IAEA International Atomic Energy Agency

Fuel Cycle and Waste Newsletter

A Newsletter of the Division of Nuclear Fuel Cycle and Waste Technology
Vol. 9, No. 1, March 2013 ISSN 1816-9287

http://www.iaea.org/NuclearFuelCycleAndWaste

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Experts share suggestions to improve

Decommissioning & Remediation after a Nuclear Accident

Vowing to improve plans to protect the public and the environment from radiation following potential nuclear incidents in the future, more than 200 international experts concluded a week-long forum to share their experience and views.

The International Experts' Meeting (IEM) on Decommissioning and Remediation After a Nuclear Accident, held in Vienna from 28 January to 1 February 2013, was part of the Agency's implementation of its Action Plan on Nuclear Safety — endorsed by the General Conference in September 2011 — and was organized by the IAEA Department of Nuclear Safety and Security and the Department of Nuclear Energy.

"This has been a very productive meeting," said Chairman Carl-Magnus Larsson, who heads the Australian Radiation Protection and Nuclear Safety Agency. "We heard recommendations for the entire international community."

The discussion revolved around several themes, Larsson added, including:

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Retire, Remediate, Recover

I hope you had a good start to 2013. We at NEFW for sure had a busy start! Let me sum up:

2012 ended with a Ministerial Conference on Nuclear Safety, held precisely at the Fukushima prefecture in Japan. The Conference on 15–17 December, amongst others, encouraged the IAEA Secretariat "to provide further assistance and support to Japan in the remediation of the large areas of land contaminated as a result of the Fukushima Daiichi NPP accident."

This was my third time in Fukushima since the March 2011 accident. Having already participated in two missions and this time tasked with duties from the Ministerial Conference, we immediately got to work.

Thus, this edition of the NEFW Newsletter focusses on how to decommission, or retire, a nuclear power plant after an accident, how to manage environmental remediation efforts afterwards, and how to recover subsequently the land for normal use. On this important topic, the IAEA held its fourth International Experts' Meeting, as required in the IAEA Action Plan on Nuclear Safety. As you will read, this particular one on Decommissioning and Remediation after a Nuclear Accident represented a step forward in the way to enhance national and international programmes in the mentioned areas. Leading experts from across the world discussed different aspects of it and provided useful advice for the future. Now it is our turn in the IAEA, and especially in NEFW, in close coordination with the Division of Radiation, Transport and Waste Safety (NSRW) from the Department of Nuclear Safety and Security, to find out practical ways to implement their suggestions. We think the whole international community will benefit from this meeting. In particular, Japan could optimize its efforts for the off-site remediation and its plans for the on-site decommissioning of the Fukushima Daiichi NPP. The IAEA is committed to support these programmes.

Also, an article on the importance of stakeholder involvement in environmental remediation projects announces an upcoming IAEA publication, which we hope will serve as a useful guidance to help Member States in this difficult endeavour.

In this edition, you will also have a chance to read about a new approach to managing the life cycle of uranium mining, as well as about lessons learned in stakeholder involvement in the field of radioactive waste disposal.

Research reactors, an important component in the fields of science, medicine and industry, are featured with two articles: The Austrian research reactor, with which the IAEA has an excellent cooperation and helped convert its fuel from HEU to LEU, hosted our Deputy Director General. We cover this visit with a colourful photo essay for you to be able to have a virtual visit. The second article focusses on lessons learned from the Fukushima Daiichi NPP accident for enhancing the safety of research reactors.

Another article emphasises a vital safety aspect of radioactive sources: How does the IAEA help Member States strengthen the control of disused radioactive sources to prevent accidental exposures?

In other words, we portray many projects that serve our Member States in their national programmes related to fuel cycle, waste and research reactors.

We are currently preparing the Mid Term Progress Report for 2012–2013, and we are in the final phase of preparing the Programme and Budget for 2014–2015. These are very good tools to assess whether the NEFW achieves its strategic and operational targets and to see whether we can optimize our activities for 2013.

The diversity and quality of our activities is based on the diversity, quality and competence of our staff. I would like to thank all NEFW staff for their professional commitment to fulfil our mission.

We are sad to bid farewell to Rob Heard and Zoran Drace from the Waste Technology Section, while we welcome Stefan Mayer to the same section, and Paul Standring to the Nuclear Fuel Cycle and Materials Section, as well as Ayhan Evrensel, who is coordinating our outreach activities.

And finally, let me encourage you to visit our website and to send us your feedback about this Newsletter, about our website and about our activities.

Juan Carlos Lentijo, Director (j.c.lentijo@iaea.org)

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- The need for detailed frameworks to provide clear direction about which national organizations are responsible for which aspects of recovering from a nuclear accident;
- The importance of thorough and sustainable stakeholder interaction to help develop clear lines of responsibility and constructive relationships among the institutions addressing a post-accident situation;
- The value in formulating appropriate targets for remediation, keeping in mind the public's perception of radiation risk;
- The need to develop methods and technologies for decommissioning and remediation, and to improve ways of making those tools widely available; and
- The challenge of managing damaged fuel and radioactive waste following an accident.

A role for the IAEA

Many of the participants urged the IAEA to act swiftly to review, and revise if necessary, the Agency's relevant safety standards and guidelines and to enhance its peer reviews by adding more comprehensive elements that address remediation.

"These steps are an integral part of the implementation of the Action Plan, and the results of this IEM will be invaluable for strengthening our standards and peer reviews," said IAEA Deputy Director General Denis Flory. "Actions will happen following this IEM."

"...recommendations for the entire international community."

The IEM Chairperson Larsson summarized four areas of advice for future Agency activities broadly related to Action 10 of the Action Plan on Nuclear Safety. He said the IEM advised:

1. The IAEA to strengthen its programme on remediation after a nuclear accident to assist Member States (MS) to facilitate the return of affected areas to normal conditions.

2. The international community to strive to develop a practical definition of 'safe' as an aid for communicating with the public, since the accident at the Fukushima Daiichi NPP has highlighted the concern of people to be assured of their safety.

3. The Agency to assist MSs with the development of end states and decommissioning strategies for decommissioning of accident damaged facilities.

