UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555

March 27, 1992

Docket No. 50-338

LICENSEE: Virginia Electric and Power Company (VEPCO)

FACILITY: North Anna Power Station, Unit No. 1 (NA-1)

SUBJECT: MEETING SUMMARY OF MARCH 23, 1992

A meeting was held on March 23, 1992 with representatives of the NRC and VEPCO to discuss the NA-1 steam generator replacement program (SGRP). A brief portion of the meeting was of a proprietary nature and is not discussed in this meeting summary. An attendance list is provided in Enclosure 1. Handouts provided by VEPCO are provided in Enclosure 2.

VEPCO stated that the NA-1 SGRP is scheduled to commence in January 1993 and would be completed in 130 days. However, alternate scheduling is being developed to be able to commence the SGRP in November 1992.

A conceptual study of the NA-1 SGRP commenced in January 1987. Also, in 1987 VEPCO evaluated the use of the Seabrook Unit 2 Model F SG for NA-1. In May 1989, SG negotiations were initiated with Westinghouse Electric Corporation and in August 1989, a contract was awarded to Bechtel Corporation for the Phase I engineering and licensing. In November 1989 a purchase order was awarded to Westinghouse Electric Corporation for the NA-1 replacement steam generators. In February 1992, the pre-SGRP outage plant modifications were completed and a contract was awarded to Bechtel in March 1992 for Phase II construction. The cost of replacing the NA-1 SGs will be approximately $185 million.

The licensee stated that the original NA-1 design basis is not changed. The new SGs remain within original design parameters and any changes from the original SGs are enhancements. In addition, there will be no impact on the containment since the SG lower bundles will pass through the equipment hatch. Finally, existing accident analyses are anticipated by the licensee to be unaffected. Since the licensee has not identified any unreviewed safety questions they plan to perform the SGRP under 10 CFR 50.59.

Plant changes include replacing the lower assembly SG tube bundles and making changes in the steam flow limiters to increase safety margins. Pipe whip restraints will be removed since they will no longer be required and thermal insulation will be replaced to provide better performance.

SGRP design enhancements will replace the current mill-annealed Alloy 600 tubing with thermally treated Alloy 690 tubing. The current drilled circular tube hole support plates will be replaced with broached quatrefoil tube hole support plates and the current carbon steel tube support plates will be replaced with thicker stainless steel tube support plates.

DF01
1/1

MEETI..g SUMMARY DATED March 27, 1982

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N. Stinson
OGC
ACRS (10)

There will be no changes in design pressure and temperature. Overall height, U-tube outer diameter and tube wall thickness also will not change. Tube pitch will be changed from 1.281 to 1.225 inches. Also, the number of U-tubes will be changed from 3388 to 3592 and the total heat transfer surface area will be revised from 51,500 to 54,500 square feet.

Improved work techniques for ALARA will include: (1) optical templating which allows extensive pre-fabrication outside radiation areas, (2) remote video coverage and remote welding and milling equipment, (3) full channel head, nozzle, and loop piping mock-up to acquaint personnel with actual SGR work items; and (4) low dose rate waiting and staging areas. Industry experience in SGR for ALARA has been studied regarding management organizations, welding, radiation protection and training.

A documented SGRP quality assurance (QA) plan will provide interface with contractor programs for QA strategy, QA organization, QA verification and QA non-conformance/corrective action. A dedicated, independent VEPCO QA team will provide oversight to all activities associated with the SGRP, to hold contractors accountable and, if necessary, initiate stop work procedures.

The last item discussed in the meeting was the SG storage/research facility. The replaced lower SG sections will be stored on site in a concrete structure. In addition, one SG will be maintained in an accessible area for research and development (R&D). The remaining two SGs will be isolated in a closed area. VEPCO will initiate and invite industry participation in R&D effort which includes: (1) investigation of new non-destructive test methods for SG tube examination qualification and probe testing; (2) SG tube pulls for degradation studies and burst pressure testing; and (3) evaluate tube repair technologies, such as laser weld repair and new sleeving techniques.

Leon B. Engle, Project Manager
Project Directorate II-2
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Enclosures:
1. Attendance List
2. North Anna 1 SGRP

cc w/enclosures:
See next page

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Document Name NA1.MTS

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Mr. W. L. Stewart
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ENCLOSURE 1

Attendance List

Meeting With VEPCO

March 23, 1992

NA-1 SG REPLACEMENT PROGRAM

NRC

H. Berkow
N. Economos
L. Engle
K. Karwoski
G. Lainas
E. Merschoff
R. Musser
D. Naujack
S. Ninh
J. Partlow
M. Sinkule
N. Stinson

D. Taylor
S. Varga
J. Wiggins

VEPCO

R. Bayer
M. Bowling
R. Carter
M. Gettler
L. Hartz
J. Lee
J. Stall
W. Stewart

BECHTEL

M. Barth

SOUTHERN TECHNICAL SERVICES

L. Connor

Laser Weld - Direct Tube Repair (DTR)

