Entergy

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Michael A. Krupa
Director
Nuclear Safety & Licensing

CNRO-2002-00004

February 15, 2002

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

SUBJECT: Entergy Operations, Inc.
Meeting to Discuss Alternate Repair Techniques for Inconel 600

Arkansas Nuclear One – Units 1 & 2
Docket Nos. 50-313 & 50-368
License Nos. DPR-51 & NPF-6

Waterford Steam Electric Station – Unit 3
Docket No. 50-382
License No. NPF-38

REFERENCE:

1. Letter CNRO-2002-00001 from Entergy Operations, Inc, to the NRC, "Letter of Intent – Proposed Alternatives to ASME Code Requirements," dated January 16, 2002

2. Letter CNRO-2002-00002 from Entergy Operations, Inc, to the NRC, "Meeting to Discuss Mechanical Nozzle Seal Assembly Design," dated January 17, 2002.

Dear Sir or Madam:

In Reference 1, Entergy Operations, Inc. (Entergy) notified the NRC of our intent to pursue licensing actions associated with review and approval of repair techniques that are alternative methods from those required by ASME Code. To further support communications regarding these actions, we requested a meeting with the appropriate NRC staff representatives to discuss these techniques.

Entergy considered portions of the information to be discussed at the meeting to be proprietary and confidential pursuant to 10 CFR 2.790(a)(4) and 10 CFR 9.17(a)(4). Therefore, in Reference 2, we provided the proprietary information to the NRC and requested that it be withheld from public disclosure. The meeting was held on January 31, 2002.

A047

Rec'd 02/04/02

As requested by the NRC, this letter transmits the slide presentation presented at the January 31 meeting. This presentation contains information based on the information previously provided to the staff in Reference 2. As such, Entergy requests the proprietary information contained in the presentation be withheld from public disclosure. The affidavit supporting this request is provided in Attachment 1. The slide presentation is provided in Attachment 2 with slides marked as proprietary, where appropriate. A redacted version of the presentation is provided in Attachment 3.

If you have any questions or require additional information, please contact Guy Davant at (601) 368-5756.

This letter contains no commitments.

Sincerely,

M. A Krupa

MAK/GHD/baa

Attachments:
1. Affidavit
2. Use of Alternate Repair Techniques for Inconel 600 – Proprietary Version
3. Use of Alternate Repair Techniques for Inconel 600 – Redacted Version

cc: Mr. C. G. Anderson (ANO) (w/1)
Mr. W. R. Campbell (ECH) (w/1)
Mr. J. K. Thayer (ECH) (w/1)
Mr. J. E. Venable (W3) (w/1)

Mr. T. W. Alexion, NRR Project Manager (ANO-2)
Mr. R. A. Gramm, Section Chief, NRR Licensing Project Directorate IV (w/1)
Mr. E. W. Merschoff, NRC Regional Administrator, Region IV (w/1)
Mr. N. Kalyanam, NRR Project Manager (W3)
Mr. W. D. Reckley, NRR Project Manager (ANO-1)

AFFIDAVIT

I, Michael A. Krupa, Director, Nuclear Safety and Licensing, of Entergy Operations, Inc. (Entergy) do hereby affirm and state:

1. Entergy is providing information in support of a request made to the NRC staff. The document being provided in Attachment 2 of this letter ("Use of Alternate Repair Techniques for Inconel 600") contains technical information developed by Entergy and Westinghouse and owned by Entergy regarding the improved Mechanical Nozzle Seal Assembly (MNSA) design. This document contains proprietary commercial information that should be held in confidence by the NRC pursuant to 10 CFR 9.17(a)(4) and the policy reflected in 10 CFR 2.790, because:

   i. The information is being held in confidence by Entergy. Because of the substantial investment made to develop this information and its commercial viability, Entergy has not released it to the public.

   ii. The information is of a type that is customarily held in confidence by Entergy and not disclosed to the public.

      ii.1 The information reveals distinguishing aspects of the improved MNSA design where its use by other companies without license or agreement from Entergy would prevent Entergy from recouping its investment in developing the component.

      ii.2 The information contains supporting data relative to the improved MNSA design, the application of which increases Entergy's ability to recoup its investment in developing the component.

