Davis-BesseNPEm Resource

From: Rutkowski, John
Sent: Thursday, January 05, 2012 9:50 AM
To: Holmberg, Mel
Cc: Smagacz, Phillip
Subject: FW: Davis-Besse Slides for Public Meeting
Attachments: DBNPS Shield Building Meeting Slides Final.pdf

From: Wilson, Adam
Sent: Thursday, January 05, 2012 7:40 AM
To: Briley, Thomas
Cc: Cameron, Jamnes; Hills, David; Mitlyng, Viktoria; Chandrathil, Prema; Hiland, Patrick; Hernandez, Pete; OBrien, Kenneth; Shear, Gary; West, Steven; Rutkowski, John; Steffes, Jakob; Sanchez Santiago, Elba; Pederson, Cynthia; Heck, Jared; Mahoney, Michael; Neurauter, James; Kimble, Daniel
Subject: FW: Davis-Besse Slides for Public Meeting

From: gmwolf@firstenergycorp.com [mailto:gmwolf@firstenergycorp.com]
Sent: Thursday, January 05, 2012 8:31 AM
To: Wilson, Adam
Cc: kwbyrd@firstenergycorp.com; ghalnon@firstenergycorp.com; acayia@firstenergycorp.com; bsallen@firstenergycorp.com; bdboles@firstenergycorp.com; dpace@firstenergycorp.com; elarson@firstenergycorp.com; jjgezo@firstenergycorp.com; jhlash@firstenergycorp.com; ostrowskik@firstenergycorp.com; mgerdes@firstenergycorp.com; brownp@firstenergycorp.com; hamrickp@firstenergycorp.com; senap@firstenergycorp.com; bolognar@firstenergycorp.com; hunsingert@firstenergycorp.com; tahenderson@firstenergycorp.com; djenkins@firstenergycorp.com; jyoung@firstenergycorp.com; tmschneider@firstenergycorp.com; pjmccloskey@firstenergycorp.com; bezillam@firstenergycorp.com; custerc@firstenergycorp.com
Subject: DBNPS Slides for Public Meeting

Adam - attached is an Adobe Acrobat version of the slides FENOC will be using at this evening's public meeting. I will have color copies of these slides available for the NRC at the meeting as well. If you have any questions or need additional assistance, please let me know.

Gerry Wolf
Supervisor, Nuclear Compliance
Davis-Besse Regulatory Compliance
desk: 419-321-8001 (extension 883-8001)
e-mail:GMWolf@FirstEnergyCorp.com

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"Smagacz, Phillip" <Phillip.Smagacz@nrc.gov>
Tracking Status: None
"Holmberg, Mel" <Mel.Holmberg@nrc.gov>
Tracking Status: None

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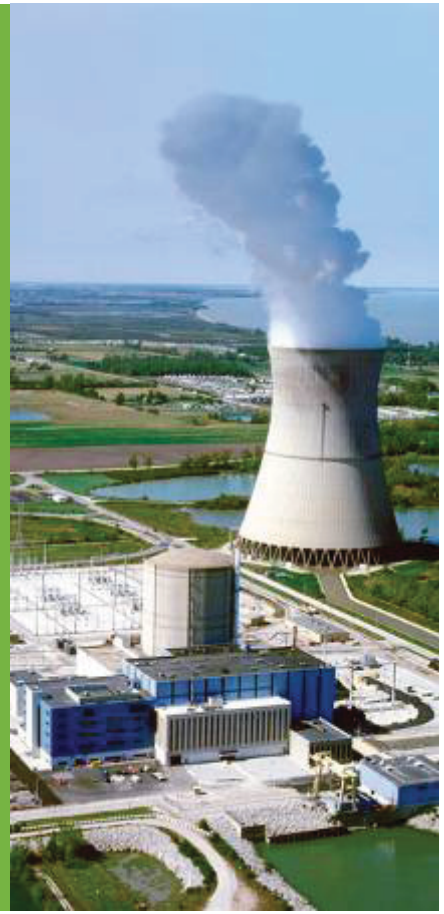
Davis-Besse Nuclear Power Station

Nuclear Regulatory Commission
Public Meeting
January 5, 2012



Agenda

- **Introduction**
  - ***Barry Allen***, Site Vice President – Davis-Besse
- **17th Mid-Cycle Outage Summary**
  - ***Brian Boles***, Director – Site Operations
- **Shield Building Condition Evaluation**
  - ***Ken Byrd***, Director – Site Engineering
- **Closing Comments**
  - ***Barry Allen***, Site Vice President – Davis-Besse

Desired Outcomes

- **Demonstrate FENOC's overriding priority and commitment to ensure the safe and reliable operation of Davis-Besse**
- **Recap 17 Mid-Cycle Outage Activities**
- **Describe the discovery and investigation of the Shield Building concrete cracking**
- **Describe the evaluations performed to verify Shield Building capability for operating conditions**
- **Provide summary of actions going forward**

