



# Westinghouse

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Our ref: AW-03-1690  
August 19, 2003

**APPLICATION FOR WITHHOLDING PROPRIETARY  
INFORMATION FROM PUBLIC DISCLOSURE**

Subject: Westinghouse MNSA Presentation to NRC Staff (Proprietary)

Westinghouse hereby transmits presentation slides to be used in a forthcoming informational meeting with the staff. Portions of this presentation contain proprietary information for which withholding from public disclosure is requested. Affidavit AW-03-1690, signed by Westinghouse Electric Company LLC, the owner of the information, sets forth the basis on which the proprietary information is requested to be withheld from public disclosure by the Commission and addresses the considerations listed in paragraph (b)(4) of 10 CFR Section 2.790 of the Commission's regulations.

For identification purposes and in conformance with the requirements of 10 CFR 2.790, Westinghouse has enclosed within brackets the proprietary information contained within the subject presentation. The justification for claiming the information designated as proprietary is indicated by means of superscript letters immediately following the brackets. These superscript designators refer to the types of information Westinghouse customarily holds in confidence as identified in Sections (4)(ii)(a) through (4)(ii)(f) of the enclosed affidavit.

Correspondence with respect to the proprietary aspects of the application for withholding or the Westinghouse affidavit should reference this letter, AW-03-1690, and should be addressed to the undersigned.

Very truly yours,

Ian C. Rickard  
Licensing Project Manager  
Regulatory Compliance and Plant Licensing

Enclosure

cc: D. G. Holland / NRR

A BNFL Group Company

AFFIDAVIT

STATE OF CONNECTICUT )

) ss: WINDSOR, CT

COUNTY OF HARTFORD )

Before me, the undersigned authority, personally appeared Ian C. Rickard, who, being by me duly sworn according to law, deposes and says that he is authorized to execute this Affidavit on behalf of Westinghouse Electric Company LLC ("Westinghouse"), and that the averments of fact set forth in this Affidavit are true and correct to the best of his knowledge, information, and belief:

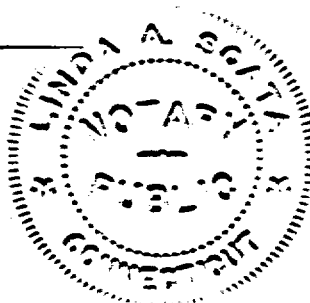


Ian C. Rickard,  
Licensing Project Manager  
Regulatory Compliance and Plant Licensing

Sworn to and subscribed before me  
this 19<sup>th</sup> day of August 2003.

  
Notary Public

My commission expires May 31, 2008.



- (1) I, Ian C. Rickard, depose and say that I am the Licensing Project Manager, Regulatory Compliance and Plant Licensing, in Nuclear Services, Westinghouse Electric Company LLC ("Westinghouse"), and as such I have been specifically delegated the function of reviewing the proprietary information sought to be withheld from public disclosure in connection with nuclear power plant licensing and rule making proceedings, and am authorized to apply for its withholding on behalf of the Westinghouse Electric Company LLC.
- (2) I am making this Affidavit in conformance with the provisions of 10 CFR Section 2.790 of the Commission's regulations and in conjunction with the Westinghouse application for withholding accompanying this Affidavit.
- (3) I have personal knowledge of the criteria and procedures utilized by the Westinghouse Electric Company LLC in designating information as a trade secret, privileged or as confidential commercial or financial information.
- (4) Pursuant to the provisions of paragraph (b)(4) of Section 2.790 of the Commission's regulations, the following is furnished for consideration by the Commission in determining whether the information sought to be withheld from public disclosure should be withheld.
  - (i) The information sought to be withheld from public disclosure is owned and has been held in confidence by Westinghouse.
  - (ii) The information is of a type customarily held in confidence by Westinghouse and not customarily disclosed to the public. Westinghouse has a rational basis for determining the types of information customarily held in confidence by it and, in that connection, utilizes a system to determine when and whether to hold certain types of information in confidence. The application of that system and the substance of that system constitutes Westinghouse policy and provides the rational basis required.

