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Draft report of the Working Group on the Use of Nuclear Power Sources in Outer Space

1. At its 738th meeting, on 7 February 2011, the Scientific and Technical Subcommittee reconvened its Working Group on the Use of Nuclear Power Sources in Outer Space, under the chairmanship of Sam Harbison (United Kingdom of Great Britain and Northern Ireland).

2. The Working Group recalled the objectives of its multi-year workplan for the period of 2011-2015, adopted by the Subcommittee at its forty-seventh session (A/AC.105/958, annex II, para. 7):

(a) To promote and facilitate the implementation of the Safety Framework for Nuclear Power Source Applications in Outer Space by providing information pertinent to challenges faced by member States and international intergovernmental organizations, in particular those considering or initiating involvement in applications of nuclear power sources (NPS) in outer space;

(b) To identify any technical topics for, and establish the objectives, scope and attributes of, any potential additional work by the Working Group to further enhance safety in the development and use of space NPS applications. Any such additional work would require the approval of the Subcommittee and would be developed with due consideration for relevant principles and treaties.

3. The Working Group held a workshop during its first meeting, on 9 February 2011, in accordance with its multi-year workplan. Five presentations were delivered at the workshop. (For the summaries of the presentations, see the appendix to the present report.)

4. The presentations were followed by an open discussion on various topics, including safety culture, transparency and the justification of the rationale for using NPS in specific space missions, as well as on the status of implementation of the Safety Framework.

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5. The Working Group noted that the presentations had contributed significantly to fulfilling part (a) of the objectives of its multi-year workplan. It also noted that there would be further opportunity for member States and international intergovernmental organizations to make presentations at the next workshop. It encouraged States and international intergovernmental organizations considering or initiating involvement in NPS applications, to provide information about their plans and progress to date.
6. The Working Group noted the comments that had been made in the presentations and general discussions about possible areas for further enhancing safety in the development and use of space NPS applications. Those were potentially relevant to part (b) of the objectives of the workplan and would be considered at future workshops and carried forward into the discussion about potential additional work that would take place at the end of the series of workshops.
7. The Working Group recalled that in accordance with its multi-year workplan, it would hold in 2012 a workshop with member States and international intergovernmental organizations making presentations pursuant to the invitations extended in 2010 and 2011.
8. The Working Group stressed that, at the workshop in 2012, it would be beneficial to have the broadest possible contribution from States and international intergovernmental organizations with experience in space NPS applications. The Working Group encouraged all those States and international intergovernmental organizations considering or initiating involvement in space NPS applications to contribute actively to the workshop in 2012.
9. The Working Group recalled that the workshop in 2012 would be held with the same arrangements as set out in the report on its meeting held during the forty-seventh session of the Subcommittee, in 2010 (A/AC.105/958, annex II, para. 9).
10. The Working Group requested the Secretariat to invite, in March 2011, member States and international intergovernmental organizations with experience in space NPS applications, as well as those considering or initiating involvement in space NPS applications, to notify the Secretariat of any plans they might have to provide workshop presentations in 2012 and 2013, in accordance with the workplan of the Working Group.
11. The Working Group agreed to hold a teleconference on 11 May 2011 at 1500 hours UTC and, subject to replies received to the invitation referred to in paragraph 9 above, to make a decision on the need to hold an informal meeting in the margins of the fifty-fourth session of the Committee or on a future teleconference.
12. At its [...] meeting, on [...] February 2011, the Working Group adopted the present report.

Appendix

Summaries of the presentations made at the workshop held during the meeting of the Working Group on the Use of Nuclear Power Sources in Outer Space

“Introduction to the workshop”, by Sam Harbison (United Kingdom of Great Britain and Northern Ireland) (A/AC.105/C.1/L.311 and A/AC.105/C.1/2011/CRP.4)

The 2011 workshop is the first in a series approved by the Scientific and Technical Subcommittee at its forty-seventh session, in 2010. The workshops are a major part of the new five-year workplan of the Working Group, aimed at following up and reinforcing the Safety Framework for Nuclear Power Source Applications in Outer Space.

