

Gilanshahi, Nikki

From: Gilanshahi, Nikki, NR20
Sent: Tuesday, June 08, 2010 3:03 PM
To: Gilanshahi, Nikki
Subject: FW: Presentation
Attachments: Crystal River 3.ppt 1-7-2010.pdf; Jan 6 Tech Consistency (1).pdf

From: Gilanshahi, Nikki
Sent: Monday, January 11, 2010 2:25 PM
To: (b)(6) ex 6
Subject: FW: Presentation

FYI;

From: Gilanshahi, Nikki
Sent: Monday, January 11, 2010 8:47 AM
To: Hawkins, Kimberly; Riddick, Nicole; Chakrabarti, Samir; Chakravorty, Manas; Gilanshahi, Nikki; Jeng, David; Kazi, Abdul; Xu, Jim; Chuang, Tze-Jer; Jain, Bhagwat; Ma, John; Park, Sunwoo; Patel, Pravin; Tegeler, Bret; Thomas, Brian; Thomas, Vaughn; Valentin, Milton
Subject: Presentation

Good morning All;

Please find attached copy of Jan6 and Jan 7 Crystal River presentation and
Please let me know, If you have any questions in this regard.

Thanks,

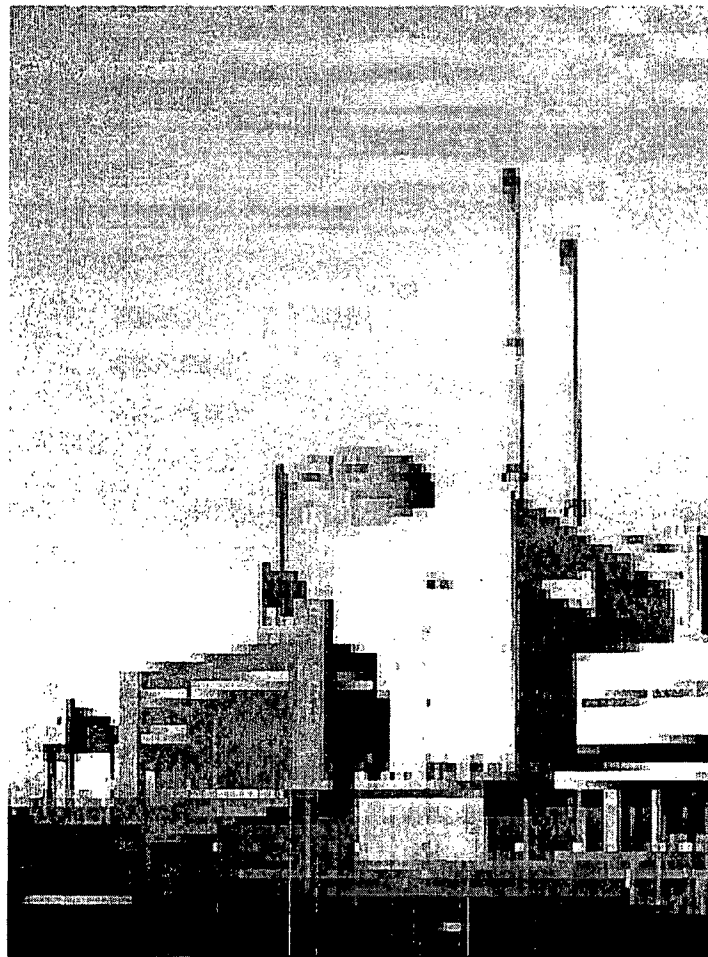
Nikki Gilanshahi
Structural Engineer
NRQ/DE/SEB2
Phone: (301) 415-3801

JT/S



Crystal River Unit # 3

Containment Delamination



Nikki Gilanshahi
Structural Engineer
NRO/DE/SEB2
1/7/2010



Purpose:

To educate the staff and make them aware of the recent discovery, Crystal River 3, Steam Generator Replacement containment delamination.

Outcome:

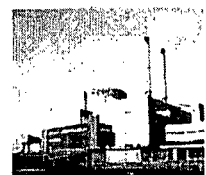
Staff can apply the insights from this operating experience to our new reactor reviews after presentation.

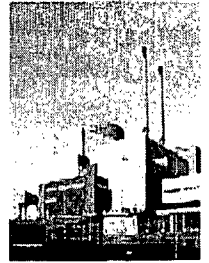
Safety Significance:

Concrete delamination Could compromise the structural integrity of the containment building, which inturn could potentially release radioactivity to the environment.

Conclusion:

Adequate Containment Design review and good quality of Construction inspection are essential to ensure safety of our future Nuclear Power Plants.

