Liability Regime of International Space Law: Some Lessons from International Nuclear Law

Lalin Kovudhikulrungsri * & Duangden Nakseeharach **

Since 1960, the international community has established a plenty of multilateral agreements on liability regime for ultra-hazardous activities, particularly in the area of international nuclear and space law. The liability regime of nuclear damage has imposed compensation exclusively on operators of nuclear installations whether private or State under strict liability principle of the international conventions. Moreover, new changes of international nuclear conventions following Chernobyl incident reflect a significant change of liability for nuclear accidents. Although there was similar incident, called Cosmos 954 case, with nuclear activity, international space law has not developed and remained ambiguous in certain respects, while imposing absolute liability on State actors. This paper, thus, studies whether States, alone, should be liable for all damage from space activities caused by private operator, similar to the liability scheme of international nuclear law. Moreover, vague term in international space law, for instance, damage and other relevant concepts such as space safety standard and international space organization have been taken into account by comparative approach with the terms of international nuclear law.

Keywords
Liability Regime, International Space Law, International Nuclear Law, Strict Liability, Cosmos 954 Case, Chernobyl Incident

* Ph.D. Candidate at Leiden University, The Netherlands. LL.B.(Thammasat), LL.M.(McGill). The author may be contacted at: lalin.kov@gmail.com / Address: 131/91 St.Louis 3 Sathorn Bangkok 10120 Thailand.

** Lecturer of Law at Mahasarakham University, Thailand. LL.B./LL.M.(Thammasat). The author may be contacted at: kikukae_25@hotmail.com/Address: 6/14 Chidchol Village, Gerng District, Maueng, Mahasarakham 44000 Thailand
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I. Introduction

Both nuclear and space sectors share similar points. Even though their activities are ultra-hazardous in character, the global community derives enormous benefit from a peaceful use of nuclear and space technology. Each sector has a serious incident caused by the former Soviet Union, namely, the Chernobyl Nuclear Power Plant and the Cosmos 954 accident. Despite such resemblance, they adopted different legal regimes with respect to liability. Due to this diversity, those injured by the Cosmos 954 space activity case were compensated while no compensation was repaid in the Chernobyl nuclear incident. Nevertheless, after the Chernobyl incident, the nuclear sector has developed its legal instruments to be more effective and practical to private and State actors, while the space sector has passed merely resolutions and not binding law. This paper examines and compares these two sectors' regimes regarding liability.

Although there are some similarities in the nature of both nuclear and space sectors, *e.g.*, their ultra-hazardous activities and serious consequences arising from accidents, there is a significant distinction between their liability regimes. The former imposes strict liability on private operators, or so called civil liability, while the latter imposes absolute liability on the State to pay compensatory damages even if there is no State action. Since the Chernobyl incident, international nuclear law has rapidly been improved and developed, respectively, by inter-governmental organizations through international liability conventions. Conversely, the development of international space law has made little progress not only with respect to liability, but also in defining damage, insurance, safety standard, geographical scope, and intergovernmental space organization. Therefore, in the light of the similar potential hazards between the two activities, international space law would benefit by comparing it to international nuclear law.

This paper is divided into seven parts including introduction and conclusion. Part II will analyze the general concepts and principles of liability regimes under international law. Most liability principles under international law have been actually developed by domestic legal systems. This part will thus explore the regime of international liability for injurious consequences arising out of acts not prohibited by international law, which is grouped into fault-based liability and no-fault (strict or absolute) liability. Part III will analyze cases relating to liability, including the Cosmos 954 case and the Chernobyl case. Part IV will discuss the international conventions regarding liability in both international space and nuclear law. Part V will compare the liability systems of the two legal categories. Part VI will make some recommendations for space law such as clarifying the definition of damage and strict State liability. This part will also explore

certain improvements in nuclear law that can also benefit the advancement of space law.

II. General Principles of Liability under International Law

Before the liability regimes were well established by international instruments, they had been developed by customary norms and general principles of law. The Trail Smelter arbitration,[1] the Corfu Channel case,[2] and the Nuclear Tests cases[3] affirmed the obligation not to cause damage to another State as well as the principle of transboundary liability. Moreover, intergovernmental organizations' practices, such as UN Resolutions, can also create new progressive development on general principles of State responsibility.[4] Taking international instruments into consideration, general principles of liability under international law have been categorized, as follows.

A. Liability with Fault

The figurative personality of States as subjects of international law poses difficulties with regard to the subjective fault of the person acting on behalf of the State.[5] In principle, malicious intent or culpable negligence of officials acting on behalf of their States does not necessarily constitute fault of the State.[6] Provided there is a breach of an existing international obligation, the State should be held internationally responsible, no matter whether there is any wrong on the part of the officer who actually carried out the act in question.[7]

Under international law, however, the notion of liability based on fault was reflected by the International Law Commission ("ILC")[8] through municipal law.[9] Although the

1 Trail Smelter (U.S. v. Can.), 3 REP. INT'L ARB. AWARDS 1905 (1938 & 1941).

2 Corfu Channel (U.K. v. Alb.), 1949 I.C.J. 4, 36 (Apr. 9).

3 Nuclear Test (Austl. v. Fr.), 1974 I.C.J. 99, 135 (Dec. 20).

4 Draft Articles on Responsibility of States for Internationally Wrongful Acts, G.A. Res. 56/83, Annex art. 1, U.N. Doc. A/RES/56/83 (Dec. 12, 2001)

5 H. LAUTERPACHT, PRIVATE LAW SOURCES AND ANALOGIES OF INTERNATIONAL LAW 134 (1927) recited by XUE HANQUIN, TRANSBOUNDARY DAMAGE IN INTERNATIONAL LAW 295 (2003).

6 *Id.*

7 *Id.*

8 The satisfying trace of liability based on fault of a State under international law was established by the International Law Commission. *See* Chorzow Factory case, PCIJ, Series A, No. 17, 1928, at 29 recited by MALCOLM N. SHAW, INTERNATIONAL LAW 781-782 (6th ed. 2008).

9 In municipal law, to determine the general principles of law recognized by civilized nations, liability based on fault

tracing and comparison of the concept of fault in legal systems is distinct in some aspects, the basis of fault liability under international law has to constitute both the fault of the actor and the breach of an international obligation (*culpa* and *dolus*).[10] This type of liability corresponds to the concept of subjective responsibility which emphasizes that an element of intentional (*dolus*) or negligent (*culpa*) conduct on the part of the person concerned is necessary before his State can be rendered liable for damages.[11]

B. Liability without Fault

There are two types of liability: strict liability and absolute liability. Although the natures of the two appear indistinguishable since they are based on a no-fault principle, there are material distinctions between them. Professor Bin Cheng summed up this difference in that strict liability requires a causal link between the person held strictly liable and the damage, whereas absolute liability does not.[12]

1. Strict Liability

The principle of strict liability was founded in common law, due to the special concern of society that the necessity of fault must be overridden in certain cases as documented in the well-known English case Ryland v. Flethcher.[13] Strict liability was then consolidated to general principles of law[14] and State practices of the international community. In addition, the principle of strict liability also used to shift the burden of proof[15] of the plaintiff to the defendant. As opposed to a fault-based system, the defendant should be liable without any judgment on the subjective condition of the perpetrator, with certain limited exceptions, *e.g.*, when the injury occurred as a result of the conduct of the injured person himself or a *force majeure*.[16]

denotes a breach the duty of reasonable care owed to those who will be injured by a failure to observe such duty of care. Consequently, such fault can be arisen either by an intentional conduct (*dolus*) or negligent conduct (*culpa*) as the evidence. *See* R. W.M. DIAS & B.S. MARKESINIS, THE ENGLISH LAW OF TORTS 29, 57 (1976); PIERRE CATALA & JOHN A. WEIR, DELICT AND TORTS; A STUDY IN PARALLEL 607-611 (1965), recited by Hanquin, *supra* note 5, at 295-298.

