Davis-Besse Nuclear Power Station Reactor Vessel Head

April 10, 2002

FENOC
FirstEnergy Nuclear Operating Company

Agenda

- Introduction - John Wood
- Inspection Results – Mark McLaughlin
- Repair Concept – Jim Powers
- Final Reactor Core Configuration – Robb Borland

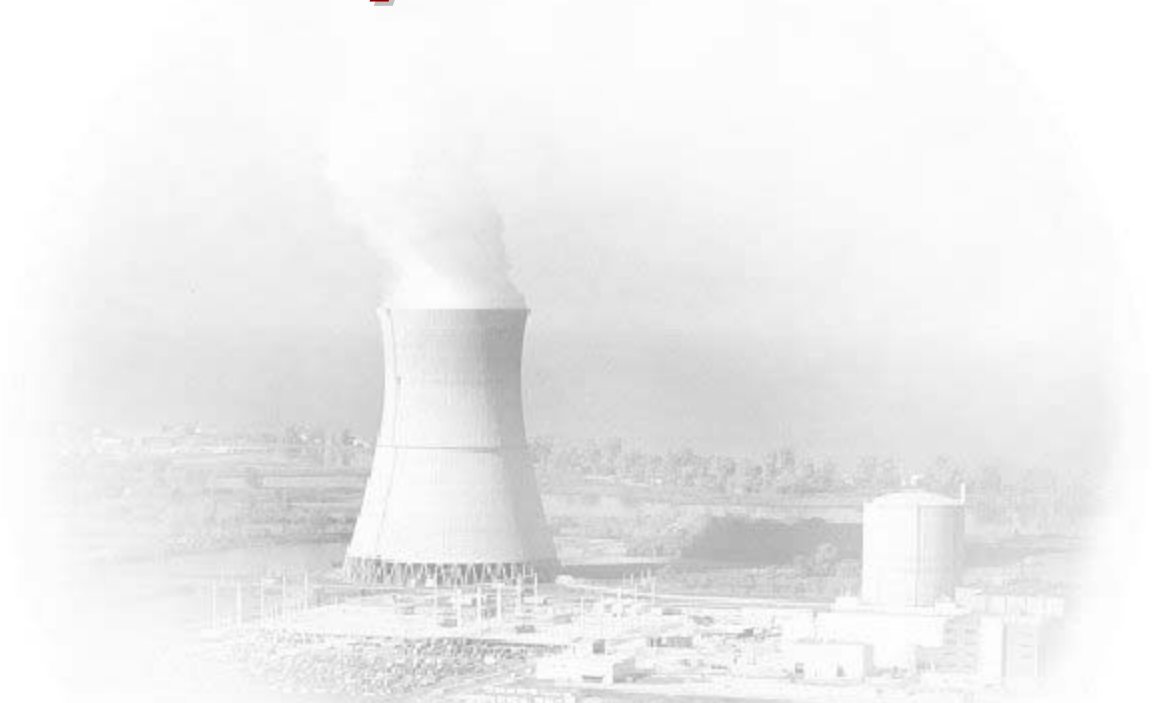
FENOC
FirstEnergy Nuclear Operating Company

Meeting Objective

Present results of the
Davis-Besse Nuclear Power Station
reactor pressure vessel head inspections
and the repair concept

FENOC
FirstEnergy Nuclear Operating Company

Inspection Results



Mark McLaughlin
Field Activities Team Leader

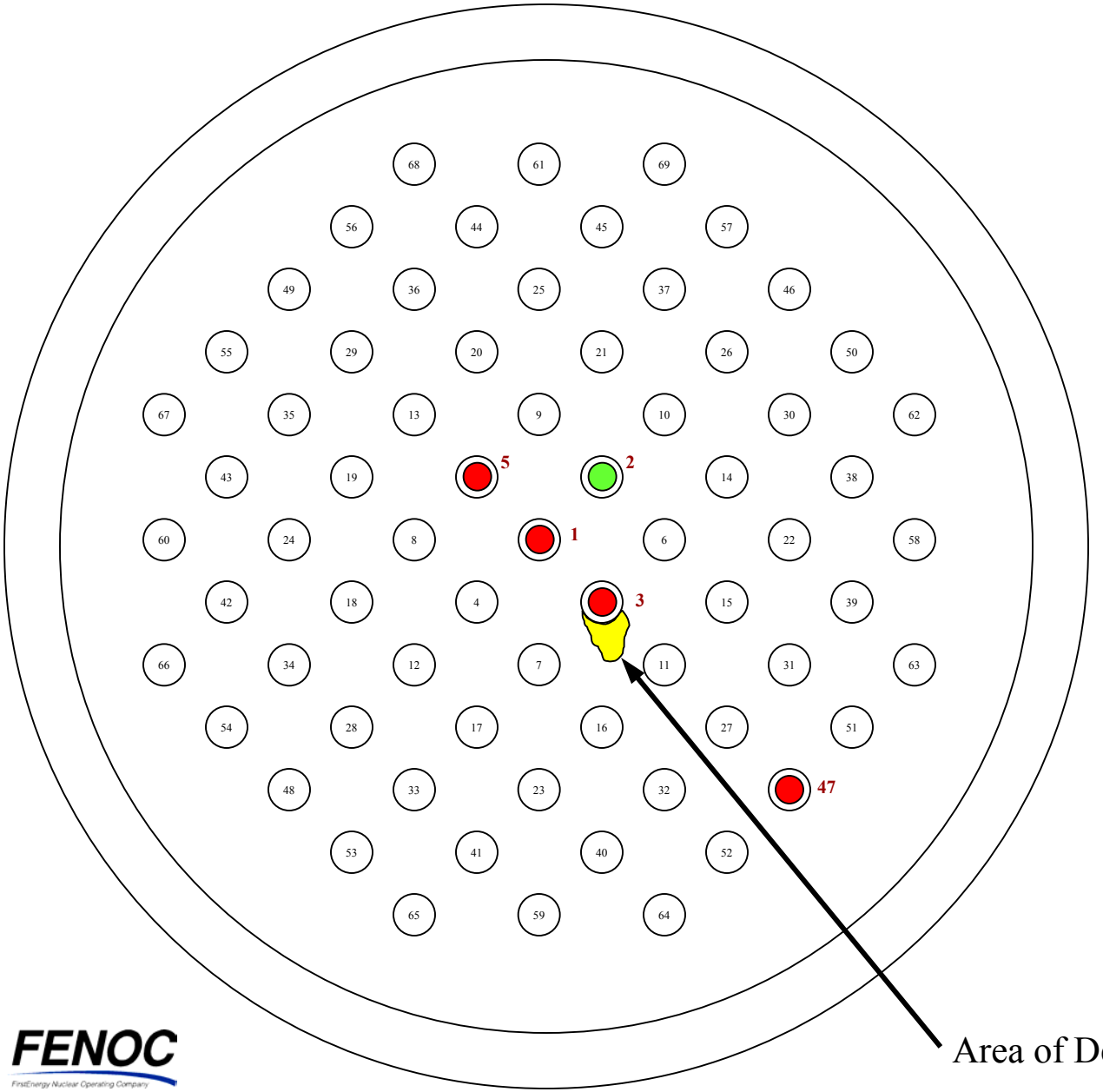
FENOC
FirstEnergy Nuclear Operating Company

