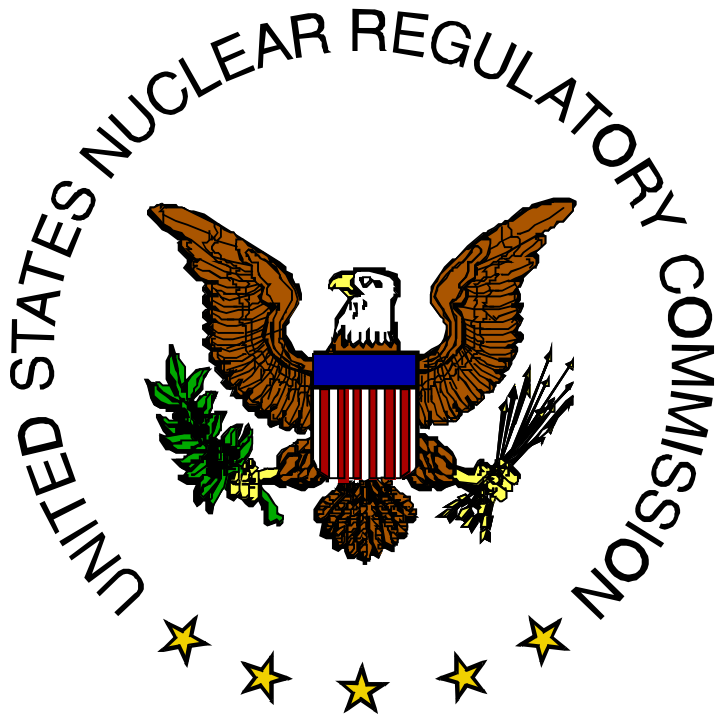
Public Meeting Between NRC and NEI and PWR Licensees to Discuss Bulletin 2002-02



Two White Flint North
11545 Rockville Pike
Rockville, Maryland 20852
TWFN Auditorium

August 23, 2002
9:00 am - 12:15 pm

Agenda

Time	Topic	Speaker
9:00 a - 9:15 a	Opening Remarks	Brian Sheron, NRC Alex Marion, NEI
9:15 a - 10:00 a	Overview of Bulletin 2002-02	Allen Hiser, NRC
10:00 a - 10:30 a	Example of Supplemental Inspections	Tim Steingass, NRC
10:30 a - 11:00 a	Q & A on 1st and 2nd Presentations	all/public
11:00 a - 11:15 a	Break	all
11:15 a - 11:30 a	Overview of Plans for Vessel Head and Nozzle Inspection Regulations	Michael Marshall, NRC
11:30 a - 12:00 p	Q & A on 3rd Presentation	all/public
12:00 p - 12:15 p	Closing Remarks	Brian Sheron, NRC Alex Marion, NEI

Contacts

- NEI Project Manager
  - Joe Birmingham, 301-415-2829
- Bulletin 2002-02 Technical Contacts
  - Allen Hiser, 301-415-1034
  - Tim Steingass, 301-415-3312
- Bulletin 2002-02 Project Managers
  - Michael Marshall, 301-415-2734
  - Steve Bloom, 301-415-1313