17th Mid-Cycle Outage Summary

Brian Boles – Director, Site Operations

Davis-Besse Plant Status

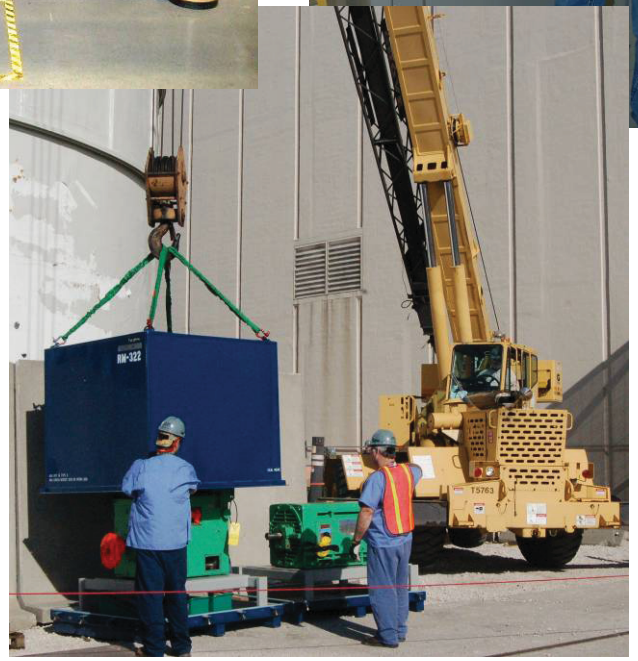
- **Currently Operating at 100% Reactor Power**
  - 950 Megawatts
- **31 Days On-Line**
- **122 Days Until 17th Refueling Outage**
- **Reactor, Primary and Secondary systems operating as designed**

Davis-Besse Mid-Cycle Outage Summary

- **Safety Upgrades**
  - Replaced Reactor Head
  - Replaced Integrated Control System

Davis-Besse Outage Summary

- **Reliability Improvements**
  - Replaced Station Battery Chargers
  - Installed new style Power Operated Relief Valve
  - Replaced power cables
  - Replaced Core Cooling Motors
  - Performed Motor Operated and Air Operated Valve maintenance

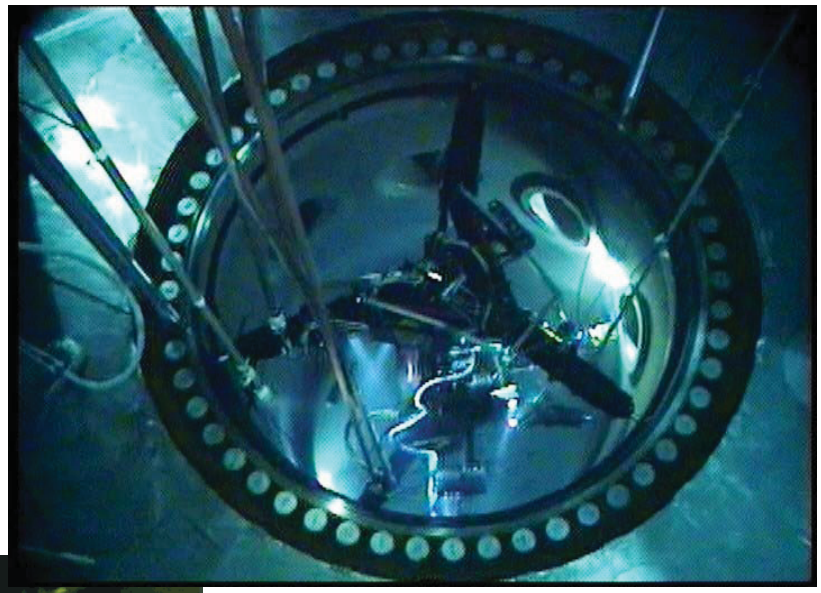


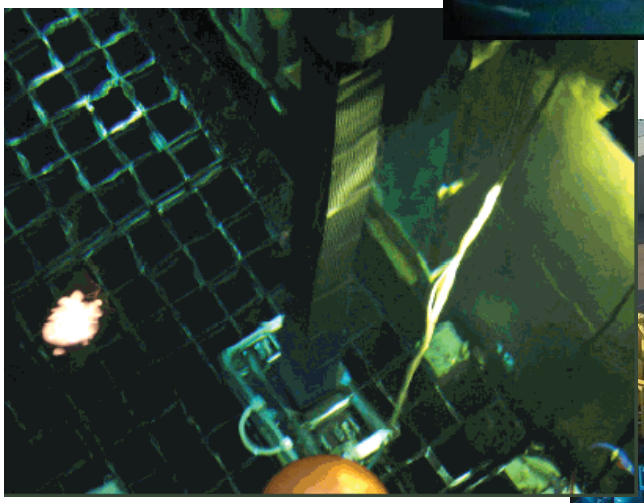
Davis-Besse Outage Summary

- **Operating Margin Improvements**
  - Replaced selected Service Water Piping
  - Drained and cleaned Turbine Plant Cooling Water System
  - Performed Cooling Tower maintenance

Davis-Besse Outage Summary

- **Inspection Requirements**
  - Completed 10 year Inservice inspection
  - Inspected all fuel assemblies
  - Performed Integrated Leak Rate Test of Containment





Outage Conclusions

- **Mid-Cycle Outage conducted in a safe manner**
- **FENOC continues to invest in safety and reliability improvements**
- **As a result of work performed during the Mid-Cycle Outage, Davis-Besse is operating safely and efficiently with improved margins to safety.**

