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Fuel Cycle and Waste Newsletter

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International Decommissioning Network (IDN) — Moving Forward

Mestral Training Centre, Vandellos, Spain

As a 'Network of Networks', the IDN was formed to co-ordinate and build on current efforts both internal and external to the IAEA that are aimed at assisting Member States in the sharing of practical decommissioning knowledge. Thus far the most successful has been the European Regional Technical Cooperation Project RER3005 on 'Support in Planning the Decommissioning of Nuclear Power Plants and Research Reactors'.

Following the successful launch of the IDN in September 2007 and the first technical meeting (TM) at the end of October, efforts have focused on initiating new activities recommended by participants and aligning these with ongoing decommissioning work in the IAEA. The annual planning meetings last December for this project provided an opportunity to understand the needs and expectations of the project's participants. Similarly, the experience with back-to-back workshops hosted within the framework of the Research Reactor Decommissioning Demonstration (R2D2) Project by ANSTO in Sydney on 'Transition to Decommissioning' and PNRI in Manila on 'Characterization Surveys', improved the IAEA decommissioning team's knowledge of what is needed to move beyond the planning stage, along with the understanding of the required IDN 'modus operandi', i.e. to create events that transfer practical know-how from those with relevant decommissioning experience to those with a demonstrated need.

The planning of the top-priority events is progressing. The IDN's 'inaugural' event will be a workshop to be offered cost-free to the IAEA by **ENRESA, Spain, 12—16 June 2008**. This workshop is on **Waste Management and Clearance**.
http://www.iaea.org/OurWork/ST/NE/NEFW/wts_IDN_announcements.html

Message from the Director

A new year and a new budget cycle, 2008—2009, has started for the IAEA with a very broad approach in the area covered by the Division of Nuclear Fuel Cycle and Waste Technology. In this issue of our Newsletter you will get insights in some of the topics. As usual I encourage you to visit our website http://www.iaea.org/OurWork?ST/NE/NEFW/index.html to get a more comprehensive view.

Nuclear power is now in a very dynamic phase and many signs point to an increased use of nuclear energy in the future. China is advancing its already ambitious plans. The first new reactor in more than 30 years has been ordered in the USA, etc. Recycling is expected to increase. The different asects of the fuel cycle and waste management will become even more important. Discussions on international approaches to the different parts of the fuel cycle are already high on the agenda. The IAEA will need to be prepared for this situation; to provide more assistance for new countries planning to have nuclear power or to mine uranium, and to ensure that the use of nuclear power all over the world is done with due regard to the challenges of safety, security and non-proliferation. To this end the Director General has created what is internally known as the 20/20 Project and set up a Commission of Eminent Persons (CEP), chaired by the former President of Mexico, Ernesto Zedillo, to advise him on the role of the IAEA in the 2020 time perspective. We will come back to this subject in future newsletter issues.

In this issue we also report on INPRO, the International Project on Innovative Nuclear Reactors and Fuel Cycles, which with 28 participating members brings together technology holders and users to help ensure that nuclear energy is available to contribute in a sustainable manner to the energy needs in this century. INPRO is a truly cross-cutting activity in the IAEA.

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Although this workshop was designed with participants from the European Regional Project on Decommissioning, RER3005, there are still a few places available for non-RER3005 participants who are actively involved in such work. A prospectus and tentative agenda are on the IDN website. The workshop will take place starting at Vandellos near Barcelona, and wrap up at the Pimic Project near Madrid. It will offer a unique opportunity for gaining hands-on experience.

Following this, a workshop (Group Scientific Visit) on **Size Reduction for Decommissioning of Nuclear Facilities** is expected to occur in Mol, Belgium, 7—9 October, hosted cost free to the IAEA by CEN/SCK. Also designed based on the needs and interests of the RER3005 participants, this event will feature visual demonstrations and participatory activities to show the decontamination and cutting methods employed at the lab. As for the above workshop, there are a few spaces available for qualified non-RER3005 participants who are able to pay their own way to the event.

Dismantlement of the ASTRA research reactor at Seibersdorf, Austria

The annual TM (of the IDN will take place on 5—7 November 2008 in Vienna. This meeting will review what has been achieved in 2008, and — importantly — prioritize and plan the activities we aim to carry out in 2009 and beyond. The meeting follows directly on from an important wrap-up exercise on the IAEA's recent foray into a peer-review for decommissioning in support of MAGNOX decommissioning. Watch for official requests for nomination for the TM from your national organization(s). These will likely go out in early July.

In addition to these activities, we are working on continuous improvements to the website, and to organize 'web-based' events. For example, we are working to restore and transfer some classic decommissioning training videos to DVD and make the most interesting segments of them available on-line. Based on the interest these generate, we will organize teleconferences with experts in the subject areas.

Planning for IDN events into 2009 has begun, with discussions to host workshops on concrete cutting (the

MOATA reactor at ANSTO will be dismantled in 2009), and laser cutting technology. Improved access to basic training consistent with IAEA standards is under discussion with organizations in the USA and Europe that currently offer this. Information on these events will be posted on the web-site as soon as it is available.

Given the strong response from all participants in the IDN, we are optimistic that in the 2009+ period it will be easier for us to arrange participation in IDN events with the introduction of changes to the funding mechanism. This confidence is based on the observation that by using a 'network' approach we are able to apply TC's well-established tools for several participating Member States simultaneously, while also providing a forum where Member States with more extensive experience can exchange ideas and gauge the effectiveness of their own programmes. The momentum gained by the success of the Underground Research Laboratory (URL) and IDN networks has encouraged us in the creation of additional networks to extend and lever the IAEA's efforts in other areas of nuclear waste management.

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INPRO—The International Project on Innovative Nuclear Reactors and Fuel Cycles

The International Project on Innovative Nuclear Reactors and Fuel Cycles (INPRO) was established in 2001, following a resolution by the IAEA's General Conference, to support the safe, sustainable, economic and proliferation-resistant use of nuclear technology to meet the global energy needs of the 21st century. It has two main objectives:

- To help to ensure that nuclear energy is available to contribute, in a sustainable manner, to the energy needs in the 21st century.
- To bring together technology holders and users so that they can consider jointly the international and national actions required for achieving desired innovations in nuclear reactors and fuel cycles.

The focus of Phase I of INPRO (2001—2006) was on the development and application of a comprehensive methodology for the assessment of innovative nuclear systems. The current Phase II on INPRO has three main activity areas: continued work on and with the methodology; common user considerations and collaborative projects. Collaborative projects will be examined in this newsletter. In a latter issue, the other areas will be further explored.

Work is progressing on twelve collaborative projects that were endorsed in July 2007 by the INPRO Steering Committee. Topics include nuclear power for small countries, nuclear fuel cycle issues, environmental impacts, safety issues, proliferation resistance, non-stationary nuclear power plants, and the global architecture of future innovative nuclear systems, including the fuel cycle.

Member States and organizations participating in INPRO

Specific active projects include:

1. Acquisition/Diversion Pathway Analysis for the Assessment of Proliferation Resistance (PRADA) — The objectives of the project are to develop appropriate methods for the identification and analysis of pathways for the acquisition of weapons-usable nuclear material and to evaluate the multiplicity and robustness of barriers against proliferation for the pathway by logic trees (success/failure trees, event trees, etc.).

2. Decay Heat Removal System for Liquid Metal Reactors — The main objective of the project is the inter-comparison of results of a candidate robust decay heat removal system of liquid metal reactors, developing matured analysis methodologies for several phenomena and identifying relevant R&D areas. Seven studies will be undertaken representing different transient cases. The scientific basis of the Collaborative Project is strengthened by an internship of a Master student in mechanical engineering from Karlsruhe University (Germany), working at the IAEA/INPRO headquarters to develop a thesis on that subject.