Under that system, information is held in confidence if it falls in one or more of several types, the release of which might result in the loss of an existing or potential competitive advantage, as follows:

- (a) The information reveals the distinguishing aspects of a process (or component, structure, tool, method, etc.) where prevention of its use by any of Westinghouse's competitors without license from Westinghouse constitutes a competitive economic advantage over other companies.
- (b) It consists of supporting data, including test data, relative to a process (or component, structure, tool, method, etc.), the application of which data secures a competitive economic advantage, e.g., by optimization or improved marketability.
- (c) Its use by a competitor would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing a similar product.

- (d) It reveals cost or price information, production capacities, budget levels, or commercial strategies of Westinghouse, its customers or suppliers.
  - (e) It reveals aspects of past, present, or future Westinghouse or customer funded development plans and programs of potential commercial value to Westinghouse.
  - (f) It contains patentable ideas, for which patent protection may be desirable.
- (iii) There are sound policy reasons behind the Westinghouse system for classification of proprietary information, which include the following:
- (a) The use of such information by Westinghouse gives Westinghouse a competitive advantage over its competitors. It is, therefore, withheld from disclosure to protect the Westinghouse competitive position.
  - (b) It is information that is marketable in many ways. The extent to which such information is available to competitors diminishes the Westinghouse ability to sell products and services involving the use of the information.
  - (c) Use by our competitor would put Westinghouse at a competitive disadvantage by reducing his expenditure of resources at our expense.
  - (d) Each component of proprietary information pertinent to a particular competitive advantage is potentially as valuable as the total competitive advantage. If competitors acquire components of proprietary information, any one component may be the key to the entire puzzle, thereby depriving Westinghouse of a competitive advantage.
  - (e) Unrestricted disclosure would jeopardize the position of prominence of Westinghouse in the world market, and thereby give a market advantage to the competition of those countries.
  - (f) The Westinghouse capacity to invest corporate assets in research and development depends upon the success in obtaining and maintaining a competitive advantage.
- (iv) The information is being transmitted to the Commission in confidence and, under the provisions of 10 CFR Section 2.790, it is to be received in confidence by the Commission.
- (v) The information sought to be protected is not available in public sources or available information has not been previously employed in the same original manner or method to the best of our knowledge and belief.
- (vi) The proprietary information sought to be withheld in this submittal is that which is appropriately marked in the presentation materials designated as "Use of MNSA-2 as a Contingency Repair for BMI Nozzles" dated September 2003.

This information is part of that which will enable Westinghouse to describe the application of mechanical nozzle seal assemblies (MNSA) to bottom mounted instrumentation nozzles, and in particular to support utilities in the application of such, including:

- (a) The identification of important phenomena relevant to the application of MNSA.
- (b) The qualification of MNSA to bottom mounted instrumentation.
- (c) A corrosion and flaw evaluation assessment relevant to MNSA.

Further this information has substantial commercial value as follows:

- (a) Westinghouse plans to sell the use of similar information to its customers for purposes of meeting NRC requirements for licensing documentation.
- (b) Westinghouse can sell support and defense of MNSA-2.
- (c) The information requested to be withheld reveals the distinguishing aspects of a methodology that was developed by Westinghouse.

Public disclosure of this proprietary information is likely to cause substantial harm to the competitive position of Westinghouse because it would enhance the ability of competitors to provide similar advanced nuclear power plant designs and to provide licensing defense services for commercial power reactors without commensurate expenses. Also, public disclosure of the information would enable others to use the information to meet NRC requirements for licensing documentation without purchasing the right to use the information.

The development of the technology described in part by the information is the result of applying the results of many years of experience in an intensive Westinghouse effort and the expenditure of a considerable sum of money.

In order for competitors of Westinghouse to duplicate this information, similar technical programs would have to be performed and a significant manpower effort, having the requisite talent and experience, would have to be expended.

Further the deponent sayeth not.

### **PROPRIETARY INFORMATION NOTICE**

Transmitted herewith are proprietary and/or non-proprietary versions of documents furnished to the NRC in connection with requests for generic and/or plant-specific review and approval.

