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Fuel Cycle and Waste Newsletter

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Tackling Sustainable Management of Disused Sealed Radioactive Sources

Sealed radioactive sources are used, among other things, to diagnose and treat medical patients, inspect welds, and prolong crop storage. However, there is a safety and security risk associated with these sources that needs to be managed and maintained under regulatory control even after their useful life is over. The sustainable management of disused sealed radioactive sources (DSRS) remains a challenge for many countries, because most have no final disposition route for DSRS. Although a number of storage facilities have recently been built or upgraded with physical protection measures allowing for improved control of DSRS, there is no better option than final disposal for long-term sustainability. In fact, disposal is generally recognized as the safest and most secure solution for all types of radioactive sources, with the possible exception of very-short-lived sources, which are suitable for decay storage. The lack of licensed disposal facilities accepting long-lived DSRS is a worldwide issue and therefore, it is imperative that dedicated solutions be developed and implemented.

Acceptance test for the BOSS system, conducted in South Africa

In an effort to highlight these issues and promote the safe and secure management of DSRS, the Thailand Institute of Nuclear Technology (TINT), under the auspices of the Asian Nuclear Safety Network (ANSN), hosted an International Workshop organized by the IAEA on *Sustainable Management of Disused Sealed Radioactive Sources (DSRS) - Working toward Disposal* in Chiang Mai, Thailand from 12 to 16 January 2009. Some 80 managers and experts from 23 countries representing

Message from the Director

Welcome to the April issue of the Fuel Cycle and Waste Newsletter. The articles in this issue cover a broad range of activities performed by the staff in the Division, ranging from support of uranium mining to the disposal of radioactive waste. The lead article discusses the important subject of how to ensure the sustainable management of disused sealed radioactive sources and in particular how to dispose of them. This is a topic that will become important for most Member States. One option is disposal in deep boreholes, a concept that has been developed and evaluated but as yet needs to be implemented in a Member State.

Another article that I would like to highlight concerns a new network that is under preparation, the Environet network on environmental remediation. This follows up on the successful introduction of networks for research for geological disposal, decommissioning and low-level waste disposal. The network concept provides a forum for exchange of information between the countries with experience and for transfer of knowledge to the countries initiating similar work. It is thus a very useful tool to both strengthen capabilities and provide technical cooperation assistance, through hands-on training courses, site visits and fellowships.

I would also take the opportunity here to thank Jan-Marie Potier, who, among other things, has been a strong driver for the development of networks as well as the borehole disposal. Jan-Marie is retiring from his position as Section Head of the Waste Technology Section at the end of May. Many of you know Jan-Marie and are well aware of his broad knowledge in the waste area and his enthusiasm for implementing new ideas in support of the IAEA activities. During his period as Section Head, he has brought a lot of 'joie de vivre' into the Section with very positive results. Together with his counterpart in Nuclear Safety Department, Didier Louvat, Jan-Marie has been instrumental in ensuring that technology and safety are addressed hand-in-hand in the waste management field. As a recognition of this, the Director General, Dr El Baradei, delivered a Distinguished Service Award last year to Jan-Marie and Didier. We wish Jan-Marie all the best in his new work in France.

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national programmes, regulatory bodies, international projects, and source management organizations attended the workshop. The topics discussed covered the life cycle of disused sources, with a special focus on long-term management aspects of storage and disposal. Discussions centered on international cooperation, national policies and strategies, storage and disposal, and associated regulatory aspects.

Broader and better coordinated international efforts to implement complete and integrated systems for 'cradle-to-grave' management of SRS (i.e., including disposal) are essential to moving forward and the IAEA is expected to play a leading role, coordinating efforts through the use of international instruments such as the Code of Conduct on the Safety and Security of Radioactive Sources (http://www-ns.iaea.org/tech-areas/radiation-safety/code-of-conduct.htm), the IAEA's Import/Export Guidance (http://www-pub.iaea.org/MTCD/publications/PDF/Imp-Exp_web.pdf), and the Joint Convention on the Safety of Radioactive Waste Management (http://www-ns.iaea.org/conventions/waste-jointconvention.htm).

Workshop participants acknowledged IAEA efforts to strengthen the safety and security of DSRS and to support DSRS management infrastructure upgrade activities in Member States. The borehole disposal system known as 'BOSS' (borehole disposal of sealed sources) was recognized as a mature concept that is ready for implementation in candidate Member States; in particular those where disused sources are the major component in radioactive waste inventories. The workshop participants, including safety and security

John H. Rowat, Disposable Waste Safety Specialist at the IAEA, Dr. Somporn Chongkum, Executive Director of the Thailand Institute of Nuclear Technology and Jan-Marie Potier, Head of the Waste Technology Section at the IAEA, welcoming participants at the Sustainable Management of Disused Sealed Sources Workshop. (Photo: Thailand Institute of Nuclear Technology)

13th International Topical Meeting on Research Reactor Fuel Management (RRFM)

The IAEA's inaugural use of the new 'M' conference building.

experts, identified it as a simple, flexible, and cost-effective solution that provides safety and security for all types of DSRS.

Additional information:

Workshop website: (http://www-ns.iaea.org/tech-areas/waste-safety/workshops/thailand2009.htm)

SHARS: A Shared Solution for Risky Radioactive Sources: (http://www.iaea.org/Publications/Magazines/Bulletin/Bull491/pdfs/49102685658.pdf)

Information on Borehole disposal of Sealed Radioactive Sources: (http://www.iaea.org/OurWork/ST/NE/NEFW/documents/BOSS_Flyer.pdf)

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IAEA hosts International Research Reactor Conference—RRFM 2009

From 22 to 25 March 2009, 230 experts from over 30 countries gathered in Vienna, Austria to discuss some of the most critical issues facing research reactor (RR) organizations. The 13th International Topical Meeting on Research Reactor Fuel Management served as an international forum for researchers, operators and decision-makers to discuss the RR fuel cycle, utilization and operational efficiency—with safety as an overarching theme within all sessions.

Fuel cycle topics

Presentations on different challenges and activities specific to the RR fuel cycle dominated the conference. Sessions included international topics, fuel development, innovative methods on RR physics and the fuel cycle back-end. Presentations shared information related to international non-proliferation programmes, advanced RR fuel R&D activities, back-end RR fuel management experiences—including spent RR fuel shipment projects, as well as RR utilization as a platform for the development of advanced power reactor fuel.

Utilization topics

Recent events related to the supply of technetium-99m (^{99m}Tc), which is used for health care and treatment, as well as increasing interest in nuclear technology led to a heightened focus on RR utilization. New experimental facilities as well projects being considered to produce medical isotopes were explained. Several presentations regarding RR networks and coalitions noted tangible

progress in the establishment of functional, collaborative entities, such as a training course offered by a European RR coalition aimed to develop human skills and resources in countries with little or no existing nuclear infrastructure.

Operation and maintenance

The international community has become increasingly concerned about shortages of ^{99m}Tc, 95% of which is produced by only 5 of the world's oldest research reactors — all over 40 years old. The shortage has highlighted the topic of RR operational performance and in particular the need for effective ageing management programmes. Therefore this year, conference organizers included a new session on RR operation and maintenance. Presenters shared information related to ageing management, inspection and monitoring techniques, and detailed maintenance systems.

The conference was organized by the European Nuclear Society in cooperation with the IAEA. In its supporting role, the IAEA is funding participation of some experts from developing countries.

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Charting the Way Forward in Innovative Nuclear Systems

INPRO Steering Committee discusses innovation in nuclear technologies and fuel cycles in the 21st century

The Steering Committee of INPRO, in a three-day meeting held in Vienna from 25 to 27 February 2009, has reviewed progress of, and determined future directions for, the **International Project on Innovative Nuclear Reactors and Fuel Cycles (INPRO)**, which provides a forum for discussion and cooperation on developing and deploying, in a sustainable manner, innovative nuclear energy systems in the 21st century.

"We continue to see growing interest in nuclear power and many international initiatives", IAEA Deputy Director General and INPRO Project Manager Mr Yuri Sokolov said in opening the meeting. "INPRO's global vision and scenarios of nuclear power development will have to include analyses and implications of such initiatives, as well as many other technical and institutional innovations". Currently 28 countries are members of the project, with another 11 countries participating on a working level or as observers. Further countries have pledged interest in becoming members. "INPRO is funded almost entirely by voluntary contributions of INPRO Member States".

"The IAEA General Conference initiated INPRO and views it as a forum for technology holders and technology users to exchange information. The USA wants to see INPRO work in close cooperation with other international projects such as the Generation IV International Forum (GIF), the Global Nuclear Energy Programme (GNEP) and the European Sustainable Nuclear Energy Platform (SNETP) to ensure that each of the projects are complementary and synergetic" said Mr Alex Burkart of the US Department of State, one of the Steering Committee members.

