IAEA
International Atomic Energy Agency

Fuel Cycle and Waste Newsletter

A newsletter of the Division of Nuclear Fuel Cycle and Waste Technology
Vol. 5, No. 2, August 2009 ISSN 1816-9287

http://www.iaea.org/OurWork/ST/NE/NEFW/index.html

Contents

Division of Nuclear Fuel Cycle and Waste Technology
Department of Nuclear Energy
IAEA
P.O.Box 100
Wagramer Strasse 5
1400 Vienna, Austria
Tel : +43 1 2600 25670
Fax: +43 1 2600 29671

IAEA International Conference on Remediation of Land Contaminated by Radioactive Material Residues, Astana, Kazakhstan

The ***International Conference on Remediation of Land Contaminated by Radioactive Material Residues*** was held in Astana, Kazakhstan and was organized by the IAEA in cooperation with Kazakhstan Atomic Energy Committee. Although different types of contaminated land were discussed the main focus of the conference was on legacy sites from uranium mining and milling activities. This was especially appropriate as uranium mining and milling was an important and intensive industry in most of the Central Asian countries of the former Soviet Union. After the countries became independent some of these activities were stopped and the countries found themselves facing the problem of safe management and remediation of many sites.

This conference was a good opportunity to discuss the relevant issues relating to the environmental remediation of these radioactively contaminated sites, as well as others around the world. It was carefully designed to cover the relevant aspects related to environmental remediation including *Financing Mechanisms*; *Regulatory and Safety Regimes*; *Innovative and Mature Technologies*; *Life-Cycle Planning;* and *Non-Technical Factors in Environmental Remediation*. A series of case-studies were presented allowing the participants to have an overview of the situation involving environmental remediation in different parts of the world.

The conference brought up some important issues that the IAEA should consider regarding environmental remediation. For example, the question of health risk to exposed populations living in

Message from the Director

The importance of the activities in the fuel cycle and waste area is increasing day by day. On the one hand there are a growing number of countries considering starting a nuclear power programme or opening up uranium mining activities. On the other hand there are increasing needs for management of radioactive waste from non-power applications, including radioactive sources. Also the importance of research reactor availability has been highlighted by the recent lack of production capacity of Molybdenum 99, the precursor of Technetium 99 that is very frequently used in medical applications. This is a very inspiring situation, but it also put increasing strains on our resources. New ways of working needs to be developed, involving even more the expertise in the Member States. This is the background for the network approach that we are introducing step by step in our activities. Such networks provide opportunities both for exchange of information between advanced organisations and for transfer of experiences to countries embarking in the field through workshops, training courses etc. Also the work on coalitions between different research reactor organisations serves the same goal.

In these dynamic times we also see important changes in the staff. At the end of May Jan-Marie Potier, the Section Head for the Waste Technology Section, left the IAEA and was immediately replaced by Irena Mele. A warm welcome to Irena.

At the end of August the Section Head for the Nuclear Fuel Cycle and Materials Section, Chaitanyamoy Ganguly, or Tona as we call him, will retire. I would like to take this opportunity to thank Tona for the excellent results that he and his section has accomplished during his five years at the lead. Tona's in-depth knowledge on all aspects of nuclear power and the fuel cycle is remarkable and renowned. His enthusiasm has been a great source of inspiration to all of us. His capacity to explain things in an elementary way has been much appreciated. He has also brought a good piece of Indian philosophy and knowledge to our work and discussions, which often has provided new interesting perspectives. It has been an honour and an educational period for me to work with Tona. I wish him all the best in his future work in India, where I am sure, he will face new interesting challenges.

Hans Forsström (h.forsstrom@iaea.org)

a contaminated environment still remains open, despite clear recommendations that have been given by organisations like the ICRP. The influence of non-technical factors in remediation projects was another clearly demonstrated issue needing attention. In many of the presentations given, it was evident that despite the fact that in many situations the exposures to radiation are low, the risk perceived by the public is very different. As such, psychological problems like anxiety and undue fear of radiation can arise.

Life-cycle planning was strongly emphasised as an important means to avoid the generation of more contaminated sites. All operations should be planned with the objective to reduce, as much as possible, the need for extensive post-operational environmental remediation work. Many presentations highlighted the importance of *effective stakeholder involvement* to achieve satisfactory results in ER programs and ethical values were presented as important elements to guide the discussions regarding the decision making in ER projects.

Several technological approaches to remediation were presented. It was demonstrated that local conditions need to be well understood to design appropriate remediation systems, because any final solution is very site-specific. Bioremediation was discussed and it has been demonstrated that this is a particularly attractive solution to situations in which the groundwater reservoir is deep and difficult to assess. However there are limitations particularly when addressing inorganic metals and radionuclides. *Natural monitored attenuation* seems to be gaining more support as opposed to a more conventional groundwater remedy such as pump-and-treat due to cost and effectiveness considerations. *In-situ vitrification* was presented as a way to turn contaminated soils into a solid, leach-resistant matrix. However, the power demands and implementation costs may not be feasible in developing nations where adequate infrastructure is not in place. In all cases mathematical modelling is an essential tool for the design and performance assessment of remediation solutions.

Concrete examples of the importance of the relationship between regulators and operators; life-cycle planning; adequate dose assessment protocols for members of the public and workers, adequate monitoring programs and clear strategies for stakeholder involvement were given. As financial constraints often play an important role in the implementation of remediation programs, the engagement and commitment of governmental authorities to the projects will be essential. The political will must be backed up by the existence of a sound and comprehensive regulatory framework that must be enforced by well trained and capable professionals. In some countries the environmental remediation works cannot be easily implemented by local technical people and international assistance will be essential. As a result, local capacity building is of utmost importance and this is an essential role to be played by the IAEA.

In relation to Central Asian countries it has been concluded that near-term actions should involve the initiation of comprehensive impact assessment for each site. Implementation of institutional controls should be pursued along with the implementation of routine monitoring programs. Public awareness regarding safety issues is also an issue to deserve attention in those countries. Finally, it was stressed that decisions for intervention must be the result of a comprehensive risk assessment, and due care must be taken not to make decisions based solely on the perceived risk. Many international or multilateral organisations are involved in assistance, e.g. UNDP, IAEA, WHO, World Bank, EC, OSCE, EBRD and NATO. Some of these projects were presented and a consensus was reached for better coordination to improve the overall situation. One possible scenario for cooperation that could guide international approaches to remediation in Central Asia is the *Contact Experts Group* (CEG), a model developed by the IAEA and used with much success in Russian Federation. A CEG for Central Asia would bring together all interested states, international organizations, non-governmental organizations, and independent experts for working-level meetings and annual plenary sessions. Regarding regulatory issues, the need for coordination among regulatory authorities was highlighted. Norway proposed an *International Working Forum for Regulatory Bodies* responsible for oversight of legacy sites, in which the IAEA could act as the Secretariat.

More detailed information on the outcome of the conference can be found on http://www-ns.iaea.org/meetings/rw-summaries/astana-2009.htm.

Horst Monken-Fernandes (H.Monken-Fernandes@iaea.org)
Russell Edge (R.Edge@iaea.org)

WTS – Waste Technology Section

Areas of work

The Waste Technology Section area of work covers wide variety of topics related to radioactive waste management, decommissioning and site remediation with the main objective to provide balanced and up-to-date information on waste management technologies to the Member States (MS), to foster the transfer of relevant technologies and to provide direct assistance to Member States that lack an appropriate infrastructure and human resources. The activities of WTS assist both the Member States with extensive nuclear power generation programmes and those with nuclear activities limited only to the application of radioactive materials in research, medicine, industry and agriculture.

Currently the WTS efforts are focusing on three major areas: the development and implementation of mechanisms for better waste technology transfer and information exchange; the promotion of sustainable and safer processes and procedures for managing the radioactive waste; and the provision of peer reviews and direct technical assistance related to waste management, decommissioning and environmental remediation.

Radioactive waste management activities include both predisposal and disposal projects. Predisposal activities aim to facilitate the implementation of the safe and cost effective technologies for waste characterization and classification, for waste minimization, waste retrieval and conditioning as well as waste storage. In the area of radioactive waste disposal the current WTS projects involve planning, design, construction and closure, and quality management for radioactive waste repositories of all types: from near-surface repositories for low level waste, disposal facilities for large volumes of very low level waste, borehole disposal for disused sealed sources to geological disposal of intermediate and high level waste or spent nuclear fuel and concepts of multinational repositories.

The decommissioning projects aim to foster safe, timely and cost-effective decommissioning of nuclear facilities, and to provide technical guidance on the efficient planning, implementation and management of decommissioning operations. Special attention is paid to the decommissioning of research reactors and other small nuclear or radiation facilities which is of interest to many Member States.

The site remediation projects aim to increase the capability of the MS to plan and implement strategies, methodologies and technologies for environmental remediation. Efforts are oriented towards putting in place proper infrastructure and technologies for managing the radioactive legacies in different MS.

Management of disused sealed radioactive sources is currently one of the WTS priority areas. Many sealed sources from different applications all over the world are abandoned and not safely and securely treated. The WTS Source Recovery Group helps Members States to retrieve and recover the disused sources, to safely and securely store them or to repatriate them to the country of their origin.

WTS also develops and runs several waste management information systems and databases which are available for use to its Members States, such as the Catalogue of Sealed Radioactive Sources and Devices, the Radioactive Waste Management Registry for recording and processing of information on radioactive waste management activities and the NEWMDB – the Net-Enabled Waste Management Database, the IAEA's principal mechanism for collection and dissemination of information on national radioactive waste management policies and programmes. Its use has recently been extended and upgraded to assist the MS as a data presentation tool for preparation of national report by the Joint Convention.