4. The Agency to review its guidance on the management of these wastes and materials with the view of ensuring their practical application after a nuclear accident, since large volumes of radioactive and materials with residual amounts of radionuclides are present in many countries.

What NEFW can do

The Division of Nuclear Fuel Cycle and Waste Technology (NEFW), in coordination with the Division of Radiation, Transport and Waste Safety (NSRW) from the Department of Nuclear Safety and Security, will contribute to the implementation of items 1, 3 and 4 as these fall under its area of expertise. NEFW's contribution can include:

(l-r) Denis Flory, IAEA Deputy Director General for Safety and Security, and IEM Chairman Carl-Magnus Larsson talking to the press after the week-long meeting, Vienna, 1 February 2013.
(Photo: A. Evrensel/IAEA)

- Enhancement of some publications under preparation to cover decommissioning, remediation and waste management after an accident;
- New publications on decommissioning, remediation and waste management after an accident;
- Decommissioning and remediation peer reviews in MSs with nuclear facilities and/or sites after an accident and in MSs that are going to develop their post-accidental decommissioning and remediation strategies;
- Implementing Coordinated Research Projects (CRPs), demonstration project(s) (Action Plan activity 10.1.3), activities/projects within the International Decommissioning Network (IDN), Network of Environmental Management and Remediation (ENVIRONET) and other WTS networks.

High turnout = Big interest

The fourth IEM attracted more interest than expected: More than 200 participants from 38 countries and five international organizations, namely the OECD Nuclear Energy Agency (NEA), the European Commission, the Food and Agriculture Organization (FAO), The United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) and the International Commission on Radiological Protection (ICRP), attended the event.

The joint work of NEFW and NSRW significantly contributed to the success of the event. Both Divisions appointed Scientific Secretaries and staff from their Waste Technology Section (WTS) and Waste and Environment Safety Section (WES), respectively, to organize and run the event. Some funding for the invited speakers was also covered by the regular budget of the two sections.

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Stakeholder Involvement in Environmental Remediation

Upcoming IAEA publication presented to ENVIRONET members

An upcoming IAEA Nuclear Energy Series document is aimed at helping those involved in stakeholder involvement activities and regulators to better communicate both technical and non-technical issues. Expected to be published in 2013, the "*Communication and Stakeholder Involvement in Environmental Remediation Projects*" offers various suggestions in such activities.

The pending publication was introduced at a training workshop held from 12 to 14 November 2012 in Roskilde, Denmark. Organised jointly by the IAEA and DD, the Danish Decommissioning Company, 17 experts from 12 countries attended the workshop. The participants, including members of the IAEA-run network ENVIRONET (Network of Environmental Management and Remediation), shared experiences and lessons learned in communicating environmental remediation issues to different stakeholders and in engaging them in the decision-making process, especially after severe nuclear accidents.

Following the introduction of the ENVIRONET and its focus on stakeholder involvement and communication issues in the area of environmental remediation, experts presented several case studies. These included remediation projects for the so-called "legacy" sites and for the lands contaminated due to formerly licensed activities, such as mining and milling of uranium ores or nuclear power plants operation in Belgium, Brazil, Canada, Germany, the UK and various countries in Central Asia. The experience and challenges in the remediation activities and stakeholder involvement programmes for the radioactively contaminated areas due to the 1986 Chernobyl accident, the 1987 radioactive contamination accident in Goiânia, and after the 2011 Fukushima Daiichi NPP accident were also discussed.

Removal of branches and fallen leaves around a shrine in Fukushima prefecture.
(Photo: Ministry of Environment, Japan)

Goiânia, Brazil: The venue of the world's worst accident involving a radioactive source. Caesium chloride from a dumped source that had ended up in a scrap yard spread undetected for over two weeks in 1987. Some 250 people were contaminated and four died in the first month. The legacy of a handful of caesium is 3,000 m^3 of contaminated waste, buried in these two green hills, at a near surface repository. It will take 300 years before the land can be used again.
(Photo: P. Pavlicek/IAEA)

Participants drew attention to the challenges faced by governments, regulators, local municipalities and implementers of environmental remediation projects in dealing with their stakeholders and the public, especially in communicating risks of the radioactively contaminated sites or radiation exposure events and in explaining plans and measures taken for the remediation activities.

The experts highlighted the important role of ENVIRONET in facilitating sharing and exchange of international experience on good practices for remediation of radioactively contaminated sites and for stakeholder involvement. They called on the IAEA to encourage ENVIRONET to develop future workshops or training courses in order to respond to the needs of the Member States.

The workshop, chaired by Peter Booth, Senior Technical Director of WSP Environment & Energy, and Chairman of ENVIRONET, was partly funded by the extra budgetary contribution from the Government of Japan, under its Expanded Programme of Public Understanding on Nuclear Power (EPPUNE).

More information on the workshop is available at:

http://www.iaea.org/OurWork/ST/NE/NEFW/WTS-Networks/ENVIRONET/WkpStakeholder-Denmark2012.html

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Extending the Life Cycle of Uranium Mining

Lisbon meeting highlights responsible closure, while keeping the option of reopening

At a meeting in Lisbon, Portugal, international experts from more than 30 IAEA Member States considered a new approach to the life-cycle of uranium mining: from exploration to end of mine-life remediation, including 'future-proofing' for potential future reopening. They also discussed using the United Nations Framework Classification for Fossil Energy and Mineral Reserves and Resources 2009 (UNFC-2009) for resource reporting. The event from 14 to 18 October 2012 covered both new and existing 'in ground' deposits, and included a review of techniques for characterizing and quantifying minerals of interest remaining in closed tailings piles from former mines.

Representatives from the United Nations Economic Commission for Europe (UNECE) presented the objectives and current state of the UN resource classification and reporting framework and IAEA experts illustrated the application the UNFC-2009 to uranium resources. Then, participants from Member States reported on their initial experiences with using UNFC-2009 for uranium and thorium projects, with a view to managing them in a financially, socially and environmentally responsible manner.

