Arms Control and International Environmental Law

Ove Bring

On 1 March 1954, the United States conducted a test explosion of a multimegaton hydrogen bomb, called Bravo, at the Bikini Atoll in the Pacific Ocean. The declared security area close to the Marshall Islands (American trust territory under UN supervision)[1] consisted of a rectangular portion of the high seas of about 130,000 sq. km. around the Bikini and Eniwetok Atolls. The detonation of Bravo demonstrated however that the security area was not large enough. An unexpected shift in wind sent radioactive particles over the islands of Rongelap, Rongerik and Uterik, exposing about 230 islanders to radioactivity. At the time of the detonation, the Japanese fishing boat Fukuryu Maru ("Lucky Dragon") was about 130 km. from Bikini. When the ship arrived at port, the crew members revealed that they had experienced strange things at sea. Something resembling snow had fallen from the sky. With outstretched hands, the seamen had received the descending grey-white flakes - which later turned out to be fatally radioactive. The fish catch on the "Lucky Dragon" had also been exposed to radioactivity. During the period March-June 1954, other contaminated catches, which amounted to 135 tons, were confiscated from seventy-seven fishing boats. At first, the catches came from the waters around Bikini, later (in April) radioactive fish were found at Formosa and finally (in June), contaminated fish appeared off the coasts of Japan.[2]

The shift in wind at the Bikini Atoll in March 1954 contributed to the emergence of the Partial Test Ban Treaty, negotiated between the superpowers in Moscow in 1963. The treaty, which, among other things, bans the testing of

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1 In 1947, the Marshall Islands, the Mariana Islands and the Caroline Islands (all American trust territories) were declared "strategic areas" in conformity with Article 82 of the UN Charter.

2 See Johnson (Theutenberg), *Suveränitet i havet och luftrummet*, Stockholm 1972, p 81 and sources cited therein.

nuclear weapons in the atmosphere (but not underground), states in its preamble that the original parties (USSR, USA and UK) are

> Seeking to achieve the discontinuance of all test explosions of nuclear weapons for all time, determined to continue negotiations to this end, and desiring to put an end to the contamination of man's environment by radioactive substances.[3]

In other words: from the environmental standpoint, among others, a limited treaty was considered insufficient; the "Partial Test Ban" (PTB) should in the long run be replaced by a "Comprehensive Test Ban" (CTB). The Bikini-PTB connection serves in any case as an illustration of how experience of the effects of weapons (in this case, nuclear weapons) can lead to an agreement on arms control. Awareness of the injurious effects of various weapons on the natural environment continues to be a memento for further efforts to bring about additional arms control regulations.

Effects of Weapons on the Environment

It is a truism that war causes environmental destruction. It is also self-evident that weapons tests themselves can have disastrous consequences for the natural environment. We will first discuss the effects of NBC weapons on our environment, i.e., the effects of nuclear, biological and chemical weapons. Thereafter, the effects of certain types of conventional weapons will be dealt with.

Nuclear weapons. The example of the Bikini bomb illustrates the damage that can be inflicted on humans and the environment as a result of radioactive fallout from atmospheric nuclear weapons tests. Several of the crew members of the "Lucky Dragon" seemed to have died as a consequence of the fallout.

The American tests on Bikini and Eniwetok were terminated in 1958. In August 1975, it was observed that Bikini was still uninhabitable, due to the radioactive contamination of drinking water and vegetation. It was not until 1977 - after nearly two decades - that Eniwetok had reached a safe level.[4]

The UN Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) regularly calculates the doses of radiation that have been and will be emitted by nuclear weapons tests. The Committee has also calculated the doses received by the earth's population through the successive contamination of the biosphere (as of January 1997, a total of 2,048 atmospheric and underground tests may have taken place).[5] Human beings receive doses from radioactive particles on the ground as well as from radionuclides that enter the body through food and inhalation and emit radiation in the body for as long as they remain

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3 *Status of Multilateral Arms Regulation and Disarmament Agreements*, United Nations, New York 1988, p 20.

4 Arthur H Westing, *Weapons of Mass Destruction and the Environment*, SIPRI, London 1977 p 23.

5 SIPRI Yearbook 1997. *World Armaments, Disarmament and International Security*, Stockholm/Oxford 1997, pp 434-435.

active. According to the 1981 UN Study on Nuclear Weapons, the total dose per person (up to the year 2000) is expected to be about 120 millirads, which translates into about 150,000 premature deaths as a result of cancer or genetic damage.

Even underground tests can contribute to the radioactive pollution of the biosphere. Explosions that take place near the earth's surface can break through that surface and "leak" radioactivity into the atmosphere. In January 1997, a total of 1,518 underground tests had taken place and a great number of these can be assumed to have resulted in radioactive leakage. In recent years, it appears however that progress has been made in keeping underground explosions well-contained. The French Government claims that this applies to the underground tests at the Mururoa Atoll in the Pacific Ocean. In May 1986, the seventy-eighth underground explosion in French Polynesia was registered since France began its underground tests in 1975. French scientific experts continually checked the air and vegetation - according to the authorities, without any alarming results. It was however observed at about this time that the ocean temperature between French Polynesia and the Equator had increased from about 28 degrees Celsius to about 32 degrees Celsius, which probably explained the increased incidence of cyclones in the area. One theory is that hot radioactive gases had been injected into the ocean water as a result of the nuclear tests.[6] This would also explain the increased incidence of poisoned (and poisonous) fish in this part of the Pacific Ocean. A number of the countries in the Pacific Ocean were concerned. The Governor General of the Solomon Islands took advantage of the Pope's visit in May 1984 to protest against the French tests. And representatives from South Pacific countries used to remark: "If the tests are as harmless as the French say, why don't they conduct them at home instead of going to the other side of the globe?"[7]

In the 1990s the French policy led to consumer boycotts of French wine, but two days after the French test on 27 January 1996 President Jacques Chirac announced that France had concluded its nuclear testing programme.

With regard to the underground tests of the former Soviet Union it was reported in 1993 that Russian scientists were convinced that the 1988 earthquake in Armenia, which took the lives of 45,000 people, was caused by a nuclear explosion in Novaja Zemlja in the Arctic Sea. Scientists at the Geological Institute in Moscow were also convinced that nuclear tests in the Semipalatinsk area in Kazachstan had produced seismic effects (small earthquakes) in other parts of the Soviet Union and northern Iran.[8]

The effects on the environment of nuclear tests in peace-time is one thing, the consequences of a nuclear war is quite another. In the latter case, we are talking about environmental effects of horrific proportions. Of the energy released during a nuclear explosion above the ground, about fifty percent will consist of

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6 Rosalie Bertell, *The Health of the Oceans, Myrdal Symposium on the Denuclearization of the Oceans*, Norrtälje 1984, p 12 f in an unpublished manuscript.