In order to conform to the requirements of 10 CFR 2.790 of the Commission's regulations concerning the protection of proprietary information so submitted to the NRC, the information which is proprietary in the proprietary versions is contained within brackets, and where the proprietary information has been deleted in the non-proprietary versions, only the brackets remain (the information that was contained within the brackets in the proprietary versions having been deleted). The justification for claiming the information so designated as proprietary is indicated in both versions by means of lower case letters (a) through (f) located as a superscript immediately following the brackets enclosing each item of information being identified as proprietary or in the margin opposite such information. These lower case letters refer to the types of information Westinghouse customarily holds in confidence as identified in Sections (4)(ii)(a) through (4)(ii)(f) of the affidavit accompanying this transmittal.

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### **COPYRIGHT NOTICE**

The reports transmitted herewith each bear a Westinghouse copyright notice. The NRC is permitted to make the number of copies of the information contained in these reports which are necessary for its internal use in connection with generic and plant-specific reviews and approvals as well as the issuance, denial, amendment, transfer, renewal, modification, suspension, revocation, or violation of a license, permit, order, or regulation subject to the requirements of 10 CFR 2.790 regarding restrictions on public disclosure to the extent such information has been identified as proprietary by Westinghouse, copyright protection notwithstanding. With respect to the non-proprietary versions of these reports, the NRC is permitted to make the number of copies beyond those necessary for its internal use which are necessary in order to have one copy available for public viewing in the appropriate docket files in the public document room in Washington, DC and in local public document rooms as may be required by NRC regulations if the number of copies submitted is insufficient for this purpose. Copies made by the NRC must include the copyright notice in all instances and the proprietary notice if the original was identified as proprietary.

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# **Use of MNSA-2 as a Contingency Repair for BMI Nozzles**

**Westinghouse Electric Company**

**September 2003**



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## **Meeting Agenda**

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- **Introduction**
- **MNSA Overview**
- **Experience**
- **Qualification of MNSA-2 Assembly  
and the RPV lower head**
- **Relief Request Overview**
- **Questions**



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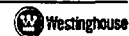
## Purpose

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- Describe MNSA-2 application to BMI nozzle
- Minimize emergent issues for both plants and NRC staff during Fall refuel outages
- Facilitate NRC staff review of relief requests
- Obtain NRC input
- Resolve Staff concerns



Westinghouse Non-Proprietary Class 3 - Slide 3



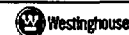
## MNSA OVERVIEW

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- The MNSA (Mechanical Nozzle Seal Assembly) is a mechanical device that provides both sealing and structural support for small bore nozzle connections.
- MNSA has been accepted and installed on small bore nozzles in the CE fleet (Hot Legs, Pressurizers and Steam Generators).
- Design and qualification test reports were submitted to the NRC in support of MNSA installation.



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## MNSA OVERVIEW

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- There are two types of MNSAs
  - MNSA-1 seals on the outside of the pressure boundary.
  - MNSA-2 seals on the flat surface at the bottom of the counterbore.
- MNSA is an alternative to weld repair for leaks in J-groove welded Alloy 600 instrument nozzles.



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## MNSA OVERVIEW

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- MNSA has been designed and qualified as a repair for an ASME Section III, Class 1 pressure boundary.
- MNSA is a permanent repair which can be visually inspected from the vessel O.D.
- NRC has accepted MNSA repairs for at least 2 fuel cycles and following successful inspections has approved it for continued use.



Westinghouse Non-Proprietary Class 3 - Slide 6



## **MNSA OVERVIEW**

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### **Why use MNSA for a Repair Strategy?**

- Installation is much faster than welded repairs:
  - Can be installed with water in the vessel,
  - Core offload not required.
- Installation does not require breaching the pressure boundary.
- No core uncover risk.



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## **Overview Summary**

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- MNSA2 is a reliable proven repair technique which can be applied to BMI nozzles in the Westinghouse and B&W fleets.
- Visual examination of the leak off tube can be performed at subsequent outages to confirm primary seal integrity.
- The anti-ejection feature provides a second barrier to nozzle ejection and the potential for a LOCA.



