

July 24, 1992

Docket Nos. 50-313
50-368
50-382
50-416

LICENSEE: Entergy Operations, Inc.

FACILITIES: Arkansas Nuclear One, Units 1 and 2 (ANO-1&2)
Waterford Steam Electric Station, Unit 3
Grand Gulf Nuclear Station

SUBJECT: SUMMARY OF A MEETING ON JULY 16, 1992, WITH ENTERGY OPERATIONS' ENGINEERING MANAGEMENT

On July 16, 1992, members of Entergy Operations' engineering management briefed NRC management and staff on engineering activities at the facilities listed above. Meeting attendees are listed in Enclosure 1. Slides presented by Entergy are in Enclosure 2.

As this was an information meeting, the discussion consisted mainly of the licensee's presentation and questions or comments from the NRC staff. Some of the more interesting topics were 1) the formation of engineering peer groups to address certain issues, 2) the alternate AC power source project and the possibility of dry storage of spent fuel at ANO-1&2, 3) the recirculation pump and lightning mitigation activities to reduce the number of scrams at Grand Gulf, 4) the chemical and volume control system inspection and the new generation support building at Waterford 3, and 5) the implementation of advanced nodal physics methods at Echelon.

Original signed by:

Thomas W. Alexion, Project Manager
Project Directorate IV-1
Division of Reactor Projects - III/IV/V
Office of Nuclear Reactor Regulation

Enclosures:
As stated

cc w/enclosure:
See next pages

NRC FILE CENTER COPY

DISTRIBUTION:

Docket File	NRC & Local PDRs	PD4-1 Reading	TMurley/FMiraglia
JParti w	BBoger	MVirgilio	JLarkins
TAlexion	SPeterson	PO'Connor	DWigginton
PNoonar	OGC	EJordan	ACRS (10)
JWechselberger	SShankman	JJohnson, RII	ABBeach, RIV
BDLiaw	EEmbros	GJohnson	HConrad
KParczewski	GHornseth	KCLew	GCwalina

OFC	LA:PD4-1	PM:PD4-1	PM:PD4-1	PM:PD4-1	D:PD4-1
NAME	PO'Connor	TAlexion	DWigginton	PO'Connor	JLarkins
DATE	7/17/92	7/22/92	7/22/92	7/23/92	7/24/92

OFFICIAL RECORD COPY Document Name: eoi71692.mts

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PDR ADDCK 05000313
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Original signed by:

Thomas W. Alexion, Project Manager
Project Directorate IV-1
Division of Reactor Projects - III/IV/V
Office of Nuclear Reactor Regulation

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NAME	PNoonan	TAlexion	DWigginton	PO'Connor	JLarkins
DATE	7/19/92	7/22/92	7/22/92	7/22/92	7/24/92



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

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A handwritten signature in cursive script that reads "Thomas W. Alexion".

Thomas W. Alexion, Project Manager
Project Directorate IV-1
Division of Reactor Projects - III/IV/V
Office of Nuclear Reactor Regulation

Enclosures:
As stated

cc w/enclosure:
See next pages

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Grand Gulf Nuclear Station

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Jackson, Mississippi 39201

President,
Claiborne County Board of Supervisors
Port Gibson, Mississippi 39150

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Frank Spencer, Asst. Attorney General
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ENERGY ENGINEERING ACTIVITIES MEETING

JULY 16, 1992

<u>NAME</u>	<u>ORGANIZATION</u>
B. Berger	NRC/NRR/DRPW
B. D. Liaw	NRC/NRR/DET
E. Imbro	NRC/NRR/RSIB
G. Johnson	NRC/NRR/EMCB
D. Wigginton	NRC/NRR/PDIV-1
H. Conrad	NRC/NRR/EMCB
K. Parczewki	NRC/NRR/EMCB
G. Hornseth	NRC/NRR/EMCB
K. C. Lew	NRC/NMSS/SCDB
G. Cwalina	NRC/NRR/RVIB
T. Alexion	NRC/NRR/PDIV-1
F. Titus	Entergy/V.P.-Eng.
W. Eaton	Entergy/ANO
D. Pace	Entergy/GGNS
J. Houghtaling	Entergy/W-3
C. Franklin	Entergy/Echelon
J. Smith	Entergy/Echelon
H. Kook	Entergy/OPS Support-Licensing