10 *Id.* at 298.

11 Shaw, *supra* note 8, at 783.

12 Bin Cheng, *A Reply to Charges of Having Inter Alia Misused the Term Absolute Liability in Relation to the 1986 Montreal Inter-Carrier Agreement in my Plea for an Integrated System of Aviation Liability*, VI ANNALS OF AIR AND SPACE LAW 9 (1981).

13 (1865) 3 H and C 774; (1868) LR 3 HL (House of Lord) 330. The court maintained that the defendants were held personally liable, despite the absence of fault either intention or negligence.

14 Wex S. Malone, *Role of Fault in the History of Negligence, in* ESSAYS ON TORTS 23 (Wex S. Malone ed., 1986), recited by Hanquin, *supra* note 5, at 300-301.

15 *Id.* at 300.

16 *Id. See also* Shaw, *supra* note 8, at 779.

2. Absolute Liability

Absolute liability begins with the premise that States are obliged to prevent all kinds of damage. Should damage occur, this premise would imply that the State failed to prevent the damage, regardless of the fact of whom or how the damage was caused. Whether the State took reasonable precautions or all necessary measures to avoid harm is irrelevant in imposing damages. In the case of injury, the State would have failed to prevent damages, and therefore, would be liable.[17] This regime obliges the State to protect against damaging the environment of other States and turns the State into an absolute guarantor of sorts. This scheme would denaturalize the content and extent of the obligation to prevent environmental harm.[18] Thus, while strict liability and absolute liability seem identical with respect the no-fault principle, there lies the significant distinction in whether a causal link between the wrongdoer the damage is required to impose liability.[19]

III. Liability Cases

A. The Cosmos 954 Case

The number of space objects that fall back to earth, including space debris, has been increasing due to the growing number of countries participating in space activities. Fortunately, most of these objects fall harmlessly in unpopulated areas. In fact, the Cosmos 954 incident has been the only claim made under the Liability Convention as well as the first nuclear-related crisis involving space activities.

Cosmos 954, launched by the Soviet Union on September 18, 1977, carried a nuclear reactor with highly radioactive materials, 20-kilogram uranium-235. On January 6, 1978, the satellite began falling and the North American Air Defense Command ("NORAD") observed the satellite's descent and warned countries situated below the satellite's orbit.[20] The satellite re-entered and crashed on January 24, 1978 over a remote area in Canada. A large amount of radioactive debris, comprising of fifty large fragments and more than 4,000 particles, were scattered over 124,000 square kilometers in northern

17 James Crawford, The International Law Commission's Articles on State Responsibility (2002); Bin Cheng, General Principles of Law as Applied by International Courts and Tribunals (1953). *See also* Shaw, *supra* note 8, at 778.

18 Andrea L. Mackielo, *Core Rules of International Environmental Law*, 16 ILSA J. Int'l & Comp. L. 260 (2009).

19 Cheng, *supra* note 12, at 9.

20 Paul G. Dembling, *Cosmos 954 and the Space Treaties*, 6 J. Space L. 129, 130 (1978).

Alberta and Saskatchewan. The Canadian government asked the Soviet Union for complete information about the satellite, but did not get any response except that it had no interest in the debris and Canada could dispose of such debris at their discretion.[21] Thereafter, in collaboration with the United States, Canada set the clean-up operation, "Operation Morning Light" which finished in October 1978 and resulted in an estimated recovery about 0.1 percent of Cosmos 954's nuclear power source.[22] This operation cost approximately CAD 14 million.

Canada reported to the United Nations about the space objects under the Rescue Agreement. They presented a claim, relying on both on the Liability Convention and on principles of international law, to the Soviet Union through diplomatic channels. The Canadian government demanded damages in the amount of CAD6,041,174.70 on January 23, 1979, within the one-year period prescribed in the Liability Convention, and later reduced the damages to CAD6,026,083.56 with a reservation for unforeseeable damage on note number FLA-268.[23]

In its claim, Canada proved that the space object was owned and launched by the Soviet Union. The Soviet Union refuted Canada's claim arguing that Canada had taken unnecessary clean-up operations and that the Soviet Union had a right to participate in the operation.[24] Finally, in 1981, the Soviet Union agreed to pay Canada CAD3 million in full and final settlement of all matters connected with the disintegration of Cosmos 954.[25]

B. The Chernobyl Incident

On April 26, 1986, operational unit no. 4 of the Chernobyl nuclear power plant of the former Soviet Union suffered a major accident.[26] An initial explosion occurred when the steam and pressure caused tubes in the core to rupture tearing the reactor vault

21 David Goren, *Nuclear Accidents in Space and on Earth: An Analysis of International Law Governing the Cosmos-954 and Chernobyl Accidents*, 5 GEO. INT'L ENVTL. L. REV. 855, 865 (1992-1993).

22 Q. BRISTOW, OPERATION MORNING LIGHT — A PERSONAL ACCOUNT (1995), *available at* http://gsc.nrcan.gc.ca/gamma/ml_e.php (last visited on Sept. 12, 2011). *See also* FRANCIS LYALL & PAUL B. LARSEN, SPACE LAW: A TREATISE 117 (2009).

23 Department of External Affairs, *Canada: Claim against the Union of Soviet Socialist Republics for damage caused by Soviet Cosmos 954 (FLA-268), available at* http://www.emp.ca/intlaw7/cases/soviet.doc (last visited on Sept. 12, 2011).

24 Michael S. Straubel, *Space Borne Nuclear Power Sources — the Status of Their Regulation*, 20 VAL. U. L. REV 187, 191 (1986).

25 Settlement of Claim between Canada and the Union of Soviet Socialist Republics for Damage Caused by 'Cosmos 954' (Released on Apr. 2, 1981) *available at* http://www.spacelaw.olemiss.edu/library/space/International_Agreements/Bilateral/1981%20Canada-%20USSR%20Cosmos%20954.pdf (last visited on June 11, 2011).

26 Serguei Milenin et. al., *The Chernobyl [Chernobyl] Accident and the Future of Nuclear Energy: The Path towards Safety and Sustainability*, *available at* http://www.huri.harvard.edu/work1.html (last visited on June 11, 2011).

apart.[27] A few moments later, a second explosion of hydrogen gas blew the roof off the reactor building.[28] Finally with the superheated graphite exposed to the air, the reactor core itself ignited and a plume of radioactive fumes spiraled into the air.[29] After the Chernobyl incident, one hundred and thirty thousand people in nearby communities were evacuated, and 29 people died of radiation poisoning.[30] More than 200 others were struck with radiation sickness.[31] Water and farmland were contaminated with radioactive isotopes covering a 235 square mile region.[32]

Within two days, winds blew the radioactive cloud over Norway, Finland and Sweden.[33] Eventually the winds spread the radioactive contamination from Europe, across Asia, and to the North American Pacific Northwest.[34] Moreover, damages and recovery from Chernobyl incident were difficult to measure.[35] The Politburo estimated direct losses in the former Soviet Union at USD2.7 billion.[36] Many countries banned the sale of products and meats contaminated by radioactive rain.[37] Total damages in Western Europe were estimated in the hundreds of millions of dollars.[38] The former Soviet Union was threatened with litigation. However, recovery and enforcement seemed virtually impossible[39] because the former Soviet Union was not a party to both the 1960 Convention on the Third Party Liability in the Field of Nuclear Energy[40] (1960 Paris Convention) and the 1963 Vienna Convention on Civil Liability for Nuclear Damage[41] (1963 Vienna Convention). Consequently, following the first accident at the Chernobyl nuclear installation causing major off-site damage, the benefits of these Conventions were unavailable. In addition, no national law in the former Soviet Union

27 William Marbach et. al., *Anatomy Catastrophe*, NEWSWEEK, Sept. 1, 1986, at 26. *See also* International Nuclear Safety Advisory Group, Summary Report on the Post-Accident Review Meeting on the Chernobyl Accident 17 (1986), recited by Goren, *supra* note 21, at 860.

