

D. C. Cook Plant Nuclear Generation Group

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



Doing it right ...
Every step of the way.
COOK NUCLEAR PLANT

American Electric Power

Meeting with

Nuclear Regulatory Commission

Discussion of Containment Subcompartment Walls

Restarting D. C. Cook
June 1, 2000

AEP AMERICAN[®]
ELECTRIC
POWER

Doing it right ...
Every step of the way.
COOK NUCLEAR PLANT

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 |

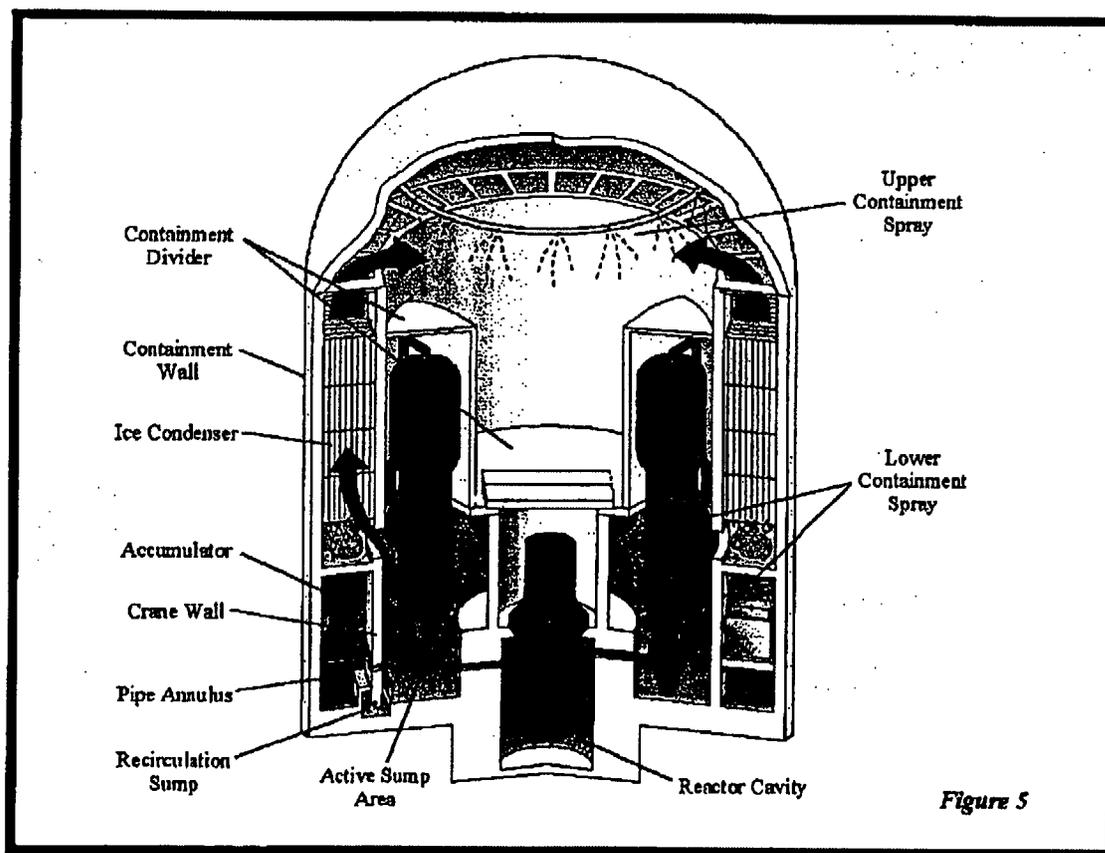
2
June 1, 2000



Doing it right ...
Every step of the way.
COOK NUCLEAR PLANT

Background: Diagram of Containment Subcompartment Walls

■ Containment



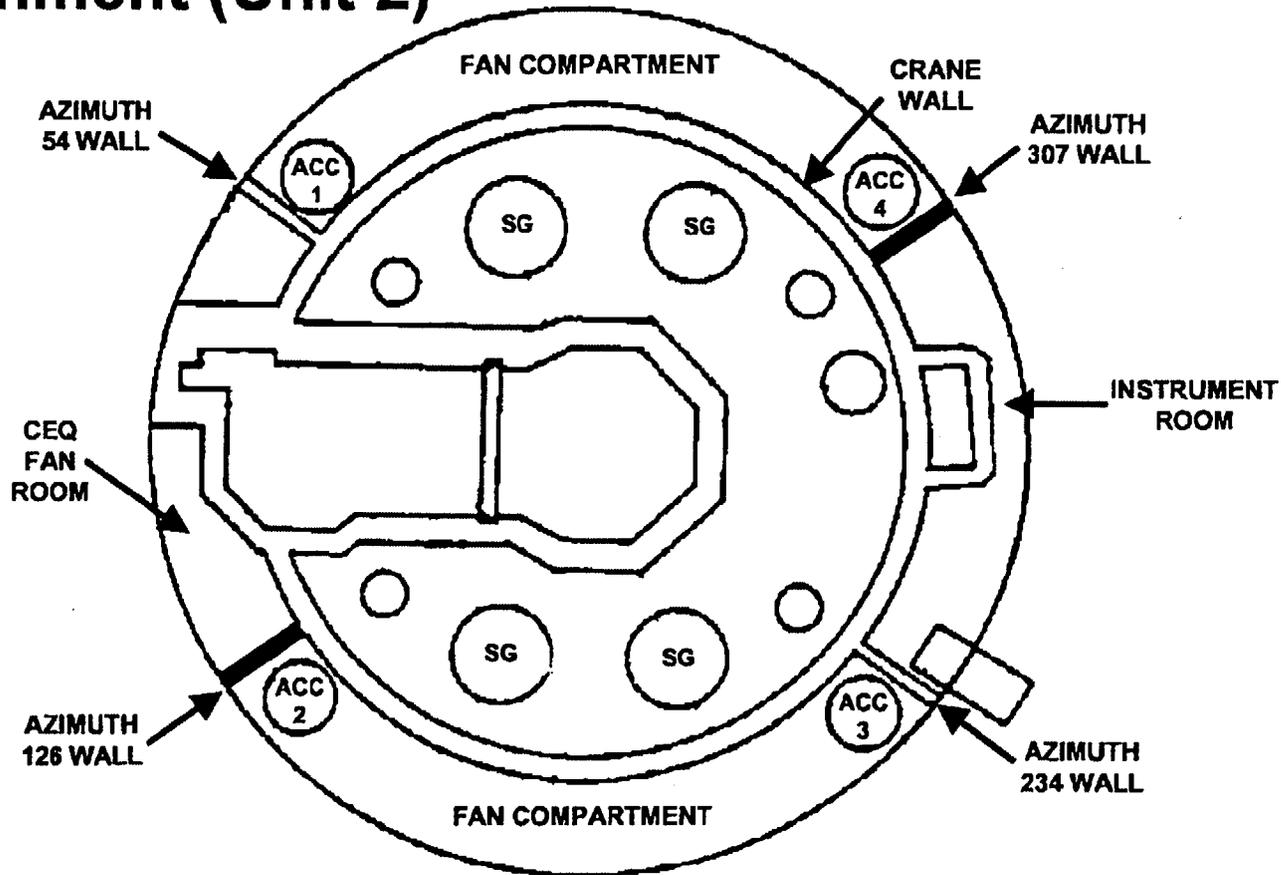
3
June 1, 2000

AEP AMERICAN
ELECTRIC
POWER

Doing it right ...
Every step of the way.
COOK NUCLEAR PLANT

Background: Diagram of Containment Subcompartment Walls

■ Containment (Unit 2)



