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Use of nuclear power sources in outer space

Reflections on further steps to enhance the safety of nuclear power source applications in outer space

Working paper prepared by the United Kingdom of Great Britain
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I. Background

1. The Working Group on the Use of Nuclear Power Sources in Outer Space of the Scientific and Technical Subcommittee of the Committee on the Peaceful Uses of Outer Space was established in 1998 with an initial mandate to identify and study the current international technical standards pertinent to the use of nuclear power sources. The mandate resulted in a multi-year workplan for developing a framework for safety assurance processes and standards for nuclear power sources in outer space.
2. The Safety Framework for Nuclear Power Sources Applications in Outer Space, adopted in 2009, was developed jointly by the Scientific and Technical Subcommittee and the International Atomic Energy Agency (IAEA) from 2006 to 2009, using a joint expert group. This process allowed for the involvement of all Member States conducting or considering the use of nuclear power sources in outer space and benefited from the expertise of IAEA, especially with respect to nuclear safety standards. It involved a fact- and information-gathering workshop jointly organized by the Subcommittee and IAEA (see A.AC.105/C.1/L.289/Rev.1).
3. Since 2010, and following its new mandate, the Working Group has been successful in promoting the safe use of nuclear power source applications in outer space among States interested in the use of such applications. The guidelines provided by the Safety Framework have been used for new nuclear power source applications in outer space. States members of the Committee and international intergovernmental organizations reported on and discussed their implementation of the guidelines provided by the Safety Framework during the meetings of the Working Group. The Working Group has been providing regular opportunities to exchange information on

* [A/AC.105/C.1/L.392](#).



safety-related aspects of past, ongoing and planned nuclear power source applications, including lessons learned and challenges faced.

4. Following the second objectives of its two latest mandates, the Working Group has also discussed technical topics for potential additional work by the Working Group to further enhance safety in the development and use of nuclear power source applications in outer space (A/AC.105/958, annex II, para. 7) and discussed advances in knowledge and practices and their potential for enhancing the technical content and scope of the Principles Relevant to the Use of Nuclear Power Sources in Outer Space (A/AC.105/1138, annex II, paras. 8 and 9).

5. All nuclear power source applications in outer space have been developed and conducted by governmental entities. The information-gathering and -exchange process has focused on governmental entities.

II. Evolving space context

6. The international space sector is evolving. Substantial changes have occurred since the adoption of the Principles in 1992 and the Safety Framework in 2009.

7. Private commercial entities are interested in the use of space nuclear power sources and are starting to propose and engage in the development and use of space nuclear power sources.

8. Some of the planned public and private space exploration and space resource utilization plans are expected to include the use of nuclear reactors, which have not been used in space since the adoption of the Principles.

9. The potential future use of nuclear reactors in the frame of long-term human installations raises a number of new safety-related questions.

10. The emerging private spaceflight sector can be expected to lead to the exposure of non-professional astronauts to ionizing radiation from nuclear power source applications in outer space, such as in the context of lunar surface installations.

III. Rationale for further work on the safety of nuclear power source applications in outer space

11. The international community would benefit from a forum to gather and exchange information on plans and projects to develop and use space nuclear power sources by new actors, including commercial entities.

12. Private commercial space entities would benefit from the safety expertise of and lessons learned by Member States with experience in developing and using nuclear power sources in outer space.

13. The international community and private commercial space activities would benefit from common nuclear safety standards and guidelines for the use of nuclear power sources in this new context. These would facilitate international cooperation, promote trust and create a level playing field for commercial entities.

14. The general public would benefit by knowing that governmental and private commercial actors are sharing information on the safety of nuclear power source applications in outer space, following best practices and engaging in common nuclear safety standards and guidelines, taking into account technical progress and the interest of future generations.

IV. Approach to further work on the safety of nuclear power source applications in outer space

15. Further work would benefit from a mechanism similar to the one used for the discussion and development of the Safety Framework, which benefited from the nuclear safety standard developing expertise of IAEA and the flexibility and inclusiveness provided by the joint expert group established by the Scientific and Technical Subcommittee and IAEA.
16. By gathering information on plans and projects related to the development and use of nuclear power source applications in outer space by private commercial entities, the further work could provide a flexible, accessible mechanism and forum to attract private commercial entities and encourage them to present and discuss their plans and projects to develop and use space nuclear power sources, and allow States with experience to provide information on related safety lessons learned.
17. Information-gathering and information exchange on plans and projects to develop and use space nuclear power sources would benefit from being inclusive and open. States members of the Committee would be encouraged to identify and invite relevant private actors to present their plans and projects.
18. To identify potential needs for further guidance or standards on the safety of nuclear power source applications in outer space, private commercial entities would be encouraged to share related challenges and propose recommendations. This could be done in the form of meetings, workshops and other events.
19. The Scientific and Technical Subcommittee and IAEA would receive reports and eventual recommendations taking into account the information gathered.

V. Potential organizational implementation

20. A group similar to the joint expert group established by the Subcommittee and IAEA for the preparation of the Safety Framework could organize the information-gathering and information exchange.
21. Such a group could be established by the Scientific and Technical Subcommittee and IAEA for a period of two to three years with a mandate to organize the information exchange and discussions on the safe use of nuclear power source applications. It would operate within this mandate with more organizational freedom than the meetings of the Working Group on the Use of Nuclear Power Sources in Outer Space.
22. Such a group could have the following main characteristics:
 - (a) The group would be chaired and convened by a Chair nominated by the Scientific and Technical Subcommittee and IAEA;
 - (b) The group would represent a partnership between the Subcommittee and IAEA and would operate using the consensus rule;
 - (c) The group could receive organizational and logistical support from interested States members of the Committee and/or IAEA;
 - (d) The Chair of the group would inform the Working Group on the Use of Nuclear Power Sources in Outer Space of the Subcommittee and IAEA about its progress in annual summary reports, and draft a final report after two to three years;
 - (e) The meetings and events of the group would be open to all interested States members of the Committee, IAEA and international intergovernmental organizations;
 - (f) Meetings and events organized by the group would be open to invited participants from academia, industry and the private sector engaged in credible activities related to space nuclear power source applications;

(g) The group could be called the “International technical expert group for the safety of space nuclear power source applications”.

23. The mandate of such an international expert group would be to exchange and discuss information on all aspects pertinent to the safety of space nuclear power source applications.

24. The mandate of the Working Group on the Use of Nuclear Power Sources in Outer Space would be to monitor the progress of the international expert group, to receive information from the international expert group on activities and plans involving the use of nuclear power source applications in outer space and to report its findings and eventual recommendations to the Scientific and Technical Subcommittee and IAEA.

25. During the information-gathering and -exchange phase, the Working Group could continue to meet at the annual sessions of the Scientific and Technical Subcommittee to monitor the progress of the international expert group and provide feedback to the Subcommittee. Alternatively, the Working Group could be suspended and re-established at an appropriate point (after two to three years) to consider and discuss the outcome of the information-gathering and information exchange of the international expert group and then provide consolidated information and eventual recommendations to the Subcommittee.

VI. Extension of current workplan

26. To facilitate reaching a consensus agreement on further work on the safety of space nuclear power sources, including a process to establish an international expert group and its terms of reference, the Working Group on the Use of Nuclear Power Sources in Outer Space could recommend an extension of its current workplan to 2023.
