

February 2, 1996

LICENSEE: Commonwealth Edison Company (ComEd)  
FACILITIES: Byron Station, Unit 1, and Braidwood Station, Unit 1  
SUMMARY: SUMMARY OF JANUARY 25, 1996, STEAM GENERATOR REPLACEMENT MEETING

On January 25, 1996, the subject meeting was held at the licensee's request to discuss its program with the NRC staff. Enclosure 1 includes a list of the meeting attendees. A copy of the licensee's presentation is included in Enclosure 2.

The licensee provided information on its overall steam generator replacement project organization, site project organization, general description of the new steam generators and a comparison with the present ones, the analyses required for replacement, and quality verification oversight. In addition to providing an overview of the program, the discussions also identified areas where future and more narrowly focused meetings between the licensee and the staff will be required.

The current schedule is for the Braidwood, Unit 1, steam generators to be replaced in the fall of 1998 and the steam generators for Byron, Unit 1, in the spring of 1999. The licensee indicated that upon review of the steam generator tube inspection results from the Byron, Unit 1, refueling outage (scheduled to begin March 30, 1996), the replacement schedule will be reevaluated.

Original signed by:

George F. Dick, Jr., Project Manager  
Project Directorate III-2  
Division of Reactor Projects - III/IV  
Office of Nuclear Reactor Regulation

Docket Nos. STN 50-454, STN 50-456

DISTRIBUTION (w/both enclosures):

Enclosures: 1. List of Meeting Attendees  
2. Licensee's Presentation

Docket  
PUBLIC  
PDIII-2 r/f  
GDick  
LMiller, RIII  
R. Zimmerman, 012-G18  
R. Assa  
E. Jordan, T4-D18  
L. Miller, R-III  
J. Lyons, 08-D1  
J. Gavula, R-III  
C. Hinson, 010-D4  
ACRS, T2-E26

cc w/encls: See next page

(w/enclosure 1 only):

W. Russell/F. Miraglia,  
J. Roe (JWR) R. Capra  
M. D. Lynch OGC, 015-B13  
G. Bagchi, 07-H15 D. Wessman, 07-E23  
J. Jacobson, R-III B. McCabe, 017-G21  
K. Manoly, 07-E23 B. Thomas, 08-D1  
D. Brewer, 09-A1 L. Campbell, 010-A19  
J. Ma, 07-H15 J. Tsao, 07-D4  
H. Walker, 08-D1

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DATE	02/1/96		02/02/96		02/2/96			

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*DFD*

Byron/Braidwood Power Stations

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JANUARY 6, 1996, MEETING  
STEAM GENERATOR REPLACEMENT  
LIST OF ATTENDEES

NRC

Goutam Bagchi  
Dick Wessman  
Robert Capra  
Lew Miller  
John Jacobson  
Brian McCabe  
Jim Lyons  
Kamal Manoly  
Brian Thomas  
Jim Gavula  
David Brewer  
Larry Campbell  
Charles Hinson  
John Ma  
John Tsao  
Harold Walker  
Ramin Assa  
M.D. Lynch  
George Dick

Sargent & Lundy

Steven Bertheau

DSA

Lynn Connor

Bechtel

Eugene Thomas  
Brain Reilly  
Chuck Weaver

Commonwealth Edison Company

John Hosmer  
Dan Shamblin  
Yves Lassere  
Bob Waninski  
Dave Rogowski  
Paul Zuranski  
Robert Moravec  
Terry Eckert  
Gerald Groth  
Tim O'Connor  
William Strawn  
Jerald Wagner  
Marcia Lesniak  
Denise Saccomando

McGraw-Hill

David Stellfox

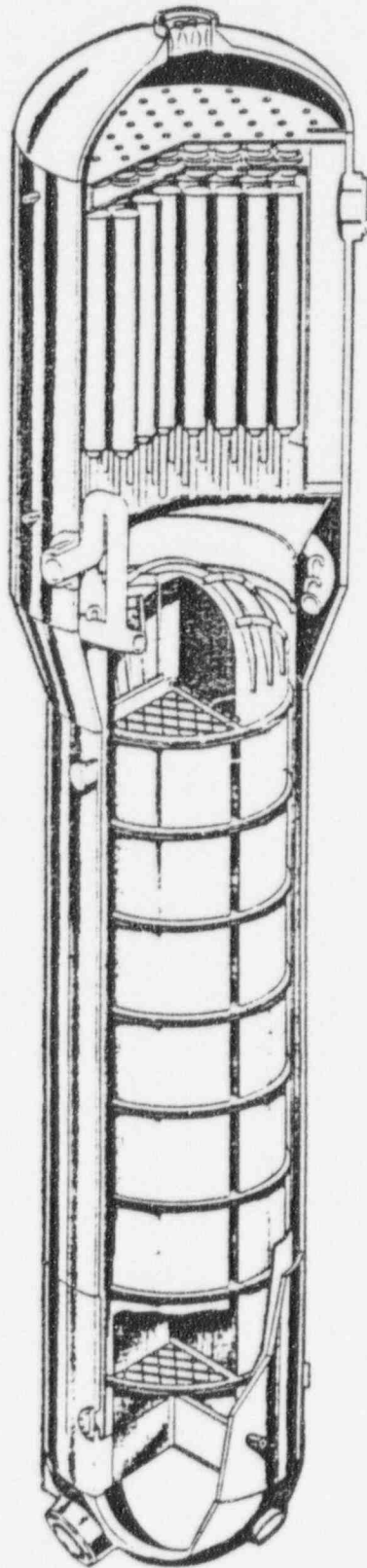
Babcock & Wilcox International

Nick Idvorian

Framatone Technologies, Inc.

Martin Parece  
Louis Redd

*Byron/Braidwood  
Steam Generator Replacement Project*



**ComEd**

*Presentation to the  
Nuclear Regulatory  
Commission*

January 25, 1996



*Byron/Braidwood Steam Generator  
Replacement Project*

Introduction

Dan Shamblin

SGR Project Manager



***Agenda***

**Introduction**

Dan Shamblin  
SGR Project Manager

**RSG Design and Fabrication**

Yves Lassere  
Fabrication Project Engineer

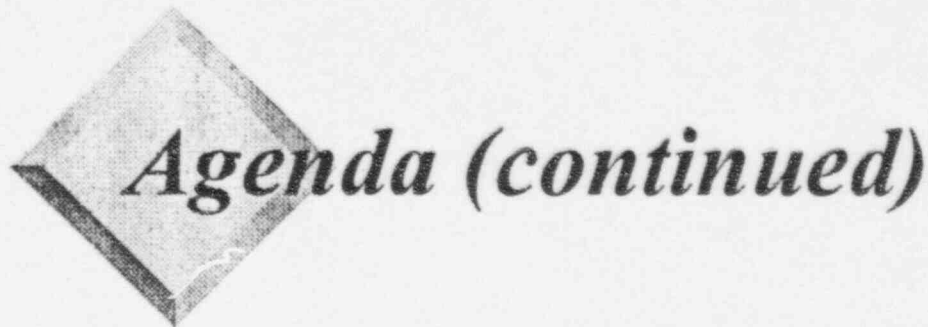
**RSG Engineering and  
Reconciliation Analysis**

Bob Waninski  
Project Engineer

**SGR Engineering and Licensing**

Dave Rogowski  
Replacement Project Engineer

(continued on next slide)



***Agenda (continued)***

**SGR Site and Outage Activities**

Bob Moravec  
Byron Site Project Manager

**Quality Verification Oversight**

Paul Zurawski  
SGR Quality Oversight  
Administrator

**Open Discussion**

All

**Closing Remarks**


Dan Shamblin  
SGR Project Manager





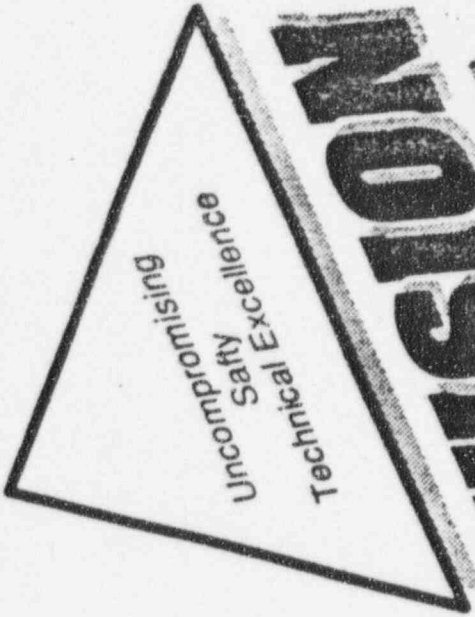
## *Meeting Objectives*

- ❖ Brief NRC About ComEd Steam Generator Replacement Project
- ❖ Provide Project Overview and Some Details
- ❖ Introduce the Steam Generator Replacement Project Core Team to NRC
- ❖ Provide Overview of Project Schedule
- ❖ Plan Future Presentations and Discussions



## *Need for Steam Generator Replacements*

- ❖ Results of Economic Studies Predicted Early End of Useful Life
- ❖ Recent Tubing Deterioration Results Support Economic Studies Predictions
- ❖ Project Authorized Late 1994
- ❖ Project Cost Is \$400 Million Over Five (5) Years



