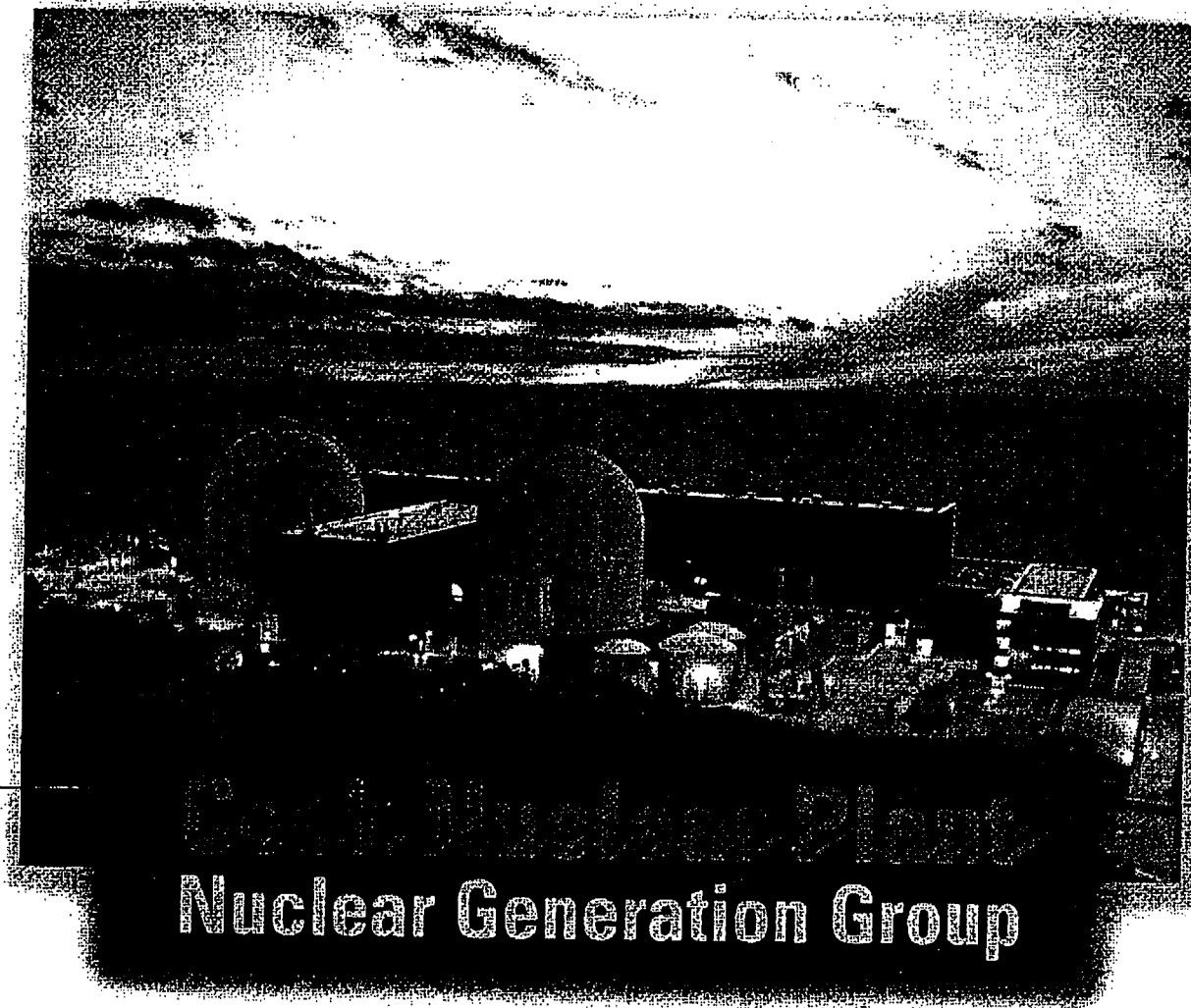




**Restarting D. C. Cook  
June 1, 2000**



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# American Electric Power

## Meeting with

# Nuclear Regulatory Commission

## Discussion of Containment Subcompartment Walls

Restarting D. C. Cook  
June 1, 2000



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# Agenda

