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# **IAEA ACTIVITIES IN SUPPORT OF OPERATION AND MAINTENANCE OF RESEARCH REACTORS**

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**Workshop on Safety**

**Reassessment of Research Reactors in the Light of the Lessons Learned  
from the Fukushima**

**Daiichi Accident and IGORR 2017; Sydney, Australia, 4 to 7 December 2017**

# Project 1.4.2.004

## Research reactor operation and maintenance

*Approximately 50% of the operating research reactors (RR) in the world are more than 40 years old. Although the life of such facilities could reach 60 years and beyond, it is of paramount importance that adequate life management programmes (ageing and refurbishment/upgradation programmes) are established well in time*

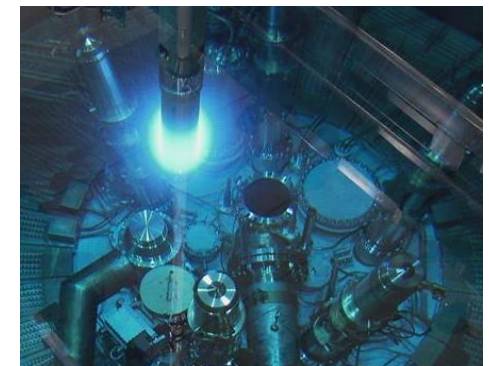
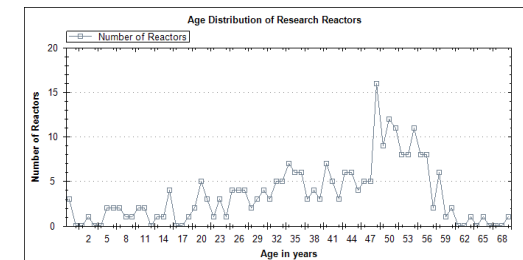
*Adequate operation and maintenance (O&M) plans, as well as management system, need also to be in place to ensure optimization of operational performances of existing research reactors*

*Considering the general trend of funding reduction for such facilities and limited succession planning, development and implementation of sound O&M as well as life management programmes are vital to ensure for these facilities a cost-effective completion of their assigned missions*

*Another very relevant issue is related to the fact that two thirds of the research reactors ever built, are currently in permanent shut-down state and need to be decommissioned*

## Objectives

- To assist Member States in developing and implementing operation and maintenance plans to improve facility's operational performances and in establishing integrated management systems
- To assist Member States in developing and implementing ageing management and renovation/upgradation programmes for facility's life management
- To contribute to IAEA cross-cutting activities on research reactors' decommissioning