Networking

Activities conducted within the Waste Technology Section make use of established IAEA mechanisms;

technical meetings, seminars and conferences to exchange information and prepare technical reports. Coordinated Research Projects (CRPs) to foster R&D cooperation, and direct assistance through technical co-operation (TC) projects. However, new developments and global technology trends require new approaches and new tools. Networking and establishment of direct links between interested parties, regional and local organizations is becoming an effective and powerful tool to assist the Member States. In 2007 the Waste Technology Section has jointly with the Waste and Environmental Safety Section successfully launched the International Decommissioning Network (IDN) which focuses on 'hands on' practical training for decommissioning planners and project managers to enable progress on decommissioning of many disused nuclear facilities around the world. It has attracted participants from both those Member State organizations facing decommissioning challenges and those with extensive expertise and expertise who are willing to share.

This year the WTS launched a new network: an international low-level waste disposal network or shortly DISPONET. It covers all aspects of disposal of low and intermediate level waste, very low level waste, and disused sealed sources using suitable surface and subsurface facilities, including borehole disposal. Already at launching it was represented by more than 20 MS and the interest for participation is still growing. The establishment of ENVIRONET - the Environmental Management and Remediation Network will be announced during the General Conference in September 2009. Its main objective is to help MS in implementing environmental remediation programmes. Further networks are planned.

Irena Mele (I.Mele@iaea.org)

IAEA International Symposium on Uranium Raw Material for the Nuclear Fuel Cycle, URAM 2009, Vienna, Austria

As the world community has become more concerned with the issue of climate change in recent years, there has been a growing debate on how to adopt measures that will reduce the speed and impact of such change. At the same time there has been growing demand for energy in emerging economies and a worldwide interest in improving energy security amongst nations with few reserves of traditional energy resources such as coal and other hydrocarbon fuels. It is with these issues as a background that the IAEA has organised a symposium on uranium, the raw material for the whole of the nuclear fuel cycle and nuclear power industry.

The quadrennial event was held in Vienna from 22-26 June 2009 and has attracted global audience of more than 210 participants drawn from 33 countries and 4 other international organisations. The contributions included 50 oral presentations and a further 40 posters on technical topics involving all aspects of the uranium production cycle.

The programme has been designed to cover the complete uranium production cycle and is been built around six main topics: Uranium markets and economics; Social licensing in the uranium production cycle; Uranium exploration and geology; Uranium mining and processing; Environmental and regulatory issues; and, Human Resources development. The topics were discussed in dedicated sessions with each session having an invited keynote paper supported by papers selected from the over 90 abstracts submitted by participants from Member States and other international organisations. Speakers included senior management representatives from leading uranium mining companies, senior personnel from major regulatory authorities and contributions from industry newcomers - both regulators and mining companies.

Each presentation was followed by a question and answer discussion period to enable the assembled participants to discuss the points raised in the papers. At the end of the meeting there was an expert panel discussion and a final question and answer discussion. This final session was to help participants develop solutions to such questions raised in the symposium as: How to meet the increasing demand for uranium? How will the industry balance the development of brown field sites against green field sites and how will the issue of legacy sites be managed as mining expands? Are residues from former operations a realistic source of new material? How will the present demand for experienced personnel be addressed when there has been little new blood entering the industry for a generation? What are the future market prospects for uranium?

In addition there was a session devoted to poster presentations and a number of side events. A short workshop on Technical Cooperation issues related to the Uranium Production Cycle was held on Wednesday 24 June for those member States involved in, or wishing to learn about, such activities.

The presentations made during URAM 2009 can be found on http://www-pub.iaea.org/MTCD/Meetings/cn175_Presentations.asp.

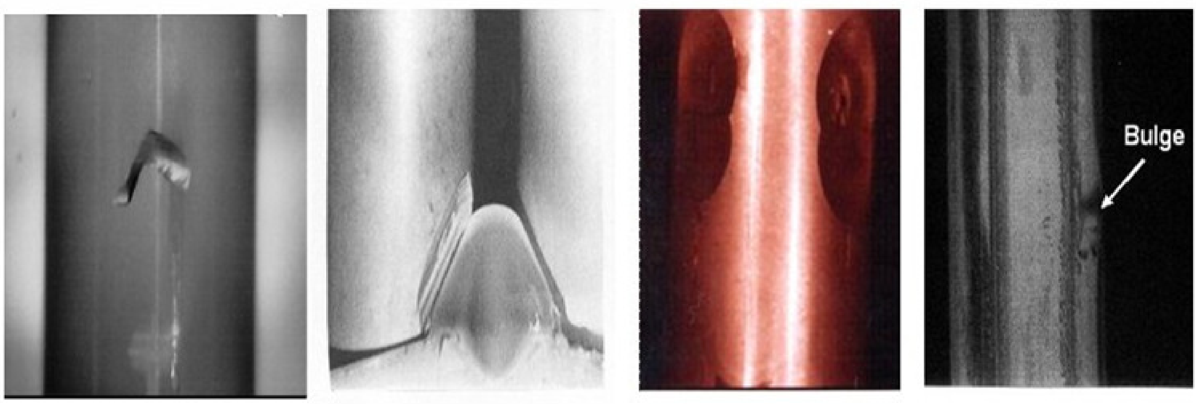
Jan Slezak (J.Slezak@iaea.org)

Spent Fuel Management activities in Nuclear Fuel Cycle and Materials Section

While nuclear industry has successfully managed spent fuel quantities arising from nuclear power production in the past, a variety of issues have been raised through considerations of the long term strategy options for spent fuel management. Currently about 10 500 HM spent fuel are unloaded every year from nuclear power reactors worldwide. Less than one third of spent nuclear fuel is being reprocessed and the rest is being stored.

The objective of the IAEA activities in spent fuel management are to improve the capability of interested Member States to plan and implement strategies and methods for long term management of spent fuel. As long term storage of spent fuel for 100 years and even more are becoming a possibility, its integrity and safety over long term become important. Spent fuel management has essential interfaces with the overall current and future nuclear fuel cycle activities. Non proliferation concerns will continue to be high on the agenda and will warrant the effort in arranging multilateral approaches in nuclear fuel cycle. Current and future reprocessing and recycle capacities can have large impact on future spent fuel management. Spent fuel management needs to be continued in such a way to keep the future management options open. Some recent and near term activities are:

- Organization of International conferences on management of power reactor spent fuel May 31-June 4, 2010 in Vienna.



Fretting due to debris interaction — *Fretting due to spacer grid vane – to – rod contact* — *Fretting due to spring relaxation* — *Secondary degradation (hydride blister)*

Fuel rod damages due to fretting and secondary degradation.

- Continuation of the CRP on Spent fuel performance assessment and research (SPAR III). **The figure shows one example of fuel rod damages that was identified during SPAR II CRP.**
- Burnup credit applications workshops.
- Technical meeting on implications of damaged spent fuel for storage and transport.
- Lessons learned from storage facility operations.
- Systems integration considerations in spent fuel management.
- Current and future options for spent fuel reprocessing.
- Regional/multilateral cooperation on spent fuel management facilities.

Zvonko Lovasic (Z.Lovasic@iaea.org)

Advanced Nuclear Fuel Cycles

Much development work is going on to introduce fast reactors and the closed fuel cycle. This involves advances in the areas of reprocessing and recycling and in fuel for new reactor types. Many of these involve Partitioning and Transmutation (P&T) to incinerate the actinides to lower the radiotoxicity of the nuclear wastes, and to improve the public acceptance of nuclear energy. A Coordinated Research Programme (CRP) on the implications of P&T was implemented during 2003-2009, with participation from China, Czech Republic, Germany, India, Japan, Republic of Korea, Russian Federation and USA participated in the CRP.

The PUREX process was established as a commercial reprocessing of spent nuclear fuel and it is in active use on a large scale in France, Japan, India, Russian Federation, and the United Kingdom. Although PUREX process has significantly improved in terms of reduced waste generation, it has some major drawbacks. In response to the concerns associated with the conventional reprocessing technologies, several 'advanced partitioning methods' are being developed that could 'co-recover actinides mixture' e.g., Pu with minor actinides instead of recovering pure individual actinides). The co-recovered actinides mixture could be utilized as the fuel for dedicated transmutation reactors. It also provides increased proliferation resistance of nuclear materials. Proliferation resistance attributes of partitioning processes has been reviewed in the above mentioned CRP.

The development of Minor Actinide (MA)-based fuel (target) is the crucial vital link in P&T. A review of the current status and future trends in the processing of MAs and their pertinent properties for the fabrication of nuclear fuels has recently been prepared (STI/PUB/1415). The latest directions in the subject of minor actinide fuel (target) development namely measurement of properties, processing, fabrication, irradiation behaviour in-pile and back-end issues are covered. IAEA has also made a database on 'thermo-physical properties of minor actinides based materials of relevance to advanced fuel cycles' MADB (http://www-nfcis.iaea.org.).

There is a sizeable experience in operating uranium-plutonium mixed oxide fuel (MOX) and considerable knowledge on alloy fuel as well as mixed carbides and nitrides of plutonium. A technical meeting on liquid metal cooled fast reactor fuel cycle was convened in 2005 at Obninsk, Russian Federation. It was recognized that for the short term prospectus (2025-2030) the MOX fuel is the first option (Japan, France, India, China, Belgium) In the long term plans different dense fuel types are under consideration: metal (Japan, India, China, Republic of Korea), nitride (Russian Federation, France). As regards to the fabrication and reprocessing technologies, the meeting recognized that in the short term prospects, advanced aqueous methods are considered as the major methods for MOX fuel. Concomitant to this meting the IAEA is preparing three state-of-the-art review documents on fuels, fuel cycles and structural materials for fast reactors and it is expected that these three documents will published by the end of 2009.