7 For example, C Narokobi, of Papua-New Guinea, Myrdal Symposium on the Denuclearization of the Oceans, Norrtälje, Sweden 1984, in an address of 12 May (according to notes of the author).

8 Reported in the French scientific magazine *Science & Vie*, November 1993.

shock waves, thirty-five percent will be heat radiation and fifteen percent, ionized radiation. The first two of the above-mentioned effects will dominate in the target area itself. There, everything will be vaporized, incinerated or ignited by the heat and pulverized, crushed or tumbled by the shockwave. Outside the area of total destruction, there may be a ring-shaped border zone where individuals of various species survive, but where the levelling of trees and other redistribution of the earth's superstratum drastically - through craters or more temporarily - changes the environment. The primary effects can be expected to trigger a secondary sequence of events, e.g., forest fires.[9]

The effects of the ionized radiation have been indicated to some extent above. A distinction can be made between initial radiation, which reaches the ground within the first minute of the explosion (a primary effect), and lingering radiation in the form of radioactive fallout or radioactivity induced in the ground (secondary effects). Both the immediate radioactive fallout and the long-term fallout following a ground explosion can affect countries not directly involved in the nuclear war. The radiation can cause mutations (genetic alterations) in plants and animals, which could in turn cause incalculable alterations of the ecosystem (research in this area has not however produced any conclusive results). As to humans, we know that radiation can have delayed somatic effects (blood cancer, diminished fertility, increased frequency of stillbirths) and probably genetic effects as well.

The secondary effects of nuclear weapons explosions will also affect the earth's climate. Dust and gases, especially nitric oxides, will be spread in the atmosphere. Huge dust clouds will filter the sunlight, i.e., result in diminished sun rays, which will inevitably be accompanied by a cooling of the earth's atmosphere. Even small changes taking place over a limited number of years can have serious consequences. A drop in the temperature by one degree Celsius would decrease the number of frost-free days in, e.g., Canada and northern Russia, so that the cultivation of wheat in these areas would no longer be possible. Some scientific studies have resulted in even more alarming scenarios. Carl Sagan introduced in a much discussed article in Foreign Affairs (Winter 1983/84) the concept of “the nuclear winter”. A nuclear war accompanied by detonation of more than 500-2,000 strategic explosions would create enormous dust clouds that rise to the troposphere and even the stratosphere. These clouds will darken life on earth in the ensuing years, especially in the Northern Hemisphere where the explosions are most likely to take place. This applies particularly to nuclear weapons attacks which are “countervalue”-oriented, i.e., intended to destroy industrial centres of value to the adversary's war capability. Burning industrial cities will generate enormous quantities of black oily smoke which will darken the troposphere and send soot up to the stratosphere. This will in turn result in rather long-term temperature drops of previously unknown proportions: about 10 degrees Celsius. This corresponds to the decrease needed to introduce a new ice age, the difference being that ice ages last thousands of

9 Tor Larsson, *Miljöeffekter av kärnvapenkrig, Krig och miljö*, report published by Miljövårdsberedningen, Stockholm 1982, p 137 ff.

years, whereas the "nuclear winter" ends after a number of months or years.[10] At that point, however, damage to the human habitat is already a fact.

Climatic alterations will also be caused by the depletion of the ozone layer in the stratosphere - a likely effect if many nuclear explosions of megaton force are detonated. Such explosions will result in the spread of nitrogen oxides in the atmosphere. These reach the ozone layer and destroy, through certain chemical reactions, large amounts of ozone without being consumed themselves. The result is damage to the filter against the sun's ultraviolet radiation which the ozone layer provides. The ensuing increase in ultraviolet radiation reaching the earth's surface will have detrimental biological consequences. The incidence of skin cancer will probably increase. Mutations in plants and animals will be another likely effect. The ozone layer recovers only slowly, if at all.

Biological Weapons (BW). There are good reasons why UN bodies since 1948 have classified chemical and biological weapons, together with nuclear weapons, as "weapons of mass destruction".[11] BC weapons are yet another example of weapons whose use in war poses a serious threat to the ecosystem's natural balance. A disturbance of that balance can result in a rapid deterioration of the human environment and the essential conditions for life. The use of BW (which would constitute a breach of international law) could serve to spread toxins and diseases among the enemy's armed forces or civilians, among the enemy's livestock or among crops or vegetation that protect the enemy's armed forces.

Biological (bacteriological) means of warfare are based on the infectious properties of pathogenic microorganisms. A single gram of any substance can contain more than one trillion bacteria. This means that a single fighter-bomber equipped with spray tanks can release hundreds of kilos of infectious fluid or powder over thousands of square kilometres. If the bacteria in question results in infectious and contagious diseases, the total area of contamination will be larger. It is not however easy to rationally exploit the military potential of BW. The spread of the diseases is unpredictable and the ability of the bacteria to survive is dependent on environmental factors.[12]

Biological weapons have not thus far been considered to be of much military value and have not therefore been used on a large scale in war. The rapid progress of microbiological and epidemic research can however change that picture. The 1972 Biological Weapons Convention (prohibiting the production and stockpiling of such weapons) perhaps came at just the right time. If the various factors of uncertainty associated with biological warfare can be minimized through new research findings, it may be tempting to use pathogenic microorganisms as terror weapons with long-term effects. In a target area, the pathogens can remain as a disease-producing reservoir, thus killing humans,

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10 Sagan, Carl, *Nuclear War and Climatic Catastrophe: Some Policy Implications*, Foreign Affairs, Winter 1983/84, p 262 ff.

11 The definition of weapons of mass destruction was established for the first time by the UN Commission for Conventional Armaments in a resolution of 12 August 1948 which set forth the Commission's mandate. UN Document S/C.3/30, 13 August 1948.

12 See generally on the subject, Julian Perry Robinson, *The Effects of Weapons on Ecosystems*, UNEP Studies, Vol 1, Oxford 1979.

animals and plants. It has been stated that if the Allies in the Second World War had implemented their contingency plan for B-weapon warfare with the anthrax bacteria, cities like Berlin, Frankfurt, Hamburg, Stuttgart, Aachen and Wilhelmshafen would to this day be contaminated and uninhabitable.[13]

Chemical weapons (CW). As with BW, chemical means of warfare are biospecific, i.e., they only attack living organisms. C weapons exploit the toxic properties of certain chemical substances. These weapons include gases containing volatile liquids or oils that disperse over vegetation and cling to and are sucked into objects that they come into contact with; or liquid drops which evaporate and release noxious vapours injurious to the human organism. Mustard gas, which was used during the First World War and in the Iran-Iraq War 1980-88, is an oily dark-coloured ethylene-based liquid that penetrates clothes and injures the skin and eyes. Other gases that damage the skin contain arsenic, e.g., lewisite.

