IAEA Research Reactor Operations & Maintenance Support

2013 TRTR Meeting
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St. Louis, MO
Ritz Carlton

By Charles R Morris

Research Reactor Section | 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 |

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Contents

1. Introduction and Departmental Structure of the IAEA
2. Digital I&C Projects
3. Improved Instrumentation and Control (I&C) Maintenance Techniques for Research Reactors
4. Condition monitoring and incipient failure detection of rotating equipment at Research Reactors
5. Operations and Maintenance Assessment of Research Reactors OMARR and IRON
6. In service inspection
7. Material Properties Database for Irradiated Core Structural Components
8. Research Reactor O&M Publications
9. Establishment of Material Properties Database

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1. Departmental Structure of the IAEA

Director General
Mr. Yukiya Amano

Department of Technical Co-operation
Mr. K. Aning

Department of Nuclear Energy
Mr. A. Bychkov

Department of Nuclear Safety and Security
Mr. D. Flory

Department of Management
Ms. J. Dunn Lee

Department of Safeguards
Mr. H. Nackaerts

Department of Nuclear Sciences and Applications
Mr. D. Mohamad

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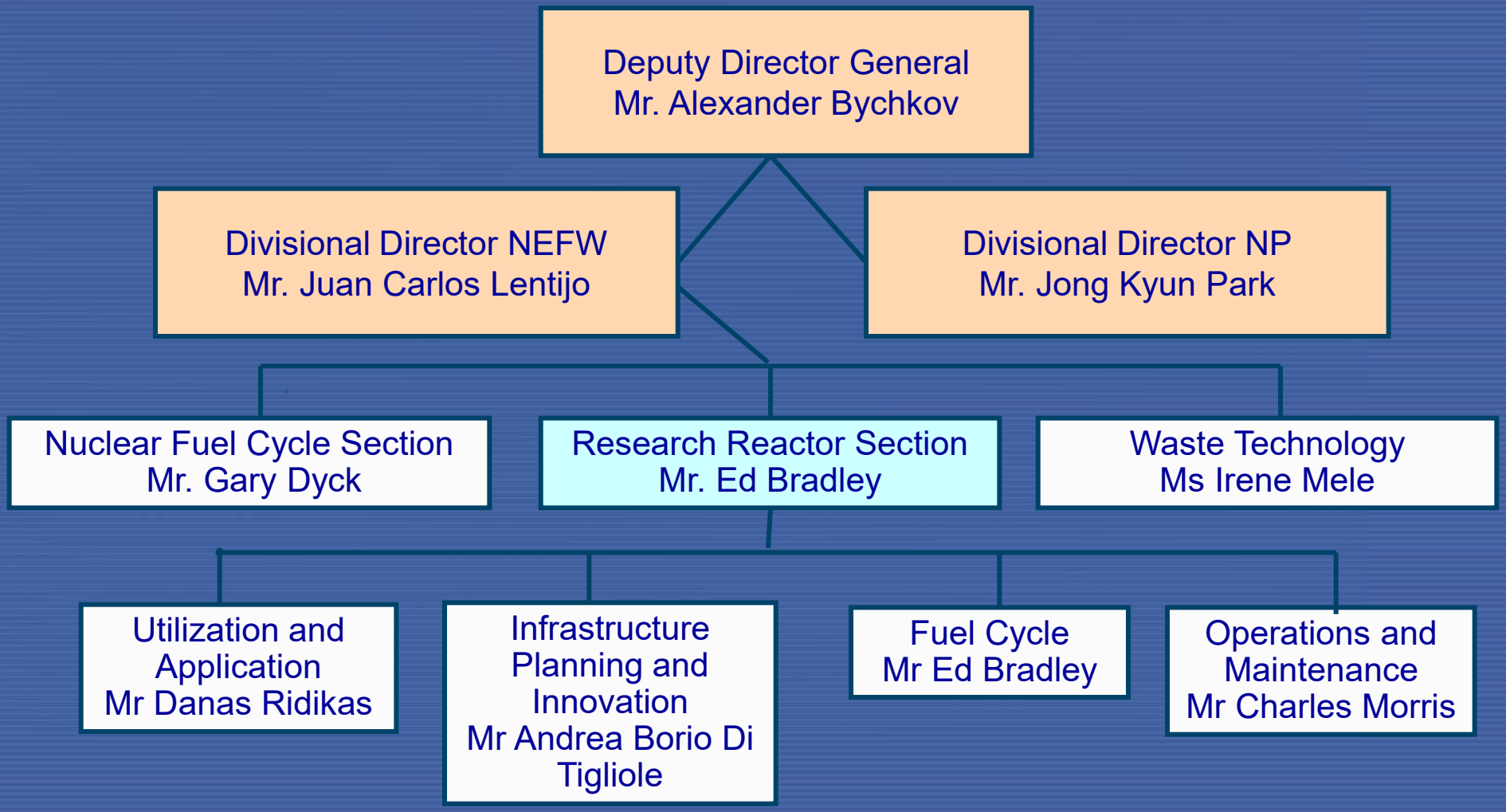
Departmental Structure of the Nuclear Energy Division