Restoration of the tube wall degraded by ID or OD indications
to a condition greater than the plugging limit
by controlled remelting of tube wall from ID surface

Fillerless (autogeneous)

overlapping spiral weld
no filler material

Consumable Insert

fusing insert of selected
material to existing tube wall

BEND DRW

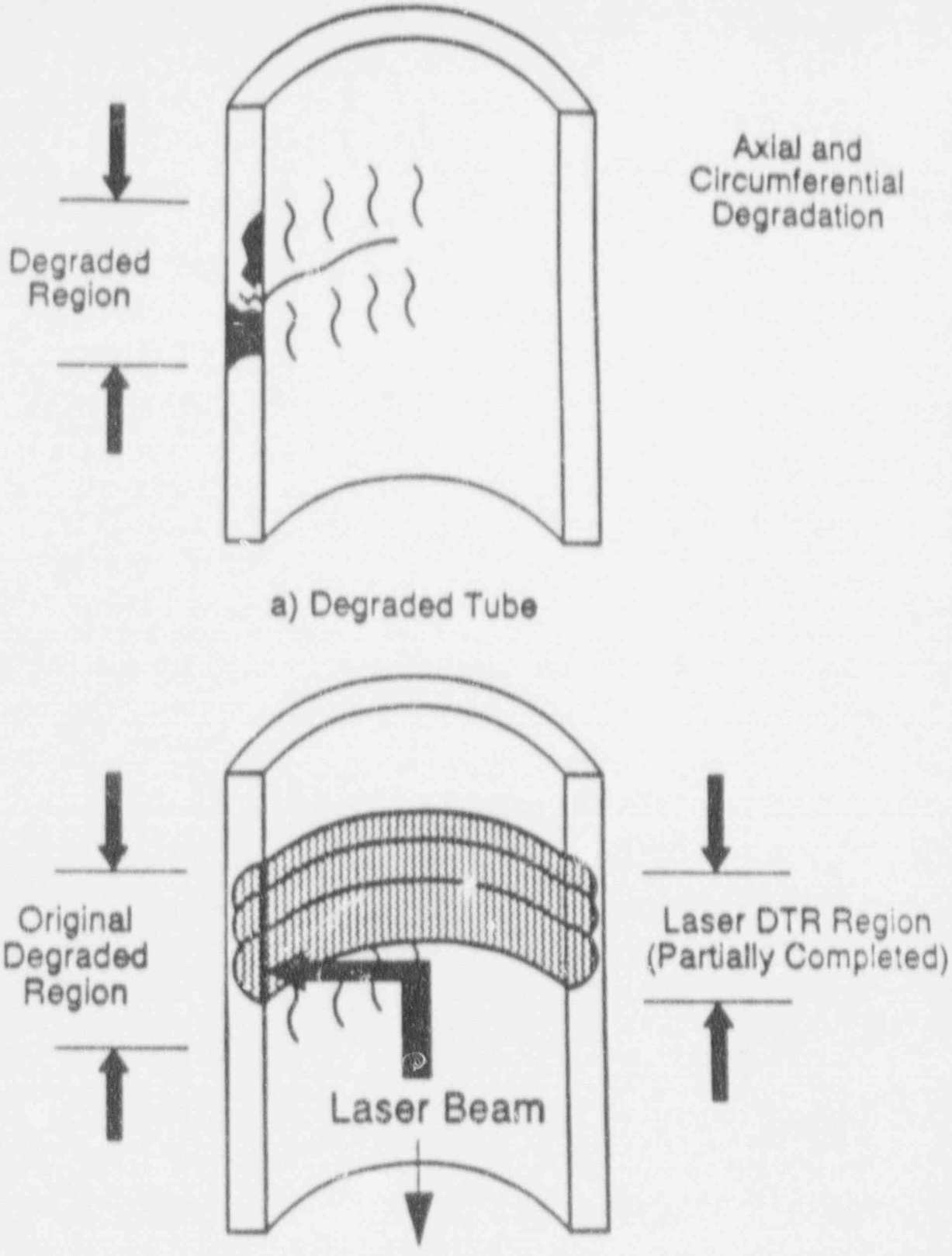


Illustration of Direct Tube Repair (DTR) by Laser Welding.

