UNITED NATIONS: GENERAL ASSEMBLY RESOLUTION AND PRINCIPLES RELEVANT TO THE USE OF NUCLEAR POWER SOURCES IN OUTER SPACE*

[December 14, 1992]
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Introductory Note
by
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A positive step towards protecting the human environment was taken on December 14, 1992, with the adoption by the U.N. General Assembly of the Principles Relevant to the Use of Nuclear Power Sources in Outer Space.[1] These eleven Principles, with the Resolution adopting them, culminate efforts going back to 1972.

The subject first came to the attention of the U.N.'s Committee on the Peaceful Uses of Outer Space (COPUOS) during the negotiations on the Convention on International Liability for Damage Caused by Space Objects of 1972.[2] The negotiators were influenced by the use by the United States of radioisotope generators in outer space, which began in 1961, and by its use of nuclear reactors in outer space, which began in 1965. The unprogrammed reentry of the Soviet nuclear-powered satellite, Cosmos 954,[3] into Canada on January 24, 1978, served to stimulate the formulation of the 1992 principles.

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[1]Report of the Committee on the Peaceful Uses of Outer Space, U.N GAOR 47th Session, Supp. No. 20, A/47/20, 25.

[2]Convention on the International Liability for Damage Caused by Space Objects. Done at Washington, London, and Moscow, March 29, 1972. Entered into force September 1, 1972. 24 UST 2389; TIAS 7762; 961 UNTS 187

[3]Documents regarding the claim by Canada against the U.S S.R. for damage caused by Cosmos 954 are reproduced at 18 I.L.M 899 (1979).]

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*[The Introductory Note was prepared for *International Legal Materials* by Carl Q Christol, Professor Emeritus of International Law and Political Science, University of Southern California, and I.L.M. Corresponding Editor for Outer Space and Telecommunications The U.N. General Assembly adopted Resolution 47/68 on December 14, 1992, without a vote]

On February 16, 1978, Canada brought the Cosmos 954 situation to the attention of the Scientific and Technical Sub-committee of COPUOS. From that date onward, Canada demonstrated an ongoing commitment to secure the promulgation of a relevant body of principles. On February 27, 1978, Canada and seven other members of COPUOS submitted a proposal to the Scientific and Technical Sub-committee urging the development of "a technical base for a multilateral regime of strict and fully effective standards, safeguards, and limitations pertaining to the use of nuclear power sources in space."[4]

On April 4, 1978, fifteen countries submitted a working paper to the Legal Sub-committee. Attention was called to issues of safety, giving of notice, emergency assistance, responsibility, and damages.[5] From the outset, both Sub-committees sought each other's advice, and were in agreement that basic standards promulgated by the International Commission on Radiological Protection (ICRP document No. 26 in particular), were relevant.

The Principles must be read in connection with the provisions of the four additional COPUOS agreements, namely, the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space of 1967,[6] the Agreement on the Rescue of Astronauts, the Return of Astronauts, and the Return of Objects Launched into Outer Space of 1968,[7] the Convention on the Registration of Objects Launched into Outer Space of 1975,[8] and the Agreement Governing the Activities of States on the Moon and Other Celestial Bodies of 1979.[9] During the negotiations, the fear was expressed that the Principles might be considered to be at variance with some of the terms of the foregoing agreements. Consensus, the modality employed in COPUOS, upheld the consistency of the Principles and the formal agreements.

The Principles must also be viewed in light of the IAEA Convention on Early Notification of a Nuclear Accident of 1986[10] and the companion Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency.[11]

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[4]U N. Doc. A/AC.105/C 1/L 103 at 2, February 27, 1978, U N Doc A/AC.105/105/216 at 31, March 5, 1978.

[5]U N. Doc. A/AC.105/C 2/L 115 at 2, April 4, 1978; U.N. Doc. A/AC 105/218, Annex 4 at 1, April 13, 1978.

[6]Done at Washington, London, and Moscow, January 27, 1967; entered into force October 10, 1967 18 UST 2410, TIAS 6347, 610 UNTS 205, 6 I L M. 386 (1967).

[7]Done at Washington, London, and Moscow, April 22, 1968; entered into force December 3, 1968. 19 UST 7570; TIAS 6599, 672 UNTS 119, 7 I L.M 149 (1968)

[8]Done at New York, January 14, 1975; entered into force September 15, 1976. 28 UST 695; TIAS 8480; 1023 UNTS 15, 14 I L.M 43 (1975).