      ii.3 The use of the information by another company would reduce its expenditure of resources in the design or licensing of a similar product.

   iii. The information is being transmitted to the NRC in confidence with the understanding that the NRC will hold the information in confidence while determining if it meets the requirements of 10 CFR 2.790(b)(4). If the NRC determines that the information does not meet the requirements of 10 CFR 2.790(b)(4), the information will be returned to Entergy.

   iv. The information is not available in public sources and could not be gathered readily from other publicly available information. The information has been developed by Entergy and Westinghouse and has not been made available to the public by either company.

   v. The information sought to be withheld is that which is appropriately marked in Attachment 2. This information is submitted for use by the NRC staff and is expected to be applicable in other license submittals for justification of the use of the improved Mechanical Nozzle Seal Assembly design. The information provided in this document represents a substantial investment, public disclosure of which would reduce Entergy's ability to recoup part or all of that investment.

2. Accordingly, Entergy requests that the designated document be withheld from public disclosure pursuant to 10 CFR 2.790(a)(4) and 10 CFR 9.17(a)(4).

I declare under penalty of perjury that the foregoing is true and correct.

Executed on February 15, 2002

M. A Krupa

Michael A. Krupa

CNRO-2002-00004
Attachment 3

Entergy Operations, Inc.

USE OF
ALTERNATE REPAIR TECHNIQUES
FOR INCONEL 600

Redacted Version

USE OF ALTERNATE REPAIR TECHNIQUES FOR INCONEL 600

Entergy Operations, Inc.

1

Meeting Agenda

- **Introduction & Purpose**
- **Discussion of Alternate Repair Methods**
  - **Use of improved Mechanical Nozzle Seal Assembly design (MNSA-2)**
  - **Ambient Temperature Temper-Bead Weld Repair**
  - **Control Rod Drive Mechanism (CRDM) NDE**
  - **Reactor Head Vent Line Repair**
- **Closing**

2

Purpose

- Communicate contingencies for repair of Inconel 600 components in the Reactor Coolant System (RCS).
- Minimize impact of emergent issues on both EOI and NRC staff during Spring refuel outages.
- Introduce and discuss the MNSA-2 design.
- Provide information to expedite NRC staff review of EOI relief requests.

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Inconel 600 Contingencies

- Reactor Vessel
  - CRDM
  - Reactor Head Vent
- Pressurizer
  - Heater Sleeves
  - Vents
  - Instrument Taps

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Potential Repairs Requiring Relief

- Reactor Vessel
  - CRDM
    - Ambient temperature temper-bead repair
    - Alternative NDE for CRDM tube repair
  - Reactor Head Vent Nozzle
    - ID partial nozzle repair
    - NDE of corner weld
- Pressurizer
  - Use of MNSA-2

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Schedule

- Based on history
  - Installed 3 MNSAs during Waterford 3 RF09.
    - Approximately 20-day evolution from discovery to approval
- Waterford 3 RF11 scheduled for 22 days
- ANO-2 RF15 scheduled for 20 days

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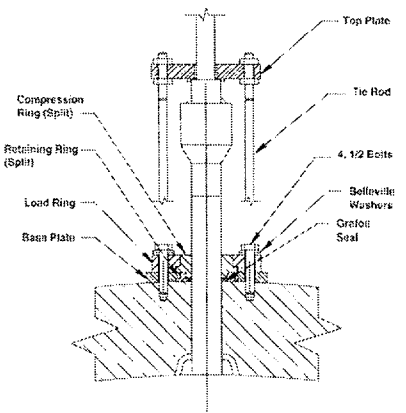
Improved Design of the Mechanical Nozzle Seal Assembly

Locations

- Small-bore pressurizer nozzles
  - ANO-2 - 90 locations
  - Waterford 3 - 33 locations

First Generation MNSA Basic Design

- Grafoil seats against nozzle OD and vessel OD
- 4 bolts load compression ring
- Belleville washers
- Tie rods prevent ejection if loss of weld



9

Why Develop an Alternative Design?