DESIGN ENGINEERING

JULY 16, 1992



**Entergy
Operations**

FRED TITUS - VICE PRESIDENT, ENGINEERING

AGENDA

1. OVERVIEW

FRED TITUS

2. SITE INITIATIVES:

- ANO
- GRAND GULF
- WATERFORD-3
- ECHELON

BILL EATON
DAN PACE
JOHN HOUGHTALING
BEN FRANKLIN

3. TECHNICAL TOPICS:

- HIGH LEVEL WASTE
STORAGE
- STEAM GENERATOR
RELIABILITY
- PROCUREMENT ENGINEERING
- BWR CORE STABILITY
- BWR IGSCC MITIGATION

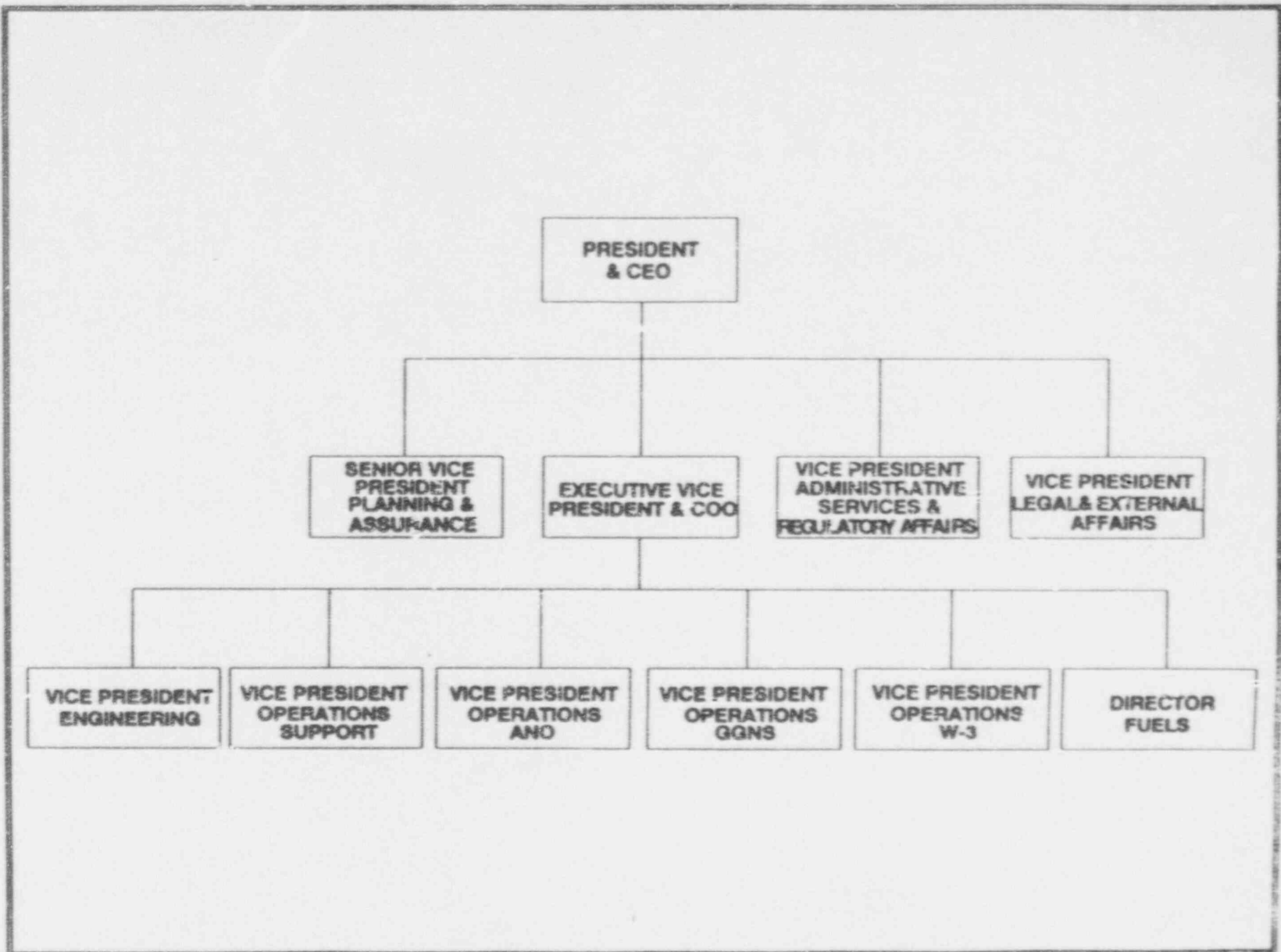
BILL EATON

BILL EATON

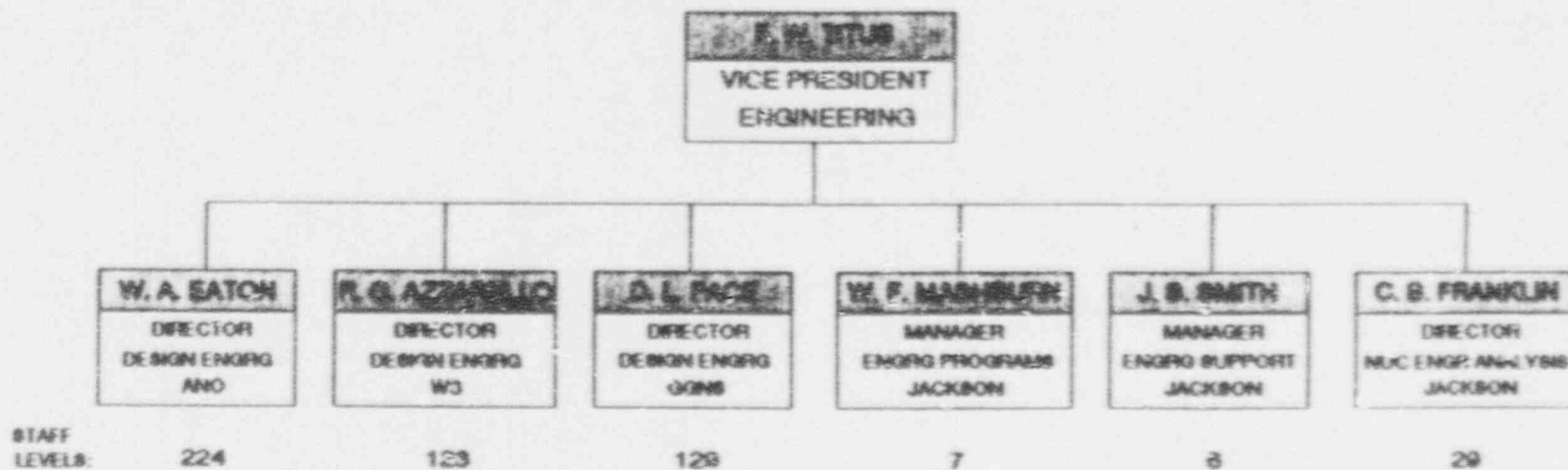
JOHN SMITH
BEN FRANKLIN
DAN PACE

4. CLOSING/COMMENTS

ALL



DESIGN ENGINEERING



DESIGN ENGINEERING STAFF LOCATION:

- SITE 92%
- JACKSON 8%

MAJOR 1991 ACCOMPLISHMENTS

- **JACKSON PIPING GROUP DECENTRALIZED**
- **NUCLEAR ANALYSIS DEPARTMENT ASSESSMENT**
- **ESTABLISHED ENGINEERING PROGRAMS AND SUPPORT GROUPS**
- **WATERFORD 3 ENGINEERING SELF ASSESSMENT**
- **ANO UNIT 2 ELECTRICAL SELF-ASSESSMENT**
- **COMPREHENSIVE PROCUREMENT INITIATIVE**
- **WATERFORD 3 CONSOLIDATION OF ELECTRICAL/I&C**
- **GRAND GULF SAFETY ANALYSIS GROUP**
- **ESTABLISHED 16 ENGINEERING PEER GROUPS**
- **LOW ENGINEERING TURNOVER**