Some Member States are developing thorium based nuclear fuel. A technical document (IAEA-TECDOC-1450) was prepared which critical reviews on thorium fuel cycle viz., its potential benefits and challenges. The document covers the latest developments in particular front-end of the cycle, applying thorium fuel cycle options as well as back-end of thorium fuel cycles. New work is initiated to provide further insight in thorium fuel cycle, different implementation scenarios and options of thorium cycle, thorium deposits, fuel fabrication, reprocessing and waste management.

High temperature gas-cooled reactors will require coated particle fuel. A technical document 'Current status and future perspectives of gas cooled reactor fuels' (IAEA-TECDOC-1614) has recently been published, providing a critical review of advanced fuel design including conventional one, fabrication technology, QA/QC, fuel irradiation qualification, fuel performance, fuel modelling and performance and overall fuel cycle issues. In addition, a handbook entitled 'Basic fact-book on coated particle fuel' for use in training and education of the new generation of scientists and engineers on coated particle fuel technology will soon be published.

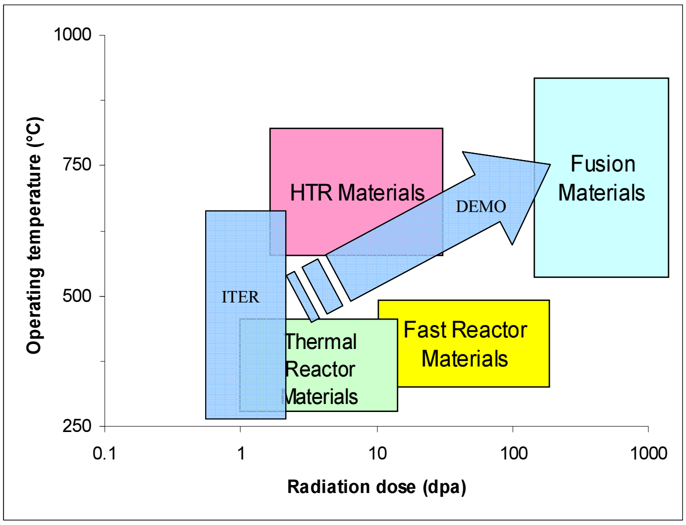
Hosadu P. Nawada (H.Nawada@iaea.org)

Recent IAEA Activities in the Area of Radiation Materials Science

Nuclear power generating devices require the use of structural materials that must reliably serve in very severe irradiation, corrosive and temperature environments for decades without failure. Internal bombardment by neutrons causes the displacement of atoms from their lattice sites, producing vacancies and interstitial atoms, which can contribute to extensive microstructural and microchemical alteration of the alloy. Generally, these alterations degrade the original mechanical and physical properties of materials, and can with higher doses produce substantial instabilities in component dimensions and volume. Such alterations often affect operational efficiency and become the life-limiting determinant of both fuel assemblies and core structural components.

Similar damaging processes can be initiated by energetic charged particles. This allows simulating real reactor irradiation environments in ion accelerators. During the last years the interest to this effective research tool has grown in many IAEA Member States in a wider context, due to increased capability of accelerators and increased computing capacities.

The behavior of materials under irradiation has been studied for more than 50 years, mainly for the existing fleet of ‘thermal reactors’ with quite limited levels of radiation loads. These levels are, however, not sufficient for advanced and innovative systems. It is projected that structural components of Generation IV fission and future fusion reactors will operate in the unknown zone of much higher temperatures and radiation doses as it is schematically shown on the picture.



The duration and cost of materials testing under neutron irradiation is continuously increasing in correspondence with required doses, while the availability of test reactors is steadily decreasing. Currently the cycle of examinations necessary for industrial employment of an improved material for an already existing power reactor requires more than 20 years, that makes direct reactor experiments with a variety of new candidate materials for innovative nuclear systems practically impossible. Additional simulation tools and theoretical models are therefore required to assist in prediction of material behavior under anticipated operational conditions.

In response to these needs the IAEA is now launching a Coordinated Research Project on Accelerator Simulation and Theoretical Modeling of Radiation Effects (SMoRE). The project unites 17 organizations from 14 Member States interested in the development of advanced radiation resistant materials and has the following overall objectives:

Facilitation of best practices and information exchange for improvement of accelerator irradiation tools and methods of materials testing;

Development, comparison and experimental verification of theoretical and computational models of radiation damage;

Joint experimental studies of existing, prospective and model materials, including round robin testing and characterization of selected materials.

The high interest to the subject among the Member States was confirmed at the IAEA International Topical Meeting on Nuclear Research Applications and Utilization of Accelerators that was held on 4-8 May 2009 in Vienna in co-operation with the American Nuclear Society and with participation of more than 220 specialists from 50 countries. One of the conclusions was the need for international discussion specifically targeting the analysis and comparison of neutron and accelerator irradiation. Responding to this request, the IAEA plans the a Technical Meeting in the fourth quarter of 2009 in Vienna.

All above mentioned activities, as well as IAEA-ICTP training workshops on basic radiation materials science, are being jointly implemented or closely coordinated by two IAEA Departments: of Nuclear Energy and of Nuclear Science and Applications.

Victor Inozemtsev (V.Inozemtsev@iaea.org)

Contact Expert Group (CEG) Discusses Operation of Mayak

The CEG workshop on *Management of Spent Nuclear Fuel and Radioactive Waste: Regulatory and Licensing Issues* (including a special session on the Production Association Mayak) was held on 27-28 May 2009 in St. Petersburg, Russian Federation. Sixty participants from nine countries and two international organizations attended the workshop.

One of the most important questions discussed at the workshop was safe operation and environmental impact of reprocessing spent nuclear fuel (SNF) at the Production Association (PA) Mayak. The discussion included both technological and regulatory aspects. Experts from PA Mayak made presentations on transportation and reprocessing of submarine SNF at the plant, and handling of RTG heat sources at their HLW storage facility. They have shown that the facilities for fuel management, interim storage, reprocessing and vitrification are adequate for handling and reprocessing SNF resulting from programmes supported by international donors.

The storage facility for vitrified HLW at PA Mayak with the loading machine at the front. This is where HLW that has been generated during reprocessing of the legacy SNF and heat sources form RTGs are stored.

Special attention was given to the problem of treatment of damaged fuel assemblies whose reprocessing is currently not possible. Rosatom plans to rebuild a hot cell at PA Mayak specifically for handling damaged SNF. This will be accomplished with the financial help of the French Commissariat for Atomic Energy. The hot cell should be commissioned by 2011. A separate presentation on specifics of licensing and regulation of safe operation of PA Mayak pointed to the need for adapting the existing normative base to the realities of legacy cites.

Comprehensive information was provided on both historical and current radioactive discharges from the SNF reprocessing plant. A detailed assessment of the impact on health of the personnel and the population in the area was also done. It was shown that the discharges are well below the permissible levels and the current radiation impact on the personnel and population is insignificant.

Over the last few years, Rosatom has allotted significant funding for projects designed to mitigate the most serious environmental risks, focusing on prevention of radioactive discharges to open river systems and improvement of RW treatment and conditioning. One of the most challenging problems of PA Mayak is accumulated radioactive waste (RW), notably the waste with activity of over 120 MCi that has been discharged over several decades into water reservoirs (lakes isolated from the rivers of the region). The current discharges of LLW and ILW into the water reservoirs as a part of the existing technological scheme are limited to ensure that the total amount of activity contained therein is gradually fading. Plans are to cease discharges of ILW in water reservoirs by 2015 once a new cementation facility becomes operational. The work on turning these reservoirs into safe disposal sites has already started. Similar plans envisage introduction of LLW treatment facilities and termination of LLW discharges.

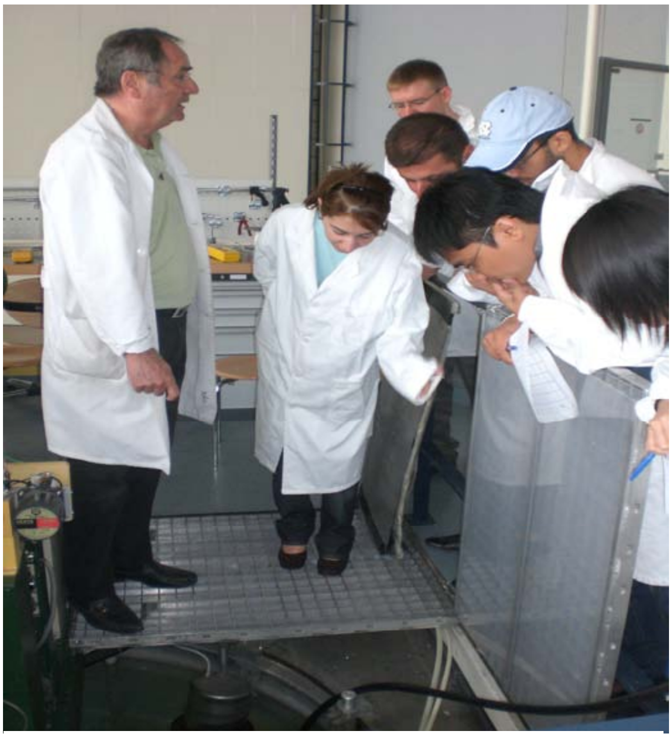
Oleg Goroshko (O.Goroshko@iaea.org)

Human Resources and Skills Development - Research Reactor Group Fellowship Training

Over the past 2 to 3 years, the IAEA has experienced increasing expressions of interest for support of research reactor (RR) infrastructure projects and staff training. A significant amount of this interest has originated from countries with few or no existing nuclear facilities. Many organisations the IAEA relies on to support TC activities, in particular for Fellowships, are becoming overburdened with requests for human resource and skill development from the IAEA and other organisations. To satisfy the growing demand with available resources, an innovative approach was developed to take advantage of a research reactor coalition being developed within TC Project RER4032. The Eastern European Research Reactor Initiative (EERRI) worked within the TC Project to develop a course. A course schedule was drafted and presented to Member States during the 2008 IAEA General Conference and at several other TC project specific meetings.

