textsuperscript{217} National licensing authorities and other government officials involved in the arms transfer decision making process require a clear and consistent procedure for determining whether there is substantial risk that transfer will seriously impair poverty reduction or socio-economic development to ensure that such transfers are prohibited. Arms should not be transferred where there is substantial risk of;\textsuperscript{218}

- Involving excessive and unaccountable allocation of human and economic resources to armaments;
- Involving a pattern of corruption;
- Increasing or maintaining high level of armed violence, nationality or regionally;
- Undermining peace building or post conflict reconstruction.

4.8. The Approach of International Environmental Legal Text on Unconventional Weapon

The importance of the environment is universally acknowledged. As the International Court of Justice proclaimed in 1996, in its advisory opinion on the \textit{Legality of the Threat or the Use of Nuclear Weapon}:

“The environment is not an abstraction but represent the living space, the quality of life and the very health of human beings, including generation unborn.

Attacks in wartime against military objectives often impact upon the environment. Oil facilities as military objectives can serve as a prime example. When an oil refinery is struck, this may give rise to toxic air pollution. When an oil storage facility is demolished, the oil may seep into the ground and poison water resources.\textsuperscript{219} When an oil tanker is at sea, the resultant oil spilt may be devastating for marine life.

The International Court of Justice, in the nuclear weapon advisory opinion, went on to say:

States must take environmental consideration into account when assessing what is necessary and proportionate in the pursuit of legitimate military objectives. Respect for the environment is one of the elements that go assessing whether an action is in conformity with the principles of necessity and proportionality. It follows in the courts dictum that, in accordance with the principle of proportionality ‘an attack o military object must be desisted from if the effect on the environment outweighs the value of military objective. 220

Thus, the legal position consistent with present day customary LOIAC is that, when an attack is launched, environmental consideration must play a role in targeting process. Hence even if an attack is planned in an area with little or no civilian population, it may have to be called off if the harm to the environment is expected to be excessive in relation to the military advantage anticipated.

Conversely if the target is sufficiently important, a greater degree of risk to the environment can be expected. Due regards must be given to the environmental consideration, and this are not static over time. Knowledge of the environment is constantly increasing and there is growing understanding of long-term risk attendant to disruption of ecosystems. Still it must be grasped that once due regard is given to environmental consideration and proportionality is observed- an attack against a military objective is liable to produce legitimate collateral damage to the environment. And question to be discussed in this chapter is to what degree treaty law confers upon the natural environment a special protection.221

4.8.1 The international Legal Text

There are two major treaties, and three supplementary texts,222 which directly deals with the protection of environment, however the protection of environment during international armed conflict are not addressed with limited effect:

222 Convention on prohibition of Military or Any Other Hostile use of Environmental modification Techniques 1976,p164
1. ENMOD Convention:- Article I (1) of the convention on the prohibition of military or any other hostile use of environmental modification techniques (adopted by the UN General Assembly 1976 and opened for signature in 1977 here in after:"ENMOD Convention) prescribes

“Each state party to this convention undertakes not to engage in military or any other hostile use of environmental modification techniques having wide spread long lasting or sever effects as the means of destruction to any other state party.

Article II of the ENMOD Conventions sets forth;

As use in Article I, the term Environmental modification technique refer to any technique for changing- through the deliberate manipulation of natural process-the dynamics, composition or the structure of the earth including its biota, lithosphere, hydrosphere and atmosphere are of the outer space.

An understanding relating to Article II is attacked to the ENMOD Convention listing on an illustrative basis the following phenomena that could be caused by environmental modification technique; “earthquakes tsunami an upset ecological balance of a region in weather patterns clouds, precipitation, cyclone of various types and tornado storms changes in climate patterns changes in the ocean current changes in state of ozone layer and changes in the state of the ionosphere.

In conformity with the ENMOD convention not every use of environmental modification technique is forbidden. The combine effect of Article I and II is that several conditions have to be met;

(i) Only military or any other hostile use of an environmental modification technique is forbidden it do not matter whether resort to an environmental modification technique is made for offensive or defensive purpose. But the prescribed use must be either military or hostile.