When it comes to destroying human life, nerve gases are however the most effective. They are two to four times as toxic as their predecessors among the war gases. Nerve gases like tabun, sarin and soman, which enter the body through the lungs, digestive system or the skin, kill quickly. Even more toxic is the oily, non-volatile fluid VX which was produced as a means of warfare by the US between 1961 and 1967. Inhalation of a half-milligram can be fatal, as can one milligram that comes in contact with the skin.[14] Compared with sarin, VX has the military advantage of a more penetrating and resistant toxicity, which translates into long-term contamination of the natural environment. Even if vegetation can survive a nerve gas attack, the resulting contamination of nature poses a serious danger to animals who feed on plants.

C-warfare substances are often designed to be spread on the battlefield with the help of conventional military means: artillery, land mines, aerial bombs, tactical missiles and rockets. An artillery shell can in theory contain several million deadly doses of nerve gas, which means that it can cause a thousand times as many deaths as conventional weapons.

Chemical weapons have only been used on a large scale in two wars: the First World War (about 250,000 tons) and the Vietnam War (about 98,000 tons). The chemical warfare of World War I did not apparently result in lasting damage to the ecosystem. This was not at all the case with the Vietnam War. More than 90,000 tons consisted of herbicides, whereas the remaining portion consisted of irritants like teargas. The toxic effects of herbicides are limited mainly to vegetation; however, the defoliant "Agent Orange" also turned out to be detrimental to humans, by producing certain adverse genetic effects. It has been said that about eighty-four percent of the herbicides in Vietnam were used to deprive the enemy of foliar protection and about fourteen percent were used against crops to reduce the food supply.[15] Defoliation resulted in destruction of

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13 Interview in 1981 with Dr. R G H Watson, Chief of British biological & chemical weapons laboratory in Porton Down, reported by Julian Perry Robinson in the 1982 Stockholm Report, *Krig och miljö*, p 83 and 91.

14 Brian Beckett, *Weapons of Tomorrow*, London 1982, p 128.

15 Julian Perry Robinson in the 1982 Stockholm Report, *Krig och miljö*, 1982, p 80.

the ecological balance in large areas. Some 85-100 percent of the trees died in certain areas and the timber supply diminished by no less than 2 million cubic meters.[16] The soil was depleted and could no longer make use of nutrients. The forest was replaced by high-growing grass and brush. The incidence of larger mammals decreased, whereas rats, other rodents and mosquitos have increased. This subjected the population to increased health hazards.

It is clear that the ocean fish outside South Vietnam have diminished since the war. This may be a result of the chemical warfare against the mangrove swamp in the coastal areas, where many fish have their spawning and breeding grounds.

In a future war with C weapons, less volatile (and thus lingering) substances would probably be used to a large extent. Local ecosystems would thereby be subjected to much greater strain than has previously been the case. Experiences from Vietnam do not provide a complete picture of the effects that herbicides can have on the environment. Heavy rains and high air temperature did after all break down the poisons rather fast. There are stronger herbicides that can be used for a long-term extermination of crops and sterilization of earth.

High-Explosive Conventional Weapons. High-explosive weapons (bombs, missiles, mines) can be so adapted that a particular type of damage will dominate: the pressure effect or fragmentation effect. In addition to pressure weapons and fragmentation weapons, there are weapons designed to utilize both types of effects equally ("general purpose weapons"). Regardless of which effect applies - pressure, fragmentation or a combination of the two - high explosive weapons can cause damage to both the biomass and the geomass of an ecosystem.[17] Fragmentation effects can be assumed to be more destructive in certain ecosystems than in others, especially as concerns forests, where fragments imbedded in trees can invite invasion by fungous microorganisms. Pressure effects often cause crater formations in the earth's crust. These craters will either be filled with water and converted to dams or remain as open sores in nature. Craters in the Southern Hemisphere which penetrate to the ground water level attract mosquitoes, which increases the risk of dengue fever and malaria. According to Westing, the Second Indochina War of 1961-75 "left a legacy of more than 20 million bomb craters as a semi-permanent feature of the landscape".[18]

The pressure effects will probably be the dominating stress factor in a war-torn ecosystem. This applies particularly to the high-explosive weapons that are pressure-maximized. FAE weapons ("fuel air explosives") fall within this category. An FAE produces a fuel-air mixture which causes a detonation just above the ground. The evenly distributed and forceful pressure wave over a large surface produced by FAE charges can reach cavities which are otherwise protected against more conventional forms of high-explosive attacks. Early FAE

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16 Arthur Westing, *Ecological Consequences of the Second Indo-China War*, SIPRI, Stockholm 1967, p 70 f. Westing has estimated the loss of saleable timber to be as much as 15 million cubic meters.

17 J Perry Robinson, *The Effects of Weapons on Ecosystems*, UNEP Studies, 1979, p 16 f.

18 In Arthur H. Westing (Ed), *Environmental Hazards of War, Releasing Dangerous Forces in an Industrialized World*, PRIO/UNEP, London 1990, p 3.

prototypes had the capacity to devastate vegetation and blow away trees in an area of ten square meters per kilogram of fuel; research and development in recent years has greatly increased this capacity.

Incendiary Weapons. Ecosystems withstand fire to varying degrees. In areas with a relatively high fire frequency, the local ecosystem has developed an ability to survive wildfires. Plants in fire-prone areas thus have good prospects of recovering after a fire, whereas plants in other areas will be decimated. In forest areas, the offspring of young trees will readily succumb. Damage to the top soil can arise and wildlife can be damaged.

Incendiary weapons (e.g., flame throwers, napalm or white phosphorus) are not generally designed to produce self-spreading fires. This can however readily be the result if the target area is sufficiently susceptible to catching fire. So-called flame weapons (e.g., napalm), which often burn through jelly-like substances, are extremely injurious to the environment. Experiences in tropical hardwood forests have shown that vegetation will be totally destroyed within the area of the flames produced by napalm bombs. Even more dangerous to the environment are certain high-intensive incendiaries, which are specifically designed to ignite objects that are not otherwise readily susceptible to catching fire. Examples include the magnesium and thermite bombs dropped over German cities during the Second World War. The new high-intensity incendiary substance trietylaluminium (TEA) has, through its high level of heat radiation, an even greater ability to produce self-spreading fires.