TECHNIQUE INCENTIVES

Reduced Cost

No sleeve inventory or associated cost

Enhanced Productivity

Fewer process steps

Enhanced Inspectability

No sleeve induced effects

Minimal Impact on Generator Preformance

No sleeve flow/thermal effects

Versatility

Apply in any location including above existing sleeves

Address axial or circumferential indications

Address primary or secondary side initiation

WSTC DGR PROGRAM

1990 PROGRAM

- Laser Stress Relief
- Direct tube repair
- Consumable insert evaluation

TEST ARRANGEMENT

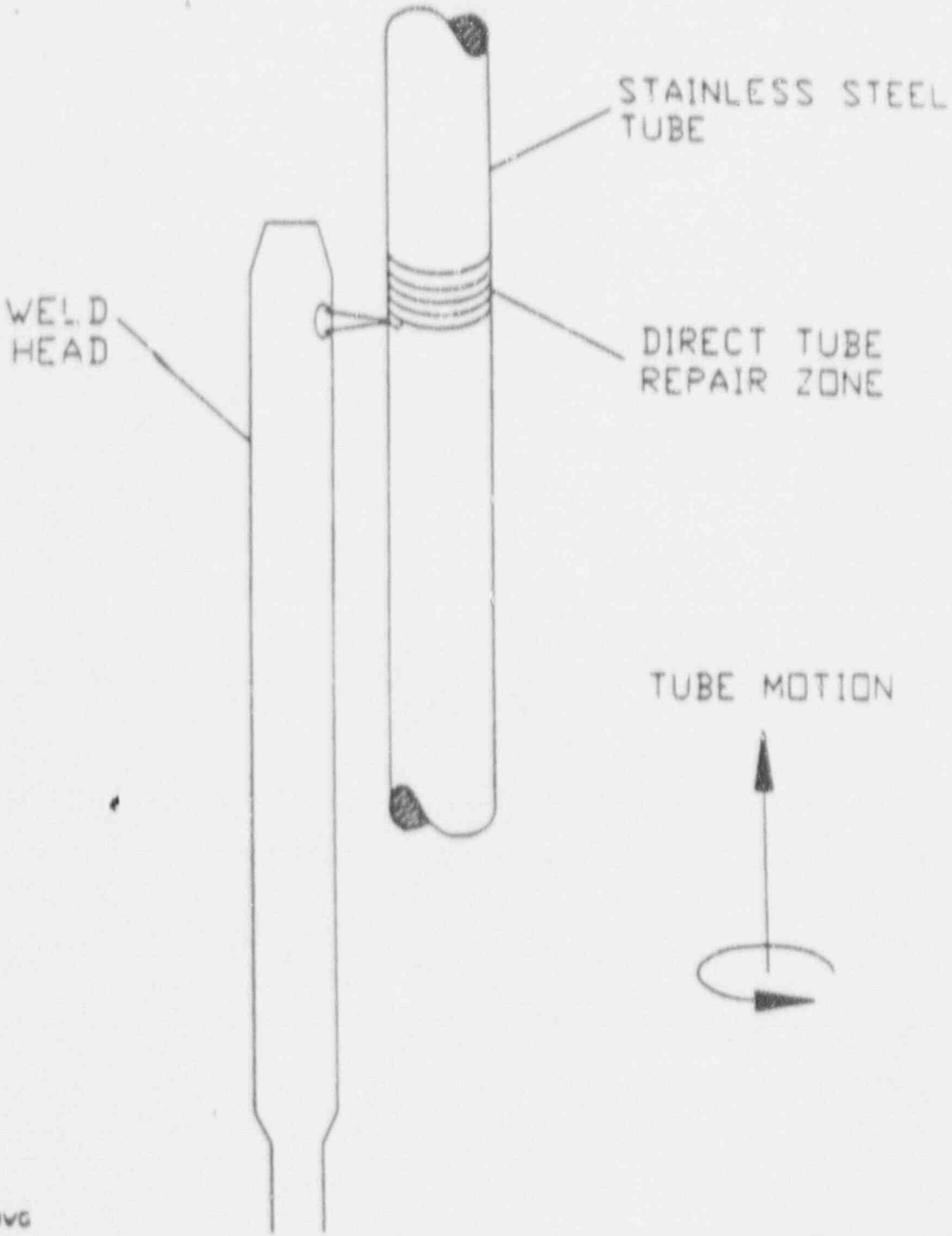
- Raytheon YAG laser
- CO_2 laser weld head
- Perform repair welds on tube OD
- Repair welds on stainless steel tubing

CONCLUSIONS

- No apparent success in stress reduction
- Favorable results with direct tube repair and and the use of consumable inserts

DR20FAR3.DRW

SCHEMATIC
WSTC TEST ARRANGEMENT



1991 DGR PROGRAM

PROGRAM OBJECTIVE

Assess feasibility of steam generator tube repair with the Westinghouse fiber optic YAG laser system

PROGRAM STEPS

Define Test Program

Assemble Test Equipment at ATRC

Conduct Feasibility Weld Studies

Preliminary Corrosion and Mechanical Tests

Define Initial Parameter Range

Evaluate Tooling Modifications

Feasibility Test Report

10155NE4.DRW

DTR FUNCTIONAL REQUIREMENTS

1. DIMENSIONAL REQUIREMENTS

   Axial repair length - 0.50 inches

   Penetration depth - 10% to 80% of tube wall

   Tube diameter - 0.875 OD

2. REPAIR APPLICABILITY

   Anywhere in tube straight length

   Acceptable for axial or circumferential indications

   Acceptable for Alloy 600 and 690 material

   Applicable to primary or secondary side initiation

   Applicable to fixed or free tubes

   Applicable for sleeve recovery

   Applicable for plug recovery

920FAR6.DRW

DTR FUNCTIONAL REQUIREMENTS

3. ENVIRONMENTAL REQUIREMENTS

Compatible with non honed tubes

Tolerant of SCC environment

Unaffected by secondary side conditions

4. INSPECTION

Compatible with existing Eddy Current techniques

Compatible with Ultrasonic inspection

5. TOOLING

Compatible with existing tooling and delivery systems

6. OTHER

Consistent with existing Codes and standards

920FAR7.DRW

WELD STATUS

Completed 150 control welds plus equal amount in samples

EXTENT OF INVESTIGATION

Laser parameters vs. penetration depth

Overlap studies

Repair axial length

Gas flow (quantity and orientation)