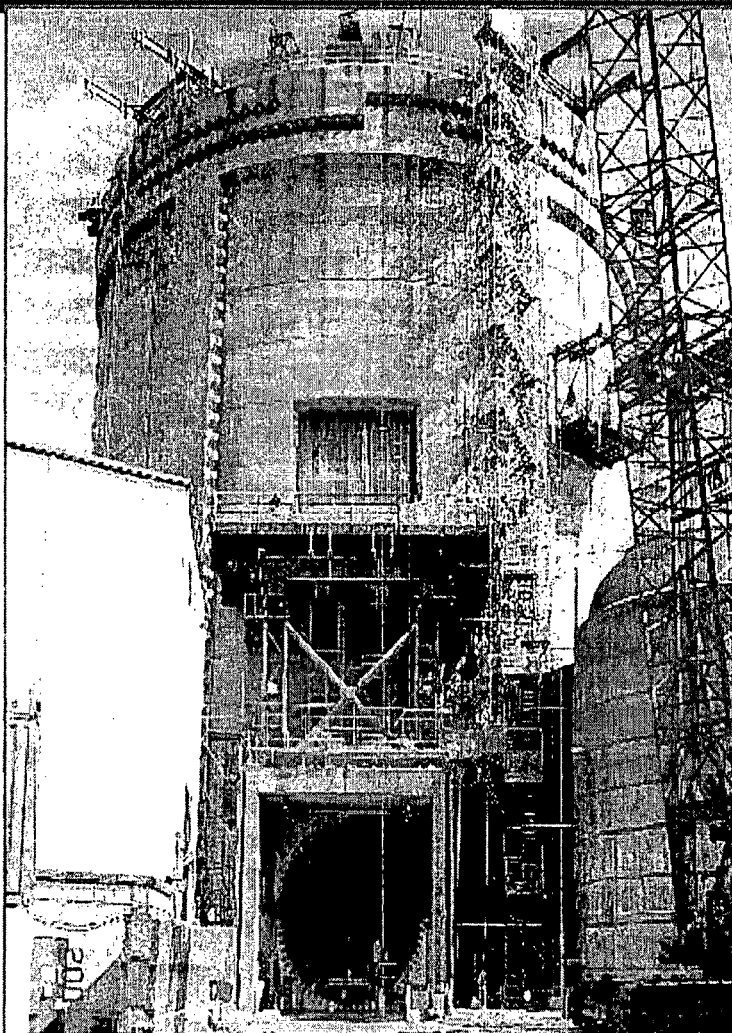




Crystal River 3

- *Pressurized Water reactor*
- *Location: Crystal River Florida*
- *Commercial Operations*
Electricity Generation since 1976 for Florida
- *Planned Outage*
- *Routine refueling scope*
Off line maintenance and fuel once every 2 years
- *Extended Power Uprate (EPU)- Phase 2*

Steam Generator Replacement (SGR) Opening (between Buttresses 3 and 4)



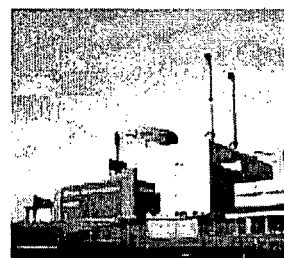
SGR Opening Dimensions

@ Liner

23' 6" x 24' 9"

@ Concrete Opening

25' 0" x 27' 0"

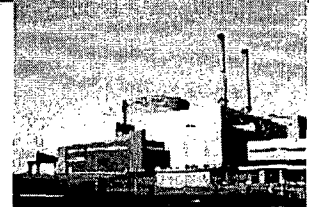
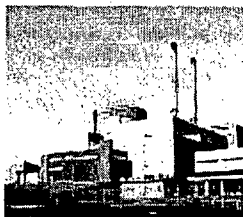
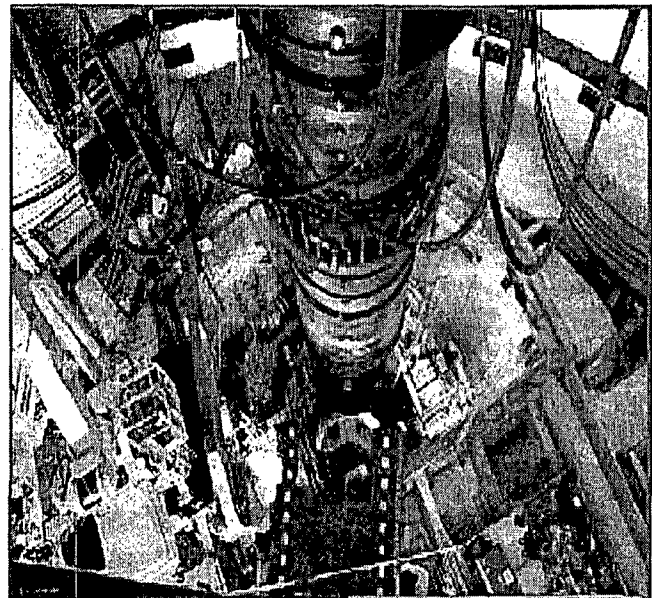
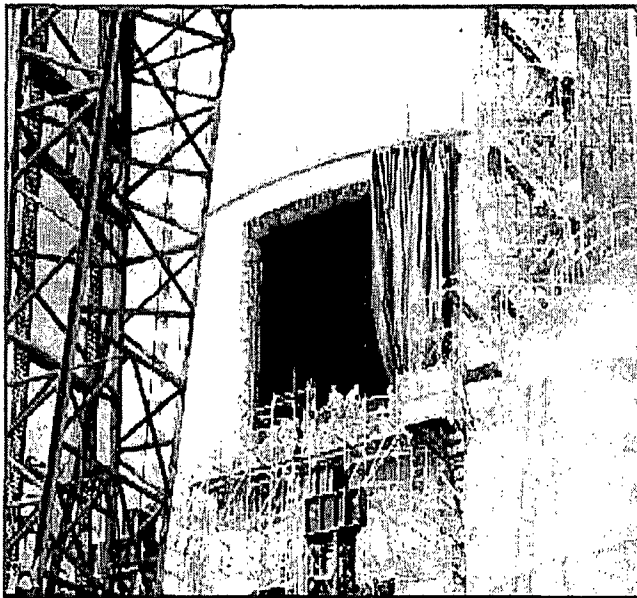


The most important role of nuclear containments is to prevent radioactive substances from leaking out, acting as final barrier in nuclear power plants

