Obsolescence & Ageing
Findings from the IAEA Initiative on Research Reactor Ageing and Ageing Management

Session: Overview of Technical Challenges Associated with Conversion & Potential Solutions

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Ageing and Conversion

- The IAEA Initiative started 2009 excluded any conversion aspect explicitly (no political obsolescence by the need to convert)

- Ageing was evaluated as general technical & safety issues

- All ageing cases were reported and categorized by the contributor only

However, the necessity to convert gave reason for evaluating the status of the RR in terms of adequacy of technics, safety, rules to come, etc.

i.e. with view to ageing on one hand & utilization on the other

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### Initiative on RR Ageing

#### Historical Context and Rough History (1)

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>03/1995</td>
<td>IAEA-TECDOC-792 issued “Management of Research Reactor Ageing”</td>
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<tr>
<td>05/1995</td>
<td>Conference on RR Ageing at Geesthacht-Germany (52 papers, &gt;100 participants)</td>
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<tr>
<td>1996-2007</td>
<td>Ongoing IAEA efforts, also in the various fields adjacent to Ageing Management</td>
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<tr>
<td>up to 2008</td>
<td>No new Knowledge-on-Ageing Compilation</td>
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<td>12/2008</td>
<td>Expert Commission Meeting at Vienna</td>
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<tr>
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<td>▶ reviewing the history and the existing supporting documents at the IAEA</td>
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<tr>
<td></td>
<td>▶ structuring an idea of collecting per RR-existing knowledge on ageing into an initiative</td>
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</tbody>
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## Initiative on RR Ageing

### Historical Context and Actual Activity (2)

<table>
<thead>
<tr>
<th>Date</th>
<th>Activity</th>
</tr>
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<tbody>
<tr>
<td>2 – 10/2009</td>
<td><strong>Collecting the information from the RR community</strong> by approaching + submitting a standard <strong>template</strong></td>
</tr>
<tr>
<td>10/2009</td>
<td>Technical Meeting at Vienna with participants and contributions</td>
</tr>
<tr>
<td>10/2009</td>
<td>Establishing of a data base</td>
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<tr>
<td></td>
<td><strong>First Update of the data base (up to 8/2011)</strong></td>
</tr>
<tr>
<td></td>
<td>► Reconfirmation of contacts (expert, mail, tel.)</td>
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<tr>
<td></td>
<td>► Updating the content of templates (new findings, improvements, etc.)</td>
</tr>
<tr>
<td></td>
<td>► Re-approach of RRs remaining silent since 2009 (still many)</td>
</tr>
</tbody>
</table>

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Brief on the Template

Very brief RR details / data / description

Max. 3 ageing problems per template permitted

No enrichment conversions & no photographs

Classification of the ageing issue / experience
  (13 mechanisms, 76 systems in 9 groups)

2 blocks of requested information
  (description of issue; description of actions)

Targeted questions on the ageing issue & its curing, e. g.
  ► on safety relevance
  ► on means / budget
  ► on support from outside the RR
  ► on authorities involvement

Contact address for the RR / the ageing issue

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Brief on the 2009-Participation

- No. of approached members of the RR community: 161 (RR-operators: 133)
- No. of replying members: 83 (RRs 77)
- No. of received templates (more than 1 per RR often): 188 (incl. replaced, withdrawn, rejected-ones)
- No. of revisions per template (average): 4.5
- No. of final templates: 155
- No. of ageing items reported from RRs (max. 3 per template): 367

- Total No. of versions of filled-in templates at my PC: 851
- Total period from approach to closing the books: 10 months

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Reasons for non-contributing

The Language:
Reading more than 160 completed templates plus performing more than 4 revisions per template in the average means you learn a lot about language problems —► fully underestimated

The Template:
No template is perfect and not the entire world is that trained in completing templates as the Germans and the US Americans —► examples can be provided

The Secrets:
Not every minor ageing issue has been reported to the authorities and they should not become known by a contribution

The Advisor
Not every RR operator trusts a simple advisor being rightfully working on behalf of the IAEA —► Non-contributing is an understandable reaction (43 % in 2009)
We do not have an ageing management program, because we do not have the funding for such a thing. We fix things when they break. That is unfortunately the nature of our business here due to monetary constraints. For me to fill out your template with something that is irrelevant is not worth your time, or ours.