It was generally agreed that the capacity of UNFC-2009 to promote cross-communication between mineral, oil and gas industries has many advantages in taking an integrated approach to energy material development. The framework permits reporting of both mineral and hydrocarbon resources in a standardized, compatible way.

"It also provides significant help in mapping resource progression pathways, for example to add value to uranium and other resources by optimizing base production, new infill drilling and enhanced recovery," said David MacDonald, Chairman of the Expert Group on Resource Classification, the working group which is tasked to develop and maintain the Framework.

UNFC-2009 can also facilitate transparent stakeholder communication by providing a powerful energy resource comparison tool for local communities, enabling them to make informed decisions about options of their energy resources.

Countries that are now entering into uranium exploration and mining will be encouraged to operate under UNFC-2009, planning for the full life-cycle from the outset.

"Closure and remediation of mines is increasingly managed as a holding intervention, not an end point," said Luis Martins from the Directorate General of Energy and Geology. "These activities are designed, where appropriate, to maintain future access to any remaining resources, while

The Cunha Baixa uranium mine site, Portugal, under remediation by EDM. (Photo: H. Tulsidas/IAEA)

safeguarding local communities and the environment from any risks or hazards that may remain at the mine sites."

There are examples of re-opened mines and re-treated tailings around the world. However, ongoing safety and geotechnical stability in the case of mines in closure phase must be ensured, since a re-opening is never assured.

A team from the Portuguese mine remediation company Empresa Desenvolvimento Mineiro (EDM) demonstrated the current state-of-the-art in closing and remediating uranium mines whilst retaining the possibility of further resource recovery in the future. The participants also visited the Urgeiriça and Cunha Baixa mines in northern Portugal, which are under remediation.

The event was held under the joint auspices of the IAEA, the UNECE and the Ibero-American Programme for Science, Technology and Development (CYTED) supported by the Government of Portugal.

Background

The UNFC-2009 is a universally applicable scheme for classifying and evaluating energy and mineral reserves and resources. Its principal objective is to enhance international communication by providing a simple, user-friendly and uniform format for the reporting of energy reserves and resources, using market-based economic criteria. It has been developed to meet the needs of applications related to international energy and mineral studies, government resource management functions, corporate business processes and financial reporting standards.

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Nuclear issues require tailored communication methods, but:

Learning from others is valuable

Good stakeholder communication has been proven to be a significant factor in successful radioactive waste disposal programmes. To provide a platform for information exchange and learning from others in this field, Poland hosted a workshop focussing on stakeholder dialogue in radioactive waste disposal.

The practical exercises and lessons presented in the case studies provided useful ideas on how the attendees could implement stakeholder communication in their particular situations. (Photo: A. Izumo/IAEA)

The workshop, entitled "Lessons Learned in the Area of Stakeholder Dialogue to Strengthen National Competencies for Radioactive Waste Disposal", provided the attendees a wide range of issues relevant to stakeholder involvement and communication. Held in Warsaw, Poland, from 19 to 23 November 2012, it covered basic principles, fundamental needs of various audiences and different approaches from planning and developing a strategy to identifying and prioritizing stakeholders, to name a few. Various communication tools and channels, such as websites, pamphlets, media/social media, information centres and site visits/tours were also introduced.

Practical perspectives on the issue were given through several case studies on radioactive waste disposal projects and stakeholder involvement and communication activities

in the Czech Republic, France, Hungary and the UK. In addition, the experiences and challenges related to the remediation of contaminated areas after the Fukushima Daiichi NPP accident were described.

Based on these examples, the participants recognized the basic rule of stakeholder involvement: there is no 'one size fits all' solution. Communication methods are country and project-specific, and they need to take into account national, cultural, political, and social backgrounds as well as the type of the nuclear facility. The experience of peers is, however, helpful and even valuable when defining appropriate ways of approaching stakeholders.

Practice helps improve skills

The participants took part in a number of group exercises. In one, for example, they identified and prioritized stakeholders in given scenarios and developed plans and strategies for stakeholder involvement and communication in order to reach the goals set out in the plans.

Participants working on a case study. (Photo: A. Izumo/IAEA)

They also identified tools for communicating with stakeholders in particular stages of a project, as well as how to respond to specific questions and concerns raised by stakeholders, and how to identify and overcome pitfalls and problems during the implementation of such projects.

Conclusions

The week-long workshop was wrapped up with four key conclusions presented by the lecturers and the IAEA experts:

- Radioactive waste disposal remains an important challenge. It needs to be managed in a safe and sustainable manner by newcomers and established users alike. The public perception that radioactive waste disposal creates potential risks and unsolved problems may have an impact on the success of nuclear power programmes. Informing and involving stakeholders is an important factor for sustainable nuclear power programmes.
- The purpose of stakeholder involvement is to enable all stakeholders to make known their views and to work together to ensure that these views are properly addressed. Public trust issues can be overcome by constructive dialogue and the use of consistent and credible messages.
- Stakeholder involvement is not necessarily a means to gain consensus, but rather a way for stakeholders to understand the basis of a decision and to trust that the decision was appropriate.
- A step-by-step approach is recommended, as it can help build trust and allow feedback. It is important to ensure that people are involved at every stage of the process, and to make it clear what their influence can be.

The participants suggested that the IAEA develop and conduct more workshops or training courses in order to respond to the growing needs of the Member States on stakeholder involvement issues.

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Fact box

More than 30 representatives from 15 countries attended the workshop; their expertise ranged from public communication to radioactive waste management, and research and development.

The workshop was organized by the IAEA in collaboration with the Government of Poland through the National Atomic Energy Agency.

The event was a joint initiative of the International Low Level Waste Disposal Network DISPONET and the Underground Research Facilities Network URF, with financial support from the IAEA Department of Technical Cooperation and the Government of Japan, under its Expanded Programme of Public Understanding on Nuclear Power (EPPUNE).

DDG Bychkov Visits Austrian Research Reactor

Alexander Bychkov, IAEA Deputy Director General and Head of the Department of Nuclear Energy (right), visited Austria's only nuclear facility on 9 January 2013, to receive first-hand information about its activities.

