IAEA's SUBPROGRAMME ON RESEARCH REACTORS

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Outline

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- Programmatic Structure
- Issues and Challenges
- Subprogramme D.2 Objectives
- Outputs of the Subprogramme
- Projects under Subprogramme D.2
- Conclusions

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Introduction

- For almost 60 years research reactors have contributed to the development of nuclear science and technology
- We know about 671 research reactors in 69 countries (67 MS) of which 241 are still operating

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Introduction:
Status of Research Reactors Worldwide

- 671 COMMISSIONED
- 241 IN OPERATION
- 242 SHUT DOWN
- 176 DECOMMISSIONED
- 5 UNDER CONSTRUCTION
- 1 PLANNED
- 1 UNVERIFIED
- 5 CANCELLED

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Introduction:
Status of Research Reactors Worldwide (Cont'd)

Status	Industrialized Countries	Developing Countries
Cancelled	3	2
Operational	154	87
Shut down	211	26
Decommissioned	162	14
Temporary shutdown	4	1
Planned	0	1
Under construction	2	3
Unverified information	0	1
Total	536	135

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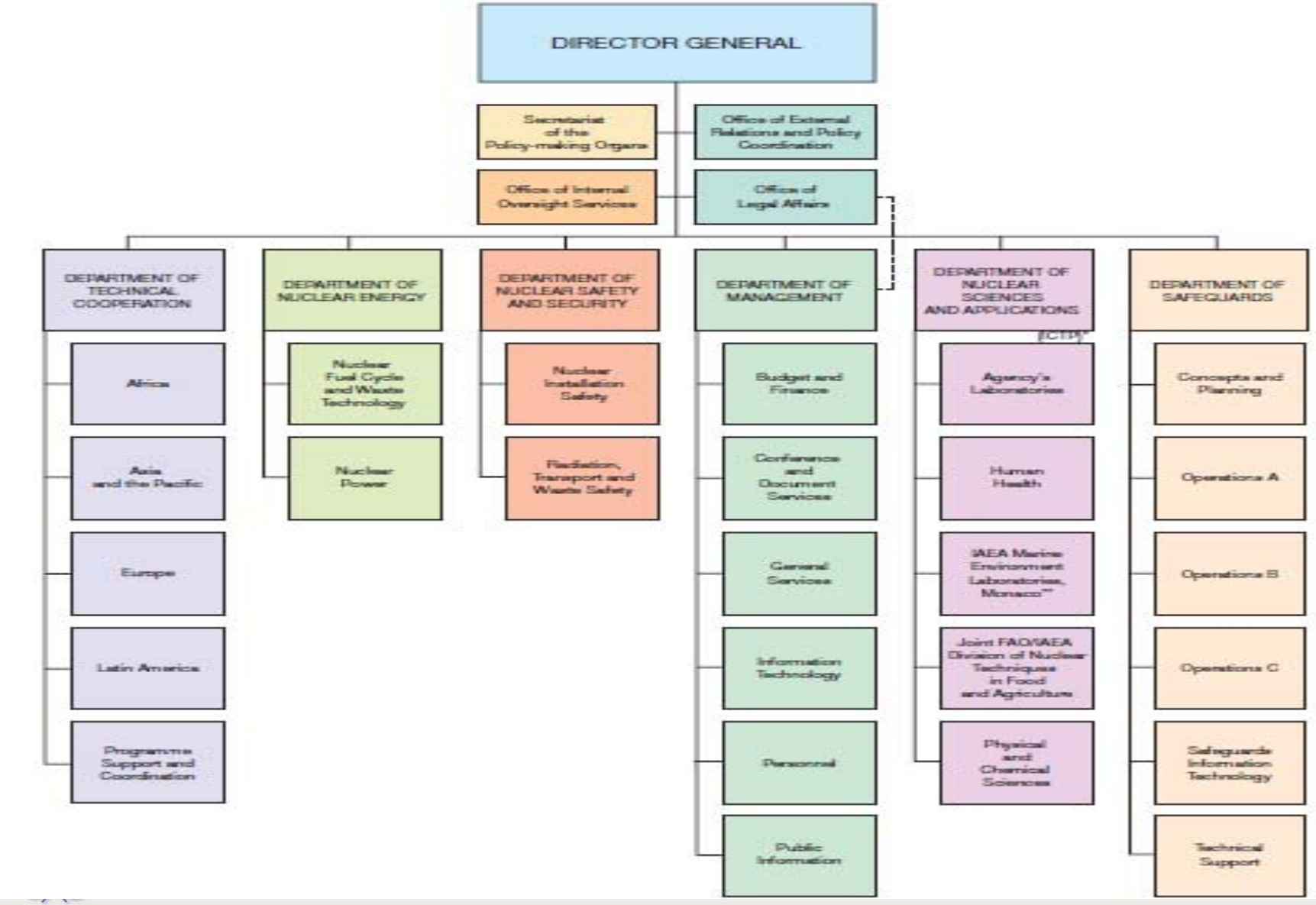
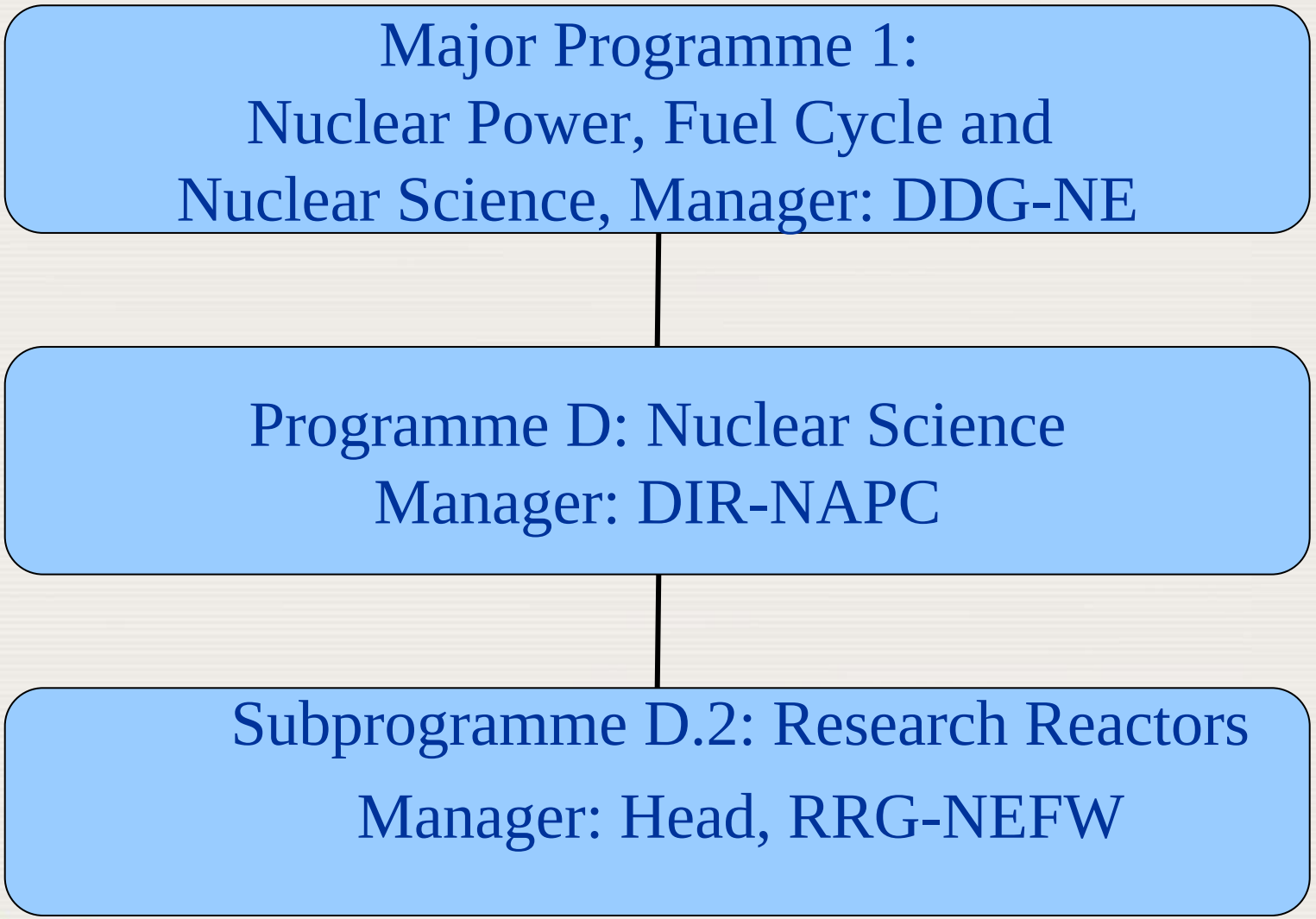
Organization Setting - IAEA Organizational Chart



Organization Setting - Programmatic Structure



Organization Setting - Cross-cutting Coordination

- IAEA's activities on RRs included in a cross-cutting coordinated area
- Activities coordinated through a Cross-Cutting Co-ordination Group for Research Reactors (CCCGRR)
- CCCGRR includes representatives from the Departments of Nuclear Safety, Nuclear Science, Nuclear Energy, Safeguards and Technical Cooperation