[9]Opened for signature December 18, 1979; entered into force July 11, 1984. U.N. Doc. A/RES/34/68, 18 ILM 1434 (1979)

[10]Done at Vienna, September 26, 1986, entered into force October 27, 1986. IAEA Doc. GC (SPL.1/2), Annex II, 25 I L M 1369 (1986)

[11]Done at Vienna and New York, September 26, 1986; entered into force February 26, 1987 IAEA Doc. GC (SPL 1/2), Annex III, 25 I.L M 1369, 1377 (1986)

The Principles apply to "nuclear power sources in or devoted to generation of electric power on board space objects for non-propulsive purposes...."[12] Launching States "shall endeavor to protect individuals, populations and the biosphere against radiological hazards."[13]

The Principles are regulatory rather than prohibitory. However, on-board "nuclear reactors are to be fueled only by highly enriched uranium 235."[14] Radioisotopic generators may be used, although no reference is made to the fuel to be used by them.

During the negotiations, developing countries called attention to their inability to monitor space objects and to provide notice respecting space objects equipped with nuclear power sources.

Much of the period between 1978 and 1992 was consumed in obtaining consensus within the Legal Sub-committee on the terms of Principle 3 — guidelines and criteria for safe use. Agreement was ultimately reached by qualifying the action provisions of the Principles. Thus, one finds references to "reasonableness," "sufficiency," "high degree of confidence," "credible possibilities," "highly reliable," "to the extent feasible," "as frequently as practicable," "as soon as possible," "sufficiently high orbits," and so forth. Even so, the Principles set forth important requirements with respect to the use of nuclear power sources. Of interest is the provision that the Principles are to be reopened for revision no later than two years from their adoption. The Principles represent important steps in the gradually evolving legal regime for outer space activities.

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[12]Preamble, para. 5.

[13]Principle 3. 1. (a).

[14]Principle 3. 2. (c).

I L.M. Content Summary

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Principle 3 Guidelines and criteria for safe use
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[Concerning the minimization of radiation exposure during normal operation and accidents]
2. Nuclear reactors
[Permitted missions, orbits, fuel, critical operation and disposal]
3. Radioisotope generators
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Principle 4 [Pre-launch] Safety assessment

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RESOLUTION ADOPTED BY THE GENERAL ASSEMBLY

[on the report of the Special Political Committee (A/47/610)]

47/68. Principles Relevant to the Use of Nuclear Power Sources in Outer Space

The General Assembly,

Having considered the report of the Committee on the Peaceful Uses of Outer Space on the work of its thirty-fifth session 1/ and the text of the Principles Relevant to the Use of Nuclear Power Sources in Outer Space as approved by the Committee and annexed to its report, 2/

Recognizing that for some missions in outer space nuclear power sources are particularly suited or even essential owing to their compactness, long life and other attributes,

Recognizing also that the use of nuclear power sources in outer space should focus on those applications which take advantage of the particular properties of nuclear power sources,

Recognizing further that the use of nuclear power sources in outer space should be based on a thorough safety assessment, including probabilistic risk analysis, with particular emphasis on reducing the risk of accidental exposure of the public to harmful radiation or radioactive material,

Recognizing the need, in this respect, for a set of principles containing goals and guidelines to ensure the safe use of nuclear power sources in outer space,

Affirming that this set of Principles applies to nuclear power sources in outer space devoted to the generation of electric power on board space objects for non-propulsive purposes, which have characteristics generally comparable to those of systems used and missions performed at the time of the adoption of the Principles,

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1/ Official Records of the General Assembly, Forty-seventh Session, Supplement No. 20 (A/47/20).

2/ Ibid., annex.

Recognizing that this set of Principles will require future revision in view of emerging nuclear power applications and of evolving international recommendations on radiological protection,

Adopts the Principles Relevant to the Use of Nuclear Power Sources in Outer Space as set forth below.

Principle 1. Applicability of international law

Activities involving the use of nuclear power sources in outer space shall be carried out in accordance with international law, including in particular the Charter of the United Nations and the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies. 3/

Principle 2. Use of terms

1. For the purpose of these Principles, the terms "launching State" and "State launching" mean the State which exercises jurisdiction and control over a space object with nuclear power sources on board at a given point in time relevant to the principle concerned.

2. For the purpose of principle 9, the definition of the term "launching State" as contained in that principle is applicable.

3. For the purposes of principle 3, the terms "foreseeable" and "all possible" describe a class of events or circumstances whose overall probability of occurrence is such that it is considered to encompass only credible possibilities for purposes of safety analysis. The term "general concept of defence-in-depth" when applied to nuclear power sources in outer space refers to the use of design features and mission operations in place of or in addition to active systems, to prevent or mitigate the consequences of system malfunctions. Redundant safety systems are not necessarily required for each individual component to achieve this purpose. Given the special requirements of space use and of varied missions, no particular set of systems or features can be specified as essential to achieve this objective. For the purposes of paragraph 2 (d) of principle 3, the term "made critical" does not include actions such as zero-power testing which are fundamental to ensuring system safety.

Principle 3. Guidelines and criteria for safe use

In order to minimize the quantity of radioactive material in space and the risks involved, the use of nuclear power sources in outer space shall be restricted to those space missions which cannot be operated by non-nuclear energy sources in a reasonable way.