28 Marbach et. al., *id.*

29 *Id.*

30 *Id.*

31 *Id.*

32 Linda A. Malone, *The Chernobyl Accident: A Case Study in International Regulating State Responsibility for Transboundary Nuclear Pollution*, 12 COLO. J. ENVTL. L. 203 (1987).

33 *Supra* note at 21, at 860.

34 *Id.*

35 *Id.* at 861.

36 *Id.*

37 *Id.*

38 *Id.*

39 *Id.*

40 956 U.N.T.S. 251, Apr. 1, 1968. As of June 10, 2009 there are 16 State Parties. *See* NEA Legal Affair, *Paris Convention on Nuclear Third Party Liability: Latest Status of Ratifications or Accessions*, *available at* http://www.oecd-nea.org/law/paris-convention-ratification.html (last visited Oct 1, 2011).

41 1063 U.N.T.S. 265, Nov. 12, 1977. As of March 29, 2011, there are 38 State Parties. *See* IAEA, *Vienna Convention on Civil Liability for Nuclear Damage*, *available at* http://www.iaea.org (last visited Oct 1, 2011).

enabled injured parties to seek reparation.[42]

IV. Liability Conventions

A. Liability Conventions under International Space Law

While the advancement of technology today is partially benefitted from the peaceful use of space science and technology, space activities can cause potential hazards, *e.g.*, pre-launch damage, the falling of space objects, collision of space objects or the spread of radioactive waste emanating from nuclear-powered satellites.[43] On December 13, 1963, the United Nations adopted the Declaration on Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space.[44] This Declaration contains two principles about the responsibility and liability in paragraphs 5 and 8 that were, with slight modifications, incorporated in Articles VI and VII of the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space ("Outer Space Treaty").[45] The principle concerning international responsibility of States for national space activities was laid down in Article VI of the Outer Space Treaty in order to make sure that every space activity, whether governmental or non-governmental, shall be carried out in conformity with the Treaty. Article VII thereof explains rules on liability for damage and jurisdiction which have been elaborated in the Convention on International Liability for Damage Caused by Space Objects[46] ("Liability Convention"). In short, responsibility for national activities in outer space is placed on State of nationality, while liability is imposed for launching State. It is noteworthy that responsibility and liability are closely connected terms in international space law, but they have never been defined.[47]

42 Besides international nuclear civil liability conventions, there are others international conventions on nuclear notification and safety, i.e. the 1986 Conventions on Early Notification of a Nuclear (IAEA INFCIRC/335) that was entered in force on October 27, 1986 with currently 111 State parties and the 1994 Convention on Nuclear Safety (IAEA INFCIRC/449) that was entered into force on October 24, 1996 with currently 74 State parties, *available at* http://www.iaea.org/Publications/Documents/Infcircs/Others/infcirc335.shtml; http://www.iaea.org/Publications/Documents/Infcircs/Others/inf449.shtml (all last visited Oct 1, 2011).

43 Hanquin, *supra* note 5, at 24.

44 *See* Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space, *available at* http://www.unoosa.org/oosa/SpaceLaw/lpos.html (last visited on June 11, 2011).

45 610 U.N.T.S. 205, Oct. 10, 1967. As of January 1, 2010, there are 100 State parties.

46 961 U.N.T.S. 187; 24 U.S.T. 2389; T.I.A.S. No. 7762, Sept 1, 1972. As of January 1, 2010, there are 90 State parties.

47 Stephen Gorove, *Liability in Space Law: An Overview*, in DEVELOPMENTS IN SPACE LAW: ISSUES AND POLICIES 223 (Stephen Gorove ed., 1991).

Before adopting the Liability Convention, the United Nations Committee on the Peaceful Uses of Outer Space ("COPUOS") passed the 1968 Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space[48] ("Rescue Agreement"). The Rescue Agreement and the Liability Convention are closely related; the former explains the duties of the State with respect to handling the reentry of space objects into its territory, while the latter holds the launching State liable for damages its space objects cause to other States. Additionally, Article 5, paragraph 5 of the Rescue Agreement may consider expenses of recovering and returning a space object or its component parts which are to be borne by the launching authority as costs or damages.

Almost fourteen years after the successful launch of Sputnik I, the COPUOS submitted the final draft Liability Convention which was endorsed by the General Assembly on November 29, 1971.[49] In fact, the issue of liability had been brought into the Legal Sub-Committee of the COPUOS in June 1962, due to the fact that some pieces of space objects, including their fragments, fell down to the States.[50]

Article I of the Liability Convention defines certain words such as damage, launching, and launching State. The definition of 'damage' under the Convention is so broad that it includes four kinds of recoverable harm such as loss of life, personal injury, other impairment of health and loss of or damage to property.[51] The phrase "other impairment of health" casts some doubts whether it covers mental injury. Professor Gorove suggested the World Health Organization's definition, which describes health as "a state of complete physical mental and social well-being."[52] Damage associated with harmful radiation emanating from a nuclear power source is also covered. Nevertheless, it fails to point out whether indirect damage is included.[53] It also bars liability for damage to elements of the environment which are not under ownership like high seas since it mentions only damage to property belonging to States, intergovernmental organizations, or natural/juridical persons.[54]

Similar to the Outer Space Treaty, liability under this Convention is placed on the launching State which launches or procures the launching of a space object and from its

48 672 U.N.T.S. 119; 1969 U.K.T.S. 56, Dec 3, 1968. As of January 1, 2010, there are 92 State parties.

49 G.A. Res. 2777 (XXVI) (Nov. 29, 1971); Liability Convention, *supra* note 46.

50 BIN CHENG, STUDIES IN INTERNATIONAL SPACE LAW, 286-287 (1997).

51 Carl Q. Christol, *International Liability for Damage Caused by Space Objects*, 74 AM. J. INT'L L. 346, 359 (1980).

52 Stephen Gorove, *Cosmos 954: Issues of Law and Policy*, in Gorove, *supra* note 47, at 242.

53 W.F. Foster, *The Convention on International Liability for Damage Caused by Space Object*, 10 CAN. Y. B. INT'L L. 137, 157 (1972).

54 Stephen Gorove, *International Space Law and the Protection of the Human Environment*, in Gorove, *supra* note 47, at 132.

territory or facility a space object is launched.[55] 'Launch' means an attempt to launch under Article I (b) of the Convention. Even though there is a definition, it is unclear when an attempt to launch under such definition begins.[56]

The term 'space object' is not defined since the Liability Convention only includes component parts of a space object as well as its launch vehicle and component parts.[57] Apart from its lack of clarification, a space object in this Convention refers to all space objects, owned by either State or private actors because most space activities were conducted by States when the Convention was drafted.[58]

There are two systems of liability in the Liability Convention which are based on fault or absolute liability. Both systems impose *prima facie* the liability on States and intergovernmental organizations.[59] The criteria for each liability are based on the area where damage occurs.

The concept of absolute liability on the part of the launching State for damage caused by a space object applies only when such damage is caused on the surface of the earth or to aircraft in flight.[60] The reason for adopting the absolute liability principle for damage on the earth is due to a practical consideration. The claimant State will face insurmountable obstacles to produce evidence of fault as a condition precedent to recovery since such evidence may be complex, technical and only known by the respondent State.[61] Another acceptable reason is due to the ultra-hazardous nature of space activities involving extraordinary risks which cannot be eliminated by the utmost care.[62] This absolute liability is unlimited. During the drafting process, some delegates expressed concern about the possible grave financial risks placed on developing countries.[63] In the end, unlimited liability was adopted with the consideration of international law and the principles of justice and equity so as to restore the aggrieved party to the condition which would have existed if the damage had not occurred.[64] However, it is sharply pointed out that the unlimited liability regime is a result of

55 *Supra* note 44, para. 8; *supra* note 45 (Outer Space Treaty), art. VII; *supra* note 46 (Liability Convention), art. I (c).