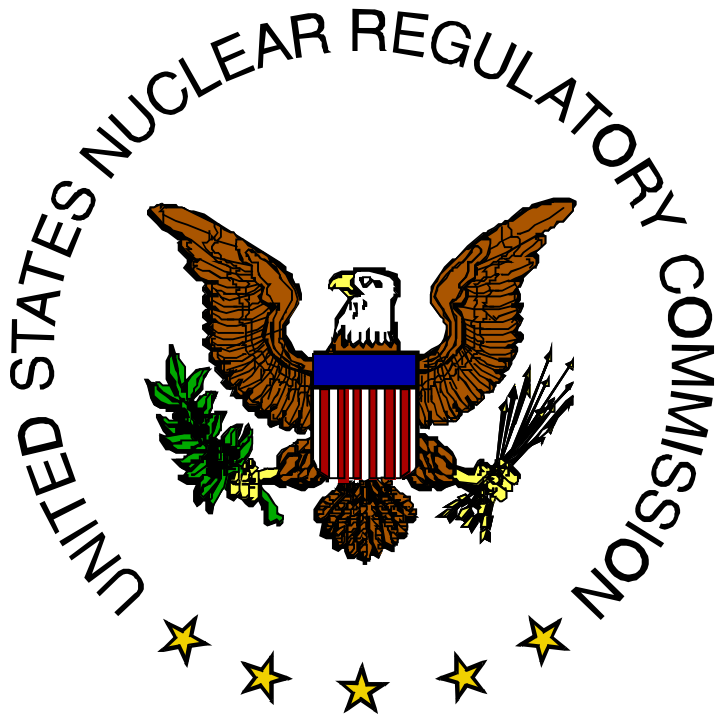
NRC Web-Site Information

- Alloy 600 Cracking (including Circumferential Cracking of CRDM Nozzles)
  - http://www.nrc.gov/reactors/operating/ops-experience/alloy600.html
- RPV Head Degradation
  - http://www.nrc.gov/reactors/operating/ops-experience/vessel-head-degradation.html

Previous Meetings with NEI and MRP
Concerning Cracking, Wastage, or Inspections

Date	Subject
08/23/2002	Bulletin 2002-02
07/24/2002	Revised MRP Proposed Inspection Plan
05/22/2002	MRP Proposed Inspection Plan, Crack Growth Rate, Probability of Detection, Probabilistic Fracture Mechanics
03/16/2002	Davis Besse Reactor Vessel Head Degradation
02/20/2002	Control Rod Drive Mechanism Vessel Head Penetration Cracking