Doing it right ...
Every step of the way.
COOK NUCLEAR PLANT

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**

Doing it right ...
Every step of the way.
COOK NUCLEAR PLANT

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

Doing it right ...
Every step of the way.
COOK NUCLEAR PLANT

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**

Doing it right ...
Every step of the way.
COOK NUCLEAR PLANT

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

■ Detail Showing Pocket for Anchorage Through Bolts



10
June 1, 2000

AEP AMERICAN
ELECTRIC
POWER

Doing it right ...
Every step of the way.
COOK NUCLEAR PLANT

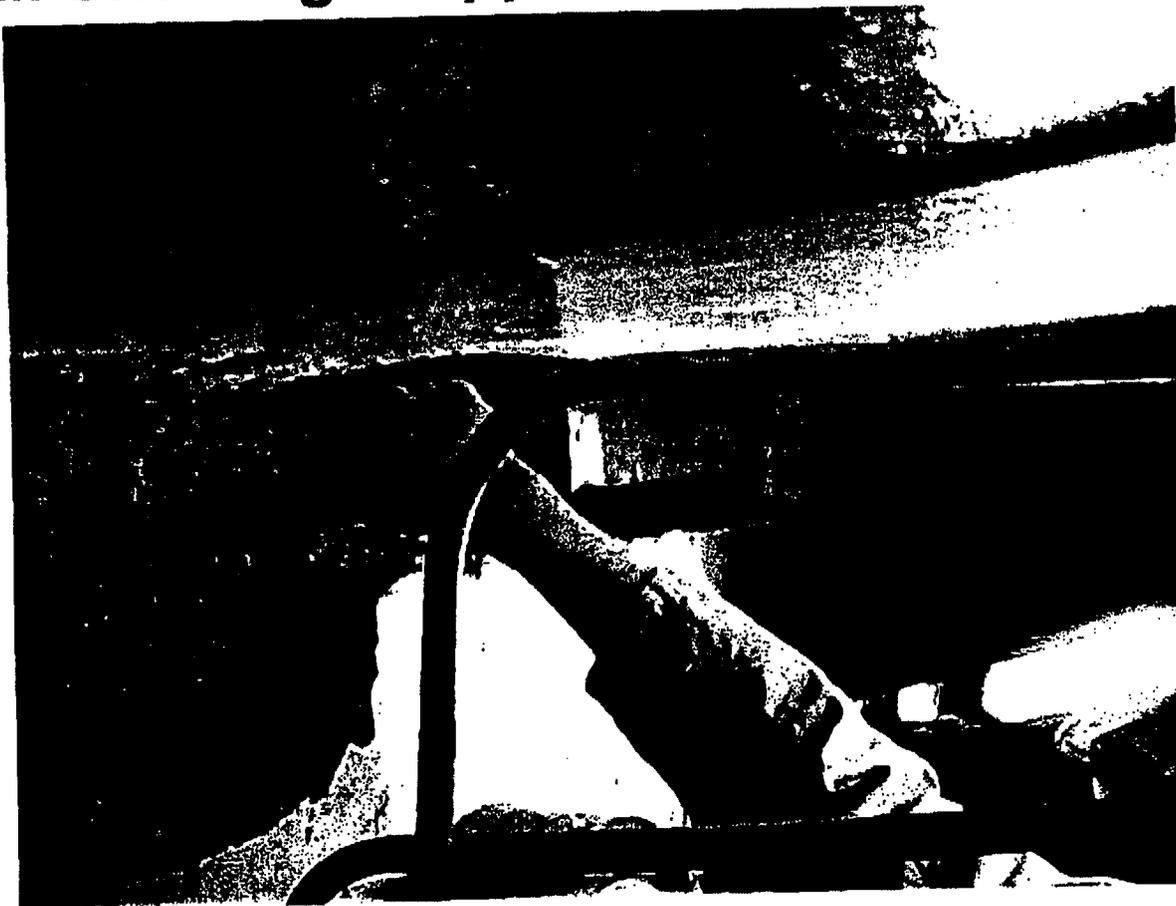
Description of the Issues: Cut Rebar

- **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**