56 B.A. Hurwitz, State Liability for Outer Space Activities in Accordance with the 1972 Convention on International Liability for Damage caused by Space Objects 20-21 (1992).

57 Liability Convention art. I (d).

58 *Supra* note 53, at 149.

59 Although the liability is placed on 'launching state,' the references to States shall be deemed to apply to any international intergovernmental organization under the condition prescribed in Article XXII of the Liability Convention.

60 Liability Convention art II.

61 Statements by the French delegate, summary record 78 at 10; the Romanian delegate, summary record. 01, at 16; the U.K. delegate, SUM.REC. 10 at 5; and the U.S.A. delegate, summary record 77, at 4-5 recited by *supra* note 53, at 150.

62 I.H.Ph. Diederiks-Verschoor & Vladimir Kopal, An Introduction to Space Law 37 (2008).

63 *Supra* note 53, at 152.

64 Liability Convention, art. XII.

neither economic nor environmental concern. This is also a global political arrangement since the participating States which were capable of space activities seemed to be more interested in the political result than in the details of liability regime.[65]

Despite no liability ceiling, there is one exception to the rule of absolute liability. It is when a launching State can prove that such damage has resulted wholly or partially for the following reasons: (1) gross negligence; or (2) from an act or omission done with intent to cause damage on the part of a claimant state or of natural or juridical persons it represents.[66] However, this exoneration must be subject to the action in conformity with international law, including in particular the UN Charter and the Outer Space treaty 1967. Interestingly, *force majeure* is not a ground of exoneration since the time of drafting; the majority viewed that to allow exoneration on this ground would be deviate from the main objective of the Liability Convention.[67]

The concept of liability based on fault may be applied when damage is caused beyond the surface of the Earth by a space object of one launching State to persons or property of another launching State.[68] Undoubtedly, the reason is that the position of both parties is equal. In the case of collisions with debris in outer space, it may be very difficult to prove fault on States.

In the case of independent launchings jointly causing damage to third State elsewhere than on the surface of the earth, meanwhile, these States shall be jointly and severally liable.[69] Joint liability applies when two or more States launch a space object in a joint effort.[70]

The Liability Convention does not apply to nationals of that launching State understandably.[71] The concept of "*volenti non fit injuria*" or no injury is done to a person who consents is adopted when damage caused to foreign nationals while they are taking part in the operation of the space object from the time of its launching or at any stage thereafter until its descent, or during such time as they are in the immediate vicinity of a planned launching or recovery area as a result of an invitation by that launching State.[72]

65 Thomas Gehring & Markus Jachtenfuchs, *Liability for Transboundary Environmental Damage towards a General Liability Regime?*, 4 EUR. J. INT'L L. 92, 103, (1993), *available at* www.ejil.org/pdfs/4/1/1228.pdf (last visited on June 11, 2011).

66 Liability Convention art. VI (1).

67 *Supra* note 53, at 162.

68 Liability Convention art. III.

69 *Id.* art. IV.

70 *Id.* art. V.

71 *Id.* art. VII (a).

72 *Id.* art. VII (b).

Under the Liability Convention, only States can present claims for compensation on behalf of its nationals and on the right of all persons with conditions.[73] First, a State shall present a claim to the launching State through diplomatic channels no later than one year following the date of the occurrence of the damage or the identification of the liable launching State.[74] The Convention allows the periodic revision of claims as further damage becomes apparent for one year after the full extent of the damage is known. Even if the claimant State cannot establish the full extent of damage within the one year time limit, it must present a claim.[75] If there is no settlement within one year of the submission, the claim shall be submitted to the Claims Commission which shall be composed of three members, one appointed by the launching State, the second appointed by the claimant State, and the third member, the Chairman, to be chosen by both parties.[76] A dispute may be disposed by the Claim Commission in the form of a decision or an award subject to the parties. However, the Convention weakens its enforcement by letting the parties agree whether to let such decision be final and binding or not. Otherwise, the Commission can render only a final recommended award which the parties shall consider in good faith.[77] In this respect, the Liability Convention is seriously defective.

B. Liability Conventions under International Nuclear Law

The need for international regulations was first felt among States engaged in common regional efforts in the field of nuclear energy, such as the members States of the then Organization for European Economic Cooperation ("OEEC") which was later reconstituted as the Organization for Economic Cooperation and Development ("OECD"), and the European Atomic Energy Community ("EURATOM"). In addition to factors such as continuity and cooperation, those countries also faced difficulties in their relations with the suppliers of nuclear fuel and equipment, who were reluctant to furnish materials the use of which might result in not clearly defined, variable and possibly unlimited liability towards the victims and the operators themselves. Moreover, exporting governments feared the consequences that might derive for their nationals and themselves from damage caused abroad by nuclear installations using material and equipment exported by them under the sponsorship and on the basis of inter-State cooperation agreements. There was a widespread feeling that the operator of

73 *Supra* note 53, at 169.
74 Liability Convention art. X.
75 *Id.* art. X (3).
76 *Id.* art. XV.
77 *Id* art. XIX (2).

a nuclear installation should bear exclusive liability for damage caused by nuclear incidents, and that all other persons (such as builders or suppliers) associated with the construction or operation of that installation should be exempted from liability.[78]

1. Existing International Conventions before the Chernobyl Incident

In the 1960s the international conventions and domestic laws on nuclear liability were adopted, among which the two most significant international conventions were the 1960 Paris Convention, a regional convention concluded within the OECD as the regional plane, and the 1963 Vienna Convention, the international plane as multilateral convention.

The 1960 Paris Convention provides that the operator of a nuclear installation shall be liable for damage or loss of life of any person and damage to or loss of any property (other than the nuclear installation and associated property or means of transport).[79] Consequently, the operation must be covered by insurance.

Thereafter, under pressure by the US suppliers, in order to ensure compensation for nuclear damage, the Contracting Parties to the Paris Convention concluded the Supplementary Convention on Third Party Liability in the Field of Nuclear Energy (the Brussels Supplementary Convention),[80] which further specified the territorial scope of application of the regime and established two or more layers of compensation.[81] After privately financed funds available under the Paris Convention are exhausted, the licensing State of a nuclear installation causing harm assumes a limited subsidiary liability in the second layer. The third layer, an insurance-like pool, is jointly financed by all Contracting States.[82]

By contrast to the development of the 1960 Paris Convention, the 1963 Vienna Convention had not come into force until 1997, more than a decade after the Chernobyl incident. Nonetheless, the 1960 Paris Convention and the 1963 Vienna Convention share similar contents on liability with only slightly different in the amount of compensation. Namely, the liability is channeled exclusively to the operators of the nuclear installations. Such liability is absolute with some prescribed exceptions. The action has to be filed within ten years from the date of the nuclear accident with an exception for an extended period as prescribed therein. The courts of the Contracting Party where the

78 IAEA, The 1997 Vienna Convention on Civil Liability for Nuclear Damage and the Convention on Supplementary Compensation for Nuclear Damage Explanatory Texts 5-6 (2007), *available at* http://www-pub.iaea.org/MTCD/publications/PDF/Pub1279_web.pdf (last visited on June 11, 2011).

79 Shaw, *supra* note 8, at 893.

80 1041 U.N.T.S. 358, Dec. 4, 1974.