Weld quality (porosity, etc)

Simulated axial and circumferential indications

Surface vs inspectability

Tube oxidation (internal and external)

Tube fixed conditions

Freespan and simulated tubesheet samples

Secondary side moisture

Weld thermal profiles

Stress relieved and non-stress relieved

Weld technique

ASME CODE STATUS

Submitted code case against 1989 addendum of Section XI - IWB-4330 (1989 edition) to address testing, qualification and NDE - August 1991

BASIS FOR ACTION:

1. Code Case N-395 for laser welding without filler metal applied and accepted by ANI for use in steam generator repairs
2. IWB-4330 allows fusion welding without filler metal
3. Section XI evaluating, possible adopting welding over piping

CURRENT STATUS:

Submitted to working group on repairs and special repair processes

Comments received from committee

Code Case to be revised & resubmitted at October 1991 meeting

920FAR15.DRW

ADDITIONAL ACTIONS:

- Tooling Mods
  - Address translation/rotation
  - Gas flow distribution
  - Weld insert design
- Process Optimization
- Mechanical Tests
  - Tensile tests
  - Burst tests
  - Fatigue tests
  - Defect propagation tests
- Corrosion Tests
  - Primary/secondary
  - Defect propagation tests
- NRC Presentation - issue resolution
- ASME Code acceptance
- WCAP Preparation

CONCLUSIONS:

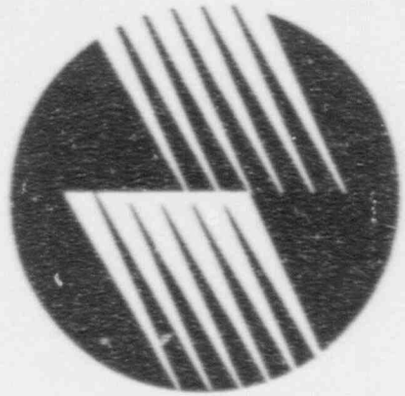
Make controlled, repeatable welds of uniform cross section with sufficient length to address axial and circumferential tube wall degradation

Welds can address primary and secondary side indications

Welds can be inspected by ECT

Corrosion performance similar to sleeve weld

R20FAR20.DRW



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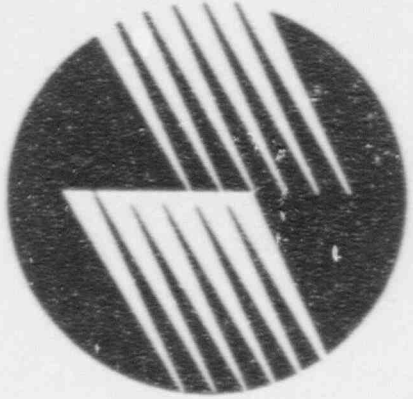
North Anna Unit 1
Steam Generator Replacement Project

March 23, 1992

NORTH ANNA 1 SGRP

ENCLOSURE 2



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Introduction

W. L. Stewart
Senior Vice President - Nuclear

VIRGINIA POWER

North Anna Unit 1
Steam Generator Replacement Project Meeting

Agenda

March 23, 1992

Introduction	W. L. Stewart
Project Overview	M. W. Gettler
Project Engineering	R. K. Bayer
Operational Considerations	J. A. Stall
SGRP Quality Assurance Plan	L. N. Hartz
Licensing Issues	M. L. Bowling
Steam Generator Storage / Research Facility	W. L. Stewart

