SESSION VI-A SUMMARY REPORT

DECOMMISSION AND REMEDIATION STANDARDS AND THEIR APPLICATION

Context

The IAEA Safety Standards GSR Part 3 defines generic requirements for existing exposure situations that apply to:

- Exposures due to contamination of areas by residual radioactive material arising from:
    - Past activities that were never subject to regulatory control or that were subject to regulatory control but not in accordance with the requirements of theses Standards;
    - A nuclear or radiation emergency, after an emergency exposure situation has been declared ended.
- Exposures due to commodities, including food, feed, drinking water and construction materials, that incorporate radionuclides arising from residual radioactive material as stated above.

Those generic requirements define the responsibilities of the government, the regulatory body or relevant authorities specific to existing exposure situations and for the remediation of areas with residual radioactive material. Remediation being defined as any measures that may be carried out to reduce the radiation exposure due to existing contamination of land areas through actions applied to:

- The contamination itself (the source) or
- The exposure pathways to humans.

Remediation does not imply the complete removal of the contamination.

However, there do not exist internationally defined objectives to be achieved by means of any protection strategy and related appropriate reference levels. They have to be established on a case by case basis by the national competent body.

Applying planned exposure reference levels to existing exposure situations may lead to disproportional efforts for decontamination. The orders of magnitude between the exemption dose of 10µSv/year and the range of total doses in post-accident situation of 1 mSv/year to 20 mSv/year do not seem to provide a satisfactory framework for effectively implementing decommissioning and remediation activities in existing exposure situations.

The presentations

Within this framework session VI-A of the IEM had the aim to discuss the *Adequacy of current standards for application to post accident situations*. The discussion was preceded by 4 presentations to introduce the topic for which the key elements are briefly summarized:

Standards for remediation (H. Nishiyama, Ministry of the Environment, Japan)

The Japanese Government follows the ICRP standards to determine kinds of treatment of contaminated areas. This lead to the following decontamination policy:

- Area less than 20mSv/year: the basic target of decontamination is to reduce exposure dose of residents by 50% during two years from August 2011 and that of children by 60%through radioactive decay, decay by natural factors and decontamination and, in a long term, to achieve an annual exposure level of 1 mSv/year or less.

- Area from 20～50mSv/year: Aiming for reducing exposure dose in residential and farmland area less than 20mSv/year by the end of FY 2013.
- Area more than 50mSv/year: Demonstration projects will be implemented. Lessons learnt will be reflected into future decontamination policy.

With respect to treatment of waste including waste generated by decontamination works, if incinerators are available, combustible wastes will be incinerated. In case radioactivity of incinerated ash is 8,000Bq/kg or less, it will be disposed of by local governments under the Waste Management Act. In case radioactivity of incinerated ash is exceeding 8,000Bq/kg, it will be disposed of by the National Government. If radioactivity is over 100,000Bq/kg which is thinkable only in Fukushima Prefecture, it is supposed to be stored at the Interim Storage Facility. Soil generated by decontamination works in Fukushima Prefecture will also be moved to the Interim Storage Facility.

Regarding standards for decontamination workers the maximum exposure allowed is 100 mSv/5 years and 50 mSv/year. For female workers, allowable doses are much smaller. Regarding working environment, 2.5μSv/hour is a threshold to impose stricter regulation such as respiratory protection, periodical measurement of internal exposure, formulation of work plan, submission of report to respective Labor Standards Supervising Bureaus.

Understanding the long-term implications of severe radiological accidents (including Infrastructure and resource needs) (W. Weiss, UNSCEAR)

The presentation highlighted the characteristic features of remediation taking into account past experience.

The first priority of strategies implemented by authorities is to protect people with the highest exposures, and in parallel to reduce all individual exposures to as low as reasonably achievable. During the remediation process, the application of the radiation protection principles „justification“ and „optimization“ has to be conducted with great care to deploy remediation actions which are the result of a *balance between objective elements* (exposure, costs, etc.) and *subjective elements* (public perception, anxiety, political pressure, etc.).

The available experience clearly shows that all dimensions of the daily life of the inhabitants within contaminated areas, as well as the social and economic activities, are affected resulting in complex *situations which cannot be managed with radiation protection considerations alone*. According to the level of contamination and its space and time distribution, remediation actions must address all relevant dimensions such as health, environmental, economic, social, psychological, cultural, ethical, political, etc. Following WHO's definition health is: "A state of complete physical, mental and social well-being, and not merely the absence of disease".

As documented by UNSCEAR (2008), the Chernobyl accident is known to have had major effects that are not related to the radiation exposure. They include effects brought on by anxiety about the future and distress, and any resulting changes in diet, smoking habits, alcohol consumption and other lifestyle factors, and are essentially unrelated to any actual radiation exposure. The Chernobyl Forum concluded that stress symptoms, increased levels of depression, anxiety (including post-traumatic stress symptoms), and medically unexplained physical symptoms, have been found in the exposed populations compared to control groups. Mostly, these conditions were subclinical and did not meet the criteria for classification as psychiatric disorders. Effects of similar nature have been observed after the Fukushima nuclear accident.

From the perspective of assessing the long-term evolution of chronic exposure situations and the effectiveness of the protection strategies, ICRP recommends that a monitoring record system be established under the responsibility of the relevant authorities. According to UNSCEAR, the Chernobyl registries have the potential to become important sources of information on the

long-term health effects of radiation exposure. Standardization of the procedures across the three registries would greatly improve their usefulness for epidemiological research.

Lessons from the clean-up of bulk contaminated soil at the Maralinga test site (G. Williams, ARPANSA, Australia)

The presentation recalled the historical background of the Maralinga test site and focused then on the remediation challenges and activities.