Shield Building Condition Evaluation

Ken Byrd – Director Site Engineering

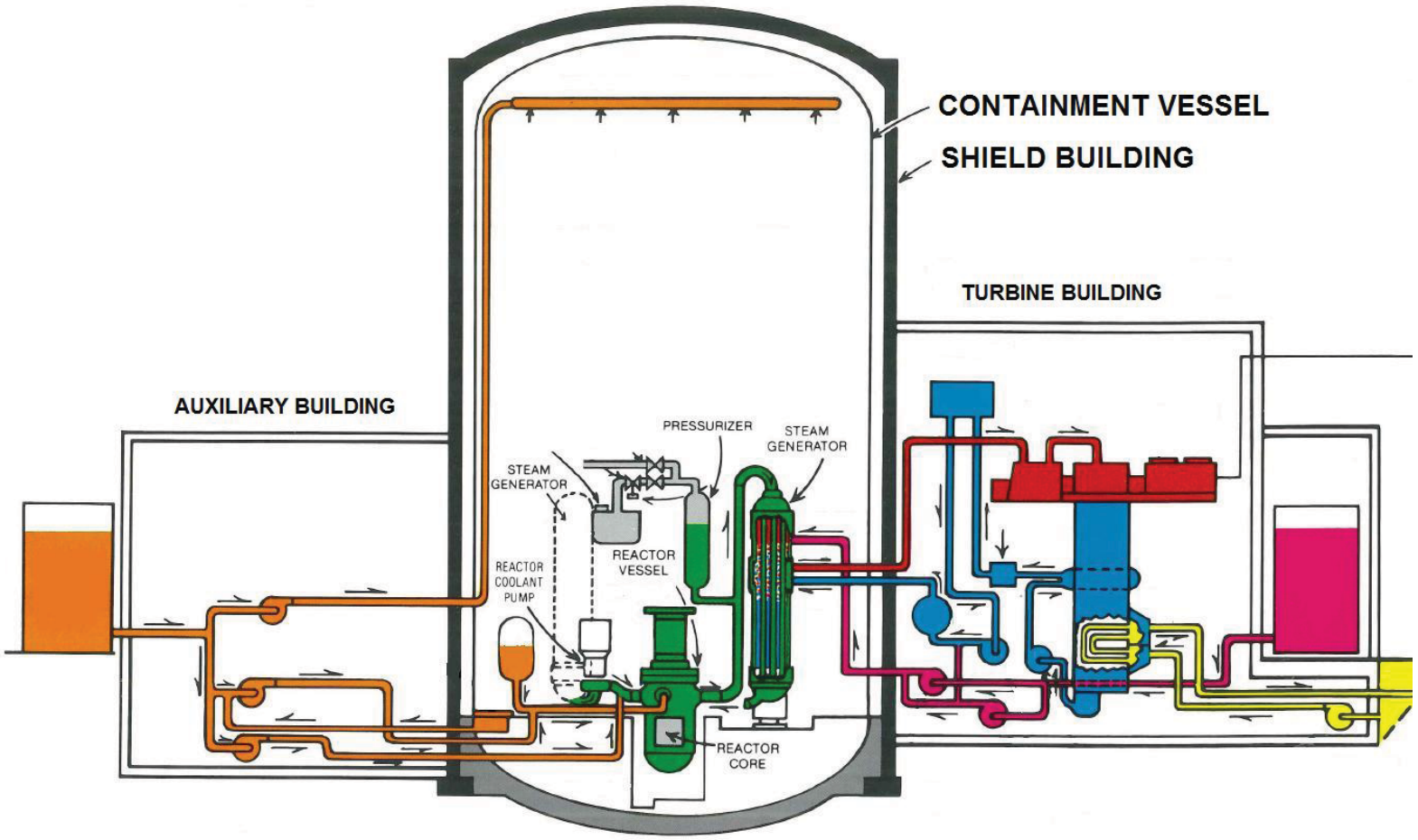
Background

- **Mid-cycle outage to replace Reactor Pressure Vessel Head**
- **Access opening required in concrete Shield Building**
- **Opening dimensions 26.5’ w X 35.5’ h**
- **Hydro-demolition method employed**
- **Previous opening in 2002 used similar method**
- **Size and orientation was different**