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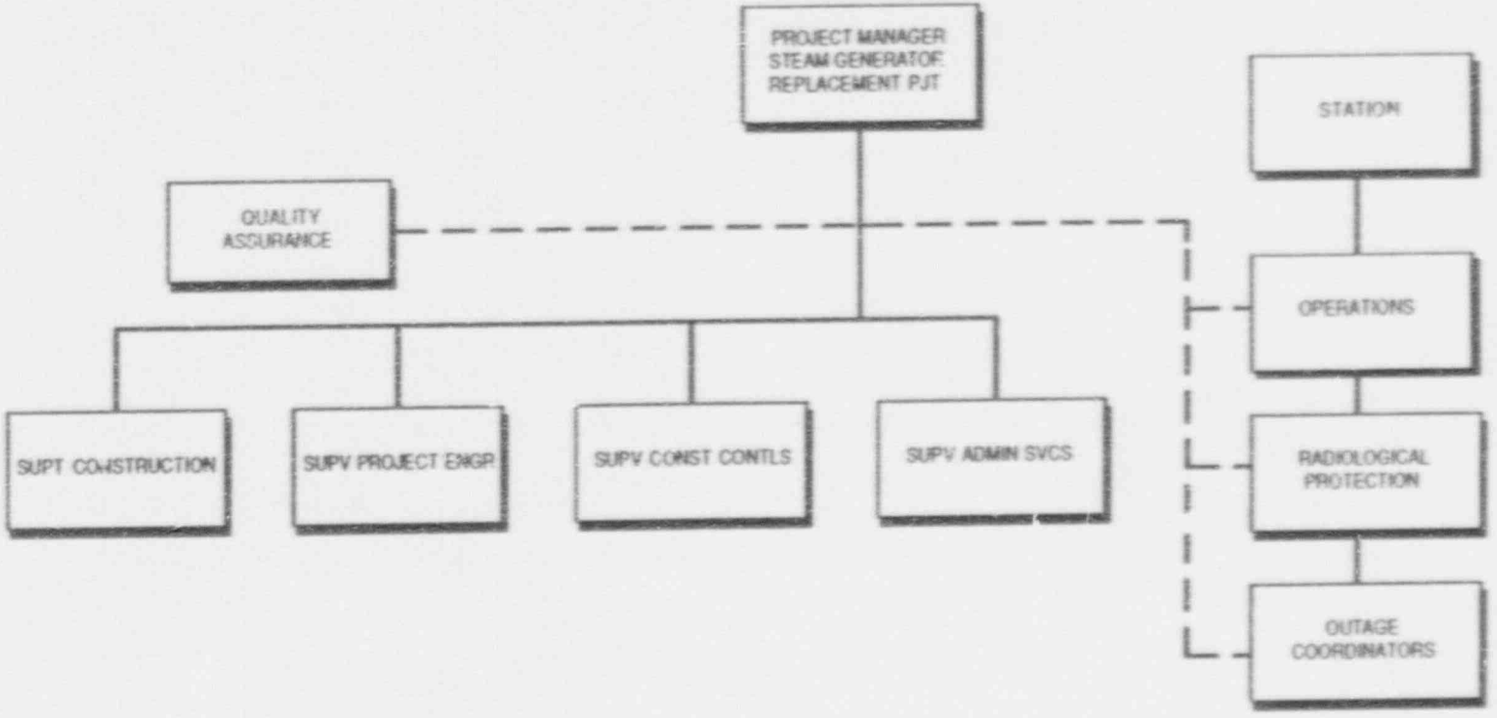
Project Overview

M. W. Gettler
SGRP Project Manager

Project Overview

- Project Management and Organization
- Project History
- Project Description
- Construction Management
- ALARA
- Industry Experience

Steam Generator Replacement Organization Chart



Project History

Jan 1987	Conceptual Study for North Anna Unit 1 SGR
Nov 1987	Seabrook Unit 2 Model F SG Evaluation for NAPS Unit 1
May 1989	S/G Negotiations Started with Westinghouse
Aug 1989	Contract Awarded - Phase 1 Engineering and Licensing (Bechtel)
Nov 1989	P.O. Awarded - Replacement Steam Generators (Westinghouse)
Feb 1992	Pre-SGR Outage Plant Modifications Completed
Mar 1992	Contract Awarded - Phase II Construction (Bechtel)

Project Description

- Videotape

- Plant Changes

  - Steam Generator Lower Assembly
    (Replaced due to Degradation)

  - Steam Flow Limiter
    (Increased Safety Margin)

  - Pipe Whip Restraint Removal
    (Work Efficiency - No Longer Required)

  - Thermal Insulation
    (Better Performance)

Construction Philosophy

- Manage Interface and Contractor
- Hire Experienced SG Replacement Contractor
- Innovative Incentives For:
  - Safety
  - Quality
  - ALARA (Dose & PCEs)
  - Schedule

ALARA

- Improved Work Techniques / Practices
  - Optical Templating Allowing Extensive Pre-Fabrication Outside the Radiation Areas
  - Remote Welding and Milling Equipment
  - Remote Video Coverage
  - Scheduling to Maintain SG Secondary Sides Full for As Long As Practical
  - Full Channel Head, Nozzle, and Loop Piping Mock-up
  - Extensive Decontamination Effort
  - Low Dose Rate Waiting and Staging Areas

ALARA

- Source Term Reduction
  - Boric Acid Flush (2000 PPM > 350°F) Upon Shutdown
  - RTD Bypass System Removal
  - RC Pipe End Decontamination
  - RC Pipe End internal Shielding

  } Projected DF ≥ 15

  - RC Pipe and General Area Shielding

Industry Experience

- Utility SGR Interfaces

Utility	Plant
Florida Power & Light	Turkey Point
Wisconsin Electric Power	Point Beach
Carolina Power & Light	H. B. Robinson
New York Power Authority	Indian Point 3
American Electric Power	D. C. Cook
Consumers Power	Palisades
Swedish State Power Board	Ringhals 2
Consolidated Edison of New York	Indian Point 2
Northeast Utilities	Millstone 2
South Carolina Electric & Gas	V. C. Summer
Alabama Power	Farley