Issues and Challenges

- Underutilization
- Inadequate funding - over-reliance on government / public sector funding
- Ageing materials and equipment, in ageing facilities, run by aged staff
- Non-existent or inappropriate business and /or strategic plans
- Lack of market analysis and marketing skills
- Need for modernization/refurbishment

Issues and Challenges (cont'd)

- Unavailability of suitable high-density LEU fuels for conversion of some RRs
- Need for enhanced international cooperation as "state of the art" facilities are too expensive for a single country
- Parochial attitudes, resistance to cooperation
- New RRs
- Accumulation of spent fuel
- Deteriorated spent fuel at some storage sites
- Presence of fresh and spent HEU
- Reluctance to decommission

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Subprogramme D.2 - Objectives

Objective 1 (P&B 2010-2011)

- Increase capabilities of interested MS to safely and reliably:
  - implement ageing management;
  - conduct refurbishment and modernization;
  - manage all RR operation issues;

Objective 1 (P&B 2010-2011) (cont'd)

- Increase capabilities of interested MS to safely and reliably:
  - ☞ cope with research reactor fuel cycle issues;
  - ☞ reduce proliferation risks by core and target conversion to LEU and repatriation of fuel to the country of origin; and
  - ☞ conduct planning and building of new national and regional facilities

Objective 2 (P&B 2010-2011)

– Increase the capabilities of interested MS to:

☞ safely, reliably and efficiently carry out scientific research and technology development at RRs;

☞ design and implement strategic and business planning; and

☞ design and implement institutional arrangements for possible regional and international RR coalitions, networks and shared-user facilities.

Subprogramme D.2 - Objectives
Advisory Bodies

- SAGNE (meets twice a year, April and October)
- SAGNA (meets once a year in June)
- TWG-RR since 2007

Outputs of Subprogramme D.2

- Advisory services
  - ☞Mainly implemented through a large number of TC Projects
- Exchange of information and ‘know-how’
  - ☞technical documents, conference presentations and CRPs
- Guidelines documentation
- Training
  - ☞mainly associated with events that are a part of TC projects

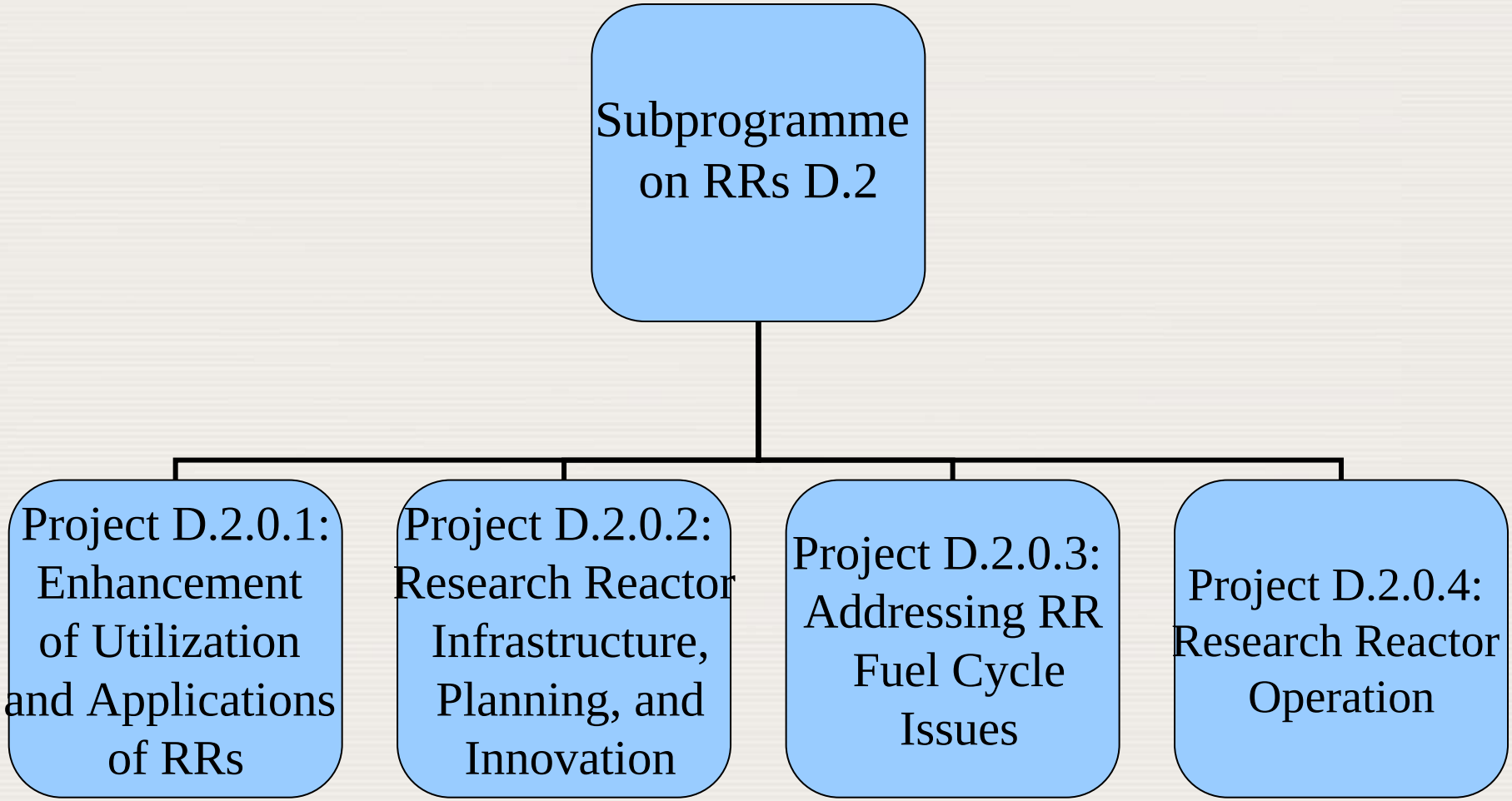
Outputs of Subprogramme D.2

- Publications
  - ☞ Nuclear Energy Series Reports
  - ☞ Technical Reports Series
  - ☞ IAEA TECDOCs
  - ☞ Conference Proceedings
  - ☞ Outreach publications

Outputs of Subprogramme D.2

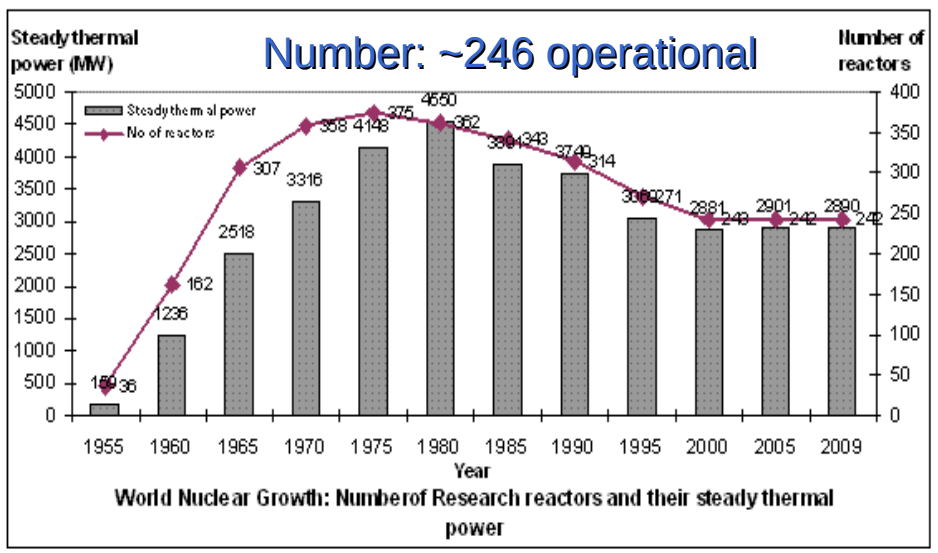
- Organization of Conferences, Symposia and Seminars
  - ☞ Organized by the IAEA
  - ☞ With IAEA participation / support
- Development and Maintenance of Data Bases
  - ☞ RRDB
  - ☞ RRSFDB
  - ☞ Ageing Management

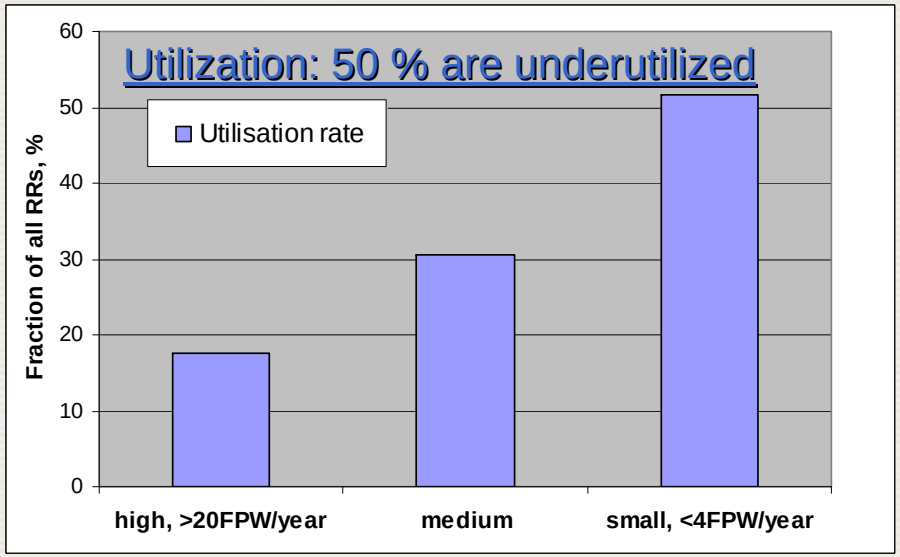
Projects Under the Subprogramme on RRs (2010-2011)