# VISION

Class

World  
Competitive

Generating

Nuclear  
Team

# VALUES

Reality

Speed

Boundaryless

Behavior

Stretch



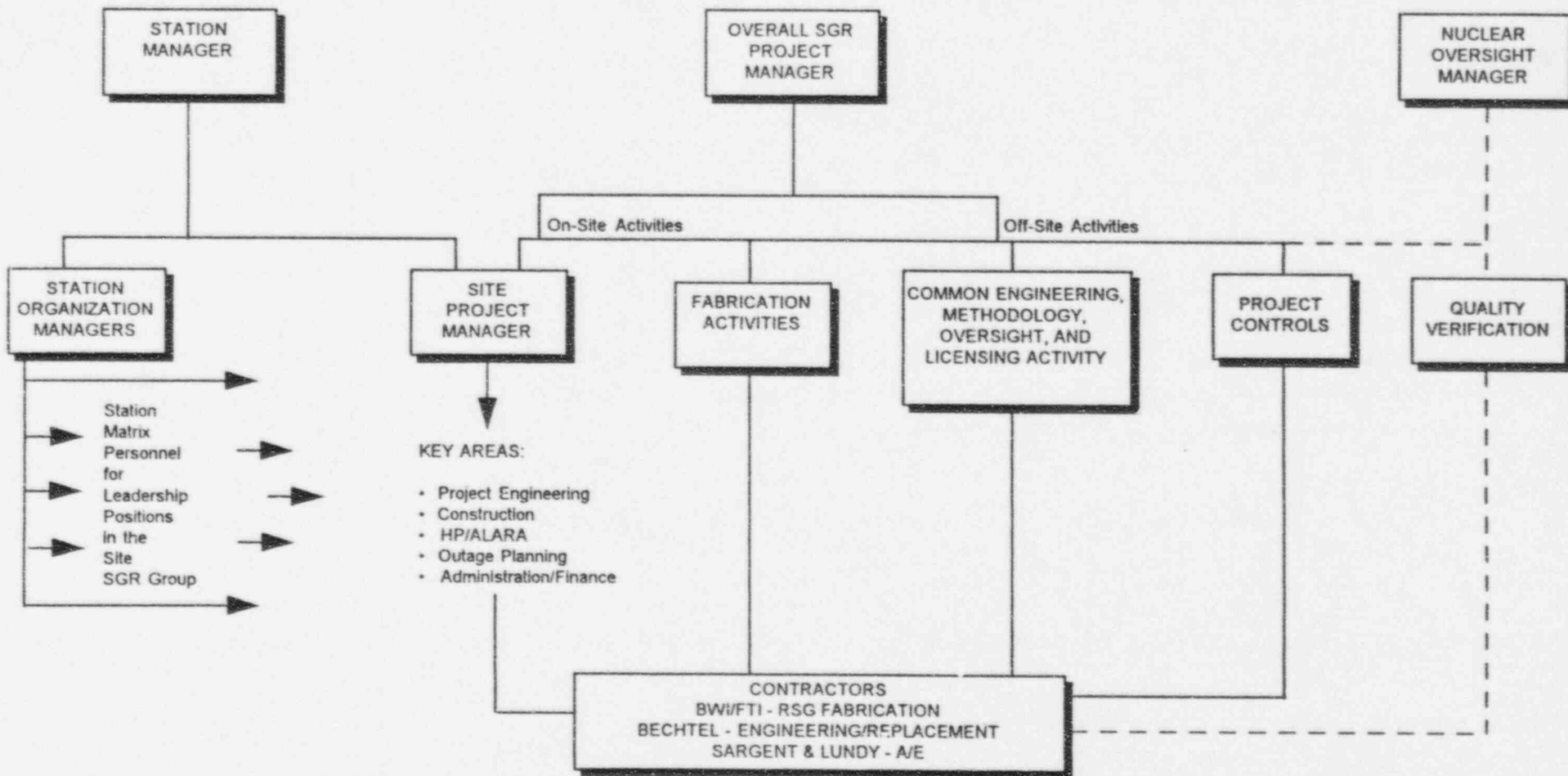


## *Key Project Strategies*


- ❖ Replace As Soon As Possible
- ❖ Integration With Braidwood/Byron Stations
- ❖ Use Lessons Learned, Experienced Contractors, and Proven Technology
- ❖ Replace Through Reactor Containment Temporary Opening
- ❖ Gain Benefits of Two Site Replacements
- ❖ Close Oversight of Contractor Activities
- ❖ Perform Replacement Under 10 CFR 50.59



# ComEd Functional Organization







## *Project Goals*

- ❖ Nuclear Safety/Quality
- ❖ Industrial Safety
- ❖ Radiation Exposure
- ❖ No Impact On Operating Units
- ❖ Post Steam Generator Replacement Unit Performance
- ❖ Schedule
- ❖ Total Cost



*Byron/Braidwood Steam Generator  
Replacement Project*

RSG Design and Fabrication

Yves Lassere


Fabrication Project Engineer






# *Replacement Steam Generator Fabrication*

- ❖ Procurement
- ❖ Design Philosophy
- ❖ Design Features
- ❖ Fabrication Process
- ❖ Management & Technical Oversight
- ❖ Current Status
- ❖ Milestones




## *Replacement Steam Generator Fabrication - Procurement*

- ❖ Release of Fabrication: October 21, 1994
- ❖ Eight (8) Steam Generators Ordered
  - ✓ Byron & Braidwood Units 1
- ❖ Fabricator: Babcock & Wilcox International (Cambridge, Ontario - CANADA)
  - ✓ Over 30 Years of Continuous Nuclear Experience
  - ✓ Over 200 Steam Generators Fabricated
- ❖ Procurement Specification
  - ✓ Resulted From Joint Utility Effort (B&W Vendor Group -10 Utilities)
  - ✓ Tailored to Needs of Byron & Braidwood



# *Replacement Steam Generator Fabrication - Design Philosophy*

- ❖ Forty Years Design Life
- ❖ Proven Technology
- ❖ Minimization of Plant Impact
- ❖ Conservative Design
- ❖ Minimization of Life Cycle Costs




# *Replacement Steam Generator Fabrication - Design Features*

## Features

- ❖ Inconel 690 Thermally Treated Tubing
- ❖ Full Tubesheet Depth Hydraulically Expanded Tubing
- ❖ Stainless Steel Grid Tube Support
- ❖ Improved Steam Separator Design
- ❖ Feedwater Feeding and “Goose Neck” Design

## Impact

- Higher Resistance to Cracking
- Low Residual Stresses  
Minimal Crevice at Top of Tubesheet
- Minimizes Corrosion Concerns  
Minimizes Accumulation of Contaminants  
Increases Circulation Ratio
- Low Moisture Carry-over
- No Feedwater/Auxiliary Feedwater Swaps due to Preheater  
Minimizes Thermal Stratification



# *Replacement Steam Generator Fabrication - Design Features*

## Additional ComEd Requirements

### Features

- ❖ Primary Head Drains
  
- ❖ Increased Number of Handholes and Inspection Ports
  
- ❖ ASME 1989 Sec. XI


### Impact

- Minimizes Contamination during Maintenance Activities
  
- Greatly Facilitates Access for Inspection and Maintenance Activities
  
- Upgrades Vessel Baseline Inspection




# *Replacement Steam Generator Fabrication*

Fabrication Process



## *Replacement Steam Generator Fabrication - Management & Technical Oversight*

- ❖ ComEd Review of Welding, Shop and Procurement Procedures
- ❖ ComEd Expert Review of Welding Processes and NDE Activities
- ❖ Weekly Reviews of Fabrication Progress
- ❖ Weekly Reviews of Non Conformance Fabrication Activities
- ❖ Monthly Project Review Meetings
- ❖ Periodic Joint BWI-ComEd Self Assessment
- ❖ Periodic Senior Management Meetings