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## Overview Summary

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- In service MNSAs have been disassembled and inspected to demonstrate that no degradation occurred while in service.



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## EXPERIENCE

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MNSAs have been installed at the following plants:

- SONGS 2 & 3
- Calvert Cliffs 1 & 2
- Fort Calhoun
- Waterford 3
- Millstone 2
- Palo Verde 1, 2 & 3
- ANO 2

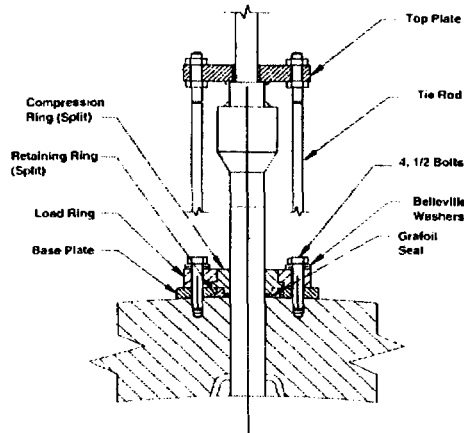


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## MNSA-1 Design

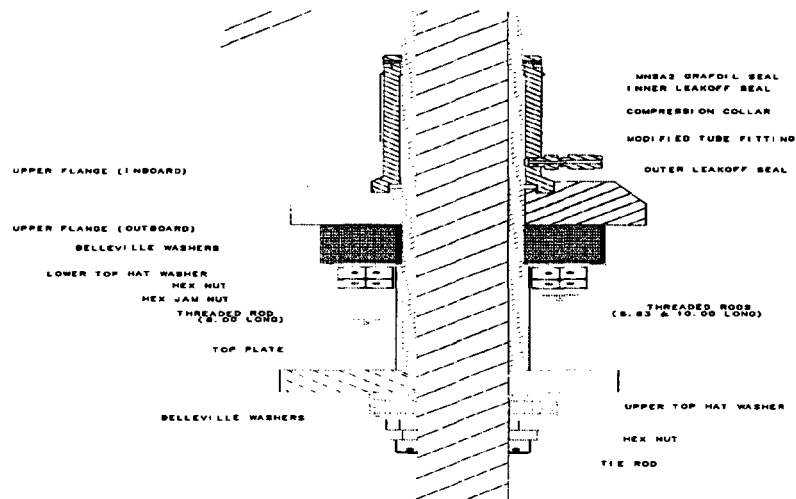
- Grafoil seats against nozzle OD and vessel OD.
- 4 bolts load compression ring.
- Belleville Washers.
- Tie Rods prevent ejection if loss of weld.



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## MNSA-2 BMI Design



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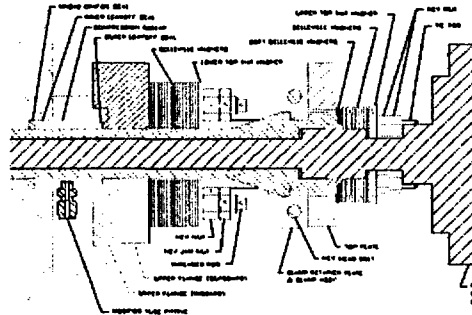
## Similarities Between MNSA-1 and MNSA-2

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



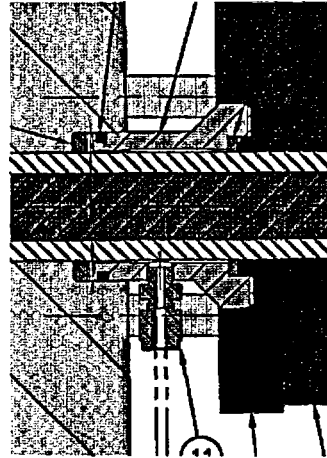
## MNSA-2 Design Features

- Standardized design
- No system breach required
- Seal - packing gland type, live loading
- Seal is NOT dependent on existing surface condition
- Anti-ejection feature
- Existing J weld not required for structural integrity
- Compression load normal to seal
- Secondary seals provide leak-off control (visual confirmation of primary seal integrity)



## MNSA-2 Primary and Secondary Seal Design

- Primary Seals Prevents Reactor Coolant (RC) Leakage.
- If primary seal were to leak, the secondary seal diverts RC away from vessel and prevent any damage to base material.