81 Hanquin, *supra* note 5, at 33-34.

82 Gehring & Jachtenfuchs, *supra* note 65, at 100-101.

nuclear incident actually occurred are the competent forum.[83]

2. New Emerging International Conventions after the Chernobyl Incident

From the Chernobyl incident, one can know there are some outstanding weaknesses in the world's existing mechanisms of international nuclear law as follows: legal provisions for the nuclear safety, especially, safety of nuclear installations and radioactive waste management; provisions of international cooperation in case of radiological emergency; systems of international liability for nuclear damage; and problems with the existing legal instruments and imperfect functional mechanism of regular and the international cooperation, human being, environment, economics and politics of those mentioned.[84]

Hence, following to the Chernobyl incident, the International Atomic Energy Agency ("IAEA") initiated work on all aspects of nuclear liability with a view to improving the basic Conventions and establishing a comprehensive liability regime.[85] As a result of joint efforts by the IAEA and the OECD, the Joint Protocol relating to the Application of the 1963 Vienna Convention and the 1960 Paris Convention[86] was adopted in 1988 and entered into force on April 27, 1992. This Joint Protocol established a link between the Conventions combining them into one expanded liability regime. Parties to the Joint Protocol are treated as though they were parties to both Conventions and a choice of law rule is provided to determine which of the two Conventions should apply to the exclusion of the other in respect of the same incident.[87]

To improve the existing nuclear liability regime, a Diplomatic Conference was held in 1997 to revise the 1963 Vienna Convention and adopted two treaties, namely, the Protocol to Amend the Vienna Convention on Civil Liability for Nuclear Damage[88] ("1997 Protocol") and the 1997 Convention on Supplementary Compensation for Nuclear Damage[89] ("1997 CSC").

The purpose of the 1997 Protocol is to 'amend' the 1963 Vienna Convention in order to provide "the broader scope, increased amount of liability of the operator of a nuclear

83 IAEA, *Vienna Convention on Civil Liability for Nuclear Damage: Background*, *available at* http://www.iaea.org/Publications/Documents/Conventions/liability.html (last visited on June 11, 2010).

84 *Id.*

85 *Id.*

86 INFCIRC/402. *Available at* http://www.iaea.org/Publications/Documents/Infcircs/Others/inf402.shtml (last visited on Oct 1, 2011). As of July 28, 2009, there are currently 26 State parties, *available at* http://www.iaea.org/Publications/Documents/Conventions/jointprot_status.pdf (last visited Oct 1, 2011).

87 *Supra* note 78.

88 INFCIRC/566 (July 22, 1998), *available at* http://www.iaea.org/Publications/Documents/Infcircs/1998/infcirc566.shtml (last visited on June 11, 2011).

89 IAEA INFCIRC/567 (not yet in force).

installation and enhanced means for securing sufficient and equitable compensation."[90] Especially, Article 18 of the 1997 Protocol states that the 1963 Vienna Convention is to be read and interpreted together as one single text[91] that will be referred to as "the 1997 Vienna Convention on Civil Liability for Nuclear Damage"[92] ("1997 Vienna Convention").

The 1997 Vienna Convention does not substantially change the scope of application of the 1963 Vienna Convention as far as rights under public international law are concerned. The liability regime is still the civil liability, not State liability, despite critical debates during the negotiations.[93] The 1997 Vienna Convention amends the scope of application of international civil liability regime in several aspects.[94] First, it envisages the possibility of the inclusion or exclusion of nuclear installation from the application of the 1997 Vienna Convention on the basis of the risk involved; the Convention does not definitely apply to installations used for non-peaceful purpose. Second, it extends the 'geographical scope' of the Convention so as to cover damage 'wherever suffered.'[95] Finally, it provides a new definition of 'nuclear damage.'[96] Moreover, the 1997 Vienna Convention sets the possible limit of the operator's liability at not less than 300 million Special Drawing Rights ("SDRs") (roughly equivalent to USD400 million) and extends the period during which claims may be brought for loss of life and personal injury.[97] It also provides for jurisdiction of coastal States over actions incurring nuclear damage during transport. Taken together, the two instruments should substantially enhance the global framework for compensation well beyond the scope of the existing Conventions.[98]

While the 1997 CSC defines additional amounts to be provided through contributions by States parties on the basis of installed nuclear capacity and the UN rate of assessment, as well as all States may adhere regardless of whether they are parties to any existing nuclear liability conventions or have nuclear installations on their territories,[99] the 1997 CSC provides the framework for establishing a global regime with widespread adherence by nuclear and non-nuclear States.[100]

90 *Supra* note 78, at 21.

91 *Id.*

92 The 1997 Convention entered into force on October 4, 2003. As of March 29, 2011, there are 9 State parties.

93 Vanda Lamm, *The Protocol Amending the 1963 Vienna Convention, available at* http://www.oecd-nea.org/law/chernobyl/LAMM.pdf (last visited 11 June 2011).

94 *Supra* note 78, at 23.

95 *Id.* at 23-24.

96 *Id.* at 24.

97 *Id.*

98 *Id.*

99 *Id.*

100 *Id.* at 2.

V. Liability Systems

A Liability System of International Space Law

The Cosmos 954 case elaborates some practical problems on international space law some of which are worth noting as follows.

1. The Vague Definition of 'Damage'

Even though the case had been settled before passed to the Claim Commission, the Cosmos 954 case illustrated the application of the Liability Convention and its limits. Due to the adoption of absolute liability without ceiling, the kinds of damage claimable from the incident should be clarified so as to be fair for every party. From the Cosmos 954 case, Professor Haanappel noted that no physical or property damage had been suffered by Canadian citizens.[101] He further observed that no measurable damage had been caused to the Canadian environment by the incident.[102] Clean-up cost for contamination-pollution such as radiation causing damage to property is viewed by scholars differently. Some hold it as direct damage,[103] while others opine that it may be treated as indirect or consequential damage.[104] Unfortunately, the Cosmos 954 case was settled through diplomatic channels which did not explain the method of compensation. Thus, it is still unknown whether indirect damage is covered and which kinds of damage are compensable under the Liability Convention.

2. Insurance System: A Consequence of Absolute Liability Regime to Allow Private Participation in Space Activity

According to the Cosmos 954 case, only one incident can produce measurable monetary harm. Despite that a space activity is carried on by private entity, a State, even if it is not the actual actor, shall still be considered as a launching entity bearing international responsibility or liability in international space law. If such a State pays damages and seeks recourse against a national private entity, the private entity has to possess substantial financial resources. To ensure that such an entity is able to pay, domestic space law in many space-faring countries adopts the insurance policy as a precondition for granting a license to engage in a space activities to non-State entities. For example,

101 Peter Haanappel, *Some Observations on the Crash of the Cosmos 954*, 6 J. SPACE L. 147-148 (1978).

102 *Id.*

103 *Supra* note 20, at 133.

104 *Supra* note 101, at 148.

liability insurance or documents showing financial responsibility is a requirement to get a license for commercial space launch activities in the United States.[105] The insurance or financial responsibility shall not be more than USD500,000,000 for claims by a third party for death, bodily injury, or property damage or loss resulting from an activity carried out under the license and than USD100,000,000 for claims by the United States against a person for damage or loss to Government property resulting from an activity carried out under the license.[106] Across the Atlantic, the United Kingdom's Outer Space Act of 1986 requires the licensee to insure himself against liability incurred in respect of damage or loss suffered by third parties, in the United Kingdom or elsewhere, as a result of the activities authorized by the license.[107] The Russian Space Agency has the right to require that the licensee at the time of preparing for launch be able to produce insurance policy to the mandatory insurance of space operations in accordance with legislation of the Russian Federation.[108] Moreover, Article 25.1 of the 1993 Russian Federation Law on Space Activities describes that appropriate insurance is required of non-State entities using Russian facilities.[109] In South Africa, the licensee is needed to offer security to meet the obligations that may be incurred concerned in respect of damages by a launch vehicle or spacecraft.[110] Similarly, the Korean Space Exploitation Promotion Act requires third-party liability insurance in an amount capable to compensate for damages occurring in possible space accidents.[111]

3. Safety Standard: Nuclear Power Sources Principle

Despite taking fourteen years to develop, one outcome of the Cosmos 954 case is the adoption of the Principles Relevant to the Use of Nuclear Power Sources in Outer Space[112] which set goal and safety guidelines for the use of nuclear power sources. However, the Principles apply only to nuclear power sources for electricity generation and leave the door open for other methods involving nuclear materials like fission, gas photon, etc.[113] Principle 2 defines the State in the terms, 'launching State' and 'State launching' which "exercises jurisdiction and control over a space object with nuclear

105 49 U.S.C. § 70112.