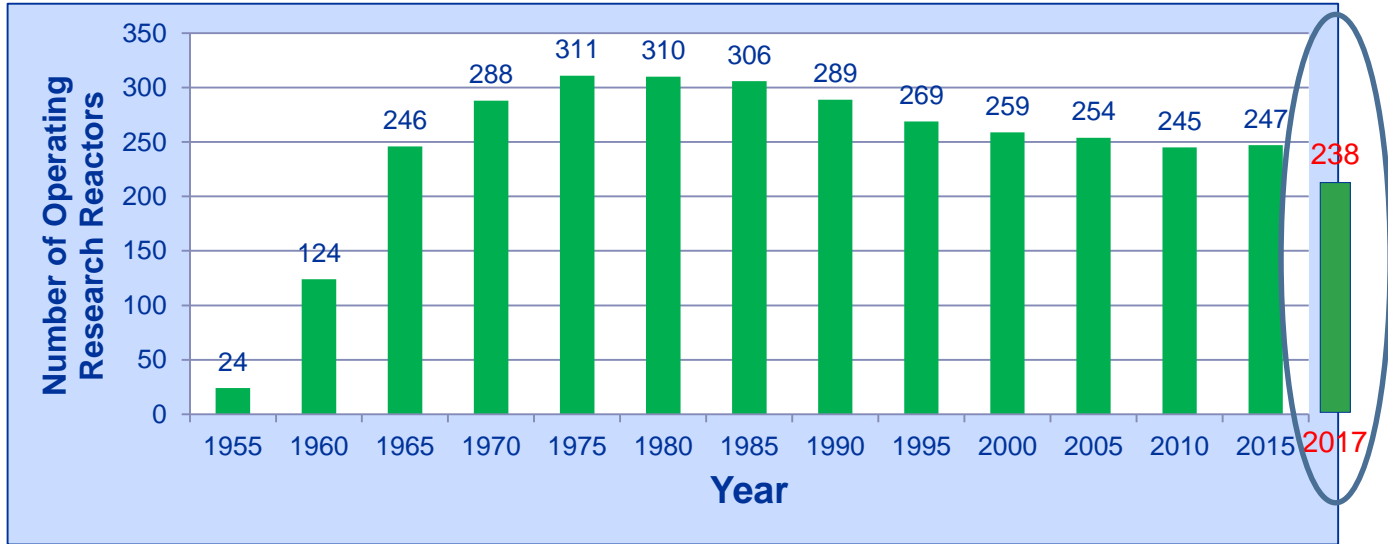


# Status of Research Reactors (RRDB)



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|                        |     |
|------------------------|-----|
| Operational            | 217 |
| TEMPORARY shutdown     | 21  |
| Will no longer operate | 511 |



# Status of Research Reactors (RRDB)



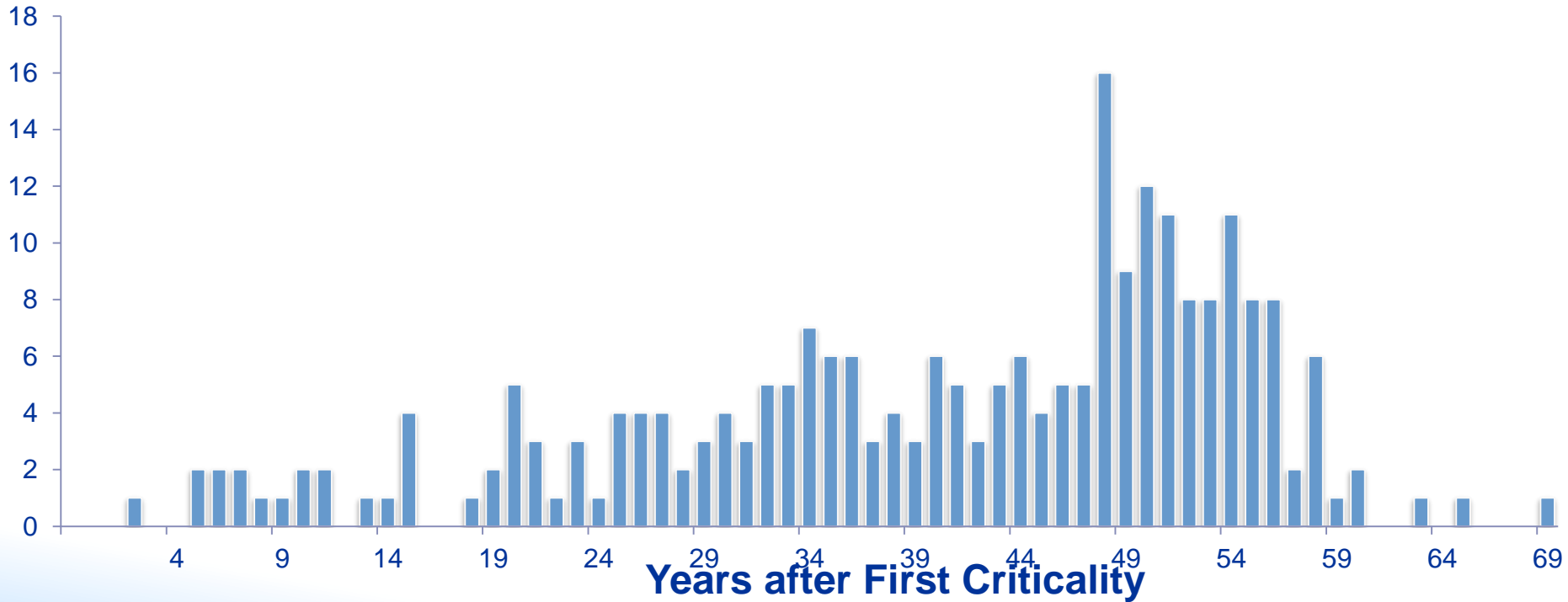
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> 60% of operating RRs are over 40 years old.

~ 30% of operating RRs are more than 50 years old.