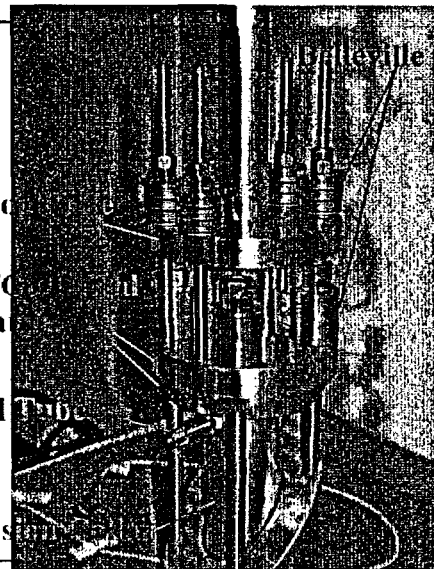
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## MNSA-2

- Seismic Test MNSA-2

To  
Inboard/Outboard  
Flange  
Channel Tube  
Compression

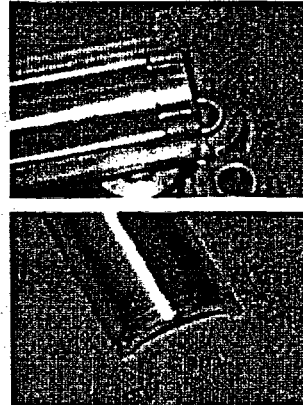


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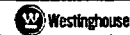


## Compression Collar

- Split Compression Collar
  - Weep holes allows fluid to be channeled away from vessel in event of primary seal leakage.

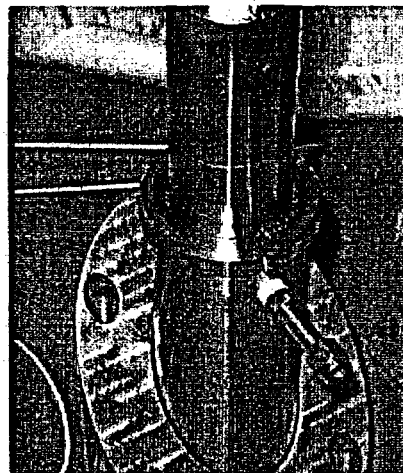


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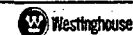


## Channel Tube

- RC is diverted away from vessel in the event that the primary seal developed a leak.
- Provides a visual confirmation of the primary seal integrity.



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## Upper Inboard and Outboard Flange

- Holds compression collar together and loads seal through the collar, threaded rods, and nuts.

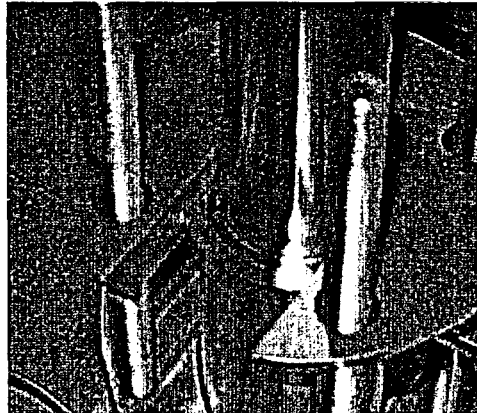


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## Inboard Upper Flange

- Inboard flange assembled onto compression collar.
- Outboard flange fits over the top of inboard flange forming a continuous solid flange.



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## Qualification of the MNSA-2 Assembly and the RPV Lower Head



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## Qualification Status

- MNSA-2 was previously qualified for use on the pressurizer lower head to repair heater sleeve leaks.
- Qualification will be upgraded to apply to the RPVLH BMI locations.
  - Generic evaluations to confirm feasibility currently being completed.
  - Plant specific conditions to be evaluated when a specific leak is identified.