- Weld repairs
  - Core offload required (for heater and hot leg)
  - Difficult to make and keep alignment
  - High dose
  - 5 to 7 days to repair
  - Cost

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Why Develop an Alternative Design?

- **MNSA Repair**
  - **Will not work if corrosion/erosion on base material**
  - **As-built dimensions required**
  - **Heater locations: parts not machined and shipped to site until after leak discovered (potential outage delay)**
  - **If primary seal leaks potential corrosion/erosion to base material**
  - **If Seal Leaks complete seal replacement required (hard bolted)**
  - **Independent designs for each location**

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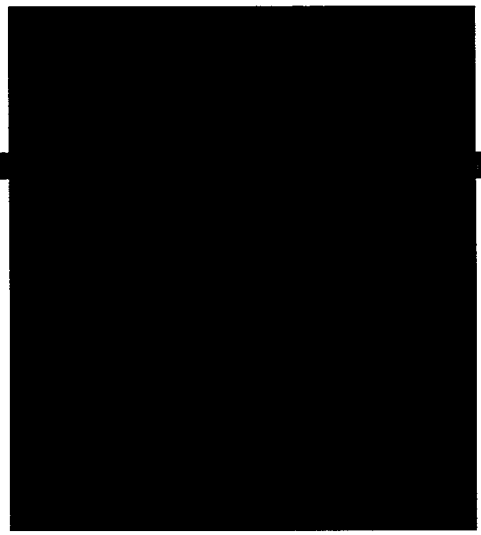
Desired Parameters for a New MNSA Design

[redacted]

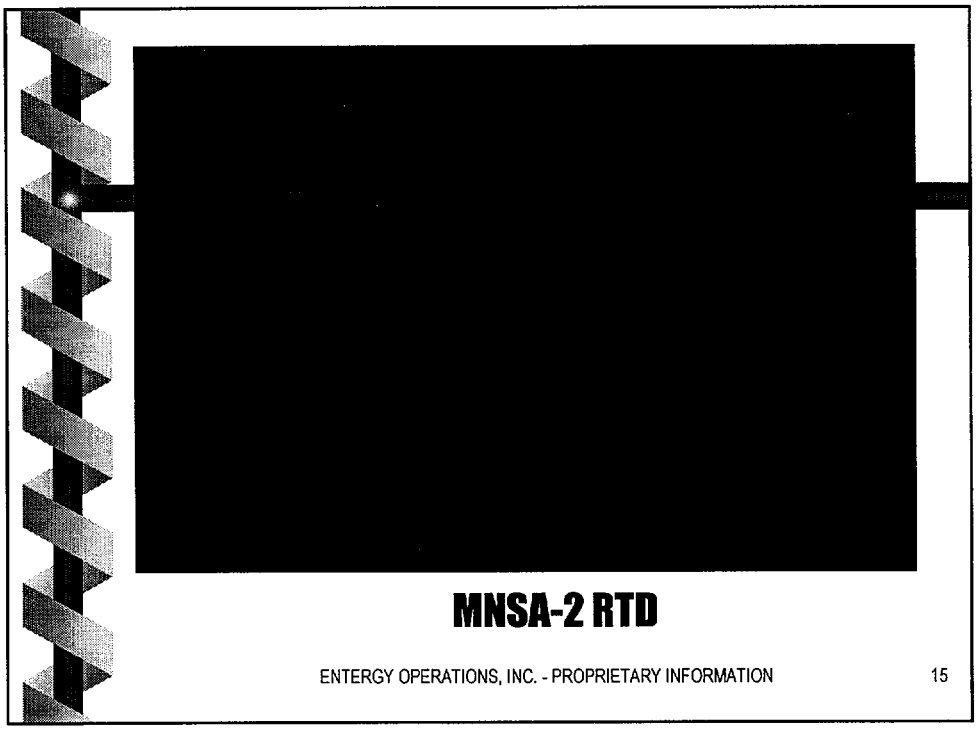
[redacted]