Article III of, 1 of the ENMOD Convention states the provision of this convention shall not hinder the use of environmental modification technique for peaceful purpose and shall be without prejudice generally recognized principle and

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223 ibid
224 J Muntz, ‘ Environmental Modification, supra at,184
applicable rules of international law concerning such use. It can be perceived that
the activity excluded from the prohibition of the ENMOD convention either;

a. being stimulation of desirable environmental condition such as reliving drought
ridden area or preventing acid rain (or at the other end of the spectrum)
b. Measuring causing destruction damage or injury to another state when the use of
environmental modification technique is non hostile and non military. As the last
part of Article III (1) clarifies the ENMOD Convention does not necessarily
legitimize such activities) (which may be illicit on other international legal
ground) but they do not come within the frame work of its prohibition.
c. The prescribe action must consist “manipulation of natural process” the natural
process then is the instrument manipulated as a weapon for wrecking havoc.
d. The prohibited conduct must be ‘deliberate.’ Could the manipulation of natural
process must be initial and causing collateral damage resulting from an attack
against military objective is not included. Consequently a bombing of a chemical
factory leading to toxic air pollution would not count under the ENMOD
convention.
e. The interdicted action must have widespread long lasting effect. Hence if such
effects are not produced the use of an environmental modification techniques
would excluded from the prohibition by not forbidding a lower level manipulation
of natural process for hostile purpose. The ENMOD convention appears to
condone military preparation for such activities.
f. The banned conduct must cause destruction damage or injury. Three points
should be appreciated:

1 Not every use of environmental modification technique for military or hostile
purpose must necessarily bring about destruction, damage or injury. For instance, an
environmental modification technique employed for the dispersal of fog above
critical enemy area may be harmless.

225 C.R. Wunsch, Environmental Modification Treaty, 4 ASILSILJ, 1980, p. 113
226 ENMOD Convention, supra at, 185
228 M.J.T. Caggiano, ‘Legitimacy of environmental Destruction in Modern
Warfare, 1978, pp 245
229 See L. Juda, Negotiating a Treaty on Environmental Modification Warfare; Convention on
Environmental Warfare and its Impact upon Arms Control Negotiation, Int. Org., 1978, p 975
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2 Should there be, destruction damage or injury, the victim of modification technique need not inevitably be the environment itself (although it would be plausible outcome). If a tsunami or an earthquake can be included by human being in the future, the likely target would be a major industrial complex or a similar non-environmental)

3 The destruction damage or injury must, of course, be generated by a deliberate manipulation of natural processes; but it may go far beyond what was intended or even foreseen by the acting state. This does not matter, as long as there is a casual nexus between the deliberate act and the result.

The destruction damage or injury must be inflicted on another state party to the ENMOD Convention. It does not matter whether that state is belligerent or neutral, provided that it is a contracting party to the instrument.\textsuperscript{230} The destruction damage or injury does not come within the ENMOD Convention if it affects solely:

a. The territory of the acting state (i.e., when the victim is the state’s own population)

b. The territory of a state not party to the ENMOD Convention proposals at the time of drafting to make the text applicable \textit{erga omens’} failed. Similar proposals did not carry the day in a Review Conference held in 1984.

c. Areas outside the jurisdiction of all states, like the high seas unless, of course, the destructive activities on the high seas affect the shipping of a state party to the ENMOD Convention.

Exceptionally environmental modification can be spawned by conventional means and method of warfare.\textsuperscript{231} A hypothetical example would be the systematic destruction by fire of the rainforest of Amazon River basin, thereby indicating a global climatic change. But by a large, the phenomena catalogued illustratively in Article II (man induced earthquakes, tsunami and such like) can only accomplished with unconventional weapons. For the most part, these techniques do not even reflect existing capabilities, and they are therefore future oriented. Weather manipulation through cloud seeding has already been attempted, albeit not with spectacular results.