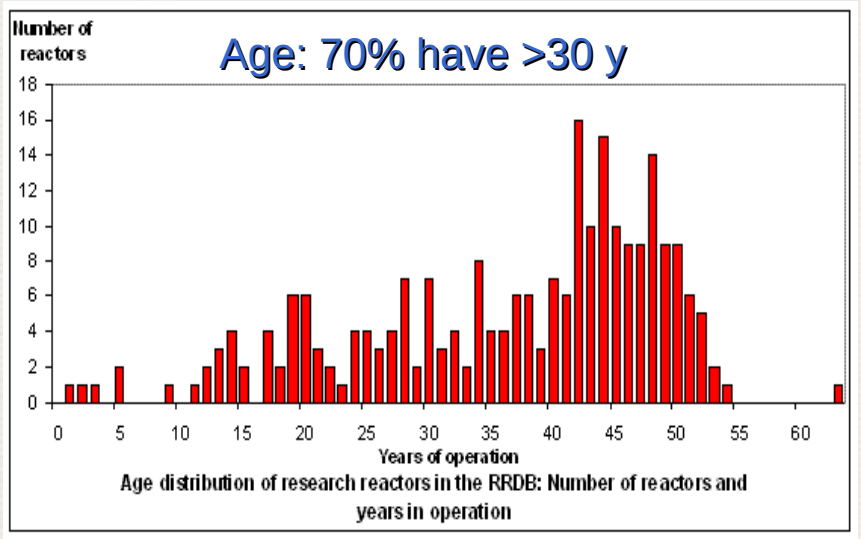


Project D.2.01
Enhancement of RR utilization and applications of RRs

TOTAL:	**665**
Operational	**241**
Temp. shutdown	**5**
Under construction	**5**
Planned	**1**
Shutdown	**237**
Decommissioned	**176**







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Project D.2.01
Enhancement of RR utilization and applications

Activity (cross-cutting)	Established	In progress	Planned
RR coalitions, networks & centres of excellence	3	2	4

- **RR coalitions:**
  - →Eastern European RR Initiative (EERRI)
  - →Eurasian RR Coalition (EARRC)
  - →Caribbean RR Coalition (CRRC)
  - *North-South America RR Coalition (NSARRC)*
  - *…*
- **RR Users' Networks:**
  - →Mediterranean RR Users' Network (M-RRUN)
  - →Network on Residual Stress & Texture Analysis (STRAINET)
  - *Baltic RR User's Network (B-RRUN)*
  - *Pacific RR User's Network (P-RRUN)*
  - *African RR User's Network (A-RRUN)*

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Project D.2.01
Enhancement of RR utilization and applications

Activity	Completed	Ongoing	Planned
Coordinated Research Projects	3	2	1

Completed:

- (2000-2004) Development & practical utilisation of SANS applications
- (2002-2006) New applications of PGNAA
- (2003-2006) Development of improved sources & imaging systems for neutron radiography

Underway:

- (2006-2009) Development and application of the techniques of residual stress measurements in materials
- (2008-2010) Innovative methods in RR analysis: benchmarks against experimental data (cross-cutting, NA+NE+NS)

Planned:

- (2009-2011) Development, characterization and testing of materials in energy sector using neutron beams (supported by last TWGRR in 2009)

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Project D.2.01
Enhancement of RR utilization and applications

Activity	Organized	Planned
Organization of Technical Meetings, Consultancy Meetings, Workshops, Schools, etc.	**TMs ~2/year** **CMs ~2/year** **WSs ~1/year**	**6**

Most recent events held:

- 2008 CM on non-destructive testing using neutron beams
- 2008 CM on data acquisition and analysis systems for neutron beams
- 2008 TM on RR application for materials under high fluence
- 2008 TM on strategic planning and regional networking for sustainability

Planned events:

- 2009 TM on Specific applications of RRs: provision of nuclear data
- 2009 support for the AONSA Neutron School at ANSTO, Australia
- 2010 IAEA/ICTP school on “Neutrons for Science and Technology: from fundamental research to applications with neutron beams” in collaboration with HZB
- 2010 TM on RR applications for materials in energy sector
- 2011 IAEA/ICTP workshop on effective use of intense neutron fluxes
- 2011 TM on applications of RRs: products and services

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Project D.2.01
Enhancement of RR utilization and applications

Activity (cross cutting)	Organized	Planned
International RR Conference	every 4 years	1

Events held:

- 2003: International Conference on RR Utilization, Safety, Decommissioning, Fuel and Waste Management, Santiago, Chile; proceedings published

- 2007: International Conference on *RRs: Safe Management and Effective Utilization,* Sydney, Australia; proceedings published

Planned events:

- 2011: International Conference on *RRs:* subtitle and venue (in Africa) to be selected shortly

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Project D.2.01
Enhancement of RR utilization and applications

Activity	Published	Ongoing	Planned
Publications, technical reports, brochures	~2-3/year	6	2

Some selected publications:

- 2006 Proceedings Series on Neutron Reflectometry: A probe for Materials Surfaces
- 2007 TECDOC on Characterization and Testing of Materials for Nuclear Reactors
- 2008 TECDOC on Neutron Imaging: A Non-Destructive Tool for Materials Testing

In preparation:

- 2009 TECDOC on RR application for materials under high fluence
- 2009 TECDOC on Guidelines on neutron transmutation doping and gem coloration
- 2009 brochure on RRs: Purpose and Future (new release of old brochure)
- 2010 TECDOC on Applications of RRs (new release of TECDOC 1234)
- 2010 TRS on application of the techniques of residual stress measurements in materials
- 2010 TECDOC on Specific applications of RRs: provision of nuclear data

Planned:

- Catalogue of RR products and services (end user targeted)
- Strategic and business planning for RRs

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Project D.2.01
Enhancement of RR utilization and applications

Activity	Completed	Ongoing	Planned
Support of national & regional TC projects relevant to RR applications & utilization	10	15	1

Ongoing National

ALG4010	Development and Improvement of Experimental and Analysis Techniques for the Es Salem Reactor
AZB4002	Conducting a Feasibility Study for Planning and Establishing a Research Reactor (Not funded)
COL1010	Integral Use and Safety of the Nuclear Research Reactor IAN-R1
CPR1007	Residual Stress Measurement using Neutron Diffraction for Industrial Application
EGY4048	Development of Neutron Irradiation and Beam Line Facilities for Effective Use of the Research Reactor
JOR4007	Establishing a Research Reactor
LIB4011	Utilizing the Research Reactor (Not funded)
PER4023	Modernizing and Improving the Utilization of the RP10 Reactor (Not funded)
SAF1002	Establishing a Small-angle Neutron Scattering Centre
SAF4003	Upgrading of the Neutron Beam Line Facilities of the SAFARI-1 Research Reactor

Ongoing Regional

RAF4022	Enhancing Research Reactor Utilization & Safety (AFRA)
RAS4026	Adding Value to Materials through Irradiation with Neutrons (RCA)
RAS4030	Developing a Regional Nuclear Training Centre for Capacity Building and Research
RER4032	Enhancing the Sustainability of Research Reactors and Their Safe Operation Through Regional Cooperation, Networking and Coalitions
RLA0037	Supporting a Sustainable Increase in the Use of Research Reactors in the Latin American and Caribbean Region through Networking, Exchange of Experiences, Knowledge Preservation and Training of Human Resources (ARCAL CXIX)

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Project D.2.02
Research reactor infrastructure, planning, and innovation

Activity	Outputs
Provide advice and assistance as requested to RR planning, modernization or refurbishment	Concrete Assistance to RR Modernization and Refurbishment

- RR Modernization or Refurbishment:
  - IEA-R1 RR, Brazil
  - GHARR-1, Ghana
  - TRIGA II PITESTI - SS CORE, 14 MW TRIGA, Romania
  - IRT-1, Libya
  - DALAT RESEARCH REACTOR, Vietnam
  - IAN-R1, Colombia
  - WWR-K ALMA ATA, Kazakhstan
  - WWR-SM TASHKENT, Uzbekistan
  - IRT-SOFIA, Bulgaria
  - UWI CNS SLOWPOKE, Jamaica

