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Ageing issues in nuclear power plants

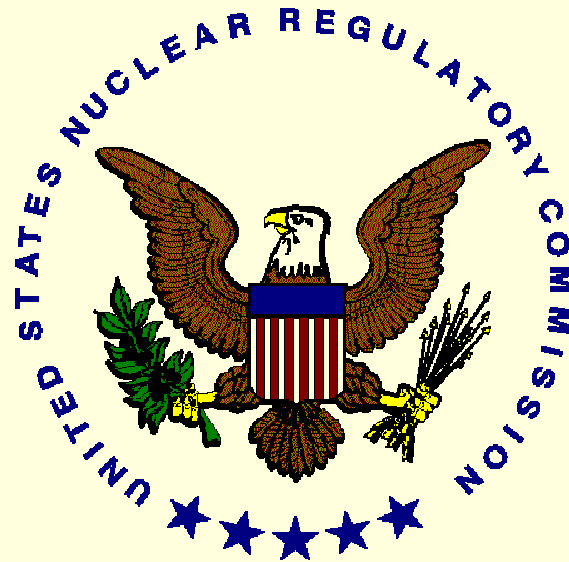
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NuPEER 2005

Regulatory Perspective on Management of Alloy 82/182/600 Susceptibility and Cracking



NuPEER Dijon 2005 Symposium

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Outline

- Organization of paper
- Regulatory Background
- Part I – Discussion
- Part I – Proposed Course of Action
- Part II – Discussion
- Part II - Proposed Course of Action
- Conclusions

Organization of Paper

- Part I – Alloy 82/182/600 components in PWR reactor coolant system other than steam generator tubes and butt welds
- Part II – Alloy 82/182 butt welds – dissimilar metal butt welds (DM BWs)

Regulatory Background

- Industry Actions - examples
- Regulatory Actions - examples
- Regulatory Vehicles Available

Part I - Discussion

- Davis-Besse lessons learned recommendation on PWSCC and BAC
- NRC Order on vessel upper head exams
- NRC Bulletin 2003-02 on vessel lower head exams
- U.S. industry Materials Reliability Program (MRP) actions

Part I – Discussion (Cont'd)

- NRC Bulletin 2002-01 on boric acid corrosion (BAC)
- ASME Task Group on BAC
 - Developed Code Case N-722, "Additional Examinations for PWR Pressure Retaining Welds in Class 1 Components Fabricated with Alloy 600/82/182 Materials, Section XI"
 - Recommended examinations

Part I – Proposed Course of Action

- Regulatory and MRP actions to date may not result in more than one-time inspections
- NRC has concluded that ongoing examinations are warranted
- Bare metal visual examinations at this time are acceptable
- NRC pursuing regulatory action to effect inspections

Part II - Discussion

- Eight cases of PWSCC in DM BWs
 - Palisades in 1993 – through-wall (TW) circumferential
 - V.C. Summer in 2000 – TW axial
 - Ringhals 4 in 2000 – part TW axial
 - TMI-1 in 2003 – part TW axial
 - Tsuruga 2 in 2003 – TW axial
 - Tihange 2 in 2003 – shallow axial
 - Calvert Cliffs in 2005 – part TW axial
 - D.C. Cook 1 in 2005 – part TW axial
- Half attributed to PWSCC – no destructive exam

Part II – Discussion (Cont'd)

- ASME Code Section XI requirements for some DM BWs may not be adequate with respect to frequency
- MRP activities
 - Letter in April 2004
 - Inspection and Evaluation Guidelines

Part II – Proposed Course of Action

- NRC pursuing regulatory action for program to manage PWSCC in DM BWs
- Regulatory action to address
 - inspection methods
 - inspection frequency based on location
 - acceptable mitigative actions

Part II – Proposed Course of Action (Cont'd)

PWSCC Category	Description of Weldments
A	Alloy 52/152 material in contact with primary coolant
B	Alloy 82/182 reinforced by a full structural weld overlay (FSWO)
C	Alloy 82/182 mitigated by stress improvement (SI)
D	Alloy 82/182 in pressurizer and hot leg not mitigated by SI or FSWO

Part II – Proposed Course of Action (Cont'd)

PWSCC Category	Description of Weldments
E	Alloy 82/182 in cold leg locations not mitigated by SI or FSWO
F	Alloy 82/182 weldment cracked and reinforced by FSWO
G	Alloy 82/182 weldment cracked and mitigated by SI

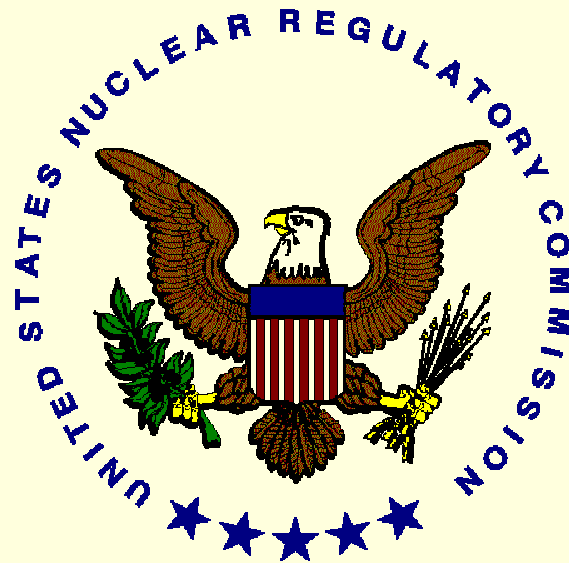
Part II – Proposed Course of Action (Cont'd)

PWSCC Category	Description of Weldments
H	a) Alloy 82/182 or Alloy 52/152 configurations requiring site-specific performance demonstration mockup or b) Alloy 82/182 configurations requiring mitigative actions to inspect per Section XI, App VIII
I	Configurations requiring examination alternative to Section XI, App VIII

Conclusions

- NRC and industry have taken actions, but actions not sufficient for long-term
- PWSCC and BAC have potential for serious failures
- NRC is undertaking steps to put regulatory framework in place for long-term programs to manage PWSCC

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