Safety Recommendations for NPS Applications in Outer Space

Sam Harbison
Consultant to the UK Space Agency

Overview

▶ Culmination of UK activities aimed at providing a more detailed interpretation of the Safety Framework for government officials, policymakers, mission designers, managers, scientists and engineers

▶ 39 recommendations covering: guidance for governments (15), guidance for management (10) and technical guidance (14)

▶ Intended to be as complete and comprehensive as possible

▶ Extent of the application of these Recommendations should be "suitable and sufficient" for the intended NPS programme of the country

▶ Should help members of international intergovernmental organisations, such as ESA, to avoid unnecessary duplication of roles and responsibilities

Justification and Authorization: Recommendations 10,11,12 and 13

► Governments need to establish policies, strategies and frameworks for justifying and authorizing the use of space NPS applications

► Policy for justification of NPS applications should give a commitment to explore all viable alternative options

► Policy should specify the process and procedures to be followed in making justification and authorization decisions for space NPS applications on specific missions, and who has responsibility for taking the final decisions

► The time frame and scope of the information required for making justification and authorization decisions should be specified

Emergency Preparedness and Response: Recommendations 14 and 15

► Governments that authorize or approve space NPS missions should establish a policy, strategy and framework for emergency preparedness and response

► The policy should assign responsibilities for preparing emergency response plans and for making arrangements for emergency preparedness and response

► The policy should designate competent authorities to deal with the consequences of an emergency, both during the emergency and in its aftermath

► The policy should make provision for an effective means of communication with affected parties, particularly the general public, during the course of an emergency involving a space NPS application

Prime Responsibility for Safety: Recommendations 18, 23, 24 and 25

- ▶ Recommendation 18 places the prime responsibility for safety on the organization that conducts the space NPS mission
- ▶ Recommendation 23 requires the organization with prime responsibility for safety to generate the technical information needed to support a decision to use an NPS on a mission and to inform interested parties
- ▶ Recommendation 24 requires the organization with prime responsibility for safety to carry out and document appropriate tests and analyses
- ▶ Recommendation 25 requires the organization with prime responsibility for safety to provide relevant, accurate and timely information to the public

Establishment and Maintenance of Technical Competence: Recommendations 26 - 29

Organizations involved in any space NPS mission should establish and maintain the technical competence to:

1. Define accident scenarios and their estimated probabilities (Rec 26)
2. Characterize the physical conditions to which the NPS and its components could be exposed in both normal operation and potential accidents (Rec 27)
3. Assess the consequences to people and the environment from potential accidents with space NPS applications (Rec 28)
4. Identify and assess inherent and engineered safety features to reduce the risk of potential accidents to people and the environment (Rec 29)

Using Risk Analysis and Conducting Risk Assessments: Recommendations 33 and 34

▶ Organizations involved in any space NPS mission should use risk analysis to assess the effectiveness of design features and controls, and to provide feedback to the design process (Rec: 33)

▶ Organizations involved in any space NPS mission should conduct appropriate risk assessments to characterize the radiation risks to people and the environment from space NPS applications, and to demonstrate the acceptability of those risks (Rec: 34)

Dealing with potential accidents involving NPS applications : Recommendations 35 - 39

Organizations involved in any space NPS mission should ensure that:

1. All practical efforts are made to mitigate the consequences of potential accidents (Rec: 35)
2. Appropriate contingency plans are developed and implemented (Rec: 36)
3. The capability is established and maintained to determine whether a radioactive release has occurred, to characterize its location and nature, and to determine the area likely to be contaminated (Rec: 37)
4. The capability is established and maintained to recommend appropriate protective measures (Rec: 38)
5. The capability is established and maintained to prepare and disseminate timely and appropriate information (Rec: 39)

Summary

- Many of the Recommendations are not unique to missions with NPS applications but should apply to all space missions

- Space nuclear power sources do create special, additional challenges because of the materials involved (security, safeguards, transport); the real and perceived harm that they could cause to humans and the environment; and the longevity of the consequences of potential accidents

- Hence the need for clearly-defined justification and authorization procedures prior to any space NPS use, and for the unambiguous identification of the organization that has prime responsibility for safety

- Establishing and maintaining technical competence vital to safe use of NPS