- Issues Studied
  - Management Organizations
  - Welding
  - Radiation Protection (Organization & Approach)
  - Training

Project Objectives

- No Unreviewed Safety Questions
- Dose < 660 Man-Rem
- Performance - SG Meet Design Specification
- Schedule ≤ 130 Days
- Cost < $185 Million

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Project Engineering

R. K. Bayer
SGRP Engineering Supervisor

Project Engineering

- Nuclear Engineering Organization and Interfaces
- Engineering Approach
- Safety Evaluation Report Status and Preliminary Results

Project Engineering

- Organizations Involved
  - Virginia Power
    (Management / Nuclear Safety Analysis)
  - Bechtel Power
    (Engineering for SG Replacement)
  - Stone & Webster Engineering Corporation
    (A/E of Record for North Anna Power Station)
  - Westinghouse Electric Corporation
    (Designed Original and Replacement Steam Generators)

Virginia Power is the Engineering Manager

- Virginia Power Procures All Permanent Plant Equipment
- Evaluates Industry Experiences
- Project Manual to be Developed to Describe Engineering Support and Other Project Interfaces During Construction

Engineering Approach

10 CFR 50.59 Replacement (No Unreviewed Safety Questions)

- Original design basis not changed
  - Steam generator overall performance
  - Within original design parameters
- Changes from the original steam generator are enhancements
- No impact on the containment since the steam generator lower bundle will go through the equipment hatch
- Westinghouse is supplier of both original and replacement equipment
- Existing accident analyses anticipated to be unaffected

Replacement Steam Generator Design Enhancements

Original Model 51	Model 51 F
Cast Channel Head	Forged Channel Head
Fabricated and Welded Shell Barrels	Seamless Forged Shell Barrels
Fabricated and Welded Transition Cone (3 Segments) without End Stand	Seamless Forged Transition Cone with Cylindrical End Stand
Mill-Annealed Alloy 600 Tubing (3388 U-Tubes)	Thermally Treated Alloy 690 Tubing (3592 U-Tubes)
Carbon Steel Tube Support Plates	Thicker Stainless Steel Tube Support Plates
Drilled Circular Tube Hole Support Plates	Broached Quatrefoil Tube Hole Support Plates

Comparison of Steam Generator Design Data

	Original	Replacement
Design Pressure, Primary / Secondary, psig	2485 / 1085	NC
Design Temperature, Primary / Secondary, °F	650 / 600	NC
Overall Height, ft-in.	67-8	NC
U-tube OD, in.	0.875	NC
Tube Wall Thickness (nominal), in.	0.050	NC
Tube Pitch, in.	1.281	1.225
Number of U-Tubes	3388	3592
Tube Length, average effective length, ft-in.	66-4	66-3
Total Heat Transfer Surface Area, sq ft.	51,500	54,500

Virginia Power Design Control Process

- Design Change Package
  - Engineering Review and Design - (STD-GN-0001)
  - Programs Review
  - Drawings List
  - Materials List
  - Testing Procedures
  - Activity Screenings and Safety Evaluations - (VPAP-3001)

Status of Design Change Package

- Design Engineering 95% Complete
- Evaluating Use of Blanket-Type Insulation
- Westinghouse Generating Mass and Energy Release Rate Data for Recalculation of the Large Break LOCA
- Accident Analyses Being Performed by Virginia Power and Stone & Webster
- Preliminary Stress Analyses Completed for S/G and RCP Supports, S/G Nozzles and Loop Piping, and Branch Piping - Final Stress Analyses to be Based on Confirmatory As-Built Dimensions
- Design Change Package to be Completed by July 1992

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Operational Considerations

J. A. Stall
Assistant Station Manager

Operational Considerations

- Outage Planning
- Shutdown Monitoring During SGRP
- Startup Assessment
- Post Modification and Power Ascension Testing

Outage Planning

- Normal outage modification considerations remain in place
  - SNSOC
  - Radiological Protection Interface
  - Operations Interface
- Normal outage practices remain in place
  - Cleanliness Reviews
- Normal operational restrictions prohibit outage evolutions that reduce margin of safety
  - Defense in Depth
- Nuclear Safety Policy and Standard ensure expectations and objective for maintaining nuclear safety during outage

Shutdown Monitoring During SGRP

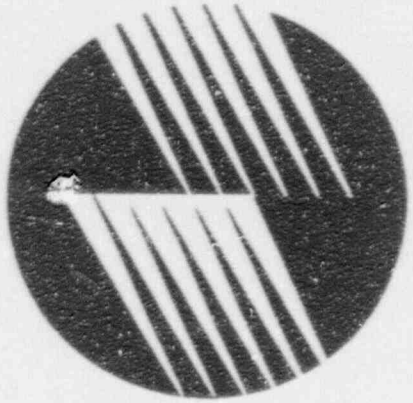
- SGRP work will be closely monitored to ensure construction activities do not have an adverse effect on other systems or the other operating unit
- All fuel assemblies will be removed from vessel and stored in the spent fuel pool
- Additional emphasis will be given to monitoring status of spent fuel pool support system and equipment
- Daily outage meetings