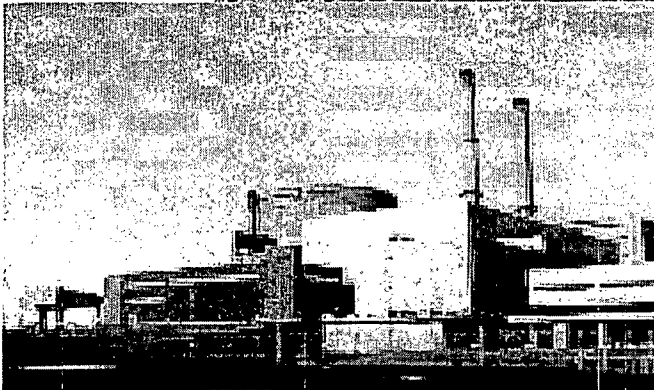
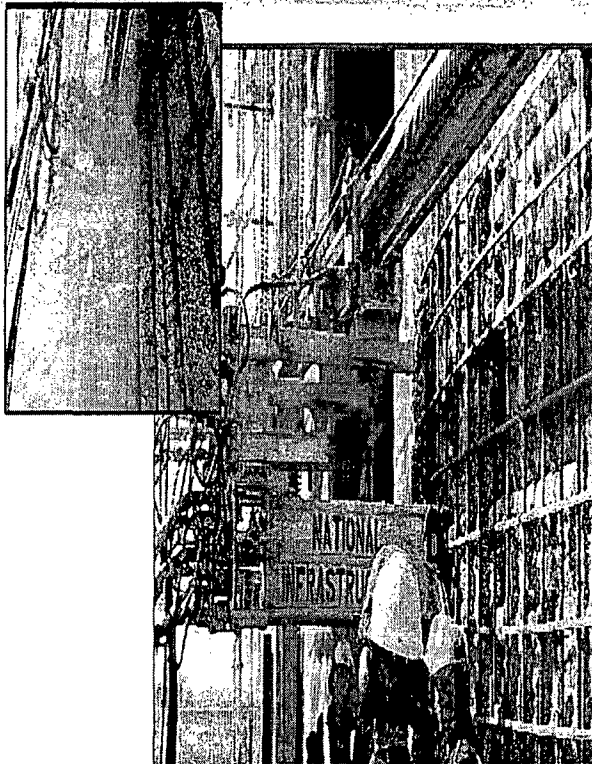
Steam Generator Replacement (SGR)

Work Breakdown

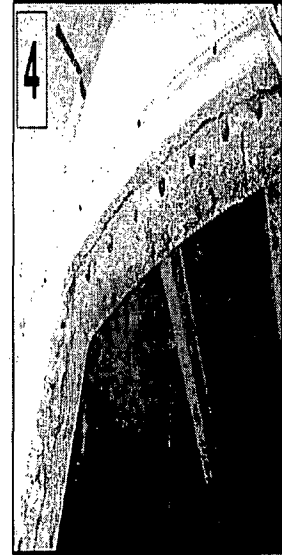
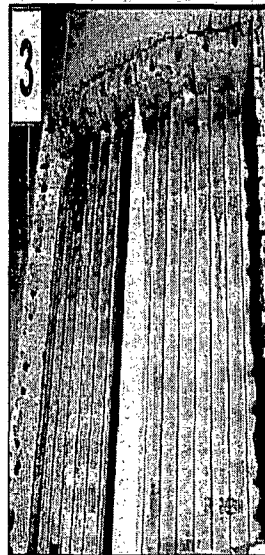
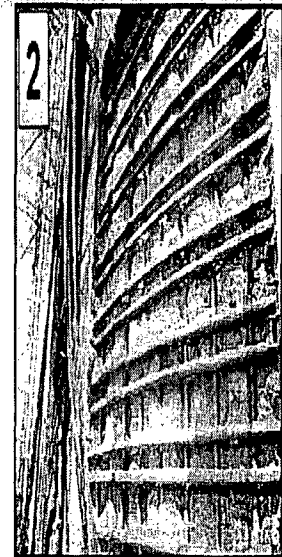
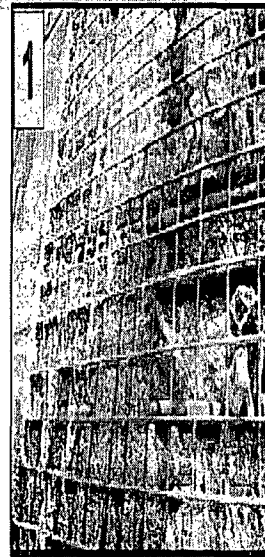
- Containment Opening
- Lifting and Rigging
- Cutting and welding