3. Thorium fuel cycle — The project has as overall objective to examine the potential of thorium-based fuel cycles in innovative configurations, aimed at enhancing the sustainability of nuclear power.

4. Global Architecture of Innovative Nuclear Systems Based on Thermal and Fast Reactors Including a Closed Fuel Cycle (GAINS) — The GAINS project lies at the thematic centre of several INPRO activities and Collaborative Projects. The objectives of the GAINS Collaborative Project are to:

   - develop a framework (a common methodological platform, assumptions and boundary conditions) for the assessment of the transition from the current thermal reactors to a sustainable deployment of nuclear energy till 2050 and afterwards up to 2100;
   - develop a reference base case for transition to architecture of the global innovative nuclear systems capable to meet in a sustainable manner requirements of energy supply, recognizing regional differences in availability of material resources, energy growth rate and nuclear energy deployment options;
   - perform sensitivity studies to assess the impact of different key assumptions and to consider the effect different transition scenarios would have on sustainability metrics.

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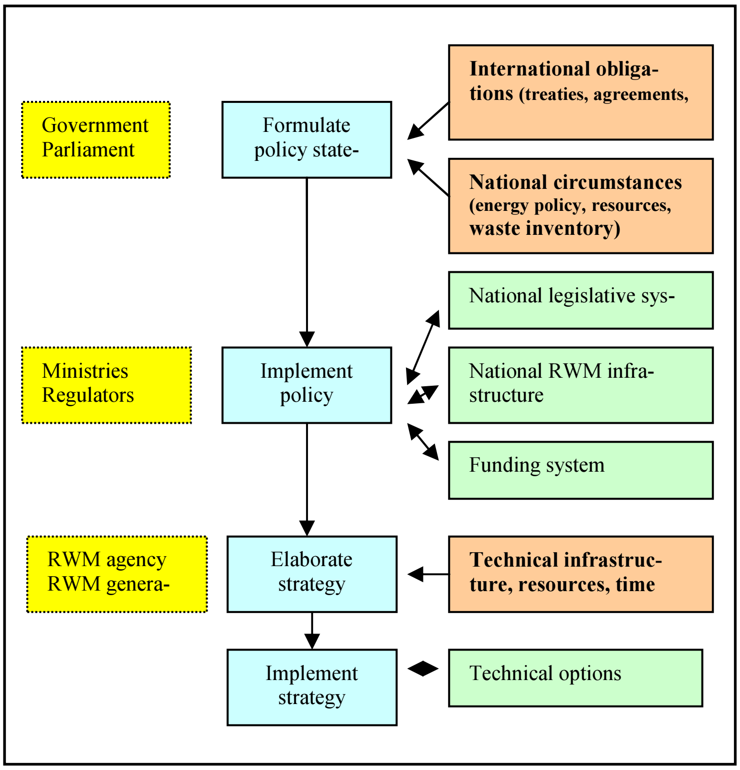
Policies and Strategies for Spent Fuel and Radioactive Waste Management

Every country should have a policy and strategy for managing its spent fuel and radioactive waste: they set out the nationally agreed position and way for its implementation in technical measures. The absence of explicit policies and strategies can result in a lack of transparency in managing radioactive waste. Also, while the content of laws and regulations cannot usually be changed quickly, the revision of national policy and strategy statements is less difficult and, in this way, allowing for a flexible response to topical problems.

A clear distinction exists between policy (a set of the particular goals or requirements) and strategy (the ways and methods used to implement the policy). Nevertheless, in some countries the line separating them is not sharp and distinguishing between the two concepts is difficult; instead, they have a national plan which is, in fact, a combined policy and strategy.

Numbers of countries have well established and documented their national policies and strategies, while



Development and implementation of radioactive waste management policy and strategy in others they exist without their explicit statements and, instead, they have to be inferred from the contents of laws, regulations and guidelines. In less developed waste management programmes they may even be based on spontaneous implementation of rules and technologies.

To assist Member States wishing to establish, revise or upgrade their national policies and strategies for spent fuel and radioactive waste management a guidance document is being developed through joint effort of Waste Technology and Waste and Environmental Safety Sections of the IAEA. The document is intended for the use of persons engaged in preparing and drafting national policies and strategies or updating existing ones and is expected to be of use to all countries that have spent fuel and/or radioactive waste to manage.

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Recent Developments in Releasing of Slightly-Contaminated Decommissioning Wastes

As a rising number of nuclear facilities approach or reach the end of their operating lives, decommissioning planning and implementation has become an increasingly important activity in Member States. An important aspect of such activities is the management of materials arising from decommissioning, some of which are activated or contaminated, some not. Some continue to have an economic value and/or are in a form that can be recycled or reused; others having little or no economic value will need to be disposed of as waste, possibly after storage if no appropriate disposal route is currently available.

Much of the material arising will contain only small amounts of radioisotopes, if any. For such material there are substantial incentives to use the principle of clearance, defined as the removal of radioactive materials or radioactive objects from any further regulatory control by the regulatory body. Environmental and sustainable development considerations encourage reutilization of non-renewable resources by way of direct reuse of equipment or buildings and by recycling usable materials. Furthermore, there may be worthwhile intrinsic value in recycled materials such as metals, or crushed concrete for construction. Furthermore, the cost of disposal of conventional (non-radioactive) waste is generally much lower than that of radioactive waste.

Despite the inherent benefits of a policy of utilizing clearance 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.

The drum monitoring trailer at Bohunice site, Slovakia

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. Pursuit of a path of unrestricted release requires systematic assessment of the pros and cons as it is not always the optimum route. Other options may be more cost effective in some circumstances. These could include releasing restricted to specific applications (either nuclear or non-nuclear) or disposal as radioactive waste. In many countries the decommissioning implementer is currently limited to a choice of unconditional release or disposal as low level waste. The implementer should be given access to a wider variety of options thereby maximizing flexibility and cost effectiveness of the overall disposition strategy. A recent technical report on IAEA, Managing Low Radioactivity Material from the Decommissioning of Nuclear Facilities, Technical Report Series No. 462, 2008] provides an overview of a number of alternatives developed in various IAEA Member States, which are intended to ensure more flexibility to the decommissioning operators and waste managers.

Need for Low Level Waste (LLW) Alternative Management Modes in the UK

The only LLW disposal vault currently operating at the UK's national low level radwaste repository near Drigg is expected to be full long before a new vault could be opened. The remaining disposal capacity is expected to be exhausted soon, and certainly will be inadequate to the large amounts of decommissioning wastes resulting from the decommissioning of UK's nuclear legacy. This outcome could lead to the need for interim storage, possibly at certain of the Magnox sites. Other options include utilization of controlled burial and conventional landfill using revised definitions for very low level waste (VLLW). Disposal of VLLW at inexpensive, dedicated sites is an approach currently being implemented in France and Spain. A further approach to help reduce the volumes of LLW for disposal is UK Government's encouragement of LLW metals being sent overseas for treatment. In such a case, the STUDSVIK smelting facility in Sweden is a likely candidate. In early 2008 STUDSVIK announced that it had obtained all necessary licences to allow construction and subsequent operation of its proposed UK Metallic Recycling Facility near Sellafield, UK. The first phase of the facility is expected to become operational in late 2008. Following treatment, the recycled metal will be proven to be below clearance limits before eventually being sold into the UK recycled metal market for industrial use [Nucleonics Week, Need for LLW Storage Expected Once UK Repository Vault Fills, vol. 48, issue 29, 19 July 2007; Nucleonics Week, UK Government Promotes Exporting Contaminated Metal for Recycling, *ibidem*; World Nuclear News, Studsvik's UK Metal Recycling Plant Approved, 13 February 2008]

The VLLW disposal cell at Morvilliers, France

US Plans to Landfill Low Level Nuclear Waste

The US Environmental Protection Agency (EPA) is planning to revive a controversial proposal that may open hazardous waste landfills to low level radioactive waste by regulating them under Subtitle C of the Resources Conservation & Recovery Act (RCRA), a plan which could answer Nuclear Regulatory Commission (NRC) fears that the nation is running out of storage space for the waste and concerns over the decommissioning of nuclear facilities.