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IAEA assistance to global Research Reactors

- Peer Review missions
- Meetings and workshops
  - Consultants' Meetings
  - Technical Meetings
  - Technical Cooperation Workshops / Training Courses
  - International Conferences and Symposia
  - International Expert's Meetings
  - Coordinated Research Projects (CRP)
- Technical Cooperation (TC) projects
- Publications (standards, guidance, and other documents)
- Mobilization of international experts

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Age Distribution of RRs

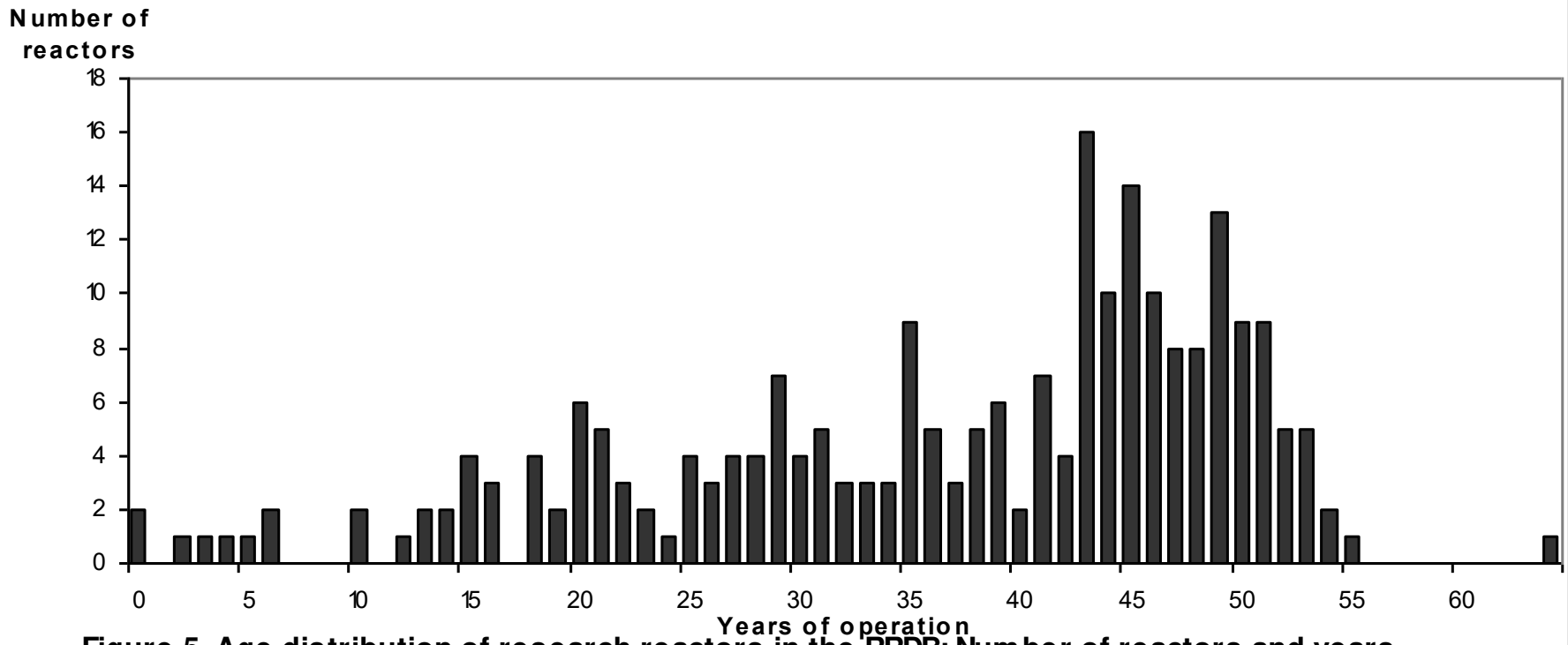

Figure 5. Age distribution of research reactors in the RRDB: Number of reactors and years in operation