MNSA-2 Design Features

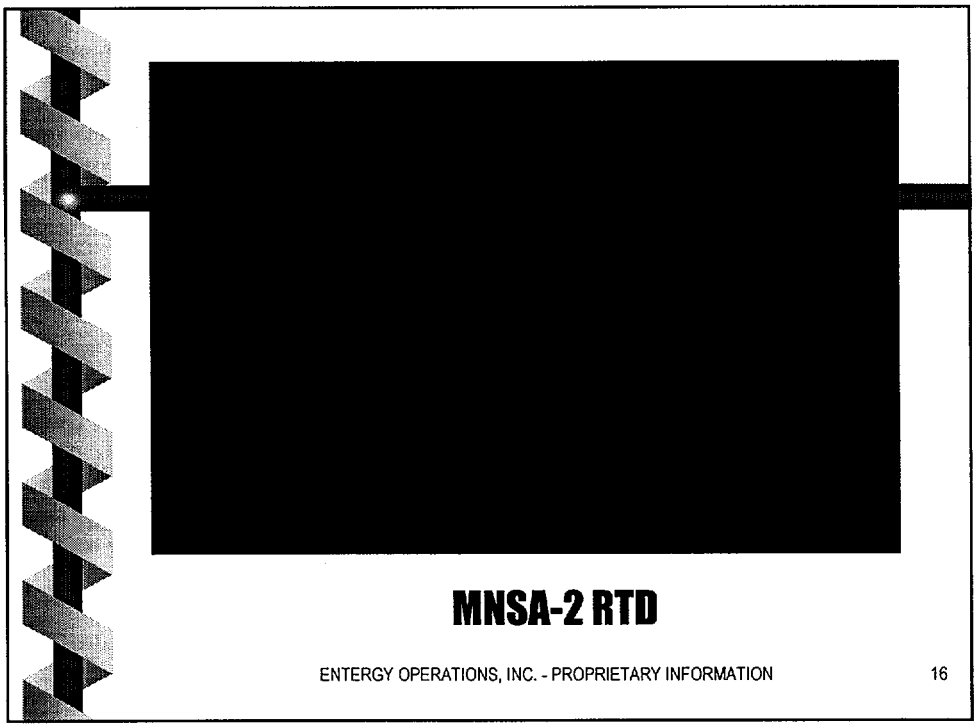
- Standardized design
- No system breach required
- [redacted]
- Anti-ejection feature
- Existing J weld not required for structural integrity
- [redacted]


[redacted]

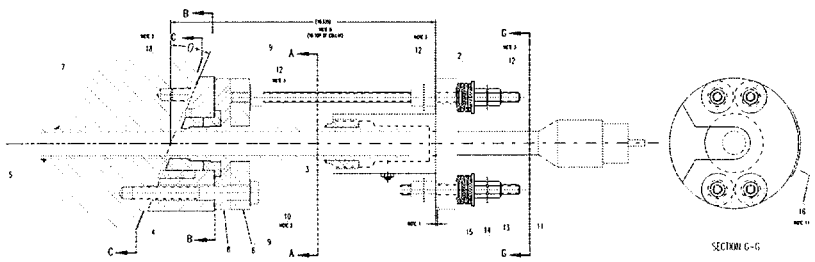
MNSA-2 Heater Design



MNSA-2 RTD



MNSA-2 RTD



MNSA Heater Design

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Similarities Between MNSA and MNSA-2

- 4-bolt pattern
- Grafoil primary seal
- Same materials
- Same bolt torque values or less
- Seal seats on OD of nozzle
- Analyzed to ASME NB 3200
- Prototype tested

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Differences Between MNSA and MNSA-2

MNSA

- Seal retained using collar and OD of vessel
  - Difficult to machine for each location
  - Vessel surface is not smooth for seating
  - Seal volume dependent on location
- Hard bolted

[redacted]

Differences Between MNSA and MNSA-2

MNSA

- No channel path in case of a leak
  - Potential for erosion of base material
- Individual design for each location
  - As-built dimensions required
  - Geometry dependent

[redacted]

Analysis of MNSA-2 Locations

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MNSA-2 Stud Connection to Pressurizer

- Maximum allowable load [redacted]
- Evaluation of installation torque [redacted]

Reinforcement Area Evaluation

- Heater Sleeves (innermost and outermost locations)
- Side Shell Instrument Nozzle
- Lower Level Instrument Nozzle

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Structural Evaluation of Attachment Locations on Pressurizer

