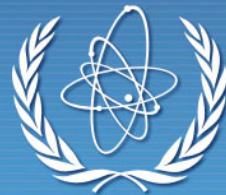


# **IAEA Research Reactor Operations & Maintenance Support**

**2014 TRTR Meeting  
August 3rd-7th, 2014  
Benson Hotel  
Portland Oregon**

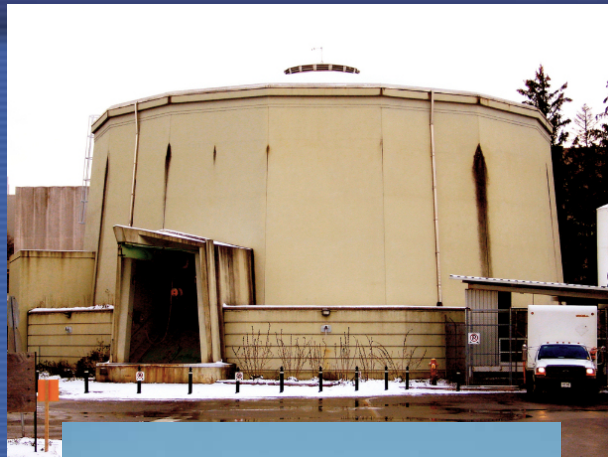
**By Charles R Morris**



**IAEA**

International Atomic Energy Agency

# Personal Nuclear History



# Contents

1. Introduction
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
6. In service inspection
7. Material Properties Database for Irradiated Core Structural Components
8. Configuration Management
9. Research Reactor O&M Publications
10. Establishment of Material Properties Database

# 1. Introduction to 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

# Departmental Structure of the Nuclear Energy Division

Deputy Director General  
Mr. Alexander Bychkov

Divisional Director NEFW  
Mr. Juan Carlos Lentijo

Divisional Director NP  
Mr. Jong Kyun Park

Nuclear Fuel Cycle Section  
Mr. Gary Dyck

Research Reactor Section  
Mr. Ed Bradley

Waste Technology  
Ms Irene Mele

Utilization and  
Application  
Mr Danas Ridikas

Infrastructure  
Planning and  
Innovation  
Mr Andrea Borio Di  
Tigliole

Fuel Cycle  
Ms Frances  
Martshall

Operations and  
Maintenance  
Mr Charles Morris

# 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

# 2. Current I&C Digital Upgrades Supported by the IAEA

- 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
- Istanbul Technical University discussed their proposed upgrade in a meeting in June this year

# RR Digital I&C Tec 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 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 finally been approved for publication and is expected to be issued by the end of this quarter.



# NEW RR Digital I&C Tech Doc

A new document is being proposed to capture newly applied techniques to RR digital systems and to address maintenance and aging concerns of digital I&C systems.

A Technical meeting is being proposed for the first quarter of 2015

A TECDOC will be generated from member states submittals and this is hoped to be a supplement to the Digital I&C Upgrade TECDOC that will be issued soon

This work was approved at the recent TWGRR meeting in Vienna

### 3. Improved 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 RCM was held December 2012 with 20 participants from 9 member states
- The last RCM was held February 17<sup>th</sup> through 21<sup>st</sup> 2014 at the IAEA in Vienna with over 30 participants from 15 member states.
- A consultancy meeting will be held the first week in December 2014 and will be used to finalise the CRP document and prepare for the second CRP in this series

## 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 after the completion of CRP T34001. The first RCM will be held the first quarter of 2015, location to be determined

# 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. OMARR is a way to interface with your peers and exchange ideas with the aim of increasing availability and reliability
- NIST (USA) and LENA (Italy) reactors were the first two Facilities to have an OMARR mission.
- IAEA Nuclear Energy Series No. NP-T-5.4 is to be revised to include OMARR's work statement

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

- The RRS is purchasing a suite of mechanical and electrical in service inspection equipment to address aging concerns. Cameras, eddicurrent testing etc.
- 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.

## 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 first RCM was held in November 2013 and the second RCM is presently scheduled for November 2014 in Korea.

# 8. Configuration Management Issues at RRs

- Lack of proper funding for O&M is perhaps the biggest contributor to poor configuration management at RRs



# Configuration Management Issues at RRs

- O&M budgets are generally over shadowed by end user requirements. NPPs focus on electricity production only and therefore typically do not have this problem

End User



O&M

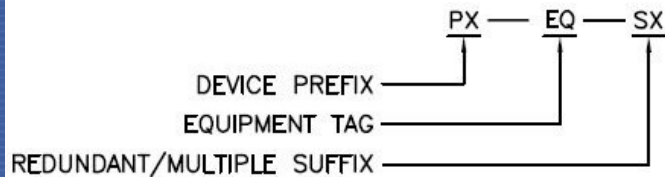




# Configuration Management Issues at RRs

ISO 9001 accreditation led to Equipment Labeling, and revisions to the majority of documentation at HIFAR