The Vienna University of Technology's Atominstitut serves as a training and research centre not only for the Austrian universities, but also at an international level.

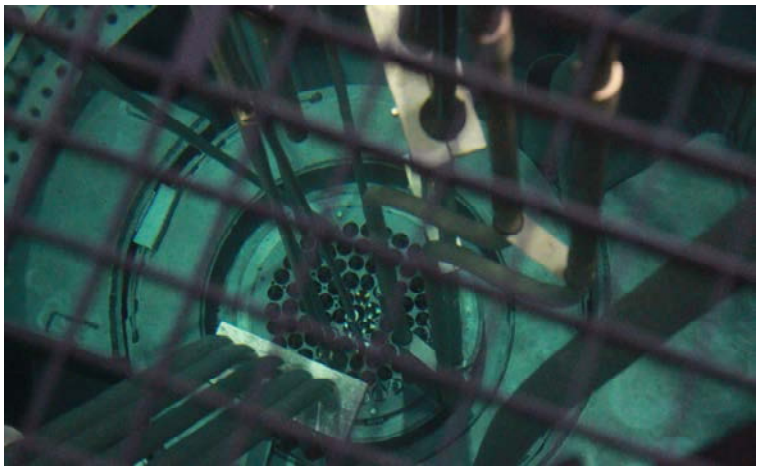
Inside the control room: Situated in Prater, Vienna's giant recreation area, this is where young scientists from across the world study and practice how to operate a nuclear reactor. As the only nuclear facility in Austria, the research reactor hosts numerous IAEA visitors each year, including diplomats, research fellows, and safeguards inspectors.

The panel on top-right shows the number and configuration of fuel assemblies that are currently inserted in the reactor core.

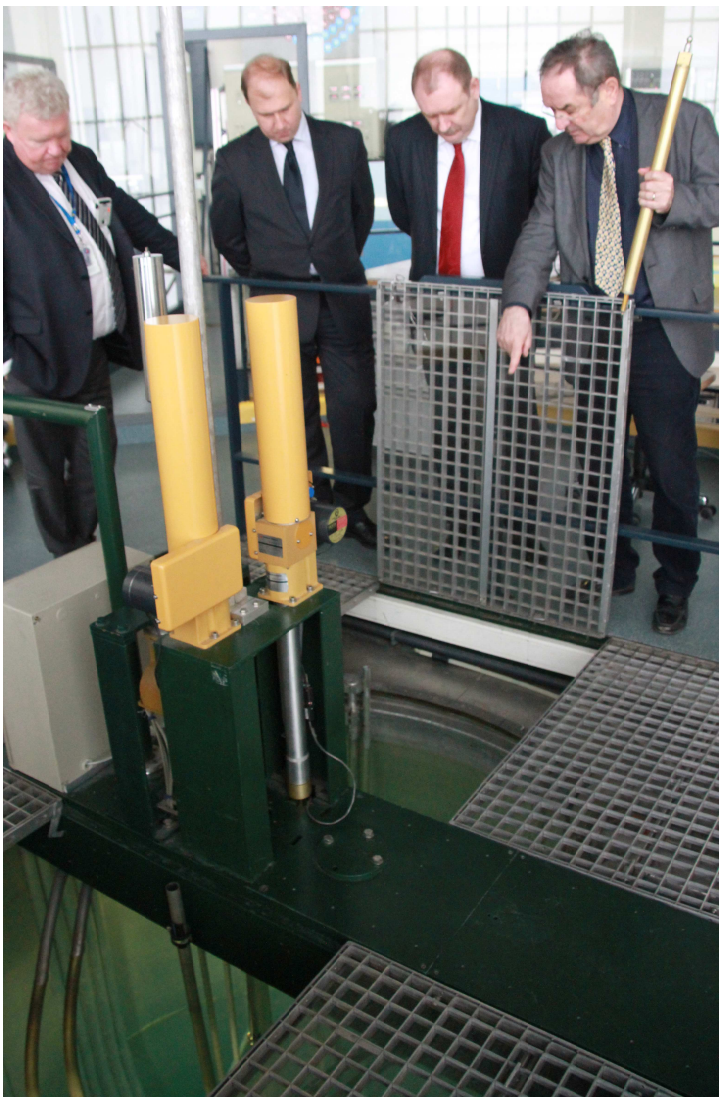
"There are over 60 countries operating research reactors," said DDG Bychkov during his visit, "whereas the number of countries with nuclear power reactors is only half of this."

"One of the core mission areas of the IAEA is to share good practices for research and development, isotope production and for applied studies. This reactor serves as a good example for IAEA Member States with only research reactors of how such facilities can be fully utilized," he added.

"We are very pleased with the cooperation we enjoy with the Vienna University of Technology research reactor and look forward to continued and improved joint work."



The core of the Vienna University of Technology TRIGA Mark-II type research reactor. The reactor was converted from highly enriched uranium (HEU) to low enriched uranium (LEU) fuel in 2012. The IAEA collaborated in the project that included both the conversion of the fuel as well as returning the spent HEU fuel back to the USA.



Standing on top of the reactor core and with a dummy fuel rod in his hand, retired reactor manager Prof. Helmuth Boeck shows how the fuel assemblies and control rods are inserted to the core. In other words, this is how the reactor is operated, controlled and shut down.

The research reactor has been working since 1962. It is a pool type reactor used for training, research and isotope production purposes on an average of 220 days per year, hence the acronym TRIGA: "Training, Research, Isotopes, General Atomics". Currently, there are more than 35 such reactors operating in the world, eight being in Europe.

DDG Bychkov (second left), Nuclear Engineers Sandor Tozser (left) and Mikhail Khoroshev (second right) from the NE Department's Research Reactor Section, were hosted at the Austrian "Atominstitut" by Prof. Helmuth Boeck (centre) and Prof. Helmut Rauch (right), 9 January 2013.