Key issues EPA would have to address in any plan to accept low level nuclear waste at RCRA landfills include how to classify the waste and whether the landfills could still be used for new construction and development. For example, NRC regulations require most nuclear disposal sites to be owned by the Government in order to prevent the property from being sold after they are closed. Yet under RCRA, landfills can be sold after a 30-year time period has passed. [Defense Environment Alert, EPA Reviving RCRA Proposal to Landfill Low Level Nuclear Waste, Vol. 16. No. 5, 4 March 2008]

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Taking an Integrated Approach to Decommissioning and Environmental Remediation

Decommissioning and remediation activities at nuclear sites are driven by some common driving forces, the most fundamental of which is the protection of humans and the environment from sources of contamination. Work carried out under decommissioning and remediation programs is accordingly aimed at achieving end-states that correspond to planned or anticipated (future) end-uses (i.e. facility or site reuse). In addition, decommissioning and remediation programs have common resource needs and share common activities. These commonalities result in synergies that when identified and fully utilized through an integrated decommissioning and remediation programme can lead to the optimization of available resources to achieve (radiological and non-radiological) risk-based results faster and at lower costs. This optimization process was the subject of a report recently produced by the Waste Technology Section and to be published in the near future. The objective of the document is to provide Member States with background information about important aspects of the process for planning the remediation of sites undergoing decommissioning. It addresses strategic planning issues and provides practical advice on decommissioning and remediation at nuclear facilities. The document is also designed to promote site remediation activities that can establish synergies with decommissioning in order to reduce the duplication of effort by various parties and minimize adverse impacts on human health, the environment, and costs through the transfer of experience and knowledge. Although the focus of this document is on nuclear facilities, the general principles of adopting an integrated approach to planning for decommissioning and remediation apply to licensed nuclear sites, sites with Naturally Occurring Radioactive Material (NORM), and non-nuclear sites. This collection of guidance is intended to promote the development of remediation strategies that are integrated with any associated decommissioning activities in order to contribute to the achievement of satisfactory results in terms of effort, cost, impacts and risks.

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CEG Workshop on System for Radioactive Waste Management in the North-West Region of The Russian Federation

At its recent workshop held last March in Oxfordshire, England, the Contact Experts Group (CEG) assembled experts from ten countries and EU to discuss the future system for radioactive waste management in north-west of the Russian Federation. Suggested by the Russian Federation, this subject remains a CEG priority – to contribute to elimination of the Cold War legacy in the Russian Federation through better management of radioactive waste and spent nuclear fuel. CEG is holding regular workshops to discuss technical aspects and proposals for international projects in the north-west and far east of Russia. The open discussions and informal atmosphere of workshops contribute to better understanding between donors and recipients.

The CEG discussed the main tasks of the Regional System, which stipulates that the radioactive waste in the north-western Region will be consolidated in the Regional Centre for radioactive waste management, where waste will be treated, conditioned and stored for up to 70 years until a final repository is built in the Russian Federation. The Regional Centre will accept waste from the local centres (i.e. former submarine bases, Andreeva Bay and Gremikha); waste from four Russian shipyards in the north-west dealing with dismantlement of nuclear powered submarines; and waste currently stored onboard nuclear service ships.

Special interest was provoked by technical presentations on the future Regional Processing and Storage Centre at Saida Bay, which is to be constructed under German funding on the same site where old submarine reactor

Saida Bay Facility from above: green — the future centre for radioactive waste treatment and storage;
yellow – storage for contaminated sevice ships (under construction); black – storage for submarine reactor units (completed)

compartments are stored. The workshop concluded that the technologies are applicable to the Russian site. Completion of construction is scheduled by 2014. One of the most challenging issues is the ability of the Saida Bay facility to manage high level waste. The current plan is to store control rods and small amounts of spent nuclear fuel in submarine reactor units, but there is concern of the risk of creating a new nuclear legacy in the region. The final destination of current inventories and expected decommissioning waste has not yet been determined.

The local radioactive waste processing centres have to be created on the existing infrastructure, jointly by the Russian Federation and other CEG members. Local centres will have to play specific roles in waste processing, since these sites are located far from Saida Bay. Transportation schemes are to be elaborated, including a special ship for transportation of containers with processed radioactive waste. The Workshop recommended performing a feasibility study for a united transportation scheme to deliver radioactive waste and review the feasibility of transportation by road when it is expedient.

The workshop also covered Russian plans to introduce a new category of waste — very low level radioactive waste (VLLW), in accordance with the proposed IAEA new classification scheme. This issue needs to be discussed further, in order to balance the economic and safety advantages of modification of the current radioactive waste management strategy. The founding concept of VLLW is that it is disposed of on the local site with appropriate packaging. This concept could significantly impact on the overall costs of transportation,

Typical inventory of disused gauges

centralized processing, and storage as well as on final disposal.

Typical neutron source

Rosatom (the Russian Federal Agency for Atomic Power) is committed to develop WAC (waste acceptance criteria) for disposal. A complicating factor is that options for final end-points for the waste are still under consideration. The workshop concluded that development of generic WAC for disposal based on IAEA recommendations and best international practices is an appropriate way forward, especially since WAC for designated disposal facilities will depend on the safety assessment performed for a particular location(s). Development of the generic WAC for disposal would allow establishment of acceptance criteria for centralized long-term storage, as well as criteria for waste processing (treatment and conditioning) including packaging at the central processing or local processing sites since. Furthermore, the workshop determined that is impossible to go forward without having WAC for storage, and that eventual concern of misalignment of WAC for storage and WAC for future disposal should be addressed in collaboration of all stakeholders in the Russian Federation.

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Source Repatriation Operations: Latin America to USA

The IAEA has entered into a cooperative agreement with the United States Department of State and with the government of Brazil to repatriate disused, potentially vulnerable radioactive sealed sources in the region to their country of origin or to the United States. Through the Latin American Regional Partnership Pilot Project, the Comissão Nacional de Energia Nuclear (CNEN) in

São Paulo will license the temporary import of sources that can be repatriated and the Centro de Desenvolvimento da Tecnologia Nuclear (CDTN) in Belo Horizonte will serve as the regional facility for consolidation and repatriation operations. The Nonproliferation and Disarmament Fund of the US State Department provided funding for the project.

Following the establishment of the inventory of US-origin sources in July 2007, a training workshop and transuranic source conditioning operation was conducted in Belo Horizonte and São Paulo, Brazil from 17-21 September 2007. Three source recovery and packaging experts from the Los Alamos National Laboratory (LANL) in the USA and one expert in the dismantling of nuclear devices and equipment from QSA Global, Inc. assisted with the training. The Brazilian team was trained to remove sealed radioactive sources from typical nuclear gauges and storage shields, to encapsulate sources in QSA Global field-sealable special form capsules and to package sealed sources to meet international shipping regulations. A total of 127 US-origin, primarily transuranic neutron sources, containing 170 Ci (6300 GBq) were packaged into 17 drums for repatriation to the USA. The drums, along with a cargo of spent nuclear fuel from Argentina and Brazil, embarked in mid-November on a ship chartered by the US Department of Energy. The ship arrived safely in the USA in December 2007.