Since as indicated the framers of the ENMOD Convention decided that its application should be circumscribed to the relations between states parties, it is

\textsuperscript{230} ibid
\textsuperscript{231} M.J.T. Caggiano, Supra 191, at, p 312
manifest that they deemed the text innovative (rather than declaratory of customary international law) nothing has happened since the adoption of the ENMOD Convention to suggest that the legal position has changed in this regard.\textsuperscript{232}

2. Additional Protocol I of 1977 Geneva Convention:- Additional Protocol I of 1977 deals with the issue of the environment twice. Article 35(3) proclaims the basic rule:

It is prohibited to employ methods or means of warfare which are intended or may be expected to cause widespread, long term or sever damage to the natural environment.

Article 55(1) goes on to state:

Care shall be taken in warfare to protect the natural environment against widespread, long term and sever damage. This protection includes a prohibition of the use of methods or means of warfare which are intended or may be expected to cause such damage to the natural environment and thereby to prejudice the health or the survival of the population.\textsuperscript{233}

The first sentence of Article 55 (1) reflects the underlying concept, to wit, the need to protect the natural environment in the warfare, and it is interesting that the word ‘warfare’ is retained in the text: ordinarily it was avoided by the framers of the protocol (who preferred the phrase international armed conflict). The second sentence in essence replicates Article 35(3). However, apart from slight stylistic changes, the second sentence adds the verb ‘includes and the rider thereby to prejudice the health or survival of the population. Both additions are problematic. The first may imply that the prohibition incorporated in Article 55 (1) is just an example for the scope of application and not a definition or interpretation of the foregoing sentence. Yet it has never been contended that the protection of the natural environment under Article 55 (1) breaks any new ground as compared to Article 35 (3). In contrast the second addition to the second sentence of Article 55 (1) appears to restrict its range to environmental damage that specifically prejudices human health or survival. Apparently the desire of the framers of protocol was to reflect two conflicting stand points: one advocating the notion that the protection of environment at the time of war is an end in itself, Article 35(3) and the other subscribing to the view that protection is

\textsuperscript{232} R.G. Tarasofs\k, Legal Protection of the Environment During International Armed Conflict, NYIL, 14, 1993, p. 47

\textsuperscript{233} P.A. Rogers, Law on the Battlefied, 1996, p. 116
only designed to guarantee the survival or health of human beings. Article 55(1) refer
to the ‘health or survival’ of the population. It follows that ‘mere survival of the
population is not enough; when the population’s health is prejudiced the ban is
applicable. Unlike many other Clause of the Protocol, Article 55(1) employs the
expressions population unaccompanied by the adjective civilian. This was a
purposeful omission underscoring that the whole population, without regard to
combatant status, is alluded to. In any event, the replication of the same prohibition in
Article 35(3)-forming part of section of the protocol related to method and means of
warfare, shows that the civilians are not the sole beneficiaries of the protection of the
natural environment. Moreover, in light of the condition that the environmental
damage be long-term, its effects are likely to outlast the war, and then any distinction
between the combatants and civilian become anachronistic.\textsuperscript{234}

Some commentators criticized the text of Article 55(1) for not elucidating
whether the whole population of the country is referred or the segment there of for
instance those people who are in the vicinity of a battle field but this is not very
persuasive. The protocol interdictions are phrased in the manner featuring what is
invented or expected to occur. The “may be expected” formula has also been
disparaged. Still what the text does is accentuate prognostication (in the sense of both
premeditation and force ability rather than result. Hence:

I. On the other hand mere inadvertent collateral environmental effect of an attack
does not come within the campus of prohibition. As long as the damage to the
natural environment is neither intended nor expected, no breach of protocol
occurs.