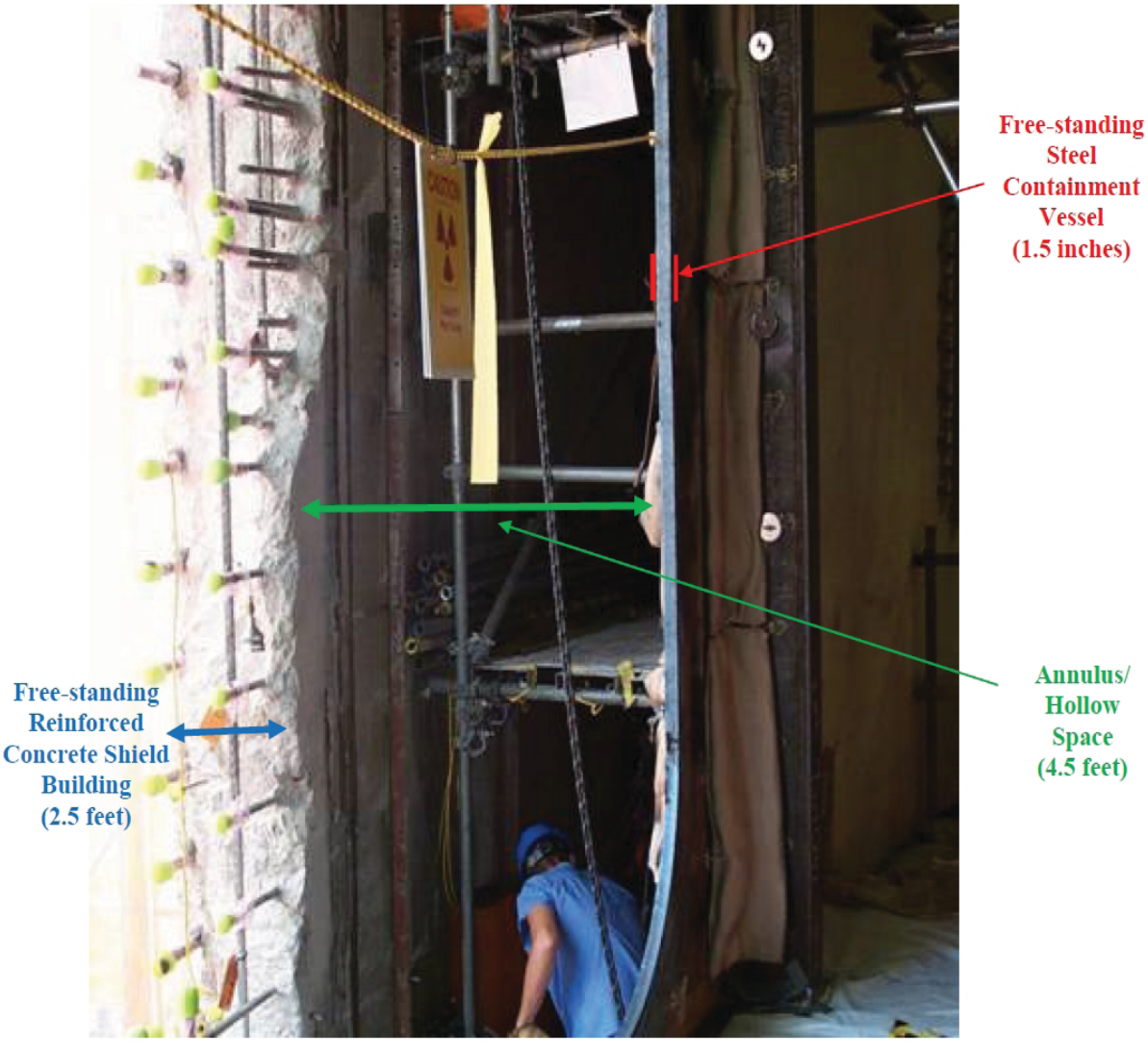
Shield Building

- **Purpose of Shield Building**
  - Biological Shielding
  - Environmental protection for containment vessel
  - Controlled release of annulus atmosphere under accident conditions