The natural environments that are most vulnerable are rather easy to identify. The most susceptible areas are those where the risk of natural wilderness fires is the greatest. Consequently, the tropical savanna is particularly vulnerable during the dry season, whereas tropical rain forests (as noted by the US in Vietnam) scarcely constitute a risk area. Once wilderness fires have gotten a foothold, they can spread thousands of square kilometres. A forest can smoulder during an entire winter under a blanket of snow, only to later become a full-fledged forest fire once summer arrives.[19]

Explosive remnants of war. At the end of the Second World War, Poland's territory was studded with unexploded mines, missiles and other explosive means of warfare. These remnants of the hostilities prevented the economic utilization of 20,000 square kilometers for more than five years. Mines laid in nature constituted a particular threat to children playing. It has been noted that between 1945-1975, nearly 4,000 persons died in Poland as a result of mine and missile explosions. Over 3,000 of these were children. During the same period, more than 8,000 persons were injured, of which nearly 7,000 were children.[20]

Libya's deserts still conceal a large number of mines from the campaigns of Generals Rommel and Montgomery between 1940-1943. According to Libyan

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19 J Perry Robinson, *The Effects of Weapons on Ecosystems*, Oxford 1979, p 17 f.

20 Bengt Anderberg, submission at UNITAR symposium in Geneva, May 1981. Publ. No UNITAR/EUR/81/WR/20, 1981.

sources, this has caused costly delays in the extraction of oil in large areas. To this day, people are mutilated and camels are killed by mine explosions.

According to estimates, Indo-China had in 1975 at least 400,000 unexploded bombs and 2 million missiles plus an unknown number of mines and traps.[21]

On the Falkland Islands, inhabitants are still, almost decades after the war ended in 1982, excluded from a large portion of nature. Many Argentine anti-personnel mines, difficult to locate because they had been indiscriminately dropped from helicopters or because they are manufactured in plastic (escaping metal detectors), are yet to be removed. The United Kingdom has been compelled to suspend its sweeping operations because of technical difficulties.

The problem of remaining explosive war matériel, according to UN terminology "material remnants of war" (MRW), is of enormous magnitude not only because the problem includes matériel designed to have a delayed destructive effect (mines and traps), but also because a large percentage of the bombs and artillery shells are regularly duds (this applied to 5-10 percent of American bombs during the Second World War).[22] Modern arms technology has produced mines that are difficult to detect, difficult to remove and which remain functional after a long period of time. This is especially apparent with respect to sea mines (the fishing industry in Japan is still inhibited by sea mines from the Second World War) as well as anti-personnel mines dropped by aircraft. The latter type tend to be small and camouflage-green; their absence of metal parts makes them nearly impossible to detect with technical instruments. There is a marked tendency in modern strategy towards the ever increasing use of ammunition intended to "neutralize" or prevent entry to large areas ("area denial"); this has resulted in an ever greater number of unexploded shells. These tendencies are naturally a reflection of the military advantages to be gained. The great loser is not however the adversary in the armed conflict but the civilian population which will live in the stricken area long after the hostilities have ceased.

Environmental Protection in Existing Treaties

The natural environment has received important protection through a number of international agreements in the fields of arms control and limitation. These agreements will be touched upon briefly here.

Among the agreements that provide positive environmental and ecological effects *in peacetime*, the following can be noted: (1) the Antarctic Treaty of 1959, which prohibits weapons tests, nuclear explosions and all storage or dumping of radioactive materials on the icy continent; (2) the previously mentioned Partial Test Ban Treaty of 1963, which prohibits nuclear weapons tests in outer space, the atmosphere and the high seas and thereby limits the spread of radioactive particles in the global environment; (3) the Outer Space

21 Malvern Lumsden, *Anti-Personnel Weapons*, SIPRI, London 1978, p 199.

22 See generally Arthur H Westing (Ed), *Explosive Remnants of War. Mitigating the Environmental Effects*, SIPRI, London 1985, and a review by this author (Bring) in Ambio Vol 15, No 2 1986, p 72 f. In the SIPRI volume, the contributions of Bengt Anderberg and Jozef Goldblat are of particular interest.

Treaty of 1967 which, among other things, provides that states, in their exploration of outer space, shall ensure that harmful pollution is avoided; (4) the BW Convention of 1972, which forbids manufacture and storage of biological weapons (including bacteriological and toxin weapons) and thereby minimizes the risk of unintentional spread of bacteria from laboratories and factories; (5) the UN Conventional Weapons Convention of 1980, which, among other things, provides that maps of mines and booby-traps laid in war shall be exchanged upon cessation of hostilities so that explosive materials can be removed from the environment.

Among the agreements that should diminish the negative environmental and ecological effects *in war*, the following can be noted: (1) the 1925 Geneva Protocol, which prohibits the use of chemical and biological weapons; (2) once again, the 1972 BW Convention which, through its prohibition on production of biological means of warfare, should guarantee that the 1925 prohibition on use will function with respect to BW; (3) the 1977 Environmental Modification Convention (ENMOD), which prohibits the use of environmental modification techniques for hostile purposes, e.g., climatic modification, when the use of such techniques produces extensive, long-term or serious damage to another state; (4) the 1977 Protocol to the Geneva Conventions (Additional Protocol I), which introduces a prohibition on methods and means of warfare "which are intended, or may be expected, to cause widespread, long-term and severe damage to the natural environment"; (5) the 1980 Convention on particularly inhumane conventional weapons, which prohibits certain uses of incendiary weapons, e.g., attacks on "forests or other vegetation" except when the vegetation is used to protect or conceal military units; and (6) the 1993 Convention on Chemical Weapons (CWC), which repeats the 1925 prohibition on use of chemical weapons in war and prohibits the production and retainment of such weapons.

During the Vietnam War, several forms of warfare were employed which would at present be clearly prohibited by the 1977 Protocol, e.g., the use of "bulldozing or earth-moving equipment to destroy large tracts of forest or cropland for military purposes"[23] as well as defoliation through aerial spraying with herbicides (to deprive guerrillas of the flourishing protection of the jungle forests). Three months after the Protocol's adoption, the US announced that it had incinerated its supply of herbicides on an island in the Pacific Ocean.

The ENMOD Convention is the only one of the above-mentioned agreements that is exclusively oriented towards protecting the environment. The use of environmental modification techniques for hostile purposes could produce severe and unpredictable effects on the human environment, but ENMOD does not by any means address any present problem or imminent threat. The convention does however constitute an important international instrument for the prevention of potentially devastating future methods of warfare. The convention is thus intended to prevent fundamental environmental alterations caused by manipulation of natural processes, e.g., the creation of earthquakes, cyclones,

23 Quotation from Richard Falk's proposed Convention on the Crime of Ecocide, in Westing (Ed), *Environmental Warfare, A Technical, Legal and Policy Appraisal*, SIPRI, London 1984, p 46.

tornadoes or tidal waves (tsunamis); or - perhaps more realistically - alterations of the ozone layer.

