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Use of nuclear power sources in outer space

Introduction to the Workshop¹

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Abstract

The paper provides an introduction to this Workshop, the first in a series approved by the Scientific and Technical Subcommittee (STSC) at its meeting in February 2010. These Workshops will be a major part of the new, 5-year work plan of the NPS Working Group, aimed at following-up and reinforcing the Safety Framework for Nuclear Power Source Applications in Outer Space. The paper describes the development of the Safety Framework and outlines the objectives and strategy of the new work plan. It indicates the expected outcome of this first Workshop and outlines the administrative arrangements that will apply.

1. Development of the Safety Framework

The Working Group on the Use of Nuclear Power Sources in Outer Space has been discussing the safe use of nuclear power source (NPS) applications in outer space for more than a decade. NPS applications in outer space have unique safety considerations compared with terrestrial applications. Unlike many terrestrial nuclear applications, space applications tend to be used infrequently and their requirements can vary significantly depending upon the specific mission. Mission launch and

* A/AC.105/C.1/L.306.

¹ This paper is also available without images, edited and in all official languages of the United Nations, in document A/AC.105/C.1/L.311.



outer space operational requirements impose size, mass and other space environment limitations not present for many terrestrial nuclear facilities. For some applications, space NPS must operate autonomously at great distances from Earth in harsh environments. Potential accident conditions resulting from launch failures and inadvertent re-entry could expose NPS to extreme physical conditions. These and other unique safety considerations for the use of space NPS are significantly different from those for terrestrial nuclear systems and are not addressed in safety guidance for terrestrial nuclear applications.

Between 2003 and 2006, the Working Group reviewed information from national and regional space agencies on the content of relevant national space NPS programmes and all planned or currently foreseeable applications. It also carried out a detailed review of existing international safety principles and standards of potential relevance to space NPS applications. In 2006, it held a joint technical workshop with the IAEA, at which the unique safety aspects of using NPS applications in space were discussed, as well as the scope, attributes and objectives of a possible space NPS safety framework. Following this successful workshop, the STSC agreed to the formation of a joint partnership between the NPS Working Group and the IAEA, to develop a safety framework for nuclear power source applications in outer space.

This partnership was realised through a Joint Expert Group (JEG) which worked throughout the period 2007 – 2009. The JEG completed its work one year ahead of schedule, with the result that the *Safety Framework for Nuclear Power Source Applications in Outer Space* (the Safety Framework) was adopted by the STSC at its 46th session in February 2009. In accordance with the agreed working arrangements the Safety Framework was considered and agreed to by the IAEA Commission on Safety Standards at its meeting in April 2009. The Safety Framework is available in A/AC.105/934 and by the IAEA secretariat as a joint publication of the STSC and IAEA.

2. Purpose of the Safety Framework

The purpose of the Safety Framework is to provide high-level guidance in the form of a model safety framework. It provides a foundation for the development of national and international intergovernmental safety frameworks while allowing for flexibility in adapting such frameworks to specific space NPS applications and organizational structures. Such national and international intergovernmental frameworks should include both technical and programmatic elements to mitigate risks arising from the use of space NPS. Implementation of such frameworks not only would provide assurance to the global public that space NPS applications would be launched and used in a safe manner, but could also facilitate bilateral and multilateral cooperation on space missions using NPS. The guidance provided reflects an international consensus on measures needed to achieve safety and applies to all space NPS applications without prejudice.

3. Follow-up to Safety Framework

The NPS Working Group held an informal intersessional meeting in June 2009, during the 52nd session of COPUOS, to discuss possible activities to follow up and reinforce the Safety Framework. At that meeting it was decided to recommend the development of a potential new work plan for the period 2010 – 2015. This was discussed and agreed by the Working Group, and approved by the STSC, in February 2010. The major component of this work plan will be a series of workshops, of

which this is the first, with further workshops planned for 2012 and 2013. This series of workshops is intended to assist the NPS Working Group to meet the *objectives* of the work plan, which are:

- (a) To promote and facilitate the implementation of the Safety Framework 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 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 STSC and would be developed with due consideration of relevant principles and treaties.