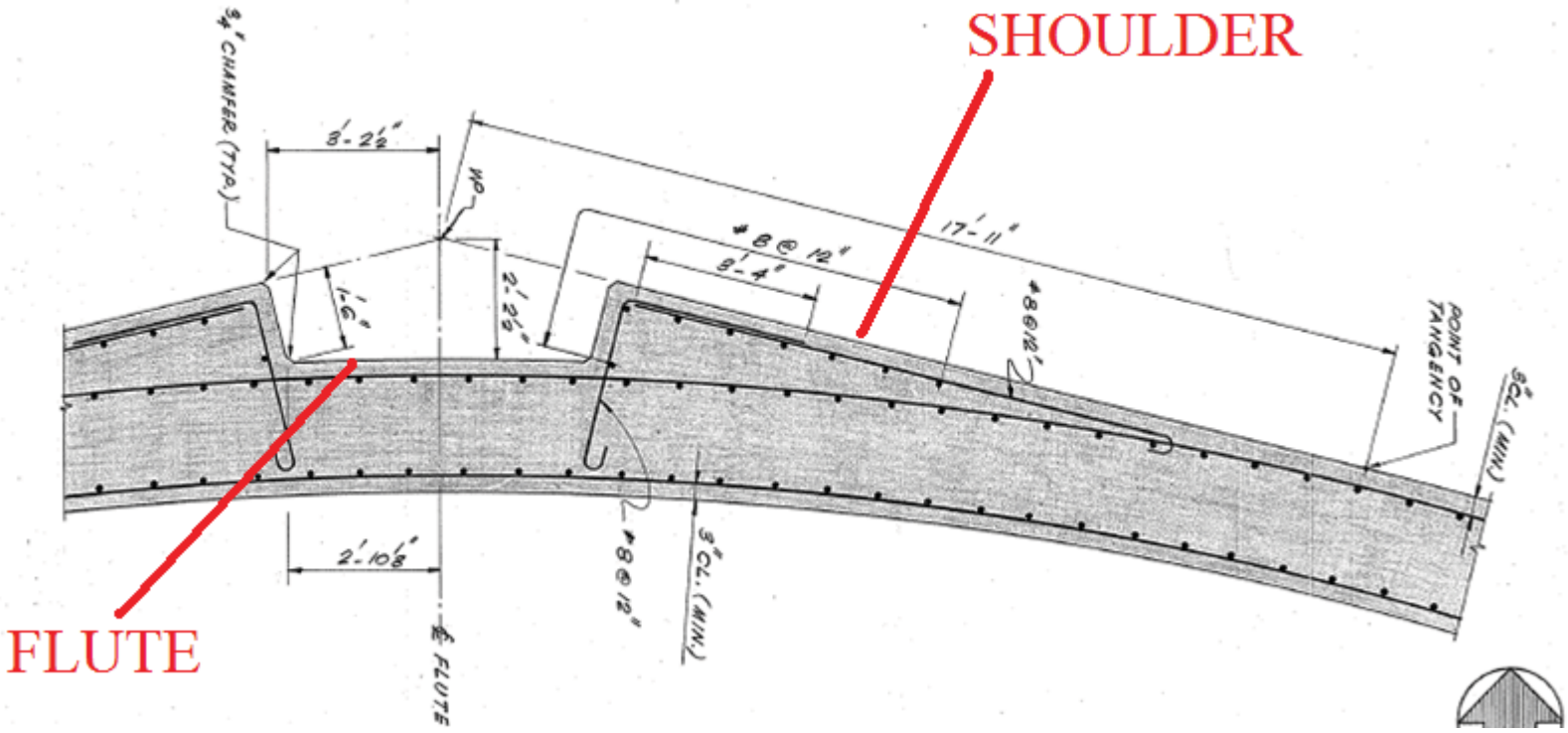
Shield Building



Shield Building

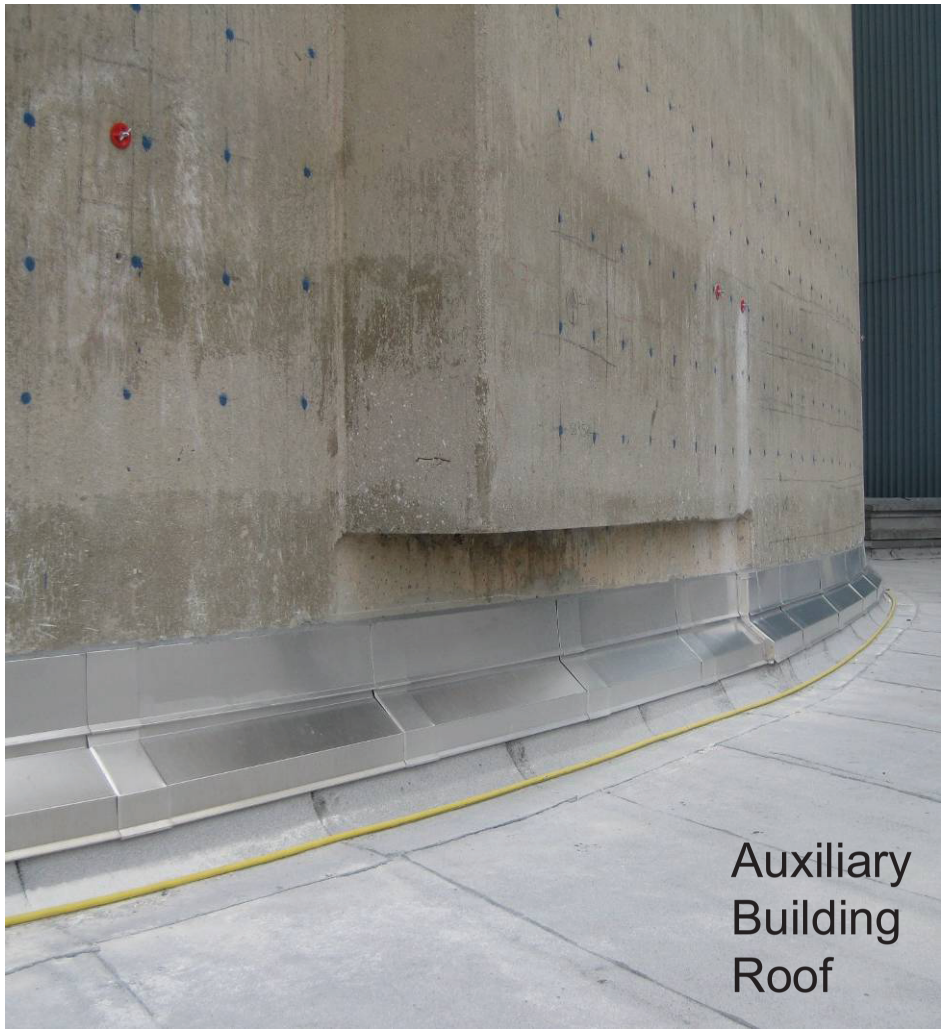


Shield Building Flutes

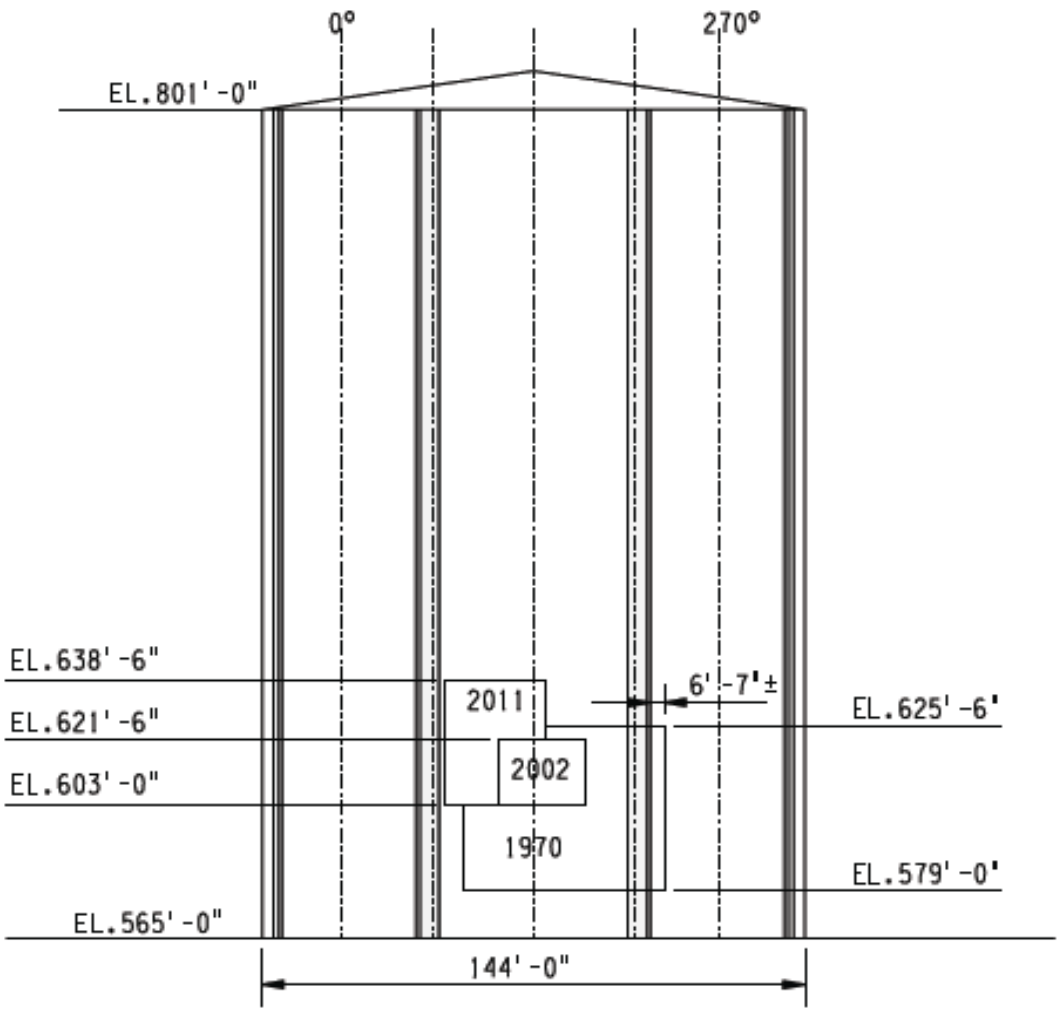


Shield Building Flutes

- **Architectural Feature**
  - The flute shoulders are part of the Shield Building. Concrete for shoulders and building shell was placed concurrently.
  - Evaluation of structural capacity of Shield Building does not credit flute shoulders.
  - Evaluated as a dead load in structural analysis.



Shield Building



2011 OPENING 26'-3" X 35'-6"
2002 OPENING 23'-6" X 18'-6"
1970 OPENING 53'-0" X 46'-6"

Discovery

- **Cracking found on October 10 during hydro-demolition**