The operation represented successful completion of the first repatriation effort under the cooperative pilot project. The IAEA and LANL had cooperatively conducted similar training and recovery operations in South Africa in 2005 and in Australia in 2006. All of these regional teams are a resource available to the IAEA to conduct source conditioning and repatriation operations around the world.

Training on special form capsule assembly

Loading the shipping container for return to the USA

Ongoing activities under the Latin American Regional Partnership Pilot Project include repatriation of a disused irradiator from Uruguay to India; pre-missions to Colombia, Venezuela and Argentina to verify inventory and plan conditioning operations; and the development of an implementation plan for repatriation of disused teletherapy units in Uruguay to the USA and Canada using CDTN in Brazil as the regional lead.

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Technical Working Group on Research Reactors (TWGRR)

From 5 to 7 February 2008, twenty five participants from 20 countries, covering several regions with considerable research reactor interest and experience, attended the first meeting of the TWGRR held at the IAEA in Vienna. Participants included international experts appointed by Member States. The TWGRR principal objective is to provide advice and support IAEA programme implementation in the area of research reactors, while drawing on and strengthening a global network of excellence and expertise.

For almost 60 years, research reactors have been centres of resource development, productivity and innovation in a wide variety of nuclear science and technology areas such as nuclear power, medical and industrial radioisotope production, neutron beams for research and analysis, and as facilities for education and training. At present with growing energy needs for sustainable and environmentally friendly development, the IAEA Member States are viewing nuclear energy as a viable option and requesting IAEA assistance to either build their first research reactor or to utilize research reactors operating in neighbouring countries as a first step in building up national capability to start their own nuclear power programmes. However, the research reactor community, which has had a long and successful history of both productive and safe operation, is now facing a number of critical issues ranging from the facility ageing and staff retirement to changes in governmental support trending toward greater financial self reliance. Under-utilisation and a lack of resources (human as well as financial) are interlinked, resulting in challenges in different areas.

The TWGRR was created to advise the IAEA on the best means to help interested Member States addressing these and other challenges, the main functions of the TWGRR are to:

- provide advice and guidance on IAEA programmatic activities in the different areas of research reactors;
- provide a forum for information and knowledge sharing on national and international programmes development in the different areas of research reactors;
- provide guidance to member states in order to improve and optimize the utilization of research reactors, in national, regional and interregional contexts; and
- address the projected needs for research reactors on a global and regional long-term basis.

During this first meeting participants mainly discussed the TWGRR organization, working mechanism and contributions to address IAEA activities proposed in 2008/9 and 2010/11 Programme & Budget related to research reactors. Subjects covered during the three day discussions were, among others:

- Effective utilization of research reactors in a more economically competitive, reliability- and sustainability-conscious world;
- Creation of 'regional centres of excellence', based on a single research reactor within one region that could be utilized by a number of neighbouring countries for co-operative research programmes and training;
- Creation of coalitions or cooperative arrangements among operating research reactors to improve all aspects of research reactor utilization.
- Minimization and eventual elimination of Highly Enriched Uranium (HEU) use in civilian, research reactor applications;
- The end-point of the research reactor fuel cycle and the long term fuel storage at reactors in extended shutdown conditions;
- Research reactor decommissioning, especially in under-utilized, resource limited facilities and the management of know-how transfer in long term activities;
- Research reactor operation, maintenance, availability and reliability, supporting their modernization and innovation; and
- IAEA support for international activities and technical meetings in this area.

RA-6 research reactor in Bariloche, Argentina

The specific items listed above are just some areas that TWGRR and the IAEA see as important over the next several years. The role of research reactors in support of infrastructure and technological development is a serious concern as interest in peaceful uses of nuclear technologies continues to grow. TWGRR members commented that the required support has not been sufficiently acknowledge until very recently and needs special attention and priority going forward. The

TWGRR commended the IAEA to recognize the need for more direct feedback from Member States on IAEA research reactor programmes and recommended the TWGRR to remain highly involved in these activities in order to act as an effective advisory group to the IAEA.

Also visit the TWGRR Website:
http://www.iaea.org/OurWork/ST/NE/NEFW/rrg_twgrr.html

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Research Reactor Networks, Coalitions and Centres of Excellence — Update

To address complex issues related to research reactor sustainability, security, and non-proliferation, and to promote international and regional cooperation, the IAEA has undertaken new activities to promote Research Reactor Networks, Coalitions and Centres of Excellence. This integrates IAEA regular and extra-budgetary funded programme activities related to research reactors, national and regional IAEA Technical Cooperation projects, and is also supported by a grant from the Nuclear Threat Initiative (NTI). The IAEA's role is to serve as a catalyst and a facilitator of ideas and proposals. Approximately fifteen 'notional proposals' for coalitions covering a range of subjects and virtually all geographic areas were formulated.

The IAEA Workshop on Advanced Strategic Planning for Research Reactor Coalitions (Europe region), Vienna, 17-19 December 2007, was attended by representatives of user organizations and research reactor operators from Armenia, Austria, Azerbaijan, Czech Republic, Italy, Kazakhstan, Norway, Romania, Russian Federation and Uzbekistan. The participants made presentations relating to their utilization patterns and the development of strategic plans. Participants from organizations without research reactors made presentations regarding their nuclear science, irradiation, nuclear power plant support and training, and radiation protection needs for which access to, or services from, a research reactor would be helpful. The participants also visited the TRIGA reactor at the Atominstitut (ATI) of the Vienna University of Technology for briefings on strategies and activities for the successful utilization of a low-power research reactor, particularly for education and training purposes (see next article).

The final report of the workshop contains suggestions from each of the participants regarding ideas for cooperation and collaboration with other research reactors and concrete proposals for research reactor coalitions with specific action items. These include:

- Representatives of the two countries later proposed formation of a Central Asia research reactor coalition, and this is now being pursued;
- Nuclear Education and Training Coalition (potentially involving Armenia, Azerbaijan, Austria/ATI, Czech Republic/CTU, and Italy);
- Innovative Reactor Systems and Fuel Cycles (potentially involving Czech Republic/Rez, Norway/Halden, Romania/INR, Russian Federation/RIAR, and Ukraine);
- Central/Eastern Europe (via an external proposal from Hungary, and also involving Czech Republic, Romania, and Poland). An exploratory meeting was organized by KFKI in Budapest, Hungary on 28—29 January 2008 concerning the formation of such an Eastern European Coalition, for which specific activities are now being discussed.

Following initial discussions with possible participants, several of the notional proposals were further elaborated and then became the basis for exploratory meetings in fall 2007, held to discuss forming specific coalitions.

Meetings with Russian experts in September and December 2007 resulted in conclusion of meeting protocols that cited a number of possible areas for coalitions among Russian research reactors and/or with research reactors outside the Russian Federation. These include Russian coalitions for i) education in nuclear science and engineering, and ii) industrial and medical radioisotopes; and international coalitions for i) nuclear science and materials testing and ii) LEU fuel conversion. Follow-up meetings and facility visits took place in Moscow and Obninsk, Russia on 12—14 March 2008 regarding formation of a coalition on nuclear education and training.

Two missions to the Institutes for Nuclear Physics in Kazakhstan and Uzbekistan from 8—12 October 2007 were completed to assist research reactors to further develop strategic plans and to consider formation of cooperative ties between research reactors in the region.