11/08/2001	Control Rod Drive Mechanism Nozzle Cracking
08/15/2001	Bulletin 2001-01
07/03/2001	Development of Bulletin 2001-01
06/07/2001	Control Rod Drive Mechanism Nozzle Cracking
04/12/2001	Control Rod Drive Mechanism Nozzle Cracking

Overview of Bulletin 2002-02



Presenter:
Allen Hiser,
301-415-1034

August 23, 2002

Background on VHP Nozzle Cracking & RPV Head Degradation

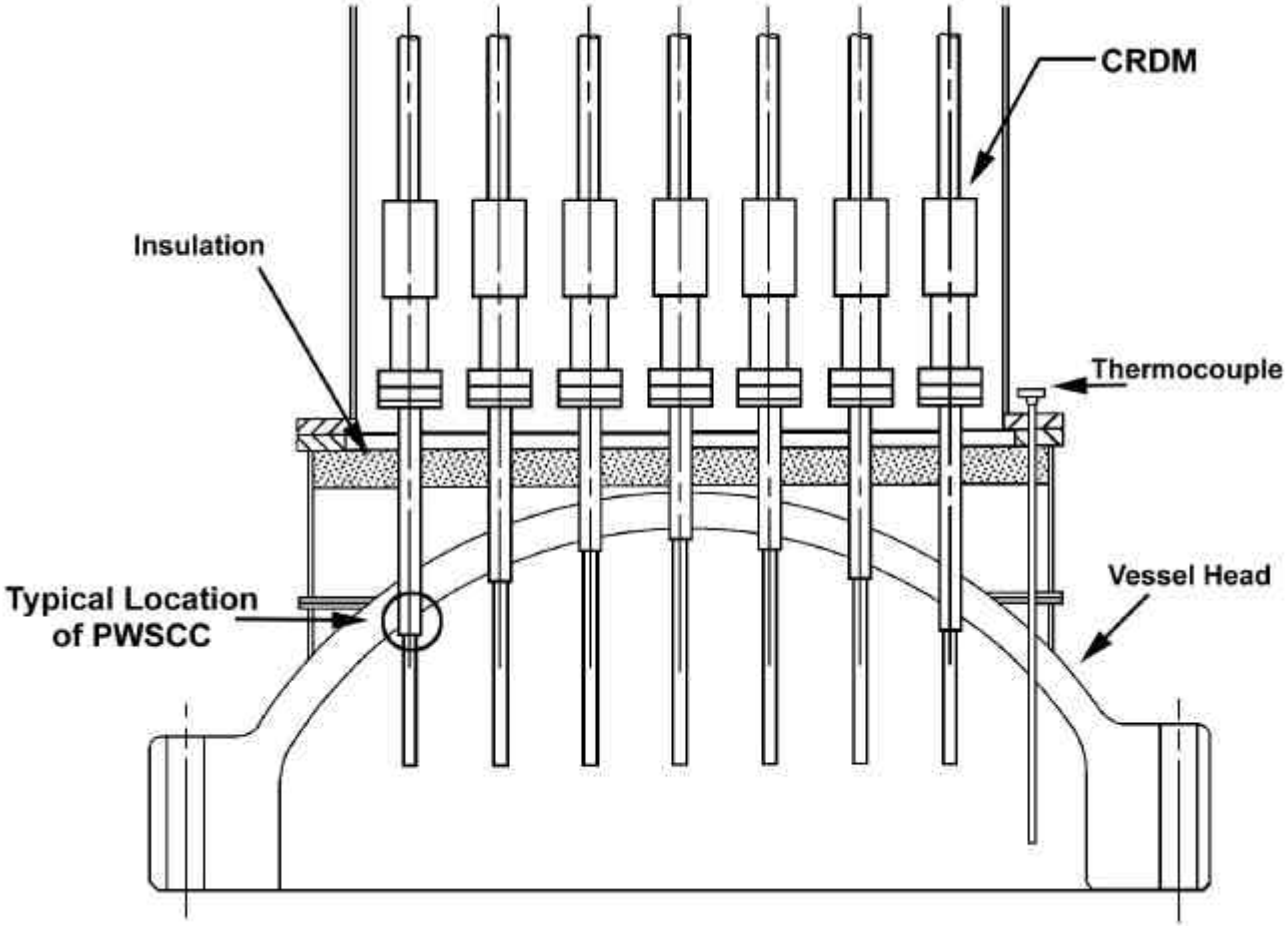
- First cracking of CRDM nozzles identified in France in 1991 - axial cracking
- Industry analyses - axial cracking not a safety concern; circumferential cracking unlikely
- NRC issued Generic Letter 97-01
- Spring 2001 Outages -- Circumferential flaws detected (boric acid deposits)