## ■ Introduction/Agenda

Mike Rencheck

## ■ Background

Scot Greenlee

## ■ Description of the Issues, Analysis, Extent of Condition, Corrective Actions

Scot Greenlee &  
Brenda Kovarik

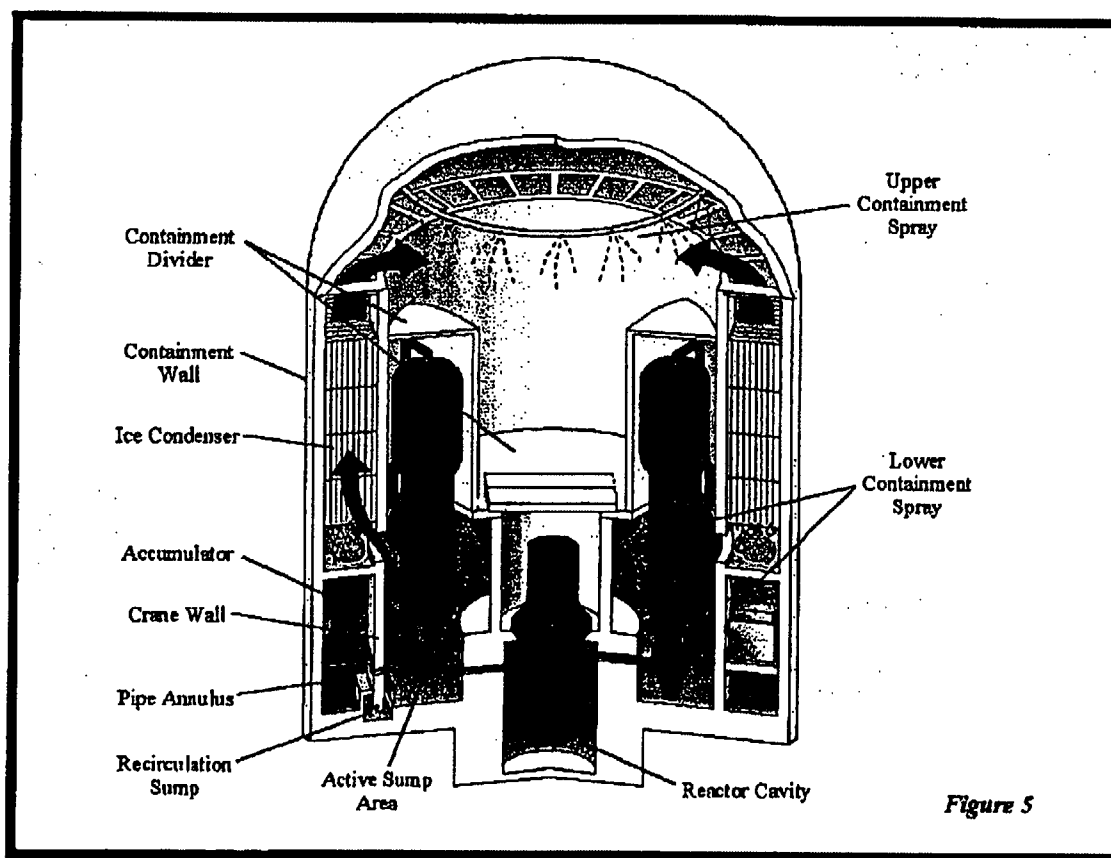
## ■ Conclusion

Mike Rencheck

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# Background: Diagram of Containment Subcompartment Walls