The final course was developed by the EERRI and implemented for 8 participants from Azerbaijan (3), Colombia (1), Estonia (1), the United Arab Emirates (1) and Vietnam (2). Four EERRI organisations from Austria, Hungary (2) and Slovenia plus select IAEA staff from NS, NE and MT contributed to the course lectures and practical exercises. Three different research reactor facilities in Austria and Hungary (2) hosted the course.

The course schedule included topics related to research reactor planning, utilization, management, safety and many specific technical subjects. The technical subjects were further emphasised by practical exercises, experiments and demonstrations on operating research



Dr Prof Helmuth Böck (left) with RR Group Fellowship Students at the Atominstitut TRIGA Reactor in Vienna.

reactors such as criticality and prompt criticality, reactivity / control rod calibration, I&C detectors and MCMP calculations.

The Atominstitut was the principal/lead organisation for the EERRI in all organisational matters. Planning for the course began in mid 2008. The six week course was conducted from 4 May through 12 June, 2009. Feedback from all students was very positive – particularly with respect to the practical aspects of the course. A second course is being organized to tentatively commence in October 2009. The Czech Technical University research reactor organisation in Prague is the lead organiser within the EERRI for the second course.

Ed Bradley (E.Bradley@iaea.org)

Deployment of a New Technology for the Conditioning of Disused High Activity Radioactive Sources: The Mobile Hot Cell

The concept of a mobile unit for the conditioning of disused high activity radioactive sources was conceived by the IAEA Waste Technology Section in March 2002. The concept was approved during an international consultancy shortly after. In its essence, this concept consisted of a mobile hot cell and a storage container for the recovery, conditioning and packaging of disused high activity radioactive sources. The unit allows international expert teams to render disused high activity radioactive sources safe and secure in those countries that use high activity radioactive sources for beneficial purposes but do not have the infrastructure to process them after termination of the application.

The mobile hot cell deployed in Sudan

Funds from the IAEA Nuclear Security Fund were made available to develop and manufacture the mobile unit. The first mobile hot cell was designed, manufactured and tested by the South African Nuclear Energy Corporation Ltd. (Necsa). Additional support on the detailed designing of the mobile hot cell, developing the protocol for operations and establishing and training regional specialised teams from Necsa on recovering disused high activity sources was provided by the IAEA. A pilot operation was performed in South Africa in March 2007.

Operators working with the manipulators on a source inside the mobile

Implementation

The new technology has been promoted through various African technical cooperation projects. The mobile hot cell has been recently deployed in Sudan to render safe and secure disused high activity radioactive sources stored at the radioactive waste storage site of the Sudan Atomic Energy Commission (SAEC). The inventory included disused research irradiators and medical teletherapy machines containing sealed high activity ^{60}Co sources. Inside the mobile hot cell the radioactive sources have been removed from the original equipment and transferred into one robust storage container that was designed for safe and secure storage for an extended period of time until they can be returned to the country of origin or disposed of.

The operation was successfully carried out by an expert team from Necsa with the efficient support of the staff of SAEC and funded from the IAEA Nuclear Security Fund. The operation provided real field experience and input for further improvements. Similar operations are in preparation or planned in further countries. Similar hot cells are being designed with the IAEA technical support in other Member States.

For more information, see the IAEA Bulletin article, located at this link: http://www.iaea.org/Publications/Magazines/Bulletin/Bull491/49102685658.pdf

Vilmos Friedrich (V.Freidrich@iaea.org)
Robin Heard (R.Heard@iaea.org)

Beijing International Ministerial Conference on Nuclear in the 21st Century

The IAEA organized an International Ministerial Conference on Nuclear Energy in the 21st Century in Beijing, China, from 20 to 22 April 2009. The conference allowed participants to discuss developments and emerging issues relevant to the role of nuclear power in providing clear and sustainable energy for national and regional development. It provided an opportunity to review the status and prospects of nuclear power including progress in the evolution of technology and to discuss the necessary actions to carry forward the positive momentum that nuclear power has witnessed in recent years. It also offered a forum for many countries considering the potential benefits of introducing nuclear power in their national energy mix to further assess the viability of the nuclear power option.

In the concluding Statement by the President of the Conference, Minister Li Yizhong, Minister of Industry and Information Technology, China, he stated that *"The conference recognized the positive momentum towards nuclear power and the decisions by many developed and developing States to pursue the use of nuclear energy. The Director General of the IAEA reported that more than 60 countries – mostly in the developing world – have informed the IAEA that they might be interested in launching nuclear power programmes. While respecting the right of each State to define its national energy policy in accordance with its international obligations, vast majority of participants affirmed that nuclear energy, as a proven, clean, safe, competitive technology, will make an increasing contribution to the sustainable development of human kind throughout the 21st century and beyond. It was widely recognized that:*

-Nuclear power contributes to global energy security while addressing climate change and avoiding air pollution;

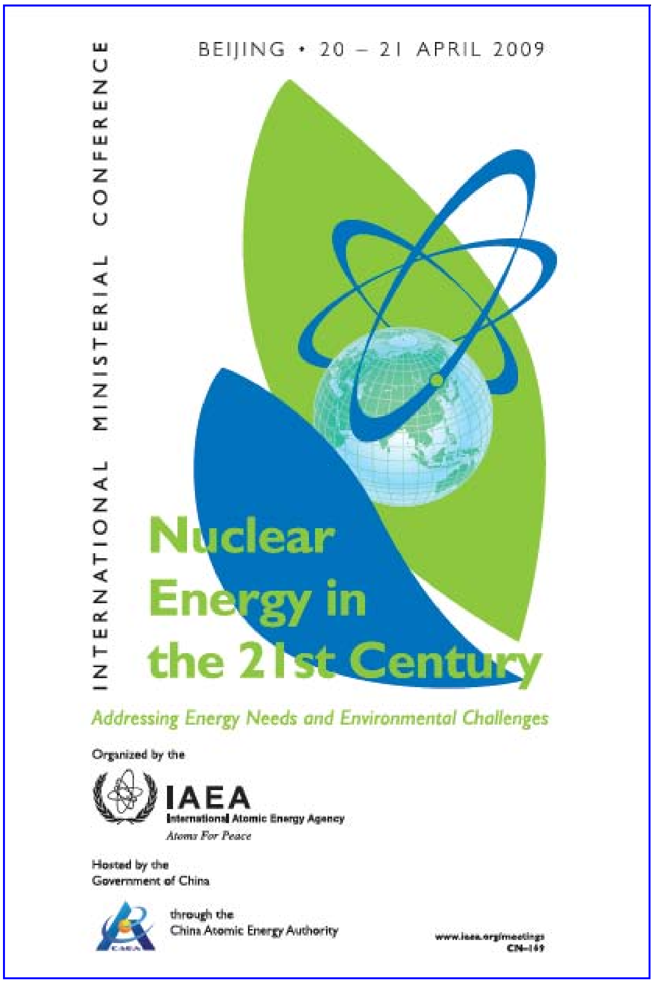
-Nuclear power is a base-load source of electricity that can make a major contribution to meeting energy needs in a sustainable manner in the 21st century;

-Nuclear energy can make a valuable contribution to worldwide socio-economic development".

In addition he presented some issues that need to be ensured to allow the development of further nuclear power programmes. He stated that *"international non-proliferation efforts should be strengthened and States must comply with their respective non-proliferation obligations, strengthen their export controls and enhance their cooperation with the IAEA"* and *"States having or developing a nuclear power program should give high priority to ensuring safety"*. He also indicated that consideration should be given to *"measures that will help to ensure reliable access to nuclear fuel supply, while maintaining the normal operation of the international nuclear fuel market"* and that *"safe management of spent fuel and the disposal of radioactive waste are of great importance for the sustainable development of nuclear power"*. He concluded that *"the progress made by the nuclear industry since the 2005 Paris Conference has been significant"* and that the *"IAEA plays an essential role in assisting States to develop the use of nuclear energy for peaceful purposes"*.

The Conference was extremely well organized by the Chinese hosts. Mr Huang Wei coordinated the activities of the Government representatives, the Conference building administration, the security services and all of the other groups who contributed to the management of the Conference in a manner that made all of the activities appear to be effortless. The fact that it was not easy was apparent on the day before the Conference when, during the Sunday there was a very large, high profile wedding ceremony and dinner in the Conference Hall. It seemed impossible for the Hall to be transformed into a Conference venue so quickly, but after the wedding party it was only two hours before the Hall resembled a major Conference venue. Large numbers of people moved and rearranged tables, the podium, microphones etc, and the culmination was the precision of the placing of the water for delegates, using lines to position the water so that the whole hall looked immaculate.

There were 29 speeches by or on behalf of 16 Ministers and these were arranged over the three days. Some Ministers were only available on one or other of the days, and some even wished a particular time for their speech. This required some delicate balancing of the speaking order, but eventually all speeches were accomplished.



In addition to the Ministerial speeches, there were four technical sessions with invited speakers covering all key issues for the nuclear industry. Active discussion sessions followed each technical session, and discussions continued long after the end of the sessions over coffee, tea or lunch. All speeches and discussions in the Conference Hall were simultaneously translated into all six UN languages and this contributed to the ability of all participants to be fully involved.