  - Oconee Units 2 & 3 - 2 nozzles 165° through-wall cracks
  - Chronology of circumferential cracks
    - Axial cracks in J-groove welds or HAZ allow leakage into annular region
    - Leakage to vessel head OD may be restricted by interference fit of nozzles
    - Circumferential cracks initiate on OD and grow in aggressive environment

Background on VHP Nozzle Cracking & RPV Head Degradation

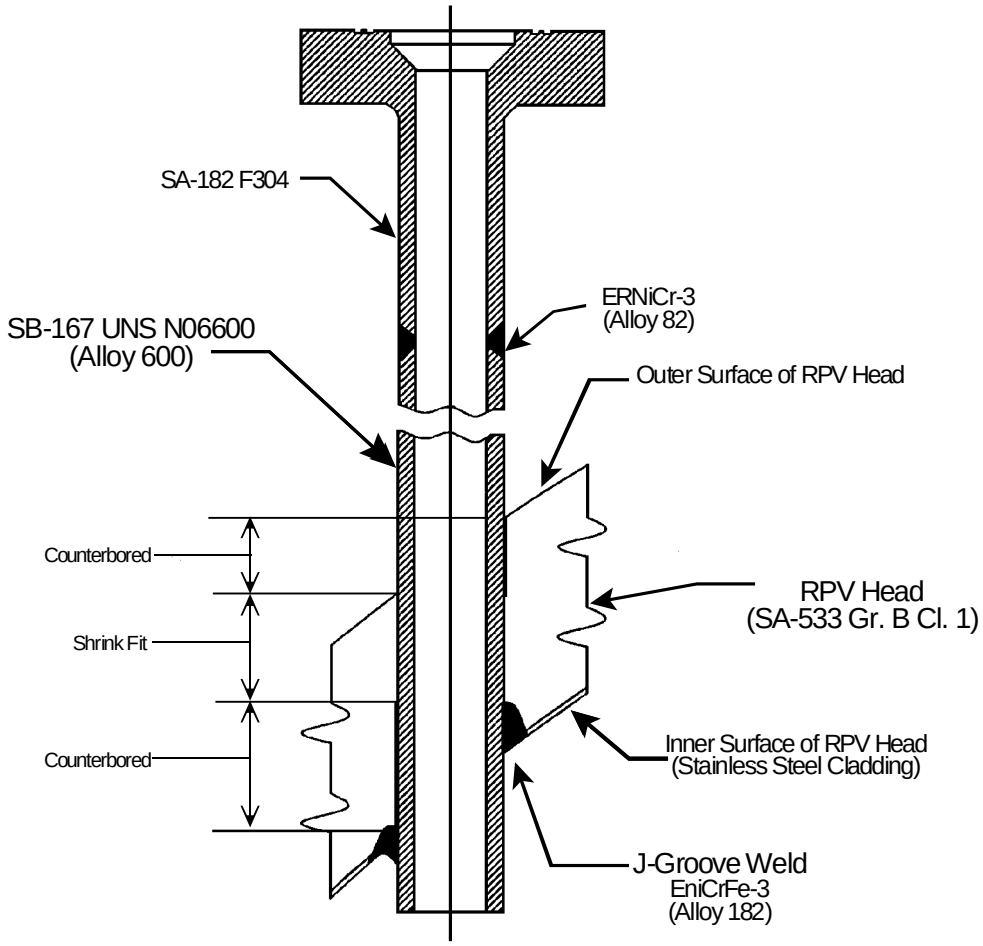
- NRC issued Bulletin 2001-01 (August 2001) -inspections for circumferential cracks
- Spring 2002 Outages – vessel head degradation identified at Davis-Besse
- NRC issued Bulletin 2002-01 (March 2002) - no head degradation at other plants
- NRC issued Bulletin 2002-02 (August 9, 2002) - inspections to prevent leakage