## INSTRUMENT/DEVICE TAGS



**NOTE:** HYPHENS ARE NOT RQD BETWEEN PX AND EQ.

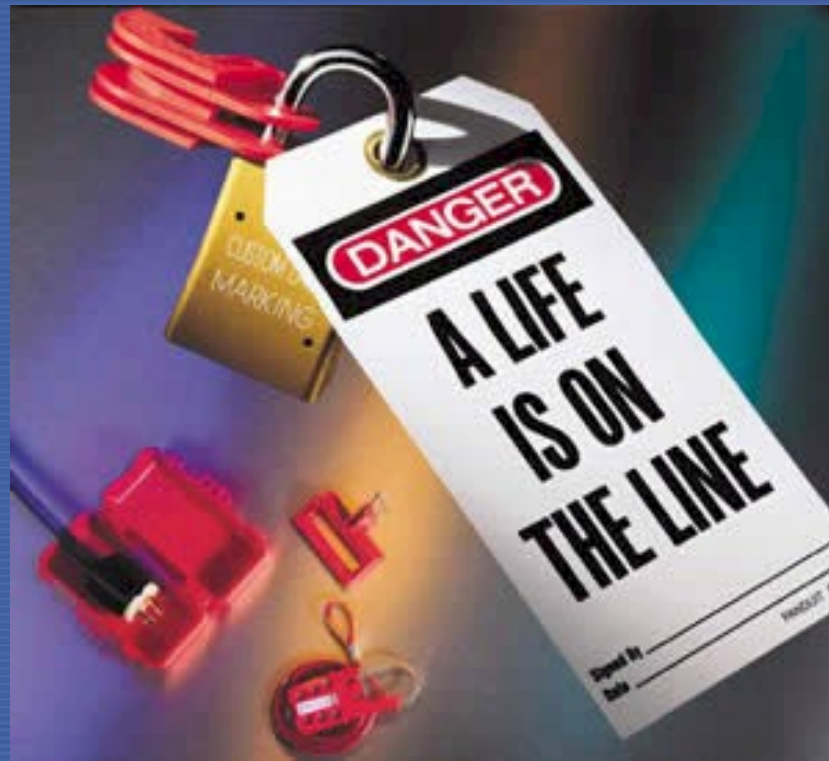
### REDUNDANT/MULTIPLE SUFFIX RULES:

1. UTILIZE SEQUENTIAL NON-HYPHENATED ALPHABETIC SUFFIXES FOR REDUNDANT DEVICES.
2. FOR MULTIPLE ITEMS OF SAME TYPE, EMPLOY A SEQUENTIAL, HYPHENATED NUMERIC SUFFIX.



# Configuration Management Issues at RRs

Proper labelling is paramount



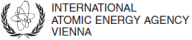
# 9. IAEA Publications

**IAEA  
SAFETY  
STANDARDS  
SERIES**

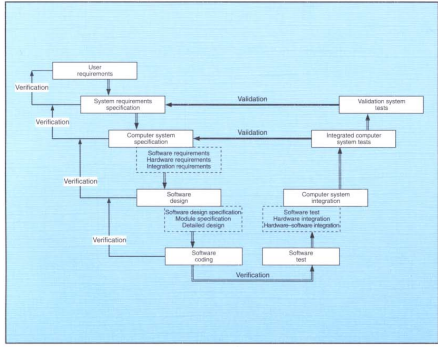
**Instrumentation and  
Control Systems  
Important to Safety in  
Nuclear Power Plants**

**SAFETY GUIDE**

No. NS-G-1.3




INTERNATIONAL  
ATOMIC ENERGY AGENCY  
VIENNA



TECHNICAL REPORTS SERIES No. **384**

**Verification and Validation  
of Software  
Related to Nuclear Power Plant  
Instrumentation and Control**




INTERNATIONAL ATOMIC ENERGY AGENCY, VIENNA, 1999

IAEA-TECDOC-1402

**Management of life cycle and  
ageing at nuclear power plants:  
Improved I&C maintenance**

*Report prepared within the framework of the Technical Working Group  
on Nuclear Power Plant Control and Instrumentation*




**IAEA**  
International Atomic Energy Agency

August 2004

**IAEA Nuclear Energy Series**  
No. NP-T-3.6

**Assessing and  
Managing Cable Ageing  
in Nuclear Power Plants**

- Basic Principles
- Objectives
- Guides
- Technical Reports**



**IAEA**  
International Atomic Energy Agency

# 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).

# 10. IAEA Research Reactor Links

- RRS Home page [http://www.iaea.org/OurWork/ST/NE/NEFW/Technical\\_Areas/RRS/home.html](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](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/>

# Research Reactor Section O&M

I hope you have a productive meeting  
and a pleasant stay in Portland

Thank you

[c.morris@iaea.org](mailto:c.morris@iaea.org)

43 (1) 2600-21752