Inspection Results

- Davis-Besse shutdown for Refueling Outage February 16, 2002
- Reactor Pressure Vessel Head (RPV) Inspections performed in response to NRC Bulletin 2001-01
- Performed ultrasonic (UT) examinations on all Control Rod Drive Mechanism Nozzles
- UT results independently verified by EPRI
- Performed visual inspections of RPV head

FENOC
FirstEnergy Nuclear Operating Company

Findings



Framatome ANP Inc. completed UT examination on all 69 CRDM nozzles using the under-head circumferential probe and subsequent confirmatory testing using the top-down UT on suspect nozzles

Nozzle with Axial Indication - ●

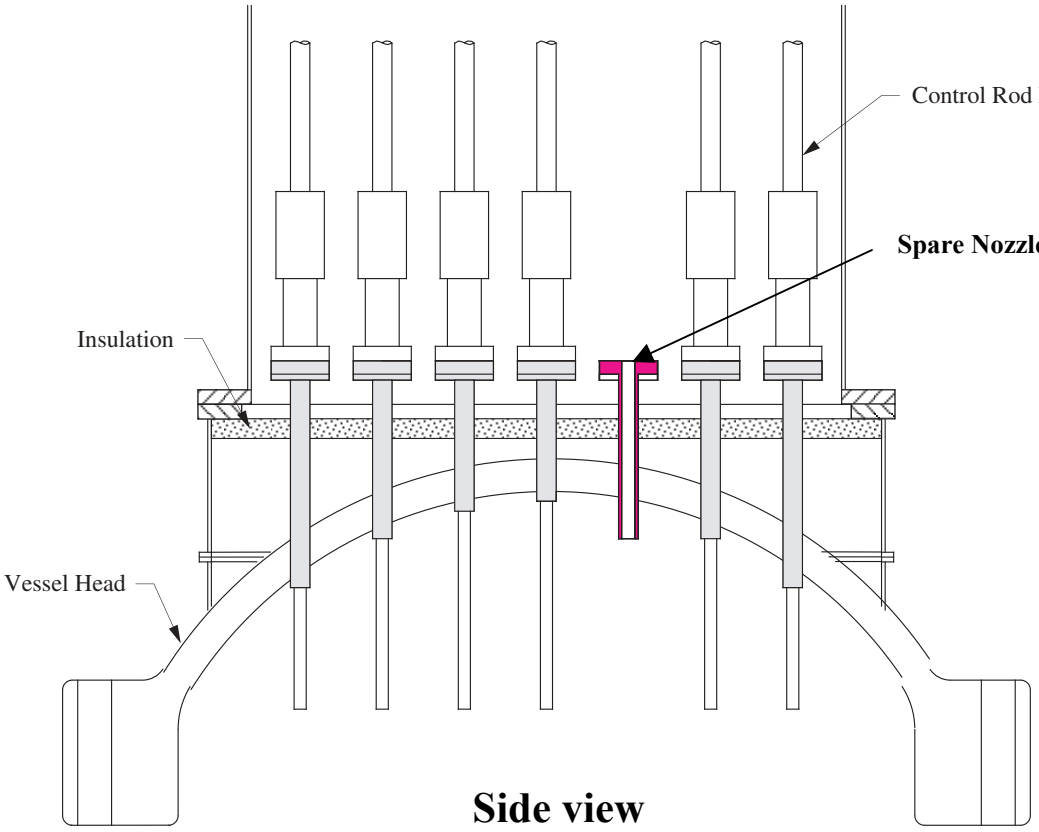
Nozzle with Axial and Circumferential Indication – ●