1. General goals for radiation protection and nuclear safety

(a) States launching space objects with nuclear power sources on board shall endeavour to protect individuals, populations and the biosphere against radiological hazards. The design and use of space objects with nuclear power sources on board shall ensure, with a high degree of confidence, that the hazards, in foreseeable operational or accidental circumstances, are kept below acceptable levels as defined in paragraphs 1 (b) and (c).

Such design and use shall also ensure with high reliability that radioactive material does not cause a significant contamination of outer space.

(b) During the normal operation of space objects with nuclear power sources on board, including re-entry from the sufficiently high orbit as defined in paragraph 2 (b), the appropriate radiation protection objective for

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3/ Resolution 2222 (XXI), annex.

the public recommended by the International Commission on Radiological Protection shall be observed. During such normal operation there shall be no significant radiation exposure.

(c) To limit exposure in accidents, the design and construction of the nuclear power source systems shall take into account relevant and generally accepted international radiological protection guidelines.

Except in cases of low-probability accidents with potentially serious radiological consequences, the design for the nuclear power source systems shall, with a high degree of confidence, restrict radiation exposure to a limited geographical region and to individuals to the principal limit of 1 mSv in a year. It is permissible to use a subsidiary dose limit of 5 mSv in a year for some years, provided that the average annual effective dose equivalent over a lifetime does not exceed the principal limit of 1 mSv in a year.

The probability of accidents with potentially serious radiological consequences referred to above shall be kept extremely small by virtue of the design of the system.

Future modifications of the guidelines referred to in this paragraph shall be applied as soon as practicable.

(d) Systems important for safety shall be designed, constructed and operated in accordance with the general concept of defence-in-depth. Pursuant to this concept, foreseeable safety-related failures or malfunctions must be capable of being corrected or counteracted by an action or a procedure, possibly automatic.

The reliability of systems important for safety shall be ensured, inter alia, by redundancy, physical separation, functional isolation and adequate independence of their components.

Other measures shall also be taken to raise the level of safety.

2. Nuclear reactors

(a) Nuclear reactors may be operated:

(i) On interplanetary missions;

(ii) In sufficiently high orbits as defined in paragraph 2 (b);

(iii) In low-Earth orbits if they are stored in sufficiently high orbits after the operational part of their mission.

(b) The sufficiently high orbit is one in which the orbital lifetime is long enough to allow for a sufficient decay of the fission products to approximately the activity of the actinides. The sufficiently high orbit must be such that the risks to existing and future outer space missions and of collision with other space objects are kept to a minimum. The necessity for the parts of a destroyed reactor also to attain the required decay time before re-entering the Earth's atmosphere shall be considered in determining the sufficiently high orbit altitude.

(c) Nuclear reactors shall use only highly enriched uranium 235 as fuel. The design shall take into account the radioactive decay of the fission and activation products.

(d) Nuclear reactors shall not be made critical before they have reached their operating orbit or interplanetary trajectory.

(e) The design and construction of the nuclear reactor shall ensure that it can not become critical before reaching the operating orbit during all possible events, including rocket explosion, re-entry, impact on ground or water, submersion in water or water intruding into the core.

(f) In order to reduce significantly the possibility of failures in satellites with nuclear reactors on board during operations in an orbit with a lifetime less than in the sufficiently high orbit (including operations for transfer into the sufficiently high orbit), there shall be a highly reliable operational system to ensure an effective and controlled disposal of the reactor.

3. Radioisotope generators

(a) Radioisotope generators may be used for interplanetary missions and other missions leaving the gravity field of the Earth. They may also be used in Earth orbit if, after conclusion of the operational part of their mission, they are stored in a high orbit. In any case ultimate disposal is necessary.

(b) Radioisotope generators shall be protected by a containment system that is designed and constructed to withstand the heat and aerodynamic forces of re-entry in the upper atmosphere under foreseeable orbital conditions, including highly elliptical or hyperbolic orbits where relevant. Upon impact, the containment system and the physical form of the isotope shall ensure that no radioactive material is scattered into the environment so that the impact area can be completely cleared of radioactivity by a recovery operation.

Principle 4. Safety assessment

1. A launching State as defined in principle 2, paragraph 1, at the time of launch shall, prior to the launch, through cooperative arrangements, where relevant, with those which have designed, constructed or manufactured the nuclear power source, or will operate the space object, or from whose territory or facility such an object will be launched, ensure that a thorough and comprehensive safety assessment is conducted. This assessment shall cover as well all relevant phases of the mission and shall deal with all systems involved, including the means of launching, the space platform, the nuclear power source and its equipment and the means of control and communication between ground and space.