Concrete Removal



Concrete & Liner Removal Sequence



13

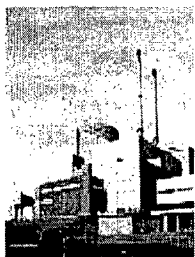
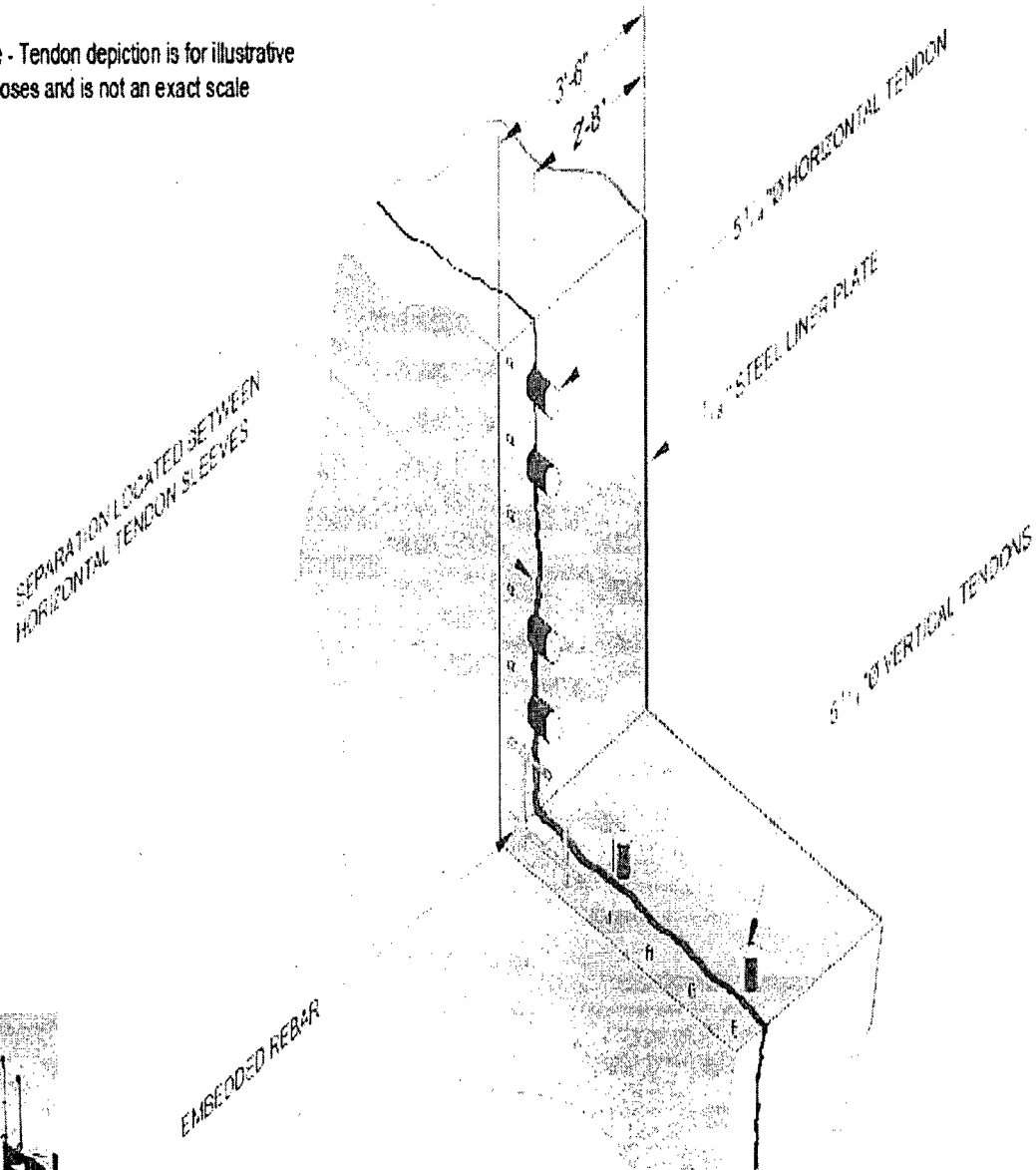
Steam Generator Replacement Opening Sequence & Identification of elamination



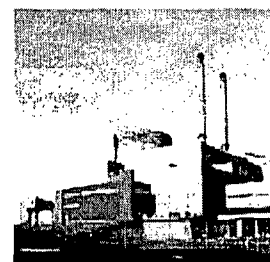
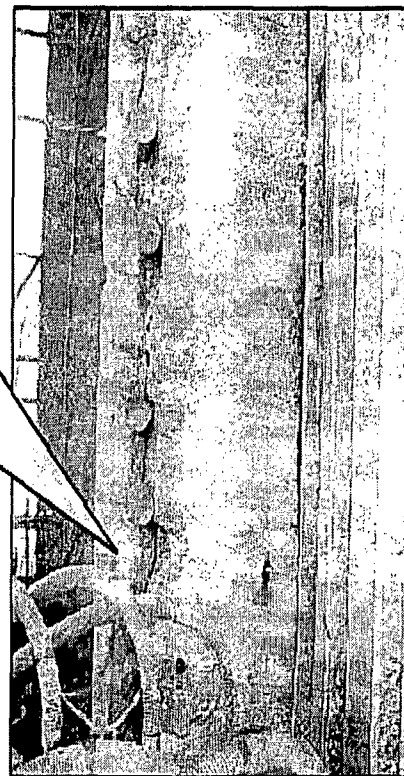
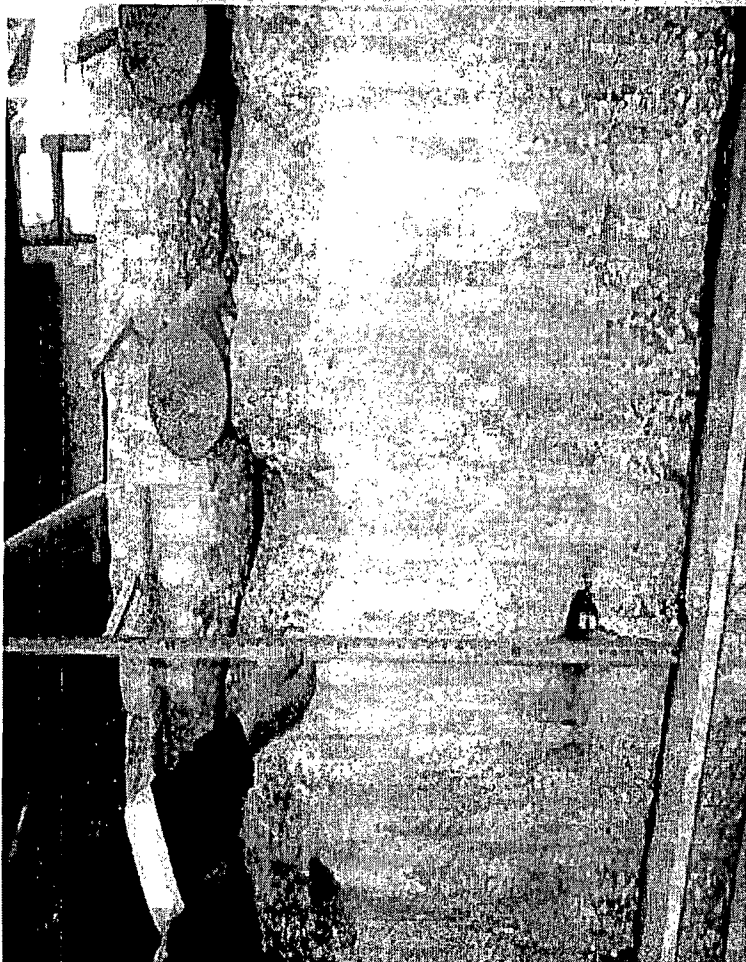
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Location of the Delamination