II. On the other hand where such an intention or expectation exists, it is immaterial
that in fact only a portion of the population has been adversely affected. Indeed, if
the intention or expectation can be established, it does not matter if ultimately
there would be no victims at all. After all the text posits ‘prejudice to health or
survival of the population, not actual injury.’\textsuperscript{235}

\textsuperscript{234} R. Desgagne, ‘The Prevention of Environmental Damage in Times of Armed Conflict:
Proportionality and Precautionary Measure, 3 YIHL, 2000, p.116
\textsuperscript{235} Ibid
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Although Article 55(1) does not expressly designate the natural environment as civilian object, it is noteworthy that the clause features in a Chapter of the Protocol entitled as ‘civilian object’. In comparison to civilian object to general, the natural environment is granted special protection. But the point is that once classified as a civilian object, the natural environment must not be the object of attack.

This general observation is subject to an important caveat. Whereas it is correct to say that natural environment in its plenitude must not be the object of attack, the legal status of the specific element of the environment would depend upon the changing circumstances. A forest for instance, can become a military objective owing to enemy use or even due to its strategic location. If so it would be exposed to attack.\(^{236}\)

Article 55(1) appears in a section of the Protocol which affects the civilian population, individual civilians and civilian objects on land only. The exclusion of naval and air warfare from the reach of Article 55(1) is emphasized by some scholars. But considering that Article 35(3) is not similarly circumscribed, it appears clear that the Protocol’s protection of the natural environment applies to all types of warfare.

The Protocol does not define the phrase ‘natural environment’. The ICRC Commentary suggests that it should be understood in the widest sense to cover the biological environment in which a population is living, i.e. the fauna and flora-as well as climatic elements. There is no doubt that Article 35(3) and 55(1) constituted an innovation in LOIAC at the time of their adoption. It is some time alleged that the provision have in the mean time been accepted as part and parcel of customary international law. But this is wrong. As late as 1996, the international Court of Justice- in the Nuclear Weapon Advisory Opinion enunciated that the provisions are not bound by these constraints. In other words the relevant Protocol’s Clause has not yet crystallized as customary international law. In 2000, the Committee Established to Review the NATO Bombing Campaign against the Federal Republic of Yugoslavia opined that Article 55 ‘may’ reflect current customary law, while nothing that ‘the International Court of Justice appeared to suggest that it does not’.

\(^{236}\) ibid at p.128
3. Supplementary texts

(a) The Rome Statute Article 8(2)(b)(iv) of the 1998 Rome Statute of the International Criminal Court stigmatize as a war crime:

Intentionally launching an attack in the knowledge that such attack will cause incidental loss of life or injury to civilians or damage to the civilian object or widespread, long-term and severe damage to the natural environment which would be clearly excessive in relation to concrete and direct overall military advantage anticipated.\(^{237}\)

This text is based on the language of the protocol, but there are two significant disparities as regard the protection of the environment: (i) the statute requires both intention and the knowledge of the outcome, rather than either intention or expectation as set forth in the Protocol; and (ii) for the war crime to crystallize, the damage to the natural environment must be clearly excessive in relation to the military advantage anticipated. The first disparity is warranted by the labeling of the act as a war crime, namely the establishment of individual criminal responsibility and liability for punishment. Only an individual acting with both knowledge and intent would have necessary \textit{mens rea} exposing him to penal sanctions. The second disparity is designed from the amalgamation in one paragraph of the \textit{materia} of the protection of the civilians and that of natural environment. The principal of Proportionality has already been mentioned; a balance must be struck between the military advantage anticipated and any incidental injury to civilians or civilian object (unless an element of environment like a forest-is deemed a military object in circumstances prevailing at the time).

But the special regime set up for the protection of the natural environment in Article 35(3) and 55(1) of the Protocol, brings in the three cumulative conditions of wide-spread long term and severe damage in lieu of proportionality. Under the protocol no action in warfare is allowed to reach the threshold of widespread long-term and severe damage to the natural environment, irrespective of any other considerations. Should the three cumulative criteria be satisfied, the action will be in breach of the protocol even if it is clearly proportional. This is not the case in the Rome statute

\(^{237}\) See, H Westing, ‘Environmental Warfare,1984, p645
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where damage to the environment is explicitly added ‘as an element in the proportionality equation.’ 238