# *Replacement Steam Generator Fabrication - Management & Technical Oversight*

## ❖ Lessons Learned

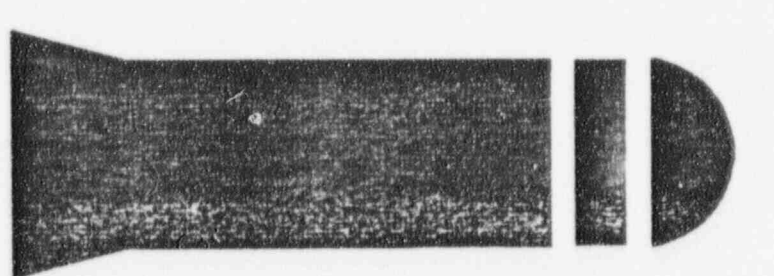
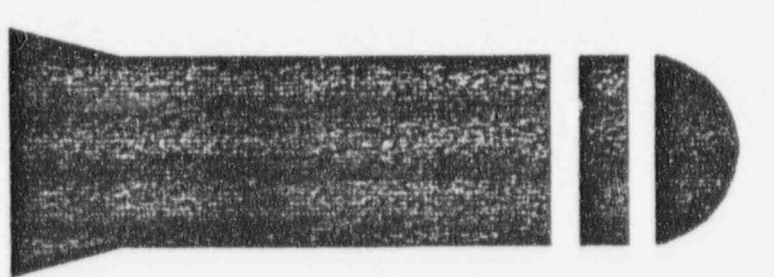
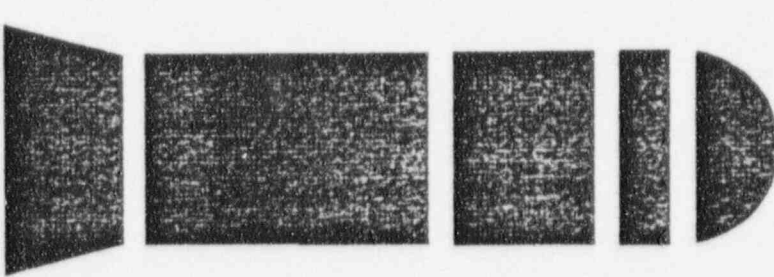
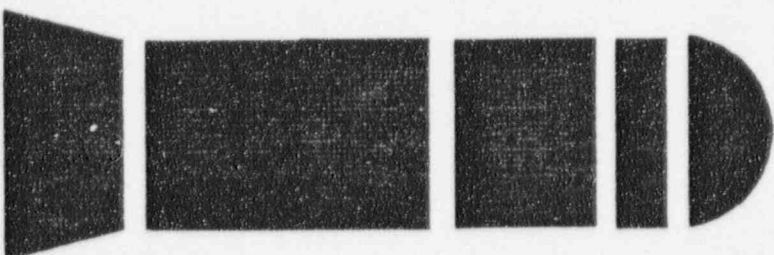
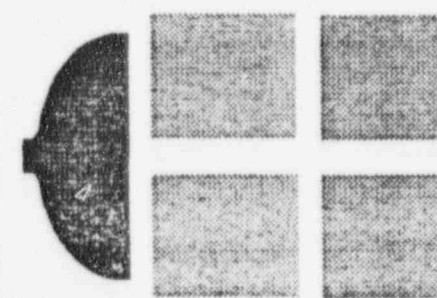
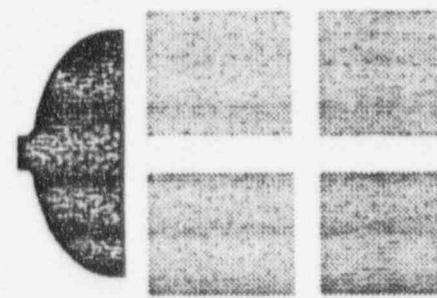
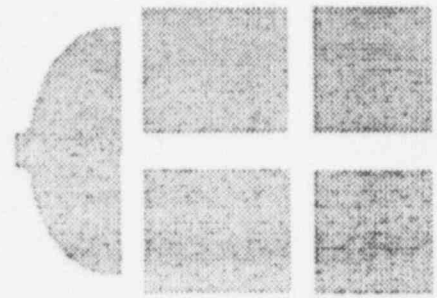
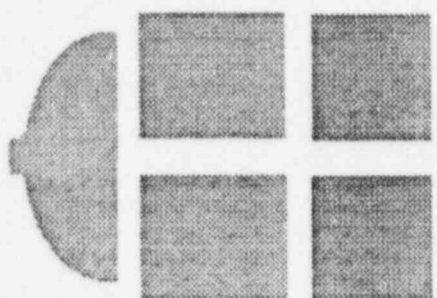
- ✓ Joint Review of Water Level Taps Locations with Duke Power
- ✓ Use of FP&L's Technical Review of FW Nozzle Design
- ✓ Threaded Hole Protection Procedure from RG&E's Experience
- ✓ Future Implementation of Corrective Actions for Schnabel Car Design for Rail Transportation
  - ◆ Transportation
  - ◆ FME Program
  - ◆ Tube U-Bend Support Assembly





## *Replacement Steam Generator Fabrication - Status*

- ❖ Long Lead Time Items Procurement Complete
- ❖ Fabrication Activities Ahead of Schedule
  - ✓ Receipt in Shop of Heavy Forgings is 75% Complete
  - ✓ Ongoing Secondary Shells/Transition Cone Assembly for all 4 Braidwood RSGs
  - ✓ 100% Completion of Gundrilling for First 3 Tubesheets
  - ✓ Ongoing Fabrication Activities for Lattice Bars and Steam Drum Internals



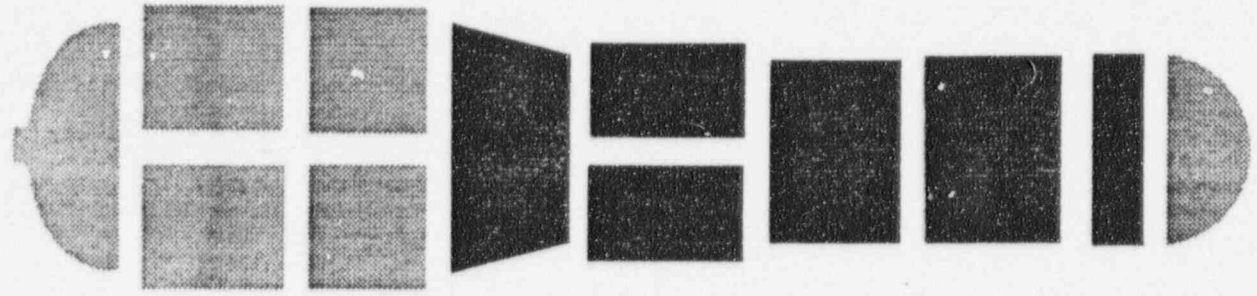
RSG #4

RSG #3

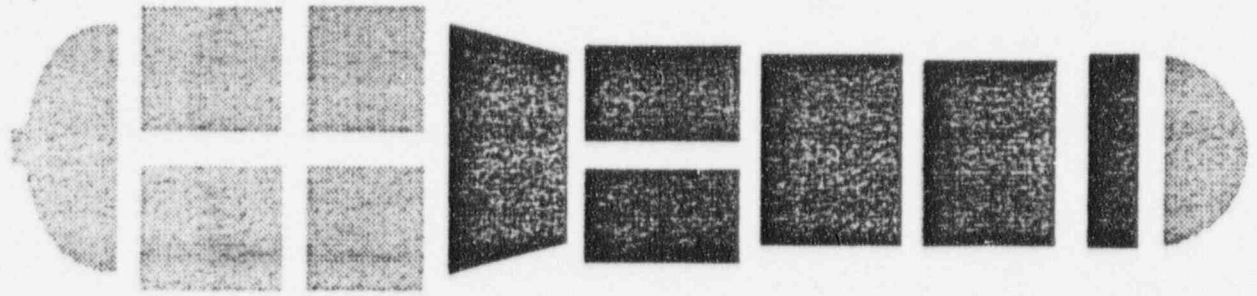
RSG #2

RSG #1

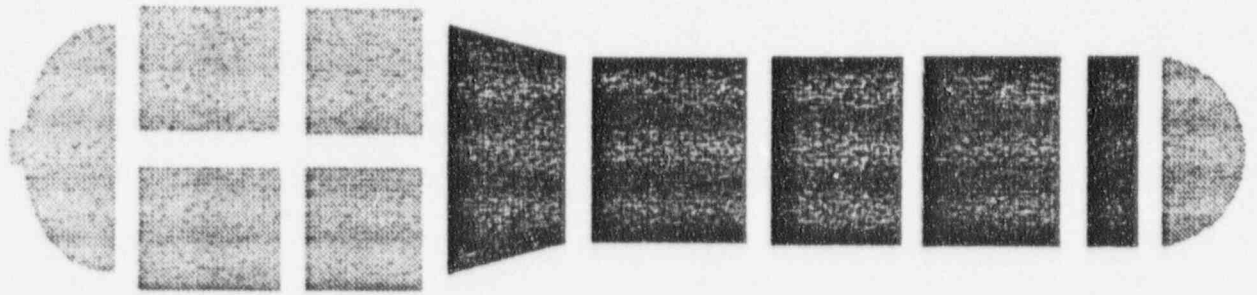
BWI FABRICATION STATUS - BRAIDWOOD STATION



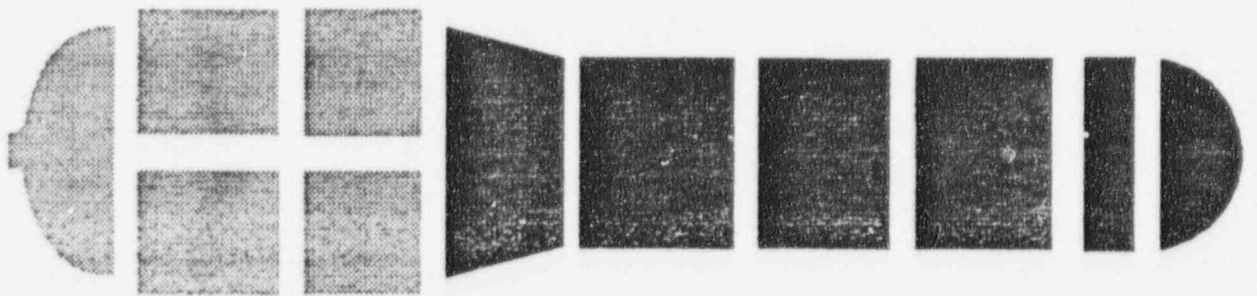
RSG #4



RSG #3




RSG #2



RSG #1

BWI FABRICATION STATUS - BYRON STATION



## *Replacement Steam Generator Fabrication - 1996 Milestones*


- ❖ Beginning of First Primary Head/Tubesheet/Secondary Shell Assembly: March 1996
- ❖ Receipt of Tubing for First RSG: June 1996
- ❖ Completion of All Gundrilling Activities: September 1996
- ❖ Entry to Clean Room Operations for First RSG: December 1996