Note - Tendon depiction is for illustrative purposes and is not an exact scale



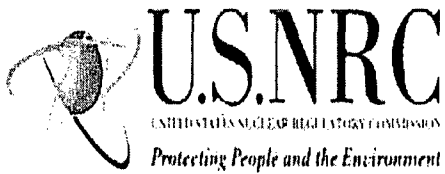
Delamination Close-up



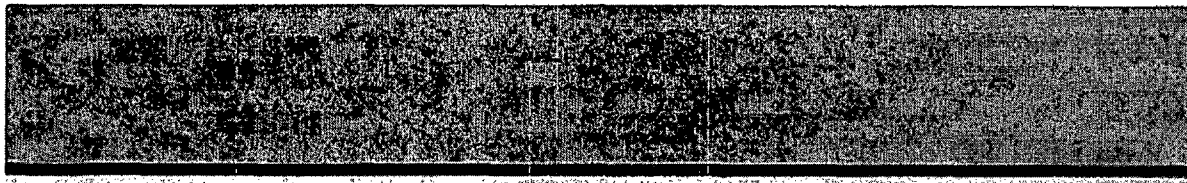
Actual Delamination

Delamination and Cause of Delamination

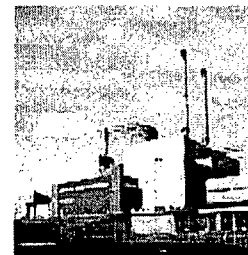
Common causes of Delamination occurs in reinforced concrete structures subject to reinforcement corrosion, inadequate use of concrete material , and more



They were Approximately 74 Possible failure mode which 1/3 investigation as of Nov, 20,2009 remaining and ongoing



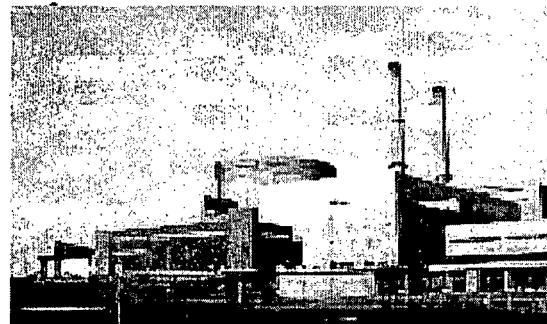
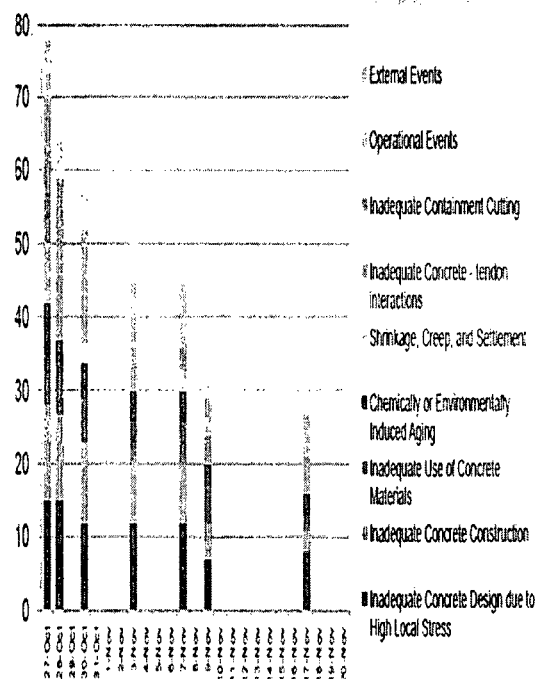
INVESTIGATION APPROACH

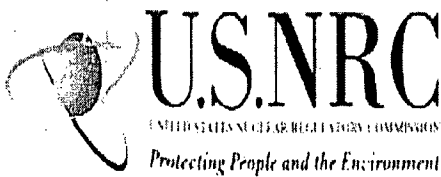


Root Cause Analysis

- External Events
- Operational Events
- Inadequate Containment Cutting
- Inadequate Concrete-tendon interactions
- Shrinkage, Creep and Settlement
- Chemically or Environmentally induced aging
- Inadequate use of Concrete Materials
- Inadequate Concrete Construction
- Inadequate Concrete Design due to High Local Stress

Root Cause Analysis – PII Metrics
Un-refuted Failure Modes as of Nov. 17th 2009





Condition Assessment Activities Completed or Planned

- **Determine Extent of Condition**

Characterize the extent of delamination at the SGR opening

Determine condition of other portions of structure

- **Non Destructive Testing (NDT) of Containment Wall Surfaces**

Use of Impulse Response (IR) Method

Comprehensive on external exposed surfaces

Accessible areas in adjacent buildings

- **Concrete Cores**

Used to confirm IR results (over 80 cores)

Visual examination of core bore holes with boroscope to identify if delamination present