FENOC
FirstEnergy Nuclear Operating Company

Inspection Results

Reactor Vessel Head and Service Structure

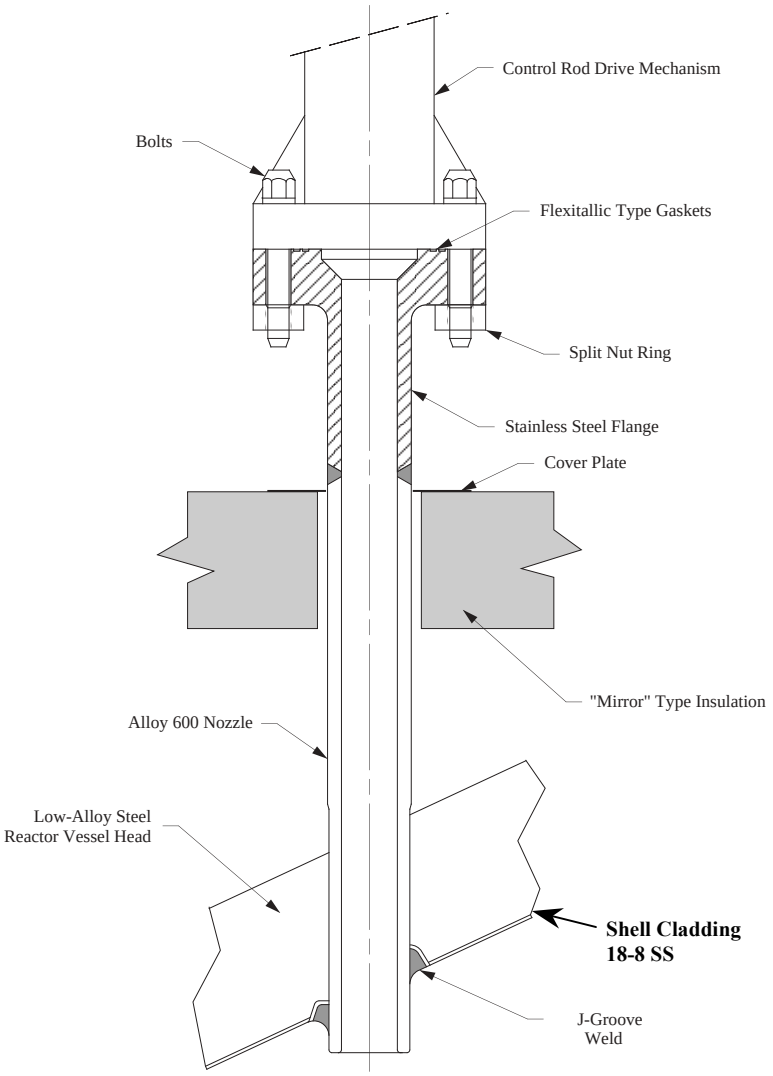
Source: EPRI/DEI



FENOC
FirstEnergy Nuclear Operating Company

Inspection Results

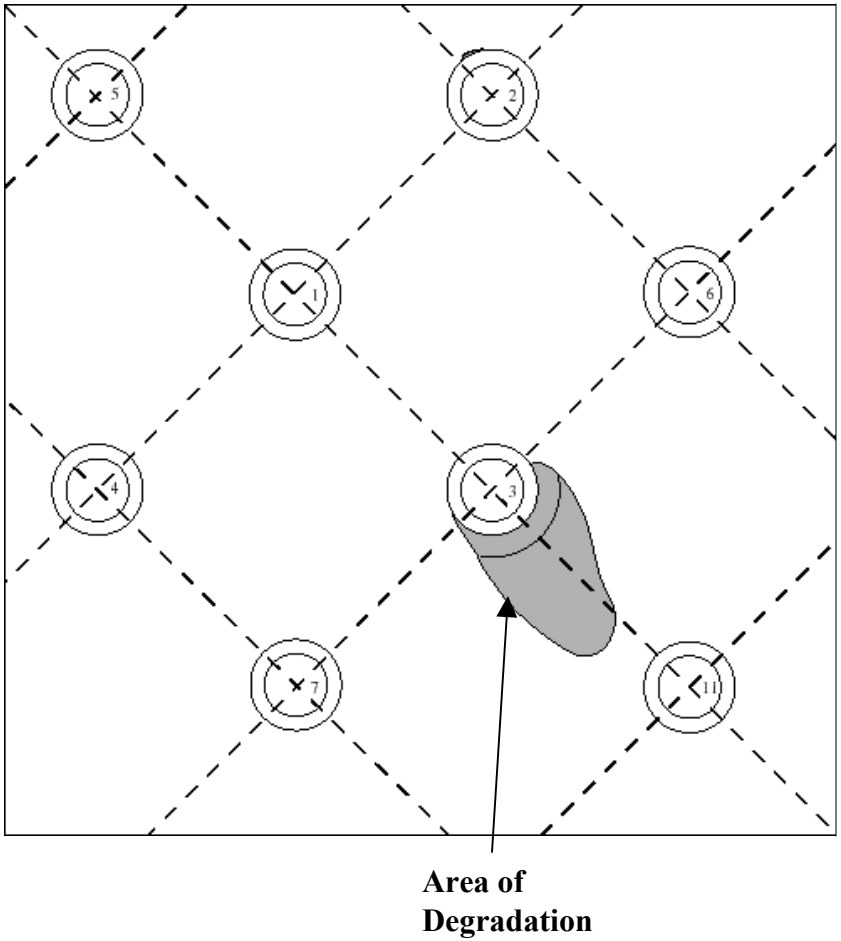
Typical B&W Control Rod Drive Nozzle



Inspection Results

Extent of Condition Investigation

- Remove Nozzles 2 and 11
- Liquid Penetrant Examination (PT) on bores
- Remove wastage area around Nozzle 3 and PT bore