Progress and Achievements

Major achievements to date have been the development and application of the INPRO methodology, and collaborative projects on scenarios for nuclear energy development, nuclear safety, proliferation resistance, technical challenges in reactor technologies, and environment and infrastructure.

The INPRO methodology is an internationally recognized product that can be used by Member States to assess innovative nuclear systems for sustainability in

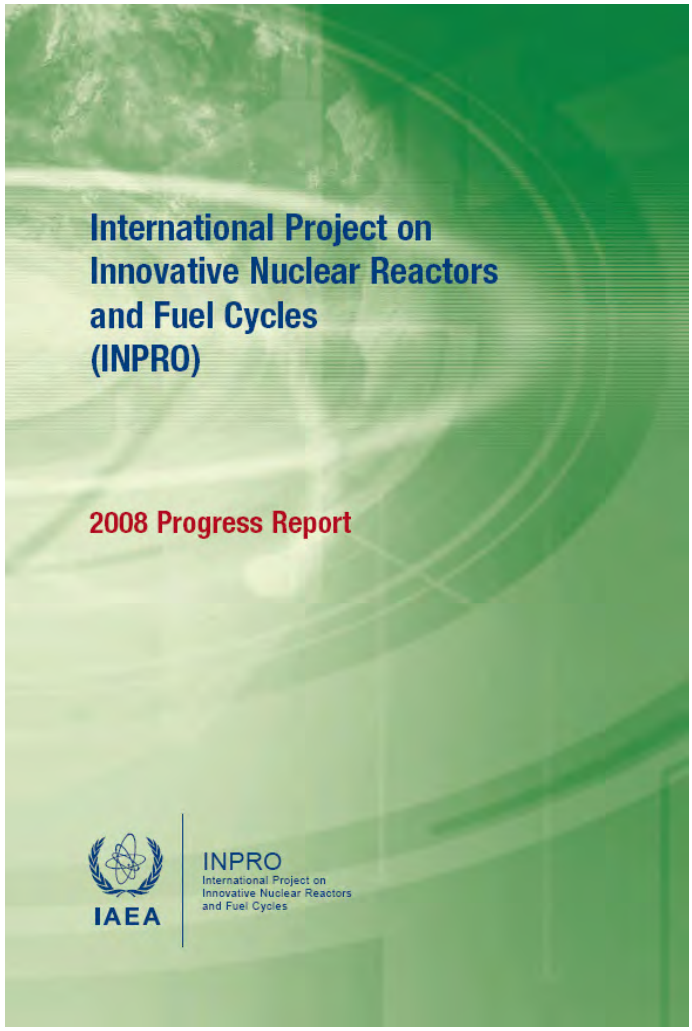

Figure 1: 2008 Progress Report on INPRO.
INPRO Home: http://www.iaea.org/inpro/
Full Report (below)
http://www.iaea.org/NuclearPower/Downloads/INPRO/Files/INPRO%202008%20Progress%20Report.pdf

terms of non-proliferation, safety, security, environmental acceptability, infrastructure, and economics of innovative reactors and their associated fuel cycles. It is suitable for use by countries with established nuclear programmes which wish to assess existing and future innovative energy solutions, and by countries that want to embark on a new nuclear programme. So far, the methodology has been applied successfully in six national assessment studies in Argentina, Armenia, Brazil, India, the Republic of Korea and Ukraine, and in a joint assessment of innovative nuclear systems based on a closed fuel cycle with fast reactors involving Canada, China, France, India, Japan, the Republic of Korea, the Russian Federation and Ukraine. Other countries have expressed interest in undertaking national studies to assess their energy systems, now termed Nuclear Energy Systems Analysis (NESA).

The INPRO methodology has been used in a variety of studies that represented both technology users and developers and different scales of assessments.

Future Directions

The Steering Committee supported and welcomed the proposed consolidation and re-structuring of INPRO activities on five major issues (quoted, with their objectives as draft text):

A: INPRO Assessments

To assist Member States in performing Nuclear Energy System Assessments (NESA) using the INPRO methodology, in support of long-term strategic planning and nuclear energy deployment decision making.

B: Global Vision

To develop global and regional nuclear energy scenarios, on the basis of a scientific-technical pathway analysis, that lead to a global vision on sustainable nuclear energy development in the 21st century, and to support Member States in working towards that vision.

C: Innovations in Nuclear Technology

To foster collaboration among INPRO Member States on selected innovative nuclear technologies and related R&D that contribute to sustainable nuclear energy.

D: Innovations in Institutional Arrangements

To investigate and foster collaboration on innovative institutional and legal arrangements for the use of innovative nuclear systems in the 21st century and to support Member States in developing and implementing such innovative arrangements.

"These new programme areas provide a very clear and concise description of INPRO's added value" said Mr Akira Omoto, INPRO Project Coordinator and Director of the Division of Nuclear Power in the IAEA Department of Nuclear Energy. "A future challenge is to develop a vision for INPRO over a longer timeframe that matches the global vision for pathways to sustainable nuclear development".

For further information visit: www.iaea.org/INPRO

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VINČA – Supply of a Critical System

The IAEA Technical Cooperation (TC) project to repatriate spent research reactor fuel from the VINČA Institute of Nuclear Sciences near Belgrade, Serbia is part of the largest TC project ever attempted by the IAEA. This year activities will commence to repackage degraded spent nuclear fuel currently stored in the fuel basins at the RA research reactor at the VINČA Institute. Elevated ^{137}Cs levels in the basins must be addressed prior to commencing spent fuel repackaging activities. A water chemistry control system (WCCS) will be used to decrease and subsequently control contamination levels before and during repackaging operations. The WCCS faces a number of challenges.

Space

VINCA, SOSNY, TECHNOS, VUJE and IAEA inspection visit—March 2009

The VINČA RA research reactor operated from 1959 to 1984. Over 8,000 spent mini-fuel elements (about 110 mm in length) are stored in the spent fuel basins. Available space in the basins to complete fuel repackaging operations is very limited. SOSNY, the principal contractor of a consortium of companies from the Russian Federation contracted to repackage and repatriate the VINČA spent fuel to the Russian

Federation, worked with the VINČA Institute and the IAEA to define an area within the basins to install the WCCS; referred to as the 'Green Zone'.

Reliability

The system must be highly reliable. The WCCS will operate submerged in the spent fuel basin before and during fuel repackaging operations. Considering the condition of the fuel, limited opportunity for hands-on maintenance will be possible once the system is lowered into the basin. Therefore redundant systems – each capable of addressing the needs of the project were specified. All activities to change out filters and individual components must be completed using custom designed, remote tooling.

Design and Fabrication

The WCCS design was provided as an in-kind donation by the United States Savannah River National Laboratory (SRNL) based on existing equipment successfully utilized there. The design was reviewed and accepted by VINČA Institute Staff with input from both SOSNY and the IAEA. In 2008, an IAEA contract was awarded to Slovakian company VUJE and its principal subcontractor TECHNOS to manufacture the system to the approved design.

Testing and Inspection

A team comprised of VINČA Institute, SOSNY, SRNL, VUJE, TECHNOS and IAEA staff met at the TECHNOS fabrication facility in Slovakia in March to inspect and test the as-built system. Pressure testing, resin loading and other quality records were reviewed and accepted. Flow tests were witnessed and accepted. The inspections identified one issue related to system spatial requirements.

During manufacture, the contractor requested a change in the system design. The design review focussed on the potential impact on performance but did not consider the resulting dimensional change. The change was accepted and upon final assembly, it became obvious that the assembled system violated the previously agreed 'Green Zone'. The SRNL design team proposed minor modifications to restore the WCCS to fit within the 'Green Zone'. VINČA staff agreed to the modifications following consultation with experts from SOSNY. The completed system is to be delivered to the VINČA site by 1 May 2009.

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Radioactive Waste at Intermediate Depth:

The Safety Basis and its Realization: Gyeongju City, Republic of Korea, 8-12 December 2008

An International Workshop on Disposal of Radioactive Waste at Intermediate Depth: The Safety Basis and its Realization was organized jointly by the IAEA Waste and Environmental Safety Section (WES) and the Waste Technology Section (WTS) and hosted by the Ministry of Knowledge Economy of the Republic of Korea through the Korea Hydro & Nuclear Power Co. (KHNP) in Gyeongju City, Republic of Korea, from 8 to 12 December 2008. The objective of the workshop was to explore the concept of intermediate depth disposal; specifically what can be claimed in terms of the degree of containment and isolation that can be provided. The workshop was structured to enable conclusions to be drawn giving particular attention to the need to develop international guidance specifically for intermediate depth disposal, and to areas where sharing of knowledge would be most beneficial. The workshop was attended by 75 participants.