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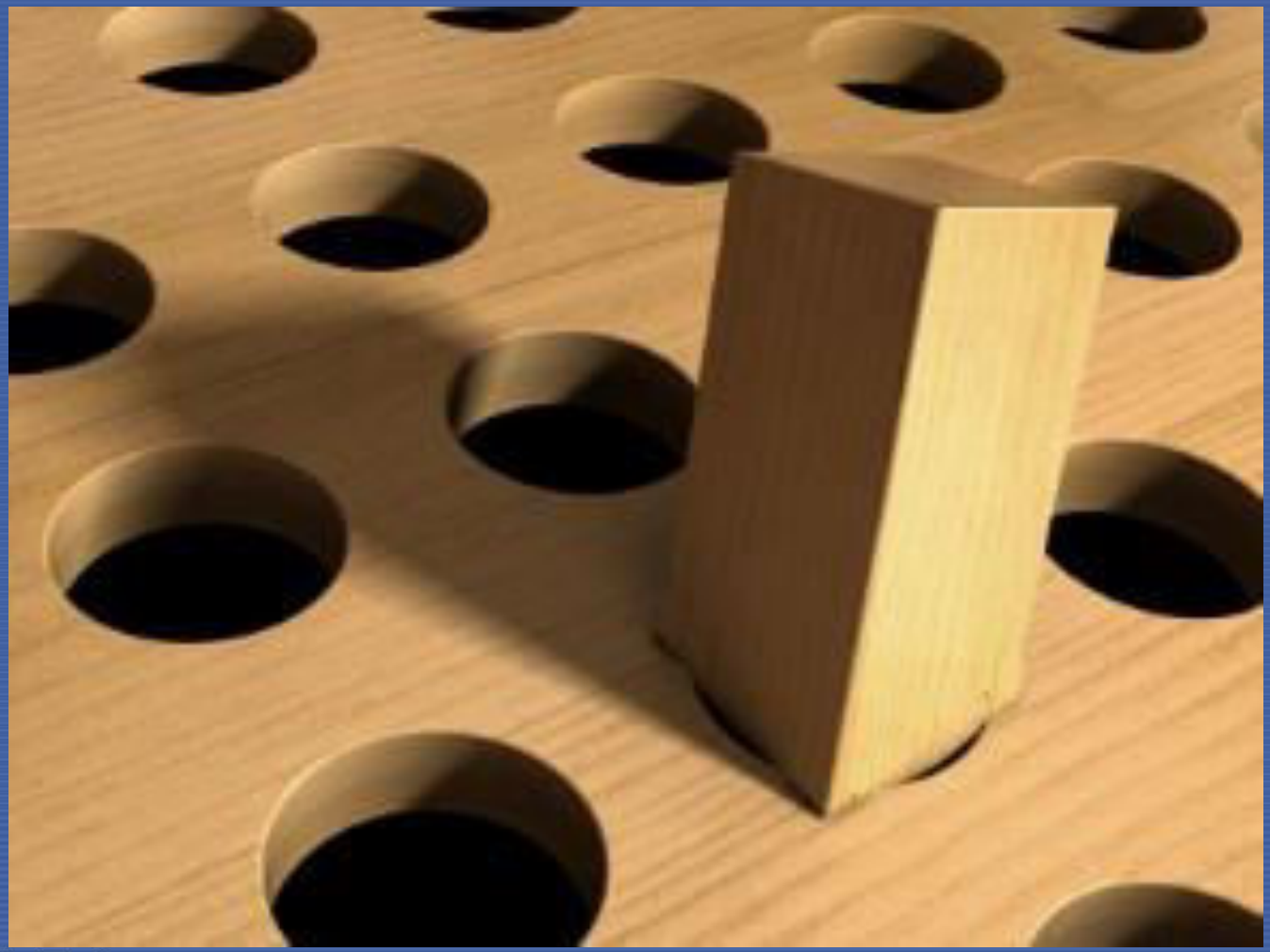
2. Digital I&C Projects



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Current I&C Digital Upgrades Supported by NEFW's RR Section for Developing Member States

- Uzbekistan 10MW WWRM Digital RPS and Nucleonics upgrade.
  - Supporting Member State in FAT
  - Support in specifications for new field sensors
- Kazakhstan 6MW WWRM Digital Upgrade, Nucleonics and CR Drives
  - Bid Review and support through the DOE (Peaceful Uses Initiative)
- Malaysia 1MW Triga Mark 2 Digital Upgrade
  - IAEA has helped in rewriting of the technical specification and is on standby for support
- Mexico 1MW Triga Mark III Digital Upgrade
  - IAEA has been asked to review the technical specification and is on standby for additional support
- Congo and Jamaica have recently requested support for an upgrade

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RR Digital I&C Tech Doc

This document is a guide for member states contemplating a digital upgrade or for a new research reactors.