Doing it right ...
Every step of the way.
COOK NUCLEAR PLANT

Description of the Issues: Cut Rebar

■ Detail Showing Chipped Grout



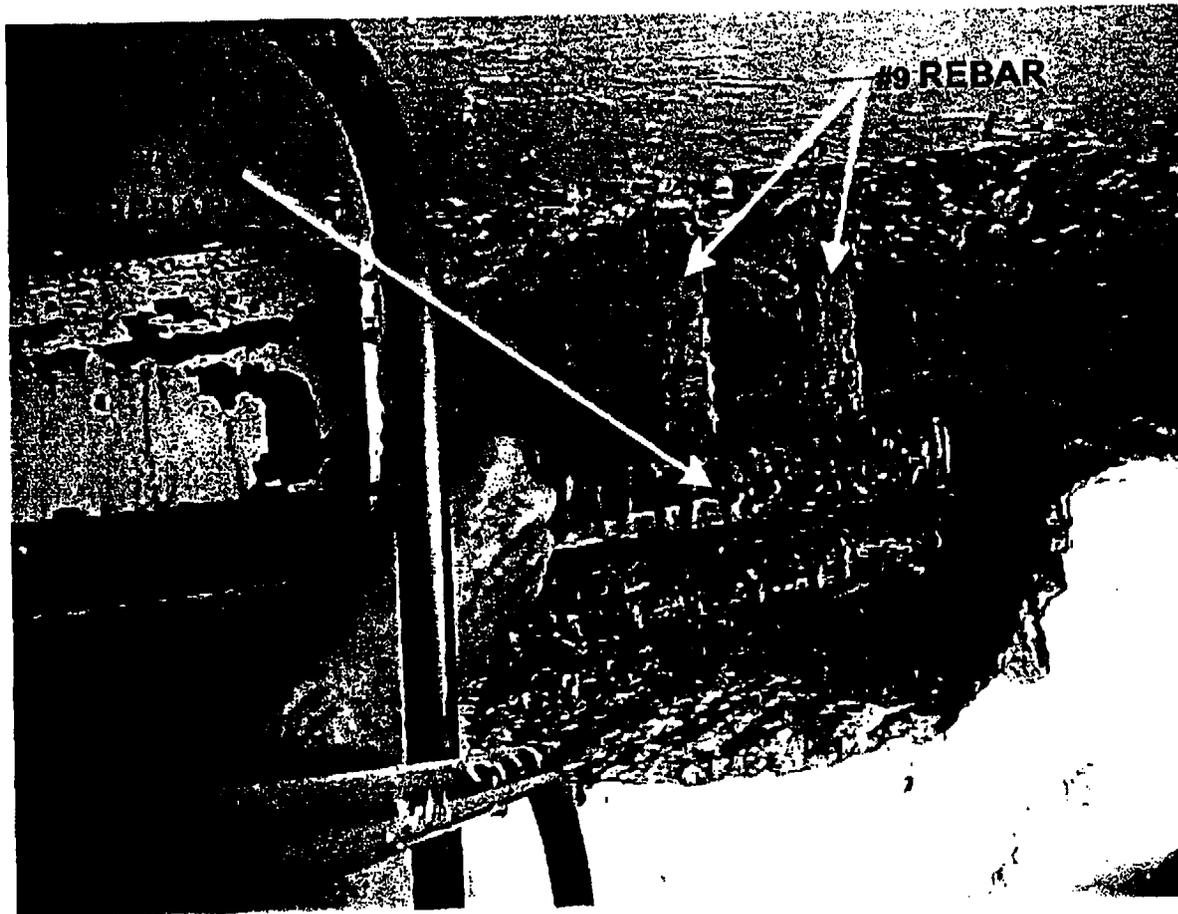
12
June 1, 2000

AEP AMERICAN
ELECTRIC
POWER

Doing it right ...
Every step of the way.
COOK NUCLEAR PLANT

Description of the Issues: Cut Rebar

■ Detail Showing Excavation and Rebar



13
June 1, 2000

AEP AMERICAN
ELECTRIC
POWER

Doing it right ...
Every step of the way.
COOK NUCLEAR PLANT

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**

Doing it right ...
Every step of the way.
COOK NUCLEAR PLANT

Evaluation: Mapping and Excavation

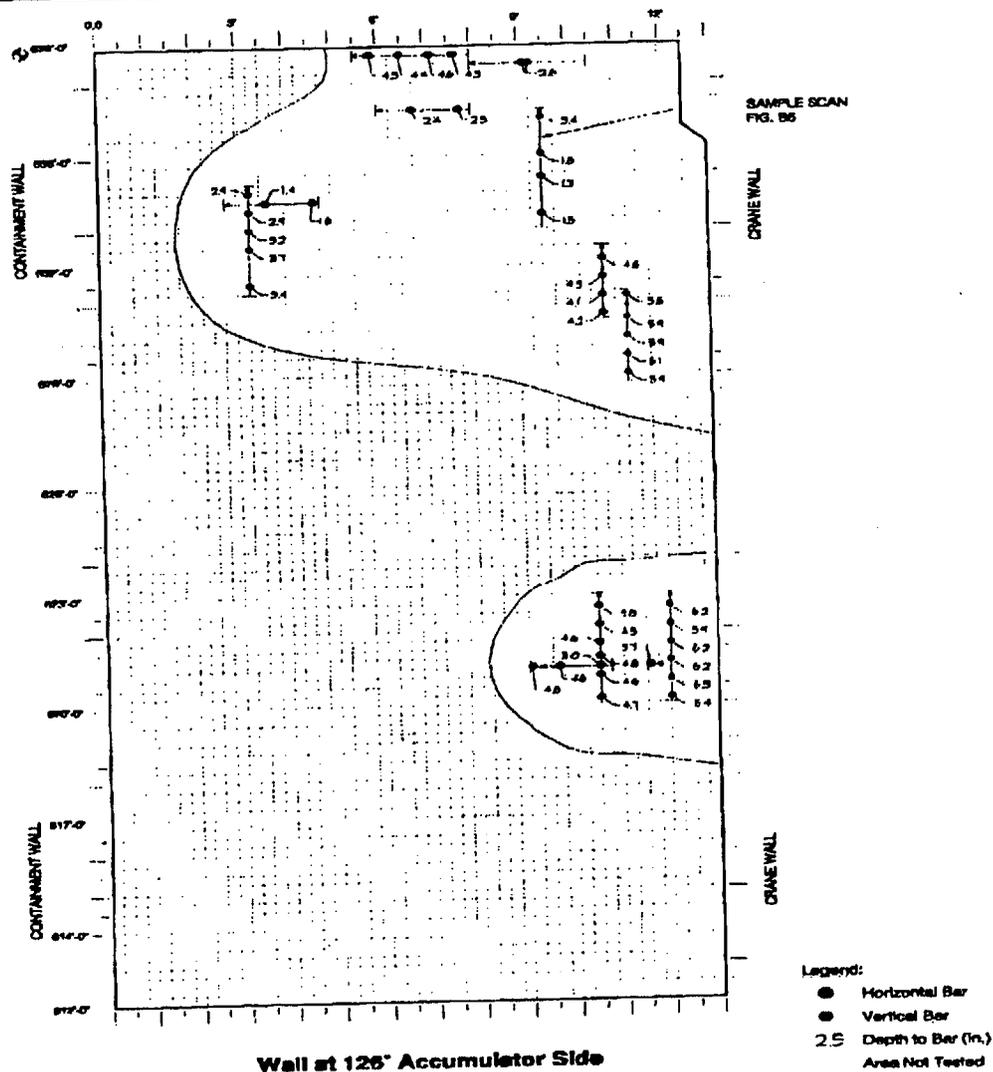
- **126° Wall Grout Excavated - Accessible Areas at Top on CEQ Fan Room Side**