*Byron/Braidwood Steam Generator  
Replacement Project*

RSG Engineering and  
Reconciliation Analysis


Bob Waninski  
Project Engineer



# ***RSG Engineering and Reconciliation Analysis***


## **RSG is functionally similar - physically different**

- ❖ RSG is heavier, different seismic response
- ❖ RSG has 66% more heat transfer area
- ❖ RSG has different operating water level and span
- ❖ Feeding vs. preheater
- ❖ Possible single FW/AF nozzle vs. dedicated nozzles



***RSG Engineering and Reconciliation  
Analysis - Framatome Technologies Inc.***


- ❖ Analysis support performed by Framatome (Formerly BWNT), a subcontractor to BWI
- ❖ Framatome (BWNT) experience
  - ✓ Millstone 2
  - ✓ St. Lucie 2
  - ✓ McGuire 1/2
  - ✓ Ginna



# *RSG Engineering and Reconciliation Analysis*

- ❖ Materials & Structural Analysis
- ❖ Safety/Accident Analysis
- ❖ Performance Analysis
- ❖ Technical Specification Issues
- ❖ Licensing Report/10CFR50.59
- ❖ Technical Oversight






# *RSG Engineering and Reconciliation Analysis - Material & Structural Analysis*

- ❖ Objective

Verify that the reactor coolant system components and piping are adequate to accommodate the RSGs under normal and accident loading conditions, and that associated stresses due to the RSGs do not exceed allowables



# *RSG Engineering and Reconciliation Analysis - Material & Structural Analysis*

## Analysis


- ❖ Primary Loop  
(Deadweight, Thermal,  
Seismic)
- ❖ Effect of LOCA on  
structural model
- ❖ Effect of secondary side  
pipe break

## Reason for Analysis

RSG is 20% heavier, change in  
center of gravity, response to  
seismic event

Mass and energy release  
expected to be greater


Mass and energy release  
expected to be greater  
on structural model



# *RSG Engineering and Reconciliation Analysis - Safety/Accident Analysis*

- ❖ Objective


Evaluate all safety/accident analyses presented in the UFSAR to ensure that these analyses continue to bound the plant with the RSGs. If not, analysis will be performed to show that plant response continues to meet NRC-approved acceptance criteria with the RSGs. Should accident transient analysis be needed, NRC approved computer codes will be used to evaluate primary and secondary side performance.



# *RSG Engineering and Reconciliation Analysis - Safety/Accident Analysis*


<u>Event</u>	<u>Reason for Analysis</u>
❖ Steam Line Break	RSG heat transfer area is 66% more
❖ FW Malfunction	S/G high level trip change due to level tap location different than OSG
❖ Loss of Load	Heat transfer area greater and steam pressure greater at same $T_{avg}$ - also ASME overpressure calc
❖ Loss of FW	S/G low level trip change due to level tap location different than OSG

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# ***RSG Engineering and Reconciliation Analysis - Safety/Accident Analysis***

<u>Event</u>	<u>Reason for Analysis</u>
❖ Feedline Break	Same as Loss of FW
❖ Large Break LOCA	S/G tube resistance is lower, feedring vs. preheat geometry differences (Offsetting effects)
❖ S/G Tube Rupture secondary	Smaller tube diameter and greater side water volume (Offsetting effects)
❖ LTOP/COMS	RSG heat transfer area is 66% greater




# *RSG Engineering and Reconciliation Analysis - Performance Analysis*

❖ Objective


Confirm that the OSG transients presented in the CDS are:

- a. appropriate for the RSG, or that
- b. OSG transients need to be modified and evaluated to reflect behavior of the reactor coolant system with the RSGs.



# *RSG Engineering and Reconciliation Analysis - Performance Analysis*


<u>Analysis</u>	<u>Reason for Analysis</u>
❖ CDS Confirmation	Ensure that as a function of time, the OSG and RSG responses are similar under common transient conditions
❖ FW Control System	RSG operating water level/span different than OSG, but stability is improved. Opportunity to improve level control performance.
❖ NSSS/BOP	Review systems such as: RHR, core flood, charging and letdown, PORVs/safety valves, S/G blowdown, instrumentation and control
❖ EOP Review	RSGs may affect response time(s) in EOPs



# *RSG Engineering and Reconciliation Analysis - Conclusions of Preliminary Review*


- ❖ As a result of the analyses discussed, only two minor Tech Spec changes are anticipated
  - ✓ 2.2.1 Reactor Trip System Instrumentation Setpoints (S/G Water Level Low-Low Trip - Table 2.2-1)
  - ✓ 3.4.9.3 Overpressure Protection Systems (PORV Setpoints - Figure 3.4-4a)
- ❖ SGR Project may be performed under 10CFR50.59





# *RSG Engineering and Reconciliation Analysis - Technical Oversight*

- ❖ Critical oversight of Framatome Technologies Inc. technical activities by:
  - ✓ ComEd RSG Project Engineering
  - ✓ ComEd Nuclear Fuel Services
  - ✓ ComEd Site Support Engineering
  - ✓ ComEd Chief Engineer Design Review
  - ✓ Sargent & Lundy
  - ✓ BWI




*Byron/Braidwood Steam Generator  
Replacement Project*

SGR Engineering and Licensing

Dave Rogowski

Replacement Project Engineer

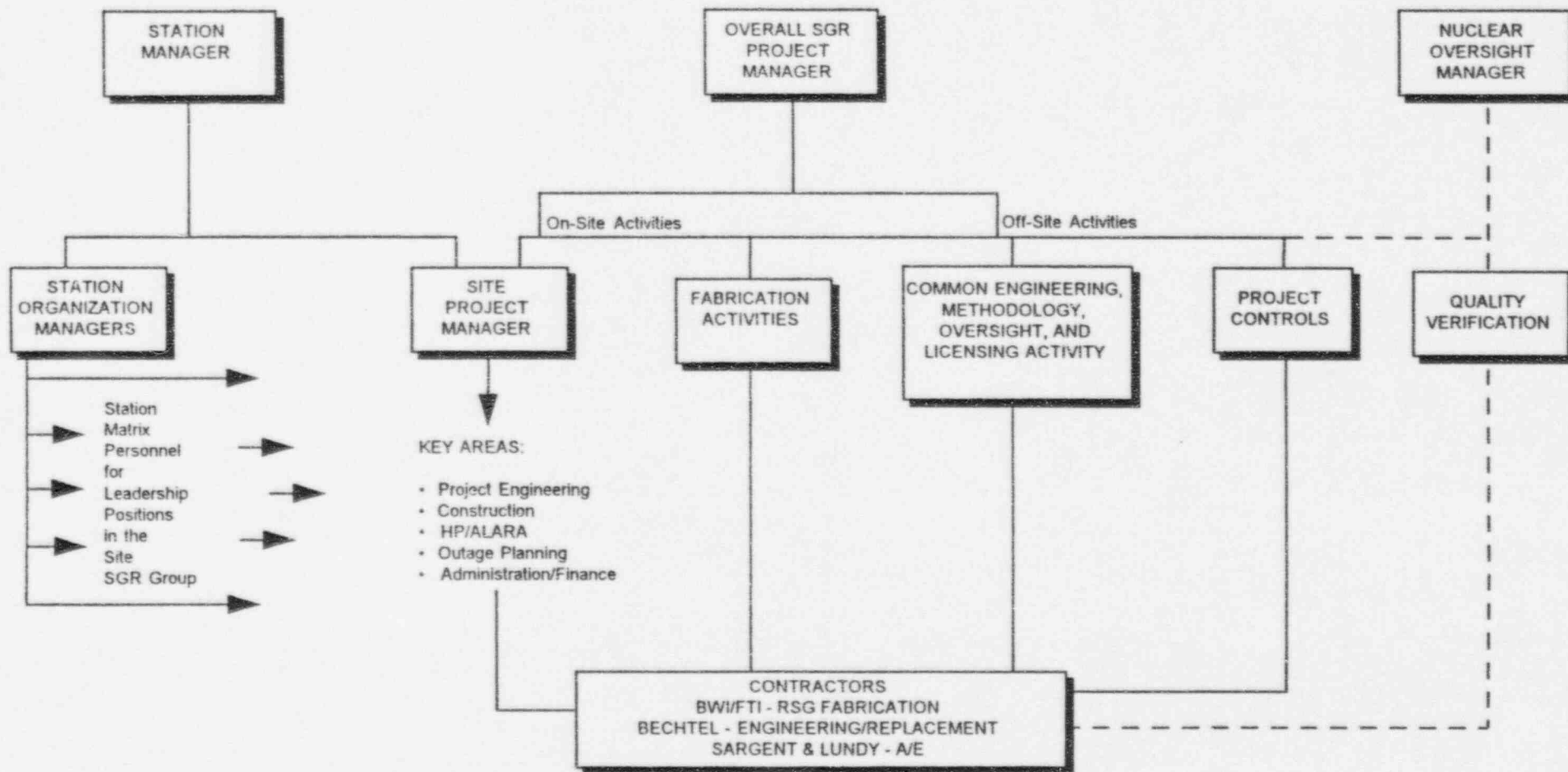


# *Byron/Braidwood SGRP*

- ❖ *Organization and Schedule*
- ❖ Safety Evaluation Concept
- ❖ Safety Evaluation Critical Design Reviews
- ❖ System Design Considerations