- Heater Sleeves (outermost location)
  - Classical analysis method [redacted]
  - Results consistent with 3-D finite element analysis (FEA)

Structural Evaluation of Attachment Locations on Pressurizer

- Side Shell and Lower Level Instrument Nozzles
  - Classical analysis method [redacted]
  - Classical analysis method [redacted]

Fatigue Evaluations of Attachment Locations

- Heater Sleeves (outermost location)

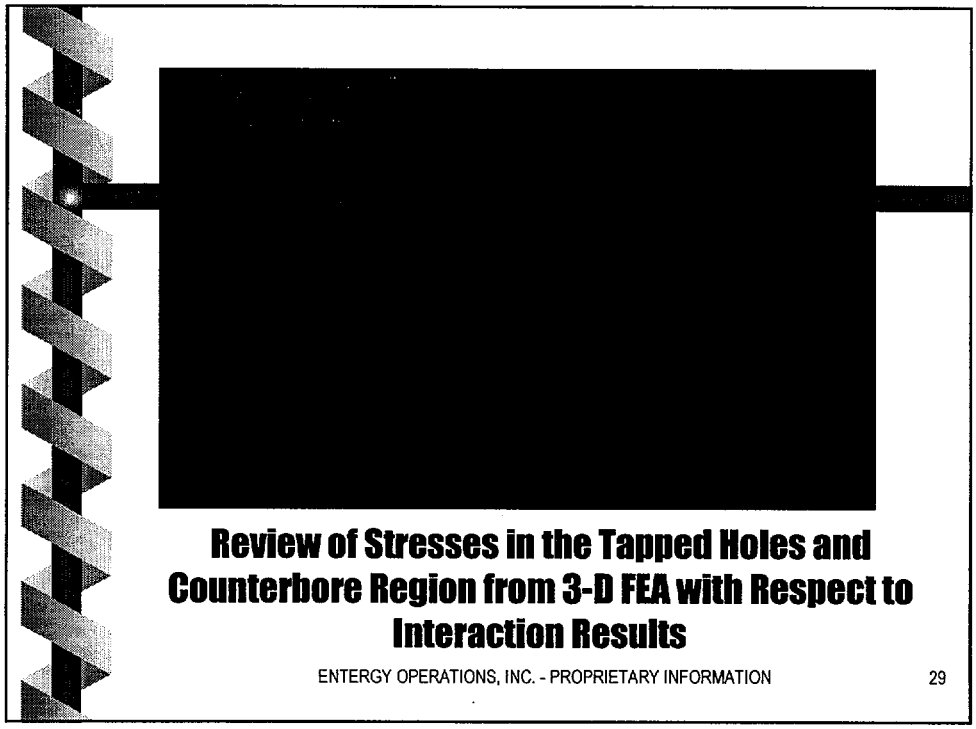
[redacted]

Fatigue Evaluations of Attachment Locations

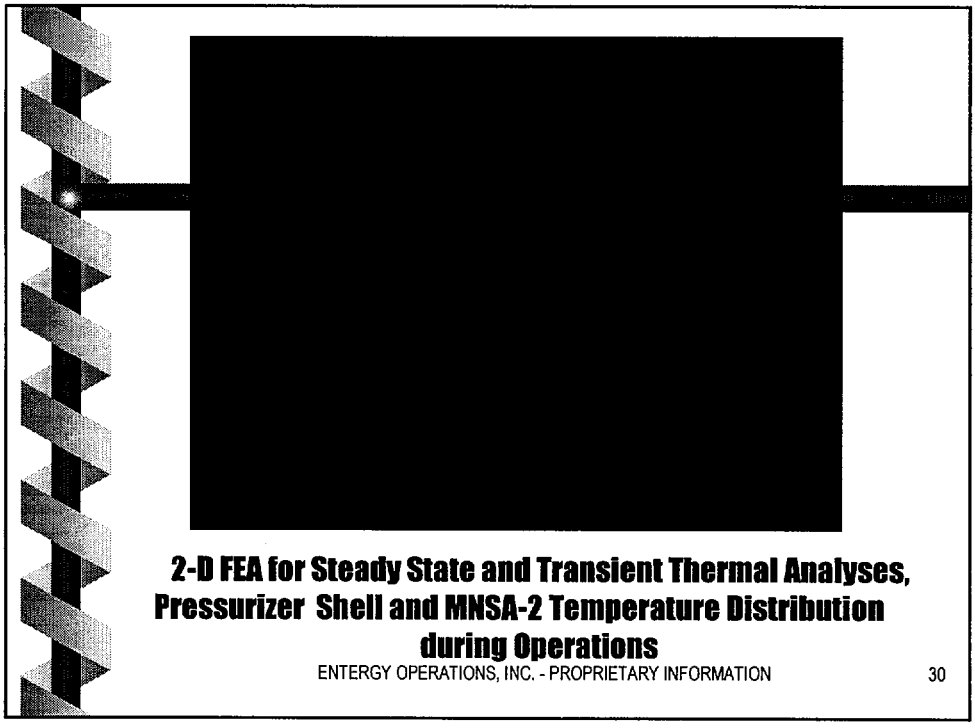
- Heater Sleeves (cont'd)