- **ASME Section XI IWL visual inspection (affected areas)**

- **Containment Dome Inspections**

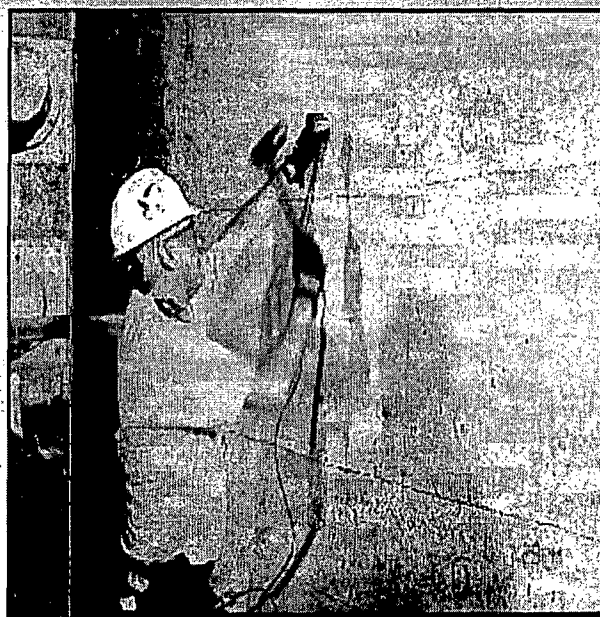
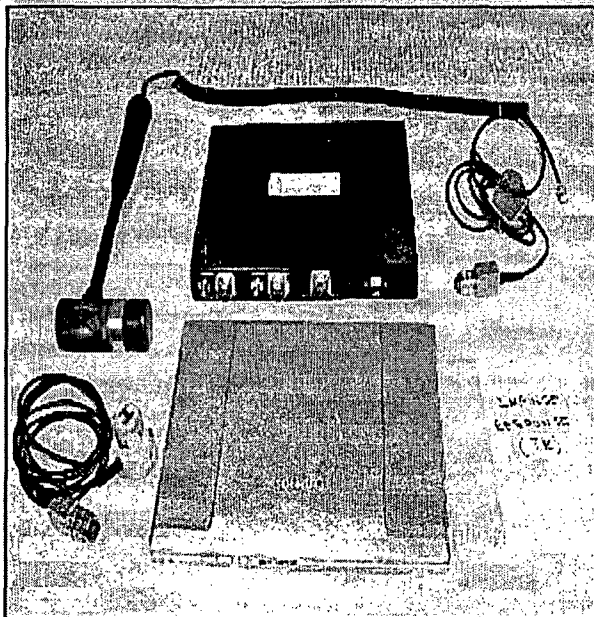
NDT IR scans in segment above the SGR opening

Concrete cores with boroscope examination of bore holes

Physical survey with established benchmarks

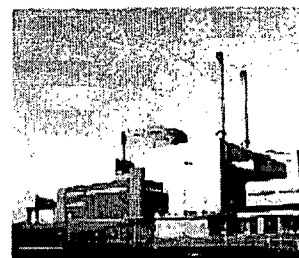
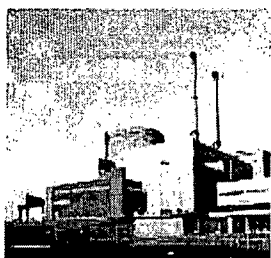
Condition Assessment

Condition Assessment Techniques *Impulse Response (IR)*



- IR Equipment
Primary test method used in this evaluation

- IR Performed in the Field





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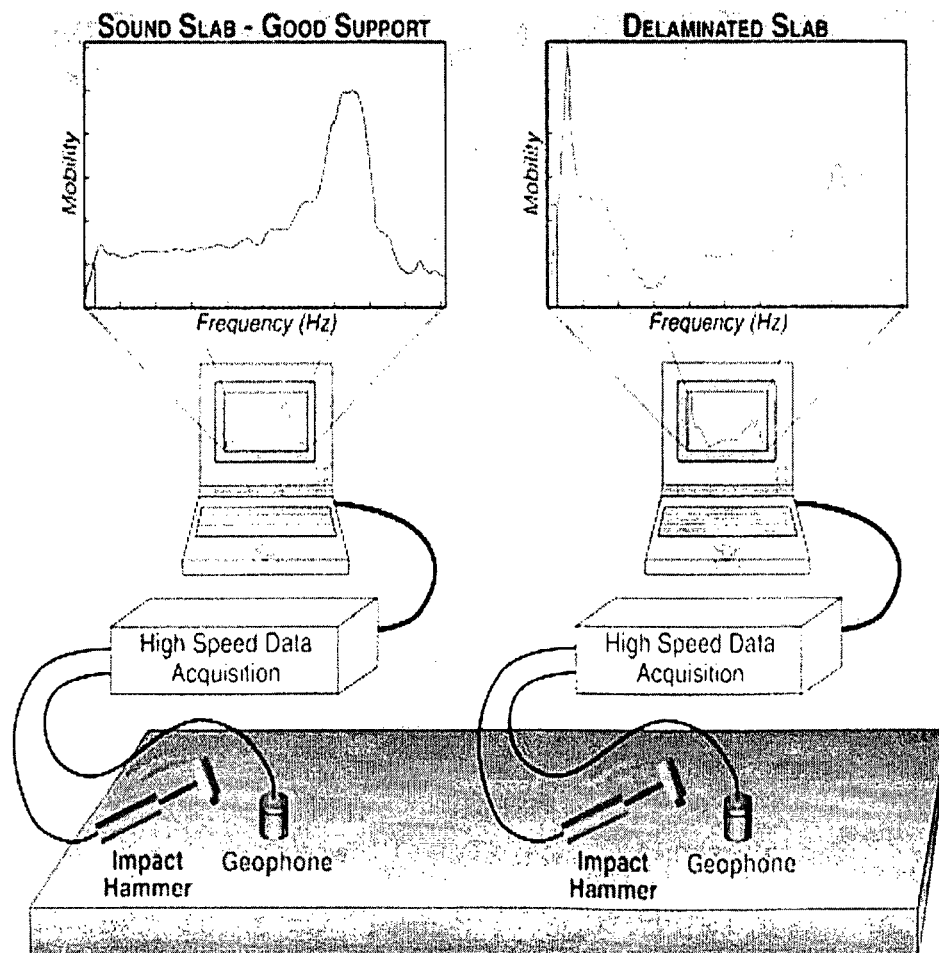
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Protecting People and the Environment