At the close of the Conference, as his last remark, the President of the Conference Minister Li Yizhong commented that *"participants are looking forward to a further conference at the Ministerial level in another four years, which would be a valuable step in the direction of developing the support and assurance by all countries involved in the peaceful uses of nuclear energy"*.

Ian Facer (i.facer@iaea.org)

Radioactive Waste Management Infrastructure - a Condition for Implementing a Nuclear Energy Programme

Introduction of nuclear energy requires solving a wide range of infrastructural matters to assure its sustainability. This might be an issue especially to countries that are considering and planning their first nuclear power plant. The infrastructures needed range from physical facilities and equipment involved in generating energy to those for managing radioactive waste, and include also effective financing, regulatory and legislative systems and adequate human resources to perform all those activities. While there is no discussion about the necessity of establishing a complex infrastructural environment, time needed for developing and installing these infrastructures is often underestimated.

Basic elements of radioactive waste infrastructure include waste generators, a waste disposal organisation, and an independent regulator; their mutual links and responsibilities should be clearly defined (see Figure 1), as described in the recently published IAEA guide on Policies and Strategies for Radioactive Waste Management (IAEA, NW-G-1.1, 2009).

Reasons for **policy** formulation are seen namely in: (i) establishing national infrastructure for radioactive waste and spent fuel management (RWM); (ii) defining a basis for the preparation of related legislation; (iii) providing a starting point for the development of national RWM programmes (strategies); (iv) assuring provisions of adequate financial and human resources over time; and (v) enhancing public confidence in relation to the subject. **Strategies** are needed to: (i) specify how the national RWM policy will be implemented by the responsible organizations using the available technical measures and financial resources; (ii) define how and when the identified goals and requirements will be achieved; (iii) identify the competencies needed for achieving the goals and how they will be provided; (iv) elaborate the ways in which the various types of radioactive waste will be managed; and (v) transparently inform stakeholders about RWM issues.

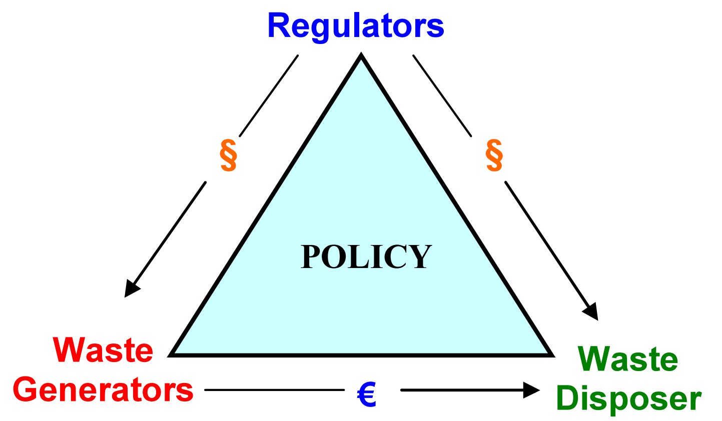


Figure 1: Waste management triangle

A generic approach for the development of national RWM policy and relevant strategies incorporates mainly organizational and planning activities. In spite of this, the time necessary for their development and implementation is relatively long (see Figure 2). The reason is that this process combines technical activities (namely when implementing strategy) and political decisions which are often complicated by stakeholder interests. As a result, while policy outline needs just few years, its approval may extend to 5 - 10 years until the policy is codified as a national law. Long term strategies without existing policy can hardly be formulated and even if the selection of a proper technical option needs just a few years, its implementation may require as much as 4 - 5 decades (construction of disposal facilities). Thus, planning for national RWM policy and implementing strategies shall be initiated early enough to have them ready for operation when the nuclear facility, e.g. NPP, is intended to be commissioned.

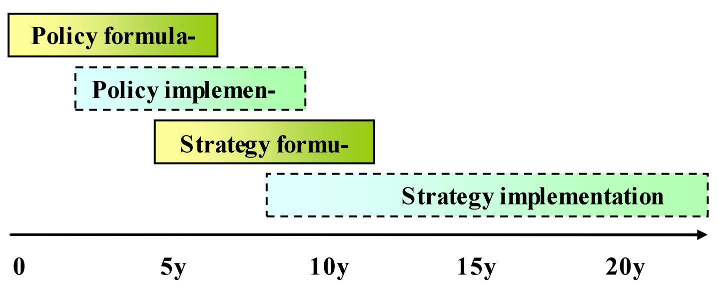


Figure 2: Indicative time links among policy/strategy formulation and implementation

Spent nuclear fuel and radioactive waste management infrastructure is a necessary element of the system to be available when implementing nuclear power programmes. The infrastructure can be best built through formulating a national RWM policy and relevant strategies. Its development and implementation requires systematic stepwise approach lasting for several decades. Thus, the building of RWM infrastructure shall be initiated in early stages of planning nuclear power programmes.

Lumir Nachmilner (L.Nachmilner@iaea.org)

IAEA Data Resources and the Joint Convention on the Safety of Spent Fuel and Radioactive Waste Management

The IAEA is a significant source of information and data on the nuclear fuel cycle. A set of databases are available on the Internet. Member States are asked to provide their respective data on an annual or multi-year basis. For radioactive waste management there is the Net-Enabled Waste Management System, or NEWMDB. To increase the usefulness of NEWMDB and to ensure the quantity and coherence of the information reported to the IAEA a universal reporting tool has been developed within NEWMDB for the use of Contracting Parties to the Joint Convention on the Safety of Spent Fuel Management and the Safety of Radioactive Waste Management (Joint Convention). The tool (DPT) provides direct reporting services as well as a web-based method to facilitate peer review of information provided in National Reports, thus saving both time and effort for the Member State points-of-contact and providing a direct incentive to regularly update their critical data with the IAEA.

Contracting Parties of the Joint Convention meet once in every three years and provide a detailed National Report containing updates and descriptions of their activities to improve their management of spent fuel and radioactive waste. These National Reports must conform to Article 32 of the Convention, as well as an agreed format and content guidance issued by the IAEA on behalf of the Contracting Parties. However, as there is no universally accepted method for the classification of radioactive wastes world-wide, it is difficult to compare between Joint Convention report data.

The DPT extracts the information from 5 IAEA databases and provides the information to the user via a web-based application. The user can also use the system to generate side-by-side comparisons of critical information regarding the fuel cycle for multiple countries, or for regions (e.g., North and South America, Eastern and Western Europe, etc.). All tables generated by the DPT are then downloadable in spreadsheet format for post-processing of the information. Each user can then manipulate the data as they would like.

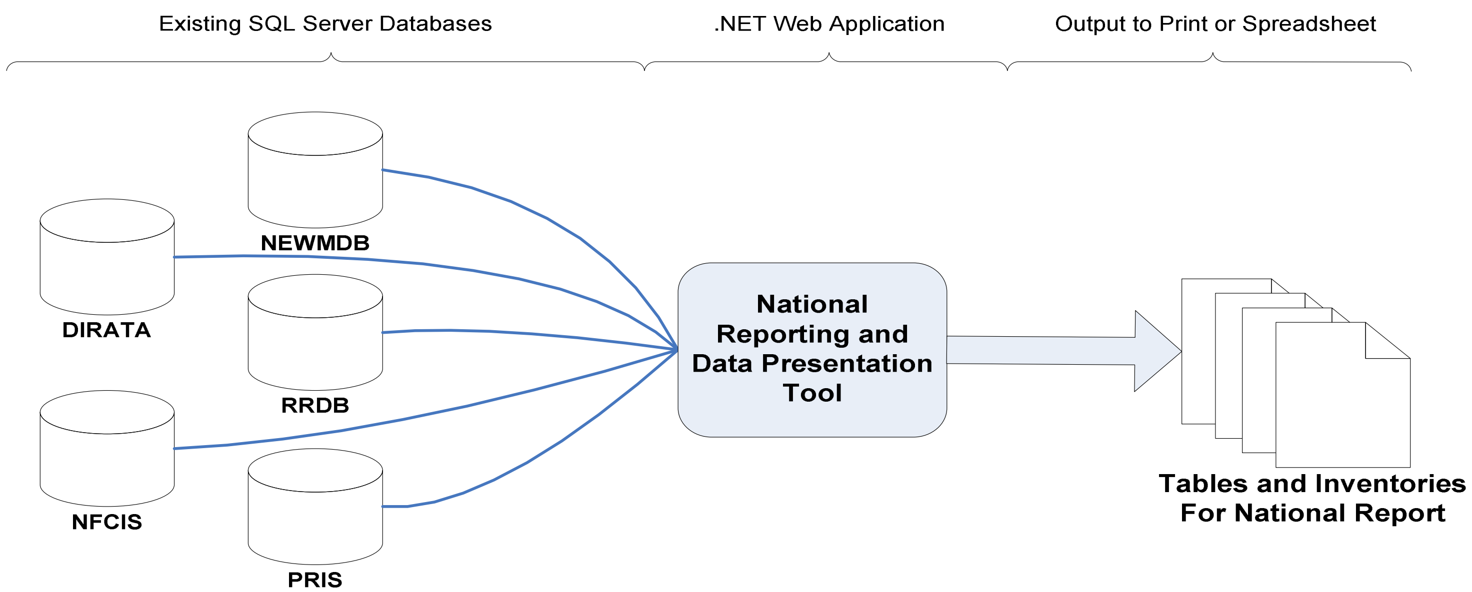
Users who regularly submit their data to the IAEA can also use the DPT to produce compliant data reports for other purposes, such as public information requests, responses to internal Government queries, and to respond to other NGO or international organizations.

The databases used are:

NEWMDB for Radioactive waste management.