Typical Reactor Vessel Head - Oconee Unit 1 (Babcock & Wilcox)



Source:

Schematic View of B&W Design CRDM Nozzle Area



Source:

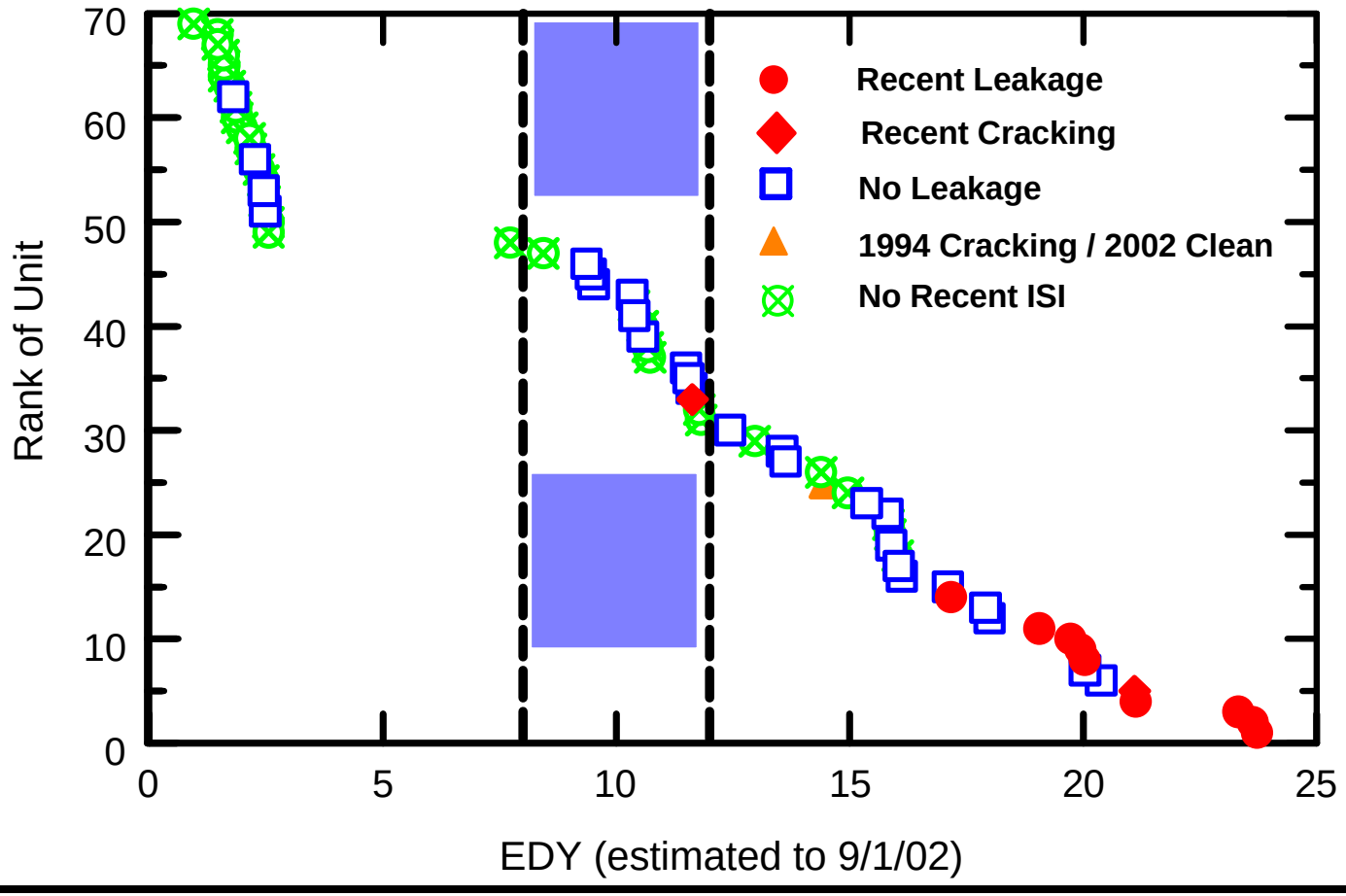
Past Inspections

Plants	Most Recent Inspection					
	Date	Method & Scope	Summary of Cracked or Leaking CRDM Nozzles			
			Leaking	Cracked	Circumferential Nozzle Cracks	Number Repaired
Oconee 1	11/2000	Qualified Visual - 100%	1★	1★	0	1
Oconee 3	02/2001	Qualified Visual - 100%	9	9	3	9
ANO-1	03/2001	Qualified Visual - 100%	1	1	0	1
Oconee 2	04/2001	Qualified Visual - 100%	4	4	1	4
Robinson	04/2001	Qualified Visual - 100%	0	0	0	0
North Anna 1	09/2001	Qualified Visual - 100%★★	0	8	0	0
Crystal River 3 ★★★	10/2001	Qualified Visual - 100%★★	1	1	1	1
TMI-1	10/2001	Qualified Visual - 100%	5★	8★	0	6
Surry 1	10/2001	Qualified Visual - 100%★★	(4)	10	0	6
North Anna 2	10/2001	Qualified Visual - 100%★★	3	3	0	3
Surry 2	11/2001	Qualified Visual - 100%★★	0	0	0	0
Oconee 3	11/2001	Qual. Visual - 100% (UT of 100%)	5	7	1	7
D. C. Cook 2	1/2002	Qual. Visual, ECT, UT - 100%	0	0	0	0
Millstone 2 ★★★	2/2002	UT Examination - 100%	0	3	0	3
Davis-Besse	2/2002	UT Examination - 100%	3	5	1	3 (5)
Oconee 1	3/2002	Qualified Visual - 100%	1	2	0	2

Status of Future Inspections

- Management by visual examination may not be considered sufficient
  - Visual examination inspectability
  - Hypotheses contained in the Davis-Besse root cause report is probable
  - Technical specification limit of “no pressure boundary leakage”
- Need further information to support visual examinations alone
  - On-going MRP activities
  - Support not sufficiently mature at this time
  - Addtional technical understanding about wastage (corrosion) rates
  - Agreement on technical basis for predictive models for crack growth in welds
  - Cracking is becoming more prevalent as plants age

Bulletin 2002-02 Susceptibility Ranking



Rockville, MD
August 23, 2002

Staff Concerns

- Understanding about wastage (corrosion) rates and wastage phenomena
- Predictive models for crack growth in welds
- Cracking is becoming more prevalent as plants age
- Occurrence of through-wall or through-weld cracks during operation
- Capability to identify through-wall or through-weld cracks by leakage detection

Proactive Actions Needed To Address Issues

- Industry needs to provide adequate technical justification to reduce necessary reliance on supplemental non-visual examinations

- New heads with Inconel 690 tubes will have to follow the same inspection criteria as heads with Inconel 600 until industry provides technical basis for changes