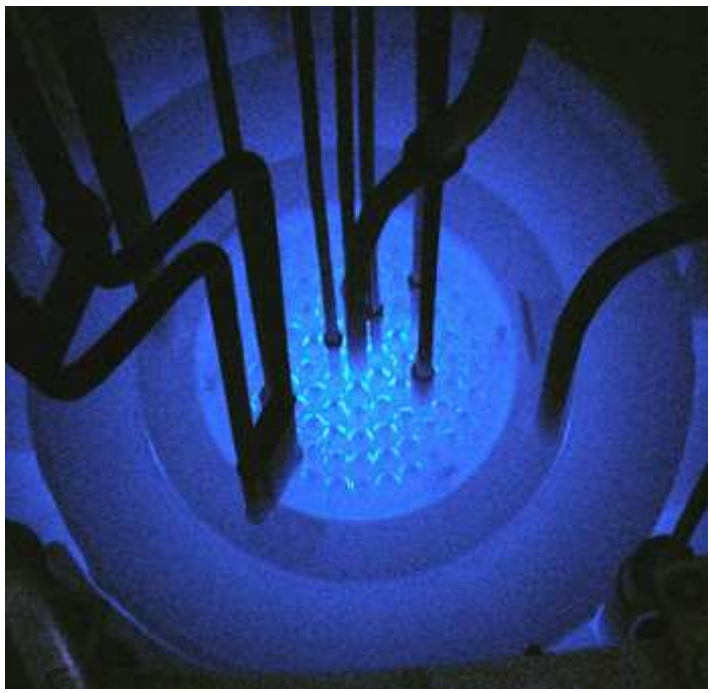
Text & Photos: Ayhan Evrensel (a.evrensel@iaea.org)

Speaking of Research Reactors: A Post-Fukushima Safety Reassessment

New IAEA report to provide guidance

Initial analyses of the March 2011 Fukushima-Daiichi Nuclear Power Plant (NPP) accident that was triggered by a severe earthquake and a subsequent tsunami highlighted the failure of necessary safety systems due to an extended blackout, caused by flooding of the facility. The loss of emergency power and the resulting loss of core fuel coolant caused the melting of the fuel in the reactors' cores and the release of radioactive materials with long-term contamination of the environment in the region.

The accident gave us crucial lessons to define and implement measures to prevent such an accident from happening again at any nuclear installation in the world. This also includes research reactors, although the inventory of radioactive materials at, and thus the potential hazard for, research reactors is much lower than for NPPs. Still, due to old designs and ageing issues, their location near populated areas and often inadequate leak tightness of confinement buildings, majority of research reactors would need a revised safety analysis in light of lessons learned from Fukushima. In this regard, the priority of this complementary assessment should be decided according to the potential hazards associated with the facilities.



The core of the TRIGA Mark II research reactor of the University of Pavia, Italy. (Photo: A. Borio di Tigliole/IAEA)

Based on the current understanding of the accident, lessons from Fukushima could be summarized under several topics, including seismic design, tsunami effect, total loss of electrical power supply, facility safety design, loss of ultimate heat sink, severe accident management, spent fuel storage pools, regulatory effectiveness, and information disclosure.

To ensure a coordinated approach, the Department of Nuclear Safety and Security and the Department of Nuclear Energy looked into the issue together. The IAEA Research Reactor Safety Section of the Division of the Nuclear Installation Safety (RRSS/NSNI) and the Research Reactor Section in the Division of Nuclear Fuel Cycle and Waste Technology (RRS/NEFW) organized a Consultancy Meeting on "Safety Reassessment of Research Reactors Post Fukushima-Daiichi Accident", as well as a Technical Meeting on "Implications of the Fukushima-Daiichi Accident on the Safety of Research Reactors", both in May 2012. The outcome of these two meetings is a future IAEA publication "*Safety Reassessment of Research Reactors in the light of the Fukushima-Daiichi Nuclear Power Plant Accident"*. It is expected to be published in 2013 as a Safety Report but a draft version of the guidelines will be available earlier at IAEA.org.

The new publication will provide guidance for all steps in performing complementary safety assessments for research reactors and associated facilities such as experimental facilities and devices, and radioisotope production facilities. Although it primarily focuses on operating research reactors, its approaches also apply to those that are in the planning, design and construction phases or in an extended shutdown condition. It does not intend to replace or supersede any of the requirements or guidance provided by the relevant IAEA safety standards, including safety analysis, evaluation of seismic and external hazards, and emergency preparedness and response for research reactors.

This publication, however, should be used in close conjunction with the IAEA safety standards. Security topics connected with extreme external events and related emergency response plans are beyond the scope of this document and have to be addressed by the Member States' authorities.

This new Guidelines publication is intended for use by operating organizations, regulatory bodies and other authorities involved in the safety of research reactors. In order to discuss, exchange information and share knowledge on the experience acquired from the Fukushima accident relevant to the safety of research reactors, RRSS/NSNI and RRS/NEFW are planning to hold a follow-up workshop in June 2013.

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Inappropriate storage of disused sealed radioactive sources is a global problem. (Photo: V. Friedrich/IAEA)

Strengthening Control of Radioactive Sources

IAEA-EU joint project highlights cradle-to-grave approach

Sealed radioactive sources are used throughout the world in agriculture, industry, medicine and research. Regulatory and physical control of sealed radioactive sources is normally ensured during manufacturing, distribution and use. However, when sources become disused, and especially when the regulatory infrastructure is weak, there is the possibility for control over these sources to be lost. Weak management of Disused Sealed Radioactive Sources (DSRS), and worse, a complete loss of their control have occurred in the past with major implications for safety and security not only within a state, but sometimes beyond borders.

A 2010 example shows what can happen when control of a DSRS is lost: The University of Delhi in India launched a campus-wide project to remove unused and unwanted equipment. An instrument last used in 1985 was identified for disposal and was sold to a scrap metal dealer in 2010, without anyone realising that it contained a Cobalt-60 source. The new owner cut off a piece of the source for testing and kept it on his person. Soon, he developed skin lesions and other symptoms of radiation sickness. The authorities did find the radioactive source the next day, but seven individuals were hospitalized with radiation injuries, one of whom died from multiple organ failures due to high radiation exposure.