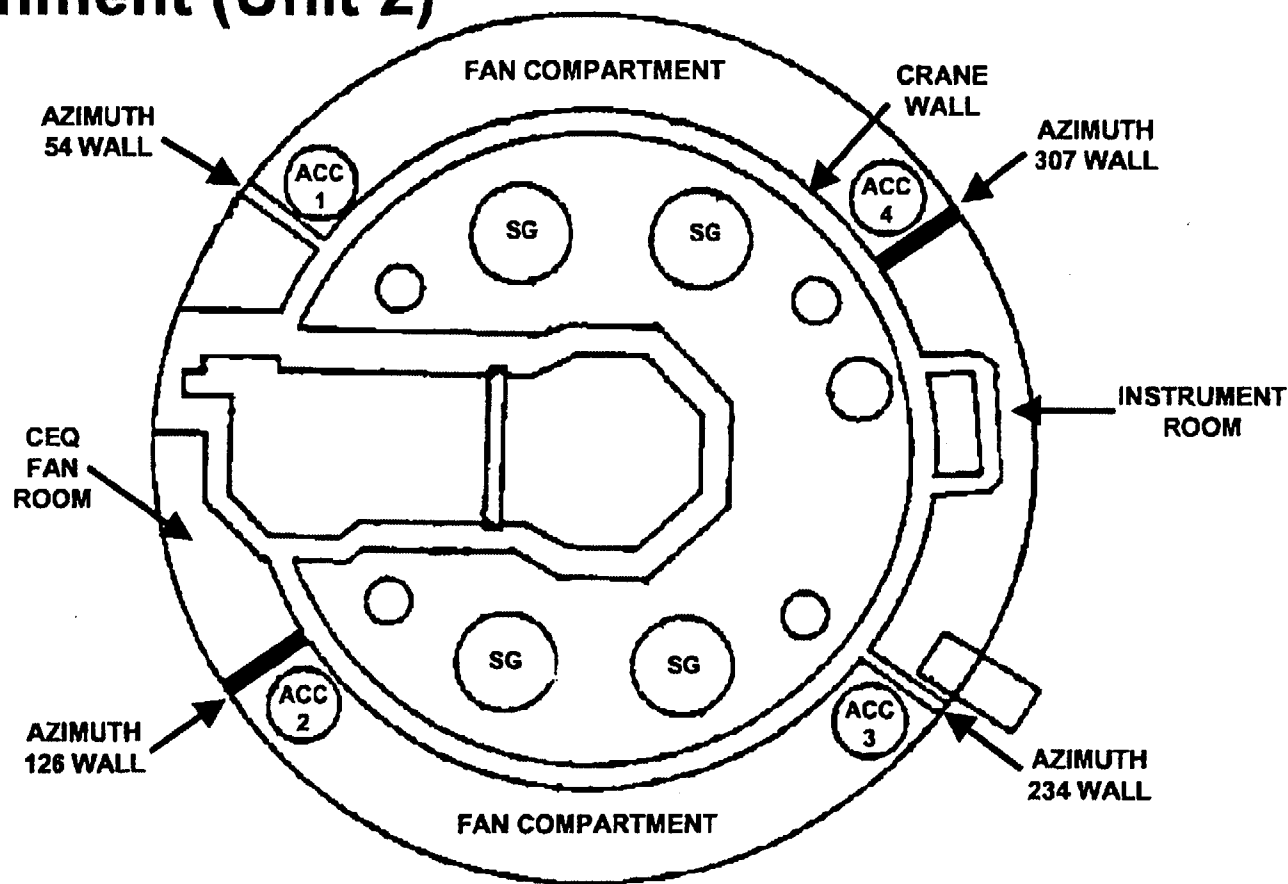
## ■ Containment



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# Background: Diagram of Containment Subcompartment Walls

## ■ Containment (Unit 2)



# ***Background: Description of Subcompartment Walls***

---

- **Four Walls in Each Unit**
  
- **Focus on Unit 2:**
  - Two end walls of CEQ Fan Room (Upper Compartment)
  - Two end walls of Instrument Room (Lower Compartment)
  - All walls restrained at three sides

## Summary of the Issues: As-found Unit 2 Subcompartment Walls

|                  | <u>54°</u> | <u>126°</u> | <u>234°</u> | <u>307°</u> |
|------------------|------------|-------------|-------------|-------------|
| ■ Grout Strength |            | X           |             | X           |
| ■ Open Pockets   |            | X           |             |             |
| ■ Cut Rebar      |            | X           |             |             |
| ■ Asbestos       |            | X           |             |             |
| ■ Rebar Location | X          | X           | X           | X           |
| ■ Rebar Cover    | X          | X           | X           | X           |

# ***Description of the Issues: Grout Strength***

---

- **Spalling Discovered During System Readiness Reviews**
  - Grout discovered during repair
- **Top of 126° and 307° Walls Grouted**
  - 126° wall due to ice condenser structure interference
  - 307° wall due to construction sequence - installed after ice condenser slab poured
- **Grout Strength**
  - Estimated as 1000 psi in 126° wall
  - Tested in 307° wall: 1,280, 1,770, and 4,380 psi

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# **Description of the Issues: Open Pockets**

---

- **Pockets at Top of 126° Wall for Bolting**
- **Design Required Pockets to be Grouted**
- **Pockets Left Open From Original Construction**

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## Description of the Issues: Open Pockets - Configuration of Unit 2 Ice Condenser Column Anchorage

### ■ Detail Showing Pocket for Anchorage Through Bolts



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## ***Description of the Issues: Cut Rebar***

---

- **Vertical Rebar Cut at Top of 126° Wall**
- **Cuts Required for Installation of Ice Condenser Anchorage**
- **Excavation Determined Extent of Condition on 126° Wall**
- **Issue Limited to 126° Wall**

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# Description of the Issues: Cut Rebar