Number of reactors

Age distribution of Research Reactors (RRDB):



→ Need good ageing management for long-term operation

# RRS (O&M) - Major Activities

- Technical Meetings
- Training Workshops
- Peer Review and Expert Missions
- Coordinated Research Projects
- RR Information Resources
- Publications

# Technical Meetings

- Ageing Management, Refurbishment and Modernization of research reactors (every two-years, held in Oct 2017, next in 2019)
- Upgrades to Digital Instrumentation and Control Systems for Research Reactors (every two years, held in Jul 2017, next in 2019)
- Good Operating Practices and sharing of experience (planned in Oct, 2018)

# Training Workshops

- ISI, NDE and On Line Monitoring (OLM) techniques (every two-year in June, 2018)
- Integrated Management Systems (IMS) (every two-year, planned in 2019)
- Safety Reassessment of Research Reactors in the Light of the Lessons Learned from the Fukushima Daiichi Accident (Every year)



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# OMARR Objectives

- Provide advice and assistance to Member States in enhancing the performance of research reactors
- Identify areas for improvement
- Address specific operational challenges
- Create a space for sharing experiences and good practices





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# Approach

- On request of RR operating organization only
- Addresses the topical areas described in IAEA Nuclear Energy Series No. NP-T-5.4, “ **Optimization of Research Reactor Availability and Reliability**”
- Pre-OMARR - A preparatory Mission of *2–3 days*
- Main OMARR - main mission of *5–7 days*
- Post-OMARR - follow up mission of 3-5 days if required by the facility



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# Outcomes

- A more efficient and reliable long-term operation of a research reactor
- Better performance
- Improved safety and safety culture
- Optimized utilization of human and financial resources.
- Sharing of experience and good practices



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# Missions undertaken

- Initiated in 2012 with first mission to 20 MW RR at the National Institute of Standards and Technology (NIST), in the United States of America
- Second at the 250 kW RR at the Applied Nuclear Energy Laboratory (LENA) at the University of Pavia, in Italy
- Third at 10 MW WWR-SM, Uzbekistan in progress – Pre-OMARR in June, 2017
- Fourth at 1 MW RPI, Portugal in progress – September, 2017

# ISI and NDE support mission

- Radiation Resistant underwater camera systems – “Proton” and “D40M” from Diakont for inspection of core components
- USM 36 ultrasonic tester
- Service on member states request.

# Coordinated Research Projects (CRP)

- CRP on “Improved Instrumentation and Control (I&C) Maintenance Techniques for Research Reactors” has been completed - TECDOC under publication
- CRP on establishment of “Material Properties Database for Irradiated Core Structural Components for Continued Safe Operation and Lifetime Extension of Ageing Research Reactors” completed – TECDOC under preparation
- CRP on “Condition monitoring and incipient failure detection of rotating equipment at research reactors” in progress (final RCM 15-19 April, 2018) – benchmark results from member states
- New CRP on “Risk Based ISI and Decision Making for RRs” (consultancy meeting just concluded - Survey and TM)

# IAEA RR Information Resources

## RRDB (<https://nucleus.iaea.org/RRDB/>)

- Contains information on more than **775 RRs worldwide** - technical characteristics, purpose, availability, capability, and facility managers' contacts.
- Being regularly updated with assistance from Member States (MSs) to share and collect information in one place

## RRADB (<https://nucleus.iaea.org/sites/rramp/>)

- Repository of the worldwide experience in **managing ageing of structures, systems and components** (SSCs) at research reactors
- Comprised of about **300 reports** with examples of affected systems, ageing issues faced, ageing mechanisms identified and remedial actions taken - serve as meta data and allow for searching/filtering of the list of reports
- Updated on biennial basis; next cycle – 2017.

## RR-MPDB (TBD)

- Material Properties Database for Irradiated Core Structural Components for Continued Safe Operation and Lifetime Extension of Ageing Research Reactors
- Developed on the SharePoint platform – a document collection(RRADB type)
- Currently contains 5 groups of different meta data; about 150 reports uploaded with attributed meta data.
- Launched on trial basis to get feedback from users

# Publications under preparation

| Title   | Type               | Status   |
|---|--------------------|--|
| OLM of instrumentations in RRs  | TECDOC             | Submitted to PC  |
| Structure and format of RR-MPDB   | TECDOC             | First Draft in 2017  |
| TECDOC on CRP on “On-line monitoring of rotating equipment”                           | TECDOC             | First Draft in 2018  |
| Application of non-destructive testing and in-service inspection to research reactors | TECDOC 1263 (2001) | Revision to be initiated in 2017                             |
| Optimization of Reliability and Availability of RRs                                   | NP-T-5.4 (2008)    | Revision to be initiated in 2017                             |
| Project Experiences in Ageing Management, Refurbishment and Modernization             | NES                | TECDOC (2014) to be upgraded to NES. To be initiated in 2019 |



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# Questions/Suggestions ?

# THANK YOU