Two missions and facility visits took place in October 2007 to Chile and Peru by a team which included representatives of the University of Missouri research reactor (MURR) and McMaster University for discussions on possible coalitions involving medical and industrial radioisotope research, development, and production. Protocols with action items were agreed for both missions, which included a number of concrete ideas for supply of radioisotopes between institutions or for transfer of production technology. There has been an extensive exchange of information in the following months and arrangements concluded for radioisotope supply. It is envisaged that meetings will be held in mid-2008 to further formalize the coalition arrangements and to plan next steps.

Missions to Argentina and Mexico in October 2007 included a representative from the TRIGA reactor, Atominstitut, Vienna University of Technology. These meetings focused on establishment of coalitions involving nuclear education and training activities, including the Instituto Dan Beninson (CNEA/Argentina), the Instituto Nacional de Investigaciones Nucleares (ININ/Mexico) and the Laguna Verde Nuclear Power Plant (Mexico). Preliminary coalition agreements were signed, with specific follow-up steps. As a result of the meeting in Mexico, ININ is currently preparing to hold, in 2008, at its TRIGA reactor, a practical reactor operations training course for personnel from the Laguna Verde Nuclear Power Plant.

Atominstitut - 2008 Safeguards training class

A preliminary agreement was reached at a meeting at ININ on 31 October 2007 to form a Caribbean research reactor coalition between three reactors in Colombia, Jamaica, and Mexico. It is envisaged that this coalition will serve as a regional resource for nuclear science and irradiation service users for other countries in the Caribbean region that do not have research reactors. The focus of its activities will initially be on neutron activation analysis especially for environmental applications, as well as training services. A draft Memorandum of Understanding for the coalition is under review by the parties, a reactor operator certification course is being formulated by ININ (for Colombia), and Jamaica is formulating a course on neutron activation analysis.

The IAEA held a meeting to explore the formation of a neutron sciences/neutron scattering coalition 11—13 February 2008 in Vienna with representatives primarily from the Europe region but also from Australia and the USA. The meeting's recommendations contain several specific proposals for coalitions in this filed.

Ira Goldman (i.goldman@iaea.org)
Pablo Adelfang (p.adelfang@iaea.org)

Facility Focus – Atominstitut Vienna

The Atominstitut Vienna is presently the sole custodian of experience based, Austrian nuclear expertise. The Atominstitut Vienna has been and remains to be a valuable partner in numerous IAEA activities related to the peaceful utilisation of nuclear technology in many areas and applications, but particularly those related to research reactors, knowledge management and nuclear human resource development. Since March 1962, the Atominstitut Vienna has operated a 250 kW TRIGA Mark-II reactor used for nuclear education and training in the fields of neutron and solid state physics, nuclear technology, reactor safety, radiochemistry, radiation protection, dosimetry, low temperature physics and fusion research. During the past 20 years about 640 students graduated with a Masters Degree or a PhD degree from the Atominstitut which is administratively attached to the Vienna University of Technology (VUT).

To perform nuclear relevant academic studies the Atominstitut offers about 100 highly specialised theoretical lectures and about 10 practical courses where students have to perform practical experiments in small groups on subjects mentioned above. Although the TRIGA reactor is a rather low power research reactor it is very easy and cheap to operate and an excellent tool to transfer knowledge and experience to younger generations.

The reactor is therefore not only used by other European universities including the University of Manchester or Slovak University of Technology in Bratislava but also by nuclear institutions such as the GRS/Germany and for staff members of the Bohunice and Mochovce nuclear power stations for nuclear training.

The University of Manchester sends 6 students for a one week practical training course in reactor physics, -kinetics, -instrumentation and -control twice a year. The course is directly implemented in the UK Nuclear Training and Education Course (NTEC). Similar exercises are carried out for NPP staff from Slovakia. On an international scale the Atominstitut co-operates closely with the IAEA on international research projects, coordinated research programmes (CRP) and the supply of expert services — including assisting in the development of specific research reactor networks, coalitions and centres of excellence. Regular training courses are carried out for IAEA Safeguard trainees, fellowships are offered to scientists from developing countries and Atominstitut staff members carry out expert missions to research centres in Africa, Asia and South America. In the past 20 years more than 120 IAEA fellows from around the world have been trained at the Atominstitut. The fellows spend between one to twelve months at the Atominstitut and are integrated into the respective work programme. Experience has shown that positive, long-term relationships between the relevant institutes have developed from these fellowships.

Austria has not developed a domestic nuclear power programme. However, because many neighbouring countries operate nuclear power plants, domestic nuclear knowledge must be preserved. Multilateral or bilateral discussions related to nuclear technologies must be conducted by experts in the nuclear field. Furthermore, nuclear knowledge covers not only nuclear power but all areas of nuclear applications in industry, medicine and agriculture. In order to develop human resources and maintain nuclear knowledge the Austrian Nuclear Society and Atominstitut Vienna have established a subgroup aimed at the development of younger professionals, with

Atominstitut – 2007 students from the University of Manchester

an age limit of 35. Since its establishment in mid-2007 around 22 new members have joined the network and are actively involved in nuclear skills development. Long-term knowledge management also provides Austria the option to expand its own nuclear programmes should it decide to do so.

Ed Bradley (e.bradley@iaea.org)

Research Reactor Modernization and Refurbishment

The majority of research reactors (RRs) are well into their fourth decade of operation but increasing demands for RR goods and services and conventional technical standards are providing no rest for the weary.

Ongoing support for the existing power reactor fleet, renewed interest in innovative nuclear systems, advanced materials research, increasing demand for medical isotopes, and the need for greater nuclear related education and training are – among other demands – creating an operational context for significantly increased RR utilization. Additionally, engineering and safety standards have evolved over the decades and many RR organizations are being held to higher standards than when the facilities were initially designed, constructed and commissioned. These constraints are resulting in a wave of modernization and refurbishment (M&R) projects.

Modernization projects change the facility design basis to; for example, meet modern technical standards or offer goods and services previously unavailable. Refurbishment projects restore or maintain previous capabilities with no change to the design basis (for example, a new control system, required due to the obsolescence of original equipment). Examples of such projects were completed at the HOR reactor at the Technical University, Delft in the Netherlands. In the control room, over the years, several systems were modernized and refurbished. The projects differed in size. The modernization of the data acquisition system being the largest to date and the in house developed LabVIEW based paperless recorder application being the smallest. The largest M&R project, the modernization of the nuclear instrumentation and the reactor protection hardware (trip logic), has just been initiated.

The decisions to implement relevant projects are typically justified through organizational strategic planning as discussed in IAEA-TECDOC-1212. However, project planning and implementation can challenge RR organizations, particularly those with limited staff and related experience who attempt to

HOR reactor control room in the 1990s TU Delft, Netherlands

HOR reactor control room today TU Delft, Netherlands

manage more complicated projects to a fixed schedule and budget. The IAEA is working to collect examples of M&R projects, the motivation for completing the scope of work, detail on how the projects were planned and implemented, and the significant lessons learned through the entire process. The aim is for the resulting report to assist relevant RRs in their efforts to optimize the planning and implementation of future projects through the incorporation of lessons learned and peer discussions during periodic workshops on the topic to be hosted by the IAEA.

Ed Bradley (e.bradley@iaea.org)

New CRP on Innovative Methods in Research Reactor Analysis

The Research Reactors Group, within the IAEA Department of Nuclear Energy, together with the Research Reactor Section of the Department of Nuclear Safety is organizing a Coordinated Research Project (CRP) to benchmark neutronics and thermal-hydraulic computational methods and tools.