106 *Id.* § 70112 (3) (A).

107 United Kingdom Outer Space Act sec. 5.2(f) (1986).

108 Statute on Licensing Space Operations sec. 24, *available at* http://www.oosa.unvienna.org/oosaddb/showDocument.do?documentUid=312&country=RUS (last visited on June 11, 2011).

109 Lyall & Larsen, *supra* note 22, at 115.

110 South African Space Affair Act of 1993 art 14.

111 Republic of Korea Space Exploitation Promotion Act Law art. 15, *available at* http://stage.tksc.jaxa.jp/spacelaw/country/korea/korea_2005_e.html (last visited on June 11, 2011).

112 G.A. Res. 47/68, U.N. Doc. A/47/610 (Dec. 14, 1992).

113 Lyall & Larsen, *supra* note 22, at 293.

power sources on board at a given point in time relevant to the principle concerned."[114] For liability, however, the Principles refer to the definition in the Outer Space Treaty and the Liability Convention.[115] Principle 3 mainly focuses on guidelines and criteria for safe use which recommend complying with the standards as set by the International Commission on Radiological Protection.[116] Safety assessment prior to the launch is also elaborated in Principles 4 as well as the notification of re-entry in Principle 5. Clearing some doubts about damages, Principle 9 deals with liability and compensation of which paragraph 3 expressly refers to expenses for search, recovery and clean-up operation, including expenses for assistance received from third parties as compensation.[117] All in all, the Principles are only *lex ferenda* and have no legal binding force.

B. Liability System of International Nuclear Law

There are two categories of the nuclear activities that might impose different regime of international liability. They are nuclear arms in time of war, and peaceful use of nuclear energy such as nuclear power plant in time of peace. The use of nuclear technology, especially peaceful use, brings about its benefits attached with risks of serious accident. The Chernobyl incident has thus manifested State practices on nuclear liability regime under international law because of directly and indirectly serious harm to natural resources, environment and human health, including the so-called transboundary damage. According to such incident, the international community as a whole had to consider whether the governing liability regime and international conventions of international nuclear law were adequate, appropriate and efficient redress for serious consequences from such activity to injured persons, *e.g.*, whether State or private operators should be partially or fully liable for injuries resulting from hazardous activity.

1. Definition of Nuclear Damage

The 1997 Vienna Convention redefines 'nuclear damage' more completely. Before the Chernobyl incident, Article I.1 (k)-(i) of the 1963 Vienna Convention directly link nuclear damage to suffered individuals or their property.[118] Other kinds of damage in Article I.1 (k) (ii) are merely included "to the extent that the law of the competent court so provides." As a consequence, damage to the general environment (water, air, the soil,

[114] *Supra* note 112, princ. 2.1.
[115] *Id.* princs. 2.2 & 9.
[116] *Id.* princ. 3.1.
[117] *Id.* princ. 9.
[118] *Id.* princ. 33.

etc.) is, *per se*, outside the scope of the regime of civil liability and can only be compensated if the applicable substantive law so provides.[119] The wide discretion allowed for the national legislation of the Contracting Parties may thus give rise to uncertainties as to the extent of compensation to be paid in the case of nuclear incident.[120] In addition to the existed definition, the 1997 Vienna Convention includes the loss in the definition of nuclear damage.

2. Economic Loss

Article I.1 (k) (iii) (v) and (vii) of the latter Convention are inserted categories of 'economic loss' as the new sort of damage. There are three categories. The first is economic loss arising from loss of life, any personal injury or loss of or damage to property. For instance, medical costs, loss of earning due to illness or death, including loss of income deriving from the destruction of contaminated crops or from the halt in production consequential to damage to a factory will fall under this head. The second category is, under Article I.1 (k) (v), the loss of income deriving from an economic interest in any use or enjoyment of the environment. This provision is sometimes labeled as "pure economic loss" because it is an economic loss incurred to a person not related to any property damage suffered by that person.[121] The third category of economic loss is enumerated under Article I.1 (k) (vii) that is provided by "any other economic loss, other than any caused by the impairment of the environment, if permitted by the general law on civil liability of the competent court." This category may be also labeled as "pure economic loss" because it cannot be linked to any property damage suffered by the person entitled to claim compensation. In contrast with Article I.1 (k) (v), it does not derive from an economic interest in a use or enjoyment of the environment. For example, if a factory is damaged as a result of a nuclear accident and the damage leads not only to a halt of production but also to the loss of jobs on the part of the employees thereof, these employees suffer loss that is not covered under either (iii) or (v), but covered under this provision. As stated earlier, however, this residual category of economic loss can only be compensated if permitted by the "general law on civil liability of the competent court." The admissibility of claims under this head is totally dependent upon the provisions of the applicable substantive law of the competent court under the rule of private international law, referred to *lex fori*. Accordingly, the term "general law on civil liability of the competent court" can be

119 *Id.*

120 *Id.*

121 Fishermen, *e.g.*, who do not own the fish in the sea, may suffer a loss because such fish is contaminated. Similarly, a person managing a hotel at some holiday resort, which does not own the public breach close to his hotel, may suffer a loss because tourists are afraid of that beach is contaminated. *See id.*

intentionally defined to include the rules of private international law of the forum, as opposed to simply the law of the competent court, though such term is not defined in the 1997 Vienna Protocol.[122]

3. Cost of Measures of Reinstatement of Impaired Environment and Preventive Measures

Article I.1 (k) (iv) of the 1997 Vienna Convention constitutes the "costs of measures of reinstatement of impaired environment," apart from economic interest in the use or enjoyment of the environment mentioned at subparagraph(v). The monetary evaluation of the environmental damage is limited by the compensation to the costs of measure of reinstatement of impaired environment which are actually taken or to be taken. Moreover, the impairment of the environment should not be 'significant.' However, the question of what constitutes a significant impairment is left to the competent court to determine the extent to which damage shall be compensated under this provision only in so far as it is not already included in subparagraph (ii), the property damage, under the applicable substantive law.[123] For example, measures taken by a farmer whose land has been contaminated will be included in the concept of property damage in subparagraph (ii). Therefore, subparagraph (iv) is mainly designed to cover measures taken in respect of areas owned by general public.[124]

The costs of preventive measures are incorporated in Article I.1 (k) (vi). Indeed, in many legal systems, the compensation of damage resulting from a tort may be refused or at least reduced if the claimant fails to take the reasonable steps to avoid or mitigate damage.[125] In the case of nuclear damage, those preventive measures may range from the taking of iodine pills to the evacuation of an entire city or area. The fact that preventive measures are said to be measures taken by 'any person' would seem to include measures taken by both private person and public authorities. In case of measures taken by public authorities, meanwhile, it would seem that at least the costs which would not have been incurred without the occurrence of nuclear accident should be compensated.[126]

4. Individual Liability

The principle of exclusive liability has two main aspects. First, liability is legally 'channeled' to the 'operator' of the nuclear installation exclusive of any other party

[122] *Id.* at 38-39.
[123] *Id.* at 39-40.
[124] *Id.*
[125] *Id.* at 40.
[126] *Id.*

potentially liable under general tort law in substitution of, or in conjunction with, that operator. Second, the operator incurs no liability outside the system established by Article IV.7 (b) of the 1963 Vienna Convention.[127] It is, however, no longer envisaged in the 1997 Vienna Convention, which specifies the operator to be liable for that damage.