Non Destructive Testing (NDT)

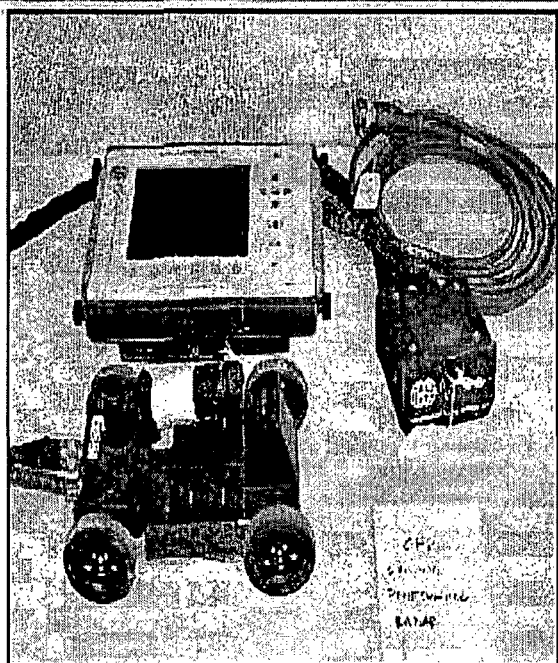
Impulse response (IR) method

- The Impulse Response method can be applied to a variety of situations that require rapid, accurate, and cost-effective nondestructive condition assessment. Which can be used to test relatively rough concrete surfaces; its fast output, Can detect the delamination of concrete & concrete around steel reinforcement, but, it dose not provide the depth of the delamination.



Condition Assessment Techniques

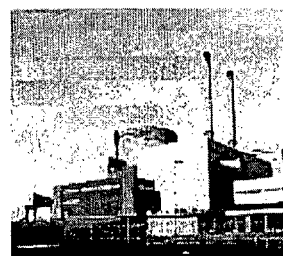
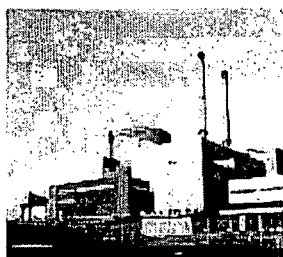
Ground Penetrating Radar (GPR)



Ground Penetrating Radar (GPR) Equipment

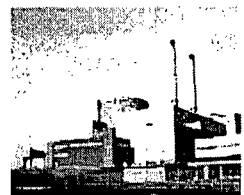
- Locates internal features (rebar, tendon conduits, etc.)

GPR Performed in the Field



Ground Penetrating Radar

- ***Ground Penetrating Radar*** technology is **ground radar** that acts as a type of ***ground sonar*** and provides critical information regarding anything that could be located below the surface. It is sometimes called **ground sonar**, ***Concrete scanning***, **surface penetrating radar** or ***ground radar***



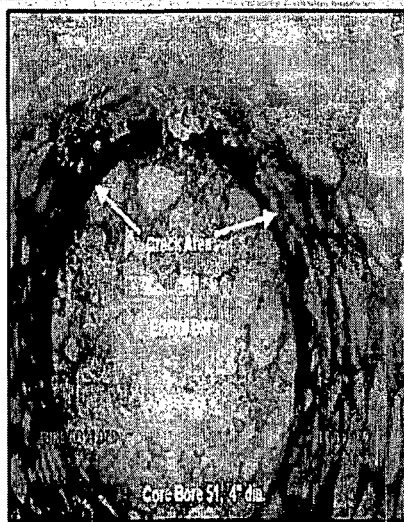
Concrete Cores

Used to accomplish the results and confirm IR results(Over80 cores)

Visual examination of core bore holes with boroscope

To identify if delamination present

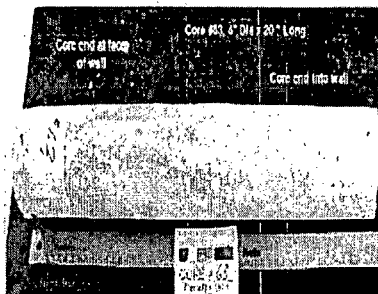
Condition Assessment Techniques Core Bores & Boroscopic Examination



Examination – Inward View



Examination – Side View



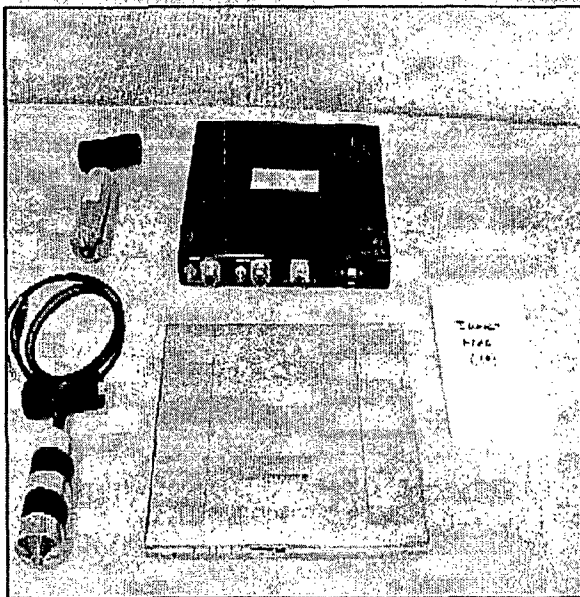
Core 51, Gap 1 Depth 5-1/4"

Gap 1 Width Less than 1/8"

