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NUCLEAR ENERGY AGENCY
RADIOACTIVE WASTE MANAGEMENT COMMITTEE

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A BROCHURE ON WASTE MANAGEMENT PROFESSION - VISION AND WAY FORWARD

24-25 MARCH 2010

This document supports item 17 of the RWMC-43 agenda.

At RWMC-42 a decision was made to produce a flyer on the waste management profession. A few countries provided relevant materials. Discussions within the RWMC Bureau produced the hereby provided "vision document". It is proposed to prepare the flyer (or brochure) in time for the ICGR2011 conference. The vision document suggests a way forward.

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About the brochure

The Waste Management Profession Brochure is aimed to be about 10-20 pages long and it is meant to show that the field of radioactive waste management offers a wide range of interesting career opportunities. It is a satisfying and challenging profession, as we know it to be.

The waste cycle include production, conditioning, transportation, storage and disposal. Many audiences are thus affected: from the nuclear industry, that has to adapt its waste streams and packages, to the regions where transportation routes are traced, to the municipalities where the waste stores or final deposits are located. Interfaces are needed with all these players.

The knowledge base may span from ethics to geology and engineering to psychology passing importantly through social and political sciences. In this sense, it is a very modern profession open to the world.

Waste acceptance and waste management is a safety-directed profession. The many fields of expertise that have to be balanced will be pointed out as an opportunity for cross-fertilization and growth. This includes contacts and work with international projects (examples will be given). R&D is carried out and contacts are made to academia.

The brochure will point out our values system and the balance we must operate between scientific and societal aspects. Some of the societal aspects are at the forefront of modern governance methods.

The brochure will show real people at work, and it may contain interviews. It will point out the international dimension of the profession and the several work opportunities in regulatory, industrial or governmental settings. These may also open the ways to academic positions, as the profession is now under-represented in academia, or to other positions in the environmental field. The brochure would become an additional resource if it provides links to schools and other initiatives.

Our reference audience should be, in principle, young colleagues, but also colleagues from other disciplines that are looking for a career change. Vis-à-vis a brochure from national organisations, a brochure from the RWMC would raise the profile of our work and of the tasks of radioactive waste management. In the future, national organisations could distribute the RWMC brochure and/or leaflet along their own or could leverage the international brochure for their own brochure.

Overall we should raise the international status of our profession and start establishing it as a professional endeavour in its own right. In doing so we are also responding to the NEA's strategic call for Human Resources development in nuclear.

A draft table on the many skills and profiles that belong to the waste management profession is provided in the Annex, as an example. This table will need to be completed.

Way Forward

The Bureau makes the following proposal:

1. Organisations send in information and materials that address some or all of the points made above, in the vision statement (**August 2010**)
2. Drafts of the brochure will be drawn within the Bureau (**December 2010**)
3. The text will be sent for review by the whole RWMC (**December 2010**) and revised (**February 2011**)
4. The latest text will be discussed at RWMC-44 (**March 2011**) before finalization (**June 2011**)
5. The brochure will be circulated to all members and to the ICGR-2011 conference (**September 2011**)

ANNEX

Qualified Human Resources for radioactive waste disposal

Any activity involving the use of radioactive substances produces radioactive waste, which will require final disposal as the management end-point from. The purpose is to ensure the protection of human health and of the environment as long as required, with due regard to the radioactive half-lives of the radioelements contained in those residues. Some waste needs to be isolated from our close environment over hundreds of thousands of years, as in the case of the waste resulting from reactor burnup in the form of spent fuel or reprocessing products.

The development of a disposal project, notably in the case of a deep geological repository, is an activity that extends over more than 100 years and includes several steps, as follows:

- the study of the radioactive waste;
- the search for a suitable site;
- site studies;
- repository design;
- safety studies;
- construction;
- operation;
- monitoring and closure of the disposal facility, and
- memory preservation.

Multiple skills are necessary in order to carry out safely any project involving a deep geological repository for radioactive waste. Depending on the relevant steps concerned, the accent will rest on the skills of one of the following trades:

- the design and steering of complex projects;
- nuclear science;
- Earth sciences, from investigations to field studies;
- engineering of underground works;
- technology, including electromechanics and automation;
- radiation protection;
- information and communication;
- territorial development;
- governance and decision-making, and
- nuclear law, especially in the international context.

The above information plus additional details is captured in Table 1.

Each country has a different array of source institutions for skilled labour and even within a country there are multiple avenues to get this labour: colleges, technical institutes, universities, apprenticeships, etc.