## ■ Detail Showing Chipped Grout



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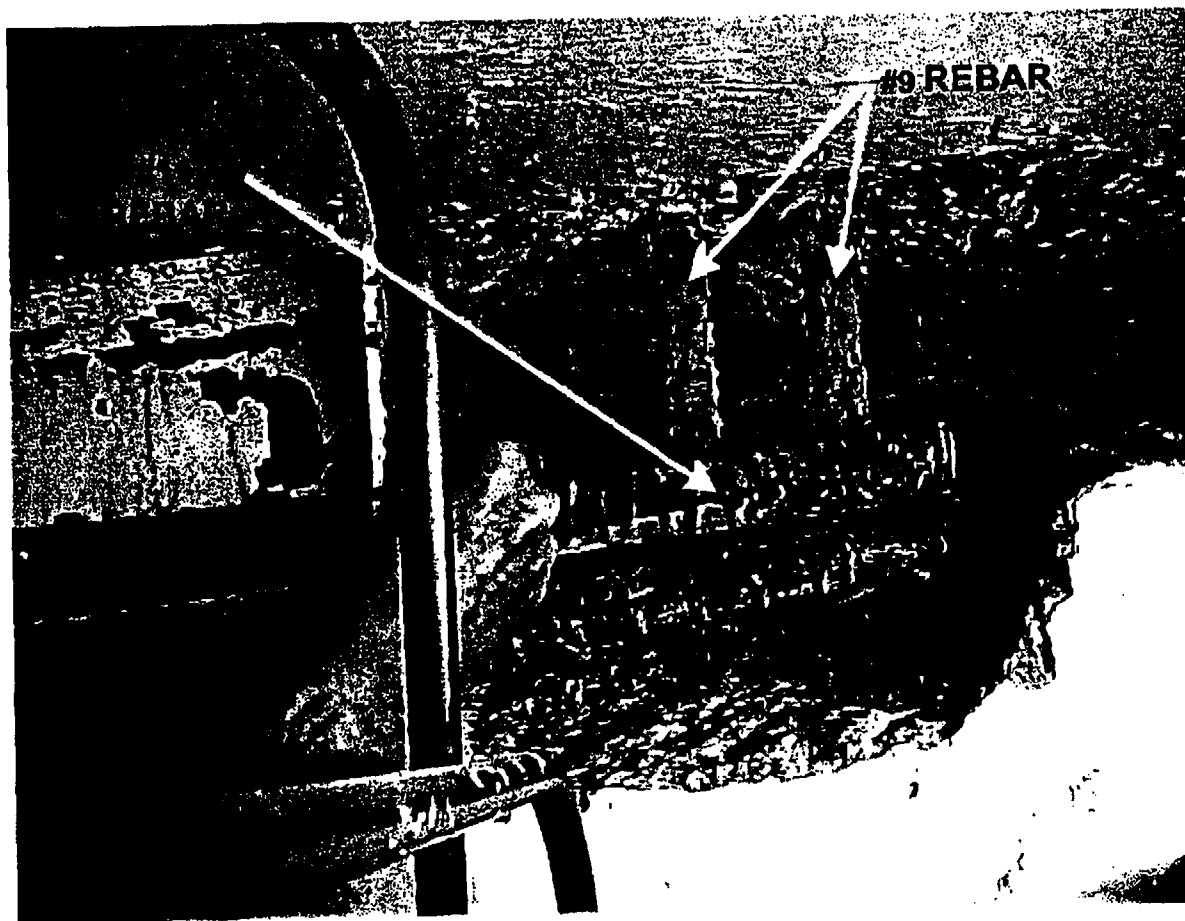
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# Description of the Issues: Cut Rebar

## ■ Detail Showing Excavation and Rebar



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## ***Description of the Issues: Asbestos***

---

- **Asbestos Blanket Found at Top of 126° Wall During Excavation**
- **Likely Used for Cutting of Embedments - Then Left Behind**
- **Embedment Cutting Limited to 126° Wall**
- **No Asbestos Found in 307° Wall**

## ***Evaluation: Mapping and Excavation***

---

- **126° Wall Grout Excavated - Accessible Areas at Top on CEQ Fan Room Side**
- **307° Wall Grout Excavated - Four Locations to Verify Bar Penetration Into Ice Condenser Slab**
- **Radar Mapping - All Four Walls**
  - **Critical accessible areas**
  - **Both sides of each wall**



# **Description of the Issues: Rebar Location**

---

## ■ Design

- #9 rebars at 12 inch centers (vertical)
- #11 rebars at 6 inch centers (horizontal - accumulator side)
- #11 rebars at 12 inch centers (horizontal - instrument/CEQ fan room side)

## ■ Excavation and Radar Mapping - Average Spacing:

- Horizontal bars per design
- Vertical bars
  - » Most areas per design
  - » Up to 15 inch spacing in limited areas

# ***Description of the Issues: Rebar Cover***

---

## ■ **Design**

- Horizontal bars - 2¾ inch cover
- Vertical bars - behind horizontal (4⅛ inch cover)