The proposed CRP will involve, for the first time, benchmarking research reactor thermal-hydraulic and neutronic computer codes against experimental data. A set of experimental data for code benchmarking will be established to support the project. A detailed comparison of results between different codes, organizations and even specific users are planned. The activities of this CRP are expected to enhance the capabilities of participating organizations to perform analyses for research reactors aimed at improving the design, operation and safety performance of research reactors and associated experiments.

This CRP is currently in the formulation phase. The kick-off consultancy meeting was held in March 2008. Interested organizations should contact the IAEA regarding participation opportunities at their earliest convenience.

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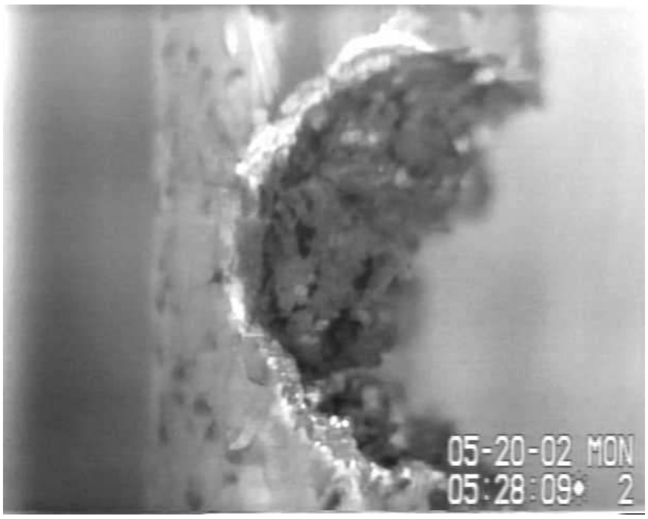
Amgad Shokr (a.shokr@iaea.org)

Management of Damaged Spent Nuclear Fuel

With growing interest and international cooperation in the nuclear fuel cycle, responsible organizations must develop a consistent methodology for identifying spent fuel requiring non-standard handling as well as sharing methods for detection and handling of this fuel. Currently, most countries define fuel as damaged if it contains one or more defects from a preset list. A concept has been advanced by the IAEA and representatives from over 20 countries that fuel should be considered damaged if it can not fulfil its intended functions. As a proposed definition, this would add the aspect that defects alone are not sufficient to conclude that a rod or assembly is damaged. Rather, this clarifies that the defect(s) must impede the fuel from performing required safety, regulatory, or operating functions, before the fuel would be considered damaged. The results of this work are to be published soon in the Nuclear Energy Series Report titled **Management of Damaged Spent Nuclear Fuel**.

A review methodology has been formulated to identify the safety, regulatory, and/or operating functions the fuel must satisfy. It shows how these functions will depend on the current, planned, and potential future stage of the back end of the fuel cycle. These functions are then translated into characteristics that might cause the fuel to be considered as 'damaged' based on potentially active degradation mechanisms and expected behaviour of these defects.

The second part of the review methodology involves techniques that can be used to detect and evaluate fuel characteristics that may impede its ability to meet the technical performance requirements. In particular, available techniques for detecting various defects are presented along with their respective advantages and limitations.



Various secondary fuel failures (top — hydride blister hole, bottom — large hydride cladding erosion and fuel loss)

Handling of damaged fuel will depend on: (1) the type of defect, (2) the function that may be compromised, and (3) the desire to carry the damaged fuel along with the undamaged fuel (as opposed to, for example, segregating it for handling with special provisions). Non-standard handling options will depend on remaining stages of the backend fuel cycle. Fifteen approaches are identified and discussed along with attributes and limitations of each. Charts are provided that show which different approaches are useful for a variety of defects and functional deficiencies in each stage of the back end of the fuel cycle. A short discussion is provided on points of consideration when choosing a technique to handle a particular situation.

Xuxin Zou (x.zou@iaea.org)

Influence of High Burnup UOX and MOX Water Reactor Fuel on Spent Fuel Management

In an endeavor to make better use of nuclear fuel there is tendency in the world to increase burnup of Uranium Oxide (UOX) and Mixed Oxide (MOX) fuels. Burnup extension affects several important stages of the nuclear fuel cycle and concerns the whole nuclear industry. Increased burnup impacts the requirements for natural uranium and the amount of MOX, enrichment and fuel fabrication, in-reactor fuel performance and spent fuel handling, transportation and storage. It will also have an impact on spent fuel disposal.

The IAEA has organized several consultancies on this topic. The latest was held in autumn 2007 in Vienna with participants from Germany, India, Japan, Russian Federation and the USA.

Most countries operating light-water reactors (LWRs) or heavy-water reactors (HWRs) use UOX nuclear fuel. Historically, UOX ^{235}U enrichment has been in the range of 3 to just less than 5%. UOX burn-up has ranged from 30-45 megawatt-days per kilogram of heavy metal (MWd/kg). A considerable amount of data on spent UOX properties with enrichments and burnups in this range have been collected such that systems to manage the back end of the fuel cycle — wet and dry UOX storage, transportation, reprocessing, reprocessed fuel fabrication, and disposal systems — have been designed for spent UOX fuel with such properties.

The mechanical designs of lower burnup UOX and higher burnup UOX or MOX fuel are very similar, but some of the properties of higher burnup UOX and MOX are significantly different; e.g. higher fuel rod internal pressures; higher decay heat; higher specific activity; and degraded cladding mechanical properties. These properties of higher burnup fuels make spent fuel management more challenging. Evaluation of these effects on the back end of the fuel cycle was based on regulatory and safety criteria, operational and economic constraints as well as some political and strategic considerations. Furthermore, the relative importance of the technical, economic, and other considerations will vary from country to country. Higher burnup UOX or MOX usage affects all spent fuel management components, such as wet and dry storage, transportation, reprocessing, re-fabricated fuel and final disposal.

The use of higher burnup fuels will reduce the mass and volume of fuel material handled in the front end and back end fuel cycle which may reduce the cost. However, higher decay heat and radioactivity must also be considered. Furthermore, given the large variations in the price of uranium and the uncertainty in the cost of reprocessing, it is difficult to make a decision whether or not to reprocess based purely on economics. The cost-benefit evaluation requires analysis and optimization that includes not only the major benefits in the resource demands of reactor operation, but also the related demands of the fuel cycle back end.

Despite studies of extended burnup, since the first Water Reactor Fuel Extended Burnup Study, some detailed information is still lacking and will require continued investigation of this topic.

Zvonko Lovasic (z.lovasic@iaea.org)

New CRP on Improvement in the Computer Code Modelling of High Burnup Nuclear Fuel (FUMEX-3)

The Nuclear Fuel Cycle and Materials Section of the IAEA Department of Nuclear Energy is organizing a coordinated research project (CRP) to improve the modelling of nuclear fuel at high burnups.

The proposed CRP continues a long standing IAEA interest in the continuous improvement of nuclear fuel modelling codes and the better understanding and representation of the operational performance and behaviour of water reactor fuel at high burnup. Emphasis will be placed on the modelling of fission product behaviour and mechanical interactions in a fuel rod at high burnup and under transient conditions, and for advanced fuel designs.