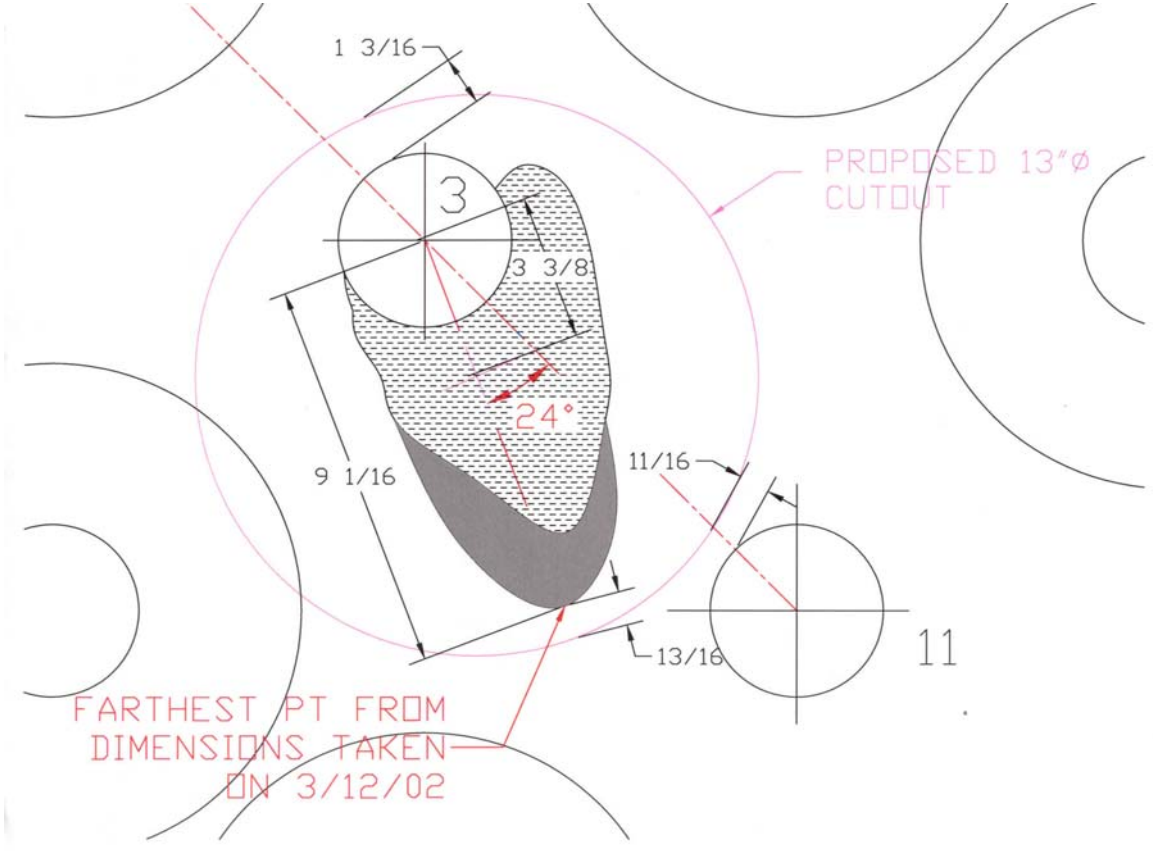


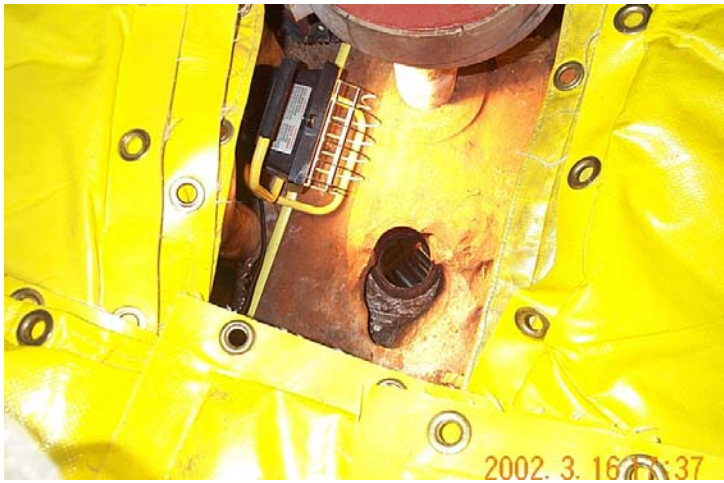
Inspection Results

Reactor Head Degradation - Nozzle 3

FENOC
FirstEnergy Nuclear Operating Company

Inspection Results

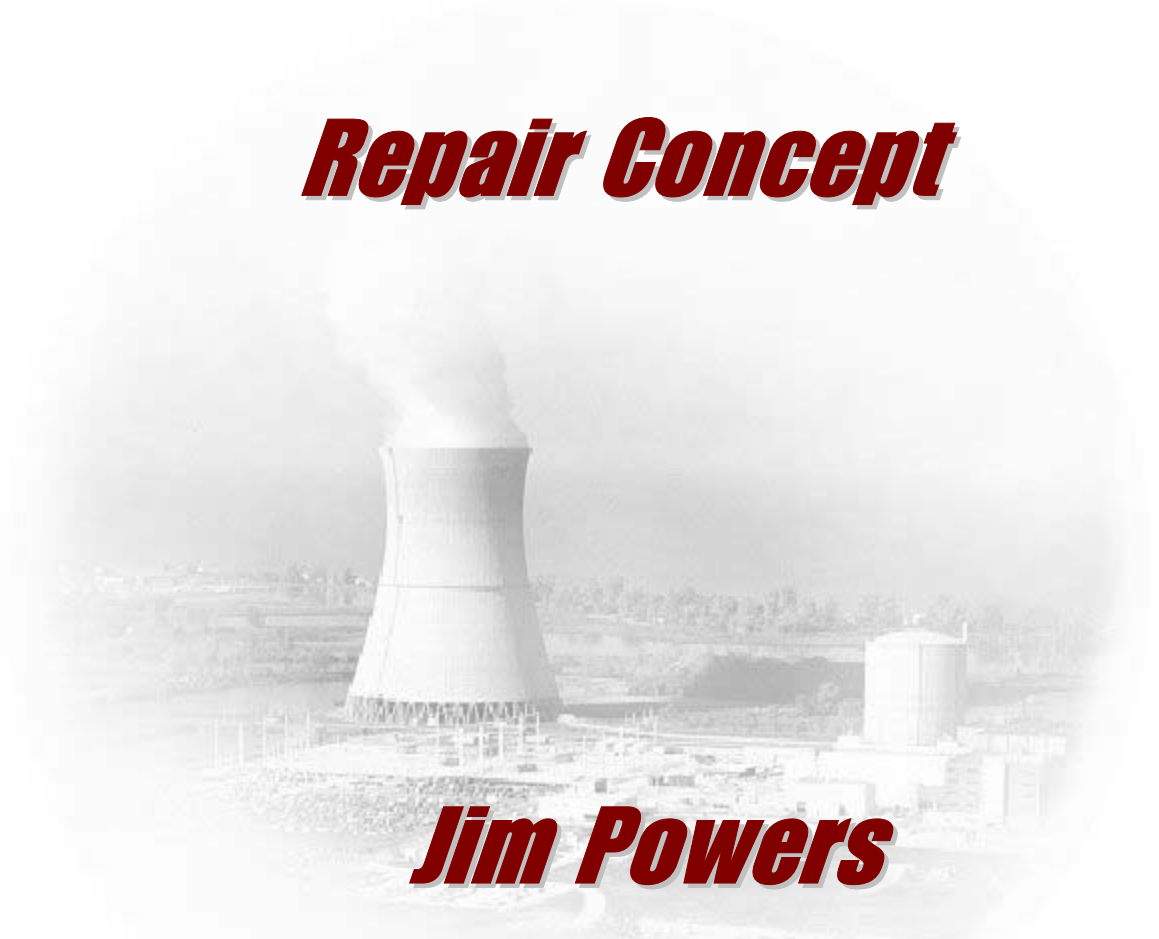




Reactor Head Degradation - Nozzle 3

FENOC
FirstEnergy Nuclear Operating Company

Repair Concept

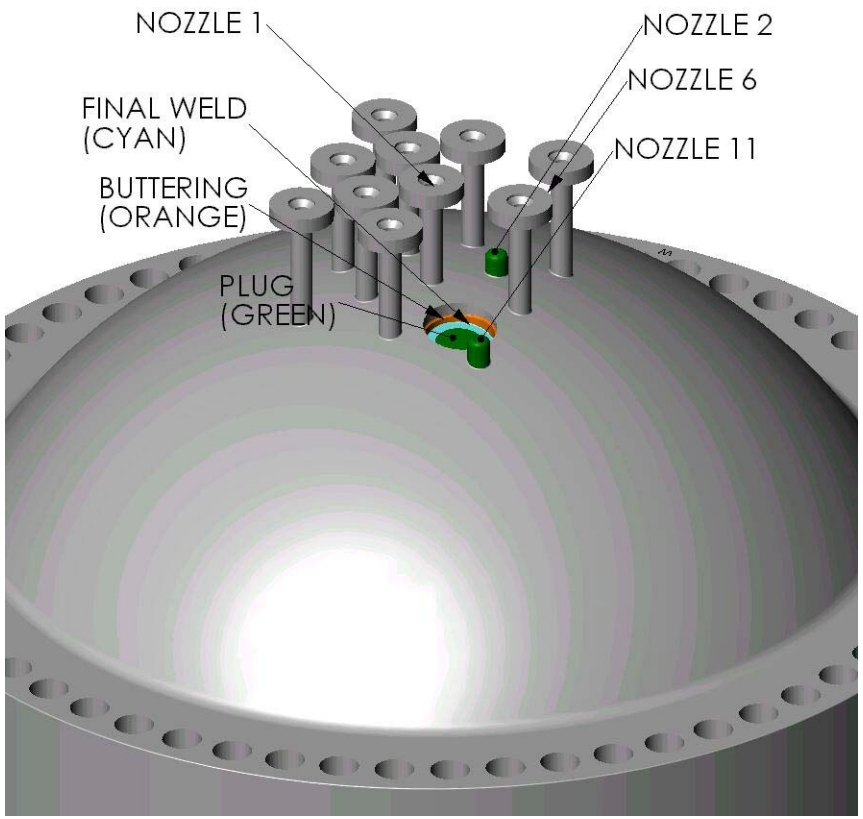


Jim Powers

Engineering Evaluation Team Leader

FENOC
FirstEnergy Nuclear Operating Company

Repair Concept



Overview

Repair will consist of two phases:

- Installation of welded plugs in Nozzles 2 and 11
- Restoration of removed wastage area around Nozzle 3 with a forged disk

Three affected control rod drives to be relocated to spare nozzles

Repair Concept

Design Criteria

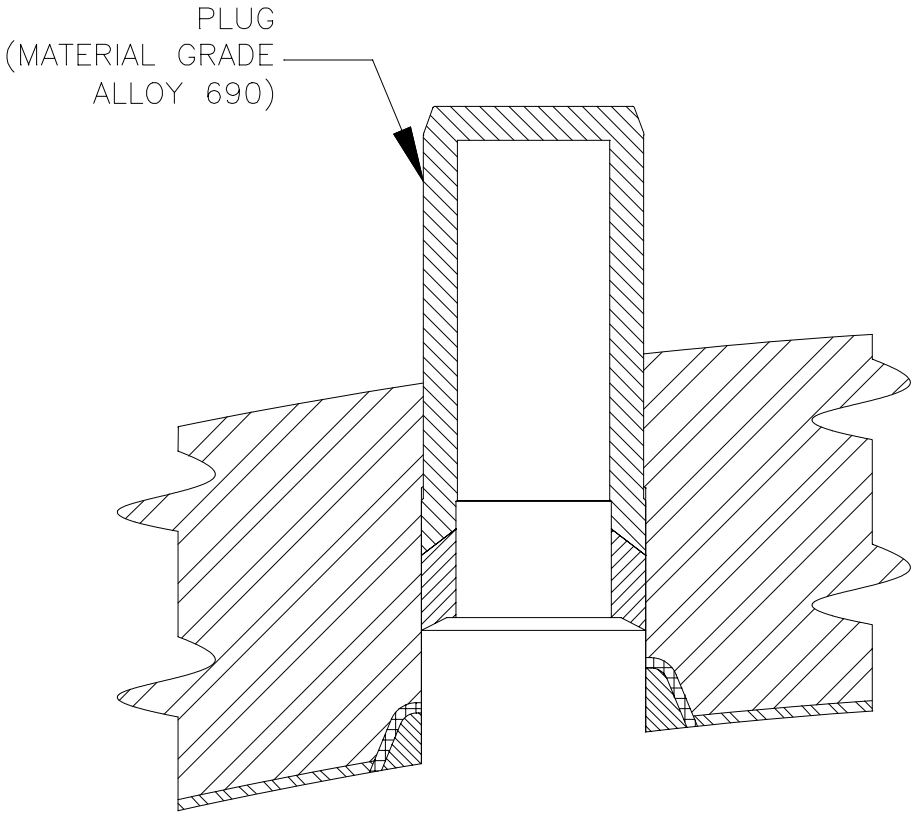
- Repair will meet design requirements of American Society of Mechanical Engineers (ASME) Boiler & Pressure Vessel Code (BPVC) Section III
- Includes all normal, off-normal and accident transient cycles and is designed for remaining licensed plant life
- Repairs will be performed by a team consisting of personnel from Davis-Besse, Framatome ANP Inc., and Welding Services, Inc.
- Third party design analysis by Structural Integrity Associates
- Mock-ups will be used to demonstrate effectiveness of cutting, welding and examination techniques

Repair Concept

Applicable Codes

- Design code for the Reactor Vessel was ASME Section III, 1968 Edition, Summer 1968 Addenda
- Design code to be used for the repair is the ASME BPVC Section III, 1989 Edition
- ASME BPVC Section XI, 1995 Edition, with 1996 Addendum is governing inservice inspection code for Davis-Besse
- Non-destructive examinations (NDE) of repair will be performed in accordance with Section III

Nozzles 2 & 11



CROSS SECTION RPV HEAD
NOZZLES 2 & 11

Repair Sequence

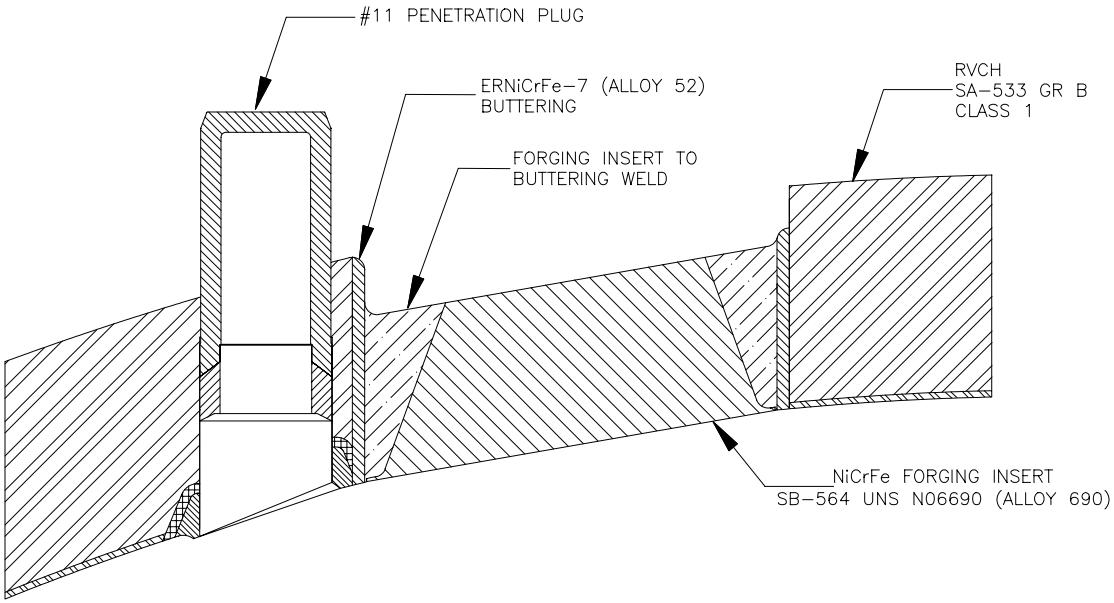
- Machine and perform Liquid Penetrant (PT) examination of bore
- Machine plug to match bore
- Insert and weld plug using remote machine Gas Tungsten Arc Welding Ambient Temperature Temper Bead and Alloy 52 Weld Filler Material
- Perform PT and Ultrasonic (UT) examination on completed weld

Forged Disk

Forging Material Alloy 690, SB-564, UNS N06690

FENOC
FirstEnergy Nuclear Operating Company

Nozzle 3 and Adjacent Area



REPAIR CROSS SECTION

Repair Sequence

- Inspect walls using Liquid Penetrant Examination (PT)
- Butter the bore surface using Ambient Temperature Temper Bead welding process
- Machine and after 48 hours hold inspect using PT and UT examination
- Fit up and weld in forged disk
- Weld to be inspected using PT and Radiographic (RT) examination