A high level of engagement from participants resulted in a very successful outcome for the workshop. The final findings and recommendations included:

The workshop covered disposal of the broad range of waste termed 'intermediate level wastes' (ILW). ILW arising from NPP operations and decommissioning, the operation and decommissioning of spent fuel reprocessing facilities as well as from diverse origins that do not fit either of these broad categories (e.g., radium waste, disused sealed radioactive sources). The countries that participated in the workshop have one or more of these types of waste.

Disposal of radioactive wastes that occupy the ends of the 'spectrum' of waste types has received the most attention (LLW and HLW). Disposal options for the broad range of materials in the middle of this spectrum (ILW) have been developed at the national level but, so far, have not been the subject of as much international attention.

A few of the countries with nuclear power programmes have operating facilities for ILW disposal. Of the remaining countries with nuclear power programmes, many have included an ILW disposal facility as one element of their national policy and strategy for radioactive waste management.

Commensurate with the diverse range of wastes, a diverse range of disposal solutions have been implemented and proposed for the broad range of ILW. Examples are: relatively shallow cavities, former mines,

disposal in bedded salt formations, borehole disposal solutions and near surface disposal facilities adapted to particular waste streams. In all cases, it is important to recognize the unique hazards of the specific sub-categories of ILW. For example, ILW containing predominantly short-lived radionuclides may not require the same disposal methods as ILW containing predominantly long-lived radionuclides.

Safety is the fundamental objective of radioactive waste disposal. The notion of an 'optimal' disposal solution is elusive. Deciding what would be an optimal solution is complicated by many factors that cloud the decision making process (e.g., policy constraints and public acceptance, siting constraints, the specific waste streams and resources available). The legal framework can often prescribe the range of disposal solutions that can be examined. In the end, a disposal system is either safe or not safe, as determined by regulatory review.

Safety assessment methods for ILW disposal are generally similar to the methods employed for HLW disposal. The differences have to do with specific issues such as assessment time frame, range of assessment scenarios considered, less need for heat dissipation, greater diversity of waste forms and waste packages, simpler operations for waste handling, a smaller inventory of radionuclides, and in many cases fewer provisions for nuclear safeguards.

On the other hand, a safety assessment for a near surface disposal facility could include a provision for specific ILW waste streams (e.g., ILW streams with short-lived radionuclides). Operational experience with near surface facilities has shown that the waste streams suitable for disposal can be enlarged as experience with the safety case evolves (i.e., waste acceptance criteria are modified as experience is gained). In other words, specific ILW waste streams could be considered for near surface disposal.

Existing IAEA safety requirements for near surface disposal and geologic disposal provide the needed foundation for addressing ILW disposal. The safety case for ILW disposal facilities would reflect a graded application of existing IAEA safety requirements to address issues such as the wastes included for disposal, the specificities of natural and engineered barriers, and operational considerations.

Additional guidance in existing IAEA draft safety guides may be needed to address ILW disposal. Depth of disposal is just one of the factors that must be considered for the safety of ILW disposal: the properties of the geological environment, the waste characteristics and engineered features of the facility, regulatory constraints, national policy, are other factors of equal or greater importance. Intermediate depth disposal is not a separate disposal concept.

Some form of borehole disposal may be appropriate for ILW disposal in countries with small waste volumes but may also be an appropriate solution in other countries as well. It should be noted that the IAEA concept for borehole disposal is limited to disposal of disused sealed radioactive sources in small diameter boreholes and is subject to a generic safety assessment. Other borehole type disposal could be used for ILW disposal, but would require a facility-specific safety case.

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Upsurge in Uranium Production Cycle Activity

As world interest in climate change has intensified, nuclear power has come back into the headlines. Many nations are looking at upgrading or extending the life of their existing nuclear power plants (NPPs) whilst other countries are looking at their options for starting up NPPs. As a consequence of this interest the issue of the supply of the raw material used for fuel for NPPs has also become a hot topic.

For some years, the demand for uranium has exceeded the annual production from mines. Whilst there were stockpiles from previous over-production this was not a major concern. However, since the sharp price increases which began in 2003, there have been many new players wanting to get into uranium production, both mining companies and new producer nations. This increase in interest has been reflected in the increased demands for assistance in Uranium Production Cycle (UPC) activities received from Member States. UPC covers all activities from prospecting, exploration, development, mining and processing operations, through to remediation of sites, all in relation to uranium resources.

As an indicator, the number of TC project concepts in UPC activity submitted for consideration has effectively doubled since 2003. For the 2009-11 TC cycle, more than 25 concepts were submitted for evaluation. After the evaluation and selection process, the final programme will include at least 17 projects, although not all of these have been funded to date. Amongst the list are two regional projects (Africa and Latin America), which are compilations of several overlapping national project requests. In addition to the TC work, there have been increasing demands for support from Member States through the Regular Budget programme, with technical meetings and consultancies being organized to provide guidance. Finally, the number of ad-hoc inquiries and

requests related to all aspects of uranium resource development has also been increasing.

For the IAEA staff, the issue has been how to meet the demands of this dynamic situation with existing resources. Human resources in particular are an issue. The global uranium industry had been static for the past 20 years and fewer new staff were being recruited as older members of the workforce retired. As a result, an increasing shortage of experienced people is one of the major challenges to the safe and successful implementation of UPC expansion plans around the world. For the IAEA staff, the situation is exacerbated due to the increasing demand and pressure from industry worldwide on the few IAEA experts available.

Some temporary staff are being recruited and this will help meet part of the demand over the next year or so; for the longer term, more emphasis needs to be put on training staff in Members States to increase their capabilities to deal with their changing situations. In addition, the IAEA is also addressing this issue through by establishing partnerships with major uranium mining operators and regulators worldwide to develop programmes that will help to mitigate the staff shortages in the medium and long term. In the short term, the IAEA is also working with these same groups to make skilled training resources more widely available to support regional training courses and similar events.

These issues are not going to go away. In the longer term, the IAEA is working with both sides of industry, particularly in developing Member States, to increase local capabilities that will ensure the safe and balanced development of uranium resources into the future.

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National Fuel Cycle Strategies

In support of proclamations of a 'Nuclear Renaissance', many countries are demonstrating their interest in the new deployment of nuclear energy. Some international or national initiatives are pursuing visions of future nuclear fuel cycles and energy systems.

In this context, the IAEA held a Technical Meeting open to the public, focusing on Member States' national policy or strategy in Fukui, Japan in December 2008. The TM was hosted by the Japan Atomic Energy Agency (JAEA) in cooperation with the Wakasa Wan Energy Research center (WERC).

The focus of the meeting was nuclear fuel cycle policies and strategies of Member States. The meeting was open to the public. In addition to overseas experts, there were 60 participants from different organizations in Japan. During the meeting, experts from six Member States (France, Japan, India, the Republic of Korea, South Africa and Sweden) made presentations and one Member State (Argentina) submitted a paper about the most important policies and strategies of their national nuclear fuel cycle.

IAEA's activities on nuclear fuel cycle profiles including INPRO (International Project on Innovative Nuclear Reactors and Fuel Cycles) activities and current status and future of GIF (Generation IV International Forum) were presented by representatives of the IAEA and the GIF respectively.

The French representative's presentation focused on the 2006 Act and detailed a national waste and radioactive material plan including a related R&D programme with a time schedule and milestones. The representative from Japan explained the Japanese R&D policy on FBR Cycle technology including a newly launched project FaCT (Fast Reactor Cycle Technology Development). The background and history of Swedish nuclear activities focusing on the debate over the 1980 referendum which recommended phasing-out nuclear energy was reported as well as the progress of the Swedish spent fuel disposal programme. South African Nuclear Energy Policy in 2008 was reported. South African Nuclear Corporations were investigating the options for re-implementing the nuclear fuel cycle and the feasibility of establishing a local uranium conversion, enrichment and fuel fabrication capability. Current progress on DUPIC (Direct Use of PWR Spent Fuel in CANDU Reactor), which is a supplementary option beyond the PWR-SFR linkage concept via a pyroprocess, was presented by the representative of the Republic of Korea. The recycled fuel fabrication experience in India and its three stage programme of plutonium bearing MOX fuel fabrication for thermal & fast reactors was presented by the Indian representative. The Argentinean representative was unfortunately absent from the meeting, but submitted a paper addressing the impact of the reactivation of nuclear activities in Argentina.

The participants visited Monju, the Japanese fast breeding reactor, and commented positively on the restart preparation efforts.