The 1972 UN Conference on the Human Environment, held in Stockholm, sought, through adoption of a Declaration containing twenty-six principles, to take the initial step for further negotiations in the field of international environmental protection. In Principle 21 of the Declaration, it was noted that states possess a sovereign right to exploit their resources in accordance with their own environmental protection policies, but that they are also under an obligation to ensure that activities within their own jurisdiction or control do not cause damage to the environment within other states' territories or in areas beyond the limits of national jurisdiction. Principle 22 declares that states are under a duty to cooperate in order to further develop international law concerning liability and compensation for environmental damage that has arisen outside the jurisdiction of the tortious state.[24] The Stockholm Declaration thereby called attention to the fact that international law already contains certain general principles that embody protection of the natural environment, but that there was still a need for specific provisions in international agreements. The principles of the Stockholm Declaration have received renewed topicality since the accident in Tjernobyl in 1986 and the 1992 UN Conference on the Environment and Development (UNCED) (see below).

General Principles of a Legal Nature

International law principles, other than those established through international agreements, often exist in the form of customary law, i.e. norms traditionally perceived as flowing from a general practice of states (*usus*) and a general view within the international community that states are legally bound to follow that practice (*opinio juris*). Article 38 of the Statute of the International Court of Justice refers to "international custom, as evidence of a general practice accepted as law" and "to the general principles of law recognized by civilized nations" (being a reflection of domestic law standards). It is however often difficult to deduce specific principles from these sources of law.

In the field of international environmental law, reference is usually made to a number of general and "overlapping" principles, whose legal status may be somewhat diffuse. In some cases, it is not clear whether the asserted principles express existing and binding norms (*lex lata*), or merely "soft law" guidelines possibly being in a process of hardening into legal norms (principles *de lege ferenda*). The principles that are usually discussed in this context, four in all, shall be briefly presented below.

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24 The two principles were worded as follows (UN Doc. A/CONF/48/14/REV.1.):

21 States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction.

22 States shall co-operate to develop further the international law regarding liability and compensation for the victims of pollution and other environmental damage caused by activities within the jurisdiction or control of such States to areas beyond their jurisdiction.

(1) *The Sic utere principle*. A number of international law authors have deduced states' environmental law obligations from the Latin maxim "sic utere tuo alienum non laedas" ("use your own property in such a manner as not to injure that of another"). This principle guided a court of arbitration in the famous *Trail Smelter Case* 1937-1940. In the Canadian city of Trail in British Columbia (near the U.S. border) a lead and zinc smelting plant had been constructed at the turn of the century. During the mid-1920s, the operation was intensified and two tall smokestacks were erected. This resulted in the increased release of sulphurous fumes and a large concentration of sulphur dioxide in the air. The United States Government claimed that the fumes carried over to American territory via the upper air streams, causing damage to agriculture and forestry in the State of Washington. Claims for damages were lodged and in 1935 both governments decided to refer the matter to an arbitration tribunal. The tribunal found that Canada was liable to pay damages to the United States, since under the principles of international law:

> no State has the right to use or permit the use of its territory in such a manner as to cause injury by fumes in or to the territory of another or the properties of persons therein, when the case is of serious consequence and the injury is established by clear and convincing evidence.[25]

This conclusion was confirmed, in more general terms, in 1974 in the UN Charter of Economic Rights and Duties of States.[26] The Charter states, inter alia, that all states have a responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other states or areas beyond the limits of national jurisdiction (Article 30). The Charter is not however a legally binding document.

The "Sic utere" principle is troublesomely vague and developments in doctrine and practice do not indicate what specific obligations states may have in the field of environmental protection. Responsibility for damage under the sic utere principle appears however to be predicated on negligence (culpa), i.e. a state has through its carelessness lack of reasonable care violated an obligation to ensure that its hazardous activities do not cause damage to other states.

(2) *Abuse of rights*. Under this principle, a legal right may not be used (abused) in a manner that is contrary to the purpose for which the right has arisen or to the detriment of other (private and public) legal subjects. Such an abuse would constitute an unlawful act. The principle covers individual, "anti-social" use of a formal right, which damages another individual or public interest. Within the sphere of public international law, the principle is linked to the requirement that international law obligations be interpreted and applied in a *bone fide* manner, i.e. honestly and in good faith.

It is not however by any means self-evident that this principle of "abuse of rights", which is found in various national legal systems, is established in

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25 UN Reports of International Arbitral Awards (UNRIAA), Vol 3, p 1965. See also Leslie C Green, *International Law through the Cases*, London 1959, p 786 f.

26 General Assembly Resolution 3281 (XXIX) of 12 December 1974.

international law. It has not been established by treaty. Nor does it find support in the general practices of states and does not thus constitute international customary law. On the other hand, it may constitute a "general principle of law recognized by civilized nations", as pronounced in Article 38(1)(c) of the Statute of the International Court of Justice. This somewhat antiquated formulation refers to principles of law existing in most national legal systems; such a principle will receive international law status when it is possible to apply it also in interstate relations. General principles of law have played a certain role in the practice of international tribunals, who (in Brownlie's words) "have employed elements of legal reasoning and private law analogies in order to make the law of nations a viable system for application in a judicial process".[27]

If the principle of "abuse of rights" is to be considered a general principle of law, it cannot be accorded an especially broad construction. It is probably limited to acts carried out or tolerated with knowledge that damage can arise. In international environmental law, the principle would thus not support strict liability for environmentally injurious pollution or the like. On the other hand, it could support liability for activities which are known to be injurious to other states or to the citizens of other states, or to fishing activities on the high seas.

If the principle of "abuse of rights" is to justify its status as a principle distinct from the "sic utere"-principle, it probably has to focus on intentional abuse, i.e. a clear awareness that the activities in question are conducted in a manner that exposes others to unacceptable risks, without measures being taken to ameliorate the situation. The basis of liability would thus be so-called *dolus eventualis*.

(3) *Principle of Good Neighbourliness*. Under this principle (which may be seen as an amalgamation of several legal standards of interstate behaviour) every state shall, in the exercise of its sovereignty, respect the legitimate rights of its neighbours. No state may conduct, promote or condone activities on its territory that cause substantial or abnormally large damage within the territory of a neighbouring state. We may note that this concept of good neighbourliness "overlaps" with the principle of *sic utere* and that it provides no more guidance than the doctrine of "abuse of rights" as to exactly which acts are unlawful. On the other hand, its purpose is to provide a universally applicable legal standard for the conduct of states in their relations with their neighbours. The emphasis appears to be on hazardous, dangerous activities, although it does not establish absolute liability.