Requested Information

- Issued August 9, 2002 - “Reactor Pressure Vessel Head and Vessel Head Penetration Nozzle Inspection Programs”
- Informs PWRs of NRC concerns with visual examinations
- Asks PWRs to provide information about planned inspections
  - Plans to supplement inspections
  - Justification for reliance on visual examinations
- Categorization based on effective degradation years (EDY)
- Provides example of supplemental inspection

Requested Information
30-Day Response

☛ For Plants that plan to supplement their RPV head and VHP inspection programs with non-visual NDE methods:

- Methods and Frequencies
- EDY
- Scope and Coverage
- Qualification Requirements
  - Method
  - Personnel
- Acceptance criteria

Requested Information
30-Day Response

- For plants that do not plan to supplement their RPV head and VHP inspection programs with non-visual NDE methods:

- Discussion of Technical Basis for Concluding that Unacceptable Vessel Head Wastage Will not Occur Between Inspection Cycles
  - Provide Data to Demonstrate Understanding Wastage Phenomena
  - Provide Data to Demonstrate Understanding Wastage Rates
  - Applicability of Data to Plant

Requested Information
30-Day Response

- For plants that do not plan to supplement their RPV head and VHP inspection programs with non-visual NDE methods:

  - Discussion on How Reliability and Effectiveness of the Inspections Method Was Demonstrated

  - Discussion on How the Six Concerns Have Been Addressed

Requested Information
30-Day Post Inspection Response

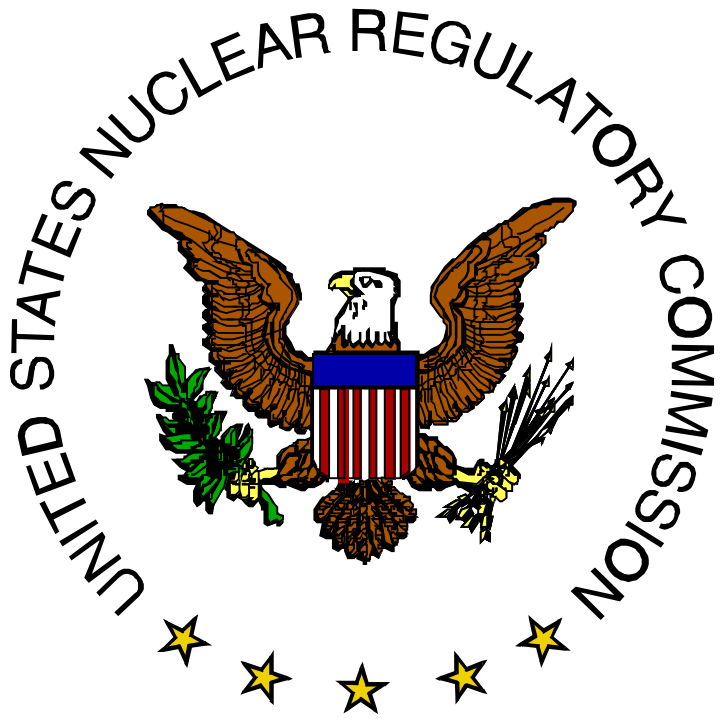
CLARIFICATION: Staff intent is a one-time submittal after next inspection of vessel head and nozzle penetrations.

- Inspection Scope and Results
  - location, size, extent, and nature of any degradation
- NDE Used
  - method, number, type, and frequency of transducers or transducer packages,
  - essential variables, equipment,
  - procedure and personnel qualification requirements

Requested Information
30-Day Post Inspection Response

- Criteria used to determine whether an indication, "shadow," or "backwall anomaly" is acceptable or rejectable

- Corrective actions taken and the root cause determinations for any degradation found.