Further information on the meeting is available at the following URL:

http://www.jaea.go.jp/english/04/turuga/info/events/081201iaea/

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Disposal of Radioactive Waste and Spent Nuclear Fuel in the Russian Federation – Experiences and Plans—a CEG Meeting

The IAEA Contact Experts Group (CEG) for International Radioactive Waste Projects in the Russian Federation assists international partners in solving nuclear legacy problems inherited from the period of the Cold War. The recent CEG workshop was devoted to Disposal of Radioactive Waste and Spent Nuclear Fuel – Experience and Plans (Sweden, 24-25 February 2009). Technical tours were conducted on 26 February to SKB laboratories in Oskarsham and Äspö. The workshop was hosted by Swedish Radiation Safety Authority (SSM). Over 50 participants from 10 countries (Canada, Finland, France, Germany, Lithuania, Norway, Russian Federation, Sweden, United Kingdom and United States of America) and 4 international organizations were in attendance.

For international partners addressing the Cold War nuclear legacy, it is important to guarantee safe and secure completion of the final stage of international efforts in this field. The Russian Federation is currently finalizing a legal base for disposal, and also planning and siting its first RW repositories.

The workshop provided the best international experience in operation, planning and siting of landfills, near surface repositories and deep underground repositories in France, Sweden and the USA. The workshop also assisted the international partners' understanding of the Russian Federation's posture and way ahead regarding the RW and SNF disposal.

The workshop discussed the issue of radioactive waste classification (existing and recommended by the IAEA) as the key for efficient RW disposal solutions. The Russian Federation intends to introduce new waste categories: Long- and Short-Lived RW, Very Low Level Waste, and principles for exempt waste. A national waste operator will be established. This will be done according to IAEA recommendations and best international practice. These steps will contribute to solving legacy problems, but also pave a way for new nuclear power build in the Russian Federation.

The Russian Federation has selected a site and has begun to design its first landfill for Very Low Level Waste at an ex-Navy base (Andreyeva Bay) in the country's north–west. This design is based primarily on Swedish experience and could be used for other facilities in the region. Creation of this repository is linked to international assistance projects in the frames of the Global Partnership Programme in North West Russia. The Russian Federation and international partners have jointly developed a concept for a surface repository for short-lived waste in the Leningrad Region that could be used as a standardized model for other repositories in the Russian Federation.

Testing technologies for SNF disposal: deposition of canisters (Äspö Laboratory, Sweden)

Presentations by international partners demonstrated well structured programmes to create deep geological repositories within the next 10 to 20 years. These presentations also show that, regardless of significant geological variances, each country has the ability to deploy such a repository by making the appropriate engineering adaptations for its given geological conditions.

Over the last couple of years, the Russian Federation has shown steady progress in planning and siting of its future Deep Geological Repository in the Krasnoyarsk Region of Siberia for long-lived ILW and HLW. The first step will be the creation of an underground research laboratory (500 m deep in a rock massif), which will then evolve into a repository. There is cooperation with Germany on geological studies of the site. The repository will be located near a to be built reprocessing plant (for SNF from PWRs).

The main feature of this facility will be the acceptance of predominately low-heat emission waste. That will make it possible to build a fairly compact disposal facility (1 km^2 for 500,000 m^3 waste) to save resources for the construction and simplify technological requirements. The low-heat emission will be achieved by long-term storage of RW and SNF prior to disposal and, secondly, by application in the future of new SNF reprocessing technologies to separate heat emitting nuclides from long-lived waste.

The CEG highlighted the importance of IAEA International Networks for studying various aspects of disposal: from deep geological repositories to landfills. The Russian Enterprise for RW Management (RosRao)

has shown interest in the IAEA networking activities. RosRao may become a contributor to the Networks once their research on disposal is initiated.

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2nd Annual TWGRR Meeting

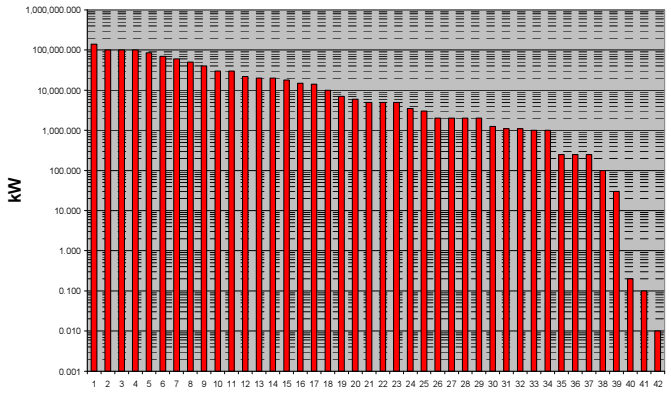
The second annual meeting of Technical Working Group on Research Reactors was held in Vienna from 9 to 11 February 2009. Twenty-three participants from 19 IAEA Member States joined IAEA staff from the departments of Nuclear Safety and Security, Nuclear Sciences and Applications, Technical Cooperation and Nuclear Energy to review past and planned IAEA support to Research Reactors (RRs).

The TWGRR is a group of senior international experts with recognized experience in the areas of research reactor operation, utilization, maintenance, refurbishment, modernization, fuel (fresh and spent) management, nuclear fuel cycle, quality assurance and new designs, with particular emphasis on strategies, implementation, technologies and methodologies. TWGRR Members come from various types of organizations and are responsible for different aspects of RR activities. It is geographically diverse and contains members from countries having a range of different types of RRs and associated facilities.

Questionnaires were prepared and distributed to contacts at numerous RRs prior to the meeting. These questionnaires were developed based on the recommendations from the 2008 TWGRR meeting and addressed various areas of RR management including utilization, planning, staffing, funding, capital project implementation, performance indications, etc. Some of the data received was compiled into representative charts 1 to 4. (note: The 'x' axis is the same for all charts - .i.e. reactor 4 in chart 1 is also reactor 4 in all other charts. Also if there is no bar, then no data was provided.)

Discussions during the meeting focused mainly on medical isotope production and supply security, increasing RR utilization, human resources issues (resources to operate the facilities as well as the role of RRs to help develop nuclear human resources and skills to support the broader industry) as well as ensuring the reliability of older facilities and support for new RR projects.

Immediate feedback from the working group reinforced ongoing IAEA activities such as efforts to ensure the supply of critical medical isotopes through – for example – an ongoing CRP on small-scale indigenous ^{99}Mo production and activities to capture and share operating



Cart 1 – RR power level

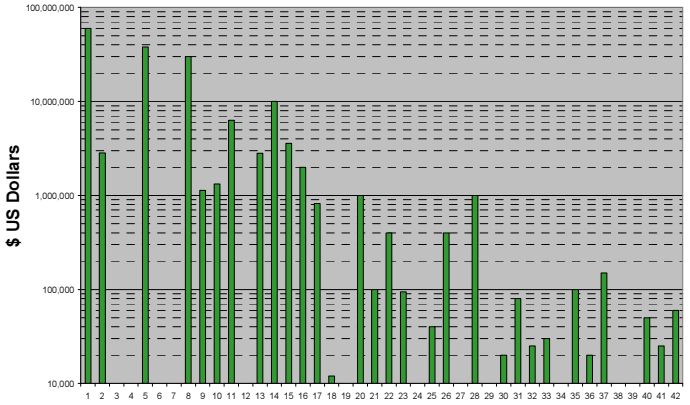


Chart 2 – O&M Budget (not including staff costs)

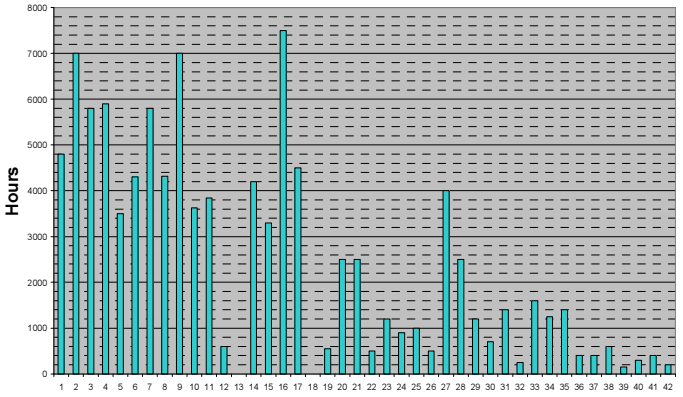


Chart 3 – Hours of yearly operation (typical)

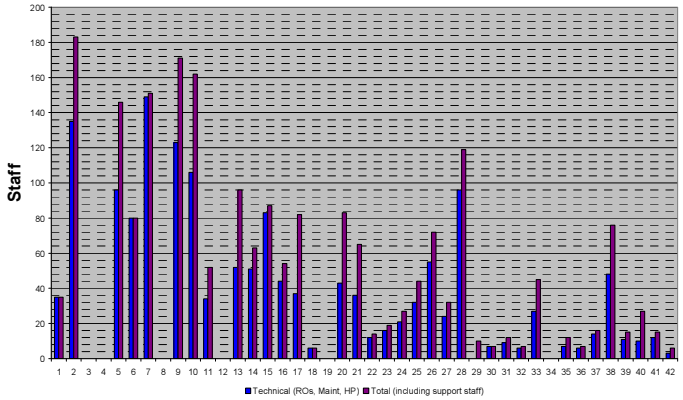


Chart 4 – RR organisational staffing levels

experiences of research reactors; particularly aged research reactors. Emphasis was also placed on efforts to improve reactor utilization through the support of TC projects, research reactor networks and coalitions, or the support of new reactor projects.