The first meeting was held March 2011 and concluded with a draft skeleton, and work assigned to each consultant (4).

Second consultancy was held in June, 2011 and the document was fully fleshed out but required consolidation.

A consultant was hired to consolidate and unify the draft document

A Technical Meeting was held in May 2012 where the document was discussed, comments received, and Member States made presentations on their digital upgrades, proposed upgrades, or new facilities.

The document has now been formatted for IAEA acceptance and will comprise the consultants work with the upgrade examples from the member states. Final document issuance is hoped for the last quarter of 2013

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Typical Issues in Analogue to Digital Conversions

Dealing with the regulatory agency

Space requirements…usually okay for computers processors, main control room panels but field cabling, sensors may be difficult
Design basis/SAR requirements

Mindset of staff regarding computer screen interfaces and upgrade to voting logic and additional sensors

Additional sensors may require new thermowells and new tap in points how to proceed?

Configuration Management, drawings, specifications not current, new environmental & seismic issues

An Unusual Issue in a Refurbishment

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Problems with Field Cabling

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From Tubes to Processors

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Field Sensor Issues

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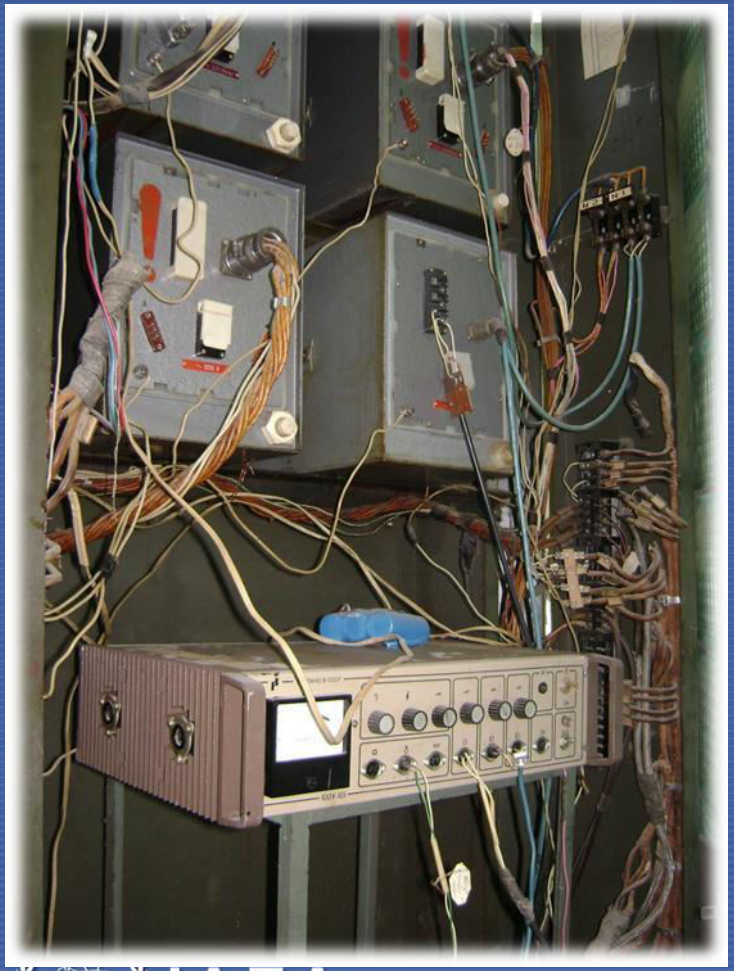
Wiring Issues
(Configuration Management)



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3. Improved Instrumentation and Control (I&C) Maintenance Techniques for Research Reactors using the Plant Computer CRP# T34001

- The CRP will result in guideline documents for research reactors to replace time based calibrations with condition based calibrations. Additionally benchmark results and a database of baseline signals, data, and information for the benefit of the worldwide research reactor community in improving plant maintenance methodology will be produced. Based on similar work completed for NPPs

- The CRP was approved in February 2011 and the first Consultancy was held in December 2011 with 8 participants.

- The first CSM was held December 2012 with 20 participants from 9 member states

- Next CSM will be held February 17th through 21st 2014 at the IAEA in Vienna with hopefully 25 participants from 12-15 member states.