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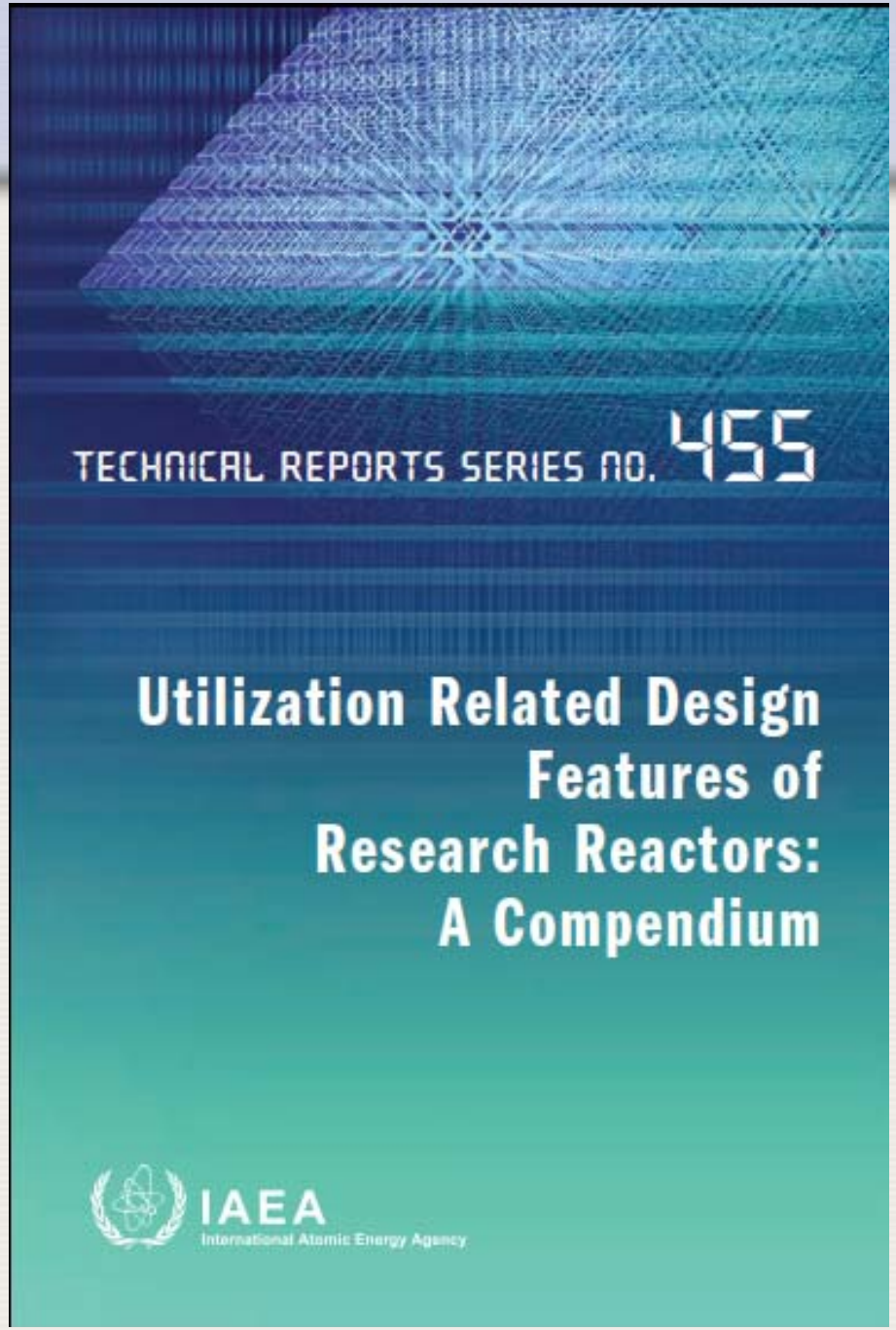
Project D.2.02
Research reactor infrastructure, planning, and innovation

Activity	Outputs
Provide advice and assistance as requested to RR planning, modernization or refurbishment	Fostering information exchange - Publications

- The Compendium on Utilization Related Design Features of Research Reactors: (Technical Reports Series No. 455) was published in 2007

- Activities related to preparation of this publication started in 2003


TECHNICAL REPORTS SERIES NO. 455
Utilization Related Design Features of Research Reactors: A Compendium
IAEA
International Atomic Energy Agency

Project D.2.02
Research reactor infrastructure, planning, and innovation

Activity	Outputs
Provide advice and assistance as requested to RR planning, modernization or refurbishment	Support to new RR projects – Publications and Concrete support to new projects

- Consultancy Meeting on “Specific considerations and milestones in the development of a Research Reactor”, 3 to 5 November 2008 in
- First draft of a document addressing, in a structured manner, the necessary steps to develop and implement a new Research Reactor (RR) project has been prepared
- Document to be finalized in the first quarter 2010

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Project D.2.02
Research reactor infrastructure, planning, and innovation

Activity	Outputs
Provide advice and assistance as requested to RR planning, modernization or refurbishment	Promoting research and development and innovation - Publications

- Consultancy meeting on assessment of utility of homogeneous aqueous solution nuclear reactors for the production of Mo-99 and other short-lived radioisotopes

- IAEA TECDOC-1601 “Homogeneous Aqueous Solution Nuclear Reactors for the Production of ^{99}Mo and other Short Lived Radioisotopes”, issued in 2008

- New CRP on the subject, for 2009-2012, formulated and approved in 2008

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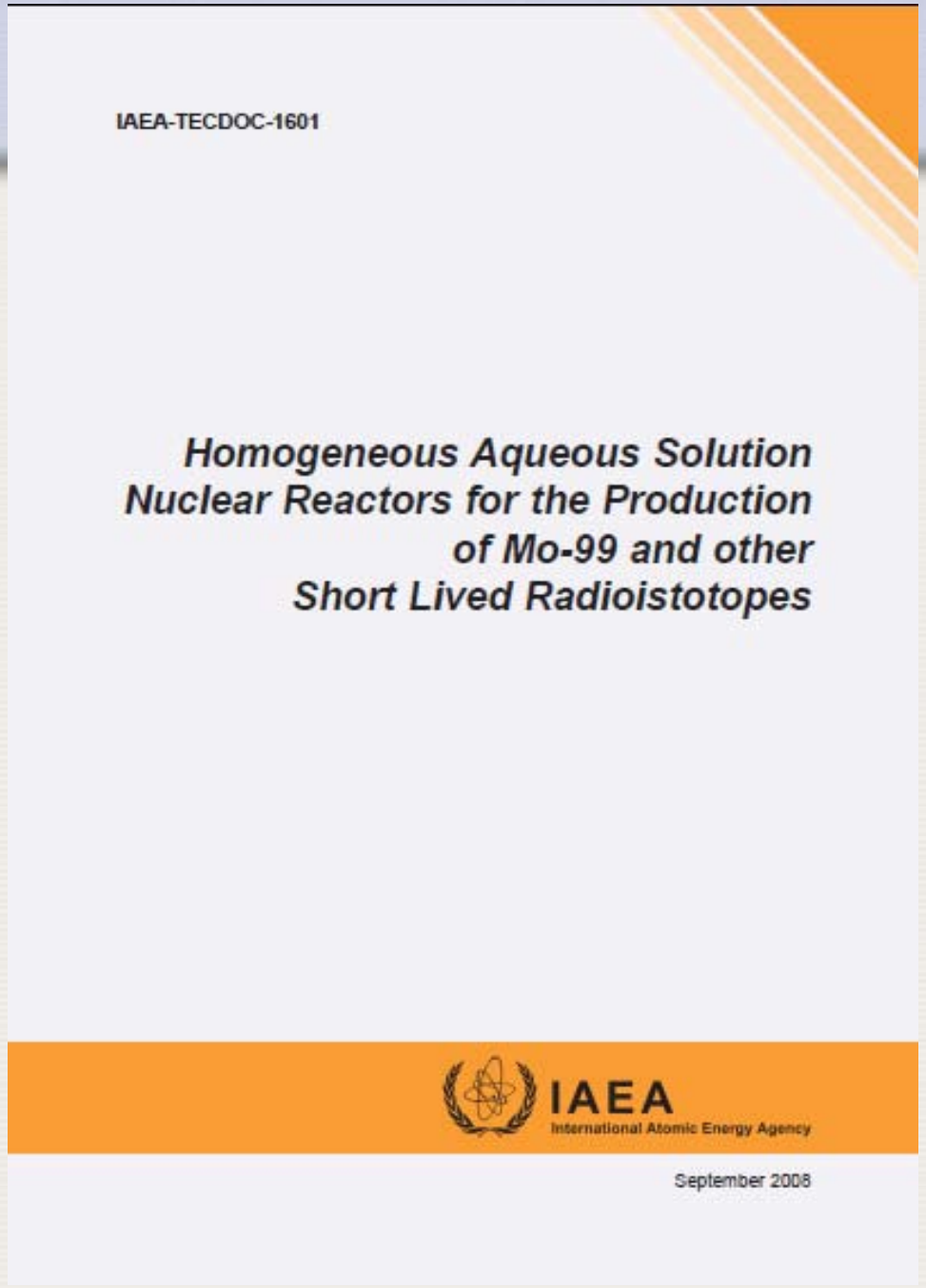
IAEA-TECDOC-1601
Homogeneous Aqueous Solution Nuclear Reactors for the Production of Mo-99 and other Short Lived Radioistotopes
IAEA
International Atomic Energy Agency
September 2008

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Project D.2.02
Research reactor infrastructure, planning, and innovation

CRP underway:

- (2008-2010) Innovative methods in research reactor analysis: Benchmark against experimental data on neutronics and thermalhydraulic computational methods and tools for operation and safety analysis of research reactors (cross-cutting, NA+NE+NS)

Objectives:

→ Transfer know-how in the area of research reactor analysis
→ Establish a set of experimental data in a suitable format for computer codes benchmarking
→ Benchmark neutronic and thermalhydraulic computer codes against experimental results
→ Enhance capabilities of the CRP participants in performing research reactor analysis