All feedback received from the working group will be reflected in activities being formulated for the 2010-2011 cycle. Several of the more urgent recommendations highlighted above will be brought forward / strengthened in the current cycle.

Pablo Adelfang (p.adelfang@iaea.org)

EC SAPIERR Study Project Leads to Practical Regional Repository Initiative

On 27 January 2009, the EC sponsored SAPIERR Project (Strategic Action Plan for Implementation of European Regional Repositories) held its final symposium in Brussels. The results of studies on the viability of shared, regional European geological repositories were presented to 50 participants from 21 countries. The aspects considered included organizational and legal issues, economic impacts, safety and security considerations, and public and political attitudes to multinational repositories.

The proposal that resulted from SAPIERR was a staged, adaptive implementation strategy for a European Repository Development Organization (ERDO). The first step in the strategy is the establishment of a Working Group of interested countries to carry out pre-cursor work to enable a consensus model to be agreed for ERDO, using the SAPIERR findings as a starting point. This model will then be presented to potentially interested countries in about two years' time, so that they can decide whether and when to set up ERDO and whether they wish to be part of it. The pilot meeting of potential participants in this Working Group took place on the day after the SAPIERR meeting. Thirty-two representatives from 14 European countries were present, all of whom had been nominated through their national governments, as well as observers from the IAEA, the EC and American foundations. Strong support for further activities was shown, dates and venues for further meetings were decided and all representatives undertook to formalize at their national levels the necessary agreements to enable the activities of the Working Group for the next 1-2 years. The secretariat will be provided by Arius, Switzerland and the administration by the Netherlands waste agency, COVRA.

From press information on the SAPIERR project

'Environet' - Network on Environmental Remediation

The role of the IAEA in promoting and facilitating international cooperation amongst its Member States is put forward in Article VIII(C) of the 'Statute' which says that the IAEA "shall take positive steps to encourage the exchange among its members of information relating to the nature and peaceful uses of atomic energy and shall serve as an intermediary among its members for this purpose". This role is supported by Member States as noted for example in one of the resolutions of the General Conference 2007 which requests the IAEA to strengthen international cooperation in nuclear, radiation and transport safety and waste management and to continue the current programme to assist Member States in improving their national infrastructures for safe waste management.

In order to achieve its mission the IAEA has at its disposal different means to support Member States such as Technical Cooperation Projects, Technical Publications, Workshops, Training Courses and Conferences/Symposia. These can be considered the traditional ways through which the IAEA has been assisting its Member States for decades. Recently, the IAEA has taken a new approach through the establishment of networks to enhance harmonization and increase the exchange of information and experience.

Networking in Environmental Remediation

Over the past decade, a number of remediation methods have been developed to deal with the environmental clean-up of radiologically contaminated sites, such as the Sillamäe Radioactive Tailings Pond in Estonia shown in Figure 1.

Fig 1. Remediation of the Sillamäe Radioactive Tailings Pond in Estonia.

Source: Barnekow, U; Jakubick A.T., and Kaasik, T. (2005). Reclaiming the Sillamäe radioactive tailings pond in Estonia: Use of integrated geo-technical and environmental solutions. In proceeding of the UMREG-2005 meeting. Freiberg. CD.

In several countries, the implementation of a safe and economical remediation approach, consistent with good international practices, may be hindered by lack of human and financial resources and/or lack of expertise in environmental remediation. By contrast, countries that had to deal with extensive remediation works have been able to test various approaches resulting in the selection of different strategies for remediation. As a consequence, they are holders of expertise that may be useful and applicable to other countries that need to implement remediation programmes.

Networking facilitates the exchange of information and identification of common needs amongst its participants through extended discussion in the form of workshops or training courses. The overall result is that by working together, synergies can be found, results can be maximized, and time spent to solve a specific problem can be reduced. In the particular case of environmental remediation, all these factors will lead to improvements and cost reduction in the scope of ER projects.

The Role of the IAEA in a Network

Until now, the IAEA has been interacting directly with its Member States. Mostly through the Technical Cooperation Department (TC), the IAEA supports projects in different countries subject to their requests. There is also the possibility of arranging regional projects. Regional projects allow for the concerted assistance of countries that share common problems in a geographical perspective. However, these projects do not allow for the interaction of countries in different geographical regions, as inter-regional projects are not frequently and easily implemented. Interactions between Member States in the current IAEA approach are somewhat constrained to countries in a same geographical region or to bilateral interactions between a Member State and the IAEA. By contrast, within the framework of a network, a massive amount of interactions that do not necessarily need to be mediated by the IAEA is possible. In this environment, the role of the IAEA is more of facilitator of interactions between complementary Member States.

Benefits for the Member States

Regarding environmental remediation, developing Member States face serious resource constraints against implementing remediation projects. However, recent experience has shown that with appropriate assistance, remedial actions are more likely to be implemented in countries where they otherwise would be impossible. In this way, the interactions of developing Member States with other, experienced countries may lead to better project implementation, while the lessons learned within these relationships may inspire other countries to reproduce the experience gained elsewhere.

Objectives

ENVIRONET is being established by the IAEA as a facilitator, to increase effectiveness and efficiency in sharing international experience in the application of state-of-the-art and proven practices for remediation of radiologically contaminated sites. The specific goals of ENVIRONET are to:

- coordinate systematic support to organizations or Member States with less advanced programmes for environmental remediation by making available the relevant skills, knowledge, managerial approaches and expertise from Member States with more experience in environmental remediation works,
- offer a broad and diversified range of training and demonstration activities with a thematic focus by providing hands-on, user-oriented experience and disseminating proven technologies;
- facilitate sharing of knowledge and experience amongst organizations with advanced environmental remediation programmes, in pursuit of good practices, identifying and mending improper past practices and assuring the longer term knowledge management in support of public and environmental protection and site monitoring; and
- create a forum in which expert advice and technical guidance may be provided on the IAEA's programme on environmental remediation.

Tentative schedule for establishing *ENVIRONET*

- Consultants' Meeting in April 2009 to finalize Terms of Reference and design preliminary working program for 2010 and 2011
- Presentation of ***ENVIRONET***; during the IAEA International Conference on Remediation of Land Contaminated by Radioactive Materials (May 2009)
- Official presentation of ***ENVIRONET*** to the MS's delegations and the media at the IAEA-General Conference in September 2009.
- Consultants' Meting in October 2009 to broaden the number of partners and establish the work program for 2010-2011
- Plenary (Technical) kick-off meeting in Vienna involving the partners of ***ENVIRONET***