APPROVED ENGINEERING PEER GROUPS AND MEMBERS

PEER GROUP	MANAGEMENT SPONSOR	ANO	ECHELON	CGNS	W3
Training	W.F. (Bill) Mashburn (801)984-9385	Darrell Williams (L) (501)984-8668	Bob Lang (601)984-9450	Dennis Berryhill (801)437-6248	Kumar Prasankumar (504)739-6422
Fire Protection	W.F. (Bill) Mashburn (801)984-9385	Ron Pispoli (501)984-8915	TBD	Emmett Roan (L) (801)437-6395	Tim Motey (504)739-8550
Piping Stress and Support	W.F. (Bill) Mashburn (801)984-9385	Bill Greeson (L) (501)984-8350	K.R. Rao (801)984-9413	Scott Martin (601)437-6253	Joe Abisamra (504)739-6471
Motor and Air Operated Valves	W.F. (Bill) Mashburn (801)984-9385	Bill Rogers (501)984-8316	K.R. Rao (801)984-9413	Jeff Wright (L) (801)437-6229	Clay Sulich (504)739-6435
Electrical Design including Electrical portion of Appendix R Station Blackout, DC Voltage Drop, R.G-1.75	W.F. (Bill) Mashburn (801)984-9385	Glenn Dobbs (501)984-8513	TBD	T. E. Barnett (801)437-6177	P. A. Jackson (504)739-6328
Civil/Mechanical Design	W.F. (Bill) Mashburn (801)984-9385	Flick Lane (501)984-8901	N/A	Danny East/ (801)437-6270 Ravi Dubey (801)437-6227	Bruce Proctor (504)739-6458
Environmental Qualification	W.F. (Bill) Mashburn (801)984-9385	Brian Steinman (L) (501)984-8675	TBD	Gerald Lantz (801)437-6351	Martin Raines (504)739-6687
Seismic Qualification/Structural	W.F. (Bill) Mashburn (801)984-9385	Doyle Adams (501)984-8319	K.R. Rao (L) (801)984-9413	Amir Shahkarami (801)437-626771 Mark Locke (801)437-6271	John Burke (504)739-6250 Marie Rose Gutierrez (504)739-6277
I&C	W.F. (Bill) Mashburn (801)984-9385	Wayne Cottingham (501)984-8526	TBD	Dennis Berryhill (801)437-6248	Richard O'Donnell (L) (504)739-6341
Welding and Inspection - including Section XI, ISI, IST and repair and replacement	W.F. (Bill) Mashburn (801)984-9385	Bill Converse (501)984-8933	Matt Tominey (L) (801)984-9436	Kenny Baker (801)437-6250	Glenn Robin (504)739-6633
Security	W.F. (Bill) Mashburn (801)984-9385	Tom Ott (501)984-8534	TBD	Dub Berfield/ (L) (801)437-6262 Dave Berway (801)437-6179	Tibbs Golladay (504)739-6262
Design Process	W.F. (Bill) Mashburn (801)984-9385	Milton Huff (501)984-8328 Steve Paquette (501)984-8505	N/A	Aziz Khanifar (801)437-6180	Ken McArthur (L) (504)739-6397 David Gray (504)739-6291

APPROVED ENGINEERING PEER GROUPS AND MEMBERS

PEER GROUP	MANAGEMENT SPONSOR	ANO	ECHELON	GGNS	W3
Configuration Management	J.S. (John) Smith (601)984-9380	Deve Bauman (L) (501)964-8461	N/A	Richard Wright (601)437-6254	Ken McArthur (504)739-6397
CAD	J.S. (John) Smith (601)984-9380	Roger Wardlaw (501)964-3453	N/A	Bruce McCall (L) (601)437-6225	Ronald Cummins (504)739-6228
Procurement Engineering	J.S. (John) Smith (601)984-9380	Charlie Tyrone (L) (501)964-8985	TBD	Linda Petterson (601)437-6252	Dale Gallodoro (504)739-6812
Compu. Applications	J.S. (John) Smith (601)984-9380	John Jehlen (L) (501)964-3510	Fred Smith (601)984-9442	Bruce McCall (601)437-6225	Steve Farkas (504)739-6714
PRA/IPE	J.S. (John) Smith (601)984-9380	John Ault (P) (501)964-8673 Mike Lloyd (S) (501)964-8654	TBD	Gary Smith (601)437-6193	Jerry Holman (504)739-6265
Safety Analysis	C.B. (Ben) Franklin (601)984-9430	Jerry Head (P) (501)964-8666 Jay Miller (S) (501)964-8670	Israel Nir (601)984-9443	Mike Withrow (601)437-6247	Jerry Holman/ (504)739-6265 Paul Scard (504)739-6438
Business Practice	J.S. (John) Smith (601)984-9380	Butch Bailey (501)964-8452	Edie Muse (601)984-9392	Randy Trevillion (L) (601)437-6226	Buzz Howard (504)739-6327