Fatigue Evaluations of Attachment Locations

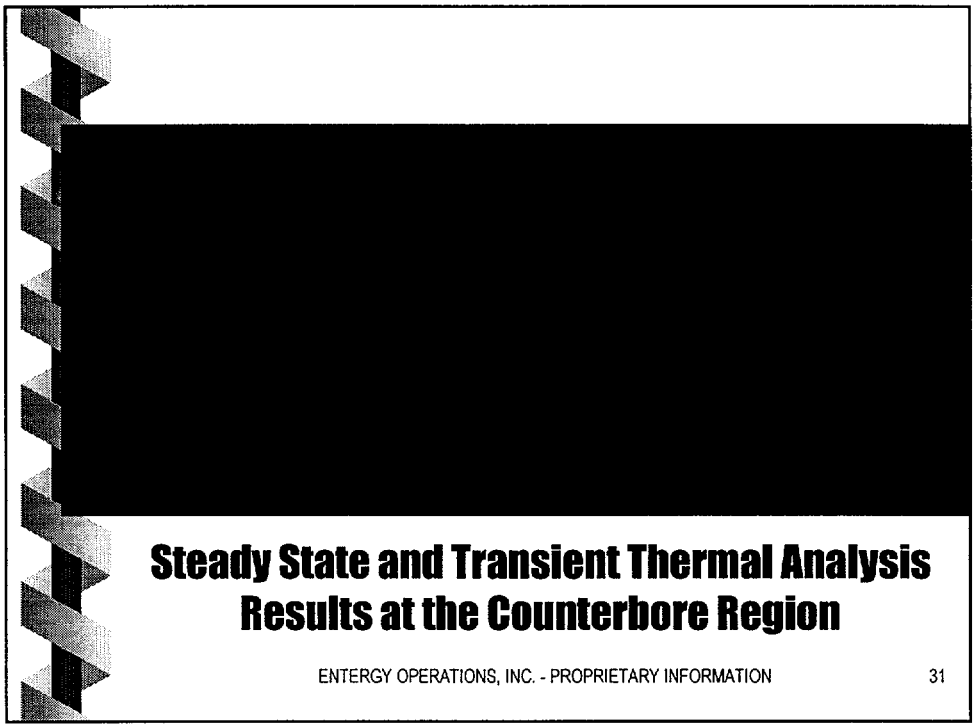
- Side Shell and Lower Level Instrument Nozzles
  - Same scope as outlined for heater sleeves.



Review of Stresses in the Tapped Holes and Counterbore Region from 3-D FEA with Respect to Interaction Results



2-D FEA for Steady State and Transient Thermal Analyses, Pressurizer Shell and MNSA-2 Temperature Distribution during Operations



Steady State and Transient Thermal Analysis Results at the Counterbore Region

MNSA-2 Connection to Side Shell and Lower Level Nozzles and Heater Sleeve

MNSA-2 Connection to Side Shell and Lower Level Nozzles and Heater Sleeve

- Connection to heater sleeve
  - Determine allowable load based on heater/sleeve weld shear.
  - Determine maximum bearing load
  - Determine allowable load on sleeve/pressurizer J-weld shear.
  - Compare with maximum operating and impact loads.