# ComEd Functional Organization





## *Corporate Engineering Team*

- ❖ Common Engineering
- ❖ Overall Coordination
- ❖ Oversight




## *Site Engineering Team*

- ❖ Design Authority
- ❖ Review and Approvals of All Safety Evaluations
- ❖ Dedicated On-Site Team
- ❖ Technical Reviews



## *Contractor Engineering*

- ❖ Prepare Engineering Packages and Design Documents
- ❖ Resident Engineering
- ❖ Safety Evaluation Qualified




# *Design Review Meetings*

- ❖ Technical Review Committee Presentation
- ❖ Modification Scoping Meeting
- ❖ 30% Design Review Meetings
- ❖ 90% Design Review Meetings







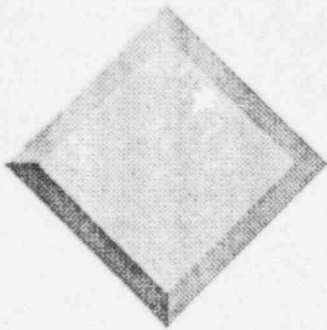
# *Byron/Braidwood SGRP*

- ❖ Organization and Schedule
- ❖ *Safety Evaluation Concept*
- ❖ Safety Evaluation Critical Design Reviews
- ❖ System Design Considerations



# *Engineering Change Documentation*

- ❖ 10 CFR 50.59 Safety Evaluation Approach
- ❖ Consistent With Industry Approach
- ❖ No Unresolved Safety Questions are Anticipated



**COMED**

**INPUT  
REVIEW**



**REVIEW  
APPROVE**



BWI/FTE SAFETY EVALUATION  
BECHTEL SAFETY EVALUATIONS  
✓SYSTEMS  
✓CONTAINMENT OPENING  
✓OTHER



**COMPREHENSIVE  
SAFETY  
EVALUATION**


**PREPARE  
REVIEW**



**PREPARE  
REVIEW**




**CONTRACTOR**




# *Byron/Braidwood SGRP*

- ❖ Organization and Schedule
- ❖ Safety Evaluation Concept
- ❖ *Safety Evaluation Critical Design Reviews*
- ❖ System Design Considerations



# *Safety Evaluation Critical Design Reviews*

- ❖ Replacement Steam Generator Not Original Equipment Manufacturer
- ❖ Handling and Transportation of Steam Generators
- ❖ Containment Construction Opening
- ❖ Storage of Old Steam Generators On-Site
- ❖ New Insulation Required for Replacement Steam Generator
- ❖ Potential FW/AFW Single Nozzle Operation



# *Handling and Transportation of Steam Generators*

- ❖ Steam Generator Heavy Load Drop Analysis
- ❖ Strict Administrative Procedures and Controls
- ❖ Training of Equipment Operating Personnel
- ❖ Protection of Underground Utilities
- ❖ Equipment Speed
- ❖ Controls on Lift Heights, Travel Directions
- ❖ Temporary Physical Protection
- ❖ Capabilities of Equipment



# *Containment Opening Design Considerations*

- ❖ Containment Analysis Required for Partial Detensioning
- ❖ Replacement Concrete - Qualify Design Mix
- ❖ Evaluate Impact on Safety Related Functions
- ❖ Ensure No Unmonitored Release of Radiation
- ❖ Containment Testing






## *Polar Crane Considerations*

- ❖ Required Lift 418 Tons
- ❖ Temporary Lifting Device (TLD) is Required
- ❖ Polar Crane Bridge Rated at 460 Tons
- ❖ Additional Load Tests / Structural Evaluations
- ❖ Manufacturer's Review
- ❖ Maintenance History




## *Old Steam Generator Storage Facility*

- ❖ Onsite Within Owner Controlled Area
- ❖ Consider Radiological Effects
- ❖ Design Per Following Requirements:
  - ✓ 40 CFR 190 Dose Rate Limits
  - ✓ Facility Restricted Per 10 CFR 20
  - ✓ 10 CFR 100 Limits
- ❖ Similar Design to North Anna and Ginna



# *New Steam Generator Insulation Required*

- ❖ 75% of Existing Insulation Would Require Rework
- ❖ Dose Concerns
- ❖ Staging and Laydown Problems



# *Steam Generator Insulation Design Considerations*

- ❖ Design to Preclude Any Increase in Containment Heat Load
- ❖ Potential Use of Fiberglass
  - ✓ Existing Metallic Design Problems
  - ✓ Reg. Guide 1.82
- ❖ Provide Greater Access to ISI Welds




## *Byron/Braidwood SGRP*

- ❖ Organization and Schedule
- ❖ Safety Evaluation Concept
- ❖ Safety Evaluation Critical Design Reviews
- ❖ *System Design Considerations*




# *System Design Considerations*

- ❖ Reactor Coolant System
- ❖ Main Steam System
- ❖ Steam Generator Blowdown System
- ❖ Main Feedwater System
- ❖ Auxiliary Feedwater System



# *Main Feedwater System Design Considerations*

- ❖ Piping Reroute
- ❖ Feedwater Pump Design Review
- ❖ Piping Material Changes
- ❖ Evaluate Feedwater Level Control