To avoid such incidents, the IAEA works to strengthen the management of DSRS in all Member States. In particular, organisations responsible for managing and regulating sources are strongly encouraged to investigate and select viable options for safe, secure, sustainable and economical long-term management of DSRS. In deciding on an appropriate management option the following factors should be considered:

- If not managed properly, radioactive sources can pose a significant hazard to human health and the environment, which is evident from the global number of incidents and fatalities.
- Security measures to prevent any malicious use of DSRS are of paramount importance. However, building and making available secure storage facilities alone is only an interim solution; it does not guarantee long-term good management.
- Long-term storage without an adequate infrastructure and resources is not a sustainable solution as there will be maintenance costs that may be difficult to bear.
- Repatriation of sources to the country of origin is expensive and sometimes not even possible.

To protect the public and the environment from the hazards of ionizing radiation, long-term management of radioactive sources must cover their entire lifecycle, from production and use to disposal. Such a “cradle to grave” approach is essential to prevent disused sources from falling outside regulatory control and becoming “orphan”. It also ensures that acceptable and lasting solutions are found: repatriation to the country of origin, transport to a third country (e.g. for re-use or recycling) or disposal. The starting point for comprehensive and robust source management is an appropriate national policy and strategy,

Experts attending the regional meeting on DSRS Management in Sharm El Sheikh, Egypt, September 2012 (Photo: IAEA)

a suitable legal and regulatory framework, and adequate resources and infrastructure.

To support Member States in developing capabilities and capacity for long-term DSRS management, the IAEA launched in 2012 the project "Strengthening Cradle-to-Grave Control of Radioactive Sources in the Mediterranean Region". The four-year project is jointly funded by the IAEA and the European Office of Development and Cooperation. Technical inputs are provided by IAEA staff from the Waste Technology Section of the Department of Nuclear Energy as well as the Waste and Environmental Safety Section, and the Regulatory Infrastructure and Transport Safety Section, both within the Department of Nuclear Safety and Security. Project Management is coordinated by the IAEA Department of Technical Cooperation.

Although the project focus is primarily on supporting countries around the Mediterranean Basin, several sub-Saharan African countries are also included. The number of Member States taking part in the project has now grown to 19: Albania, Bosnia and Herzegovina, Croatia, Cyprus, Egypt, Ghana, Greece, Jordan, Lebanon, Libya, Malta, Montenegro, Morocco, Nigeria, Slovenia, the Former Yugoslav Republic of Macedonia, Tunisia, Turkey and the United Republic of Tanzania.

After the initial Technical Meeting, held in March 2012 in Vienna, several National Workshops have been organised to clarify and strengthen national policies and strategies with respect to DSRS management. In a September 2012 regional meeting in Sharm El Sheikh, Egypt, participants presented their national DSRS management policies, strategies, as well as infrastructure, legal and regulatory frameworks, DRSR inventories and existing or planned facilities for the conditioning, storage and disposal of DSRS. The presentations confirmed that most countries have yet to adopt comprehensive cradle-to-grave policies to achieve satisfactory end-points. Resource gaps and challenges in DSRS management were identified.

Another specific area identified for improvement was the safety culture at both regulatory bodies and within the organisations responsible for the operation of radioactive waste management facilities. Based on common and country-specific challenges, the IAEA is now prioritising needs for providing further assistance in the formulation and/or consolidation of national policies and the implementation of action plans for managing DSRS. The IAEA pays special attention to ensure that such plans result in safe and secure end-points. Where re-use, recycling or repatriation may not be possible, an alternative end-point might be borehole disposal, especially for countries in which DSRS is the only type of radioactive waste to be dealt with.

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IAEA helps Honduras condition over 100 disused sealed sources

The IAEA has been working to improve safety and security conditions in Member States by assessing inventories of sealed radioactive sources and performing disused sealed radioactive source (DSRS) conditioning and removal projects. Recently, Honduras has requested IAEA assistance for the safe management of its DSRS. The Source Management Unit (SMU) of the Waste Technology Section in the IAEA Department of Nuclear Energy has for several months assisted Honduras in this endeavour.

As a result, 124 DSRSs have been recovered between June 2011 and April 2012 from different premises and safely transported to the country's Central Storage Facility (CSF).

The conditioning operation was the next step to put these sources under safe and secure conditions. Out of the six companies that have submitted bids, the IAEA has contracted Hungaroster Co. Ltd., of Hungary, to carry out this operation, which took place in Tegucigalpa from 19 to 23 November 2012.

Meticulous preparation

Before the actual operations, the following activities were carried out:

Fig.1: Handling DSRS prior to encapsulation.

Fig.2: Measuring dose rate on the shield container containing the encapsulated radioactive sources.

Fig.3: Final package with conditioned ^{226}Ra, ^{137}Cs and ^{241}Am sources.

Fig.4: Measuring dose rate on the final package with the shield and the encapsulated sources.

- The contractor provided relevant documentation to support a licence application for the operations;
- The national regulatory authority, the Honduras Ministry of Natural Resources and the Environment (SERNA), reviewed and approved the corresponding authorization;
- The IAEA's SMU representative verified the inventory of all radioactive sources to be conditioned and recovered a $^{137}Cs/^{241}Am$-Be source from a device.
- The team covered the floor of the entire working area, and erected the working ventilation hood and shield. They installed and tested the ventilation system, and prepared the concrete-lined drum.
- The IAEA's SMU representative verified that the working conditions in the operational area fully met the technical requirements according to the NEFW Waste Technology Section's (WTS) operational manual for conditioning low activity DSRS.
- Dry runs of planned operations were conducted and all safety aspects were discussed.

Conditioning of DSRS

Conditioning includes all operations that produce a waste package suitable for handling, transport, storage and/or disposal. As such, for this particular project in Honduras, radium and caesium tubes, needles, and spheres were removed from the original containers (Fig.1) and transferred to the conditioning area. Altogether, 88 ^{226}Ra sources with a total activity of 391 mCi (14.48 GBq), 33 ^{137}Cs sources with a total activity of 449 mCi (16.61 GBq), and two Am/Be sources with a total activity of 110 mCi (4.07 GBq) were conditioned into six capsules.