## ■ **Excavation and Radar Mapping:**

- Minimum ACI cover requirements met
- Average maximum depth developed for horizontal bars and vertical bars

# Wall Analysis: Overview

- **Given Issues, All Walls Analyzed to Ensure Operability**
- **In-situ Parameters Used**
  - Grout strength
  - Concrete strength
  - Rebar location
  - Rebar cover
- **All Walls Operable With Margin**

# Wall Analysis: Design Inputs

## ■ Grout Strength

- 307° wall - 1,000 psi
- 126° wall
  - » Filled pockets and excavation with new grout
  - » 2,500 psi new grout (conservative)
  - » No credit for old grout

## ■ Concrete Strength

- 5,300 psi design strength concrete based on cylinder test data

## ■ Rebar Locations From Mapping and Excavation Data

## ■ New Transient Mass Distribution (Pressure) Loads

# Wall Analysis: Acceptance Criteria

## ■ Limiting Design Load Combination

- UFSAR Eq. (i):  $C = 1.5 P1 + DL + T + TL$ 
  - »  $C$  = Wall capacity
  - »  $P1$  = Pressure load due MSLB
  - »  $DL$  = Dead load
  - »  $T$  = Operating thermal gradient load
  - »  $TL$  = Liner temperature load (not applicable to walls)
- $DL$  and  $T$  loads are negligible

## ■ Operability Criteria: $C > 1.0 P1$

# Analysis: Results

- Conservative Analysis
- All Four Walls Operable
- Margin Available ( $C > 1.0$  P1)

| <u>Wall</u> | <u>Simplified</u> | <u>Yield Line</u> |
|-------------|-------------------|-------------------|
| 54°         | 1.36              | 1.48              |
| 126°        | 1.21              | 1.34              |
| 234°        | 1.25              | 1.54              |
| 307°        | 1.29              | 2.83              |

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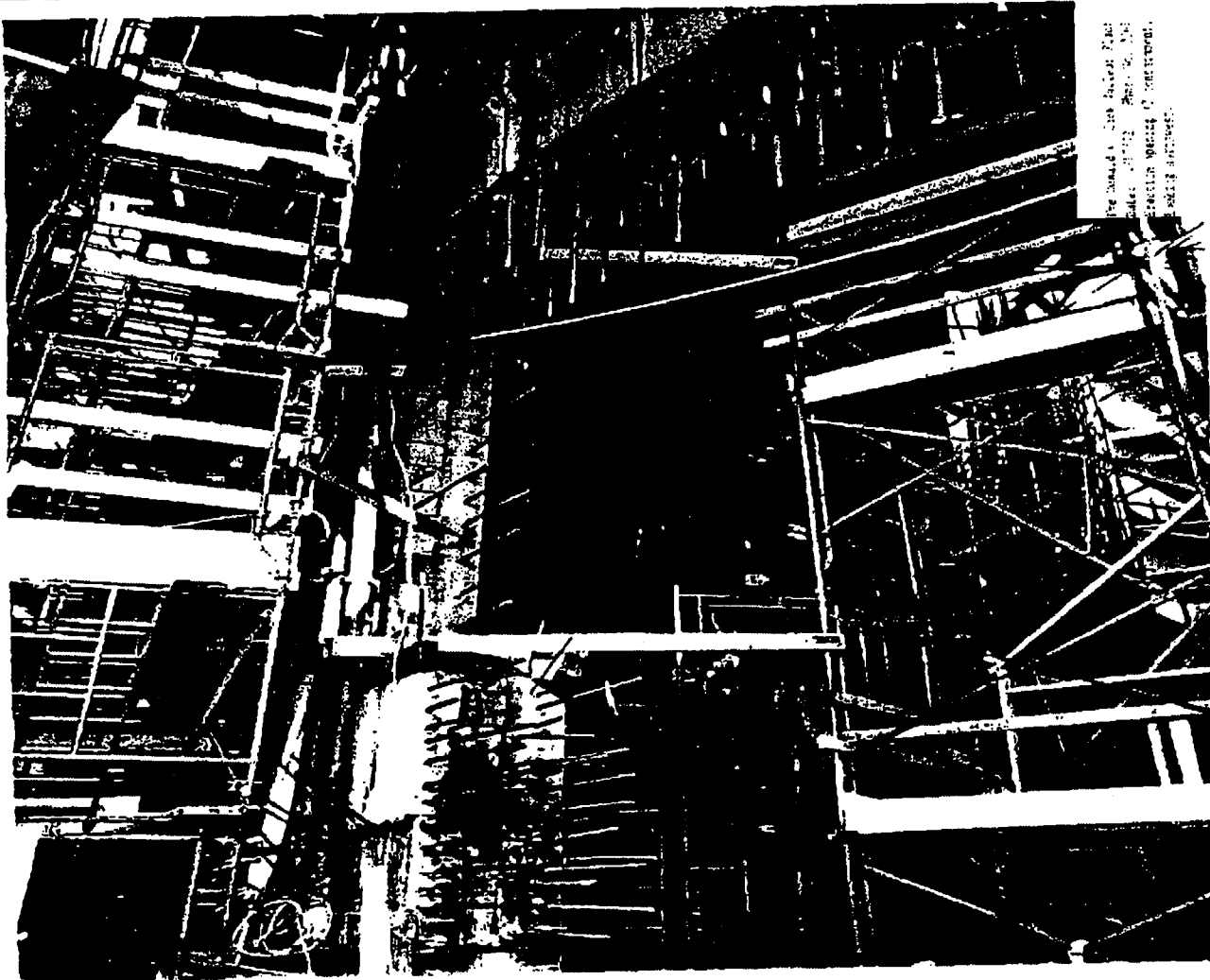
## ***Extent of Condition: Other Unit 2 Structures***