The principle of good neighborliness cannot be interpreted to apply only to the relationship between states whose territories adjoin each another; it must be deemed to encompass a broader scope of neighbourly relationships (e.g., the coastal states around the Mediterranean and the Baltic Sea). Today, this perspective can be broadened even further. It can be stated that modern international law views all states as "neighbours" to each other insofar as the protection of the common values of the international community is concerned. The title of the so called Carlsson-Ramphal Report on Global Governance of 1995, "Our Global Neighbourhood", is a case in point. Under the 1982 Law of

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27 Ian Brownlie, *Principles of Public International Law*, 5th edition, Oxford 1998, p 16.

the Sea Convention, states are under a basic obligation to take measures and enact laws for the prevention, reduction and control of pollution of the marine environment and to cooperate within international bodies to realize that goal.[28]

(4) *Usus publicus*. Finally, we will here comment upon a principle which is not in itself a principle of international environmental law, but which nonetheless has ramifications in that field. The concept of *usus publicus* functions as an all-encompassing term for the legal order applicable to the high seas. All users of the oceans have an equal right to all types of use. But they shall show reasonable consideration for one another, respect each other's activities and not obstruct the use by others of the high seas or the airspace above the sea. The principle has also been said to entail that no nation is entitled to use the high seas in such a way as to make it impossible for other nations, for an extended period of time, to use the ocean at the same time.[29] The foregoing means that, from an environmental viewpoint, activities will be contrary to international law when they pose long-term dangers to the environment or produce long-term effects which limit the possibilities to freely use the high seas. In each individual case, a determination of reasonableness has to be made within the framework of the concept of *usus publicus*. The question is which uses of the high seas are to be deemed reasonable (or unreasonable) in light of the needs of other states and the common interest of the international community. Every contemplated or implemented measure must be examined in relation to all other claims that can be based on the principle of the freedom of the high seas. Once again, we are dealing with a principle of reasonableness whose exact consequences are unclear at the present stage of legal development, but whose potential relevance to military uses of common spaces is obvious.

A Customary Law Test Ban?

The fact that the mere testing of arms systems often has deleterious effects on the environment has provided arms limitation advocates with weighty arguments. In the debate on the to-be or not-to-be of nuclear weapons tests, these arguments have been reinforced by general principles of environmental law as well as by the legal norms flowing from the 1963 Partial Test Ban Treaty (PTBT).

In May 1973, ten years after adoption of the PTBT, Australia and New Zealand instituted a claim against France before the International Court of Justice in the Hague concerning ongoing atmospheric nuclear weapons tests in Polynesia. Not only France but also China had refrained from ratification of the PTBT and both countries conducted atmospheric tests after the agreement had entered into force. Between 1966 (when the French Pacific Ocean tests were

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28 See Articles 192-197 in the UN Law of the Sea Convention, adopted 6-10 December 1982 in Montego Bay, Jamaica. 21 *International Legal Materials* 1982, p 1261 ff. Concerning general principles of law in the field of international environmental law, see Kari Hakapää, *Marine Pollution in International Law*, Helsinki 1981, p 136 ff.

29 Bo Johnson (Theutenberg), *Suveränitet i havet och luftrummet*, Stockholm 1972, p 98.

started) and December 1973, thirty-four atmospheric tests took place at the Mururoa Atoll and the adjacent island of Fangataufa.

The Hague Court was called upon to declare that the carrying out of atmospheric nuclear weapons tests was contrary to the principles of international law (including customary law) and that France should terminate all such tests in the Pacific Ocean. France, for its part, challenged the jurisdiction of the Court and requested that the Court strike the matter from its docket.[30] At the same time, it was denied (in a letter from the French Ambassador in the Hague) that nuclear weapons tests were contrary to any rules of international law. French Government representatives were completely absent from the hearings before the International Court.

Under Article 41 of the Statute of the International Court, the Court can, pending the final decision, order "any provisional measures which ought to be taken to preserve the respective rights of either party". Such an interim decision had been requested by the petitioners and was issued by the Court in June 1973. According to that decision, France, pending a final determination, was to avoid carrying out nuclear weapons tests that resulted in radioactive fallout on territory belonging to Australia or New Zealand; e.g. the Cook Islands, Niue or the Tokelau Islands (all of which belong to New Zealand). The Court clarified that Article 41 did not in any way dispose of the question of the Court's jurisdiction or the merits of the claim. In a dissenting opinion, Judge Isac Forster (Senegal) argued however that the Court had already exercised jurisdiction through its interim decision and that the significance of that decision was such that the Court had, de facto, expressed its opinion on the merits of the case. Forster indicated that the Court should have declared that it lacked jurisdiction due to the French reservation to the Statute of the Court which excluded jurisdiction in questions of national defence.[31]

France did not consider itself to be bound by the interim decision and initiated, as early as July 1973, a new series of nuclear weapons tests in the Pacific Ocean. The world community was in a rage. International organizations such as WHO and ILO protested. New Zealand sent the frigate *Otago* into the test zone to photograph. Peace organizations rented private ships which entered the zone in protest, e.g. the American ship *Spirit of Peace*. Demonstrations took place in Tokyo and Hiroshima, and in Australia, French interests were boycotted through actions that affected the mails, telecommunications, shipping and banking.

Australia's and New Zealand's legal argumentation before the Hague Court was strongly supported by international lawyers in various countries. Since France was not a party to the Partial Test Ban Treaty, it was necessary to argue

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30 The International Court of Justice is the UN's "main judicial organ", consisting of fifteen justices chosen by the General Assembly and the Security Council. The Court has jurisdiction in all cases submitted to it by the parties. A state can also recognize the jurisdiction of the Court in advance concerning any dispute that might arise (Article 36 of the Statute of the International Court of Justice). In 1966, France recognized the compulsory jurisdiction of the Court under Article 36, however with the reservation that questions concerning that nation's defence were excluded from the Court's jurisdiction.

31 International Court of Justice, Reports 1973, p 111 ff.

that France was bound by a customary law rule entailing a prohibition on atmospheric nuclear weapons tests.

Australia claimed in the Hague that the deposit of radioactive fallout on its territory, in the absence of its government's consent, constituted a violation of that country's sovereignty. It was also claimed that the prohibitory content of the PTBT, especially the ban on atmospheric nuclear weapons tests, had attained the status of a general principle of law reflecting an *opinio juris* among the majority of the members of the international community. This *opinio juris* was evident from the large number of parties to the PTBT (over ninety states had ratified the treaty at the time), and in a number of resolutions of the UN General Assembly and other international bodies. Particular note was made of General Assembly Resolution 1762 A of 1962 and Resolution 3(1) of the UN Conference on the Human Environment (Stockholm 1972). The Australian lawyers also referred to the maxim *sic utere tuo* as an alternative ground for the claim that France was bound by customary rules in the context.[32]

New Zealand presented nearly identical arguments. It was stressed that the French obligation to refrain from atmospheric tests was largely implied by the norms of international environmental law, which create (it was argued) duties in relation to all states (*erga omnes*). The responsibility of France in this context was thus not limited bilaterally - it existed in relation to all members of the international community. New Zealand did however also claim that France had violated rights held by New Zealand specifically - the right not to have its territory, including the territorial sea and the superjacent airspace, contaminated by radioactive fallout and the right to be free of any damage that accompanies such contamination. There was no escaping the fact that all French test series between 1966-1973 had exposed New Zealand, the Cook Islands, Niue and the Tokelau Islands to radioactive fallout, with uncertain genetic and somatic effects as a consequence.[33]

On 25 September 1974, while the International Court considered the pleadings of the petitioners, the French Foreign Minister announced to the UN General Assembly that French nuclear technology had reached such a stage that it was possible to switch to underground tests. France would thus terminate the atmospheric explosions and begin with underground testing in 1975.