Horst Monken-Fernandes
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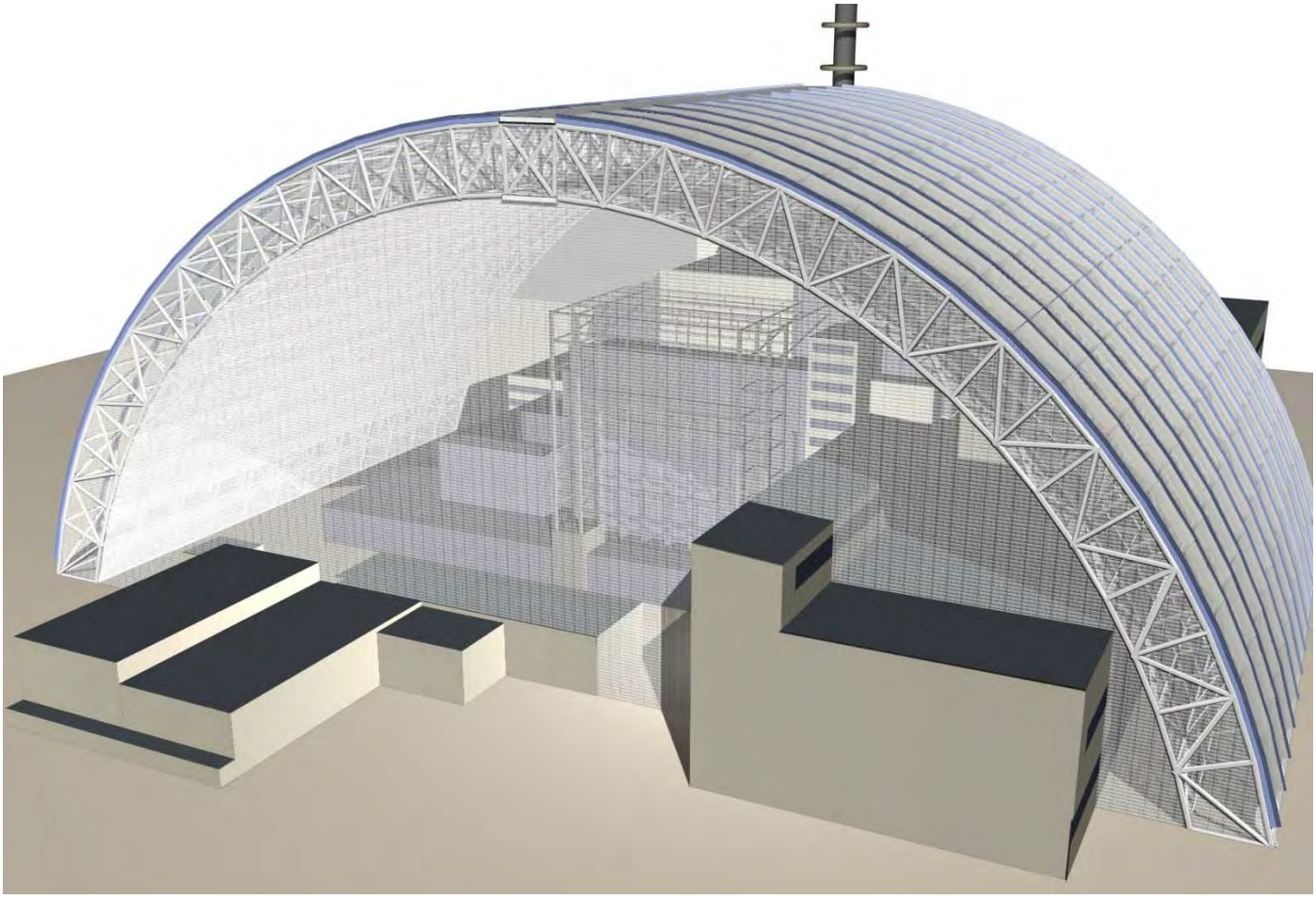

Concept rendering of the new shelter for Chernobyl Unit 4

Waste Management in Ukraine

The main priority for the cooperation between the IAEA and Ukraine are activities related to the design and construction of a safe confinement 'shelter' for the destroyed Chernobyl NPP (ChNPP) Unit 4 and the safe management of radioactive waste in the Exclusion Zone, as well as the remediation of the area. Assistance to the ChNPP is currently being managed under the framework of a national TC Project focused on three major goals:

1. Assistance in development of a realistic decommissioning plan for units 1, 2 and 3 of ChNPP
2. Support in establishing a comprehensive Waste Management Programme for the ChNPP
3. Support of smooth transition of ChNPP from an operating organization to a decommissioning organization.

Assistance in development of decommissioning plans is to ensure consistency with international safety standards, national regulatory requirements, and world-wide good practices. The establishment of a comprehensive Waste Management Programme for the ChNPP needs to include support for the processing of the waste streams from operation, post-accident clean-up, and decommissioning activities, in order to meet Waste Acceptance Criteria for disposal. This will necessarily include waste streams consisting of low- and intermediate-level liquid and solid waste, and the packaging and conditioning of HLW.

Assistance to development of the new shelter will focus on ensuring the long-term stability of fuel-containing masses (i.e., the mixture of melted fuel and construction material of the former operating block).

IAEA support in the transition of the ChNPP operating organization to a decommissioning organization includes strengthening of their project management capabilities and adjustment of human resources required to manage radioactive waste and decommissioning activities. IAEA assistance to the Government of Ukraine in strengthening its Radioactive Waste Management Policy, Strategies and Practices is envisaged to address both specific problems and needs already identified:

Problems

1. Specific Exclusion zone conditions (post-accident contamination).
2. Legislation exists only for normal operation conditions.
3. Reference radionuclide compositions of radioactive waste are difficult to determined (post-accident conditions).

Needs

1. Safety assessment capability and capacity to develop safety arguments as a basis for safety demonstration and licensing
2. Systematic and structured safety assessment for waste disposal and use of supporting analytical software tools
3. Methodology for full understanding of the waste inventory
4. Methodology for waste management economics
5. Waste Acceptance Criteria for disposal of radioactive waste from Chernobyl, operating NPPs and Radon Facilities

In preparation for these activities, an IAEA Integrated Regulatory Review Service (IRRS) mission was carried out in Ukraine in 2008 to review the whole regulatory framework of Ukraine and to assess its consistency with respect to the IAEA Safety Standards.

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Cooperation with RADON to establish a network of Regional Centres for training in waste management

The Russian State Unitary Enterprise Scientific and Industrial Association (RADON) is responsible for radiation safety and radioactive waste management in the Moscow Region and central part of Russia. RADON carries out work on characterisation, collection, transportation, treatment, conditioning, and long-term storage of radioactive wastes. RADON has a well-developed scientific, technological, methodological, and training basis for work in the area of radioactive waste management, with approximately 2800 employees, RADON works with practically all state-of-the-art technologies currently used in the management of radioactive wastes, including: innovative plasma arc incineration; ash residue plasma melting; vitrification of the low- and intermediate-level waste; thermo-chemical treatment of spent ion exchange resins and reactor graphite waste containing ^{14}C; and electrokinetic purification of soil. Mobile technologies are being developed for liquid waste processing, cementation, and immobilization of DSRSs.

RADON has 25 years experience in training of national specialists in the field of radioactive waste management. These training activities are carried out jointly with the Lomonosov's Moscow State University. A variety of training programs in the scientific fundamentals, applied research, and practical operational areas of pre-disposal and disposal activities of radioactive waste management are offerred. About 600 specialists have received training certificates since the courses were established.

RADON has for the past 11 years successfully collaborated with the IAEA to offer an annual two-week training course for Russian-speaking waste managers. The training course includes theoretical lectures and practical demonstrations of waste management technologies. In addition, specialized and specifically tailored training courses are organized in the framework of national TC projects. The training courses in RADON are organized by IAEA WTS and WES sections and cover both technology and nuclear safety. In this way, more than 300 specialists from 32 European and Central Asian countries have been trained to increase their knowledge and skills in RW management.

In addition, RADON has directly transferred waste technologies via IAEA to Iran, Syria, Bangladesh, Serbia, Uzbekistan, Belarus, and Ukraine, strengthening the technological capability of these Member States for processing of solid and liquid radioactive wastes.

Practical Arrangement IAEA-Radon

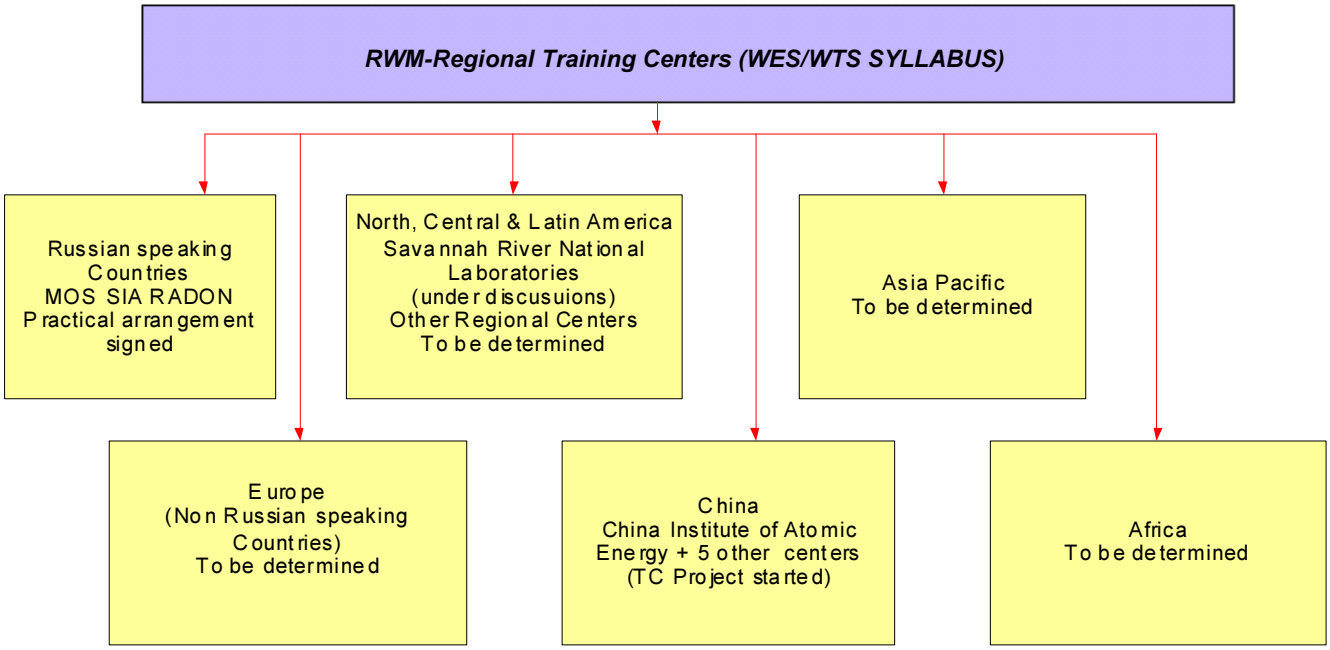
The Practical Arrangement signed between IAEA TC and RADON provides a general framework for cooperation. It is an expression of interest of two parties to continue to have *bona fide* relationship, specifically to:

- provide a basis for assistance in training of waste managers in the region, including development of joint educational and training courses,
- utilize expertise of RADON in various activities of Technical Cooperation, Waste and Environmental Safety and Waste Technology Sections, and
- increase exchange and dissemination of useful information, including joint publications.

Standardized training syllabus

Further development of standardized training syllabus based on experience with training courses for waste managers in Radon will include multiple modules that can be delivered as separate blocks of training. Every training module will consist of both theory and practical demonstration of technology. So far, the following training modules are anticipated:

- Decontamination and Deactivation technologies
- Environmental Remediation technologies



- Safety Modules on development of safety assessments and safety cases for decommissioning, environmental remediation, pre-disposal and disposal.
- Waste Pre-disposal, including characterization methods, waste collection techniques, and waste processing and storage technologies.
- Waste Disposal, including design, operation, maintenance, monitoring and upgrade of facilities.

Development of an IAEA syllabus should lead to the establishment of a network of designated regional training centres for waste management at existing R&D facilities, utilities, and universities. Prerequisites for Regional Training Centres are the existence of facilities to demonstrate RWM technologies and provide hands-on training opportunities, experience in organization and execution of training at various levels, and on-going R&D cooperation with Universities to provide theoretical bases for education and training.

The figure provides an example how the network could look at the beginning. Expectations are that lateral cooperation links that will be established among participants will minimize the need for centralized organization of training.

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Meeting of the Technical Working Group on Nuclear Fuel Cycle Options and Spent Fuel Management (TWGNFCO)

The 7th meeting of TWGNFCO was held from 10th to 13th March in the IAEA offices in Vienna. The meeting proceeded with a reconstituted committee, involving nuclear fuel cycle experts from Belgium, Canada, China, France, Germany, India, Japan, Republic Of Korea, Russian Federation, South Africa, Sweden, Switzerland, United Kingdom and the USA, functioning in their personal capacities. The meeting was chaired by Mr Y. Chang from Argonne National Laboratory, USA.

During the meeting the experts participated in panel discussions on 4 specific topics related to the back end of the nuclear fuel cycle and shared their views and recommendations on the ongoing and planned IAEA fuel cycle activities related to the management of spent fuel from power reactors and topical issues of nuclear fuels and fuel cycle for advanced and innovative reactors.

Proliferation Resistance in Nuclear Fuel Cycle – Recent Developments

The intrinsic features and extrinsic measures of 'proliferation resistance' in uranium and thorium fuel cycles were discussed in detail .The general consensus was that no technology could provide sufficient intrinsic proliferation resistant features. Comprehensive safeguards agreements (CSA), additional protocol and other state level measures and commitments remain necessary to ensure adequate proliferation resistance.

The working group recommended a technical meeting on the optimization of safety, security, and safeguards in different nuclear fuel cycle systems. Consideration of the development of a comprehensive assessment methodology was also recommended.

Fast reactor fuels, closed fuel cycles and trends in partitioning and transmutation

Fast reactor technology and its associated closed fuel cycle including the recycling of plutonium, reprocessed

uranium and minor actinides are of high interest and importance for the long term sustainability of nuclear power. Currently there are no real commercial interests in fast reactor technology deployment, which clearly shows its weak economic competitiveness and /or low level of industrial maturity. Most current activities and plans are focused on Sodium-cooled Fast Reactor (SFR) with mixed uranium plutonium oxide (MOX) driver fuel. Other fast reactor fuel technologies include experience with U-Pu-Zr metal fuel with enhanced passive safety in the USA and experience with mixed uranium plutonium monocarbide fuel in India and limited (U, Pu)N fuel experience in Russian Federation.

Wet and dry reprocessing routes are available for efficient treatment of fast reactor fuels but current experience in reprocessing technology for Pu-bearing fast reactor fuels has not yet reached industrial maturity. Different aqueous and dry partitioning techniques are under development in France, Japan, the Russian Federation and the USA. Uranium based fast reactor fuels are reprocessed using the PUREX process in the Russian Federation. France has industrial scale expertise in LWR and fast reactor MOX fuel reprocessing using PUREX. India has successfully reprocessed irradiated (U,Pu)C fuel on a laboratory scale. Dry reprocessing schemes based on dissolution of the fuel matrix in molten salts are developed mainly for oxide fuel in the Russian Federation and metal fuels in the USA with no detailed information on process overall efficiency.

Partitioning capacities and efficiency for the dry reprocessing schemes based on a molten salts system are still to be evaluated and confirmed for a range of technological operations including equipment maintenance, losses, etc. Minor actinides can be most efficiently burnt in a fast spectrum, and the successful development of partitioning processes will bring additional advantages for fast reactor technology implementation taking into account economical considerations.

Recognizing that technology innovations in the next generation of reprocessing and partitioning processes are important for fast reactor deployment and the closed fuel cycle, participants encouraged the IAEA should give high priority to activities on ‘advanced partitioning’. Members suggested the IAEA give high priority to the activities related to development of fast reactor fuels with high burn up (~ 200,000MWd/tHM) and fuel assembly structural materials capable of withstanding high neutron dose (> 200 dpa). Finally the working group asked for IAEA assistance to address fuel cycle issues during the expansion of nuclear power technologies and transition between the operating thermal reactors and forthcoming fast reactors.

Fuel cycle options and issues to meet rising expectations for nuclear power

The experts from France, Germany, Switzerland, the UK, Canada, the Russian Federation and India summarized the ongoing nuclear fuel cycle activities in their respective countries.

The French strategy is to avoid spent fuel accumulation by recycling plutonium initially in light water reactors (LWR) and subsequently in Gen IV fast reactors to efficiently burn plutonium and minor actinides, thereby reducing long term radiotoxicity and utilizing uranium resources efficiently.

In Germany some 2275 MOX fuel assemblies have been utilized in LWRs and 700 are awaiting to be inserted in the reactor.

In Switzerland reprocessing with recycling in LWRs cannot be justified economically. The Swiss plan to pursue interim storage and direct disposal.

In UK the current situation tends to support a growth in the use of nuclear energy and recycling as a sustainable spent fuel management strategy.

Canada noted the potential for advanced fuel cycles in the future. The advanced fuel cycle options include the use of enriched uranium to extend burn up, utilization of reprocessed uranium from spent LWR fuels, utilization of CANDU reactors for minor actinides transmutation and exploring the thorium fuel cycle in CANDU reactors.

In the Russian Federation the present focus is mainly on expansion of the WWER 1000 fleet domestically and overseas. An industrial scale (400 t/y) reprocessing plant is planned by 2020 and a large scale reprocessing facility after 2025. The BN 800 sodium cooled fast reactor is expected to be ready by 2013.

India has plans for large expansion of nuclear power programme, from the present level of 4 GW(e) to 20 GW(e) by 2020. International cooperation is expected to provide additional impetus to nuclear power in India. Construction activities of PFBR 500 are underway and SFRs will play a dominant role. The long-term nuclear power programme in India would make use of the large thorium resources.

Chaitanyamoy Ganguly (c.ganguly@iaea.org)

New Staff

Mr Jerry Mc Alpin has recently taken up duties in the Waste Technology Section of the Division of Nuclear Fuel Cycle and Waste Technology as a Cost-Free Expert. He will work on matters related to source recoveries in Latin America. Mr Mc Alpin joins us from Los Alamos National Laboratory where he worked on the Off-site Source Recovery program. This programme recovers sealed sources domestically and packages them for disposal at the WIPP facility in southern New Mexico. In addition, the programme recovers U. S. origin sources internationally for repatriation. He has worked in several consultancies and expert missions with the IAEA.