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- **Ice Condenser Support Interference and Asbestos Limited to 126° Wall**
- **Grout Deficiencies Limited to the 307° Instrument Room and 126° CEQ Fan Room Walls**
- **Other Construction Openings Evaluated**
  - **Containment**
  - **Crane Wall**

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# Extent of Condition: Crane Wall Construction Opening



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# ***Extent of Condition: Other Unit 2 Structures***

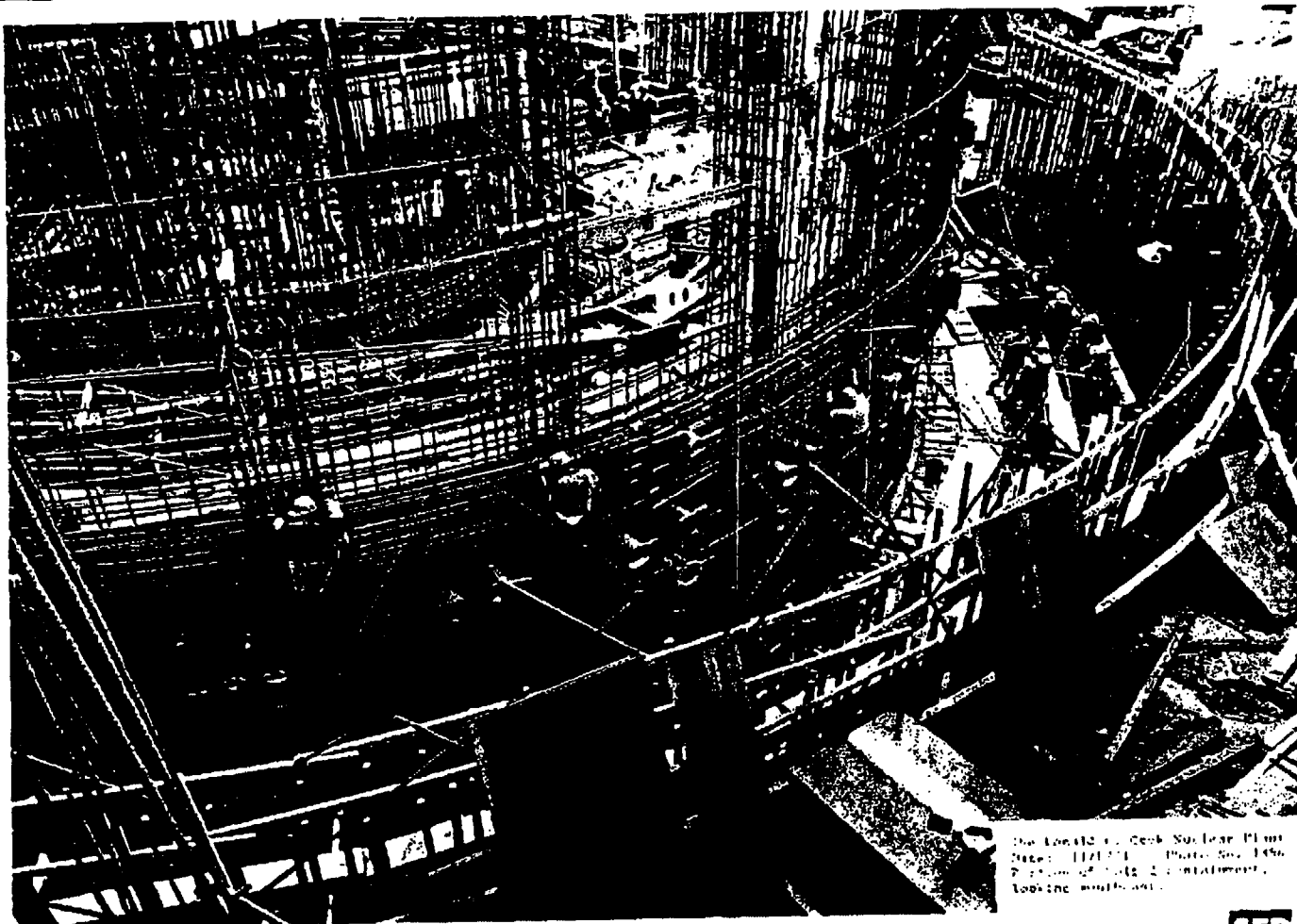
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## **■ Rebar Placement**