TABLE 1: THE WASTE MANAGEMENT PROFESSION – AREAS AND SKILLS FOR RADIOACTIVE WASTE DISPOSAL

Life cycle steps of a geological repository	Areas	Objectives	Qualified Human Resources	Skills
Siting	• Governance and decision making process	Set up regulatory and planning processes, in which there is confidence, to protect residents, the workforce and the environment from the aspects of safety and security	**Specialists in Governance and Regulation**	• Research practices in regulatory issue • Training courses taken in regulation issue
	• Geological and technical survey	Plan and participate in the initial geological screening and identify a sufficient number of areas to make further progress possible	**Specialists in Technical sciences**	• Geology, rock mechanics, geochemistry, hydrogeology • Mapping, drilling, field geophysics • Environmental science, biosciences, climatology
	• Territorial development • Communication • Public engagement • Negotiation with stakeholders	To assure **community benefits** by negotiating with local and regional authorities an appropriate package, and by implementing an effective follow-up plan	**Specialists in Human sciences and Social relations**	• Information, communication, negotiation • Regional and local development, territorial planning • Political sciences

Life cycle steps of a geological repository	Areas	Objectives	Qualified Human Resources	Skills
Long-term Safety	• Science Basis	To provide quality assured data and models on basic processes and to identify knowledge gaps	**Research-oriented technical specialists**	• Geology, rock mechanics, geochemistry, hydrogeology • Environment • Chemistry and radiochemistry • Materials and radioactive waste • Physical modelling (thermics, hydraulics, mechanics, chemistry) • Numerical modelling
	• Engineering feasibility	To develop technical and engineering basis through • Design and construction of a pilot facility or URL • Development of waste acceptance criteria • Conception and testing of technologies for excavation, construction, and operation • Conception and testing of technologies for verification and monitoring • Identification and testing of engineered barrier material	**Application-oriented engineers**	• Underground construction technology and underground operations • Engineering feasibility • Earth sciences • Environment • Chemistry and radiochemistry • Materials and radioactive waste • Methodology development, including safety and risk management • Data assessment • Filing
	• Safety demonstration	To develop strategy for long-term protection of man and the environment through • Integration of the knowledge basis	**Technical managers**	• System modelling • Risk assessment • Regulatory assessment • Documentation

		• Modeling and simulation • Risk evaluation and assessment		
Life cycle steps of a geological repository	**Areas**	**Objectives**	**Qualified Human Resources**	**Skills**
Design, Construction and Operation	• Design and Construction	To implement the conceptual design and improve on it following quality assurance procedure	**Technical professionals, mostly engineers**	• Underground construction technology • Underground transfer and emplacement technologies • Nuclear operations technologies • Quality assurance
	• Safety of the underground operations	To assure construction and operation are respectful of health and safety criteria	**Technical profession, mostly engineers**	• Nuclear safety • Conventional safety (mining, venting, fire, electrical..., etc.) • Monitoring
	• Waste acceptance	To assure that the waste is correctly managed according to specifications	**Technical profession, mostly engineers**	• Waste generation, conditioning and packaging • Waste specification • Waste control • Waste packages design and handling
	• Closure and sealing	To assure where there is confidence that the closure and sealing processes are robust and implementing surveillance/monitoring provisions	**Technical profession, mostly engineers**	• Civil and mining engineering • Monitoring and surveillance
	• Industrial organization • Costing and funding	To assure that the construction and operation phases are properly managed.	**Managers of engineering projects**	• Project management • Nuclear and conventional industrial organisation

Life cycle steps of a geological repository	Areas	Objectives	Qualified Human Resources	Skills
Throughout the life cycle of a geological repository	• Quality assurance • Public engagement, communications • Regulatory affairs and approvals • Socio-economic impact assessments • Environmental assessment and monitoring • Procurement, contracting, legal support	To assure that all the administrative, technical, and social tasks are correctly carried out at all times, respecting all the regulatory constraints	• **Project managers of engineering, social and environmental studies** • **Social relations specialists** • **Specialists in procurement, contracting, legal affairs**	• Project management • Risk management • Quality management • Information, communication and negotiation • Procurement • Contracting • Legal affairs
	• Competence management • Education and training • Knowledge management • Memory keeping	To assure that, over time, that competence of the workforce is maintained or improved, and that information is available and retrievable when needed.	• **Project managers of engineering, social and environmental studies** • **Engineers** • **Specialists in education and training** • **Technical specialists in archiving and in data management**	• Knowledge management • Data and files management • Expert systems • Education and training