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4. Condition monitoring and incipient failure detection of rotating equipment at Research Reactors CRP # T34003

Improved knowledge of equipment, system and plant conditions can be exploited using OLM to improve operational availability and safety by:

- Identification of abnormal plant conditions through monitoring sensor interrelationships
- Condition assessment of plant components and early warning of sensor or component degradation
- Compression of the information from a multitude of sensors that may need to be reviewed instead of the currently identified sensors of the control and safety systems
- Faster actions in response to abnormal conditions identified due to the above compression of information

This CRP has been designated to start with the completion of CRP T34001 however a kick off Technical meeting which was initially scheduled for this October 14-18 at the Demokritos reactor in Greece has been postponed, indefinitely.

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5. Operations and Maintenance Assessment of Research Reactors OMARR

- OMARR is an IAEA service to provide advice and assistance to Member States to improve their operational and maintenance (O&M) practises by peer to peer reviews.
- OMARR missions consist of a pre-meeting at the facility, the main mission, and a follow-up mission if requested
- OMARR results and recommendations are confidential and are not sent to the regulatory agency
- NIST and LENA reactors were the first two Facilities to have an OMARR mission and a NIST follow-up meeting will be held this November.
- IRON, (International Research Reactor Operations and Maintenance Network) potential to set up a network of RRs. This may be done based on reactor type or power

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6. In service inspection equipment to enable member states to address aging issues

- The RRS will be purchasing a suite of mechanical and electrical in service inspection equipment to address aging concerns.
- The agency will, on request assemble an experienced team of experts to utilise this equipment to inspect the following mechanical SSCs:
  - Fuel assemblies, core internals, reactor vessels, pool liners, thermal shields, beam tubes, piping, pumps, valves, heat exchangers and any other equipment as required
- Additionally electrical inspection, either by the facility, or a team of agency experts, can address aging effects on electrical equipment. This may also include the supply of insitu monitoring equipment for temperature and radiation levels.
- The RRS is investigating the purchase of sensor time response testing equipment to assist facilities in validating tech specs.

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7. Establishment of Material Properties Database for Irradiated Core Structural Components CRP T34002

- This CRP will provide a material properties Database for irradiated core structural components. The Database will be a compilation of data from research reactor operator input, comprehensive literature reviews and experimental data from research reactor. This effort is part of the aging management work to assist RRs in identifying possible areas for increased surveillance by in service inspections, to minimize unpredicted failures of core components and to mitigate lengthy and costly shutdowns.

- The present status is that we have started the evaluation of the research proposals for the CRP

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8. IAEA Publications

Research Reactor Publications

- IAEA, IAEA Safety Standards Series No. SSG-20, 'Safety Assessment for Research Reactors and Preparation of the Safety Analysis Report', Vienna (2012
- IAEA, IAEA Safety Standards Series No. SSG-10, 'Ageing Management for Research Reactors', Vienna (2010).
- IAEA, IAEA TECDOC Series No. 1625, 'Research Reactor Modernization and Refurbishment', Vienna (2009).
- IAEA, IAEA Nuclear Energy Series No. NP-T-5.4, 'Optimization of Research Reactor Availability and Reliability: Recommended Practices', Vienna (2008).
- IAEA, Safety Standards Series No. NS-G-4.5, 'The Operating Organization and the Recruitment, Training and Qualification of Personnel for Research Reactors - Safety Guide', Vienna (2008).
- IAEA, Safety Standards Series No. NS-G-4.4, 'Operational Limits and Conditions and Operating Procedures for Research Reactors - Safety Guide', Vienna (2008).
- IAEA, Safety Standards Series No. NS-G-4.2, 'Maintenance, Periodic Testing and Inspection of Research Reactors Safety Guide', Vienna (2007).
- IAEA, IAEA TECDOC Series No. 1263, 'Application of Non-Destructive Testing and In-service Inspection to Research Reactors', Vienna (2001).

9. IAEA Research Reactor Links

- RRS Home page http://www.iaea.org/OurWork/ST/NE/NEFW/Technical_Areas/RRS/home.html
- RRDB: http://nucleus.iaea.org/RRDB/RR/ReactorSearch.aspx
- Ageing Database: http://www.iaea.org/OurWork/ST/NE/NEFW/Technical_Areas/RRS/databases.html
- TRIGA network: http://triga-world.net/index.html
- NEA Committee on nuclear safety of installations: http://www.oecd-nea.org/nsd/csni/
- NEA High Level Group on medical radioisotopes: http://www.oecd-nea.org/med-radio/security/
- Int'l Group on Research Reactors: http://www.igorr.com/scripts/home/publigen/content/templates/show.asp?L=EN&P=55&ITEMID=2
- RRS O&M I&C CRPs : http://www.rrcrp.com/

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Research Reactor Section O&M

I hope you have a productive meeting
and a pleasant stay in St. Louis
Thank you

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