2. This assessment shall respect the guidelines and criteria for safe use contained in principle 3.

3. Pursuant to article XI of the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, the results of this safety assessment, together with, to the extent feasible, an indication of the approximate intended time-frame of the launch, shall be made publicly available prior to each launch, and the Secretary-General of the United Nations shall be informed on how States may obtain such results of the safety assessment as soon as possible prior to each launch.

Principle 5. Notification of re-entry

1. Any State launching a space object with nuclear power sources on board shall in a timely fashion inform States concerned in the event this space object is malfunctioning with a risk of re-entry of radioactive materials to the Earth. The information shall be in accordance with the following format:

(a) System parameters:

(i) Name of launching State or States, including the address of the authority which may be contacted for additional information or assistance in case of accident;

(ii) International designation;

(iii) Date and territory or location of launch;

(iv) Information required for best prediction of orbit lifetime, trajectory and impact region;

(v) General function of spacecraft,

(b) Information on the radiological risk of nuclear power source(s):

(i) Type of nuclear power source, radioisotopic/reactor;

(ii) The probable physical form, amount and general radiological characteristics of the fuel and contaminated and/or activated components likely to reach the ground. The term "fuel" refers to the nuclear material used as the source of heat or power.

This information shall also be transmitted to the Secretary-General of the United Nations.

2. The information, in accordance with the format above, shall be provided by the launching State as soon as the malfunction has become known. It shall be updated as frequently as practicable and the frequency of dissemination of the updated information shall increase as the anticipated time of re-entry into the dense layers of the Earth's atmosphere approaches so that the international community will be informed of the situation and will have sufficient time to plan for any national response activities deemed necessary.

3. The updated information shall also be transmitted to the Secretary-General of the United Nations with the same frequency.

Principle 6. Consultations

States providing information in accordance with principle 5 shall, as far as reasonably practicable, respond promptly to requests for further information or consultations sought by other States.

Principle 7. Assistance to States

1. Upon the notification of an expected re-entry into the Earth's atmosphere of a space object containing a nuclear power source on board and its components, all States possessing space monitoring and tracking facilities, in the spirit of international cooperation, shall communicate the relevant information that they may have available on the malfunctioning space object with a nuclear power source on board to the Secretary-General of the United Nations and the State concerned as promptly as possible to allow States that might be affected to assess the situation and take any precautionary measures deemed necessary.

2. After re-entry into the Earth's atmosphere of a space object containing a nuclear power source on board and its components:

(a) The launching State shall promptly offer and, if requested by the affected State, provide promptly the necessary assistance to eliminate actual and possible harmful effects, including assistance to identify the location of the area of impact of the nuclear power source on the Earth's surface, to detect the re-entered material and to carry out retrieval or clean-up operations;

(b) All States, other than the launching State, with relevant technical capabilities and international organizations with such technical capabilities shall, to the extent possible, provide necessary assistance upon request by an affected State.

In providing the assistance in accordance with subparagraphs (a) and (b) above, the special needs of developing countries shall be taker into account.

Principle 8. Responsibility

In accordance with article VI of the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, States shall bear international responsibility for national activities involving the use of nuclear power

sources in outer space, whether such activities are carried on by governmental agencies or by non-governmental entities, and for assuring that such national activities are carried out in conformity with that Treaty and the recommendations contained in these Principles. When activities in outer space involving the use of nuclear power sources are carried on by an international organization, responsibility for compliance with the aforesaid Treaty and the recommendations contained in these Principles shall be borne both by the international organization and by the States participating in it.

Principle 9. Liability and compensation

1. In accordance with article VII of the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, and the provisions of the Convention on International Liability for Damage Caused by Space Objects, 4/ each State which launches or procures the launching of a space object and each State from whose territory or facility a space object is launched shall be internationally liable for damage caused by such space objects or their component parts. This fully applies to the case of such a space object carrying a nuclear power source on board. Whenever two or more States jointly launch such a space object, they shall be jointly and severally liable for any damage caused, in accordance with article V of the above-mentioned Convention.

2. The compensation that such States shall be liable to pay under the aforesaid Convention for damage shall be determined in accordance with international law and the principles of justice and equity, in order to provide such reparation in respect of the damage as will restore the person, natural or juridical, State or international organization on whose behalf a claim is presented to the condition which would have existed if the damage had not occurred.

3. For the purposes of this principle, compensation shall include reimbursement of the duly substantiated expenses for search, recovery and clean-up operations, including expenses for assistance received from third parties.

Principle 10. Settlement of disputes

Any dispute resulting from the application of these Principles shall be resolved through negotiations or other established procedures for the peaceful settlement of disputes, in accordance with the Charter of the United Nations.

Principle 11. Review and revision

These Principles shall be reopened for revision by the Committee on the Peaceful Uses of Outer Space no later than two years after their adoption.

85th plenary meeting
14 December 1992

4/ Resolution 2777 (XXVI), annex.