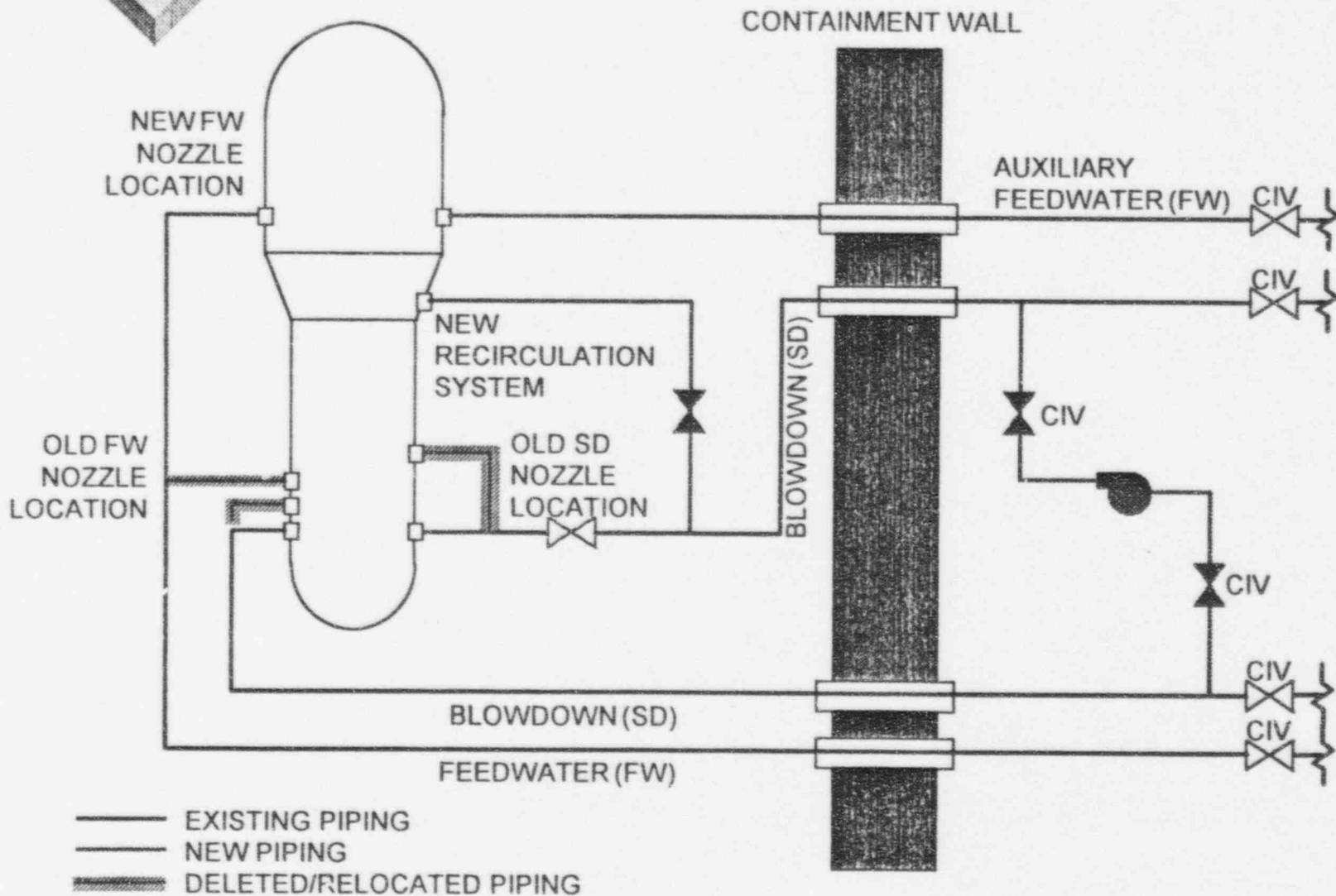


# *Auxiliary Feedwater System Design Options*

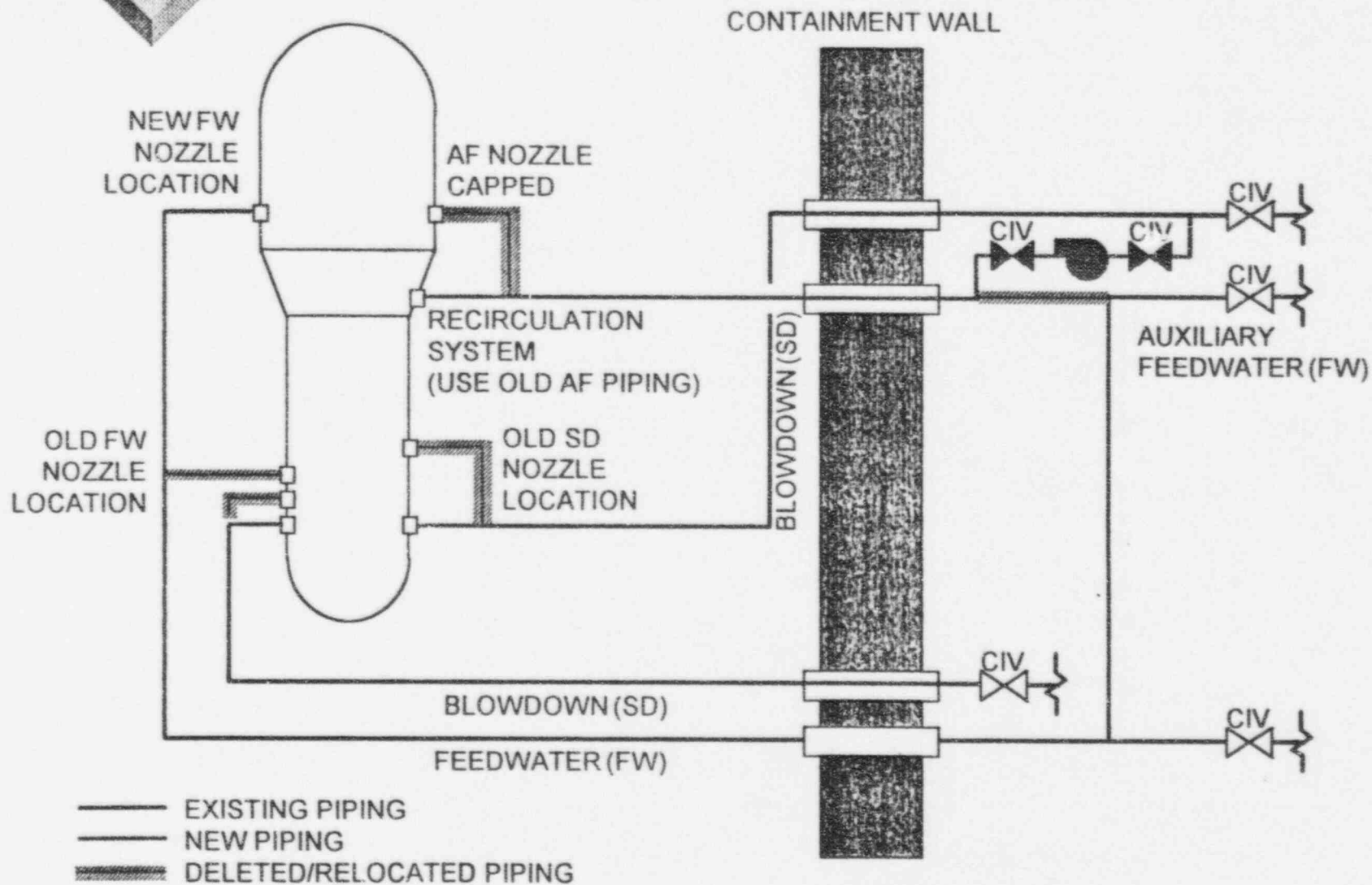
- ❖ OPTION A - Current Design
- ❖ OPTION B - FW/AFW Single Nozzle Operation
  - ✓ Tie into Feedwater
  - ✓ Effects on Aux Feedwater Pump
  - ✓ Aux Feedwater Penetration Available
  - ✓ Components Relocated in a Non-RCA



# Conceptual Pipe Routings



# Conceptual Pipe Routings





*Byron/Braidwood Steam Generator  
Replacement Project*

SGR Site and Outage Activities

Bob Moravec

Byron Site Project Manager

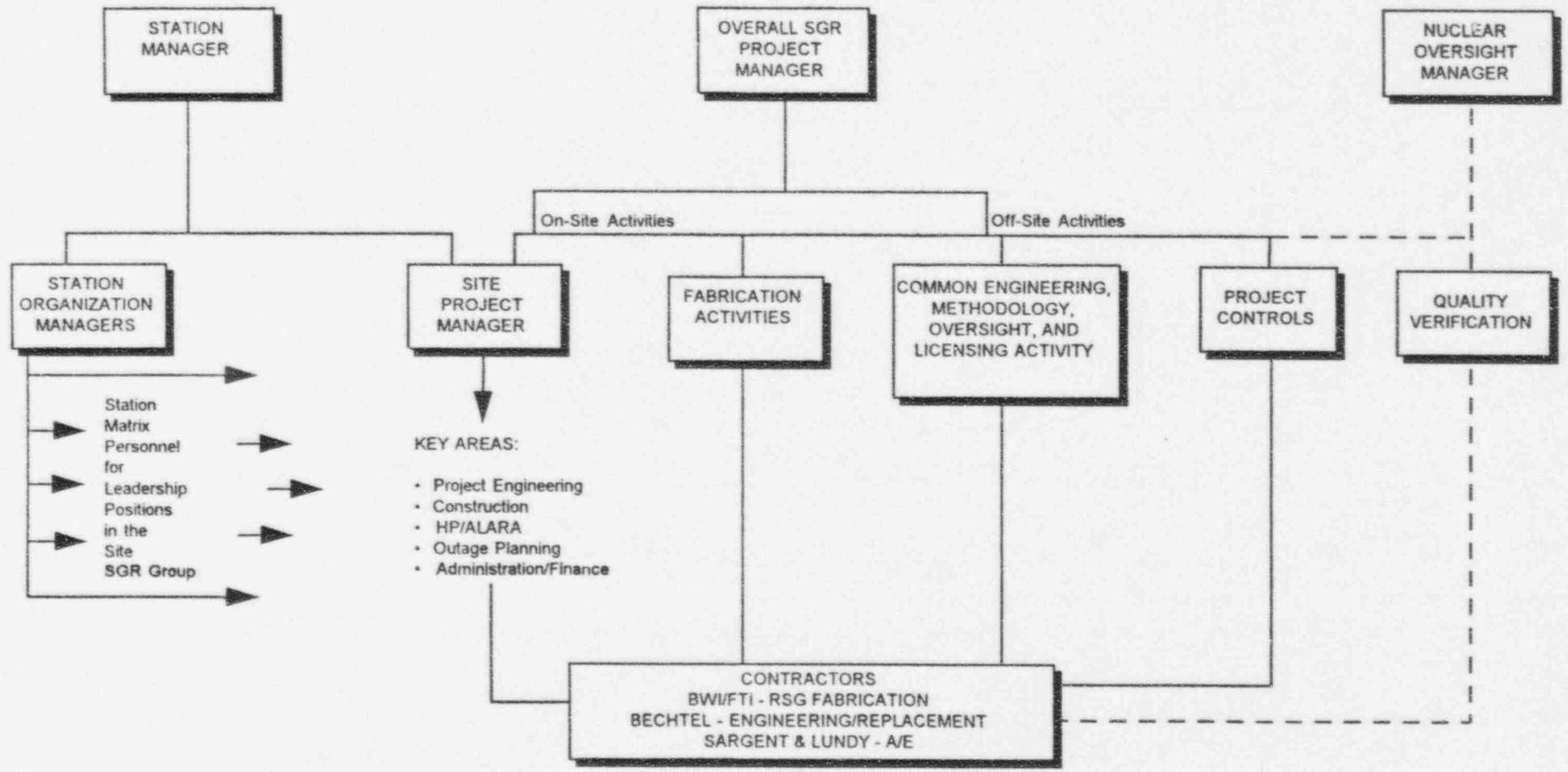


## *Topics of Discussion*

- ❖ Site Organization
- ❖ Schedule
- ❖ Pre-SGRO Activities
- ❖ SGRO Activities
- ❖ Inspection and Testing