The capsules were welded, tested and placed into the shield container. The shield lid was welded to the shield container, and the dose rate on the external surface measured and registered (Fig.2). The shield container was placed in the cavity of a concrete-lined drum and two bars were welded for security reasons (Fig.3). The dose rate at the external surface of the container and at 1 m was measured and registered (Fig.4). The container was placed in the designated area at the storage facility, with detailed information about the content on a metallic plate. Fig.5 shows the final product, the waste package HON-01.

The IAEA's SMU representative monitored all operations, which were conducted according to written and approved procedures. A final Protocol was prepared and signed by representatives from both the contractor and the national counterpart and by the IAEA's officer.

Substantial Improvements in Safety & Security

The Honduras mission was organized by the IAEA Department of Technical Cooperation and carried out by the Waste Technology Section (WTS) of the Division of Nuclear Fuel Cycle and Waste Management (NEFW).

The mission was accomplished by successfully conditioning these radioactive sources, and the situation regarding the safety and security of DSRS in Honduras was substantially improved. The SMU is also currently planning an operation to remove other higher-activity DSRSs from the country. The sources will be either returned to the country of origin or to another country for recycling and reuse.

Text & Photos: Juan Carlos Benitez-Navarro
(j.c.benitez-navarro@iaea.org)

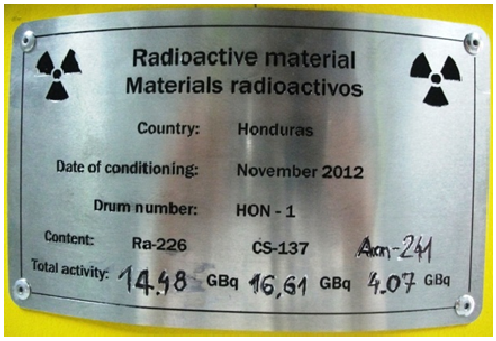
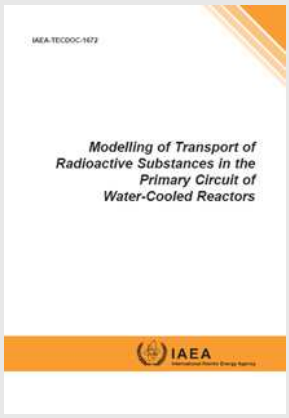


Fig.5: All conditioned radioactive sources in the waste package under safe and secure conditions at Centralized Storage Facility.

Recent Publications

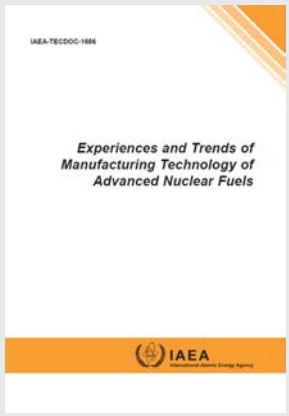


IAEA-TECDOC-1672

Modelling of Transport of Radioactive Substances in the Primary Circuit of Water Cooled Reactors
(2012)
www-pub.iaea.org/MTCD/publications/PDF/TE_1672_web.pdf

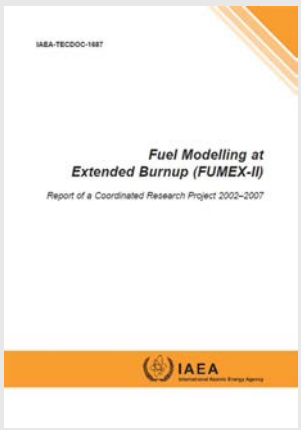
IAEA-TECDOC-1680

Spent Fuel Performance Assessment and Research: Final Report of a Coordinated Research Project (SPAR-II)
(2012)
www-pub.iaea.org/MTCD/publications/PDF/TE_1680_web.pdf



IAEA-TECDOC-1686

Experiences and Trends of Manufacturing Technology of Advanced Nuclear Fuels
(2012)
www-pub.iaea.org/MTCD/publications/PDF/TE_1686_web.pdf

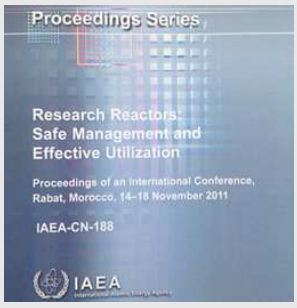


IAEA-TECDOC-1687

Fuel Modelling at Extended Burnup (FUMEX-II): Report of a Coordinated Research Project 2002-2007
(2012)
www-pub.iaea.org/MTCD/publications/PDF/TE_1687_web.pdf

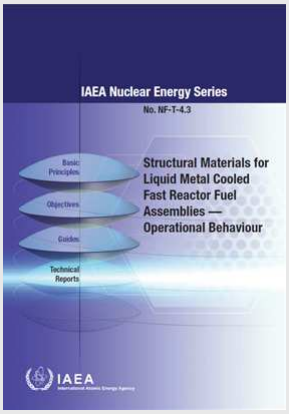
IAEA-TECDOC-1690

Review of Sealed Sources Designs and Manufacturing Techniques Affecting Disused Source Management
(2012)
www-pub.iaea.org/MTCD/publications/PDF/TE_1690_web.pdf



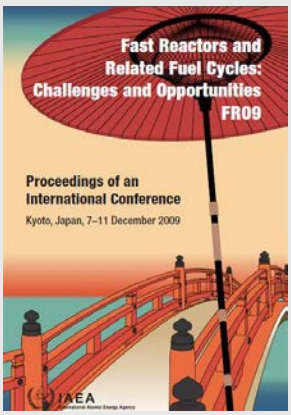
Research Reactors: Safe Management and Effective Utilization

Proceedings of an International Conference, Rabat, Morocco, 14-18 November 2011
Proceedings CD Series
(2012)
www-pub.iaea.org/MTCD/publications/PDF/P1575_CD_web/datasets/foreword.html



IAEA Nuclear Energy Series NF-T-4.3

Structural Materials for Liquid Metal Cooled Fast Reactor Fuel Assemblies — Operational Behaviour
(2012)
www-pub.iaea.org/MTCD/publications/PDF/Pub1548_web.pdf