“Safety in the design and development of United States nuclear power source applications for use in outer space”, by Reed Wilcox (United States of America) (A/AC.105/C.1/L.313 and A/AC.105/C.1/2011/CRP.6)

The United States of America subjects its planned nuclear power source (NPS) applications in outer space to a safety analysis and risk assessment process consistent with the relevant guidance recommended in the Safety Framework, as jointly published by the Scientific and Technical Subcommittee and the International Atomic Energy Agency in 2009. Safety considerations receive close attention from the earliest design stages of both space NPS and their proposed mission applications.

Since the design/development phase for space NPS typically occurred well in advance of specific NPS applications, the safety basis for United States NPS initially focuses on containing NPS fuel under a wide range of postulated accident scenarios. Subsequent proposed mission applications focus on detailed risk assessments of the integrated NPS application (i.e. NPS, spacecraft, launch system, mission design, flight rules) to identify potential design modifications that can enhance the mission’s nuclear safety consistent with accomplishing mission objectives. Quantitative requirements on the performance of safety systems guide design/development, but are not as important as a rigorous launch nuclear safety review process that encourages continual evaluation and consideration of safety enhancements throughout the entire design, development and approval process.

“Safety workshop for space nuclear power sources: the roadmap for its implementation in a special case for Argentina”, by Conrado Varotto (Argentina) (A/AC.105/C.1/2011/CRP.7 and Corr.1)

Argentina, a country with wide experience in nuclear projects and their regulation, is working to establish the internal process for the inclusion of NPS on Earth observation satellites, particularly to ensure adequate availability of power during early orbits. To this end, short half-life radioisotope sources are being considered.

The definition of the project involves the participation of the National Atomic Energy Commission (CNEA) of Argentina, working together with the National

Commission on Space Activities (CONAE) to meet the needs of the satellite missions of the Argentine space programme and to fulfil international commitments.

The Nuclear Regulatory Authority (ARN) is in charge of the authorization and control of the inclusion of NPS on Earth observation satellites, ensuring that the design and use of NPS will be fully compatible with Argentina's radiological safety standards and with the Safety Framework for Nuclear Power Source Applications in Outer Space (A/AC.105/934).

This project allows Argentina to implant a culture of safe use of nuclear power sources, not just for missions around Earth, but also for foreseeable projects in deep space.

During the process of analysing its implementation of the Safety Framework, Argentina identified two specific challenges. For countries with NPS applications but without the capacity to launch the applications, the mission launch authorization process presents one of the biggest difficulties. Another challenge is how to coordinate emergency preparedness and response with other countries over which the space mission would fly.

“The United States approach to risk assessment and its role in implementing an effective safety programme for nuclear power source applications in outer space”, by Ryan Bechtel (United States of America) (A/AC.105/C.1/L.312 and A/AC.105/C.1/2011/CRP.5)

The United States subjects its planned nuclear power source applications in outer space to a safety analysis and risk assessment. The United States safety analysis for nuclear power sources begins with an understanding of the launch vehicle, spacecraft, mission design and launch rules. These inputs are used to characterize a range of postulated accident scenarios to create a launch accident environment and the probabilities of such an accident occurring. Safety testing of nuclear power source components and continuum mechanics modelling are used to understand how the nuclear power source and nuclear fuel will respond in a variety of accident scenarios. The accident environments, accident probabilities, safety testing results and computer simulations are combined in a safety analysis to characterize the risk of the mission.

“Implementing the Safety Framework for Nuclear Power Source Applications in Outer Space at ESA: status and plans”, by Leopold Summerer (European Space Agency) (A/AC.105/C.1/2011/CRP.19)

The European Space Agency (ESA) subjects all its space missions to a rigorous, well-established safety programme with an excellent track record. ESA has used the energy provided by nuclear power sources on past interplanetary science missions and is currently planning their use in collaborative international science and exploration missions. ESA has started the process of implementing the recommendations provided by the Safety Framework.

While preliminary analysis indicates that the implementation of many recommendations appear to be straightforward, the implementation of some recommendations requires a deeper analysis of the options available within the organizational setup of ESA. These currently include aspects related to:

- (a) The implementation of the prime responsibility of the organization conducting the space NPS mission and its formal arrangements with all relevant participants to the mission;
 - (b) The share of responsibilities between ESA and its member States related to recommendations for Governments and relevant international intergovernmental organizations authorizing, approving or conducting space NPS missions;
 - (c) The organization of launch safety and emergency preparedness and response for different launch phases and accident scenarios.
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