For the rights to recourse, Article X only grants the operator two cases. First, this is expressly provided for by a contract in writing or second the nuclear incident is a result of an act or omission done with intent to cause damage, against the individual who has acted or omitted to act with such intent. In the latter case, the right of recourse is limited to a right against the individual natural person who acts or omits to act with intent to cause damage. Eventually, there is no right of recourse against the employer of that person. A private operator shall be liable for his action or omission that caused damage. Thus, it will conform with the purpose of 1997 Vienna Convention that imposes strict liability to the operator.[128] In fact, operators of nuclear installations can never be held liable beyond the amount laid down in accordance with Article V, even if the damage was caused intentionally.[129]

5. Limitation of Liability

The deficiencies inherent in the regime of limited liability for nuclear damage in both amount and time were revealed by the Chernobyl accident.[130] The 1997 Vienna Convention, thus, corrected the following.

In terms of amount, the limit set up by treaty was far below the actual amount of compensation paid to Germany after the Chernobyl accident.[131] However, the 1997 Vienna Convention limited the liability of the operator by the Installation State for any one nuclear incident, either to not less than 300 million SDRs or to not less than 150 million SDRs. At least 300 million SDRs public funds shall be made available by that State to compensate for nuclear damage; or (c) for a maximum of fifteen years from the date of entry into force of the 1997 Vienna Convention, to a transitional amount of not less than 100 million SDRs in respect of a nuclear accident occurring within that period. An amount lower than 100 million SDRs may be established, provided that public funds shall be made available by that State to compensate nuclear damage between that lesser

127 Article IV.7 reads: "Nothing in this Convention shall affect the liability of any individual for nuclear damage for which the operator, by virtue of paragraph 3 or 5 of this Article, is not liable under this Convention and which that individual caused by an act or omission done with intent to cause damage."

128 The 1997 Vienna Convention art. IV (7).

129 *Supra* note 78, at 12.

130 Hanquin, *supra* note 5, at 80.

131 Norbert Pelzer, *Concepts of Nuclear Liability Revisited: A Post- Chernobyl Assessment of the Paris and Vienna Conventions, in* NUCLEAR ENERGY LAW AFTER CHERNOBYL 97 (P. Cameron, L. Hancher & W. Kuhn eds., 1988).

amount and 100 million SDRs.[132] Moreover, the Installation State may establish a lower amount of liability of the operator, provided that in no event shall any amount so established be less than 5 million SDRs, and provided that the Installation State ensures that public funds shall be made available up to the amount established pursuant to Article V, paragraph 1 of the 1997 Vienna Convention.[133]

In terms of time, it is said, the ten-year period is too short in relation of the peculiarities of radiation defects.[134] Article VI of the 1997 Vienna Convention extends the time limit for submission of claims to thirty years from the date of the nuclear accident with respect to loss of life and personal injury or ten years from the date of the nuclear incident with respect to other damage.[135] In addition, rights of compensation under the 1997 Vienna Convention shall be subject to prescription or extinction, as provided by the law of the competent court, if an action is not brought within three years from the date on which the person suffering damage had knowledge or ought reasonably to have knowledge of the damage and of the operator liable for the damage, if the periods established pursuant to sub-paragraphs (a) and (b) of paragraph 1 of this Article shall not be exceeded.[136] Moreover, the provision requires a Contracting Party or any of its constituent subdivisions, such as States or Republics, to maintain insurance or other financial security to cover their liability as operators.[137]

The 1997 Vienna Convention allows for some exoneration from liability. Article IV.3 mentions that: "No liability under this Convention shall attach to an operator if he proves that the nuclear damage is directly due to an act of armed conflict, hostilities, civil war or insurrection."

Nonetheless, on March 11, 2011 such devastating catastrophe of nuclear damage arose again in Japan when the Fukushima Dai-ichi nuclear power plant (hereinafter called "Fukushima Dai-ichi NPP") of the Tokyo Electric Power Company ("TEPCO")[138], located at the east coast of Honshu, was attacked by major earthquake of magnitude 9.0 and accordingly a series of large tsunami wave.[139] It brought about the most severe consequence at Fukushima Dai-ichi NPP, among other things, the loss of all

132 The 1997 Vienna Convention art. V.1.

133 *Id.* art. V.2.

134 Hanquin, *supra* note 5, at 80.

135 The 1997 Vienna Convention art. VI.1.

136 *Id.* art. VI.3.

137 *Id.*

138 Board of Governors, *IAEA Activities in Response to the Fukushima Accident*, GOV/INF/2011/8

139 *Id. See also* Report the Greatest East Japan Earthquake Expert Mission, *IAEA International Fact Finding Expert Mission of the Fukushima Dai-ichi NPP Accident Following the Great East Japan Earthquake and Tsunami*; Report to the IAEA Member States, Tokyo, Fukushima Dai-ichi NPP, Fukushima Dai-ni NPP and Tokai Dai-ni NPP, Japan 11-13 (2011).

instrumentation and control systems at reactor 1-4, with emergency diesel 6B providing emergency power to be shared between Units 5 and 6, including radioactive releases.[140] Although such destruction and radioactive releases were caused by *force majeure*, it was not taken into account as exoneration under Article IV.3. TEPCO as an operator thus, was strictly liable under the 1997 Vienna Convention, to victims injured by the Fukushima Dai-ichi NPP's widespread radioactivity.

6. Insurance and Financial Security

To balance the interests between the State and private nuclear industry, the solution to control the adverse effects of such activity has to be both effective and pragmatic.[141] The answer laid down in Article III of the 1997 Vienna Convention is that operator shall be required to maintain insurance or other financial security covering his liability for nuclear damage in such amount, of such type and in such terms as the Installation State shall specify. The Installation State shall ensure the payment of claims for compensation for nuclear damage which have been established against the operator by providing the necessary funds to the extent that the insurance or other financial security is inadequate to satisfy such claims, but not in excess of the limit, if any, established pursuant to Article V of the 1997 Vienna Convention. Where the liability of the operator is unlimited, the Installation State may establish a limit of the financial security of the operator liable, provided that such limit is not lower than 300 million SDRs.[142] Nothing in paragraph 1 of this Article shall require a Contracting Party or any of its constituent subdivisions, such as States or Republics, to maintain insurance or other financial security to cover their liability as operators.

7. Litigation Procedure

Article XI (A) of the 1963 Vienna Convention has been amended by the 1997 Vienna Convention as follows:

> The Contracting Party whose courts have jurisdiction shall ensure that in relation to actions for compensation of nuclear damage – (a) any State may bring an action on behalf of persons who have suffered nuclear damage, who are nationals of that State or have their domicile or residence in its territory, and who have consented thereto; and (b) any person may bring an action to enforce rights under this Convention acquired by subrogation or assignment.

140 For Report the Greatest East Japan Earthquake Expert Mission, *see id.* at 11. *See also* Steven L. Kass, *International Law Lessons from the Fukushima Nuclear Disaster*, (2011) *available at* http://www.clm.com/publication.cfm?ID=324 (last visited on Oct 01, 2011).

141 *Id.*

142 *Id.* art. VII.

8. Geographical Scope

The geographical scope in Article XI of the 1963 Vienna Convention was amended by the 1997 Vienna Convention. The geographical scope means maritime zones or areas under the 1982 United Nations Conventions on the Law of the Sea. The terms of 'territory' in Article XI.1 refers to maritime zones such as internal waters and territorial seas that a coastal State has sovereignty to exercise enforcement jurisdiction when nuclear damage occurs. Although the incident occurs in or beyond such zones of non-Contracting State, the court of the Installation State will have jurisdiction. The territorial sovereignty is imposed not only over such zones, but also over the exclusive economic zone ("EEZ") to expand the former geographical scope to cover sovereign rights of State, 200 nautical miles from territorial sea baselines.[143]

VI. Recommendations

The damages resulting from a space object or nuclear power plant accident are similar in such ways as to required changes in the law to avoid drastically different outcomes. Even though Canada, the injured party, received compensation, the proposed regulation regarding nuclear power source was passed only as a recommendation. While the Soviet Union had paid nothing for the Chernobyl incident, a number of nuclear legal loopholes were filled.