8 Research Contracts + 7 Research Agreements= 15 MS

- **Syria**
- **Nigeria**
- **Egypt**
- **Bangladesh**
- **Ghana**
- **Pakistan**
- **Uzbekistan**
- **Romania**
- **Australia**
- **Argentina**
- **Germany**
- **Canada**
- **South Africa**
- **USA**
- **France**

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Project D.2.02
Research reactor infrastructure, planning, and innovation

Activity	Completed	Underway	Planned
Support of national & regional TC projects relevant to RR applications & utilisation	4	11	1 (Sudan)

BUL4014	Refurbishment of Research Reactor
AZB4002	Conducting a Feasibility Study for Planning and Establishing a Research Reactor (Not funded)
COL1010	Integral Use and Safety of the Nuclear Research Reactor IAN-R1
GHA4/012	Enhancing the Operation and Utilization of the Miniature Neutron Source Reactor (GHARR-1) for Socio-economic Development
BRA4056	Modernization of the IEA-R1 Reactor for Radioisotope Production
JOR4007	Establishing a Research Reactor
LIB4009	Enhancement of the Safety System of Tajoura Research Reactor and Critical Facility
ROM4024	Full Conversion of TRIGA 14 MW Core from HEU to LEU Fuel
KAZ9010	Supporting Upgrades and Conversion of WWR-K Reactor to Low Enriched Uranium Fuel
JAM6010	Nutritional Status and Exposure to Toxic Elements of Jamaican Children
BRA4059	Modernization and Refurbishing the IEA-R1 Research Reactor to Secure Safe and Sustainable Operation and Radioisotope Production for Medical Applications
UZB9004	Improving Operational Safety of the Research Reactor at the Institute of Nuclear Physics
RER3006	Supporting the Repatriation, Management and Disposal of Fresh and/or Spent Nuclear Fuel from Research Reactors
RAS4030	Developing a Regional Nuclear Training Centre for Capacity Building and Research
RLA0037	Supporting a Sustainable Increase in the Use of Research Reactors in the Latin American and Caribbean Region through Networking, Exchange of Experiences, Knowledge Preservation and Training of Human Resources (ARCAL CXIX)

Project D.2.03
Addressing RR fuel cycle issues

Table of contents of major activities:

- Support RR conversion and return of RRSNF to the country of origin
- Database on spent fuel from research and test reactors (RRSFDB)
- Provide advice and assistance to RRs with spent fuel issues
- Support TC projects on RR fuel cycle issues

Project D.2.03
Addressing RR fuel cycle issues

- Almost 30 years of IAEA support to international efforts to reduce HEU in international commerce
- IAEA projects and activities have directly supported RERTR and fuel take back programmes
- IAEA efforts have included:
  - Dissemination of information
  - Transfer of pertinent technology
  - Management of contracts related to RR conversions and shipments of spent and fresh HEU fuel
  - Publication of guidance documents

Project D.2.03
Addressing RR fuel cycle issues

- Support to the RERTR Programme
  - Research Reactor Conversion
  - Fostering the Use of LEU in Mo-99 Production
  - Qualification of High Density LEU RR Fuels
  - Conversion of MNSRs
  - Use of LEU in ADS Systems
  - Assessing Facilities Utilizing HEU
  - Building Consensus on HEU Minimization

Project D.2.03
Addressing RR fuel cycle issues

- Support to the Research Reactor Fuel Take Back Programmes
  - Support to the U.S. Foreign Research Reactor Spent Nuclear Fuel (FRRSNF) Acceptance Programme
  - Support to the Russian Research Reactor Fuel Return Programme (RRRFR)

Project D.2.03
Addressing RR fuel cycle issues

Fresh HEU Fuel Returned to Russia under IAEA Contracts

Country	Amount of HEU, kg	Date of Removal
Yugoslavia (Serbia)	48.0	08/2002
Romania	14.0	09/2003
Bulgaria	17.0	12/2003
Libya	17.0	03/2004
Czech Republic	6.0	12/2004
Uzbekistan	3.0	09/2004
Latvia	3.0	05/2005
Czech Republic	14.0	09/2005
Libya	3.0	07/2006
Poland	40.0	08/2006
Germany	268.0	12/2006
Poland	8.8	08/2007
Vietnam	4.5	09/2007
Hungary	18.0	09/2009

Total = 464.3 kg of HEU

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Project D.2.03
Addressing RR fuel cycle issues

Spent HEU Fuel Returned to Russia with IAEA Support

Country	Amount of HEU, kg		Amount of LEU, kg		Date of Removal
Uzbekistan	63.0	Spent Fuel			04/2006
Czech Republic	80.0	Spent Fuel			11/2007
Latvia	14.4	Spent Fuel			05/2008
Bulgaria	6.3	Spent Fuel			07/2008
Hungary	154.5	Spent Fuel			10/2008
Kazakhstan	73.7	Spent Fuel			5/2009

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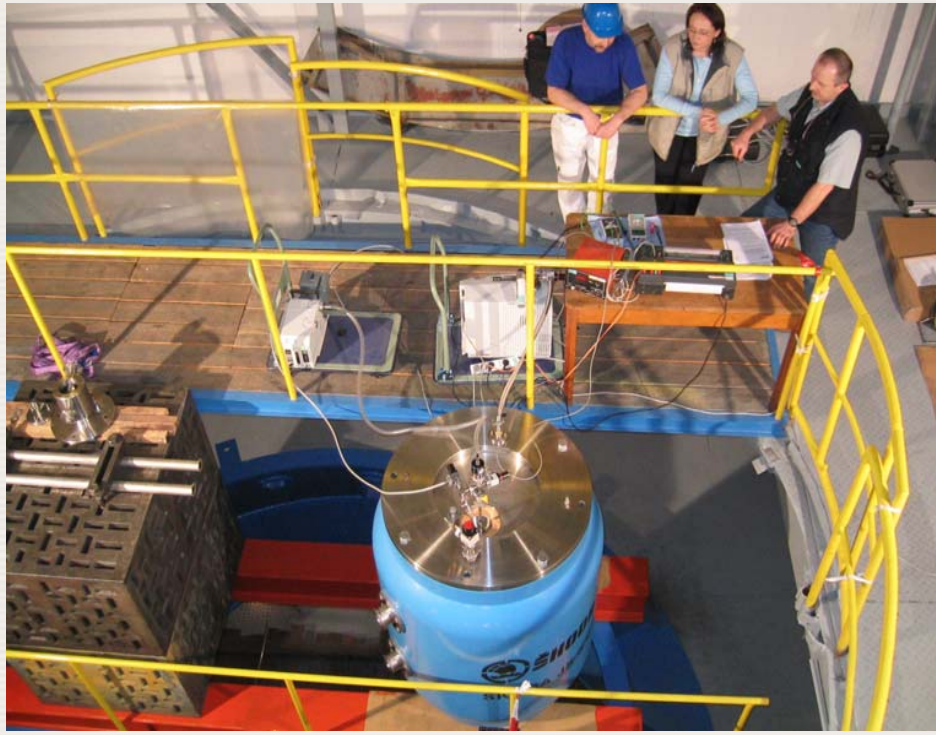
Total = 391.9 kg of HEU

Project D.2.03
Addressing RR fuel cycle issues



Project D.2.03
Addressing RR fuel cycle issues

- Vinca (Serbia) Spent Fuel Removal

- 2.5 tonnes of spent fuel (half of all exported Russian research reactor spent fuel)
- Serious security, non-proliferation, environmental and safety concerns
- International tender conducted by IAEA
- Contract being smoothly and timely implemented
- ~$ 50 million (fully funded, NTI, DOE, European Union)
- Largest ever IAEA TC project

