

Section 8:
Panel Discussion

NRC Perspective on the Management of Materials Degradation

Dr. Richard Barrett, Director
Division of Engineering
Office of Nuclear Reactor Regulation
Nuclear Regulatory Commission
October 2, 2003

ALLOY 600 ISSUES

- Cracking frequently identified and repaired in pressurizer heater sleeves and instrument nozzles
- Hot leg weld cracking – V.C. Summer
- Upper head nozzle cracking – ANO, Oconee, etc.
- Upper head wastage – Davis-Besse
- Lower head nozzle cracking – South Texas Unit 1



RECENT NRC ACTIONS

- **Bulletin 2001-01: Upper head inspections for high-susceptibility plants**
- **Bulletin 2002-01: Adequacy of boric acid corrosion control programs**
- **Bulletin 2002-02: Bare metal visual and non-destructive examinations of upper heads**
- **NRC Order EA-03-009**
- **Bulletin 2003-02: Lower vessel head inspections**

1173



October 2, 2003

FUTURE NRC NEEDS

- **More complete and realistic technical basis for inspections and repairs**
 - ◆ **Crack initiation and growth rates**
 - ◆ **Susceptibility models**
 - ◆ **Alloy 600 and 690**
- **Continued progress on inspection methods**
- **Regulatory requirements that accommodate materials differences, evolving technical information, and emerging inspection methods**



October 2, 2003

SUMMARY

- Frequency and significance of materials degradation issues are growing
- Research community must continue to develop technical basis for inspections and repairs
- Industry must be prepared to provide comprehensive approaches in a timely manner
- NRC will continue in its regulatory role and will take necessary actions based on its evaluation of the available information

1175



October 2, 2003

INTEGRATED INSPECTION MODEL FOR MANAGING MATERIALS ISSUES

- Inspection Scope
- Inspection Method
- Acceptance Criteria
- Inspection Frequency

1177

Integrated Inspection Model (con't)

- Inspection Scope
 - How Many Components to Look at
 - How Much of Each Component to Look at
 - Expansion Criteria
 - *Based on statistical evaluations to provide the reliability necessary to maintain desired level of component reliability and an acceptable level of overall risk*

Integrated Inspection Model (con't)

- Inspection Method
 - Inspection Technology (e.g., VT, PT, ECT, UT,)
 - Technique and Personnel Qualification (Detection and Sizing)
 - *Based on performance demonstration with defined level of reliability*

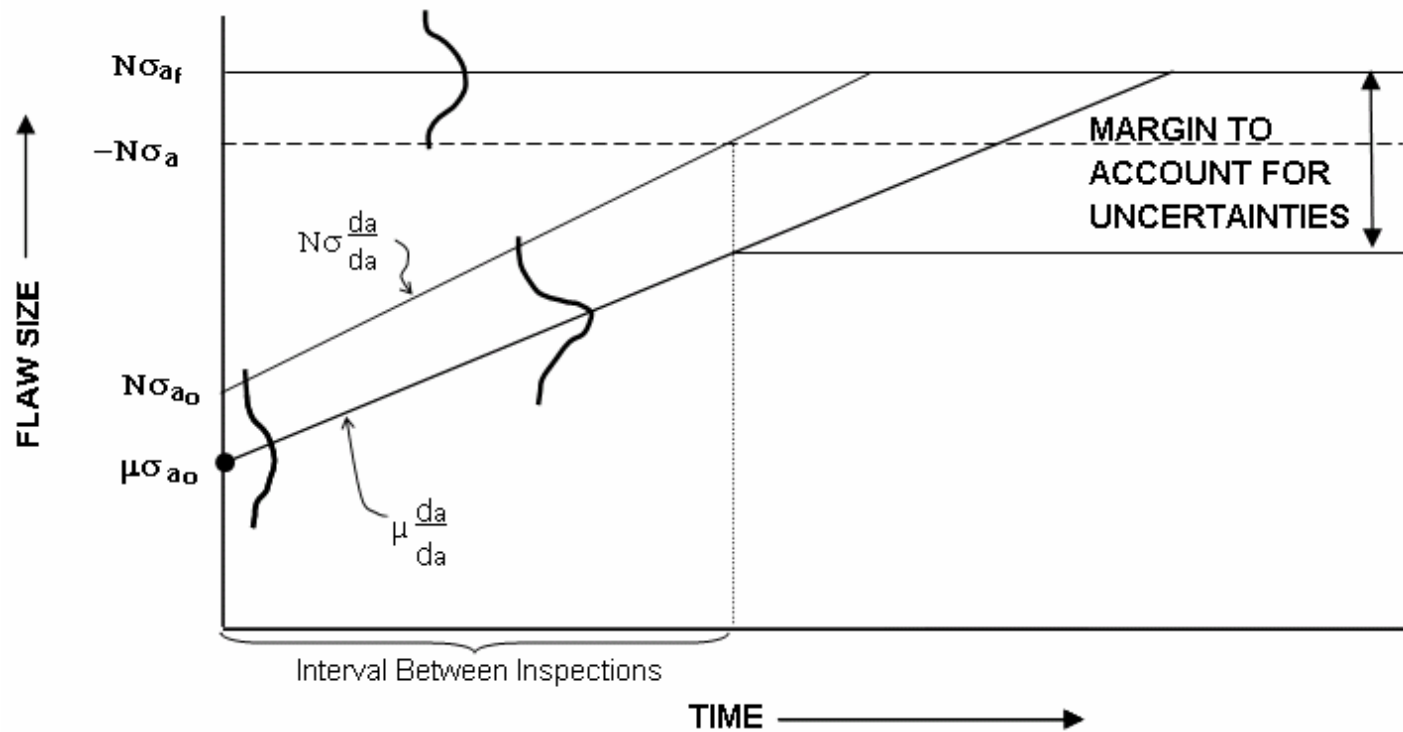
Integrated Inspection Model (con't)