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## Qualification Criteria

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- Analysis as an ASME Code Section III Class 1 Pressure Boundary Component (RPVLH and MNSA):
  - Primary Stresses,
  - Primary + Secondary Stresses,
  - Fatigue Usage.
- Functional Tests to confirm sealing effectiveness:
  - Leakage Tests, (Pressure, Seismic, Thermal Cycling)
  - Bellville Washer Compression Test.
- Corrosion Evaluation of RPVLH BMI nozzle bore.
- Flaw Evaluation of remaining leakage crack in J-weld.



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## Loading Conditions

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- Loads are evaluated prior to and after an assumed nozzle ejection:
  - Installation preload,
  - Internal pressure,
  - Steady-state and transient thermal conditions,
  - Seismic Loads,
  - Design Mechanical Loads,
  - Impact load due to "sudden ejection" of nozzle.



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## Locations Evaluated

- RPVLH:

- Typical innermost and outermost locations are analyzed,
- » Intermediate locations are bounded
- Counterbore,
- Tapped attachment holes.

a,  
b,  
c,  
f



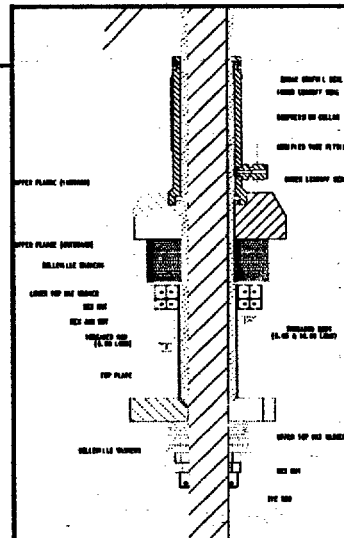
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## Locations Evaluated

- MNSA-2:

- Threaded rods to vessel shell.
- Tie rods for preventing nozzle ejection.
- Compression collar.
- Flanges and impact plate.
- Belleville washers, flat washers and nuts.

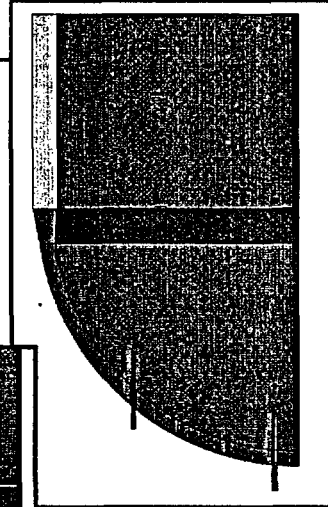
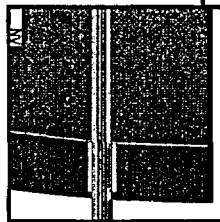


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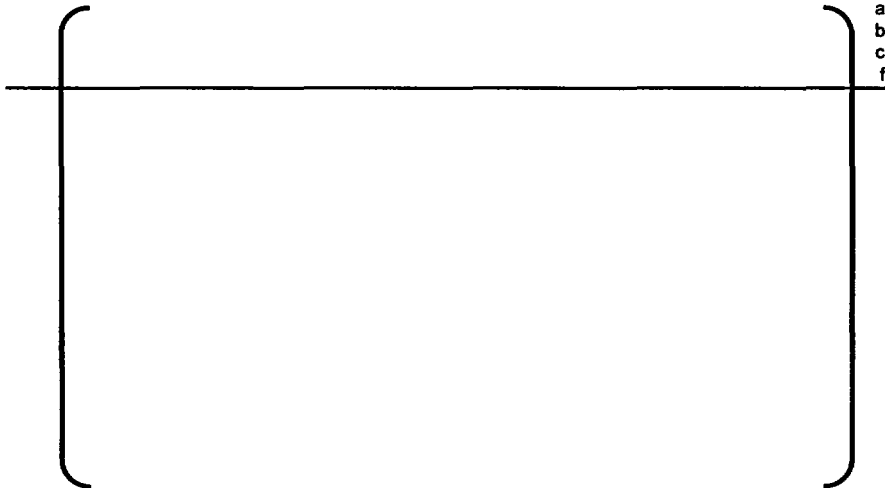


## Analysis Methodologies

- 3-D Finite Element Analysis:
  - Temperatures and Stresses.
- Handbooks and classical methods:
  - Stress concentration factors and fatigue strength reduction factors.