L = Leader

1992 CHALLENGES/INITIATIVES

- **ENGINEERING SUPPORT OF PLANT NEEDS**
 - **PLANNED MODIFICATIONS**
 - **REFUELING OUTAGES**
 - **EMERGENT ISSUES**

- **REGULATORY INITIATIVES**
 - **IPE**
 - **IPEEE**
 - **STATION BLACKOUT**
 - **ANO-ALTERNATE AC**
 - **ON-SITE SPENT FUEL STORAGE**
 - **LIFE EXTENSION**
 - **MOV PROGRAM**

- **ORGANIZATIONAL**
 - **ANO-TRANSFER PROCUREMENT ENGINEERING**
 - **CONSOLIDATE FUEL FABRICATION GROUP**
 - **COMPLETE ALIGNMENT OF DESIGN ENGINEERING**
 - **ISSUE DESIGN ENGINEERING DIRECTIVES**

1992 CHALLENGES/INITIATIVES (CONT'D.)

- ENGINEERING PROGRAM ENHANCEMENTS
 - DBD WORK
 - ELECTRICAL CALCULATIONS
 - SETPOINT CONTROL PROGRAM
 - PROCUREMENT ENGINEERING UPGRADES
 - EROSION/CORROSION PROGRAM
 - COMMON WELDING PROGRAM
 - WATERFORD 3 NOZZLE LOAD EVALUATIONS
 - WATERFORD 3 EQ PROGRAM ENHANCEMENTS
 - ANO PIPING ISOMETRIC PROGRAM
 - ANO ELECTRICAL SCHEMATIC PROGRAM
 - ANO BACKLOG ELIMINATION
 - GRAND GULF MECHANICAL CALC REVIEW

- CONTINUE TO IMPROVE DESIGN QUALITY
 - TRAINING
 - IMPROVE DESIGN PROCESS
 - "TOTAL QUALITY"

ANO



**Entergy
Operations**

ANO SITE INITIATIVES

- **DESIGN DOCUMENT RECONSTITUTION**
- **ALTERNATE A/C**
- **WORKLOAD MANAGEMENT**

**ARKANSAS NUCLEAR ONE
DESIGN DOCUMENT RECONSTITUTION**

- **APPROACH**
- **PROJECT SUMMARIES**
- **PROJECT DETAILS**

DESIGN DOCUMENTATION RECONSTITUTION

- ISOMETRIC UPDATE PROJECT - \$30 MILLION

- ELECT. DRAWING UPGRADE PROJECT - \$ 9 MILLION

- DESIGN CONFIG. DOCUMENTATION - \$24 MILLION
 - DESIGN BASIS DOCUMENTS
 - PLANT SETPOINT CONTROL PROGRAM
 - SAFETY ANALYSIS BASIS DOCUMENTS
 - DESIGN CONFIGURATION INFORMATION MANAGEMENT SYSTEM

- TECHNICAL MANUAL REVIEWS - \$ 2 MILLION

- COMPONENT DATA BASE - \$ 2.5 MILLION

- VALVE PROGRAM - \$ 4 MILLION

- COMPONENT LEVEL Q-LIST - \$ 1 MILLION

ISOMETRIC UPDATE PROJECT

- SEISMIC CATEGORY I PIPE & SUPPORTS
- FIELD WALKDOWNS GATHER AS-BUILT DATA
- RECONCILED AGAINST DESIGN BASIS
- NEW CAD DRAWING GENERATED
- DISCREPANCIES IDENTIFIED AND PRIORITIZED

DESIGN CONFIGURATION DOCUMENTATION PROJECT

- UPPER LEVEL DOCUMENTS DEFINE DESIGN CRITERIA, REQUIREMENTS, AND BASES FOR SYSTEMS, STRUCTURES, AND TOPICAL AREAS
- SYSTEM REVIEW CONFIRM CONSISTENCY, COMPLETENESS AND ACCURACY
- INFORMATION SYSTEM PROVIDES EASY ACCESS
- DISCREPANCIES IDENTIFIED AND PRIORITIZED
- SETPOINT BASES RECONSTITUTED WITH IMPROVED CONTROLS FOR 80 MAJOR SAFETY RELATED SYSTEMS
- SAFETY ANALYSIS BASES COMPILED FOR 23 TOPICS/ACCIDENTS
- COMPONENT AND SYSTEM DESIGN BASIS CALCULATIONS DEVELOPED FOR VALVE PROGRAM