- Acceptance Criteria
 - Defined Failure Point
 - Applicable Margins
 - *Margins account for uncertainties e.g., in inspection methods, degradation rates, failure criteria*

Integrated Inspection Model (con't)

- Inspection Frequency
 - Degradation Rates
 - Performance Based?
 - *Requires integration of reliability of inspection method, degradation rates and acceptance criteria to maintain desired level of component reliability*

INTEGRATED INSPECTION MODEL



1182

IMPORTANCE OF IMPLEMENTATION

- The Best Research and Technical Work Will Be for Naught If:
 - Results Are Not Put Into an Implementable Format (e.g., Code or Guidance Document)
 - Implementation Is Not Monitored to Ensure Effectiveness

BIBLIOGRAPHIC DATA SHEET

(See instructions on the reverse)

NUREG/CP-0191

2. TITLE AND SUBTITLE

Proceedings of the Vessel Penetration Conference on Inspection, Crack Growth and Repair;
Volume 1: Manuscripts
Proceedings of the Vessel Penetration Conference on Inspection, Crack Growth and Repair;
Volume 2: Presentations

3. DATE REPORT PUBLISHED

MONTH

YEAR

September

2005

4. FIN OR GRANT NUMBER

5. AUTHOR(S)

Compiled and edited by T. S. Mintz and W. H. Cullen, Jr.

6. TYPE OF REPORT

Conference Proceedings

7. PERIOD COVERED (Inclusive Dates)

8. PERFORMING ORGANIZATION - NAME AND ADDRESS (If NRC, provide Division, Office or Region, U.S. Nuclear Regulatory Commission, and mailing address; if contractor, provide name and mailing address.)

Division of Engineering Technology
Office of Nuclear Regulatory Research
U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001

9. SPONSORING ORGANIZATION - NAME AND ADDRESS (If NRC, type "Same as above"; if contractor, provide NRC Division, Office or Region, U.S. Nuclear Regulatory Commission, and mailing address.)

Same as above

10. SUPPLEMENTARY NOTES

Conference held September 29 - October 2, 2003 in Gaithersburg, Maryland, USA

11. ABSTRACT (200 words or less)

These two volumes of proceedings contain the visual projections (in Volume I), and the contributed manuscripts (in Volume II) from the Conference on Vessel Head Penetration, Crack Growth and Repair, held at the Gaithersburg Marriott at Washingtonian Center on September 29 - October 2, 2003. The conference was co-sponsored by the U. S. Nuclear Regulatory Commission and Argonne National Laboratory. Over two hundred attendees were provided with 45 presentations, divided into five sessions: (I) Inspection Techniques, Results, and Future Developments, (II) Continued Plant Operation, (III) Structural Analysis and Fracture Mechanics Issues, (IV) Crack Growth Rate Studies for the Disposition of Flaws, and (V) Mitigation of Nickel-Base Alloy Degradation and Foreign Experience. The conference opened with a plenary session including presentations giving the overview from the NRC Office of Regulatory Research, and an overview of nickel-base alloy cracking issues worldwide. The conference closed with a panel session consisting of industry representatives and NRC management discussing the prognosis for future issues in this area of concern.

12. KEY WORDS/DESCRIPTORS (List words or phrases that will assist researchers in locating the report.)

Stress corrosion cracking
Non-destructive inspection
Ultrasonic inspection
Eddy Current inspection
Alloy 600
Alloy 182
Alloy 690
Alloy 152

13. AVAILABILITY STATEMENT

unlimited

14. SECURITY CLASSIFICATION

(This Page)

unclassified

(This Report)

unclassified

15. NUMBER OF PAGES

16. PRICE