FENOC
FirstEnergy Nuclear Operating Company

Repair Concept

Confirmatory Action Letter - Repair Plan

NRC Approvals per 10 CFR 50.55a

Penetrations #2 & #11

- Approval to use Ambient Temperature Temper Bead Welding - Code Case N-638 Methodology (Consistent with those granted to other plants for CRDM Nozzle Repairs)
- Approvals include:
  - Interpass Temperature Qualification (Section XI IWA-4610 (b))
  - Impact Testing to meet ASME BPVC Section III (Section XI IWA-4632 (b))

Penetration #3 - Weld Buttering

- Approval to use Ambient Temperature Temper Bead Welding - Code Case N-638 Methodology
- Approvals include:
  - 100 In^2 Limitation (Section XI IWA-4631 (b))
  - Interpass Temperature Qualification (Section XI IWA-4610 (b))
  - Preheat/Interpass Temperature Monitoring (Section XI IWA-4610 (a))

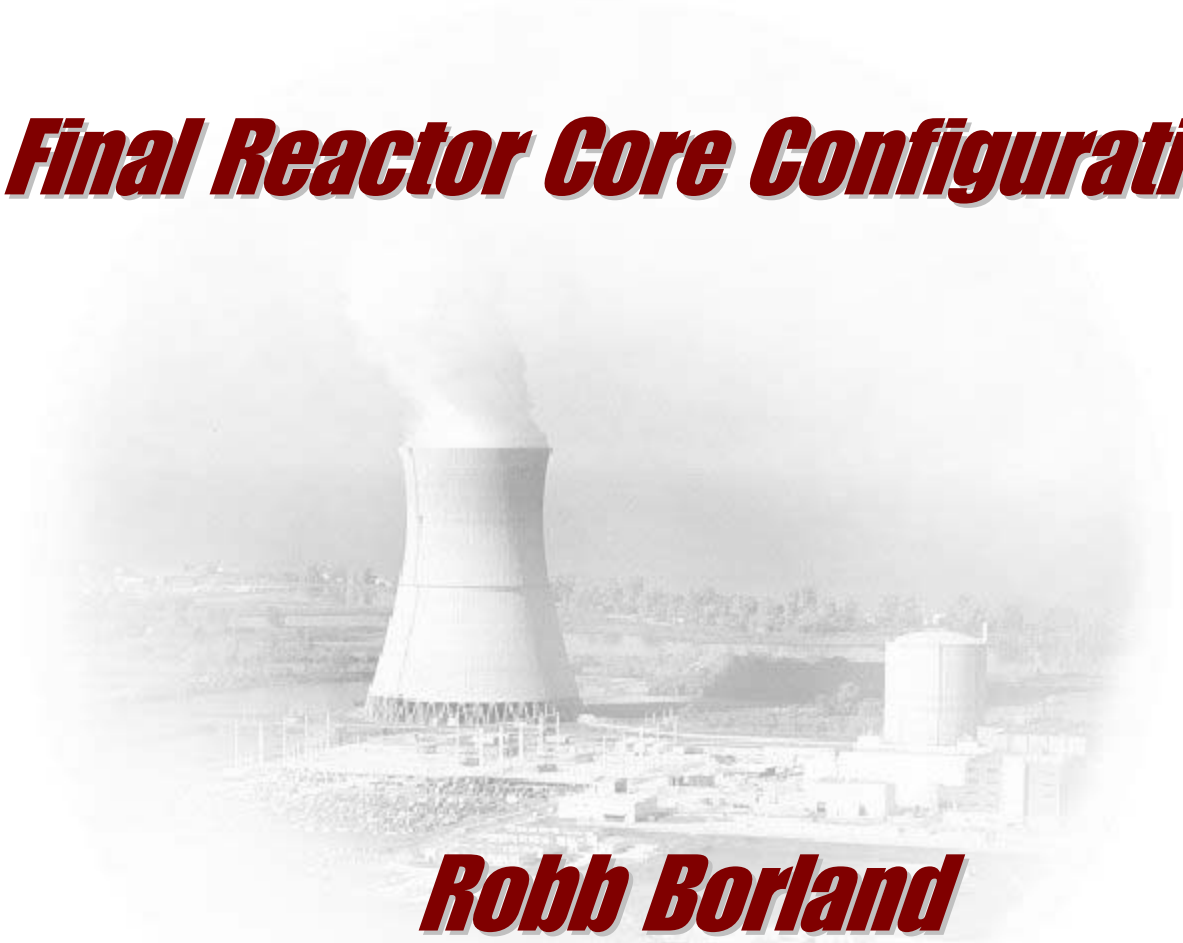
Repair Concept

Post Repair and Inspection Testing

- Liquid Penetrant Examination
- Radiographic Examination
- Code Case N-416-1

  - System leakage test at full temperature and pressure

Final Reactor Core Configuration



Robb Borland
FENOC Nuclear Fuel Supervisor

FENOC
FirstEnergy Nuclear Operating Company

Final Reactor Core Configuration

Overview

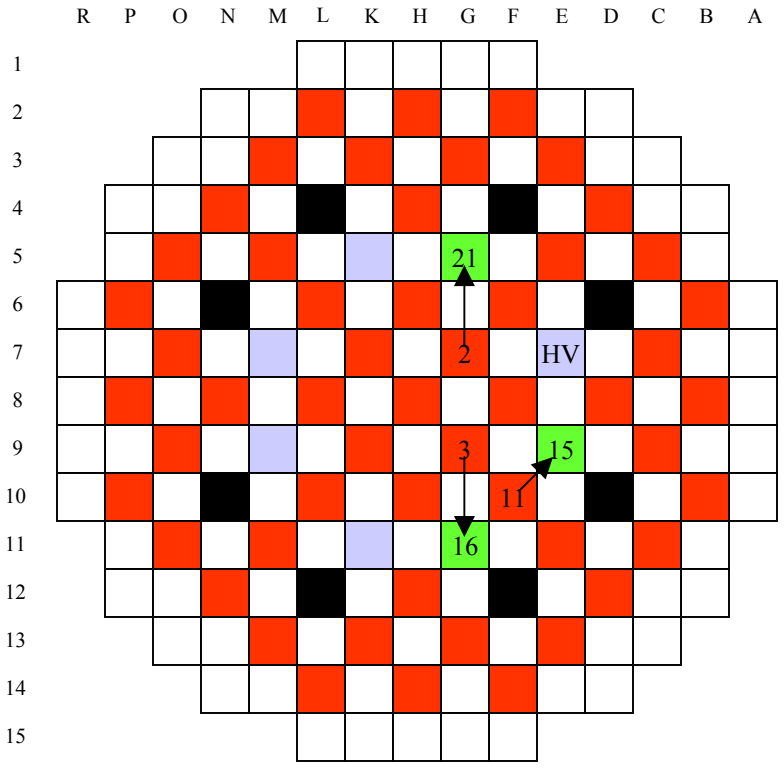
- Total number of control rod assemblies (CRAs) remains the same
- Number of individual CRAs in each control rod group remains the same
- Original Cycle 14 fuel loading pattern maintained