- **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**

Doing it right ...
Every step of the way.
COOK NUCLEAR PLANT

Description of the Issues: Wall Radar Mapping



16
June 1, 2000



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 - 2³/₄ inch cover
- Vertical bars - behind horizontal (4¹/₈ inch cover)

■ Excavation and Radar Mapping:

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

Doing it right ...
Every step of the way.
COOK NUCLEAR PLANT

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: $C > 1.0 P1$

Doing it right ...
Every step of the way.
COOK NUCLEAR PLANT

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

Doing it right ...
Every step of the way.
COOK NUCLEAR PLANT

Extent of Condition: Other Unit 2 Structures

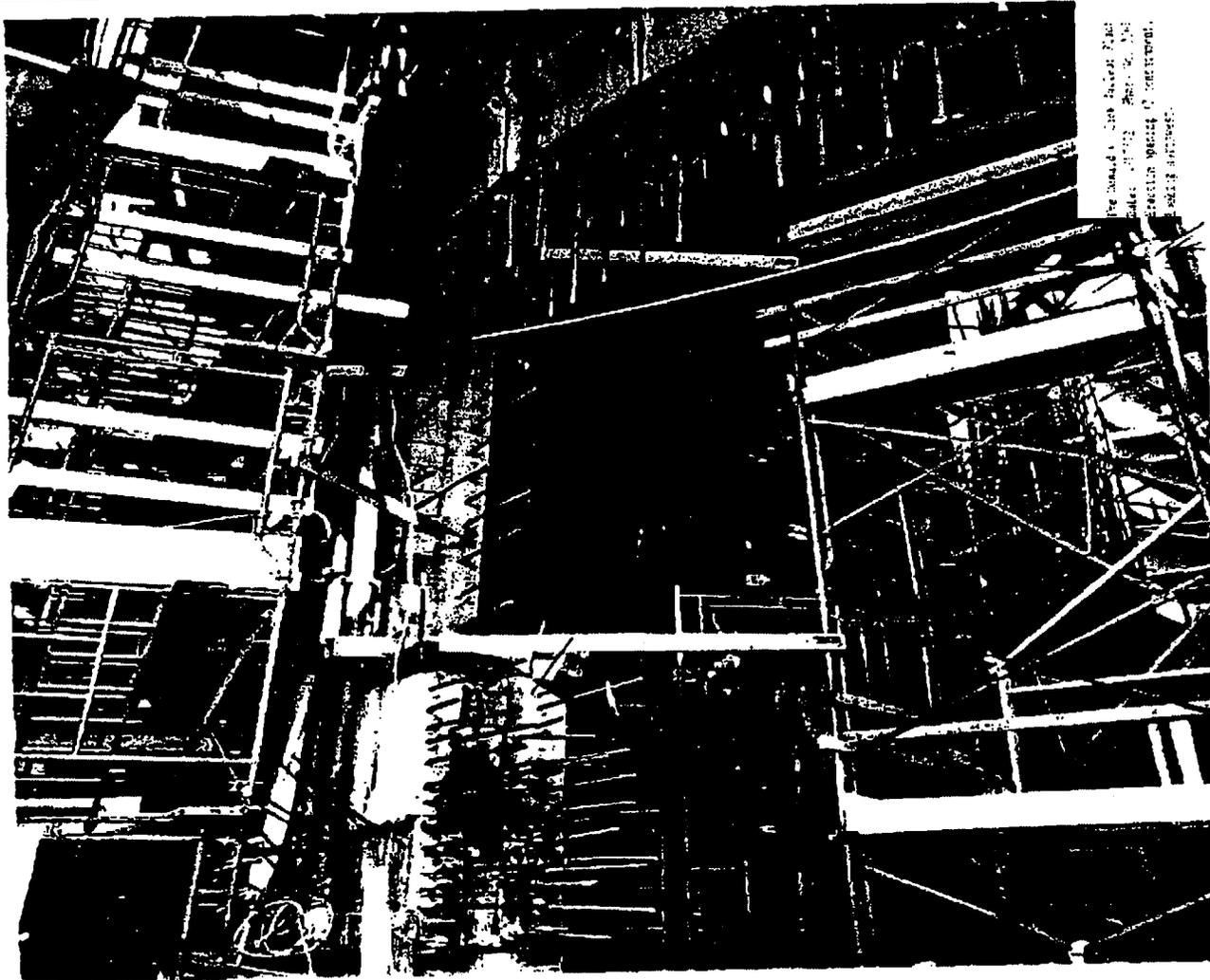
- **Ice Condenser Support Interference and Asbestos Limited to 126° Wall**