(b) Protocol III, annexed to the Weapons Convention;

The Preamble of the 1980 Convention Weapons Convention repeats verbatim the text of Article 35(3) of the Protocol I(without sighting the sources ). Article 2 (4) of the Protocol III, annexed to the Convention, lay down:

It is prohibited to make forests or other kinds of plant cover the object of attack by incendiary weapons except when such natural elements are used to cover, conceal or camouflage combatants or other military objectives.239

This provision is of course, very limited in scope. It relates to only a small part of the natural environment: forest and other kind of plant cover. In addition, it grants protection not against attacks in general, but only against attack by specific weapons. And the protection ceases when the enemy issuing the forest for cover, concealment or camouflage. It has therefore been contended that the provision has little or no practical significance. But the protection of civilian or civilian object in general is contingent on non-abuse, and there is no reason to protect a forest from attack when the enemy is conducting military operations under cover. The reference in the text to forest as military objectives presumably relates either to their actual use by the enemy or to their strategic location. Protocol III is not accepted as customary international law.

c) The Chemical Weapon Convention:

The use of Herbicides (chemical defoliants) for military purposes-primarily, in order to deny the enemy sanctuary and freedom of movement in dense forest- caught wide attention during the Vietnam War, owning to the magnitude of American herbicides operations and the fact that they stretched over a long period of time. The United States conceded that to herbicides can come within the purview of the prohibition of ENMOD Convention, but only if it upset the ecological balance on the ground that recourse to herbicides, albeit destructive of an element of the

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environment, does not amount to a manipulation of natural process.\textsuperscript{240} However the interpretation that use of herbicides can under certain condition be equated with environmental modification techniques under Article II of the Convention was authoritative reaffirmed in a Review Conference in 1992. Evidently, the conditions listed in Article I(1) of the ENMOD Convention must not be ignored. In particular, widespread long lasting or severe, in which case it would not be in breach of the ENMOD Convention. It is therefore desirable to recall the seventh Preamble Paragraph of the 1993 Chemical Weapons Convention, Recognizing the prohibition, embodied in the pertinent agreements and relevant principles of international law of the use of herbicides as a method of warfare.

Although herbicides were simultaneously omitted from the definition of banned chemical weapon in the operative clause of the Convention as part of a compromise package- the United States has formally renounced the first use of herbicides in time of armed conflict, except within U.S installation or around their defensive perimeters.\textsuperscript{241}

The allusion in the preamble of the Chemical Weapon Convention to the pertinent agreement is somewhat vague, but it seems that the framers had in mind both the ENMOD Convention and Protocol I. Of greater weigh is the reference to the relevant principle of international. The inescapable connotation is that the prohibition is now predicated on customary international law.

\subsection*{4.8.2 The Dissimilarities between the ENMOD Convention and Protocol I}

It is well worth recalling that the ENMOD Convention and Protocol I although negotiated separately (the former in the context of the UN and the other as the part of the process of updating the Geneva Convention) were both signed in 1977. Needless to say the framers of each text were fully cognizant of other.\textsuperscript{242} The two instruments were designed to achieve different purposes, and there is no overlap in substance. In its temporal sphere of application, Protocol I is narrow in scope then in the ENMOD Convention. Although Protocol I draws no distinction between enemy territories and the territories of the belligerents causing the environmental damage, the instrument

\textsuperscript{240} K. Korhonen, 'The ENMOD Review Conference: The First Review Conference of ENMOD Convention on Disarmament ,1985,137