Example of Supplemental Inspections

Presenter:
Timothy Steingass,
301-415-3312

August 23, 2002

Example of Supplemental Inspections

▲High Susceptibility Plants

(> 12 EDY) - ~ 33 plants

- " UT of nozzle base metal every RFO
- " Surface examination (eddy current or PT) every RFO
- " Bare metal visual every RFO

▲Moderate Susceptibility Plants

(> 8 EDY & <12 EDY) -~ 15 plants

- " UT of nozzle base metal at RFO after next RFO and then every other RFO
- " Surface examination (eddy current or PT) at RFO after next RFO and then every other RFO
- " Bare metal visual at next RFO and then every other RFO

▲Low Susceptibility Plants

(< 8 EDY) - ~ 21 plants

- " UT of nozzle base metal within 5 years and then at least once every 5 years
- " Surface examination (eddy current or PT) within 5 years and then at least once every 5 years
- " Bare metal visual within 3 years and then at least once every 5 years

Example of Supplemental Inspections

- Example of Supplemental inspections is not the definitive answer to testing - other approaches may be technically sound
- Another Supplemental NDE approach may be warranted based on a particular licensee's configuration, geometry and method of construction
- The licensee is responsible to provide their technical basis for their Supplemental NDE approach

Bare Metal Visuals

- Bare Metal Visuals (BMV) detect through wall leakage after the leakage has begun.
- Once leakage has been identified, supplemental nondestructive examinations (NDE) are performed
- BMV can be challenging to complete. Through-wall leakage may not detected in part due to access restrictions
  - There may be field impediments to overcome
- Supplemental NDE may be necessary to assure that long term leakage does not go undetected to prevent head wastage

Bare Metal Visuals

- BMV are beneficial because access limitations or surface conditions may prevent complete coverage of the J-groove weld
- Therefore, it is reasonable to continue performing BMV as part of the inspection plan
- Performing supplemental NDE is consistent with Inservice Inspection Programs and ASME to monitor Class 1, 2 and 3 components

Ultrasonic Testing

- Ultrasonic testing effectively detects flaws in the CRDM tube base material, both the ID and OD
- If flaws are detected, their location, orientation and size must be characterized
- Ultrasonic inspections detect CRDM base metal flaws prior to leakage onset
- Ultrasonic inspection of the weld material has not been demonstrated to be effective in detecting flaws in the J-groove weld, therefore, PT or ET is required

Eddy Current or Dye Penetrant Testing

- The Eddy Current or PT examination acts as assurance that no unacceptable flaws exist in the CRDM nozzle or J-groove weld area

- ET or PT examination provide assurance that J-groove weld flaws will be detected

- ET or PT examinations detect cracks prior to any loose parts issues developing in the lower portion of the CRDM tube

Frequency of Examinations

- The industry with MRP and EPRI have been diligently working to expand NDE capabilities and effectiveness
- MRP have also provided a proposed inspection plan that we have used as basis with modifications for the suggested frequencies in the Bulletin
- Increased testing frequency as EDY increase is consistent with the ASME Code approach of successive inspections if flaws are identified.
- The testing frequencies will be assessed by the staff after a significant amount of field data can justify changes

CONCLUSIONS

- Detection and characterization of unacceptable flaws cannot be accomplished with inspections based on BMV alone
- Supplemental NDE and BMV synergistically increase the effectiveness of each method
- This approach is consistent with the methodology used in Inservice Inspection Programs and ASME to monitor components for service related failures

CONCLUSIONS

- Testing frequencies can be evaluated after sufficient data exists to warrant change

- The example supplemental inspection in the bulletin is not definitive

  - Other NDE techniques that are effective when used in conjunction with each other should be discussed and technically justified by the licensee

Overview of Plans for Vessel Head and Nozzle Inspection Regulations

Presenter:
Michael Marshall,
301-415-2734

August 23, 2002

Main Aspects of NRC Plans

- Issue Bulletin - Request Information on Supplemental Inspections and Justification for Current Inspection Practice

- Additional Regulatory Action If Warranted

- Request Changes to ASME Section XI - Address Deficiencies in Inspection Requirements
  - Inspection Methods
  - Acceptance Criteria

- Revise 10CFR55.55a - Revised Inspection Requirements

Rockville, MD
August 23, 2002

Other Aspects of NRC Plans

Near-Term

- Formally Review MRP Proposed Inspection Plan
  - Waiting for Complete Submittal
  - NRC has not found proposed plan acceptable 