On 20 December 1974, the International Court delivered its judgment. The Court decided by nine votes to six, that since France had unilaterally announced its intention to stop the atmospheric tests, the petitioners' claim no longer had any object. The Court did not therefore need to render judgment.[34] Four of the

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32 For the Australian Government's line of argumentation in these questions, see International Court of Justice, Pleadings, *Nuclear Tests Cases* 1973, Vol I (Australia v. France), p 182, 184 f, 495 and 500 ff. Australia also claimed that the French tests violated the principle of the freedom of the seas. See p 188 f and 514 ff.

33 See International Court of Justice, Pleadings, *Nuclear Tests Cases* 1973, Vol II (New Zealand v. France), p 203-206, 264 f. New Zealand's line of argumentation on the merits were only presented in the context of its pleadings on the jurisdictional question. It was therefore shorter than its Australian counterpart.

34 International Court of Justice, Reports 1974, p 266-272. The Court found that France's unilateral undertaking was addressed to the entire international community and was thereby

justices in the minority opposed this evasive decision and stated in a dissenting opinion that the object of the case had by no means disappeared. That object consisted of a legal dispute between the petitioner-states and France over the contents of international law as concerned atmospheric nuclear weapons tests.[35]

The inability of the Court to shoulder its responsibility as the UN's primary judicial organ resulted in widespread disappointment. There is still no authoritative clarification of the contents of customary law within the field of international environmental law as concerns the permissibility of nuclear weapons tests. - In the opinion of this author, a legal assessment necessarily leads to the following conclusion: Atmospheric nuclear weapons tests that cause damage or pose a substantial risk of damage within other states' territories, or that unreasonably limit the free enjoyment of the world's oceans, are inconsistent with modern international law. If such tests have caused significant damage to another state's interests, the state that has conducted the tests will be liable to pay compensation. If Australia and New Zealand had claimed damages in 1973 for tests already carried out (which they did not do), the International Court would presumably have been compelled to make a determination on the merits of the case and it would have been difficult for the Court to avoid the above-stated conclusion as to existing law. On the other hand, the International Court would hardly have been able to show the existence of a categorical ban on atmospheric nuclear weapons tests - except with respect to the states that were bound by the Partial Test Ban Treaty. Under the present state of the law, a state like China (which does not participate in the PTB regime) may as a practical matter carry out nuclear weapons tests within its own territory as long as the effects of those tests are limited to Chinese territory.

The customary law ban outlined above can be derived from general standards of good neighbourliness as well as from the opinio juris manifested by the large membership of the PTBT (125 parties in 1998) in conjunction with resolutions of global international bodies.[36] Also the practice of nuclear testing states indicates a customary law ban on atmospheric tests, the effects of which cannot

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binding in international law; this further strengthened the view that there was no need to render judgment.

35 *International Court of Justice, Reports 1974*, p 320. The minority opinion also claimed that the French undertaking could not provide the petitioners with the same legal security as a clear declaration by the Court that the type of nuclear weapons test in question was contrary to general international law. A conclusion of this import appeared the same year in a book published in Basel: Herbert Julius von Arx, *Atombombenversuche und Völkerrecht*, Basel & Stuttgart 1974.

36 It should be stressed that the resolutions of the General Assembly, in their capacity as recommendations, are not legally binding in themselves, but that some of them can contain expressions of *opinio juris*. Such resolutions, in conjunction with other elements of state practice, are of relevance in the determination of the contents of international law. A characteristic feature of modern international law debate is that representatives of the developing countries accord greater weight to resolutions of the General Assembly as potentially law-creating recommendations than do their Western colleagues. This question arose on several occasions during JUS 81, UNITAR's and Uppsala University's seminar “on International Law and Organization for a New World Order” in 1981. See *The Spirit of Uppsala*, Berlin/New York 1984, p 64-67 (M K Yasseen), p 209 (Jimenez de Aréchaga), p 264 f and 271 (Achol Deng) and p 466 f (do Nascimento e Silva).

be limited to the testing state's own territory. Under general international law the members of the international community have a common responsibility to abide by the norms that protect the natural environment and the freedom of the high seas - and they have a common interest in preventing violations of those norms. Consequently, it could be argued that each state has the right to apply to a tribunal for a remedy since each state can assert a sufficient legal interest in the matter. This claim of *locus standi*, implying a right for all states to act upon a violation of a multilateral obligation (*actio popularis*), applies to situations where common values of humanity, as sanctioned by international law, are in jeopardy.

The customary law test ban, as it has been defined above, only covers atmospheric nuclear weapons tests. The question is however whether the development of customary law has not progressed even further? The Partial Test Ban Treaty bans, in the same categorical manner as concerns atmospheric tests, explosions "under water". Underground test explosions are also covered by the treaty, although in a less categorical fashion. Such an explosion is prohibited if it causes "radioactive debris to be present outside the territorial limits of the state under whose jurisdiction or control such explosion is conducted" (Article I). This formulation has received increased topicality and normative impact through the successive development of international environmental law and through the discovery that underground nuclear weapons tests are not as risk-free as previously believed. The present *opinio juris* (of a majority of states) has probably developed to the state where sub-surface nuclear tests in the high seas are also considered unlawful (see further below).

Since 1974, the tests in Polynesia were conducted underground, but this was of little consolation from the environmental viewpoint as concerns Mururoa, an atoll consisting of porous coral. It has been stated that explosions have taken place every 500 meters, that the cavities formed are 300-400 meters in diameter and that the atoll is now as perforated as a Gruyère cheese. On one occasion, supposedly one million cubic meters of coral were blown apart and caused an enormous tidal wave. It has also been asserted that the entire atoll is greatly polluted by plutonium and that, to conceal this, it has been covered with asphalt which is now full of cracks, and that radioactive waste that was stored on the atoll has eroded bit-by-bit and been spread further by the Polynesian ocean currents.[37] This alarming scenario has naturally not been confirmed by the French authorities, but even if it is only partially correct, it gave rise to legal expectations of an immediate cessation of these tests - in accordance with an evolving opinio juris of a majority of states.