We also do not necessarily wish to have this information be publicly available.
2009-Regional & Institutional Differences

- General Success Rate of the Initiative

| World RRs | 133 / 77 = 58% |

- Number of RRs approached / replied / %

<table>
<thead>
<tr>
<th>Region</th>
<th>Number (Approached/Replied)</th>
<th>Success Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Europe</td>
<td>48 / 28</td>
<td>58%</td>
</tr>
<tr>
<td>Asia</td>
<td>34 / 20</td>
<td>59%</td>
</tr>
<tr>
<td>America (N+S)</td>
<td>37+12 / 13+8</td>
<td>35/67%</td>
</tr>
<tr>
<td>Africa</td>
<td>7 (9) / 4</td>
<td>57%</td>
</tr>
<tr>
<td>Australia</td>
<td>3 / 2</td>
<td>67%</td>
</tr>
</tbody>
</table>

- Number of Institutions approached

<table>
<thead>
<tr>
<th>Sector</th>
<th>Number (Approached/Replied)</th>
<th>Success Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industry</td>
<td>9 / 1</td>
<td>11%</td>
</tr>
<tr>
<td>Authorities</td>
<td>10 / 4</td>
<td>40%</td>
</tr>
</tbody>
</table>

- Max Emails forward-backward for 1 Contribution: 55
- Min Emails for 1 Contribution: 1

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2009-Power Dependence of Reply Rate

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38 nominations for ‘Primary Cooling’
24 nominations for ‘Reactor Protection’
22 nominations for ‘Secondary Cooling’
& ‘Control Console’

97 nominations for ‘Reactor Block & Fuel’
90 nominations for ‘I & C’
70 nominations for ‘Cooling’
110 for the entire rest

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2009 - Frequency of named Ageing Mechanisms

**blue:** Nominated systems (out of 76)
per mechanism

**red:** Total nominated issues (out of 367)
per mechanism

A = Radiation induced  
B = Temperature induced  
C = Creep due to stress...  
D = Mech. displ./fatigue/wear  
E = Material deposition  
F = Erosion  
G = Corrosion  
H = Damage ← power exc.  
I = Flooding consequences  
J = Fire consequences  
K = Obsolesc./techn. change  
L = Requir./standard changes  
M = other (staff, PSA, ...)

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2010-Age of the involved RRs

► 133 RRs approached, av. age 39.5 years of operation
► 77 RRs successfully completed templates (37.8 YoO)

More interesting:
► 152 templates with 249 mentioned aged systems represent an average age of 35.6 YoO

Deduction: Ageing is no question of RR-Age as the average age of the reported cases 35.6 is smaller than the average age 37.8 of all reporting RRs or simpler the younger the RR the more ageing issues have been reported.

Minimum conclusion:
Ageing starts with operating the RR, latest

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2010-Age Distribution of involved RRs

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Help for Conversion Planning?

да/Yes,

as for the thorough analysis of the RR undergoing conversion the IAEA Data Base on RR Ageing provides support in terms of:

• the systems and mechanisms to preferably investigate
• the items to discuss with the authorities
• the clear advice to evaluate rules to come
• the contacts for advice for about any kind of ageing and applied curing of ageing
• demonstrating the need for future ageing management

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Ageing Analysis prior to Conversion

My personal view: There is more

Conversion

Ageing
past & future
see: http://www.iaea.org/Our Work/ST/NE/NEFW/AD/index.html

Utilization
present & future
see e.g. IAEA Techn. Report Series No.455

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The End

Thanks to all Contributors
(who enabled this paper by their contributions)

Thanks/спасибо to the audience for listening

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