- **Indications reported**
  - Full length of left side of opening
  - Top and bottom of opening on left side
  - Indications appeared to be near the first (outer) rebar mat

Initial Response

- **NRC Resident Inspector notified**
- **Condition Report written**
- **Restraint on restart established**
- **Mobilized team of experts to investigate issue**

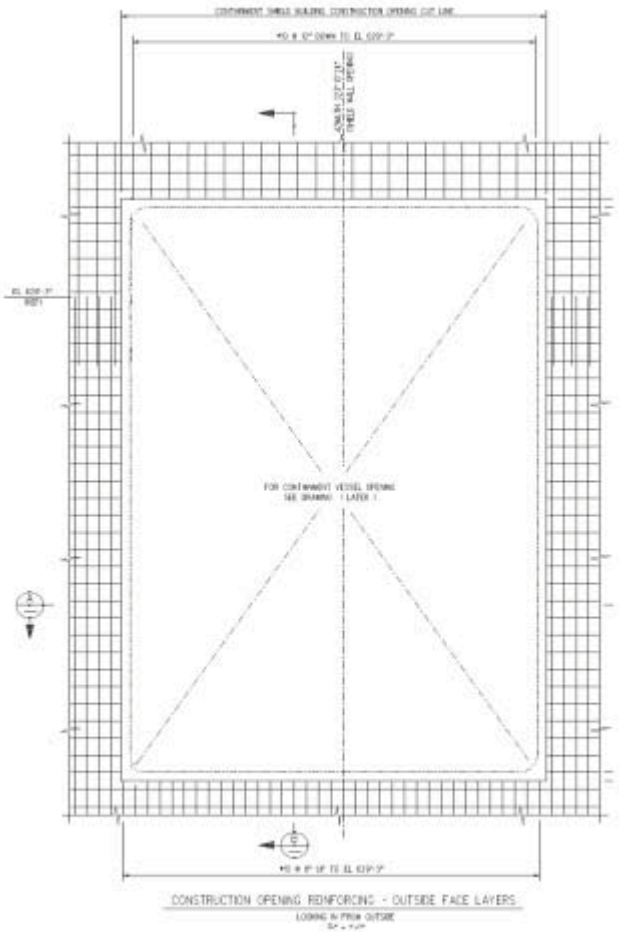
Initial Investigation

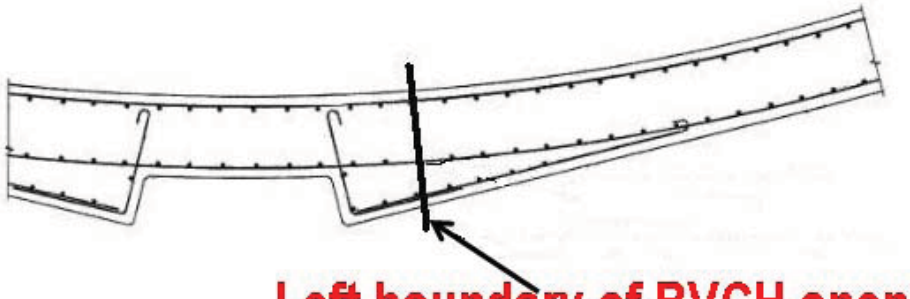
- **Decision made to “chip back” concrete to observe indication**
- **No indications remained on bottom or left side of opening after chipping**
- **Chipping at top of opening revealed the crack extended beyond the construction opening**