- **Grout Deficiencies Limited to the 307° Instrument Room and 126° CEQ Fan Room Walls**

- **Other Construction Openings Evaluated**
 - **Containment**
 - **Crane Wall**

Doing it right ...
Every step of the way.
COOK NUCLEAR PLANT

Extent of Condition: Crane Wall Construction Opening



24
June 1, 2000

AEP AMERICAN
ELECTRIC
POWER

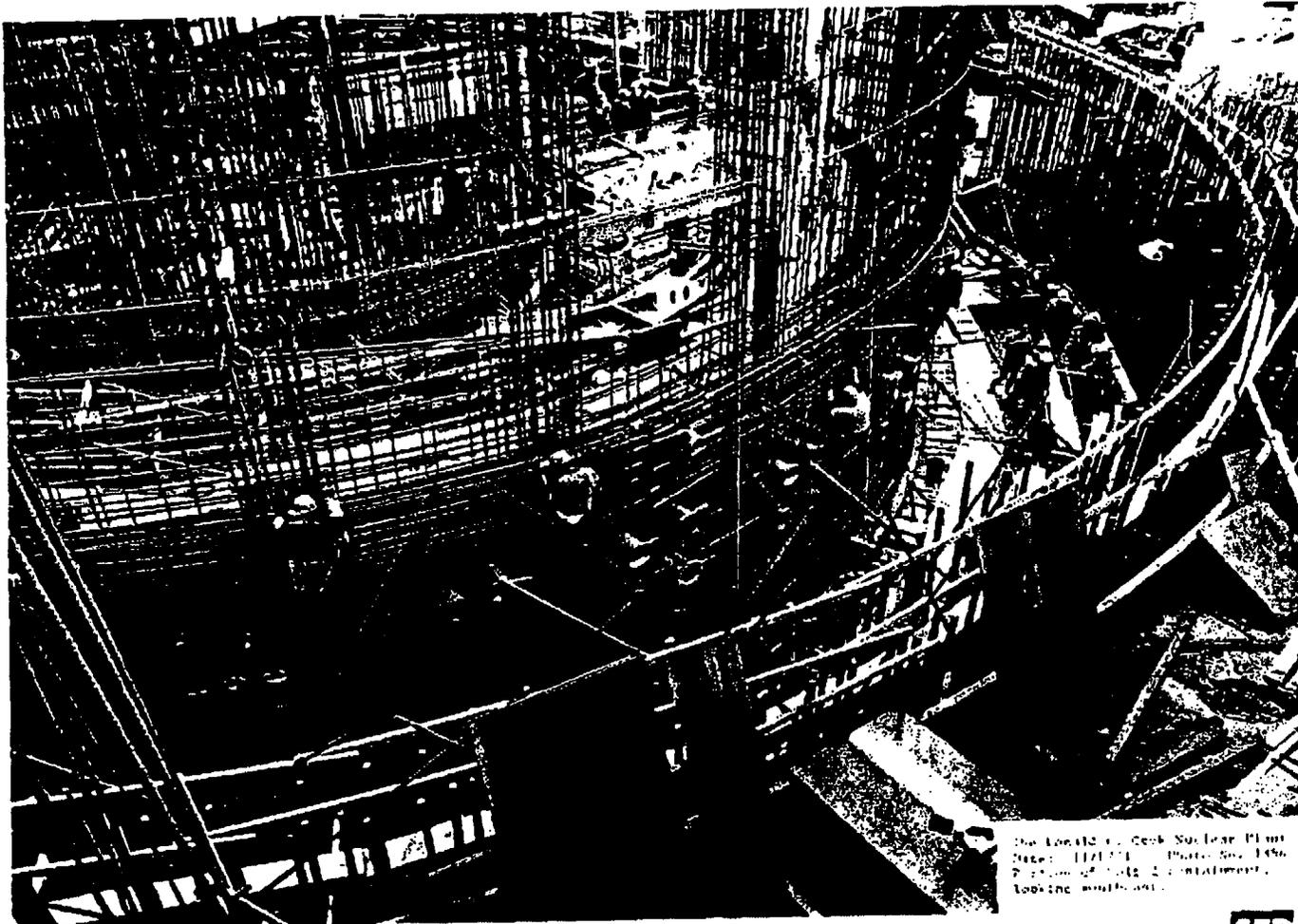
Extent of Condition: Other Unit 2 Structures