A. Definition of Damage

As discussed above, the term 'damage' in the Liability Convention should be clarified. Even though Professor Christol summed up his opinion that during the negotiation process the drafters of the Liability Convention, in case of any doubt, made clear that the Convention was designed to benefit potential claimants.[144] It will be far better to prevent any future doubt by amending the definition. The new definition in the 1997 Vienna Convention can be used as a good analogy. Legally speaking, economic loss under Article I.1 (k) (iii) (v) and (vii) thereof should be added to the Liability Convention. Since the Cosmos 954 caused damage to no person but rather the environment, attention must be paid to environmental damage and reparation costs. Like the new nuclear law, damage to the environment and the costs of measures of

[143] *Id.* art. XI 1*bis*.

[144] *Supra* note 51, at 371.

reinstatement of impaired significant environment should be provided in space law. If doing so, it should clearly draw the line with the expenses regarding recovering and returning a space object or its component parts, as stipulated in Article 5 of the Rescue Agreement. In addition, the cost of preventive measures should be included.

B. Liability

Unlike international maritime, air or nuclear law, space law places liability on the State, not a private entity. Therefore, its liability is unlimited. There are, nevertheless, four conditions to apply limited liability.[145] First, the activity is under either strict or absolute liability regime. Second, the risk involved in or the damage caused by the activity is immeasurable. Third, the continuity of such activity will benefit the community. Last, the activity is carried on by private operators who may not be able to cover with the compensation without financial ruin.[146] Until the 1970s, space activities were fully run by States because only States had advanced space technology and the financial resources. However, more players are private companies and many developing countries without stable financial status are participating in space activities today. The question would arise whether it is time to reconsider the liability regime in space law to shift from State liability to civil liability. Space law should change its regime to civil liability with the three-tier system, similar to nuclear law. The first tier is funded by the liable nuclear operator. The second tier comes from public funds of the installing State. The third tier is contributed from all State parties. If the regime will be changed to the proposed nuclear law model, the burden of proof in each tier has to be clarified. The advantages are not only to place the liability upon the real actor, but also to create a faster compensation system for injured persons. The additional benefit is, in the case of unidentified liable person, that injured person or State can be compensated from the fund.[147]

C. Insurance

Insurance is another concern. As mentioned above, domestic space laws, in spite of the variety in the amount, require insurance as a precondition before giving any license to private actors to engage in space activities. If the international civil liability regime is established in a similar way to the nuclear law, insurance will be a precondition and have to be maintained while conducting space activities. Furthermore, the insurance

145 *Supra* note 53, at 153.

146 *Id.* at 153-154.

147 Lotta Viikari, *Nuclear Liability — A Feasible Model for the Space Sector? in* THE 60TH INTERNATIONAL ASTRONAUTICAL CONGRESS PROC. (Daejeon, Republic of Korea, 2009).

policy limits of each State will correspond to the liability ceiling.[148] Regarding space law, the Korean Space Liability Act, for instance, prescribes the limit of compensation which is the minimum amount of the third party insurance of the private entity who participates in space activities.[149]

D. Safety Standards

During the negotiation of the Liability Convention, there was an opinion that if liability is limited, there should be some safety standards for space activities.[150] Due to this concept, practically, there is neither an international safety standard nor a regulator although space is a province of all mankind. The risk of space debris led to the adoption of the Principles Relevant to the Use of Nuclear Power Sources in Outer Space[151] and the Space Debris Mitigation Guideline.[152] Unfortunately, both do not have legal binding force. International space law then vests the State with authority to scope the safety of its national activities whether such activities are carried on by either governmental agencies or non-governmental entities. As a consequence, safety standards, under the license approval process, vary from one country to another. In addition, the new spacefaring countries mostly develop their own space technology due to each country's limitation in transfer of technology resulting in a conflict with the non-discrimination principle. This practice also raises the world an unclear situation whether outer space is safe as transfer of technology between countries remains limited and thus the below-standard technology might be secretly used in some countries. Therefore, international space safety standards should be set in a binding nature. The Convention on Nuclear Safety,[153] which encourages contracting parties to pursue agreed nuclear safety obligations at the national level and to report on its duty from time to time, can be used as an example.[154]

E. Geographical Scope

The 1997 Vienna Convention refers to the jurisdiction of State under the 1982 United

148 The 1997 Vienna Convention art. VII.

149 ROK Space Liability Act Law arts. 5 & 6, *available at* http://www.oosa.unvienna.org/oosaddb/showDocument.do?documentUid=402&country=ROK (last visited on Sept. 12, 2011).

150 Summary record 29-37 at 107; Summary record 77 at 11; and Summary record 106 at 52, recited by *supra* note 53, at 152.

151 *Supra* note 112.

152 G.A. Res. 62/217, U.N. Doc. A/62/403 (Feb. 1, 2008), para. 26.

153 INFCIRC/449 Oct. 24, 1996.

154 Shaw, *supra* note 8 at 892. *See also* Alexandre Kiss, *State Responsibility and Liability for Nuclear Damage*, 35 DENV J. INT'L L. & POL'Y 67, 71-72 (2006).

Nations Convention on the Law of the Sea ("UNCLOS")[155] in respect of the EEZ[156] that space law should follow. This expanded jurisdiction together with the more detailed term of 'damage' can protect the marine environment[157] in the area farther than the current space law. Moreover, the EEZ jurisdiction is for the purposes of adjudicating claims for compensation of such nuclear damage.[158]

F. Intergovernmental Space Organization

Like the IAEA, the COPUOS is the main international forum discussing the development of international space law and principles for peaceful uses of outer space. The COPUOS and its Legal and Technical Subcommittees works on the basis of consensus and meets annually in order to consider issues raised by the Member States. However, after passing the Agreement Governing the Activities of States on the Moon and Other Celestial Bodies[159] in 1979, the COPUOS submits only principles and declarations, including the Principles Relevant to the Use of Nuclear Power Sources in Outer Space. This undeniably reflects an obstacle in the structure and law-making process of the Committee.

While the IAEA and the COPUOS share same goal in creating peaceful uses in their area of expertise such as nuclear and space activities respectively, their organization structure and working procedure are dissimilar. The IAEA's way is proved to be faster in terms of law and policymaking. Due to this, the IAEA can be one of good analogous international regulatory organizations. Not only could this benefit the inspection of international safety standard mentioned earlier, but also accelerate the lawmaking process.

VII. Conclusion

As seen above, the space and nuclear sectors share as well as differ in various aspects. An interesting issue is the liability regime including State liability for space activity and civil liability for nuclear activity. The Soviet Union paid for damages caused by the crashed nuclear satellite but unfortunately paid nothing for those caused by the

155 1833 U.N.T.S. 3, Nov. 16, 1994.

156 *Id.* arts. 55-60.

157 *Supra* note 78, at 56.

158 *Id.* at 3.

159 363 U.N.T.S. 3, Dec. 5, 1979. As of January 1, 2010, there are 13 State parties.

Chernobyl incident. This discrepancy indicated weak points in international nuclear law, in which international nuclear law has been developed while space law has not.

This paper demonstrates some distinctions between space law and nuclear law. First, the term 'damage' in space law is unclear and does not fully cover all possible damage, while this term in nuclear law is much clearer. Second, the liability regime is not similar which leads to insurance problems. Owing to private participation in space activities, domestic space laws require an insurance policy as a precondition and cap the liability of a private entity. Safety standards are another difference; where nuclear law sets standards in a binding form, space law has only a set of principles.

The authors conclusively argue that space law should adopt a civil liability regime comparable to nuclear law. Owing to an increasing number of private as well as State players in space activities, the absolute liability does not reflect the actual polluter. Moreover, the unlimited liability leads to delay or non-payment. Adopting a three-tier system similar to nuclear law means developing a space safety standard, clarify vague terms and, possibly, establishing an international space organization.