Following several clean-up attempts of the Maralinga site during and immediately after the period of the twelve major nuclear weapons tests in Australia between 1952 and 1957, it was discovered in 1984 that significant contamination, mainly comprising the long-lived 239Pu, remained on and close to the surface. Australia was not aware of the extent of this residual contamination which had resulted from the explosive dispersal of some 24 kg of plutonium (plus uranium and americium). Contamination was found to range in size from inhalable dust all the way through to large, highly contaminated fragments of the test assemblies that were eminently collectible.

The dosimetry, together with social and economic factors, underpinned the setting of clean-up criteria in terms of activity concentrations averaged over large areas, and limits on particulate contamination. Successful rehabilitation of the most contaminated areas (in total 2.3 km2) was undertaken, with scraping of surface soil and burial on site.

The Maralinga lessons learned are:

- Recognition that every remediation will be very different from the others before it due to i.e. the local environment and geosocial aspects, value of land, radionuclides …
- The need for a vision into the future, to look beyond present societal values: land considered worthless and uninhabitable forever has turned into highly valued land to its inhabitants.
- A focus on fixing the possibilities for giving very high doses: removal of contaminated soil and highliy radioactive particles to prevent inhalation of Pu and to prevent deliberate collection of contaminated fragments and particles; Legacy burial pits containing debris contaminated with plutonium rendered practicably inaccessible by the process of exhumation and burial at depth.
- Critical importance of stakeholder consultation and feedback, building trust and confidence. Consultation with local stakeholders resulted in a balance between disruptive cleanup and results acceptable to the local population.
- The need for efficient, effective and cooperative regulatory processes for the implementation of common clean-up goals.
- The value of breaking the remediation down into manageable bits.

The international safety regime for the decommissioning and remediation after a nuclear accident: lessons from Fukushima (A.J. González, Autoridad Regulatoria Nuclear, Argentina)

The presentation provided an overview of existing framework of international safety regime that includes legally binding instruments of which Japan is a contracting party. These are mainly the Conventions on Early Notification of a Nuclear Accident (IAEA, 1986a.), on Assistance in the Case of a Nuclear Accident or Radiological Emergency (IAEA, 1986b), on Nuclear Safety (IAEA, 1994) and on the Safety of Spent Fuel Management and the Safety of Radioactive Waste Management (IAEA, 1997), as well as the Radiation Protection Convention, No. 115 of International Labour Organization (ILO, 1960). These instruments contain –mutatis mutandi– obligations for the State parties on safe decommissioning and remediation.

The presentation further raised numerous questions on how this International Safety Regime allows (or not) addressing the challenges posed by the decommissioning and remediation of the Fukushima-Daiichi nuclear accident:

- How to handle, within the prescriptions of the international regime, the vast amounts of radioactive waste that are in the same order of magnitude as those at Chernobyl, but with the difference that large amounts are in liquid form kept in a myriad of containers?
- How to define and decide when the emergency exposure situation is terminated and the existing exposure situation starts?
- Rehabilitating evacuated areas raised questions such as: what is the category of the exposure situation, what is the type of exposure, and consequently how should the exposure be controlled?
- How to deal with the 'contamination' of territories, rubble and residues, and consumer products. The presence of radioactive substances originating from the accident in the public domain, including the surrounding environment and consumer products caused serious concerns to the population and placed pressure on the authorities to act.
- How to effectively deal with contaminated rubble? A fraction of the contaminated rubble may contain substantial amounts of radioactive substances, which may mean that it has to be treated as radioactive waste with the regulations required by relevant international conventions. The main problem, however, is that most of the rubble is not really contaminated but will be so perceived by the public, making its disposal an artificially serious issue.

Findings and Recommendations

The discussion addressed the aspects addressed and questions raised during the presentations. The following findings and recommendations can be drawn from this session:

- Balance between numerical and descriptive standards: There seems to be a common understanding that the numerical basis for standards is important for defining appropriate level of doses or activities. It is recommended however to further develop guidance (in descriptive language) in support for the implementation of the standards.
- Indirectly linked to the previous finding is the need to find the right balance between a "technical" approach and "social" approach regarding decommissioning and remediation measures. It is recommended to assess the possibility to elaborate a code of practice for the Member States on how to combine both approaches is an optimal manner.
- Firm numerical standards that were defined for planned situations may not always result in an optimal solution with regard to the impact on the population and/or the environment. It is recommended to consider specific standards and/or acceptance criteria taking into account the particularity of remediation waste (high quantity and radioisotope vector).
- There are inconsistencies in international standards for consumer products (GC(44)/RES/15, September 2000 "develop…radiological criteria for long-lived radionuclides in commodities, particularly foodstuffs and wood"). It is recommended to seek for consistency of international standards.
- The health protection of the public is going beyond radiation protection considerations only, requiring also dealing with the psychological impacts. It needs to be asses to what extend such psychological (and also social) aspects fall within the remit of the IAEA mandate and/or to what extend it would require the involvement of other international organisations (WHO, ICRP …).

- Psychological and social aspects being considered as key to the successful remediation, it should be assessed if and how these impacts could be considered and integrated in planning and implementing remediation.
- For the transition from emergency to existing exposure situations the policy level is considered reasonably firm. Additional implementation guidance with technical basis and the timely involvement of stakeholders may be recommended.
- Successful implementation of remediation measures should allow answering unambiguously key questions of the concerned public, such as: Is it safe to live here? Can the children play outside? Is it safe to eat this food? This refers to the overarching question: What is safe? Further reflection may be considered to assess whether it is possible to define what is ‘safe’ or 'safe enough' as compared to 'perfectly safe' (what by a matter of fact would any way not be reachable). Such considerations should take into account to what extend benefits of agreeing on a universal level of ‘safe’ exposure would outweigh disadvantages and limitations.