■ **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**

Doing it right ...
Every step of the way.
COOK NUCLEAR PLANT

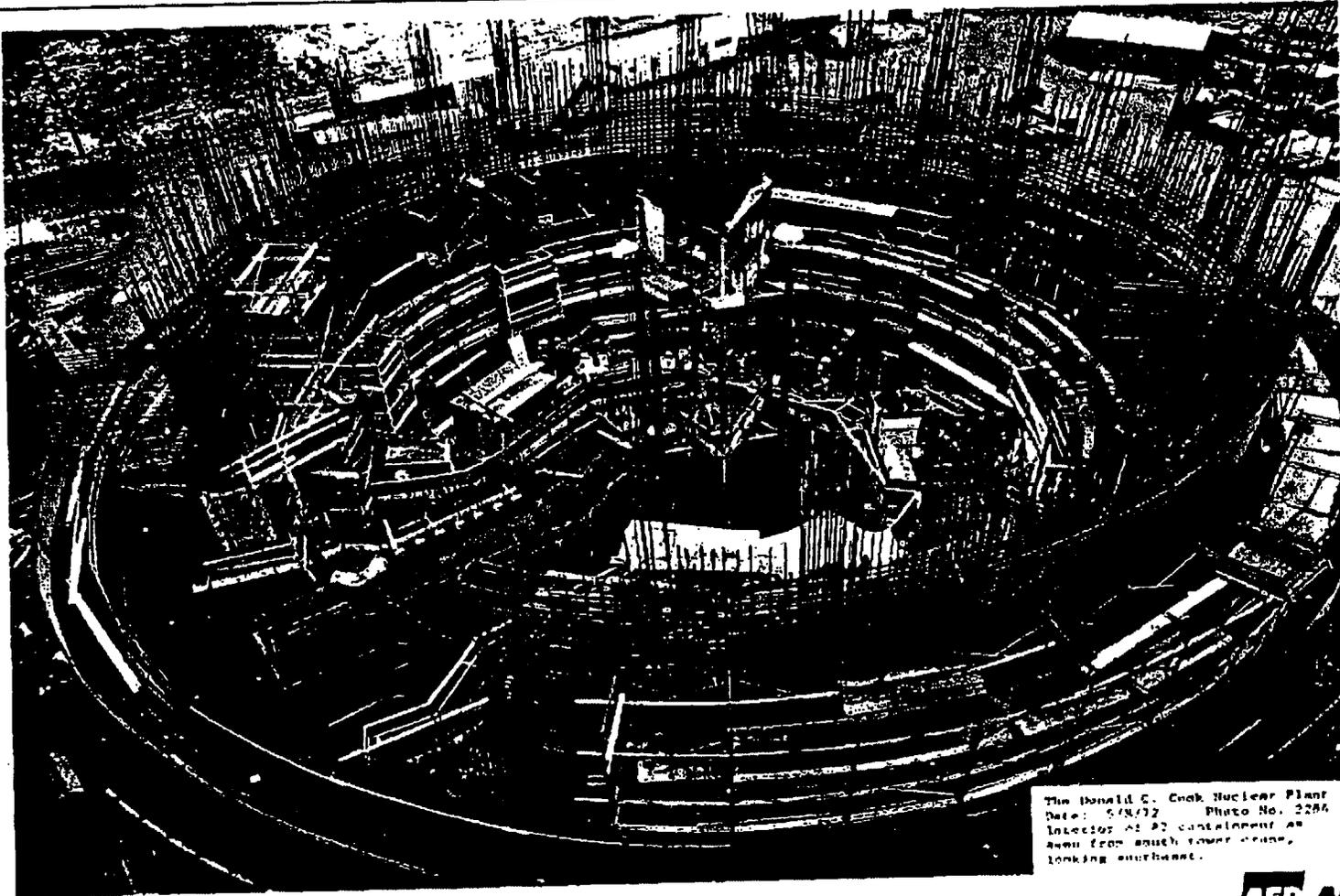
Unit 2 Containment Under Construction



The Lovell Cook Nuclear Plant
Unit 2 Containment Under Construction
Photo No. 1456
System of Unit 2 Containment,
Looking South-East.

Doing it right ...
Every step of the way.
COOK NUCLEAR PLANT

Unit 2 Containment Under Construction



The Donald C. Cook Nuclear Plant
Date: 5/8/72 Photo No. 2286
Interior of Unit 2 containment as
seen from south tower crane,
looking southeast.

27
June 1, 2000