\textsuperscript{241} Ibid

\textsuperscript{242} W.D Verwey, Supra, 202
applies only to international armed conflict—Protocol II—does not incorporate a provision parallel to articles 35(3) and 55(1). For its part the ENMOD Convention is germane to any situation to which a environmental technique is deliberately resorted to for military or hostel purpose and inflicts sufficient injury on another state party. The phraseology would cover the case of a hostile use of an environmental modification technique in the course of a non international armed conflict, were the weapon is wielded intentionally against domestic foe, but cross border environmental damage to another state party. Where weaponry is concern, the Protocol has a wider scope that the ENMOD Convention. Whereas the ENMOD Convention is confined to one single type of weaponry, i.e., an environmental modification technique the Protocol protects the natural environment and the population against damage inflicted by nay weapon what so ever. This can be looked at from the additional angle. In its thrust the Protocol protects the environment whereas the ENMOD Convention protects from the manipulation of the environment. The Protocol goes much further than the ENMOD Convention in protecting the natural environment not only against intentional infliction of damage in the course of warfare, but also against purely unintentional and incidental damage which however can be expected. The Protocol accordingly provides protection also against non-intentional ecological war, provided that the consequences for the natural environment are foreseeable.243 Neither the Protocol nor the ENMOD Convention applies in every case of destruction or damage. A threshold is set up in the two instruments, and remarkably both use the same, qualifying adjectives ‘widespread, long term and severe. This ostensible resemblance between the two texts is deceptive for the following reasons:

1) In the ENMOD Convention the three terms are enumerated alternatively (widespread, long lasting severe effects), whereas in the Protocol they are listed cumulatively (widespread, long lasting and severe) thus, under the ENMOD Convention suffice it for one of the three yard sticks to be met, but under the Protocol all three conditions must be satisfied concurrently. Since environmental damage often

meets one or even two of the condition yet not the third, sets a bar which may prove to high.244

2) The three conditions, whether conjunctive or disjunctive, governs the scope of area affected, duration and degree of damage. But the ENMOD Convention and the Protocol attribute different meaning to identical terms in conformity with an understanding relating to Article 1, attached to the ENMOD Convention, “widespread” encompasses an area on the scale of several hundred square kilometers long lasting endures for period of months or approximately a season and sever, involves serious or significant destruction or harm to human life, natural and economic resources are other assets. The first two criteria, defined in quantitative terms are clear enough, the third is more ambiguous.245 In may event the understanding explicitly states that its definitions are not intended exclusively for the ENMOD Convention and they do not “prejudice the interpretation of the same or similar terms” when used in any other agreement. The understanding definition are therefore inapplicable to the Protocol were the position is radically divergent. The meaning of the adjective in the Protocol is sufficiently not clear. However it is accepted that the extent of widespread may well be less than several hundred kilometers. Above all the time scales are not the same. While in the ENMOD Convention long lasting effects are counted in months, for the Protocol long terms was interpreted as a matter of decade. Where injury to the health of the population is concern it is discerned that since short term effects are beyond the ambit of the prohibition, what is meant is acts causing, e.g., ‘congenital defects, degenerations or deformities. The trouble is that it is impracticable to calculate in advance the likely durability of environmental damage.246

4.9. Role of UNO toward Nuclear safety and Disarmament policy

The two major bodies that directly deal to dismantle the nuclear weapon issue are Security Council and International Atomic Energy Agency.

244 1977 Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques Article 1(2)1976
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a) Security Council

Security Council, as one of the principal organs of the United Nations and is charged with the maintenance of international peace and security. By and large the Council has predominantly passed several resolution in view of disarmament but it can be argued that that the five permanent members of the United Nations Security Council, who are all nuclear powers, have created an exclusive nuclear club that predominately addresses the strategic interests and political motives of the permanent members; for example, protecting the oil-rich Kuwaitis in 1991 but poorly protecting resource-poor Rwandans in 1994. To promote their national interests, Indian officials have suggested that the number of permanent members be expanded to include non-nuclear powers, or abolishing the concept of permanency altogether. However the year 2009 seem to be more affirmative.\(^{247}\) The Security Council affirmed its commitment to the goal of a world free of nuclear weapons and established a broad framework for reducing global nuclear dangers, in an historic summit-level meeting chaired by United States President Barack Obama on 24th September 2009.