STATION BLACKOUT RULE AT ANO

- THE RULE: 10CFR50.63, LOSS OF ALTERNATING CURRENT POWER

- ANO SUBMITTAL OVERVIEW
 - SUBMITTALS FROM APRIL 1989 THRU SEPTEMBER 1990
 - UNIT CROSSTIE PROPOSED WITH USE OF EXCESS CAPACITY OF EDGs

 - SER RECEIVED OCTOBER 1990
 - STATED THAT SUBMITTAL DID CONFORM TO THE RULE

 - SUBMITTALS FROM APRIL 1991 THRU AUGUST 1991
 - PROPOSED AN INDEPENDENT ALTERNATE AC POWER SOURCE

 - SSE RECEIVED OCTOBER 1991
 - ANO'S PROPOSED METHOD OF COPING WITH AN SBO FOUND ACCEPTABLE.

ALTERNATE AC POWER SOURCE PROJECT

- FOUR PHASE PROJECT
 - SCOPING PHASE - COMPLETE
 - CONCEPTUAL DESIGN - EXPECTED COMPLETION, AUGUST 1992
 - DETAILED DESIGN - EXPECTED COMPLETION, DECEMBER 1993
 - CONSTRUCTION - EXPECTED COMPLETION, DECEMBER 1994

ALTERNATE AC POWER SOURCE DESCRIPTION

- AAC BUILDING
- DIESEL GENERATOR
- 4160 KV AAC BUS (UNIT CROSSTIE)

**OPERATIONAL FLEXIBILITY EXPECTED WITH AAC
POWER SOURCE**

- **OPERATING SCENARIOS**
 - **STATION BLACKOUT**
 - **LCO EXTENSION**
 - **LOSS OF OFFSITE POWER**
 - **PEAKING**

- **TOTAL ESTIMATED PROJECT COST**
 - **\$ 7,850,012**

DESIGN WORKLOAD MANAGEMENT

- **INTEGRATION INTO SITE PROCESSES**
- **DEVELOPMENT OF COMMON MANAGEMENT SYSTEMS**
- **ONGOING AND FUTURE INITIATIVES**

INTEGRATION INTO SITE PROCESSES

- RELOCATION OF DESIGN TO SITE

- INTEGRATION INTO SITE MANAGEMENT TEAMS
 - SAFETY REVIEW COMMITTEE
 - PLANT SAFETY COMMITTEE
 - SRC QA & 50.59 SUBCOMMITTEES
 - ALARA MANAGERS COMMITTEE
 - STEAM GENERATOR INTEGRITY COMMITTEE
 - CONDITION REVIEW GROUP
 - PLAN OF THE DAY MEETINGS

- INVOLVEMENT IN SITE QUALITY ACTION TEAMS
 - COST AND PLANNING
 - ENGINEERING DUTIES AND RESPONSIBILITIES

GRAND GULF



**Entergy
Operations**

GRAND GULF NUCLEAR STATION DESIGN ENGINEERING

- **FOCUS**

- **NUCLEAR SAFETY**
- **PLANT SUPPORT (SCRAM REDUCTION)**
- **EMPLOYEE DEVELOPMENT**
- **WORK PROCESS**
- **CONFIGURATION MANAGEMENT**

- **METHODS**

- **HIGH QUALITY TEAM**
- **SELF CRITICAL ATTITUDE**
- **KNOWLEDGE OF OPERATIONS**
- **REDUCED CONTRACTOR USE**
- **MANAGEMENT INFORMATION SYSTEMS**

CONFIGURATION MANAGEMENT STATUS

- **PROGRESS TO DATE**

- **PIPING/SUPPORT CALCS REVIEWED**
- **INSTRUMENT SETPOINT CALCS COMPLETE**
- **ELECTRICAL CALCS COMPLETE IN 1992**
- **SEISMIC QUALIFICATION CENTRAL FILE**
- **LOWER TIER DRAWINGS CURRENT**
- **VENDOR DRAWINGS CURRENT**
- **UPPER TIER DRAWINGS WITHIN 30 DAYS**
- **INSTRUMENT INDEX UPDATED**
- **DESIGN CRITERIA ISSUED**