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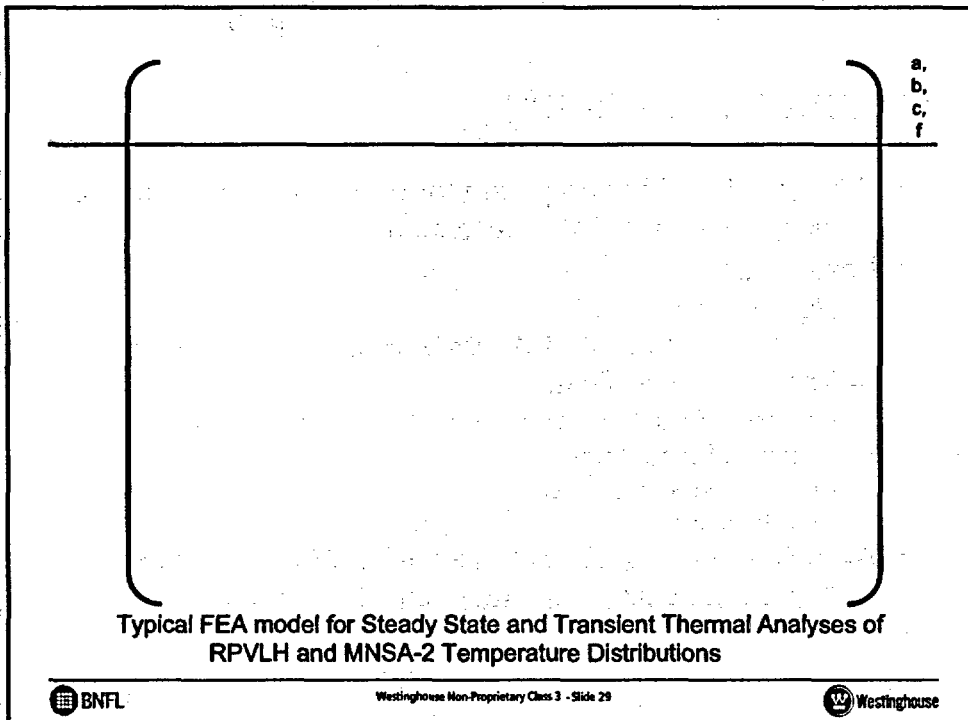
a,  
b,  
c,  
f

Typical model for evaluation of  $P_M$ ,  $P_L$  and  $P + Q$  stresses



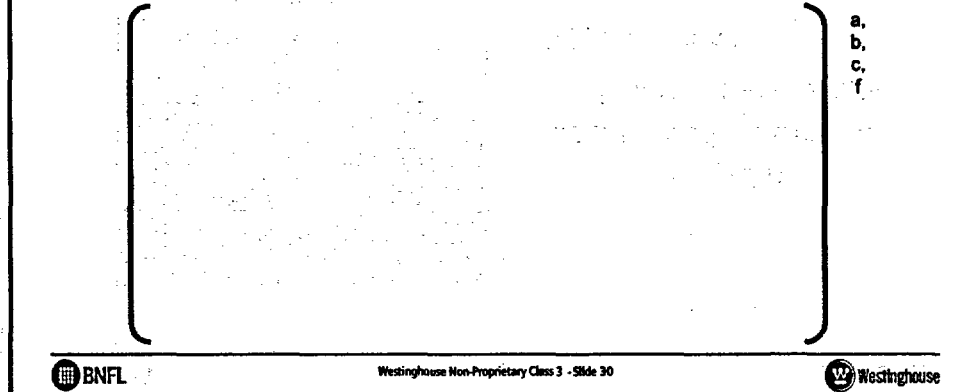
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## Analysis Results per 1989 ASME III Code