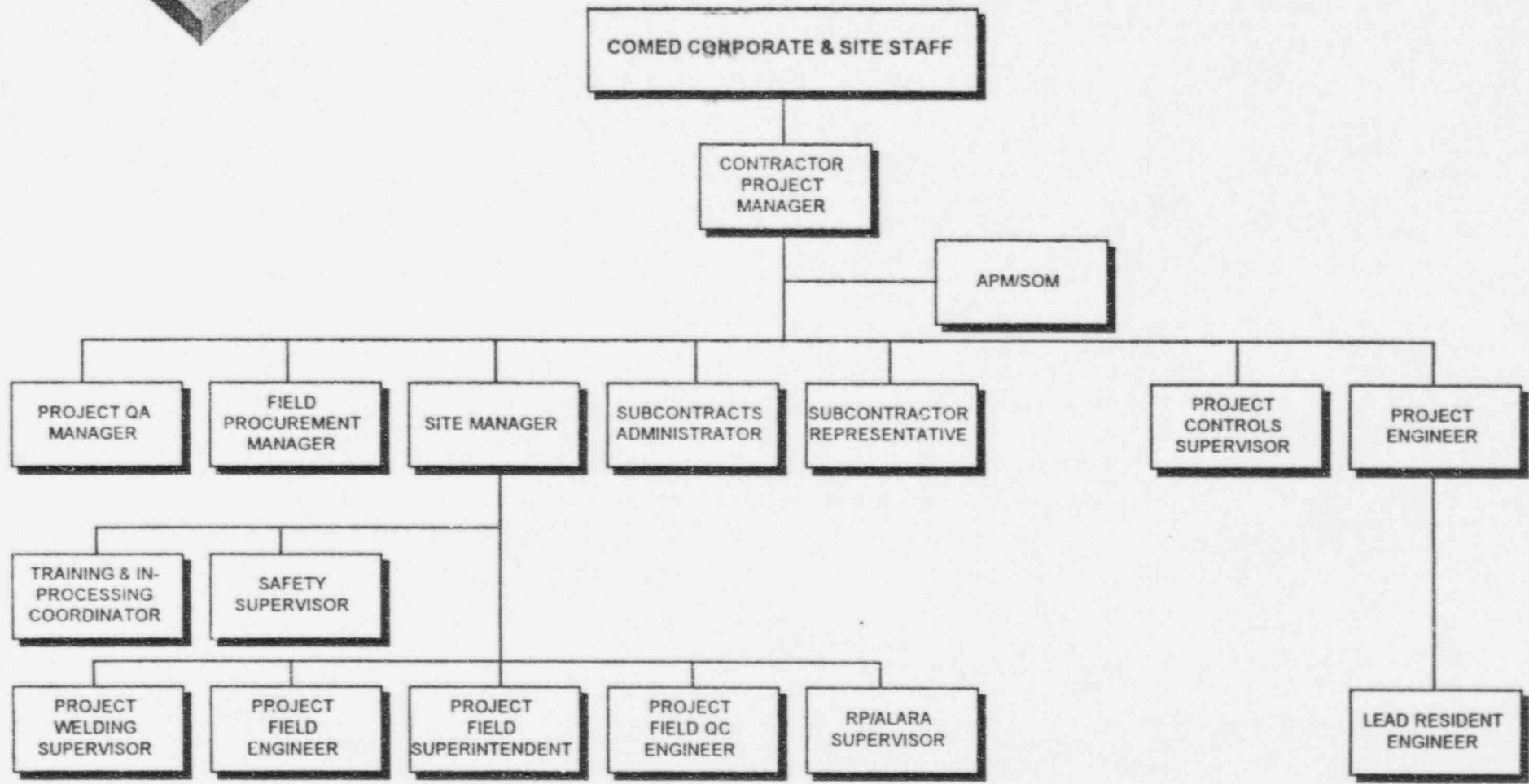


# ComEd Functional Organization

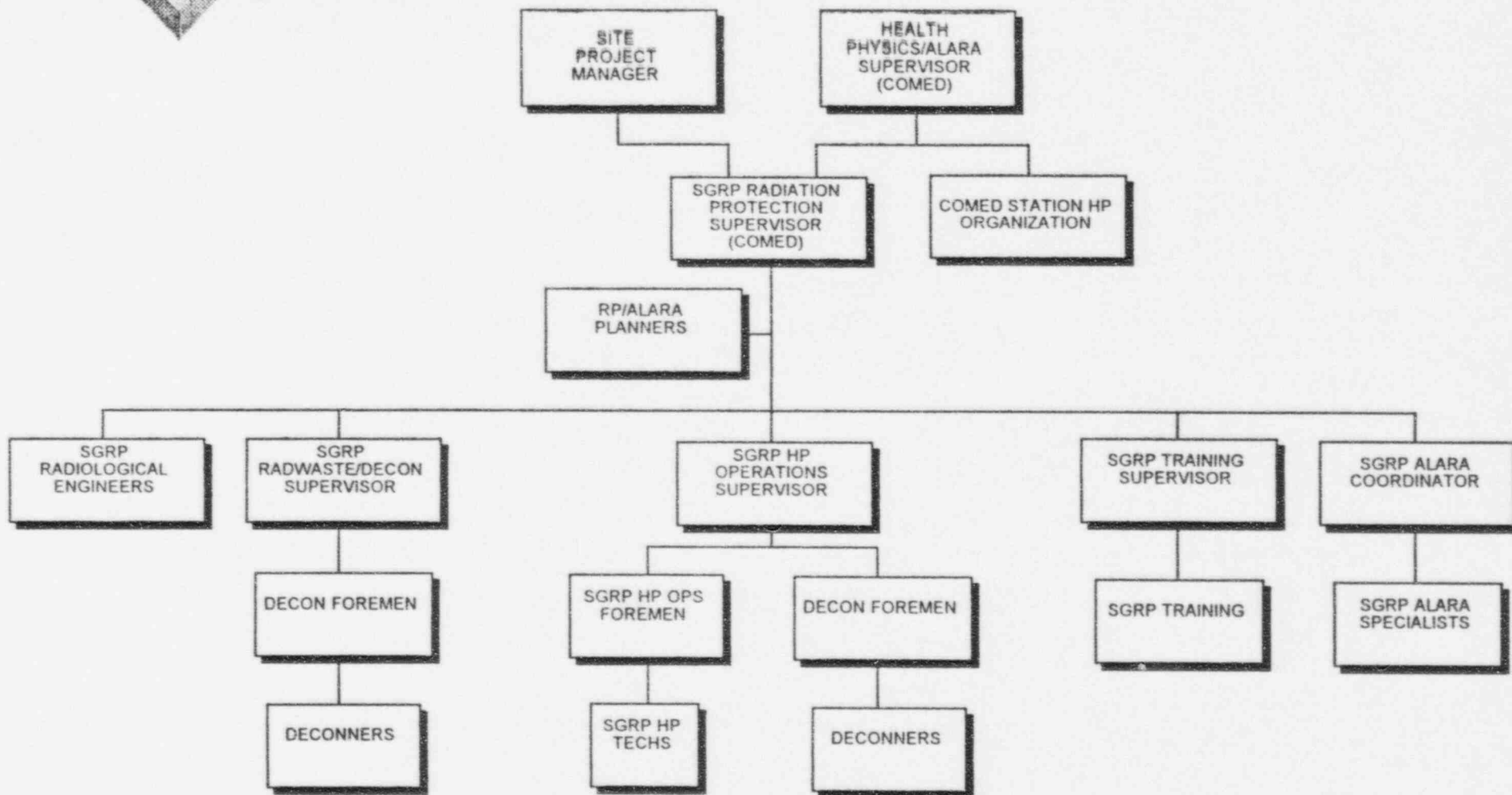




# Bechtel SGR Organization




# SGRP Radiation Protection Group Organization



## Key Outage Dates

1997												1998												1999							
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug





## *Pre-SGRO Activities*

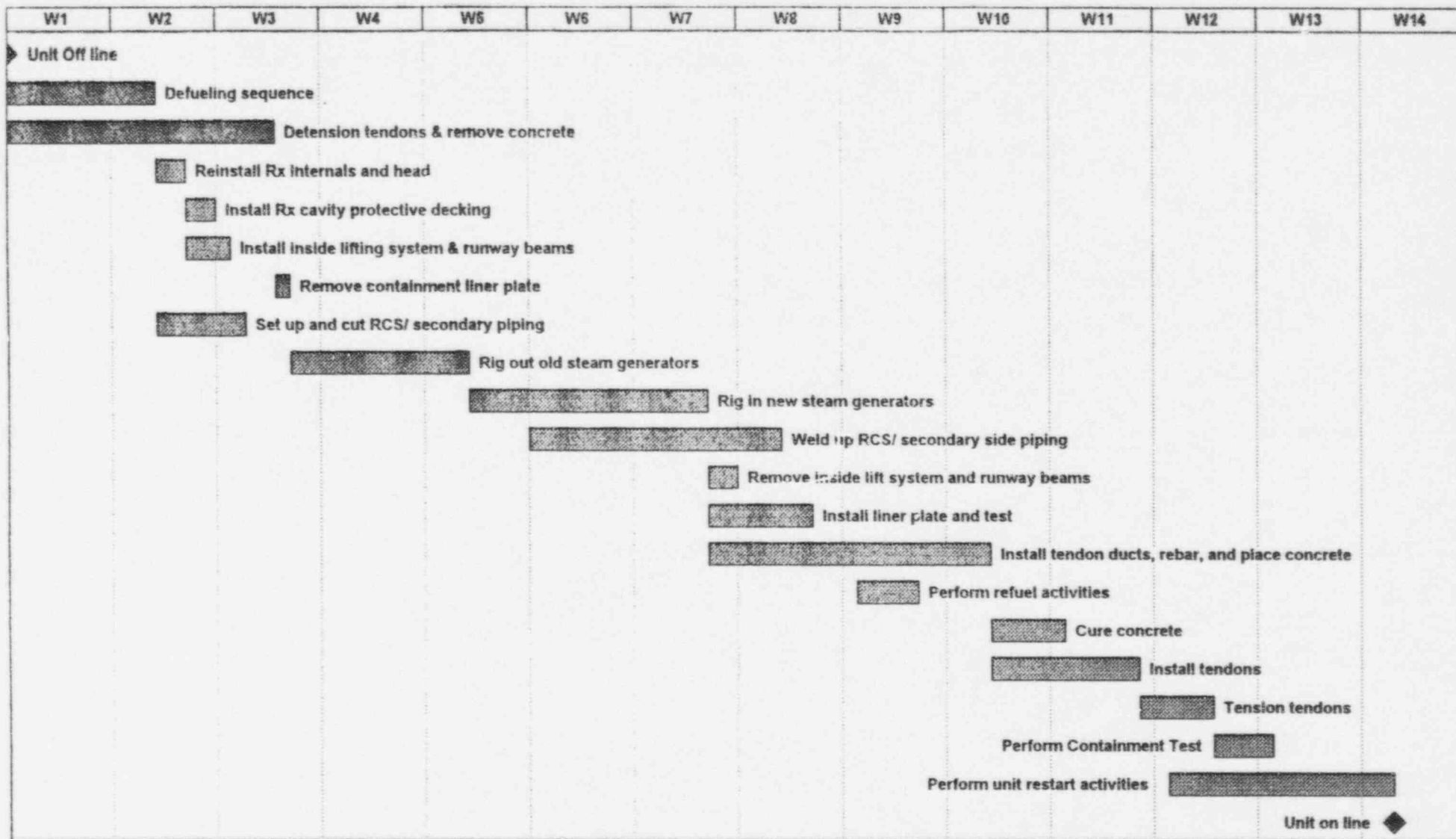
- ❖ Support Facilities
- ❖ Transportation Planning
- ❖ Security Planning
- ❖ RP Planning
- ❖ N-1 Outage
- ❖ Material Staging & Procurement




## ***RP Planning***

- ❖ SGRP Radiation Protection Plan
- ❖ Dose Goals
- ❖ Incorporate Latest Technologies
- ❖ ALARA Reviews
- ❖ Lessons Learned
- ❖ Mock-Up Training


# SGRO Schedule





# *Inspection and Testing*


- ❖ Non-Destructive Examination
- ❖ System Leakage Testing
- ❖ Containment Testing
- ❖ Post Modification & Startup Testing



*Byron/Braidwood Steam Generator  
Replacement Project*

Quality Verification Oversight

Paul Zurawski  
SGR Quality Oversight  
Administrator

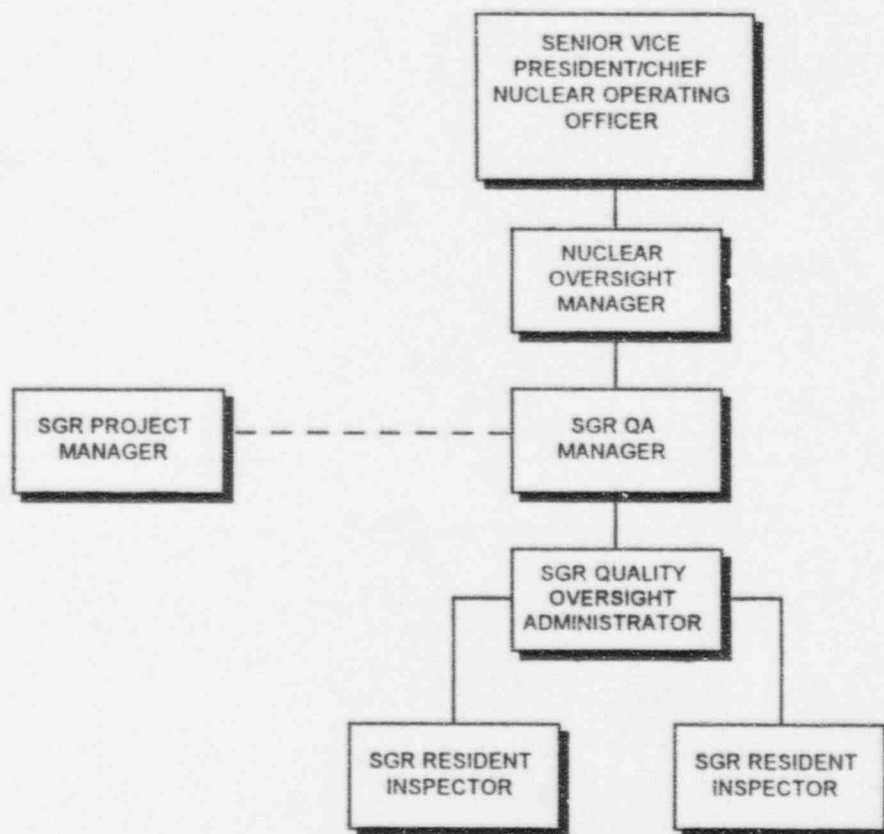



# *SGR Quality Oversight*

- ❖ Quality Oversight Organization
- ❖ Fabrication
- ❖ Engineering/Installation



# *Quality Oversight Organization*





## *Fabrication (Planning)*

- ❖ Quality Oversight Plan
  - ✓ Resident Inspectors
  - ✓ Sub-Vendor Audits
- ❖ Resident Inspector Selection
  - ✓ Technical Knowledge
  - ✓ Communication
  - ✓ Project Management





## *Fabrication (BWI Oversight)*

- ❖ Resident Inspector Activities
  - ✓ Daily Shop Monitoring
    - ◆ Performance Based Inspections/Surveillances
    - ◆ Witness/Hold Points
    - ◆ Non-Conformance Reviews
    - ◆ Inspection/Test Plans
    - ◆ 24 Hour Availability



## *Fabrication (BWI Oversight)*

- ❖ Resident Inspector Activities (continued)
  - ✓ Project Team Meetings
    - ◆ ComEd
    - ◆ ComEd/BWI
    - ◆ Weekly Conference Calls
  - ✓ Activity Reporting



## *Fabrication (ComEd Audits)*

- ❖ BWI Audits
  - ✓ Three (3) 1995 Audits Conducted
  - ✓ Three (3) 1996 Audits Planned
- ❖ Sub-Vendor Audits
  - ✓ 1995 Audits - Creusot Loire and JSW
  - ✓ 1996 Audits - Sumitomo and Schultz

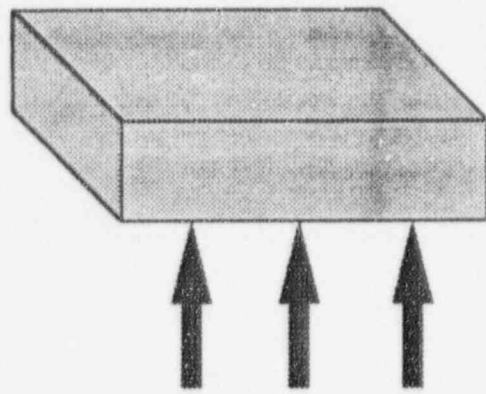


## *Engineering/Installation*

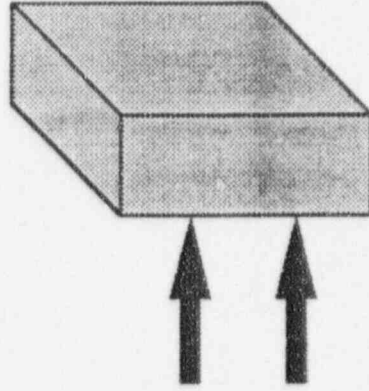
- ❖ Engineering Reviews
  - ✓ Framatome
  - ✓ Bechtel
- ❖ Installation Oversight Planning
  - ✓ Braidwood/Byron Interface
  - ✓ Benchmarking



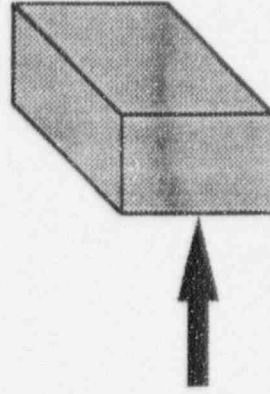
# *Quality "Defense in Depth" Model*



Individual  
Worker



BWI  
QC/QA



ComEd  
Quality  
Oversight