Mr Harikrishnan Tulsidas is serving the IAEA as an expert consultant in the Uranium Resources and Production Unit in the Nuclear Fuel Cycle and Materials Section. He will be supporting the IAEA in Technical Cooperation projects, maintaining the IAEA database on Uranium deposits, organising symposium and in bringing out various publications. He has 20 years of experience in Uranium exploration in India including strategic planning and management of the technical programmes. He has been involved in organization-wide implementation of Information and Communication Technology systems, database development, sharing of information and Knowledge Management activities.

International Symposium on Uranium Raw Material for the Nuclear Fuel Cycle

The quadrennial symposium on Uranium Production Cycle activities (URAM 2009) will be held in Vienna from 22-26 June 2009.

The purpose of the symposium is to analyse uranium supply–demand scenarios and to present and discuss new developments in uranium exploration, mining and processing, and environmental requirements for uranium operations and site decommissioning. The presentations and discussions at URAM 2009 will:

- lead to a better understanding of the adequacy of uranium sources (both primary and secondary) to meet future demand;
- provide information on new exploration concepts, knowledge and technologies that will potentially lead to the discovery and development of new uranium resources;
- describe new production technology that has the potential to more efficiently and economically exploit new uranium resources;
- document the environmental compatibility of uranium production and the overall effectiveness of the final remediation and decommissioning of production facilities.

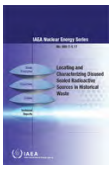
The session themes of the symposium will be:

- uranium markets and economics (including supply and demand);
- social licensing in the uranium production cycle; uranium exploration (including uranium geology and deposits);
- uranium mining and processing; environmental and regulatory issues; and
- human resources development.

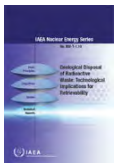
In addition, on Wednesday afternoon, there will be a special session on IAEA technical cooperation in the uranium production cycle and a poster session.

Although abstract submission closed in March general registrations are open and will be received right up to the middle of May. If you have not registered yet, now is the time to do so. If you are involved in any part of the Uranium Production Cycle, as an operator, regulator or stakeholder, this is an event you should attend to find out the latest developments in the global uranium mining industry.

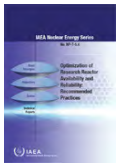
Recent Publications



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



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

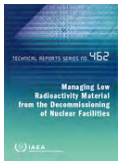


Nuclear Energy Series No. NP-T-5.4
Optimization of Research Reactor Availability & Reliability: Recommended Practices (2008)

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

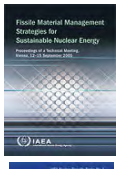
Technical Reports Series No. 463
Decommissioning of Research Reactors and Other Small Facilities by Making Optimal Use of Available Resources (2008)

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

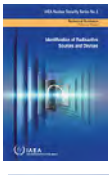


Technical Reports Series No. 462
Managing Low Radioactivity from the Decommissioning of Nuclear Facilities (2008)

Technical Reports Series No. 460
Considerations of Waste Minimization at a Design Stage of Nuclear Facilities (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) **NEW!**

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) **NEW!**

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

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

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

IAEA-TECDOC-1587
Spent Fuel Reprocessing Options (2008) **NEW!**

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

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)

IAEA-TECDOC-1563
Spent Fuel and High Level Waste: Chemical Durability and Performance under Simulated Repository Conditions (2007)

IAEA-TECDOC-1566
Factors Affecting Public and Political Acceptance for the Implementation of Geological Disposal (2007)

IAEA-TECDOC-1558
Selection of Away from Reactor Facilities for Spent Fuel Storage (2007)

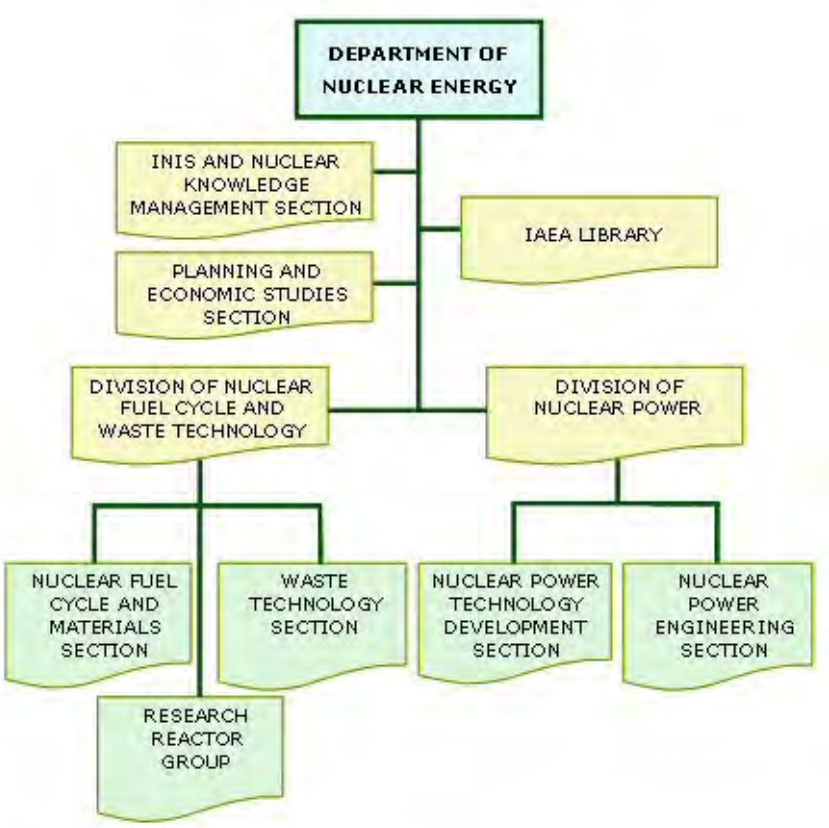
Radioactive Waste Management Profiles No. 8
A Compilation of Data from the Net Enabled Waste Management Database (NEWMDB) (2007)

Upcoming Meetings in 2009

Date	Title	Place	Contact
4-8 May	International Topical Meeting on Nuclear Research Applications and utilization of accelerators (AccApp09)	Vienna Austria	V.Inozemtsev@iaea.org
11-14 May	TM on techniques and technologies for the reduction of liquid and gaseous effluents from nuclear reactors	Vienna Austria	S.Samanta@iaea.org
18-22 May	**International Conference on Remediation of Land Contaminated by Radioactive Material / Residues**	**Astana Kazakhstan**	**H.Monken-Fernandes@iaea.org**
15-18 June	Technical Meeting on Organization, Principles and Technical Options for Waste Minimization	Vienna Austria	A.Morales-Leon@iaea.org
17-19 June	43rd Joint IAEA-OECD/NEA Uranium Group Meeting	Vienna Austria	J.Slezak@iaea.org
22-26 June	**International Symposium on Uranium Raw Material for Nuclear Fuel Cycle: Exploration, Mining, Production, Supply and Demand, Economics and Environmental Issues (URAM-2009)**	**Vienna Austria**	**C.Ganguly@iaea.org**
31 Aug-4 Sep.	Technical Meeting to Develop a Laypersons Guide to Environmental Remediation	Vienna Austria	H.Monken-Fernandes@iaea.org
22-25 September	Technical Meeting on Post-Operational Environmental Monitoring and Surveillance of Disposal Facilities for Radioactive Waste	Cherbourg France	L.Nachmilner@iaea.org
28 Sep.-2 Oct.	Training Meeting / Workshop to Update Waste Management Information in the Net Enabled Waste Management Database	Vienna Austria	J.Kinker@iaea.org
28 Sep.-2 Oct.	Technical Meeting on Mobile Processing Technologies and Systems for Radioactive Waste Management	Vienna Austria	S.Samanta@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
5-9 October	Technical Meeting on Management and Disposal of (TE)NORM Waste	Vienna Austria	H.Monken-Fernandes@iaea.org
12-16 October	Technical Meeting on the IAEA Network of Centres of Excellence on Environmental Remediation	Vienna Austria	H.Monken-Fernandes@iaea.org
19-23 October	Technical Meeting on Technical Requirements and Technical Procedures to Operate Processing and Storage Facilities for Institutional Waste Including Radioactive Sources	Vienna Austria	M.Al-Mughrabi@iaea.org
28-30 October	44th Joint IAEA-OECD/NEA Uranium Group Meeting	Paris France	J.Slezak@iaea.org
2-3 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 Uranium from Unconventional Resources	Vienna Austria	J.Slezak@iaea.org

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

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