Final Reactor Core Configuration

Proposed Changes

- Three CRAs moved to new core positions using existing spare CRDM nozzles
- Eight CRAs exchanged between two control rod groups to maintain appropriate core symmetry
- Cycle 14 reload analysis redone by Framatome ANP for the new CRA pattern

Core Modifications



Non-Rodded Locations

Normal CRA Locations

New CRA Locations
(Nozzles 15, 16, 21)

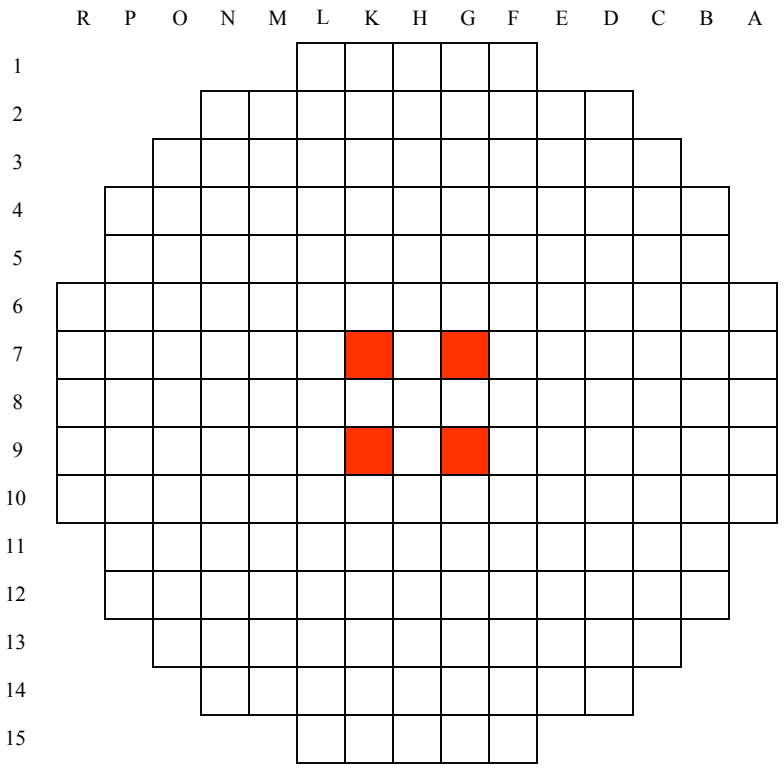
Spare CRDM Nozzles
(HV = Head Vent)