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MNSA-2 Loading Conditions

- Internal pressure
- Loads due to operating temperature and plant heatup/cooldown
- Installation pre-load as affected by heatup/cooldown
- Impact load due to "sudden ejection" of nozzle/heaters

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MNSA-2 Components

- Attachment threaded rods to pressurizer shell
- Tie rods for preventing nozzle ejection
- Compression collar
- Flanges, impact plate, clamps, and bolts
- [redacted]

Analysis per ASME III Code, 1989

- Evaluate operating loads both prior to and post nozzle/heater ejection
- Perform heat transfer (both classical and FEA methods) to determine MNSA-2 temperature profiles
- Compute maximum load in MNSA-2 resulting from ejection considering thermal growth effects

Analysis per ASME III Code, 1989

- Determine installation pre-loads for fasteners and changes due to heatup/cooldown
- Determine seismic loads on MNSA-2
- Compute design, average, maximum, and shear stresses and compare with Code allowables.

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Analysis per ASME III Code, 1989

- Determine fatigue usage factor for 700 heatup/cooldown cycles.
- Provide input loads for pressurizer attachment evaluations.

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Analysis per ASME III Code, 1989

- Component stresses meet ASME Code criteria.
- Pressurizer attachment stresses meet ASME Code criteria.
- 2-D thermal analysis and 3-D FEA analysis result in loads/stresses that are consistent with those used based on classical analysis methods.

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Qualification Tests

-
- Hydrostatic Test
  - Perform hydrostatic test on MNSA-2 in accordance with ASME Code to demonstrate "zero" leakage.
- Thermal Cycle Test
  - Planned 3 heat-up/cool-down cycles

Qualification Tests

- **Seismic Test**
  - **Determine enveloping seismic criteria for pressurizer locations.**
  - **Verify rigid response of Waterford-3 heater sleeve design (selected as most critical design).**
  - **Perform seismic qualification test on MNSA-2 while pressurized to 3,000 psig.**

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Qualification Tests

- **MNSA-2 will be qualified to the same criteria as original MNSA.**
- **Hydrostatic test and seismic test already successfully completed.**
- **Thermal cycling in progress. Results expected by 2/15/02.**

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MNSA-2 Request

- System
  - RCS
- Components
  - Will identify specific nozzle locations
- Section XI Applicability
  - Will identify year/addenda for each site

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MNSA-2 Request

- Code requirements for which relief is requested
- Identify applicable industry information
- Basis for Relief
  - Industry/Inconel history
  - General application and description of the MNSA-2 design and materials
  - MNSA-2 qualification testing
  - Modification to the RCS pressure boundary

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MNSA-2 Request

- Installation
  - Method and process
  - Installation controls
- Post-Installation Testing and Inspection
- Conclusions

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Ambient Temperature Temper Bead Request

- Contingency for temper bead welding
- Information comparable to contents of Code Case N-638
- Similar to other relief request previously docketed

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CRDM Tube NDE Request

- Alternative to NDE requirements contingency
  - ASME NB-2500 requires repair cavities, the lesser of 3/8" or 10% t to be radiographed
  - CRDM configuration does not permit radiography
- Alternative NDE may require surface inspection and ultrasonics

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Reactor Head Vent Nozzle Request

- ID partial nozzle repair contingency
- Design
  - Corner weld vs. full or partial penetration weld
- NDE of corner weld vs. NDE for full or partial penetration weld

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Relief Request Schedules

- MNSA-2
  - Waterford 3
    - EOI submittal - 2/28/02
    - NRC approval - 3/22/02
  - ANO-2
    - EOI submittal - 3/20/02
    - NRC approval - 4/12/02

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Relief Request Schedules

- Ambient Temperature Temper Bead
  - EOI submittals - 3/8/02
  - NRC approvals - 3/22/02
- CRDM Tube NDE
  - EOI submittals - 2/25/02
  - NRC approvals - 3/22/02
- Vent Nozzle
  - EOI submittals - ~ 3/1/02
  - NRC approvals - 3/22/02

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