1. Nuclear Fuel Cycle Information System (NFCIS), which collects information on spent fuel management at fuel cycle facilities and at away-from-reactor facilities.
2. Research Reactor Database (RRDB), collects the same information for research reactors.
3. Power Reactor Information System (PRIS), contains information regarding the status of the world’s NPPs.
4. DIRATA, is the IAEA’s database on discharges of radionuclides to the atmosphere and the aquatic environment

The draft tool was demonstrated and discussed at the 2009 Review Meeting of the Joint Convention. The full system will be available by the end of 2009.



Architecture of the Data Presentation Tool

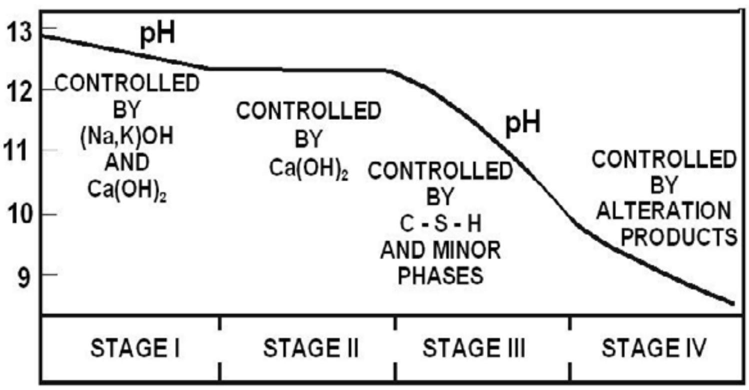
IAEA Nucleus Data Portal: http://nucleus.iaea.org/
NEWMDB: http://newmdb.iaea.org
DIRATA: http://dirata.iaea.org
RRDB: http://www.iaea.org/worldatom/rrdb/
NFCIS: http://www-nfcis.iaea.org
PRIS: http://www.iaea.org/programmes/a2

John Kinker (J.Kinker@iaea.org)

Behaviour of Cementitious Materials in Long-Term Storage and Disposal

The IAEA Coordinated Research Project (CRP) on **'The behaviours of cementitious materials in long-term storage and disposal',** highlights some of state of the art understanding of cementitious materials behaviour. Twenty-six research organizations from 21 Member States were involved. The CRP investigated the behaviour and performance of cementitious materials used for overall waste conditioning systems based on use of cement, including the waste package, waste form, and backfill. Interaction and interdependencies of these individual elements was also investigated in order to understand the processes that can result in the degradation of component physical and chemical properties. The main research outcomes are outlined in four generic topical streams: (i) conventional cementitious systems; (ii) novel materials and technologies; (iii) testing and waste acceptance criteria; and (iv) modelling long term behaviour.

The overall conclusion of the CRP is that more research is required on the physical and chemical effects of waste ions on the cement structure during solidification, the formation of further hydration products or species of waste ions, and the stability of these phases. These areas must be understood, because a slight change in chemistry of the matrix could result in significant changes in immobilisation capacity and the release of radioactive material into the biosphere. Interactions and durability especially of phases containing waste ions are the focus of current research.



Evolution of cements in a disposal environment. *Stage I:* the pH is dominated by alkalis all normal cement mineral hydrates are present. *Stage II:* the pH is dominated by $Ca(OH)_2$ all normal hydrates are present. *Stage III:* $Ca(OH)_2$ consumed: C-S-H, depending on composition, buffers pH in the range 10 to 12. *Stage IV:* only degradation and reaction products

For more information, visit http://www.iaea.org/OurWork/ST/NE/NEFW/wts_crp_cement.html.

Zoran Drace (Z.Drace@iaea.org)

Use of Scaling Factors for Waste Characterization in Nuclear Power Plants

The management of radioactive waste requires knowledge of the amounts and concentrations of specific radionuclides in the waste. Many of the radionuclides important for long term management of the waste are difficult to measure (DTM) from the outside of a waste package. Identification and quantification of these DTM nuclides require analysis of waste samples using complex radiochemical methods to separate the various radionuclides for measurement. Direct measurement is generally not practical to employ for large numbers of waste packages or for many heterogeneous waste streams.

An alternative is to exploit the relationship between some easy to measure (ETM) key nuclides, such as certain gamma emitters, and the DTM nuclides to derive information for the DTM nuclides of interest. The scaling factor (SF) method is such an approach that is widely used to evaluate these DTM nuclides. The SF method is based on developing a correlation between ETM and DTM nuclides. The activities of DTM nuclides in waste packages are then estimated by measuring the ETM nuclides based on gamma measurements from outside the package and applying the SFs to calculate the DTM activities.

A new Nuclear Energy Series report provides information on the international experience in the determination and use of SFs, shows actual examples of the ways in which SFs have been derived and applied in various Member States. It provides an essential and effective complement to the recently published ISO standard 21238:2007, which gives guidelines for the general methodology for empirically determining SFs to evaluate the radioactivity of DTM nuclides in low and intermediate level radioactive waste (LILW) packages.

Although the main focus of the report is on LILW from the operation of nuclear power plants, the SF technique is also applicable to other situations where it is desirable to infer the activity of DTM nuclides from easy to make measurements, such as for research reactors, nuclear fuel manufacturing plants, nuclear fuel reprocessing plants, decommissioning waste, contaminated land, etc. In each case, the technique employed is similar, but consideration must be given to the unique aspects of the situation, such as the radionuclides of concern.

The experience compiled from Member States indicates that the development and use of SFs is a widely accepted practice by waste generators, facility operators and regulators in many countries. While the details and scope of SF programmes differ in Member States, the basic techniques and methodologies are very similar.

Waste management professionals can facilitate the processing of larger quantities of heterogeneous radioactive waste, by exploiting the benefits of the scaling factor SF method of waste characterization.

Zoran Drace (Z.Drace@iaea.org)

New Initiatives in Management and Disposal of Low Activity Decommissioning Waste

Waste management is a critical aspect of the decommissioning process, especially of commercial scale facilities. Managing tens of thousands of tonnes of decommissioning material is a significant task and requires a dedicated organization. Moreover, the costs of radioactive waste management are a significant element of the overall decommissioning costs and may even dominate in some cases. This emphasizes the need for an accurate radiological characterization of materials and for seeking to maximize opportunities for reuse or recycling of materials so as to minimize the amounts requiring treatment, storage and disposal as radioactive waste.

Large quantities of the materials arising will contain, or are suspected of containing only small amounts of radioisotopes. For these there are substantial incentives to maximize the use of the principles of clearance from further regulatory control. First, environmental and sustainable development considerations demand maximum reutilization of non-renewable resources by way of direct reuse of equipment or buildings and by recycling usable materials. Second, there may be worthwhile intrinsic value in recycled materials (e.g., metals or crushed concrete for construction). Finally, the cost of conventional (i.e., non-radioactive) waste disposal is generally much lower than that of radioactive waste.

The principle of *unconditional clearance* has already been utilized successfully in several countries. The recent promulgation of IAEA guidance in this field (i.e., ***Application of the Concepts of Exclusion, Exemption and Clearance***, Safety Standard Series No. RS-G-1.7, 2004) should assist harmonization in this area and should also encourage more usage of the flexibility available than is currently achieved in some countries or by some operators.

Mock-up testing of entombment concept for reactors, conducted in Georgia

Despite the inherent benefits of the clearance policy, there can be significant costs in reclaiming scrap, equipment, and other materials. These include *inter alia* the costs (and extra man-sieverts) of labour resulting from decontamination and monitoring to ensure compliance with clearance criteria, the costs of administering the recycling programme, and the costs and other implications of managing the secondary wastes associated with these activities. In addition, these costs increase as the clearance levels decrease due to the need for a more demanding monitoring schedule when making measurements at low-activity levels, as well as the potentially greater decontamination effort required to achieve these levels.

Clearance for any future use may or may not be profitably applied to the disposition of one or more waste streams from the decommissioning of any given nuclear facility. Other options such as restricted release, release for specific non-nuclear uses, or disposal as radioactive waste may be more cost-effective than clearance in some circumstances. Ideally, the decommissioning practitioner should have access to a variety of options to maximize flexibility and cost-effectiveness of the disposition strategy. A number of such alternative options are described in the recent **Technical Reports Series No. 462** (2008), ***Managing Low Radioactivity Material from the Decommissioning of Nuclear Facilities***. Some recent papers describe new initiatives to decrease the waste management burden on decommissioning organizations.

A Slovak paper (*Tatransky, P., Necas, V., Conditional Release of Materials from Decommissioning Process into the Environment in the Form of Steel Railway Tracks, Nuclear Engineering and Design, 239 (2009) 1155-1161*) describes a conditional release of material with higher release criteria. This is based on a pre-determined use of the released material that can be analyzed and proven to result in negligible doses to the public, since several theoretical scenarios can be excluded *a priori*.

In quite a few countries, the traditional decommissioning strategy can be nicknamed ‘Rip-and-Ship’, meaning plant/building decontamination followed by either manual or remote dismantling (*rip*) and subsequent storage or disposal of large volumes of conditioned waste offsite (*ship*). The principal competitor to ‘Rip-and-Ship’ is Entombment. This strategy is routinely employed in the USA, where for example 250m³ cells were filled with grout at Idaho without decontamination. Instead the in-cell vessels and pipe work are encased in concrete until the cell is completely entombed *in situ*. This strategy is described as one means to reduce waste generation from the UK’s large decommissioning programme in a recent paper (*Kelly, B., Mort, P., Lowe, A., A Nationwide*

New Staff

Irena Mele has recently joined the Division of Nuclear Fuel Cycle and Waste Technology and taken up duties as Section Head of the Waste Technology Section. She is Slovenian and has worked previously at the Slovenian National Waste Management Organisation where she was as a Member of the Board and counsellor for strategic issues, advising the company on different aspects of radioactive waste management. She has many years of experience in the radioactive waste management area and in nuclear research activities and has also been involved in a number of international activities and projects including IAEA activities. A physicist by education, she obtained a Masters degree in nuclear engineering and a PhD in reactor physics. She accomplished a number of projects covering technical and safety aspects, projects dealing with public acceptance and social aspects of radioactive waste management. She was also engaged in research work in the area of radioactive waste management as well as in teaching radioactive waste management at the post-graduate study of Nuclear Engineering at the University of Ljubljana.