The *strategy* of the work plan is as follows:

- (a) Member States and international intergovernmental organizations with experience in the design, development and use of space NPS applications will be invited to provide information on their implementation of the Safety Framework.
- (b) Member States and international intergovernmental organizations considering or initiating involvement in space NPS applications will be invited to summarize their plans, progress to date and any challenges faced or foreseen in implementing the Safety Framework or specific elements thereof.
- (c) Member States and international intergovernmental organizations with relevant experience will be invited to provide information (e.g. best practices) targeted to address those implementation issues and challenges identified by member States considering or initiating involvement in space NPS applications.
- (d) Based on a synthesis of the information exchanged, the Working Group will identify any technical topics and draft the objectives, scope and attributes of potential additional work to further enhance the safe development and use of space NPS applications.

4. Expected outcome of this Workshop

As this is the first in a potential series of three workshops it will have a vital role in establishing a rigorous, open and inclusive method of working that should ensure the success of the entire series. It is intended to utilise a small panel of experts, drawn from the NPS Working Group, to stimulate questions and discussion at the end of the presentations but it is also expected that other participants will raise points for clarification or discussion.

It is expected that the presentations will:

- (a) lead to a sharing of information and best practices about the implementation of the Safety Framework
- (b) help to identify any challenges faced in the implementation of the Safety Framework
- (c) establish a sound basis for a possible two further workshops in 2012 and 2013
- (d) provide information of assistance to the NPS Working Group in its deliberations about any potential future work to promote and facilitate implementation of the Safety Framework.

5. Administrative arrangements

The time allocated for this first workshop is limited to two hours with full interpretation facilities. This means that presenters will be expected to adhere rigorously to their time allocation. After each presentation there will be 5 minutes for questions of clarification, with more substantive questions being held over until the general discussion, which will take place when all the presentations have been completed. This general discussion will be initiated by a small panel of members of the NPS Working Group, with the intention of generating a wide-ranging interaction.

After the workshop, the NPS Working Group will produce a summary of the proceedings, make it available to participants and include it in a report to the STSC.

Introduction to Workshop

Sam Harbison
Chairman of NPS Working Group

Development of the Safety Framework

- Discussions for more than a decade within NPS Working Group
- Joint workshop with IAEA in 2006
- Work of Joint Expert Group from 2007 – 2009
- Safety Framework adopted by STSC in February 2009; agreed to by IAEA CSS in April 2009; and published jointly by STSC and IAEA in October 2009.

Purpose of Safety Framework

- To provide high-level guidance in the form of a model safety framework
- It provides a foundation for the development of national and international intergovernmental safety frameworks
- It recognizes the need for flexibility
- Its implementation will provide safety assurance to public and facilitate cooperation

Follow-up to Safety Framework

- Discussion of possible follow-up actions in margins of June 2009 COPUOS meeting
- Multi-year work plan for 2010 – 2015 adopted by STSC in February 2010
- Major component of work plan will be a series of workshops, of which this is the first
- Further workshops planned for 2012 and 2013

Objectives of Work Plan

- To promote and facilitate implementation of Safety Framework by providing information pertinent to challenges faced by member States and international intergovernmental organizations
- To identify any technical topics for, and establish the objectives, scope and attributes of, any additional work to further enhance the safe development and use of space NPS applications

Expected outcome of Workshop

- Sharing of information and best practices about implementation of Safety Framework
- Identification of any challenges faced in implementing the Safety Framework
- Providing basis for a possible further two workshops in 2012 and 2013
- Providing information of assistance to NPS Working Group in deciding on any new work

Administrative arrangements

- Duration and interpretation facilities
- Length of presentations
- Questions for clarity
- General discussions
- Summary of proceedings and report of the NPS Working Group to the STSC