The fifth in the Council’s history to be held at the level of heads of State and government began with the unanimous adoption of a resolution by which the 15-member body voiced grave concern about the threat of nuclear proliferation and the need for global action to combat it. Secretary-General Ban Ki-moon welcomed the resolution, adding that the summit was “an historic event that has opened a new chapter in the Council’s efforts to address nuclear disarmament and non-proliferation. Stressing that “nuclear disarmament is the only sane path to a safer world,” Mr. Ban said in his opening remarks that “nothing would work better in eliminating the risk of use than eliminating the weapons themselves.” In resolution 1887, the Council called on countries to sign and ratify the Nuclear Non-Proliferation Treaty (NPT), and created additional deterrence for withdrawal from the treaty. In addition, the Council called on all States to refrain from conducting a nuclear test explosion and to sign and

ratify the Comprehensive Nuclear-Test-Ban Treaty (CTBT), thereby bringing it into force as soon as possible.248

However the propaganda was made clear when the representative members of Security Council initiated their desire to see a nuclear weapon free world. The proposals were a welcoming sign and a ray of hope to the present humanity.

b) International Atomic Energy Agency

The IAEA was created in response to the deep fears and great expectations resulting from the discovery of nuclear energy, fears and expectations that have changed profoundly since 1945 and continue to fluctuate. As a result, what the IAEA is asked to do about nuclear energy and indeed, what it can do and does, are much affected by the vicissitudes of national moods, international politics and technological change. The IAEA’s history illustrates these points.249 Its genesis was President Eisenhower’s address to the General Assembly of the United Nations on 8 December 1953, though many of the ideas he presented had earlier roots. Diplomats and lawyers, advised by scientists, and drawing on the precedents set by other organizations, developed these ideas into a charter of an international agency, the IAEA Statute, which 81 nations unanimously approved in October 1956. In the years following Eisenhower’s speech and the approval of the IAEA’s Statute the political and technical climate had changed so much that by 1958 it had become politically impracticable for the IAEA to begin work on some of the main tasks foreseen in its Statute. But in the aftermath of the 1962 Cuban missile crisis, the USA and the USSR began seeking common ground in nuclear arms control. As more countries mastered nuclear technology, concern deepened that they would sooner or later acquire nuclear weapons particularly since two additional nations had recently ‘joined the club’, France in 1960 and China in 1964.250 The safeguards prescribed in the IAEA’s Statute designed chiefly to cover individual nuclear plants or supplies of fuel, were clearly inadequate to deter proliferation. There was growing support for international, legally

248 BECHHOEFER, B.G., Postwar Negotiations for Arms Control, (New York 1992), p. 34
250 BECKMAN, R.L., Nuclear Nonproliferation, Congress and the Control of Peaceful Nuclear Activities, p. 30; and RHODES, R., “The day Jimmy Byrnes appointed Bernard Baruch was the day I gave up hope”, Dark Sun: The Making of the Hydrogen Bomb, (New York 1974), p. 240
binding, commitments and comprehensive safeguards to stop the further spread of nuclear weapons and to work towards their eventual elimination. This found regional expression in 1967 in the Treaty for the Prohibition of Nuclear Weapons in Latin America (the Tlatelolco Treaty) and global expression, in 1968, in the approval of the Treaty on the Non Proliferation of Nuclear Weapons (NPT), a treaty that Ireland had been the first nation formally to propose some ten years earlier. The 1970s showed that the NPT would be accepted by almost all of the key industrial countries and by the vast majority of developing countries. At the same time the prospects for nuclear power improved dramatically. The technology had matured and was commercially available, and the oil crisis of 1973 enhanced the attraction of the nuclear energy option. The IAEA’s functions became distinctly more important. But the pendulum was soon to swing back. The first surge of worldwide enthusiasm for nuclear power lasted barely two decades. By the early 1980s, the demand for new nuclear power plants had declined sharply in most Western countries, and it shrank nearly to zero in these countries after the 1986 Chernobyl accident. Paradoxically, when all was well with nuclear energy, the governments of countries that had advanced nuclear industries tended to keep the IAEA at a distance; when matters went badly they were ready to agree to a more extensive role for the organization. This was true on the two occasions when it became clear that IAEA safeguards had been violated and also after the two major accidents that have taken place in nuclear power plants. In 1991, the discovery of Iraq’s clandestine weapon programme sowed doubts about the adequacy of IAEA safeguards, but also led to steps to strengthen them, some of which were put to the test when the Democratic People’s Republic of Korea (DPRK) became the second country that was discovered violating its NPT safeguards agreement. The Three Mile Island accident and especially the Chernobyl disaster persuaded governments to strengthen the IAEA’s role in enhancing nuclear safety. In the early 1990s, the end of the Cold War and the consequent improvement in international security virtually eliminated the danger of a global nuclear conflict. Broad adherence to regional treaties underscored the nuclear weapon free status of