Paul Degnan has recently joined the Waste Technology Section as a Nuclear Engineer. His primary area of responsibility will be the management and co-ordination of activities in the Network of Centres of Excellence for Underground Research Facilities. His research background is in geology and hydrogeology. He has twelve years of experience working with Nirex, the Radioactive Waste Management organization in the UK that had responsibility for the geological disposal of long-lived LILW prior to the establishment of the NDA. He was employed at various times as Hydrogeologist, Biosphere Research Manager and Geosphere Characterisation Manager. During his employment with Nirex he was involved in several international research projects involving the use of palaeohydrogeology, natural analogues and natural safety indicators to support safety case development. He has also supported Posiva as a member of the ONKALO international advisory group and has worked together with NUMO and RWMC in Japan. He joins us from CSIRO, the national scientific research organization of Australia, where he led a research programme to optimize rock drilling and develop innovative rock mass characterisation technologies using down-hole methods.

Modelling Approach to Decommissioning, submitted to ICEM '09, 11-15 Oct 2009, Liverpool, UK). The figure shows one example of reactor entombment.

An important aspect of any decommissioning work is the accurate measurement of low levels of radioactivity in waste forms such as building materials, so that these materials can be assigned to the correct waste streams. It is also important to avoid over-conservative measurements, which may lead to over-classification as 'radioactive' of certain exemptible waste. This has led to a call for suitable standards and reference materials. A recent UK study focused on so-called 'soft waste' by testing gamma-emitters in a 200L drum format, with an activity concentration of just under 0.4 Bq/g (UK's clearance level). The drum was loaded with plastic bottles, each partially loaded with ion-exchange resin. The resin in each bottle had been previously spiked with a mixture of ^{241}Am, ^{137}Cs and ^{60}Co, all traceable to national standards. The drum would be used primarily as the basis of a comparison exercise, but feedback on its usefulness as a calibration standard would also be sought *(Dean, J., A UK Comparison for Measurements of Low Level of Gamma-Emitters in Waste Drums, Applied Radiation and Isotopes 67 (2009) 678-682).*

Michele Laraia (M.Laraia@iaea.org)

Training Course on Decommissioning Offered by Argonne National Laboratory for the IAEA

Participants at the ANL Decommissioning Course for Small Facilities

During the first week of June, 15 decommissioning devotees from 13 countries attended the Argonne National Laboratory (ANL) Training Course on the Decommissioning of Small Nuclear Facilities. This course, directed by Larry Boing and based on the popular decommissioning course offered regularly by Argonne, provides a complete overview of all aspects of decommissioning. The course mix lectures with field visits to re-enforce key concepts. It was offered to IAEA nominees 'cost free' to the IAEA International Decommissioning Network (IDN). Argonne, with US State-Department support, brought several of the world's best known experts in decommissioning to Chicago for the week to lecture and mentor the participants. These included Jean-Guy Nokhamzon (CEA), Mark Price (SCE – SONGS), Rock Aker (DOE-NBL), and Mark Hannan (IAEA-WES). Trainee support was provided by the Department of Technical Co-operation organized through the European Regional Project on Decommissioning (RER 3009). The course and lecturers were highly rated by the participants, who suggested that it be repeated on a regular basis.

Paul Dinner (P.Dinner@iaea.org)

International Conference on Fast Reactors and Related Fuel Cycles: Challenges and Opportunities FR09

The International Conference on 'Fast Reactors and Related Fuel Cycles - Challenges and Opportunities (FR09)', hosted by the Japan Atomic Energy Agency, will be held from 7–11 December 2009 in Kyoto, Japan.

The necessary condition for successful fast reactor deployment in the near and mid-term is the understanding and assessment of innovative technological and design options, based on both past knowledge and experience, as well as on ongoing research and technology development efforts.

This conference aims at promoting the exchange of information on national and multinational programmes and new developments and experience, with the goal of identifying and critically reviewing problems of importance, and stimulating and facilitating cooperation, development and successful deployment of fast reactors in an expeditious manner.

Main Topics

- Advanced and innovative reactor concept designs and associated objectives and driving forces
- Recycle strategies for fast reactors and associated technologies
- Proliferation resistance and physical protection • Economics and performance (including reliability, availability, service life, public acceptance)
- Transition scenarios: the path to fast reactor deployment
- Fast reactor safety:
  - Design and assessment approaches, issues and requirements
  - Special emphasis on severe accidents
  - Licensing issues
- Advanced fuels for fast reactors:
  - Fuel concepts, targets, high burnup fuels
  - Performance
  - Manufacturing
  - Irradiation experiments
- Structural materials: new challenges, manufacturing and performance
- Coolant technologies and instrumentation
- In-service inspection and repair
- Advanced and innovative fast reactor component and system design, and technologies (primary system, balance of plant, handling systems, simplification in plant layout, etc.)
- Past 20 years' experience with fast reactors, lessons learned and perspectives: design, construction, commissioning, operation, decommissioning
- Fundamental issues, new experiments and requirements (basic data, reactor physics, thermal hydraulics, etc.)
- Advanced simulation, modelling and verification/ validation/qualification in various areas
- Availability and capability of experimental facilities
- Human resources, education, infrastructures and knowledge management.

Conference Websites
www-pub.ieaea.org/MTCD/Meetings/
Annoucements.asp?ConfID=35426
and www.FR09.org

Chaitanyamoy Ganguly (C.Ganguly@iaea.org)

Recent Publications

IAEA Nuclear Energy Series No. NW-G-1.1
Policies and Strategies for Radioactive Waste Management (2009) **NEW!**

IAEA Nuclear Energy Series No. NW-T-3.3
Integrated Approach to Planning the Remediation of Sites Undergoing Decommissioning (2009) **NEW!**

IAEA Nuclear Energy Series No. NW-T-2.5
An Overview of Stakeholder Involvement in Decommissioning (2009) **NEW!**

IAEA Nuclear Energy Series No. NW-T-1.18
Determination and Use of Scaling Factors for Waste Characterization in Nuclear Power Plants (2009) **NEW!**

Nuclear Energy Series No. NW-T-1.17
Locating and Characterizing Disused Sealed Radioactive Sources in Historical Waste (2009)

Nuclear Energy Series No. NW-T-1.19
Geological disposal of radioactive waste: Technological implications for retrievability (2009)

Nuclear Energy Series No. NP-T-5.4
Optimization of Research Reactor Availability & Reliability: Recommended Practices (2008)

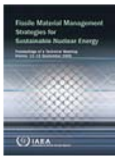
Technical Reports Series No. 467
Long Term Preservation of Information for Decommissioning Projects (2008)

Technical Reports Series No. 463
Decommissioning of Research Reactors and Other Small Facilities by Making Optimal Use of Available Resources (2008)

Technical Reports Series No. 464
Managing the Socioeconomic Impact of the Decommissioning of Nuclear Facilities (2008)

Technical Reports Series No. 462
Managing Low Radioactivity from the Decommissioning of Nuclear Facilities (2008)

STI/PUB/1299
Proceedings of Dec. 2006 International Conf. on Lessons Learned from the Decommissioning of Nuclear Facilities and the Safe Termination of Nuclear Activities (2007)



STI/PUB/1288
Proceedings of Sept. 2005 Technical Meeting on Fissile Material Management Strategies for Sustainable Nuclear Energy (2007)

STI/PUB/1278
Identification of Radioactive Sources and Devices (2007)

IAEA-TECDOC-1613
Nuclear Fuel Cycle Information System - a Directory of Nuclear Fuel Cycle Facilities, 2009 Edition **NEW!**

IAEA-TECDOC-1602
Innovative and Adaptive Technologies in Decommissioning of Nuclear Facilities (2008)

IAEA-TECDOC-1601
Homogeneous Aqueous Solution Nuclear Reactors for the Production of Mo-99 and other Short Lived Radioistotopes (2008)

IAEA-TECDOC-1593
Return of Research Reactor Spent Fuel to the Country of Origin: Requirements for Technical and Administrative Preparations and National Experiences (2008)

IAEA-TECDOC-1587
Spent Fuel Reprocessing Options (2008)

IAEA-TECDOC-1579
New Developments and Improvements in Processing of 'Problematic' Radioactive Waste (2007)

IAEA-TECDOC-1572
Disposal Aspects of Low and Intermediate Level Decommissioning Waste (2007)

Radioactive Waste Management Profiles No. 9
A Compilation of Data from the Net Enabled Waste Management Database (2008)