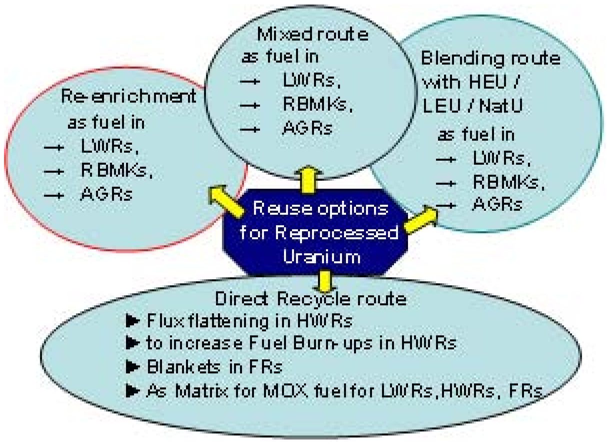
This CRP is currently in the formulation phase. A consultancy meeting is to be held in April to prepare a list of fuel experiments to be assessed by fuel modelling teams. Interested organizations should contact the IAEA regarding participation opportunities at their earliest convenience.

John Killeen (j.killeen@iaea.org)

Reuse Options for Reprocessed Uranium (RepU)

Recycling valuable material is an important attribute of any effort to optimise available resources. This is particularly true for the nuclear fuel cycle in the context of sustainable growth of nuclear energy. The largest component of spent fuel is uranium and, therefore, recycling spent fuel through chemical reprocessing yields large quantities of separated uranium, referred to as reprocessed uranium or RepU. Reusing RepU and Pu, also recovered during spent fuel reprocessing, not only reduces the radio-toxicity and volume of final radioactive waste, but also cuts requirements for fresh uranium milling.

Recognizing the importance of this subject, the IAEA recently published a document entitled 'Management of Reprocessed Uranium: Current Status and Future Prospects' (IAEA-TECDOC-1529) which provides an overview of facilities, inventories and recycling programmes in pertinent countries. However, the publication focuses on a management level overview and does not include in-depth technical detail.



In parallel, responding to increasing interest from different Member States, the IAEA conducted a technical meeting (TM) — attended by more than 50 experts — on 'Reuse Options for Reprocessed Uranium' in Vienna during August 2007 with support from a Working Group (WG). The WG reviewed several issues with respect to RepU reuse options and is planning to issue a document on 'Reuse of Reprocessed Uranium: Challenges and Options'. The purpose of this new document is to disseminate technical and economic issues related to the storage, handling, processing and reuse of RepU for nuclear energy generation. It could be an important, practical handbook for nuclear power plant operators and for those organizations interested in providing RepU related services.

The industry has adopted different strategies to reuse RepU. No single strategy has emerged as the preferred route. During the TM, the experts identified the following, challenges to be addressed in the future:

- Difficulties for suppliers to forecast the nuclear fuel market demands specific to RepU;
- To comply with ALARA, taking into account the accumulation of ^{232}U daughter products after each stage of chemical separation;
- 5.0% ^{235}U licensing limits for reactor loading, processing and transport;
- Restrictions attached to batches of RepU by obligation codes;
- The lack of facilities for cleaning cylinders containing enriched reprocessed uranium (ERU).

Many of the TM participants expressed interest in initiating annual meetings of a 'Uranium RECycling Advocates & Associates' (URECAA) group with a focus on the competitiveness and economics of a RepU based fuel cycle.

Hosadu Nawada (h.nawada@iaea.org)

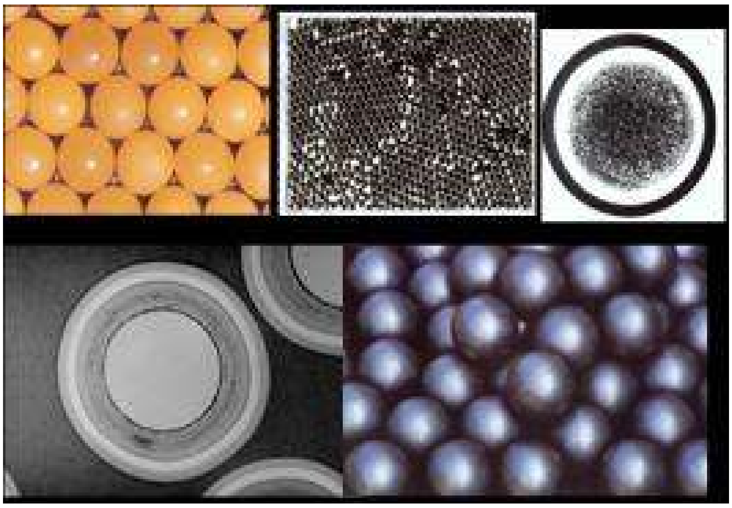
Basic Fact-Book on Coated Particle Fuel

There are several technology development projects focusing on high temperature gas cooled reactors with an aim to develop innovative nuclear fuel cycles in the context of Generation IV International Forum (GIF) and ReActor for Process Heat, Hydrogen And ELectricity Generation (RAPHAEL). In the context of supporting the interested IAEA Member States and to enhance the capacity in developing innovative technologies for sustainable nuclear energy, the IAEA is developing a handbook for use in training and education of the new generation of scientists and engineers on coated particle fuel technology. In this regard a draft document entitled Basic Fact-Book on Coated Particle Fuel is under preparation by an expert working group. The document will address a variety of relevant technical subjects including: nuclear hydrogen generation, nuclear fuel, fuel and non-fuel structural materials, quality management/ assurance/control, sphere making, block making, fuel chemistry, fuel failure mechanisms, fission product retention, accident testing, particle modelling, and spent fuel management.

To enhance synergies in the area of coated particle fuel, the IAEA has cooperated in conducting a Euro-course on 'Coated particle fuel', which was conducted by EC-RAPHAEL together with Plutonium and Minor Actinides Management by Gas-Cooled Reactors (PUMA), High Temperature Reactor Technology Network (HTR-TN), University of Stuttgart and Nuclear Research & consultancy Group (NRG) 4 — 7 Dec 2007 at NRG, Petten, Netherlands. The course covered all pertinent areas of coated particle fuel cycle. The final fact-book encompassed many of the subject areas.

Through cooperation in conducting the Euro-course and an IAEA consultancy meeting on the same subject area, both meetings achieved the following synergistic benefits:

1. Participation of several experts in the IAEA fact-book preparation;
2. Identification of new pertinent areas for consideration in the document through feedback;
3. Avoidance of duplication;
4. Availability of the Euro-course for the global community;
5. Comprehensive technical coverage of the Euro-course by appropriate experts from several non-European Member States.



Various stages of manufacturing of spherical fuel element for HTR-10 at INET, Tsinghua University, China

The IAEA is also exploring the possibility of conducting a course at ICTP, Trieste, Italy in March 2009 for young scientists and engineers on physics aspects of coated particle fuel.