- Structural elements similar to accumulator walls
  - » Steam Generator Enclosure
  - » Pressurizer Enclosure
  - » Primary Shield Wall
  - » Crane Wall**
- Similar structural elements significantly thicker (less limiting)**
- Variations offset by conservatism in design
  - » Confirmed by Steam Generator and wall evaluations**
- No generic issues from review of construction records**

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## Unit 2 Containment Under Construction



The Lovell A. Cook Nuclear Plant  
Unit 2 Containment Under Construction  
Photo No. 1456  
Looking south east.

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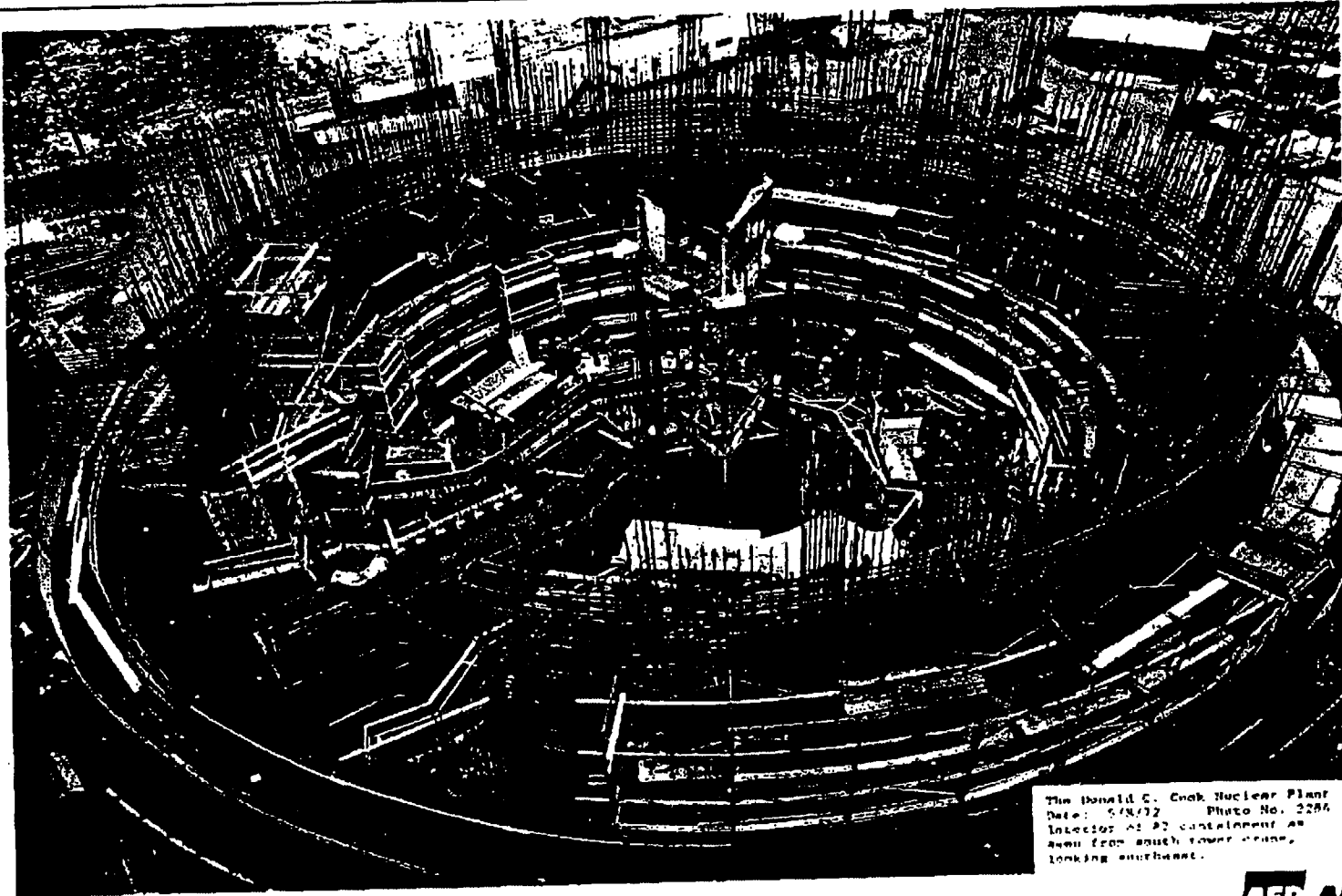
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## Unit 2 Containment Under Construction