AEP AMERICAN
ELECTRIC
POWER

Doing it right ...
Every step of the way.
COOK NUCLEAR PLANT

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

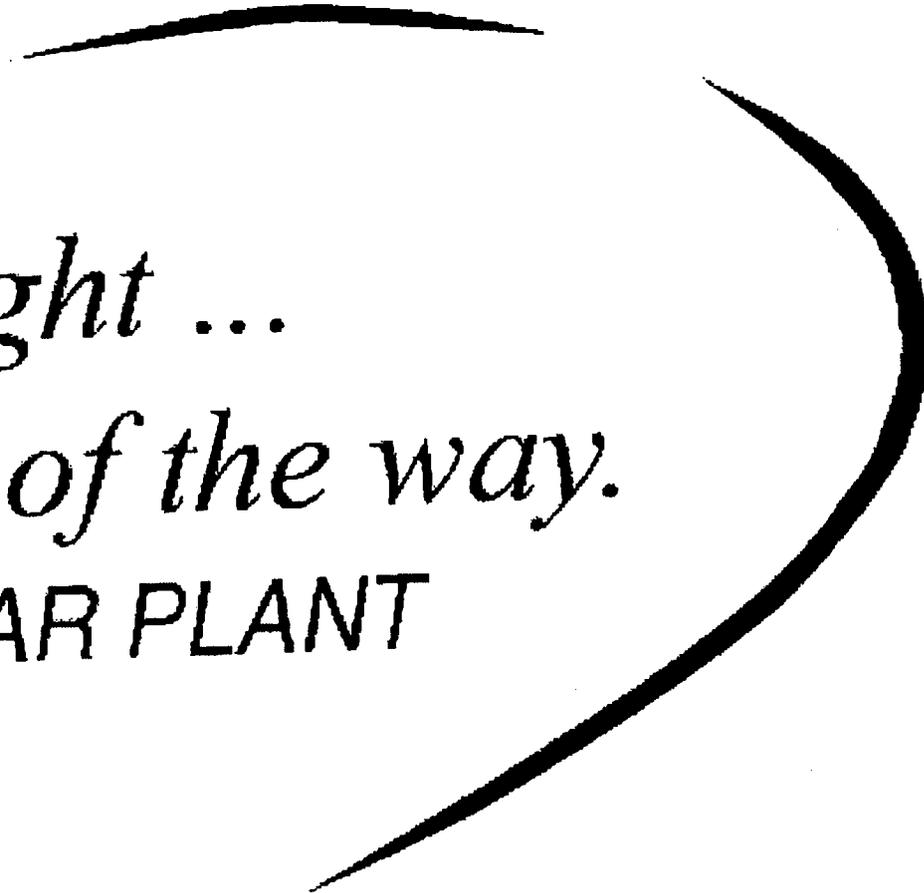
- **Develop Schedule for Permanent Resolution during Unit 1 Restart Preparations**
 - Review with NRC prior to restart of Unit 1

- **Achieve Agreement on Final Course and Schedule by Unit 1 Restart**

Doing it right ...
Every step of the way.
COOK NUCLEAR PLANT

Conclusion: Unit 2 Walls

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



Doing it right ...
Every step of the way.
COOK NUCLEAR PLANT