Upper Opening Indication Investigation

- **Construction Technology Laboratory (CTL) Impulse Response (IR) testing methodology used to investigate extent of crack**
- **IR was employed as a tool to provide a non-destructive means to identify regions of interest for further investigation**
- **Core bores were taken to confirm the boundary of cracking based on IR results**

Initial Investigation Around Construction Opening





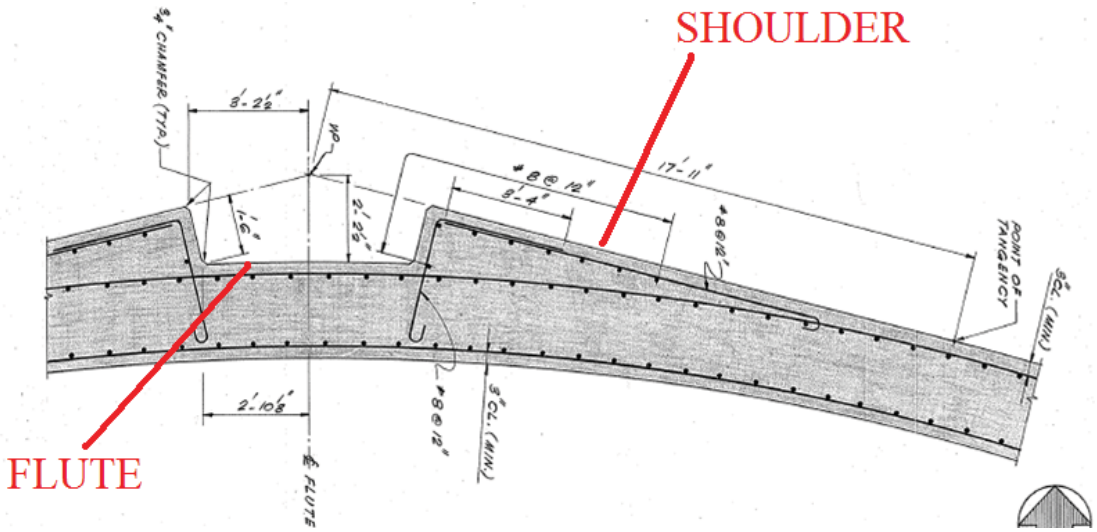
Left boundary of RVCH opening

Investigation of Extent of Condition

- **Extent of Cracking Condition was investigated using IR testing and Core Bores.**
- **The results of the investigation were documented in the Corrective Action Process as follows:**
  - October 10, Initiated CR and notified NRC – Unexpected concrete crack within Shield Building temporary opening
  - October 24, Initiated CR and notified NRC – Additional crack identified in Shield Building architectural flute shoulder area
  - October 26, Initiated CR and notified NRC – Cracking identified in Shield Building at Main Steam Line Penetration region
  - October 31, Initiated CR and notified NRC – Shield Building IR indications above Elevation 780

Impulse Response Inspection

- **IR Testing Performed:**
  - 15 of 16 flute shoulders
  - 6 of 8 flutes
  - 8 of 8 shell regions between flute shoulders
  - Main Steam Line Rooms and Fan Equipment room
  - Vertically to the top of Shield Building wall

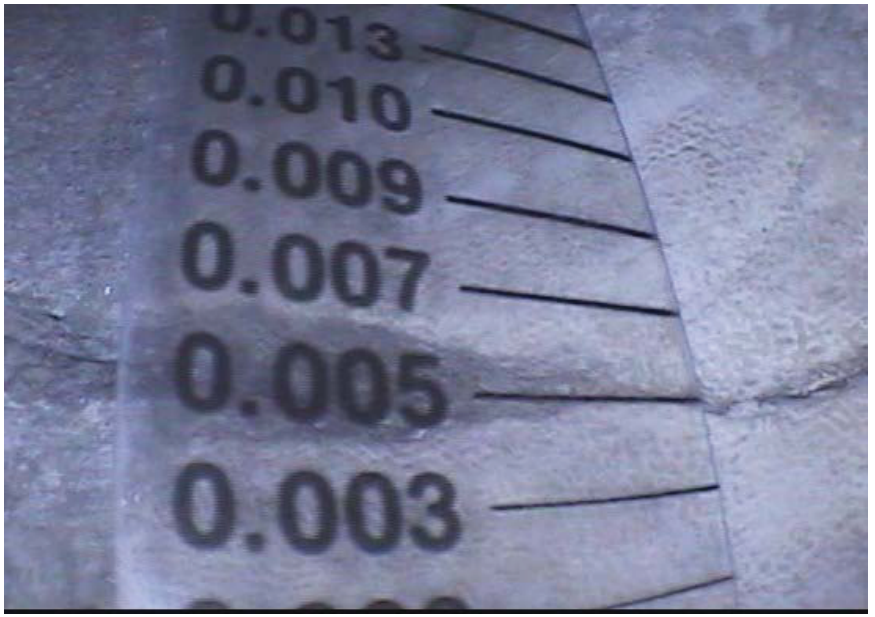


Shield Building Core Bores

- **70 core bores performed**
- **Core bore pairs were used to validate the IR results**
- **Measured cracks were adjacent to the Shield Building outer rebar mat**

Shield Building Core Bores

- **All measured cracks were very tight**
- **Eight deep core bores were taken that reached the interior reinforcing steel mat. Confirmed cracking only in outer rebar mat.**
  - 2 in flute shoulders
  - 4 in flutes
  - 2 in Main Shell Region