- **COMPUTER APPLICATIONS**

- **ME101 PIPING ANALYSIS**
- **FAPS SUPPORT CALCS**
- **DAPPER/CAPTOR ELECT CALCS**
- **CABLE/RACEWAY/INSTRUMENT INDEX AUTOMATED**
- **CAD IN ALL DISCIPLINES (MICROSTATION)**
- **DRAWING CONTROL/CALC DATABASES**
- **DREM PIPING NETWORK CALC**
- **STARDYNE FINITE ELEMENT PROGRAM**

CONFIGURATION MANAGEMENT FUTURE FOCUS

- SAFETY ANALYSIS DBD
- GENERAL DESIGN CRITERIA ISSUE
- MECHANICAL SYSTEMS CALC REVIEW
- SPECIFICATION UPGRADE
- ADDITIONAL CONSTRUCTION STANDARDS
- VENDOR MANUAL UPGRADE

SCRAM REDUCTION

- EVALUATING PIR PROCESS

- HI-LITE SCRAM CRITICAL SYSTEMS
 - EXTRA ATTENTION
 - PRIORITY RCM
 - WALKDOWNS
 - NEAR-MISS LISTING

- SPECIFIC PROBLEM AREAS
 - RECIRC PUMPS
 - LIGHTNING

SCRAM REDUCTION ACTIVITIES

RECIRCULATION PUMPS

- HISTORY

- FIRST SHAFT FAILURE APPROXIMATELY 30,000 HOURS
- SECOND AFTER ONE CYCLE
- THIRD AFTER ONE YEAR
- MID-CYCLE SEAL FAILURE
- INDIRECT SCRAMS

- MECHANISM

- HIGH CYCLE THERMAL FATIGUE
- UNKNOWN LOW CYCLE PROPAGATION
- FLAW IN EARLY SHAFTS

INVESTIGATION

- WORLD WIDE EXPERTISE
- FAA-GE-SULTZER/BINGHAM-LEIBSTADT
- OWNERS GROUP
- TEPCO VISIT

- CURRENT STATUS - RF05

- DETERMINED HYDROSTATIC BRG PROBLEM/WEAR RING
- INSTALLED IMPROVED BRG
- INSTALLED SHIELDED SULTZER-BINGHAM SHAFTS
- INSTALLED IMPROVED AECL SEALS

SCRAM REDUCTION ACTIVITIES

LIGHTNING

- THREE RELATED TRIPS LATE 1988-89
 - REMOVED ROOFTOP STRUCTURES
 - INSTALLED DISSIPATION SYSTEM
 - TWO YEARS W/O A LIGHTNING TRIP
-
- TWO TRIPS IN 1991
 - EXPANDED DISSIPATION SYSTEM
 - INITIATED POWER REDUCTIONS
 - REVIEW TEAM ON ISSUE
 - IMPLEMENTED 10 RECOMMENDATIONS
-
- ONE TRIP IN 1992 AT LOW POWER
 - COMPLETING FINAL RECOMMENDATION
 - FAILURE PREVENTION ROOT CAUSE
 - DETAILED REVIEW OF OTHER BWR'S
 - NEUTRON MONITORING TIME DELAY
 - GROUNDING SYSTEM WALKDOWN

WATERFORD-3



**Entergy
Operations**

WATERFORD 3

SETPOINT CALCULATIONS PROJECT

- 1990-1991 ACCOMPLISHMENTS
 - CALCULATION METHODOLOGY MANUAL DEVELOPED AND IMPLEMENTED IN 1990
 - 50 INSTRUMENT SETPOINT/LOOP UNCERTAINTY CALCULATIONS COMPLETED IN 1991