- MNSA-2 components meet all ASME Code Criteria for pressurizer application.
- Pressurizer Lower Head meets all ASME Code Criteria.
- Typical Margins:



## Qualification Testing

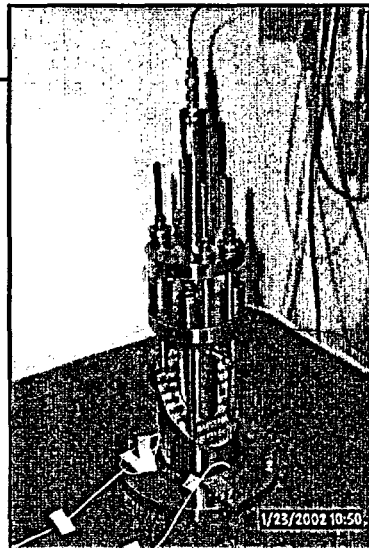
- Functional testing completed for pressurizer application; tests applicable to BMI application.
- Leak testing:
  - Hydrostatic Test,
    - » Test in accordance with ASME Code demonstrates "zero" leakage
  - Thermal Cycle Test,
    - » 3 Heat-up/Cool-down Cycles demonstrates "zero" leakage
  - Seismic Load Test.
    - » Demonstrates zero leakage
    - » Establishes rigidity
- Axial Compression Test on Belleville Washer Packs
  - Determines stiffness values for FEA model.



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- Seismic Qualification Setup:
  - MNSA-2 is "Rigid."
  - Frequency is  $> 50$  Hz.
  - Sine sweep testing performed pressurized to 3000 psi.



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## Corrosion Evaluation of Nozzle Bore

- Primary coolant will leak through cracks and fill annulus between nozzle and vessel:
  - Unclad low alloy steel exposed to primary coolant.
  - Some general corrosion of the steel will occur during operation, outages, startups.
  - Calculate an overall corrosion rate.
  - Estimate total corrosion (increase in hole diameter) to end-of-life.
  - Calculate maximum increase in hole diameter before Code rules exceeded.
  - Compare total lifetime corrosion with the maximum increase in hole size to demonstrate acceptability to EOL.

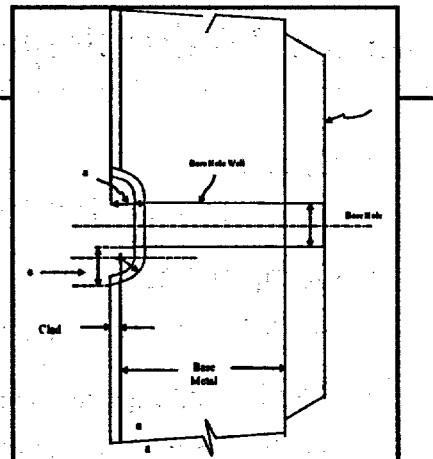


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## Flaw Evaluation

- Flaw evaluation performed in accordance with ASME Code Section XI.
- Free field stresses in RPVLH determined with 3-D FEA model:
  - Maximum combined pressure + thermal stress.
- Assumed flaw:
  - Through cladding, butter and J-weld.
- Stress intensity factors determined using Raju-Newman correlations.



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## MNSA-2 Relief Request Overview



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## MNSA-2 Relief Request

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



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## MNSA-2 Relief Request

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- Code Requirements
  - Cite ASME Section XI and Section III requirements for which relief is required
- References
  - Identify applicable industry information
- Basis for Relief
  - Cite regulatory provisions for relief [10 CFR 50.55a]



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## MNSA-2 Relief Request

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- Basis for Relief (cont'd)
  - Industry/Inconel history
  - General application and description of the MNSA-2
  - MNSA-2 design
  - MNSA-2 materials
  - MNSA-2 qualification testing
  - Modification of the RCS pressure boundary



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## MNSA-2 Relief Request

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- Installation
  - Method and process
  - Installation controls
- Post-Installation Testing and Inspection
  - ASME Section XI Pressure Test
  - ASME Section XI Preservice
- Conclusions



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