Fast Reactors and Related Fuel Cycles: Challenges and Opportunities (FR09)

Proceedings of an International Conference Held in Kyoto, Japan, 7-11 December 2009
(2012)
www-pub.iaea.org/MTCD/publications/PDF/Pub1444_web.pdf

NEFW Online

NEFW Home

- www.iaea.org/NuclearFuelCycleAndWaste

Nuclear Fuel Cycle and Materials Section (NFCMS)

- Main activities: www.iaea.org/NE/NuclearFuelCycle
- Technical Working Group on Nuclear Fuel Cycle Options (TWGNFCO) www.iaea.org/NE/NuclearFuelCycle/twgnfco
- Technical Working Group on Water Reactor Fuel Performance and Technology (TWGFPT) www.iaea.org/NE/NuclearFuelCycle/twgfpt
- Integrated Nuclear Fuel Cycle Information System (iNFCIS) www.iaea.org/NE/NuclearFuelCycle/infcis

Waste Technology Section (WTS)

- Main activities: www.iaea.org/NE/WasteTechnology
- International Radioactive Waste Technical Committee (WATEC) www.iaea.org/NE/WasteTechnology/watec
- Technical Group on Decommissioning (TEGDE) www.iaea.org/NE/WasteTechnology/tegde
- Databases (NEWMDB, DRCS) www.iaea.org/NE/WasteTechnology/databases

Research Reactor Section (RRS)

- Main activities: www.iaea.org/NE/ReseachReactors
- Technical Working Group on Research Reactors (TWGRR) www.iaea.org/NE/ReseachReactors/twgrr
- Research Reactor Database http://nucleus.iaea.org/RRDB/RR/ReactorSearch.aspx?rf=1

Introducing the Authors

Greg Webb is a Press and Public Information Officer in the Media and Outreach Section of the IAEA Division of Public Information. His Section has corporate responsibility for relations with the media and the public.

Vladimir Michal is the team leader of the Decommissioning and Environmental Remediation Team in the Waste Technology Section. His work includes a wide range of technical and non-technical aspects related to decommissioning of nuclear facilities and environmental remediation of contaminated sites.

Horst Monken Fernandes is an Environmental Remediation Specialist in the Waste Technology Section. He provides support to Member States on environmental remediation programmes. He is also responsible for the Network of Environmental Management and Remediation (ENVIRONET).

Akira Izumo is a Public Information Specialist in the Waste Technology Section and is involved in activities aimed at improving public communication in the field of nuclear fuel cycle. He coordinates overall activities of EPPUNE.

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Ayhan Evrensel is the Communication Adviser of the NE Department. He coordinates the Department's internal and external communication strategies and is the editor of this edition of the NEFW Newsletter.

Andrea Borio di Tigliole is a Nuclear Engineer in the Research Reactor Section. He provides support to Member States that are considering the construction of a new research reactor. This includes assistance in developing the justification for a research reactor and in implementing the infrastructure needed to support all phases of the project.

Paul Degnan is a Nuclear Engineer in the Waste Technology Section. He provides support to Member States concerning the design and implementation of repository programmes, including the borehole disposal of disused sealed radioactive sources. He is the Scientific Secretary for the Underground Research Facility (URF) Network.

Juan Carlos Benitez is a Nuclear Engineer in the Waste Technology Section. The focus is on providing support to Member States upgrading their disused sealed radioactive source (DSRS) infrastructure and strengthening their technical/operational capabilities to safely and securely manage DSRS.

IAEA
International Atomic Energy Agency

Nuclear Fuel Cycle and Waste Technology

Upcoming Meetings in 2013

Date	Title	Place	Contact
5-7 Jun	Technical Working Group on Nuclear Fuel Cycle Options and Spent Fuel Management (TWGNFCO)	Vienna Austria	G.Dyck@iaea.org
12-14 Jun	TM on Uranium 2013: Resources, Production and Demand (UGM)	Vienna Austria	A.Hanly@iaea.org
17-19 Jun	TM on Metasomatite Uranium Occurrences and Deposits	Vienna Austria	H.Tulsidas@iaea.org
17-21 Jun	TM on the Use of Radioisotopes for Estimating Ground Water Residence Times and Determining Groundwater Flow Pathways	Trieste Italy	P.Degnan@iaea.org
17-21 Jun	TM on Decision Making Process in the Remediation of Sites Affected by Nuclear and Radiological Accidents	Vienna Austria	H.Monken-Fernandes@iaea.org
17-21 Jun	TR/WS on the Implementation of Integrated Management Systems for Research Reactors	Vienna Austria	A.Borio@iaea.org
24-28 Jun	TR/WS on Implementation of the Complementary Safety Assessment for Research Reactors Post Fukushima-Daiichi	Vienna Austria	A.Borio@iaea.org
2-4 Jul	TM on Spent Fuel Storage Options	Vienna Austria	P.Standring@iaea.org
26-30 Aug	TM of the Uranium Mining and Remediation Exchange Group (UMREG 2013)	Straz Czech Republic	P.Woods@iaea.org
3-5 Sep	TM on Uranium Production Cycle Network on Education and Training (UPNET)	Vienna Austria	P.Woods@iaea.org
9-5 Sep	TM/DISPONET Workshop on Disposal of Low and Intermediate Level Waste	Vienna Austria	P.Ormai@iaea.org
24-27 Sep	TM on Thorium Resources and Provinces	Vienna Austria	H.Tulsidas@iaea.org
30 Sep-4 Oct	TM on Repository Design for VLW, Low-level and Intermediate-level Wastes	Vienna Austria	J.Faltejsek@iaea.org
7-10 Oct	Annual Meeting of Labonet Network	Vienna Austria	S.K.Samanta@iaea.org
7-10 Oct	TM on Uranium Production Cycle Pre-feasibility and Feasibility Assessment	Vienna Austria	P.Woods@iaea.org

Impressum

Fuel Cycle and Waste Newsletter
Vol. 9, No. 1, March 2013

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

International Atomic Energy Agency
Vienna International Centre, PO Box 100, 1400 Vienna, Austria
Printed by the IAEA in Austria, March 2013

13-07241