Upcoming Meetings in 2009

Date	Title	Place	Contact
7-11 Sept	Technical Meeting on Guidelines of Good Practice for the Management and Storage of Research Reactor Spent Fuel	Dounreay U.K.	P.Adelfang@iaea.org
7-11 Sept	Regional Workshop on Experience in Corrective Actions at Near Surface Radioactive Waste Repositories (TC RER9094)	Tallinn Estonia	V.Kurghinyan@iaea.org
Sept/Oct	Workshop on Approach, Development and Application of Waste Acceptance Criteria (TC LIT3003 & SLR3001)	TBD	Z.Drace@iaea.org
15-20 Sept 21-24 Sept	Regional Training Course on Surface based and Underground Site Characterization for Geological Repositories in Sediments and Hard Rocks (TC RER9103)	Pruhonice Czech Rep. & Meiringen Switzerland	P.Degnan@iaea.org
22-25 Sept	Technical Meeting on Post-operational Environmental Monitoring and Surveillance of Disposal Facilities for Radioactive Waste	Cherbourg France	L.Nachmilner@iaea.org
28 Sept-2Oct	Technical Meeting on Mobile Processing Technologies and Systems for Radioactive Waste Management	Vienna Austria	S.K.Samanta@iaea.org
28 Sept-2 Oct	Decommissioning of Multi-facility sites (TC RER3009)	Sellafield &Dounreay U.K.	P.Dinner@iaea.org
5-7 October	Technical Meeting on Application of Geographical Information System (GIS) in Repository Development	Vienna Austria	L.Nachmilner@iaea.org
5-9 October	Technical Meeting on Research Reactor ageing Management, Modernization and Refurbishment	Vienna Austria	E.Bradley@iaea.org
19-23 October	Training Meeting/Workshop to Update Waste management Information in the Net Enabled Waste Management Database (NEWMDB)	Vienna Austria	J.Kinker@iaea.org
Oct	Regional Training Course on Design Specifications and Safety Case for Radioactive Waste Processing and Storage Facilities (TC RLA 3009)	TBD	Z.Drace@iaea.org
27-30 Oct.	Activation Inventory Calculation for NPP (TC RER3009)	Hungary or Vienna	v.Ljubenov@iaea.org P.Dinner@iaea.org
26 Oct- 4 Nov	Regional Training Course on Fundamentals of Geological Disposal in Sedimentary Environments (TC RER9103)	Peine Germany	P.Degnan@iaea.org
28-30 October	44th Joint IAEA-OECD Uranium Group Meeting	Paris France	J.Slezak@iaea.org
Oct/Nov	Workshop on WWER Waste Management Benchmarking (TC RER 3007)	TBD	Z.Drace@iaea.org
2-6 November	Annual Forum for Regulators and Operators in the field of Decommissioning: the International Decommissioning Network (IDN) and Other Major Decommissioning Initiatives	Vienna Austria	P.Dinner@iaea.org
3-6 November	Technical Meeting on Potential Interface Issues in Spent Fuel Management	Vienna Austria	Z.Lovasic@iaea.org

Upcoming Meetings in 2009

Date	Title	Place	Contact
3-7 November	Training Course on Remediation after Uranium Production (TC RLA 3006)	Buenos Aires Argentina	J.Slezak@iaea.org
4-6 November	Technical Meeting on uranium from Unconventional Resources	Vienna Austria	J.Slezak@iaea.org
23-27 Nov.	Technical Meeting on High Level Waste (HLW) Processing and Spent Nuclear Fuel (SNF) Encapsulation	Vienna Austria	Z.Drace@iaea.org
23-17 Nov.	Technical Meeting on the IAEA Network of Centres of Excellence on Environmental Remediation	Vienna Austria	H.Monken-Fernandes@iaea.org
24-28 Nov.	Meeting on Uranium Exploration, Mining, Production, Mine Remediation including Environmental Issues (TC RLA 3006)	Salvador Brazil	J.Slezak@iaea.org
7-11 Dec.	International Conference on Fast Reactors Fuels and Closed Fuel Cycle – Challenges and Opportunities in 2009	Kyoto Japan	C.Ganguly@iaea.org
1-5 December	Training Course on Environmental management Systems in Uranium Mining and Processing (TC RLA 3006)	Lima Peru	J.Slezak@iaea.org

International Conference on Management of Spent Fuel from Nuclear Power Reactors Vienna, Austria 31 May—4 June 2010

Appropriate management of increasing spent fuel quantities is a key issue for the further use of nuclear energy generation. Spent fuel storage, wet or dry, is the current phase of spent fuel management that is applied in all countries. Some countries reprocess and reuse their spent fuel successfully but most keep it in long term storage. Spent fuel from nuclear power reactors requires safe, secure environmentally sound and efficient storage that will keep future options for spent fuel management open.

- **Current outlook for spent fuel management:** the status and trends of spent fuel management in Member States, spent fuel arising, amount of spent fuel stored, wet and dry storage capacities, storage facilities under construction and in planning, and national policy for the back end of the fuel cycle [e.g. papers organized by region].
- **Technical innovations and operating experience:** technological approaches for long term storage, new storage concepts, spent fuel and material behaviour in long term storage, operating experience in wet and dry storage.
- **Safety framework for spent fuel management:** licensing and regulatory practices for spent fuel storage facilities, license extension for existing facilities, security considerations.
- **New and future spent fuel management strategies:** highly enriched fuel, high burnup fuel, MOX fuel, advanced materials for storage racks and baskets, quality and maintenance of records, reprocessing and recycling technologies.

A Poster Session will also be held covering topics from the topical sessions.

Synopses should be submitted **by 10 December 2009.**

Conference website:
http://www-pub.iaea.org/MTCD/Meethings/Announcements.asp?ConfID=38089

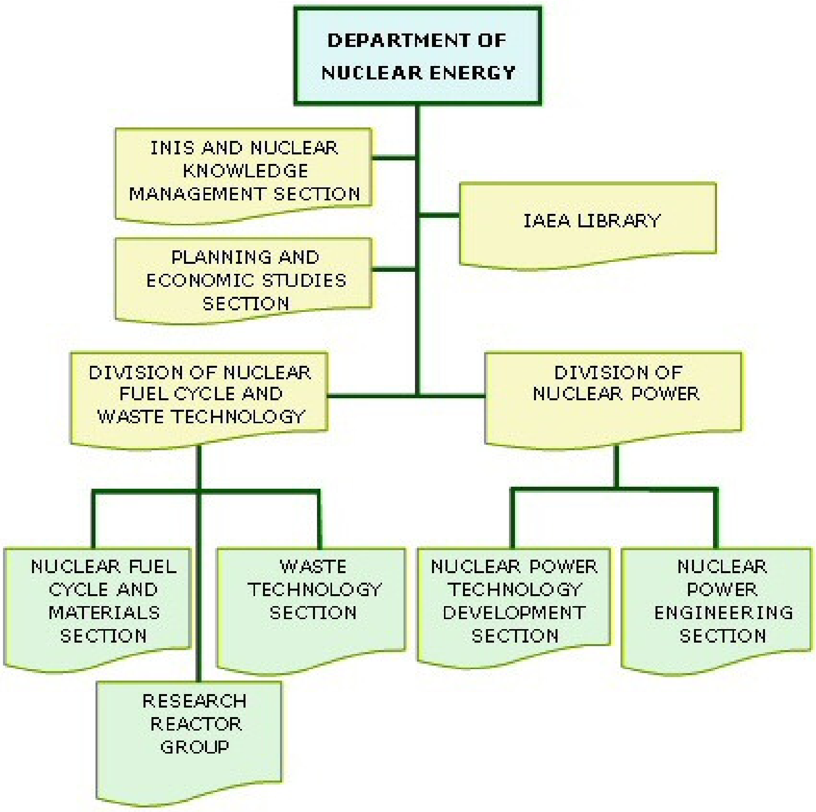
Vacancy Notices for Professional Posts

New vacancy notices will be available on the IAEA webpage addressing
http://recruitment.iaea.org/phf/p_vacancies.asp

Applications from qualified women and candidates from developing countries are encouraged.

Division of Nuclear Fuel Cycle and Waste Technology (NEFW) WebSite Links

Division Introduction - NEFW Home: http://www.iaea.org/OurWork/ST/NE/



Nuclear Fuel Cycle and Materials Section (NFCMS)

- Main activities
  http://www.iaea.org/OurWork/ST/NE/NEFW/nfcms_home.html
- Technical Working Group on Nuclear Fuel Cycle Options (TWGNFCO)
  http://www.iaea.org/OurWork/ST/NE/NEFW/nfcms_twgnfco.html
- Technical Working Group on Water Reactor Fuel Performance and Technology (TWGFPT)
  http://www.iaea.org/OurWork/ST/NE/NEFW/nfcms_twgfpt.html
- Databases (NFCIS, UDEPO, VISTA, PIE)
  http://www.iaea.org/OurWork/ST/NE/NEFW/nfcms_infcis.html

Waste Technology Section (WTS)

- Main activities
  http://www.iaea.org/OurWork/ST/NE/NEFW/wts_home.html
- International Radioactive Waste Technical Committee (WATEC)
  http://www.iaea.org/OurWork/ST/NE/NEFW/wts_watec.html
- Technical Group on Decommissioning (TEGDE)
  http://www.iaea.org/OurWork/ST/NE/NEFW/wts_tegde.html
- Databases (NEWMDB, DRCS)
  http://www.iaea.org/OurWork/ST/NE/NEFW/wts_information.html

Research Reactor Group (RRG)

- Main activities
  http://www.iaea.org/OurWork/ST/NE/NEFW/rrg_home.html
- Technical Working Group on Research Reactors (TWGRR)
  http://www.iaea.org/OurWork/ST/NE/NEFW/rrg_twgrr.html
- Research Reactor Database
  http://www.iaea.org/OurWork/ST/NE/NEFW/rrg_RRDB.html

IAEA
International Atomic Energy Agency

Fuel Cycle and Waste Newsletter
Vol. 5, No. 2, August 2009

09-32471

Vienna International Centre,
PO Box 100, 1400 Vienna, Austria

The Fuel Cycle and Waste Newsletter is prepared quarterly by the Division of Nuclear Fuel Cycle and Waste Technology, Department of Nuclear Energy.

Printed by the IAEA in Austria, August 2009