OPTIONS FOR INTERMEDIATE DEPTH DISPOSAL - Chairperson J. Loy (Australia)

The session began with a presentation on the safety issues related to disposal at intermediate depths (tens to about one hundred metres). Disposal at these depths is seen as having has the same aims as geological disposal (as stated in the new IAEA Safety Requirements on the Geological Disposal of Radioactive Waste): to contain the waste until most of the radioactive content has decayed, to isolate the waste from the biosphere until such time that much of the radioactive content has decayed, to delay any significant migration of radionuclides to the biosphere, and to ensure that, for any migration that does occur, there is an acceptably low radiological impact. In terms of the safety case, the advantages of intermediate depth over near surface disposal are that there is likely to be a lower risk of inadvertent intrusion, a much lower impact of biological processes and less aggressive conditions for barriers. The performance of the repository may be more predictable because of the absence of surface processes and because of the inaccessibility of a repository at geological depths. The issue of human intrusion is a challenge for all forms of repository. The likelihood of human intrusion can be reduced in the long term, if knowledge of the repository is retained. Information conservation may be achieved through establishing an appropriate archive. It is suggested that national archive bodies should be involved through legislation and that the IAEA would be a possible location for an international waste disposal archive.

The next presentation described the current status of a sub-surface tunnel and cavern facility being developed at Rokkasho-mura in Japan. The concept is aimed at disposal of 'relatively higher low level radioactive waste', that is, reactor core surrounding parts (channel boxes, control rods, burnable poisons), ion exchange resins, decommissioned or replaced reactor core-internals and long-lived waste from the fuel cycle plants. The depth of the facility has been selected to limit the possibility of human intrusion, taking into account excavation depths for high rise buildings and other activities. The detailed investigation for the facility has involved borehole drilling and seismic investigation to establish site scale geology and hydro-geology; an exploratory drift to establish the near field geology and hydrogeology; and a test cavern to establish the stability of an underground facility.

The third presentation addressed the disposal of disused sealed radioactive sources in small diameter boreholes. The issue is that certain sealed radioactive sources are too active and/or too long-lived for disposal in a near surface facility, particularly because of their potential impact in the event of human intrusion into the repository. The small volume of the sources also means that they do not require large near surface or cavern type disposal at intermediate depth. The presentation focused on the development of the specific borehole design being supported by the IAEA under the aegis of the AFRA regional organization. The safety case for this form of borehole disposal of sealed sources derives from the small volume and nature of the waste, and a high near-field integrity due to the surrounding stainless steel and concrete

barriers. This emphasis on the near field for safety means that knowledge of the geochemistry of the site is more important than the hydro-geological characterization, because of the need to limit the likelihood of localized corrosion of the stainless steel. The risk of human intrusion is minimized by the depth, of at least 30 m, the small footprint of the facility, the deflector plate, and the use of native soil in the upper layer. The particular value of the concept is that it is 'one size fits all' and can be adapted to the inventory of the country and to the nature of the site. An international peer review team has reviewed the borehole concept and reported that it offers a potentially safe, economic, practical and permanent means of disposing of disused radioactive sealed sources. It was stated that the AFRA Member States have decided to proceed to the next phase of the project, which includes implementing the borehole technology.

The final keynote presentation described the IAEA programme on assisting Member States in dealing with sealed high activity radioactive sources (SHARS). This has arisen from the international work in the management of sources, the analysis of lessons learned from radiation accidents, and the requirements of the Code of Conduct, as well as the success of the radium conditioning programme. The new programme includes the development of mobile conditioning capacity and of storage and transport shields together with the development of the borehole concept described in the previous presentation.

The session participants, through the statements of the panel members, also heard about a proposed intermediate depth facility in France for dealing with low level but long-lived waste, such as radium and irradiated graphite, and the assessment of intermediate depth cavern and borehole proposals in Cuba.

The highlights and conclusions of the panel discussions in the session are summarized below:

- Intermediate depth disposal is an appropriate concept that many countries may need to consider as part of their radioactive waste management strategies. Choice of the option by any country would depend on several factors including: the national inventory, the cost effectiveness of different available disposal routes, the availability of deep geological repositories, and public acceptance.
- The basic safety requirements for intermediate depth disposal are the same as for near surface and geological disposal and therefore no new international Safety Requirements are needed. In addition, the approach to assessing safety is also the same. However, it might be useful to have additional guidance for intermediate depth disposal to reflect the different balance of argument in an intermediate depth safety case as compared with near surface or deep geological disposal.

- There may be elements of safety assessment that can be applied generically, especially in relation to human intrusion, but otherwise safety assessment must be specific to the site and the disposal concept.
- The Rokkasho project is a very good example of a thorough evaluation of a cavern disposal facility.
- The borehole concept being developed through AFRA and the IAEA is a highly promising approach that could enable some countries to dispose of disused sealed sources and it is appropriate, in principle, that it is supported by the IAEA.
- The same standard of safety must be achieved for boreholes as for other types of disposal. However, the IAEA should develop specific safety guidance applicable to the borehole concept. An important step for the general acceptance of the technique would be for a borehole system to be licensed and operated in one or more countries.