The Donald C. Cook Nuclear Plant  
Date: 5/8/02 Photo No. 2286  
Inspector A2 P2 containment as  
seen from south tower crane,  
looking southeast.

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## ***Corrective Actions - Completed***

- **Performed Field Investigation and Confirmation of Rebar Depth and Location**
- **Tested Cores of Existing Grout (Unit 2 Wall at 307°)**
- **Excavated/Missing Grout Replaced with High Strength Grout**
- **Verified Concrete Strength from Construction Records**
- **Determined Wall Structural Capabilities**
- **Assessed Extent of Condition**

## ***Corrective Actions - Post Restart***

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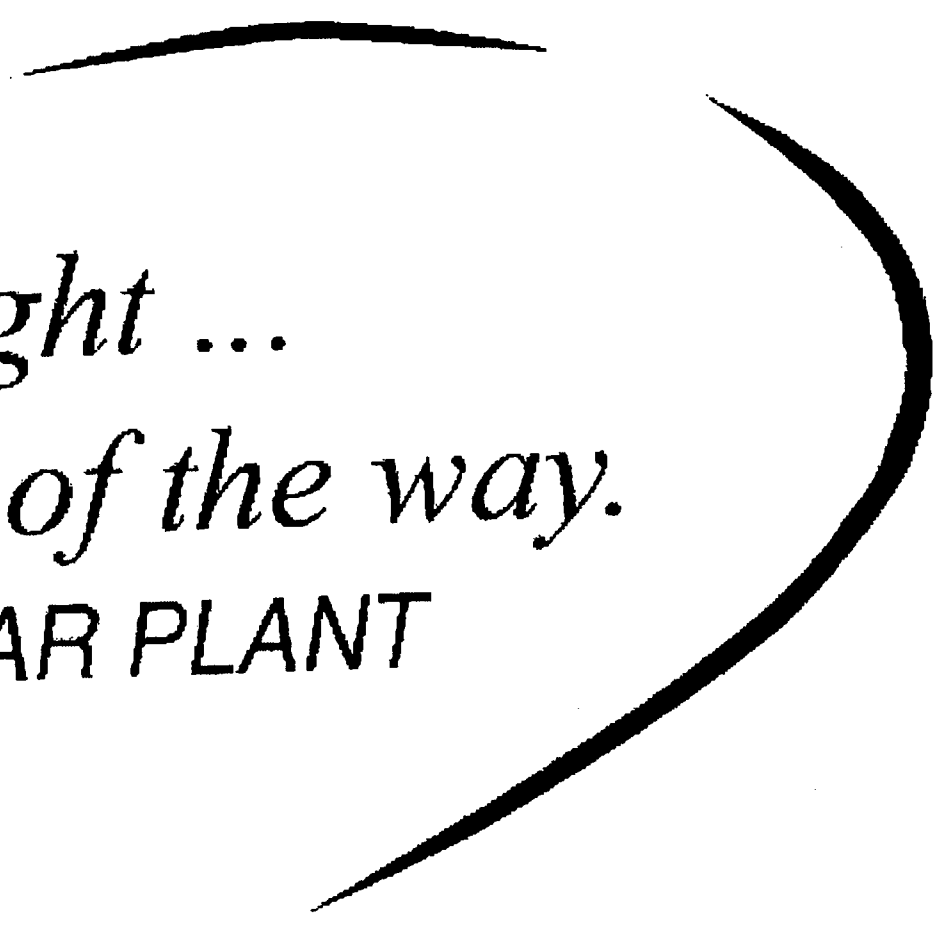
- **Develop Schedule for Permanent Resolution during Unit 1 Restart Preparations**
  - Review with NRC prior to restart of Unit 1
- **Achieve Agreement on Final Course and Schedule by Unit 1 Restart**

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## ***Conclusion: Unit 2 Walls***

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- **Walls Safe for Restart**
- **Reasonable Assurance that Other Structures Not Impacted**



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