APSR Locations

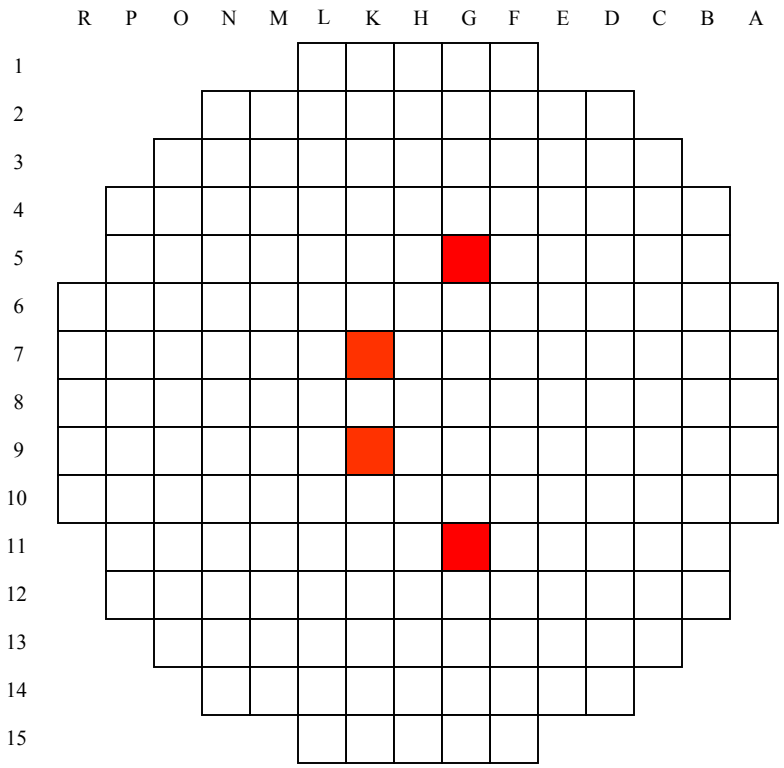
CRA Relocation

Group 1 Relocations

Original Group 1



New Group 1

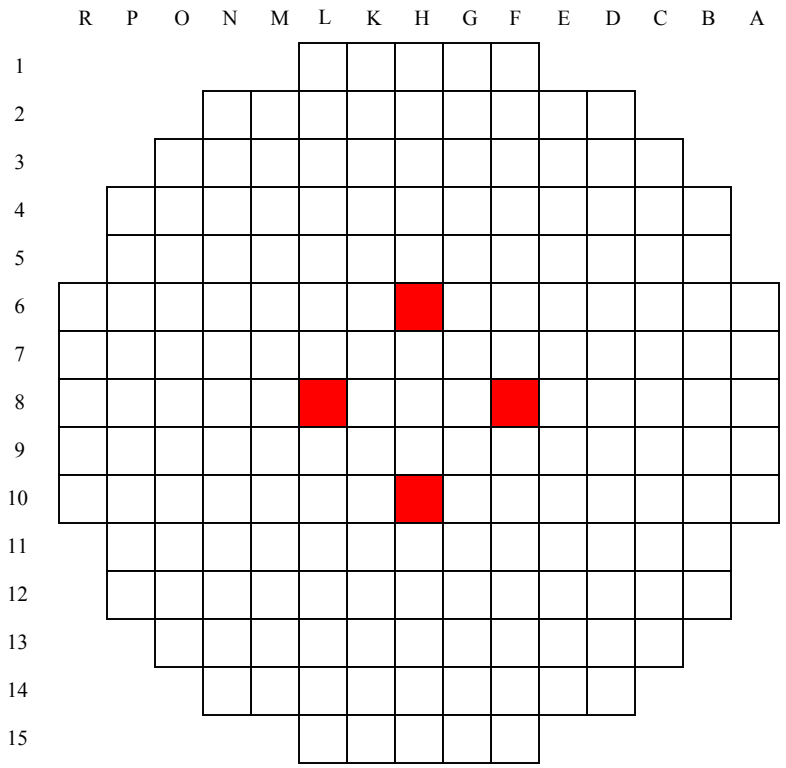


FENOC
FirstEnergy Nuclear Operating Company

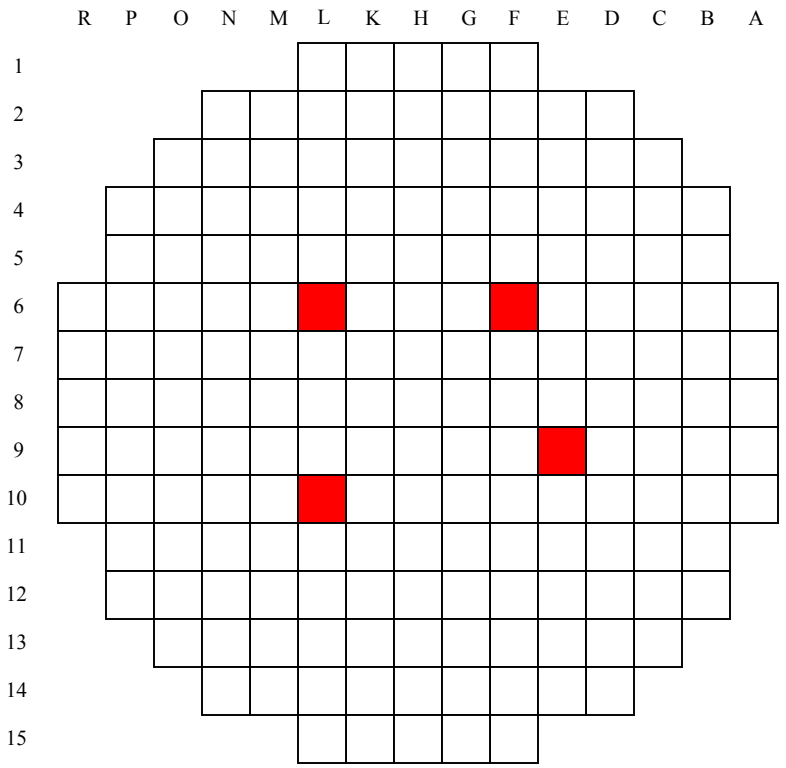
CRA Relocation

Group 3 Relocations

Original Group 3



New Group 3

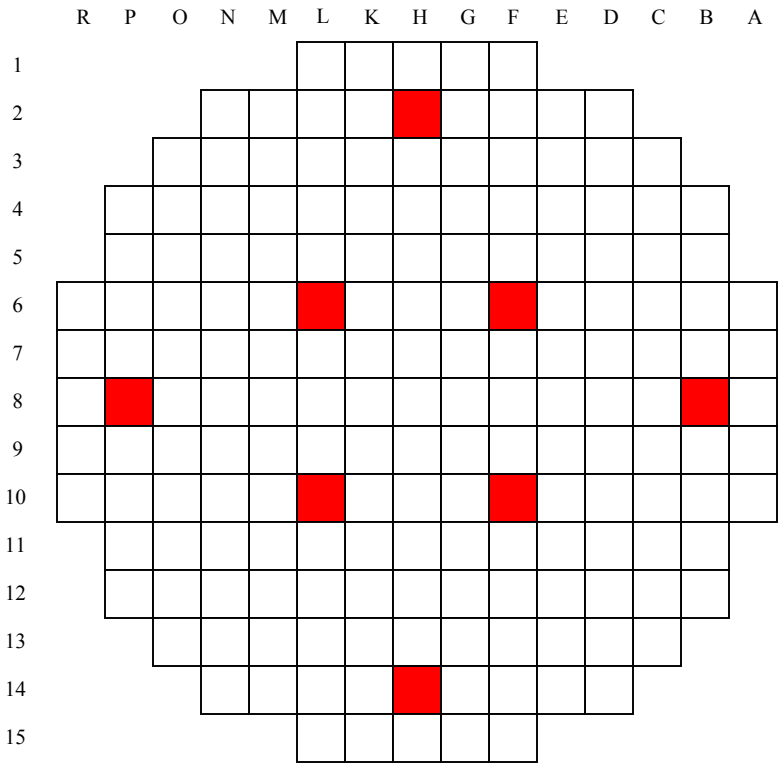


FENOC
FirstEnergy Nuclear Operating Company

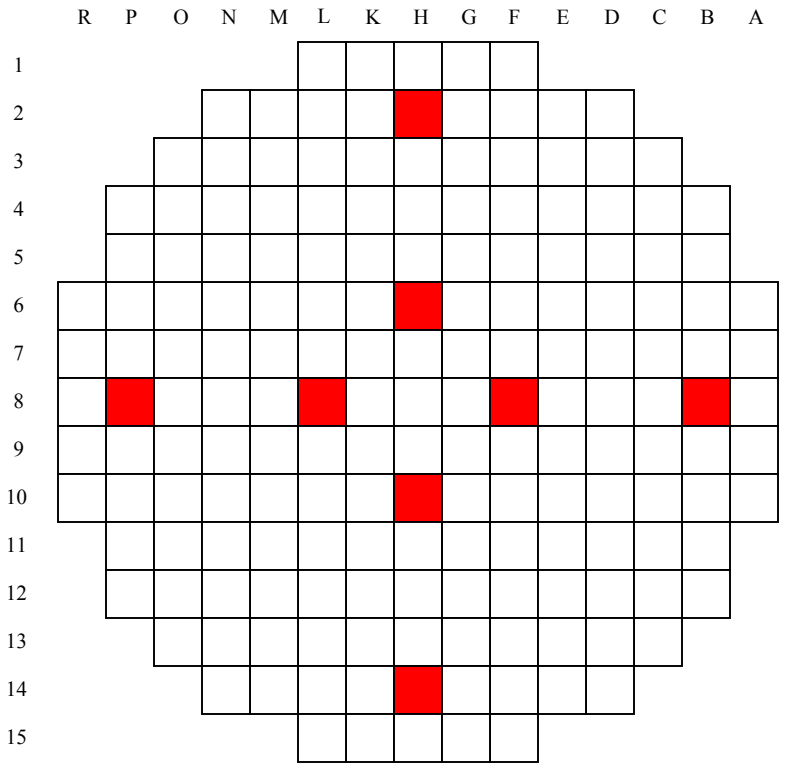
CRA Relocation

Group 6 Relocations

Original Group 6



New Group 6



FENOC
FirstEnergy Nuclear Operating Company

CRA Relocation

CRA Relocation Effect

All CRA worths (total, group, stuck, ejected, dropped) well within those assumed in USAR safety analyses

Rod insertion limits meet shutdown margin requirements

Final Reactor Core Configuration

NRC approvals in accordance with Confirmatory Action Letter

FENOC
FirstEnergy Nuclear Operating Company

Concluding Remarks

FENOC
FirstEnergy Nuclear Operating Company