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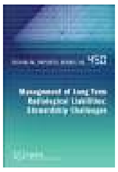
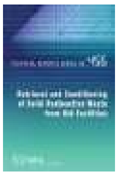
Recent Publications

Technical Reports Series No. 446
Decommissioning of Research Reactors: Evolution, State of the Art, Open Issues (2006)



Technical Reports Series No. 450
Management of Long Term Radiological Liabilities: Stewardship Challenges (2006)

Technical Reports Series No. 455
Utilization Related Design Features of Research Reactors: A Compendium (2008) **NEW!**



Technical Reports Series No. 456
Retrieval and Conditioning of Solid Radioactive Waste from Old Facilities (2007)

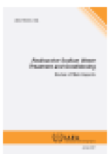
Technical Reports Series No. 460
Considerations of Waste Minimization at a Design Stage of Nuclear Facilities (2008) **NEW!**

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

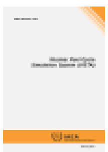
Technical Reports Series No. 464
Managing the Socioeconomic Impact of the Decommissioning of Nuclear Facilities (2008) **NEW!**

STI/PUB/1295
Proceedings of June 2006 International Conference on Management of Spent Fuel from Nuclear Power Reactors (2007)

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

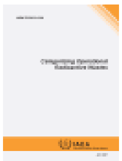


IAEA-TECDOC-1534
Radioactive Sodium Waste Treatment and Conditioning: Review of Main Aspects (2007)



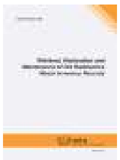
IAEA-TECDOC-1535
Nuclear Fuel Cycle Simulation System (VISTA) (2007)

IAEA-TECDOC-1537
Strategy and Methodology for Radioactive Waste Characterization (2007)



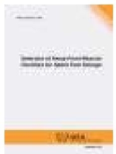
IAEA-TECDOC-1538
Categorizing Operational Radioactive Waste (2007)

IAEA-TECDOC-1547
Advances in Applications of Burnup Credit to Enhance Spent Fuel Transportation, Storage, Reprocessing and Disposition (2007)



IAEA-TECDOC-1548
Retrieval, Restoration and Maintenance of Old Radioactive Waste Inventory Records (2007)

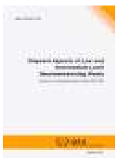
IAEA-TECDOC-1553
Low and Intermediate Level Waste Repositories: Socioeconomic Aspects and Public Involvement (2007)



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

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

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



IAEA-TECDOC-1572
Disposal Aspects of Low and Intermediate Level Decommissioning Waste (2008) **NEW!**

IAEA-TECDOC-1579
New Developments and Improvements in Processing of 'Problematic' Radioactive Waste (2008) **NEW!**

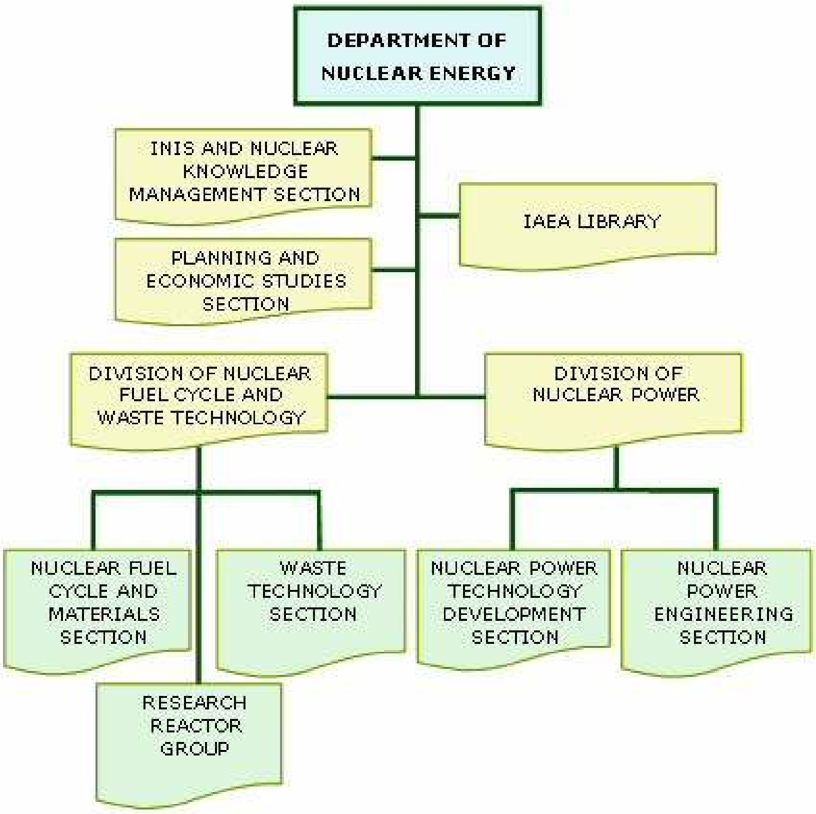
Radioactive Waste Management Profiles No. 8
A Compilation of Data from the Net Enabled Waste Management Database (NEWMDB) (2007)

Upcoming Meetings in 2008

Date	Title	Place	Contact
23-25 April	Technical Meeting on Training in and Demonstration of Waste Disposal Technologies in Underground Research Facilities—an IAEA Centre of Excellence	Wettingen Switzerland	B.Neerdael@iaea.org
28-29 April	Annual Meeting of the Technical Working Group on Fuel Performance and Technology (TWGFPT)	Vienna Austria	V.Inozemtsev@iaea.org
13-16 May	Technical Meeting to Prepare a Technical Document on Spent Fuel Data Management	Vienna, Austria	Z.Lovasic@iaea.org
19-23 May	Technical Meeting to Prepare a Technical Document on Management of Equipment Containing Radioactive Sources	Vienna Austria	J.Balla@iaea.org
19-29 May	Technical Meeting to Prepare a Technical Document on Discussing the Use of Underground Caverns for Long Term Radioactive Waste Management	Vienna Austria	B.Neerdael@iaea.org
26-30 May	Technical Meeting on PHWR Fuel Design, Fabrication and Performance	Buenos Aires Argentina	J.Killeen@iaea.org
9-13 June	Technical Meeting on Accelerator Simulation and Theoretical Modelling of Radiation Effects	Kharkov Ukraine	V.Inozemtsev@iaea.org
13-19 June	42nd Joint OECD/NEA-IAEA Uranium Group Meeting	Adelaide Australia	J.Slezak@iaea.org
2-4 July	Technical Meeting on Status and Trends of Stainless Steel Cladding and Fuel Assembly Materials and Components for Liquid Metal-cooled Fast Reactor (LMFR) - Fabrication, Properties and Irradiation Behaviour	Hyderabad India	C.Ganguly@iaea.org
8-12 September	Technical Meeting to Prepare a Technical Document on Benchmarking of Liquid and Solid Waste Generated by WWER and CANDU Reactors	Vienna Austria	Z.Drace@iaea.org
9-11 September	Technical Meeting to Prepare a Technical Document on Borehole Repositories for the Disposal of Disused Radioactive Sources: Technical and Institutional Considerations	Vienna Austria	L.Nachmilner@iaea.org
13-16 October	Technical Meeting to Prepare a Technical Document on Storage Facility Operations and Lessons Learned	Vienna Austria	Z.Lovasic@iaea.org
13-17 October	Technical Meeting to Prepare a Technical Document on Best Practices in Uranium Mining, Milling and Production	Vienna Austria	J.Slezak@iaea.org
20-24 October	Technical Meeting on the International Decommissioning Network	Vienna Austria	P.Dinner@iaea.org
28-30 October	Technical Meeting to Develop a Network of Low-level Waste (LLW) Management Centres	Vienna Austria	L.Nachmilner@iaea.org
3-7 November	Technical Meeting on Planning and Design of Geological Repositories	Vienna Austria	B.Neerdael@iaea.org
12-14 November	Technical Meeting to Maintain and Update the Nuclear Fuel Cycle Information System	Vienna Austria	M.Ceyhan@iaea.org
10-14 November	Technical Meeting to Prepare a Technical Document on Reference Design for Storage Facility for Low-level Radioactive Waste from Nuclear Applications and/or Disused Sealed Radioactive Sources	Vienna Austria	Z.Drace@iaea.org
10-21 November	Workshop on Training in Basic Radiation Materials Science and its Applications to Radiation Effects Studies and Development of Advanced Radiation Resistant Materials	ICTP Italy	V.Inozemtsev@iaea.org
17-21 November	Technical Meeting on Uranium Exploration and Mining Methods	Brazil	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

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