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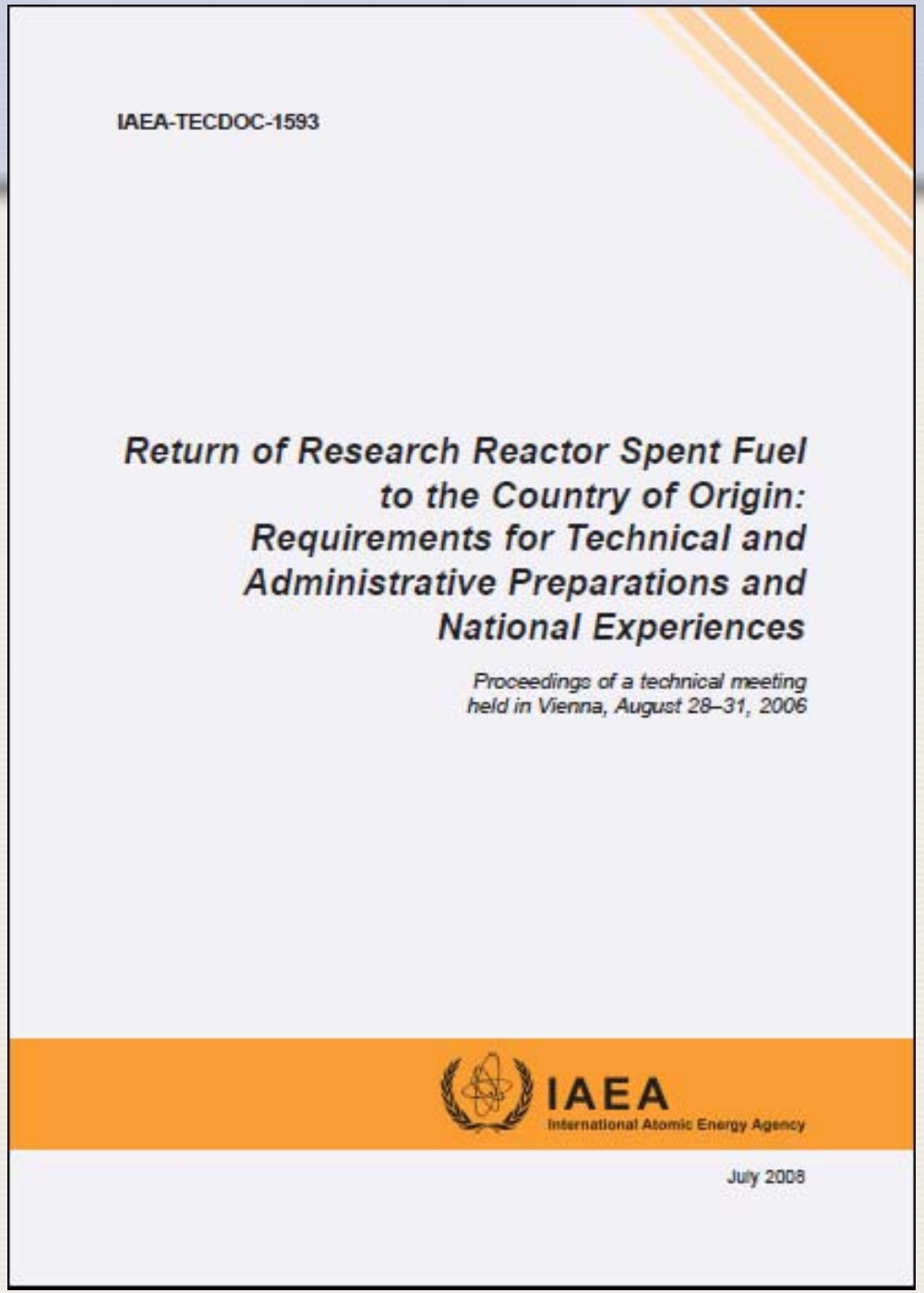
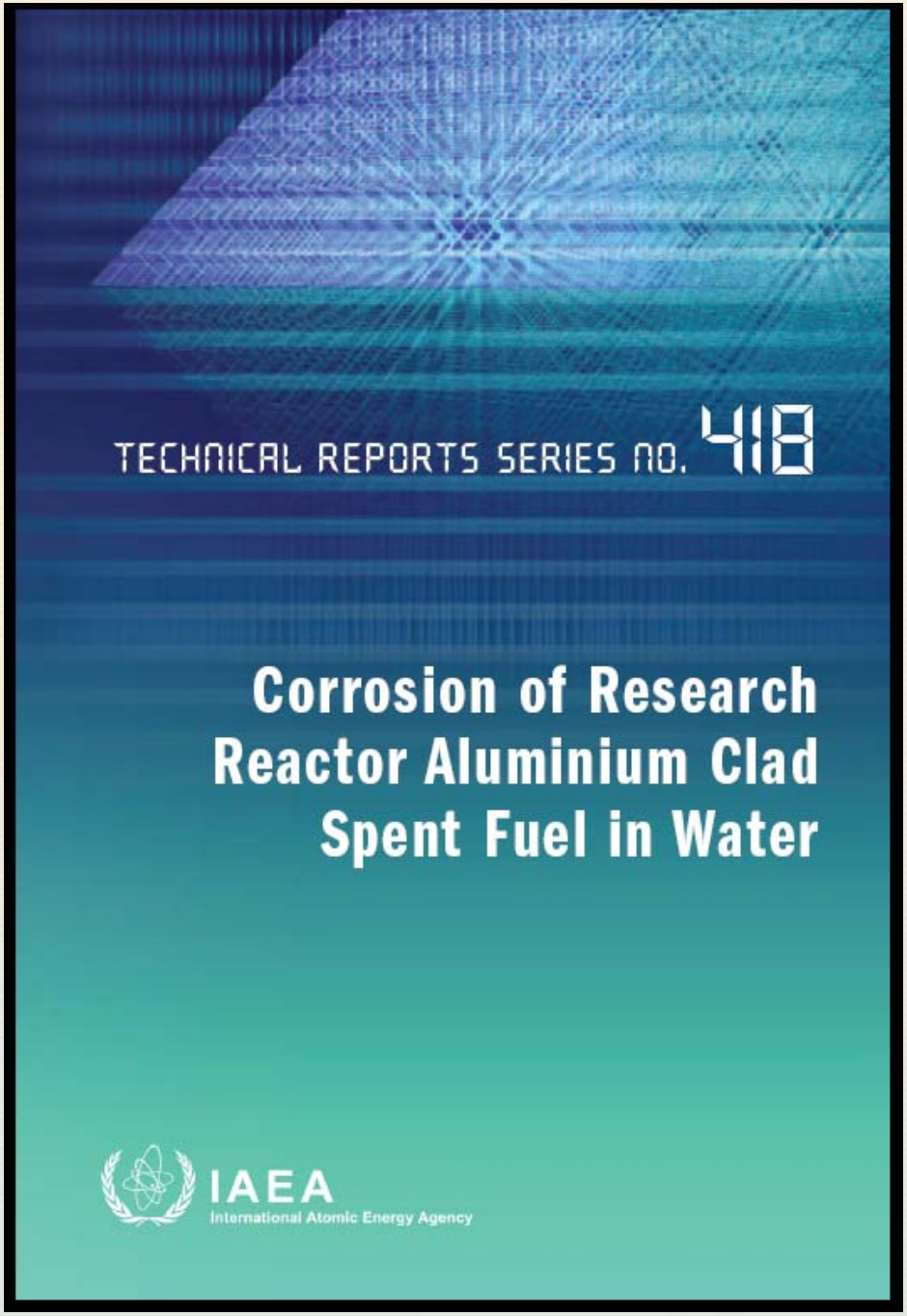

IAEA-TECDOC-1593
Return of Research Reactor Spent Fuel to the Country of Origin: Requirements for Technical and Administrative Preparations and National Experiences
Proceedings of a technical meeting held in Vienna, August 28–31, 2006
IAEA
International Atomic Energy Agency
July 2008

Project D.2.03
Addressing RR fuel cycle issues

Experience of shipping Russian-origin research reactor spent fuel to the Russian Federation
TC-PROJECT RER/4/028
Repatriation, management and disposition of fresh and/or spent nuclear fuel from research reactors

The final report is “in press” now (Tecdoc)


TECHNICAL REPORTS SERIES NO. 418
Corrosion of Research Reactor Aluminium Clad Spent Fuel in Water
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Corrosion of Research Reactor Aluminium Clad Spent Fuel in Water

Report of a Coordinated Research Project on Corrosion of Research Reactor Aluminium-Clad Spent Fuel in Water (Phase II) and TC Regional Project RLA/4/018 – Management of Spent Fuel from Research Reactors

Recommended practices for water quality management in research reactors & spent fuel storage facilities

In preparation:

"Good Practices for the Management and Storage of Research Reactor Spent Fuel"

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Project D.2.03
Addressing RR fuel cycle issues

Activity	Outputs
Provide advice and assistance to RRs with spent fuel issues	Concrete Assistance to RR on spent fuel issues, through TC projects and CRPs

- Assistance delivered to:
  - Argentina
  - Chile
  - Peru
  - Mexico
  - Brazil
  - Serbia
  - Indonesia
  - Thailand
  - Pakistan
  - Kazakhstan
  - Romania

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Project D.2.03
Addressing RR fuel cycle issues

Activity	Outputs
Support TC projects on RR fuel cycle issues	Concrete Assistance to RRs

- TC projects, related to RR conversion:
  - KAZ/9/00, Support to Convert WWR-K Reactor to LEU;
  - LIB/4/009, Enhancement of the Safety System of Tajoura Research Reactor and Critical Facility;
  - BUL/4/014, Refurbishment of Research Reactor;
  - UKR/9/024, Modernization and Safety Improvement of Research Reactor;
  - UZB/9/004, Improving Operational Safety of the Research Reactor at the Institute of Nuclear Physics;
  - POR/4/016, Core Conversion of the Portuguese Research Reactor to LEU Fuel and
  - POL/4/017, Full Conversion of Maria Research Reactor Core from HEU to LEU.