Startup Assessment

- Systematic and comprehensive self assessment prior to restart with emphasis on matters related to replacement of S/Gs
- Detailed technical review of project to be completed prior to declaration of operability
- Functional areas assessed include all appropriate areas and departments
- Action plan for resolution prior to restart for noted deficiencies
- Formal authorization required for restart

Post Modification And Powe Ascension Testing

- Ultrasonic Testing of ISI Welds (Baseline Inspection)
- Radiography of RCS Loop Welds / Girth Weld
- Type A Testing of Containment Building
- Moisture C. ryover Test
- Primary Side Steam Generator System Pressure Test
- Secondary Side Steam Generator Hydrostatic Test
- Small Bore Piping Hydrostatic Test



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SGRP Quality Assurance Plan

L. N. Hartz
Manager - Quality Assurance

SGRP Quality Assurance Plan

Quality plan designed to meet Quality Assurance objectives for the replacement steam generator activities

- Ensure that the activities are conducted in accordance with specified requirements
- Provide a proactive system of Quality Assurance through planning, organization, and team work
- Inform appropriate management of Quality status in a timely manner

SGRP Quality Assurance Plan

Documented Quality Plan to provide interface with contractors program and instructions for Virginia Power QA activities

- QA Strategy
- Organization
- Verification
- Non-Conformance / Corrective Action

Strategy

- Quality built in - not inspected in
- Management and Project Team dedicated to Quality

Organization

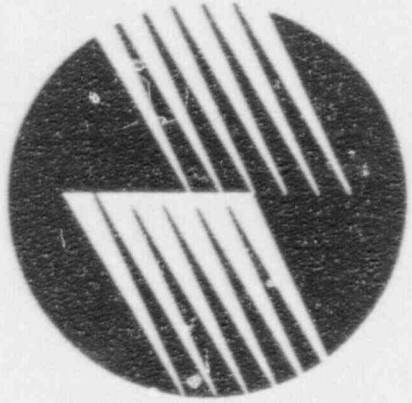
- Contractor responsible to Virginia Power for QA/QC activities
- Dedicated Virginia Power SGR QA Oversight Team

Verification

- Audit Contractors QA Program
- Surveillance of Activities in Progress
- Customer / ANII Notification Point Inspections

Non-Conformance / Corrective Action

- Contractor Accountable
- Project Specific Escalation / Stop Work Procedure



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Licensing Issues

M. L. Bowling
Manager - Nuclear Licensing and Programs

Licensing Approval

- Since no unreviewed safety questions are identified and no Technical Specifications are changed, SGRP will be performed under 10 CFR 50.59

Interaction With NRC

- Design Change Package and Overall Safety Evaluation Report will be completed by August 1992
- Region II Inspections
- NRC Project Manager Status Updates
- UFSAR will be Updated