Shield Building Visual Examinations

- **Surface examinations of all areas investigated for spalled concrete, corrosion/staining, surface bulging and loose concrete**
  - Surface examination results revealed no indications of concrete surface distress impacting the structural integrity of the Shield Building
  - Condition Report initiated to document a case of exposed reinforcement and spalling in the corner of a shoulder.
- **Rebar inspected at the construction opening in good condition**

Laboratory Evaluation of Shield Building Concrete

- **Initial Laboratory evaluation of two core bores performed by CTL Group**
- **Results of tests indicate**
  - Concrete is in good condition with no apparent deficiencies that would affect its continued service
  - Carbonation is at a depth consistent with the age of the concrete

Summary of Shield Building Condition

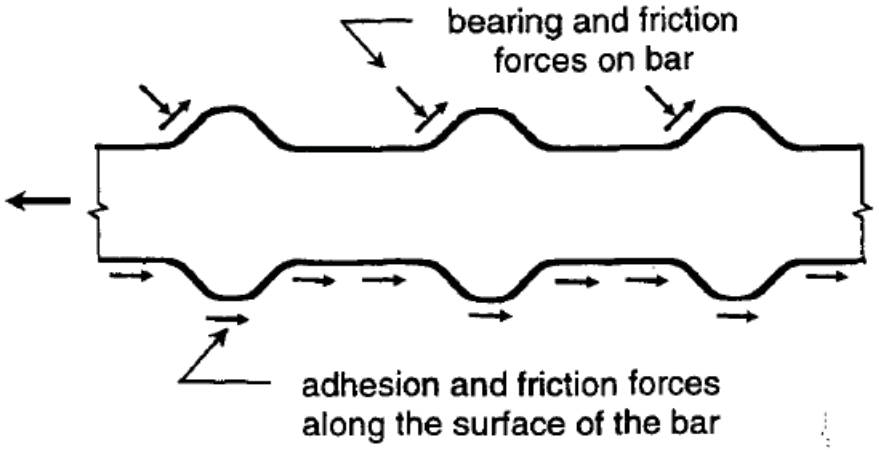
- **Cracking is generic to flute shoulder regions and can be assumed to be present at any elevation in the flute shoulders. Cracking observed to be more prevalent on the south side of the building.**
- **Cracking exists at the top 20 feet of the Shield Building wall outside the flute shoulder region.**
- **Two small regions adjacent to the Main Steam Line penetrations have similar cracks. The extent of these regions is localized and unique to these particular penetrations.**
- **Cracks are located near the outer reinforcing mat. No cracking observed in interior reinforcing mat.**
- **Cracks are very tight.**

Structural Evaluation

- **Shield Building Design**
  - Building designed and constructed with significant reinforcement
  - Significant Margin under design basis loads
  - Design Basis
    - Earthquake 6 – 6.5 on Richter magnitude scale
    - Tornado winds of 300 miles per hour
    - Tornado wind-driven debris
    - Tornado depressurization
- **Impact of laminar cracks on design**
  - Potentially reduce the bond strength between concrete and reinforcing steel

Bond Strength

- **Force transfer between reinforcement and concrete**
  - Adhesion (small contribution)
  - Friction (moderate contribution)
  - Mechanical bearing of lugs (most contribution)



Bond Strength

- **Bond stress about 50% of capacity under Design Basis Load**
- **Concrete much stronger than specified (>6000 psi vs specified 4000 psi)**
- **Test results indicate a margin of at least 50% after initiation of a splitting crack.**

Bounding Building Analysis

- **Bond strength with adjacent cracks can not be quantified and is conservatively treated as non-existent in analysis.**
- **Calculations performed to provide a bounding evaluation of the effect of cracking.**
  - Vertical and horizontal reinforcement ineffective for strength in flute shoulders, two steam line penetration areas and in regions at top of shield building.
- **Any bond between reinforcement and concrete in crack regions provides additional margin.**

Bounding Building Analysis

- **Calculations are consistent with the original design and methodology.**
- **Calculations were performed by highly qualified and experienced Bechtel engineering team.**
- **FENOC Engineering staff performed detailed owner's acceptance review.**
- **Independent third party engineering review was performed by Sargent & Lundy.**

Root Cause

- **Root Cause determination in progress**
  - Director Fleet Performance Improvement
  - Davis-Besse Root Cause Evaluator
  - MPR Associates, Inc.
  - Performance Improvement International

Root Cause

- **Root Cause Team Activities**
  - Visual Inspections
  - Review of IR and Core Bore Inspection Results
  - Review of Construction Records
  - Analysis of Core/Rebar Samples
  - Detailed Modeling of Shield Building
- **Expected Results of Root Cause**
  - How, Why and When Cracking Occurred
  - Long Term Monitoring Program

Summary of Evaluation Results

- **Shield Building meets strength requirements.**
- **Meets serviceability as demonstrated by the structure's past performance.**
- **Any bond between the concrete and reinforcement in cracked regions would be an additional margin of safety.**
- **Shield Building is capable of performing its safety functions.**

Closing Comments

Barry Allen – Site Vice President

Summary of Actions Going Forward

FENOC has committed to the following ongoing actions:

- **Determine Root Cause of cracks in the Shield Building**
- **Perform interim monitoring of the Shield Building during this run cycle**
- **Perform additional monitoring of the Shield Building during the 2012 refueling outage**
- **Develop Long-Term Monitoring Requirements**

Conclusions

- **The Shield Building condition has been extensively investigated to establish a thorough understanding of the extent of cracking.**
- **Conservative calculations demonstrate the Shield Building meets strength requirements.**
- **The Shield Building is structurally sound, and is fully capable of performing its safety function.**
- **Davis-Besse is being operated safely.**