Project D.2.03
Addressing RR fuel cycle issues

Activity	Outputs
Support TC projects on RR fuel cycle issues	Concrete Assistance to RRs

- TC projects, related to Spent Fuel Issues:
  - RLA4/018 Management of Spent Fuel from Research Reactors
  - RLA/3/004 Spent Fuel Management for Research Reactors
  - RLA/3/008 Engineering Casks for the Transport of Spent Fuel from Research Reactors, Phase II
  - RLA/4/020 Engineering of Casks for the Transport of Spent Fuel from Research Reactors
  - RER/3/006 Supporting the Repatriation, Management and Disposal of Fresh and/or Spent Nuclear Fuel from Research Reactors
  - RER/4/028 Repatriation, Management and Disposition of Fresh and/or Spent Nuclear Fuel from Research Reactors

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Project D.2.03
Addressing RR fuel cycle issues

Activity	Outputs
Support TC projects on RR fuel cycle issues	Concrete Assistance to RRs

- TC projects, related to Spent Fuel Issues (Cont'd):
  - ARG3010 Temporary Storage of Spent Fuel from Research Reactors
  - ARG/4/092 Irradiation and Post-irradiation Examination of Low-enriched Uranium Very High Density Fuel Assembly in a High-flux Reactor
  - SCG/4/002 Safety of Irradiated Fuel and Radioactive Waste at Vinca Research Institute
  - SCG/4/003 Safe Removal of Spent Fuel of the Vinca RA Research Reactor
  - SRB/4/002 Safe Removal of Spent Fuel of the Vinca RA Research Reactor

Project D.2.04
Research reactor operation

Rationale of this new project

- Since the mid 1980's, investment in nuclear RR facilities and infrastructure has decreased significantly compared with earlier decades
- Many older facilities have been decommissioned, permanently shutdown, or are faced with probable shutdown in the very near future
- Funding reductions and limited succession planning have strained available resources, pressuring many facilities to increase utilization (including commercial activities) to remain in operation

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Project D.2.04
Research reactor operation

Rationale of this new project

- Many RRs are looking to optimize operations and maintenance activities to meet new requirements
- This project aims to fulfill these requests by documenting good practices and lessons learned as an element for strengthening the operational management
- Recent several high profile, unplanned shutdowns and outage extensions of RRs highlighted the need for effective operation and maintenance programmes at RR facilities

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Project D.2.04
Research reactor operation

RR Availability and Reliability

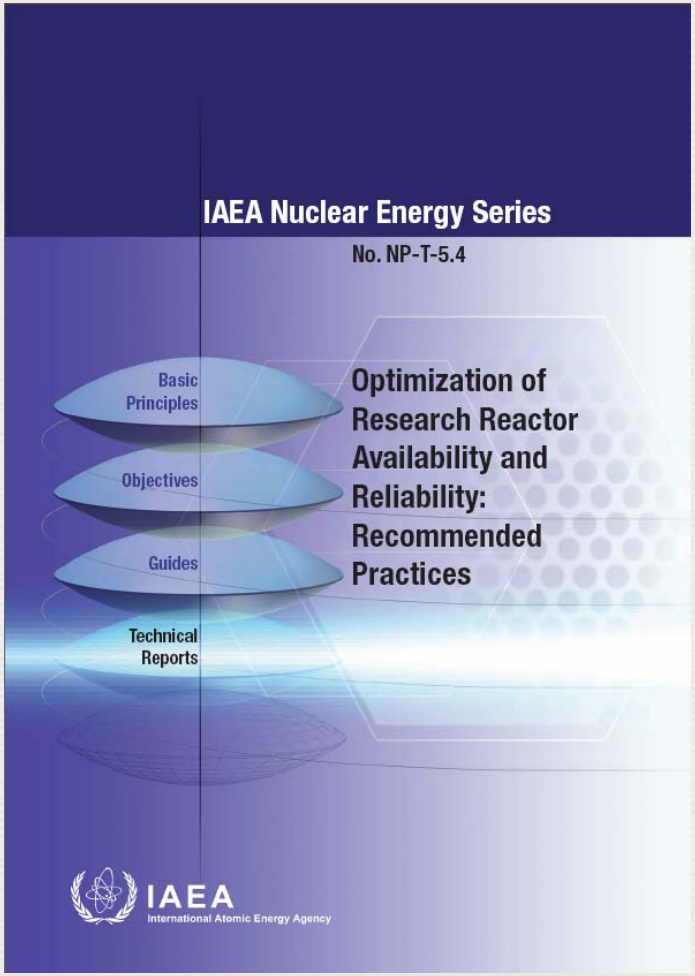
- Officially commenced January 2008
- Focus on maintaining RRs available as a platform for research, isotope production, human resources development and other goods and services as set out in individual organizational strategic plans
- Aim is to build collaborative relationships to facilitate information exchange and/or direct assistance for the mutual benefit of all

Project D.2.04
Research reactor operation

Publication

NP-T-5.4

- 2 consultancies (Sept 2006 and April 2007)
- 12 experts representing 11 RR organizations in 7 countries
- Well utilized RRs
- Diverse in size and mission



Project D.2.04
Research reactor operation

Activity	Outputs
Provide advice and assistance as requested to RR planning, modernization or refurbishment	Fostering information exchange – Publications and Databases

- Consultancy Meeting on "Compilation of a Knowledge Basis on Research Reactor Ageing and related Ageing Management Systems", 15 to 17 December 2008
- No need to 're-invent' foundation (definitions, descriptions, etc.) already covered in TECDOC-792 and DS-412
- Build on this work by progressing recommendations of TECDOC-792 (gather, compile and share relevant experience)
- Combined meeting with M&R planned for October 2009
- Anticipated outputs – IAEA document and a simple database (searchable by system and ageing mechanism)
- …

The ‘bathtub curve’