VIRGINIA POWER

Steam Generator Storage / Research Facility

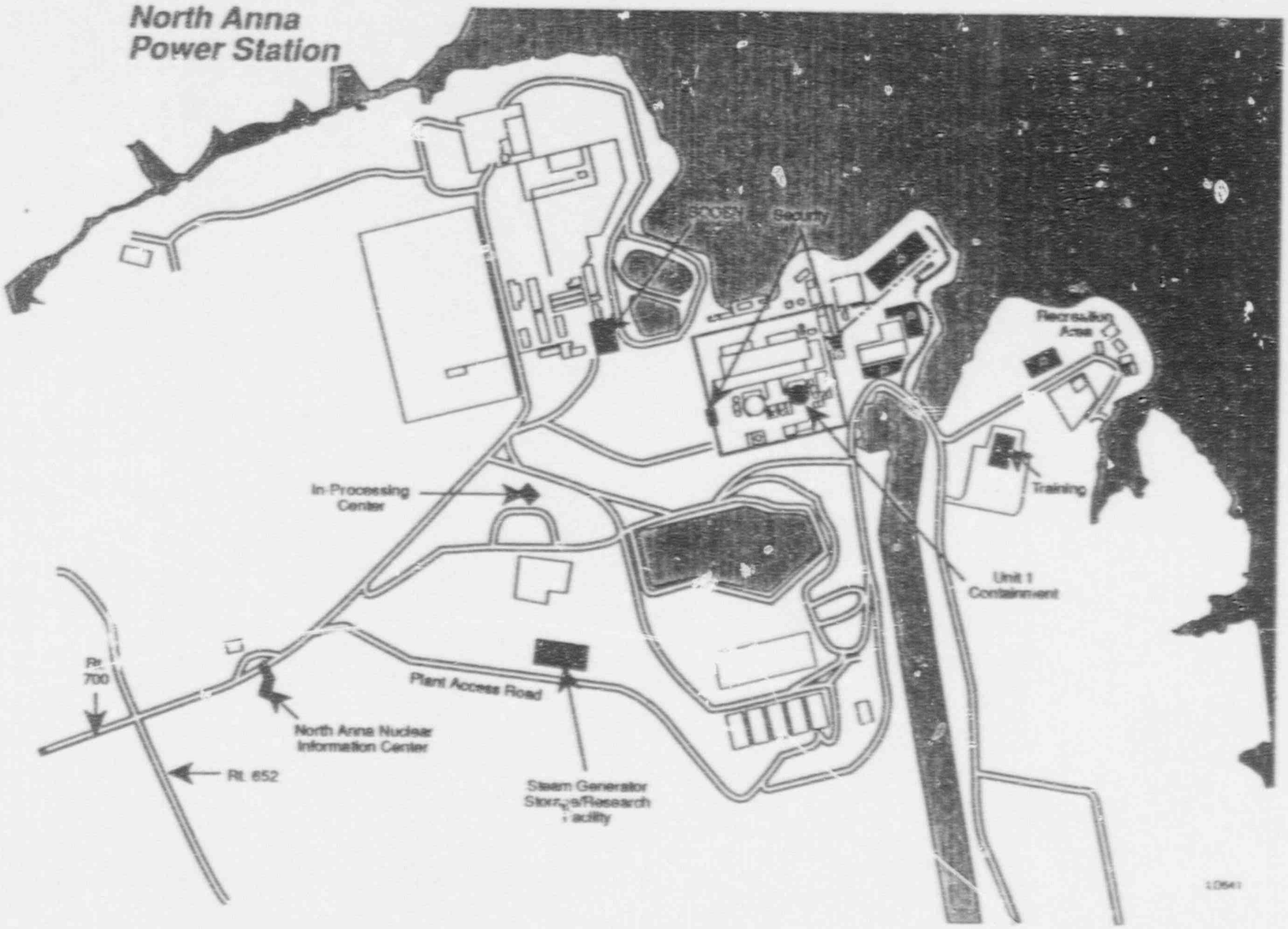
W. L. Stewart
Senior Vice President - Nuclear

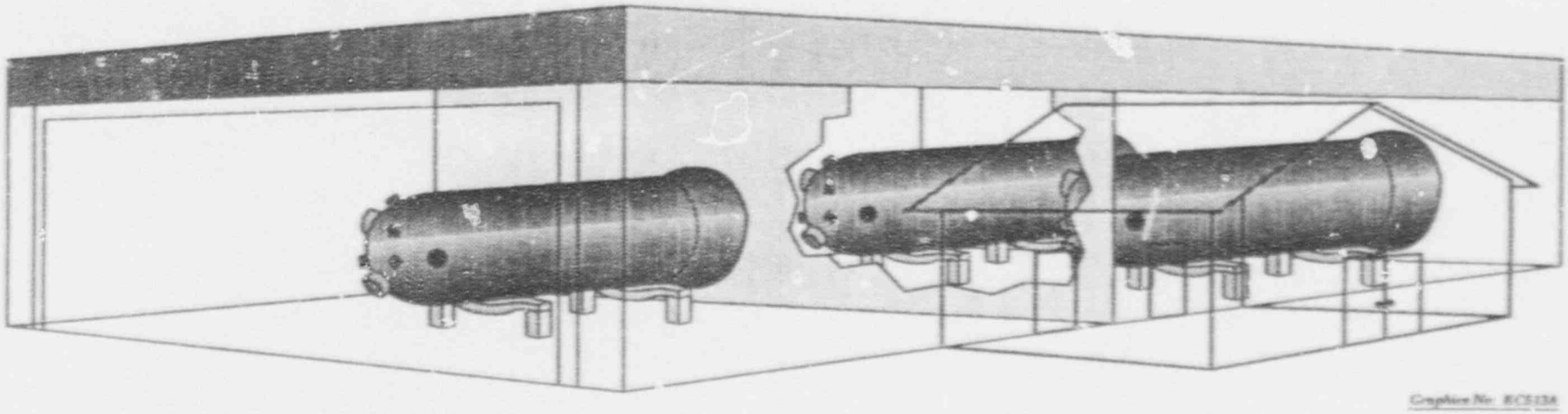
Steam Generator Storage / Research Facility

- Objectives
- General Arrangement
- Long Term Storage

Objectives

- Safe on-site storage of old steam generators
- Maintain one S/G accessible for R&D and remaining two S/Gs in closed compartment
- Invite industry participation in R&D effort
- Research / Testing Plans
  - Investigate new non-destructive NDE methods for tube examination qualification and probe testing
  - Tube pulls for degradation studies and burst pressure testing
  - Evaluate tube repair technologies such as laser weld repair and new sleeving techniques
- Use of R&D data for possible application to North Anna Unit 2


North Anna
Power Station
Security
Recreation
Area
Training
In-Processing
Center
Unit 1
Containment
Rt
700
Plant Access Road
North Anna Nuclear
Information Center
Rt 652
Steam Generator
Storage/Research
Facility



Graphics No. 8C5134

STEAM GENERATOR STORAGE BUILDING