At last - during the summer of 1996 when the negotiations for a Comprehensive Test Ban Treaty (CTBT) were in the final phase - France, and later China, declared that they had conducted their last underground tests. The atmospheric tests had been discontinued by France in 1974 and by China in 1980. When the new Treaty for a Comprehensive (all-embracing) Test Ban was opened for signature in New York on 24 September 1996 a new era without any kind of nuclear testing was in the offing. The General Assembly of the United

37 Ann-Marie Westman, in the Swedish newspaper *Sydsvenska Dagbladet* 24 May 1984.

Nations had accepted the new treaty text with an overwhelming majority - only three states (India, Bhutan, Libya) had opposed the text, India with the argument that the treaty lacked an obligatory time-table for eliminating all nuclear weapons.

Several of the principles adopted at the 1972 Stockholm Conference on the Human Environment constituted at that time expressions *de lege lata* (of existing law). Other principles were not as yet established legally, but the Conference clearly viewed these as expressions *de lege ferenda* - indicative of the desired future state of the law. A principle of the latter type was embodied in Resolution 3(1), calling for cessation of all nuclear weapons tests that can cause damage to the natural environment. Today - supplemented by the almost universally accepted text for a Comprehensive Test Ban Treaty - the contents of Resolution 3(1) accord with an even more universal *opinio juris* on this question.[38] This majority opinion within the international community, which indicates the present position of general or customary international law, comes very close to a complete test ban pending the entry into force of the new Comprehensive Test Ban Treaty (CTBT). Thus, it can be assured that the present state of customary international law requires cessation of all nuclear weapons tests whose radioactive fallout cannot be expected to be limited to a state's own territory or otherwise would cause damage to the natural environment. The next step, the entry into force of the negotiated CTBT (should it happen) would conclude a legal development where customary law and treaty law have slowly moved on parallel tracks towards the same goal.

From Stockholm to Rio de Janeiro

Test ban treaties, whether limited or comprehensive, entail a certain degree of arms control, but not immediate arms limitation and certainly not actual disarmament. Test bans based on international commitments can however in practice result in arms limitation, in the sense that the development of new nuclear weapons types is stopped. The path towards genuine disarmament can thereby be cleared for further progress. As we have seen, the standards of environmental law have an impact on the test ban issue. The question then arises whether international environmental law also encompasses prescriptions that are of relevance to disarmament itself.

The answer is probably yes, even if environmental law does not readily provide specific norms transferable to the law of disarmament.

The peacetime production and transfer of nuclear weapons, as well as the waste from nuclear weapons production, constitutes a threat to the environment. A nuclear explosive, accidently falling apart over Greenland in 1971, contaminated a large area of the island's marine environment with plutonium.

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38 In Resolution 3(1), the Stockholm Conference resolved (a) to condemn nuclear weapons tests, especially in the atmosphere, and (b) to "call upon those States intending to carry out nuclear weapon tests to abandon their plans to carry out such tests since they may lead to further contamination of the environment". See Report of the United Nations Environmental Conference in Stockholm 5-16 June 1972, UN Doc. A/CONF/48/14/Rev.1.

The manufacture and processing of chemical weapons can pose serious environmental risks - as demonstrated by a nerve gas accident in Utah in 1968, which resulted in the death of some 5,000 sheep. The conventional weapons industry processes several substances (explosives, rocket fuel, hazardous chemicals) which provide further examples of such risks.

The international norms adopted to address these problems and risks are non-binding recommendations or vague and general exhortations. At the Stockholm Conference on the Human Environment, the following memento was adopted in the preamble to the Environmental Declaration:

> 6. A point has been reached in history when we must shape our actions throughout the world with a more prudent care for their environmental consequences.

The twenty-sixth and last principle of the 1972 Declaration states:

> Man and his environment must be spared the effects of nuclear weapons and all other means of mass destruction. States must strive to reach prompt agreement, in the relevant international organs, on the elimination and complete destruction of such weapons.[39]

This text calls attention to the fact that the greatest environmental destruction follows from a nuclear war. The negative environmental and ecological effects of peace-time production and transfer of weapons or of war in general was not touched upon.

The UN Conference on Environment and Development (UNCED), held in Rio de Janeiro in June 1992, may have taken matters somewhat further. The (non-binding) Rio Declaration contains two principles of relevance to arms testing and arms transfer:[40]

> Principle 14. States should effectively cooperate to discourage or prevent the relocation and transfer to other States of any activities and substances that cause severe environmental degradation or are found to be harmful to human health.
>
> Principle 17. Environmental impact assessment, as a national instrument, shall be undertaken for proposed activities that are likely to have a significant adverse impact on the environment and are subject to a decision of a competent national authority.

Another principle is concerned with warfare and the environment:

> Principle 24. 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 development, as necessary.

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39 *Principle 26*, UN DOC. A/CONF/48/14/REV.1.

40 The Rio Declaration (UN Doc A/CONF. 151/5/REV.1, 13 June 1992) and Agenda 21 (UN Doc A/21/39, 14 June 1992) are reproduced in *inter alia SIPRI Yearbook* 1993, pp. 37-41.

This principle should inter alia be seen against the background of the Gulf War of 1991 when Saddam Hussein's forces released oil into the Gulf and set fire to Kuwaiti oil wells and installations. According to some lawyers these actions were covered by existing prohibitions in the law of warfare, while others have argued that although oil and other installations were protected against wanton destruction under the 1907 Hague Regulations and corresponding customary law of armed conflict, the environment as such was not so protected, and that therefore existing law ought to be strengthened.[41]

The negative environmental effects of a modern war may be reduced through the law of warfare, but at the same time the approach of arms limitation and disarmament must be pursued. As we have already seen, a number of international agreements in this field have been concluded - with possible effects on the environment. The latest advance is the 1993 Chemical Weapons Convention which will progressively reduce the risks of chemical releases in peace time and the use of poisonous substances in war. Whether the 1996 comprehensive Test Ban Treaty will ever enter into force (taking into account India's and Pakistan's nuclear policy and the non-ratification decision of the U.S. senate in late 1999), remains to be seen. The best arms control guarantee for protection of the natural environment is, of course, general and complete disarmament, which would eliminate the risk of a major war. In pursuit of that goal, environmental law principles provide added weight to moral and political demands for arms limitation and disarmament.

41 For an interesting study on customary law of armed conflict, as it relates to the protection of the natural environment, see Heike Spieker, *Völkergewohnheitsrechtlicher Schutz der natürlichen Umwelt im internationalen bewaffneten konflikt*, Bochum 1992. See also L. Lijnzaad & G.J. Tanja, *Protection of the Environment in Times of Armed Conflict: The Iraq-Kuwait War*, Netherlands International Law Review 1993, pp. 169-199; and Michael N. Schmitt, *Green War: An Assessment of the Environmental Law of International Armed Conflict*, 22 Yale Journal of International Law, 1997, pp. 1-109.