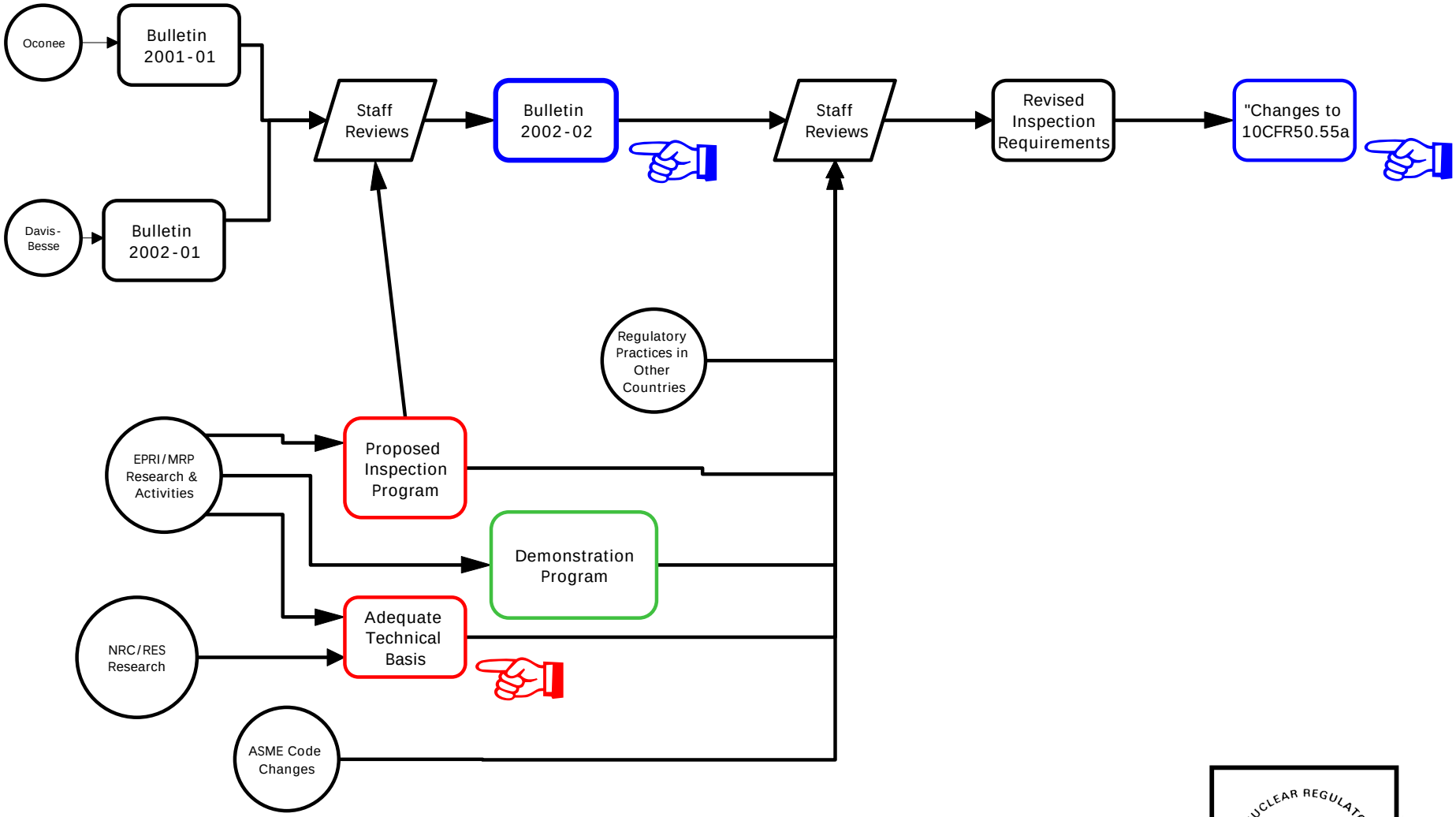
- Formally Review MRP Crack Growth Rate Report
  - Received Report This Week

Long-Term

- Review Planned Changes to ASME Code Requirements

- Develop Alternate Inspection Plan/Requirements Based on Current State of Uncertainty

Flow Chart of NRC Plans



Rockville, MD
August 23, 2002

Proactive Actions Needed To Address Issues

- Industry needs to provide adequate technical justification to reduce necessary reliance on supplemental non-visual examinations

- New heads with Inconel 690 tubes will have to follow the same inspection criteria as head with Inconel 600 until industry provides technical basis for changes