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Latin America, Africa and South East Asia, as well as the South Pacific. The threat of proliferation in some successor States of the former Soviet Union was averted; in Iraq and the DPRK the threat was contained. In 1995, the NPT was made permanent and in 1996 the UN General Assembly approved and opened for signature a comprehensive test ban treaty. While military nuclear activities were beyond the IAEA’s statutory scope, it was now accepted that the Agency might properly deal with some of the problems bequeathed by the nuclear arms race verification of the peaceful use or storage of nuclear material from dismantled weapons and surplus military stocks of fissile material, determining the risks posed by the nuclear wastes of nuclear warships dumped in the Arctic, and verifying the safety of former nuclear test sites in Central Asia and the Pacific.

4.10 Analytical Summary

The post war study on nuclear weapon reveals out the most horrifying truth of human plight that the weapon has the potentiality to aggregative the suffering of disabled and renders their death inevitable, contrary to law of humanity. The dearth of universal consensus on prohibition of nuclear weapon use and the want of sufficient enquiry and study on the consequential effect of nuclear war, nuclear plant disaster alarms the future generation. These events are beyond human control and tragically the consequence can hardly be treated. At such juncture there is a need to protect the existing humanity and the future generation. It is indeed a regrettable fact that customary international law has not yet developed to point where as adequate protection is provided for the environment in wartime. The treaty law is more advanced, but the threshold set up by the Protocol I is too high especially where durability of environmental damage is concerned and the ENMOD Convention lends itself to restrictive interpretations. There is no doubt that some intentional and direct damage to the environment is not covered by either the ENMOD Convention or the Protocol, and is consequently still permissible.

A number of scholars have called for completely new Conventions, devoted exclusively to the subject and addressing it systematically. However, such a dramatic metamorphosis of lex scripta is not likely at the present juncture. One well-versed

commentator, inclined to believe at first blush that formulation of such a treaty was timely, had to concede upon reflection that governments are not at present ready to accept significant new obligations in the field. Regardless of the advisability of adopting a comprehensive and innovative treaty, what is evidently necessary is putting an end to any current controversy in identifying the threshold of environmental damage amounting to breach of international law.

4.11 Conclusion

It has become clear, from the evidence cited in this chapter, that there is scientific and factual basis for the connection that nuclear war can result in the destruction of civilization-and perhaps of man himself, along with various other creatures that exist on this planet.\(^{253}\) The possibility is sufficient to sustain this thesis. Certainty is neither claimed nor required. While all form of conventional warfare leave open the prospect recovery and a continuance of human civilization and the human species, nuclear war has the potential to eliminate recovery, shatter civilization beyond restoration, and destroy the human species and human habitat.\(^{254}\) The expressive words of jimmy carter in his farewell speech of January 14, 1981 bear repetition: “In an all-out nuclear war, more destructive power than in all of World War II would be unleashed every second more people killed in the first few hours then in all the war of history put together. It is important to note that all discussion prior to 1983 concerning the legal implication of nuclear war was conducted without any reference winter scenario. Even without reference to it, the legal evidence was strong enough.”\(^{255}\) The dramatic new scientific facts now available must necessarily make a significant further impact upon discussion of the legal question involved.


\(^{254}\) 1977 Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques Article III(1)