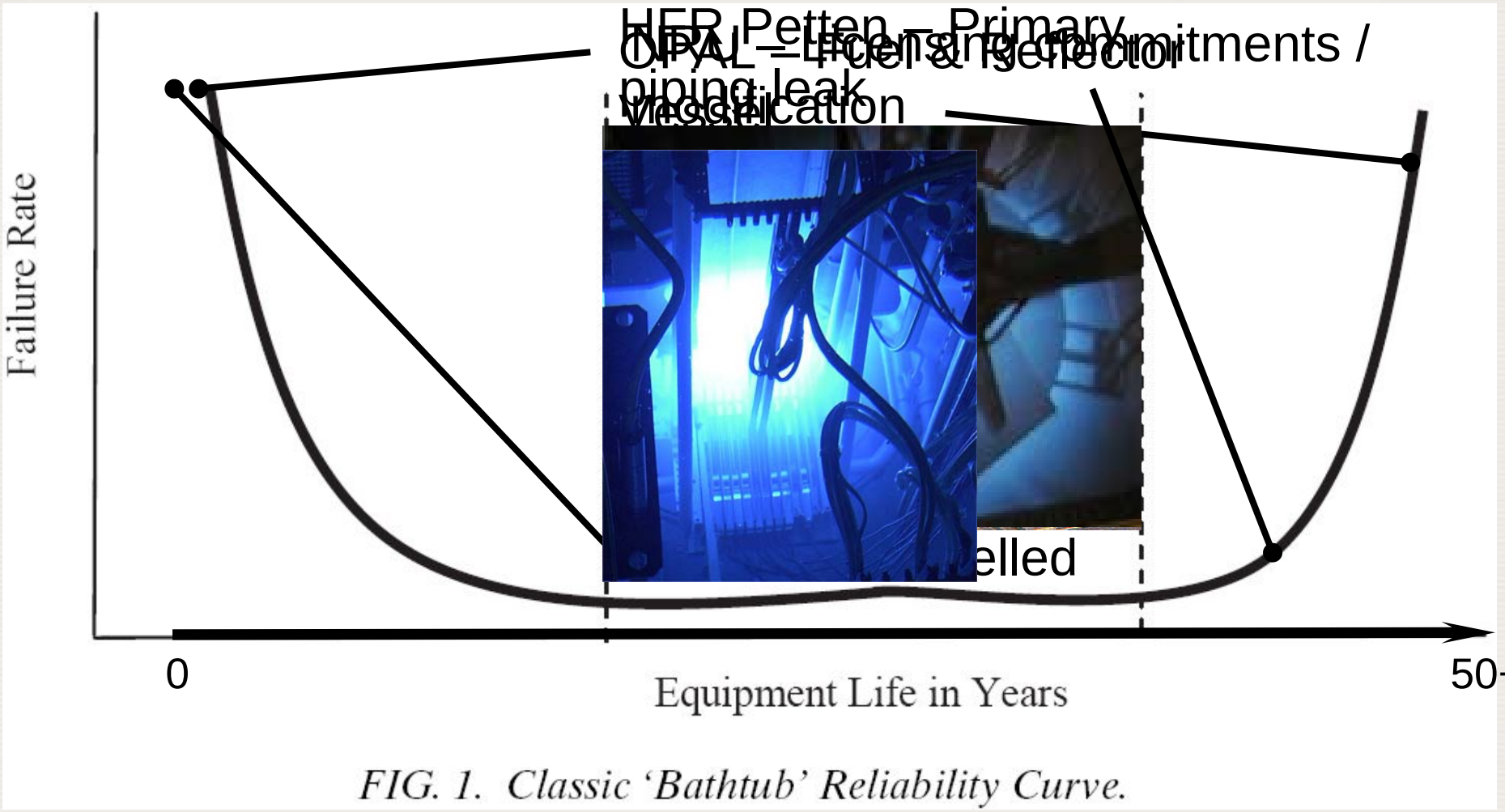
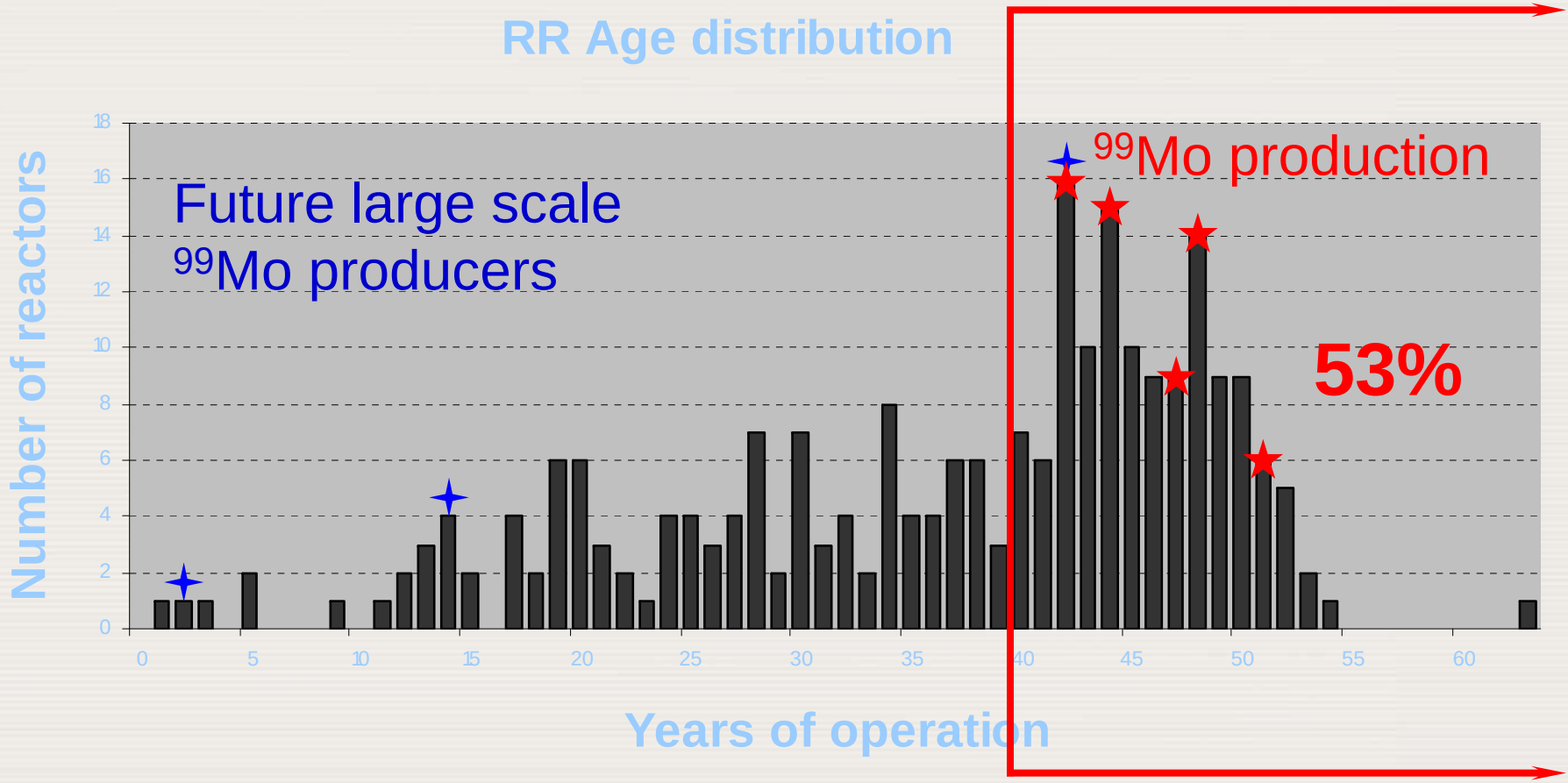
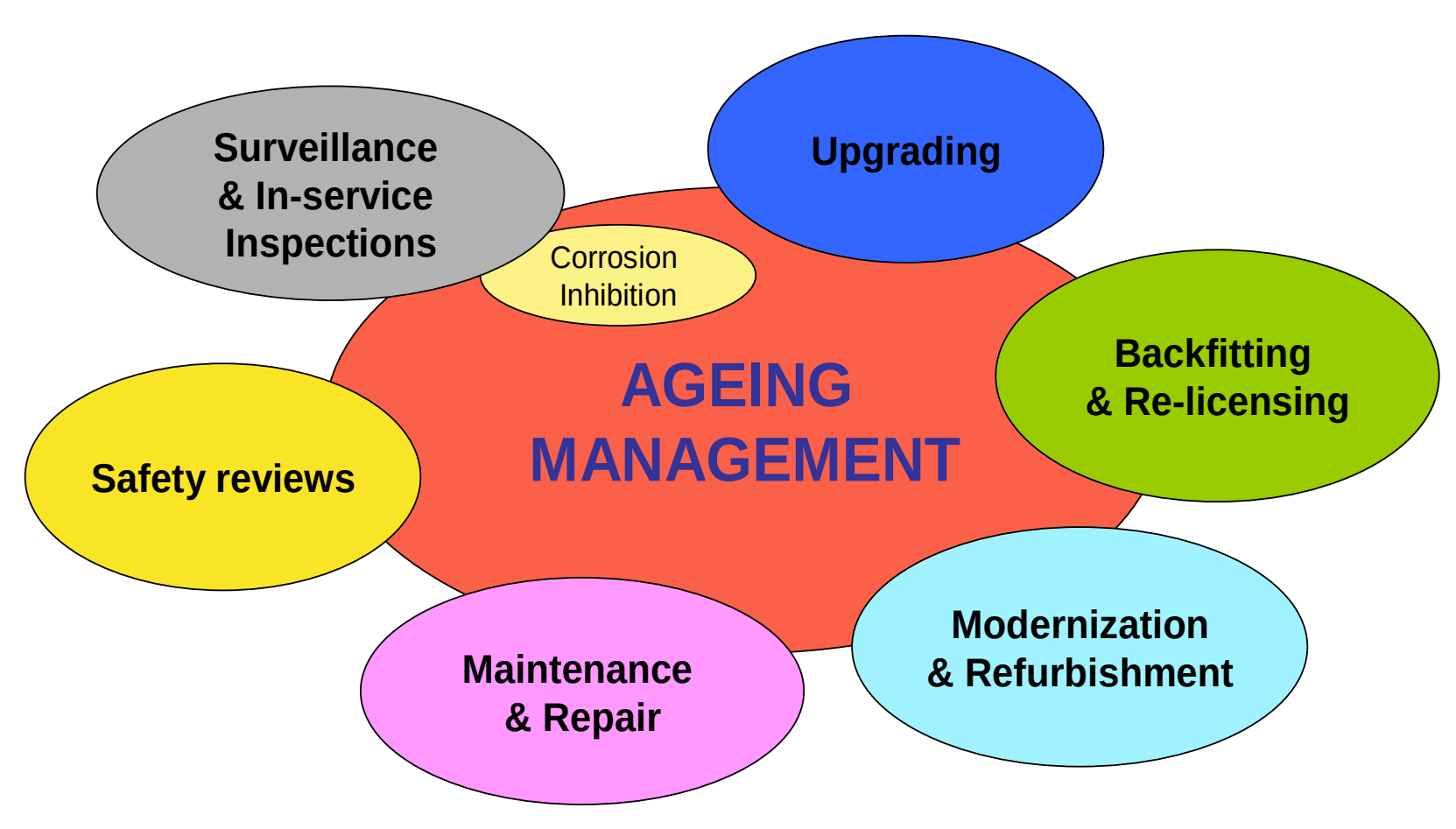


FIG. 1. Classic ‘Bathtub’ Reliability Curve.

RR Ageing


RR Age distribution
Number of reactors
Years of operation
Future large scale
99Mo producers
99Mo production
53%
0
2
4
6
8
10
12
14
16
18
0
5
10
15
20
25
30
35
40
45
50
55
60

RR Ageing management



Project D.2.04
Research reactor operation

Future orientation of the project

Overarching

- Keep all activities practical and focused on information sharing

Ageing Management (in addition to planned activities)

- Include asset integrity / condition monitoring programs
- Consider a probabilistic approach to maintenance (all systems relevant to operation)
- Relevant to all facilities of any age
- Consider the impact of changing engineering and safety codes / standards
- Expert meeting on safety analysis and surveillance activities to extend life of the RRs.
- CRPs for residual life measurement in core components, assessment of Wigner energy in graphite etc.
- Technical meeting on facing the challenges in I&C issues with the threat of obsolescence looming around (verification / validation – computer based systems.)

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Project D.2.04
Research reactor operation

Future orientation of the project

Human skills and resources

- **Innovative RR O&M staff development and retention techniques / succession planning**
- **Utilize previous A&R approach / team to capture and share experiences and lessons learned**

Other

- **Creation of a platform for exchange of information for improvements in O&M practices**

Conclusions

- SP D.2 is designed to address RR issues and challenges
- SP D.2 focuses on the different facets of RRs for their effective utilization and management
- SP D.2 addresses non-proliferation concerns: support to GTRI
- SP D.2 supports the establishment of coalitions, regional and interregional thematic collaborations, networking and centres of excellence

Conclusions

- SP D.2 promotes international collaboration to assess projected needs over the long term for RRs on a global and regional basis
- SP D.2 addresses RR operation, maintenance, availability and reliability
- SP D.2 addresses RR Modernization and Refurbishment
- SP D.2 deals with New RR projects

Thank You
for your attention!

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