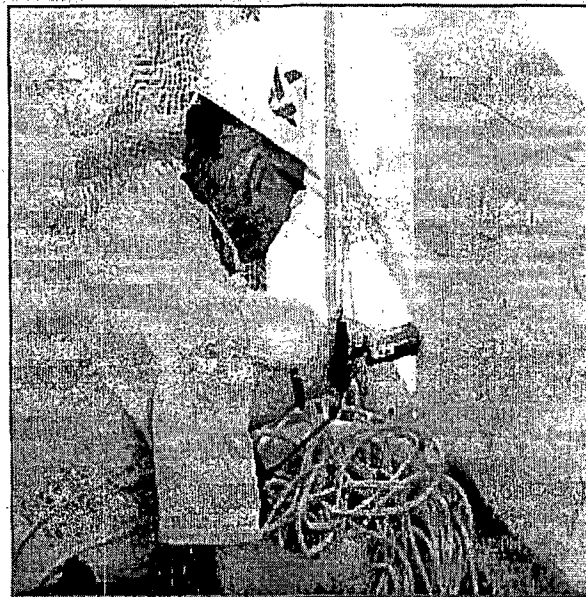


Condition Assessment Techniques

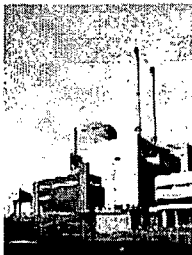
Impact Echo (IE)



- IE Equipment
 - Ability to determine depth of delamination



- IE Performed in the Field



Delamination has only been observed in core bore holes (s) boroscopic exams in the buttress 3-4 span, as accurately predicated by IR

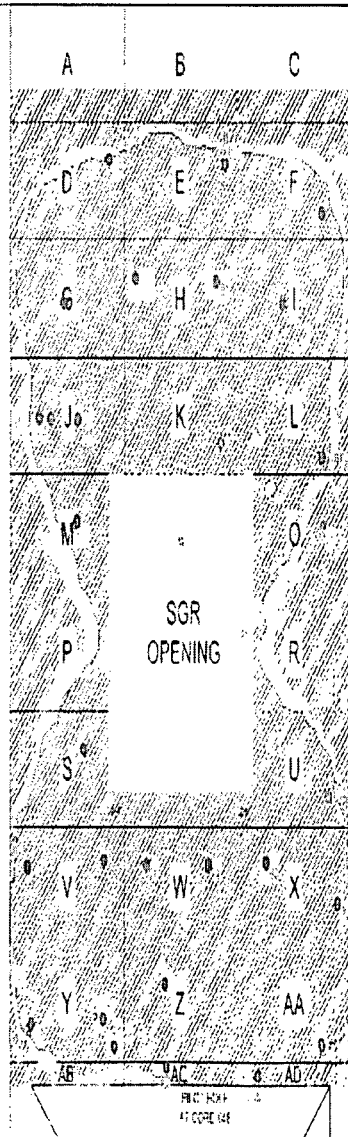
Red: Core bore with delamination Green :Core bore not delaminated

White: To be Core bored

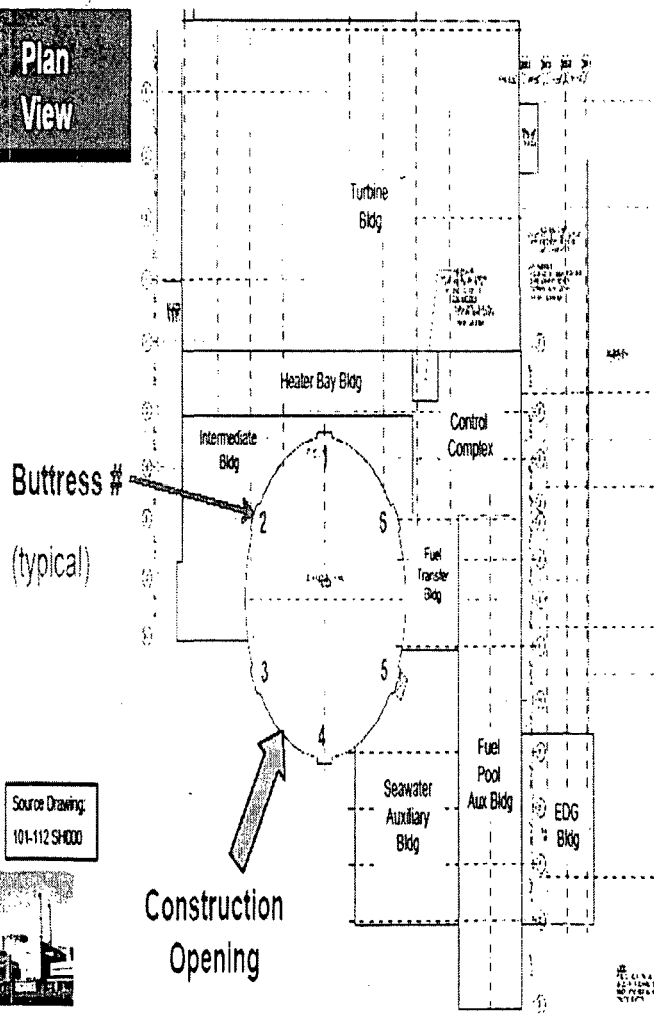
Core Borings



CONCLUSION - Delamination has only been observed in core bore hole(s) boroscopic exams in the buttress 3-4 span, as accurately predicted by IR

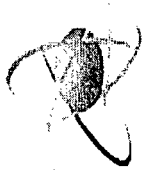


Plan View



Source Drawing:
101-112 SH000





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Protecting People and the Environment



This Issue is still under Investigation by a team of Industry experts hired by Licensee.

Possible Repair:

Delamination Removal and Replacement.

Conclusion:

Adequate Containment Design review for New Reactors and good quality of Construction inspection are essential to ensure safety of our future Nuclear Power Plants.

Questions