- 1992 STATUS
 - 21 OF 53 SETPOINT CALCULATIONS ARE COMPLETE

- 1993-1994 PLAN & SCHEDULE
 - 53 CALCULATIONS ARE TO BE GENERATED IN 1993
 - 9 CALCULATIONS ARE IN 1994

- TOTAL SETPOINT CALCULATIONS: 165

WATERFORD 3

SSFI CHEMICAL & VOLUME CONTROL SYSTEM

- PERFORMED BY MAINLINE ENGINEERING ASSOCIATES

- ACCOMPLISHED JUNE 8 THROUGH JULY 3

- SCOPE: EVALUATE FUNCTION, ACCURACY, THOROUGHNESS AND PROVIDE INDEPENDENT ASSESSMENT OF DBD

- RESULTS
 - CVCS WILL ACHIEVE DESIGN BASIS FUNCTIONS UNDER POSTULATED ACCIDENT CONDITIONS
 - DBD IS ACCURATE AND GENERALLY THOROUGH
 - NO MAJOR SAFETY SIGNIFICANT OBSERVATIONS
 - EIGHTEEN TOTAL OBSERVATIONS (8 MECHANICAL, 10 ELECTRICAL/I&C)

WATERFORD 3

APPLIED MECHANICS UNIT

- NEW IN-HOUSE COMPUTER HARDWARE & SOFTWARE
- CALCULATION UPGRADE PROGRAM - 450
CALCULATIONS EVALUATED TO DATE
- 10 NEW DESIGN GUIDES PREPARED IN-HOUSE TO DATE.
2 MORE UNDER PREPARATION
- PRELIMINARY REVIEW OF SAFETY RELATED
EQUIPMENT NOZZLE COMPLETE. FINAL RESOLUTION
ECD: 12/15/92
- CORPORATE & PEER GROUPS
 - OPERABILITY CRITERIA
 - TEMPORARY LEAD SHIELDING
 - MAXI BOLTS
 - FLOW STRATIFICATION
 - SMALL BORE PIPING & SUPPORTS
 - EROSION/CORROSION

WATERFORD 3

GENERATION SUPPORT BUILDING

- COMPLETE & MOVE IN BY MARCH 1, 1993

- WILL CONSOLIDATE IN ONE BUILDING
 - ENGINEERING
 - 3 SEPARATE LIBRARIES
 - DOCUMENT CONTROL
 - PLANT MONITORING COMPUTER DEVELOPMENT CENTERS
 - PURCHASING

- BENEFITS EXPECTED
 - SYSTEM & DESIGN ENGINEERING INTERFACE
 - LIBRARY ACCESS
 - PLANT ACCESS CONTROL
 - LABOR & MATERIALS COSTS

ECHELON



**Entergy
Operations**

**IMPLEMENTATION OF ADVANCED NODAL
PHYSICS METHODS**

JULY 16, 1992

BY

C. B. FRANKLIN

IMPLEMENTATION PLAN

- 1991** **OBTAIN RIGHTS TO STUDSVIK CASMO-3/SIMULATE-3
CMS SYSTEM**
- 1992** **DEVELOP BASIS MODELS FOR ENERGY SYSTEM
UNITS**
- 1993** **COMPLETE BENCHMARK AND ESTABLISH
UNCERTAINTIES**
- 1994** **PERFORM SAFETY EVALUATION AND POTENTIALLY
SUBMIT FOR NRC REVIEW**
- 1995** **FIRST APPLICATION FOR CECOR/PHYSICS DATA
BOOK AT ANO and WSES-3**

INCREASED FUEL VENDOR OVERSIGHT

- **ALLOWS MORE DETAILED EVALUATIONS OF VENDOR ACTIVITIES**
 - **CORE DESIGN**
 - **RELOAD ANALYSIS**
 - **TEST PREDICTIONS**
 - **OPERATIONAL RECOMMENDATIONS**
 - **CORE MONITORING SYSTEMS**
- **APPLY COMMON EXPERIENCES FROM ENERGY UNITS**
- **POSITIONS US TO DEVELOP OUR OWN RELOAD ANALYSIS CAPABILITY**

IMPROVED ACCURACY

- **RELATIVE TO CURRENTLY APPROVED EOI METHODS IMPROVEMENTS IN:**
 - **POWER DISTRIBUTION**
 - **ROD WORTH**
 - **CRITICAL PREDICTIONS**
 - **REACTIVITY COEFFICIENTS**

- **DETERMINISTIC METHODS MAY BE APPLIED TO WIDER RANGE OF PROBLEMS THAN CURRENT METHODS**

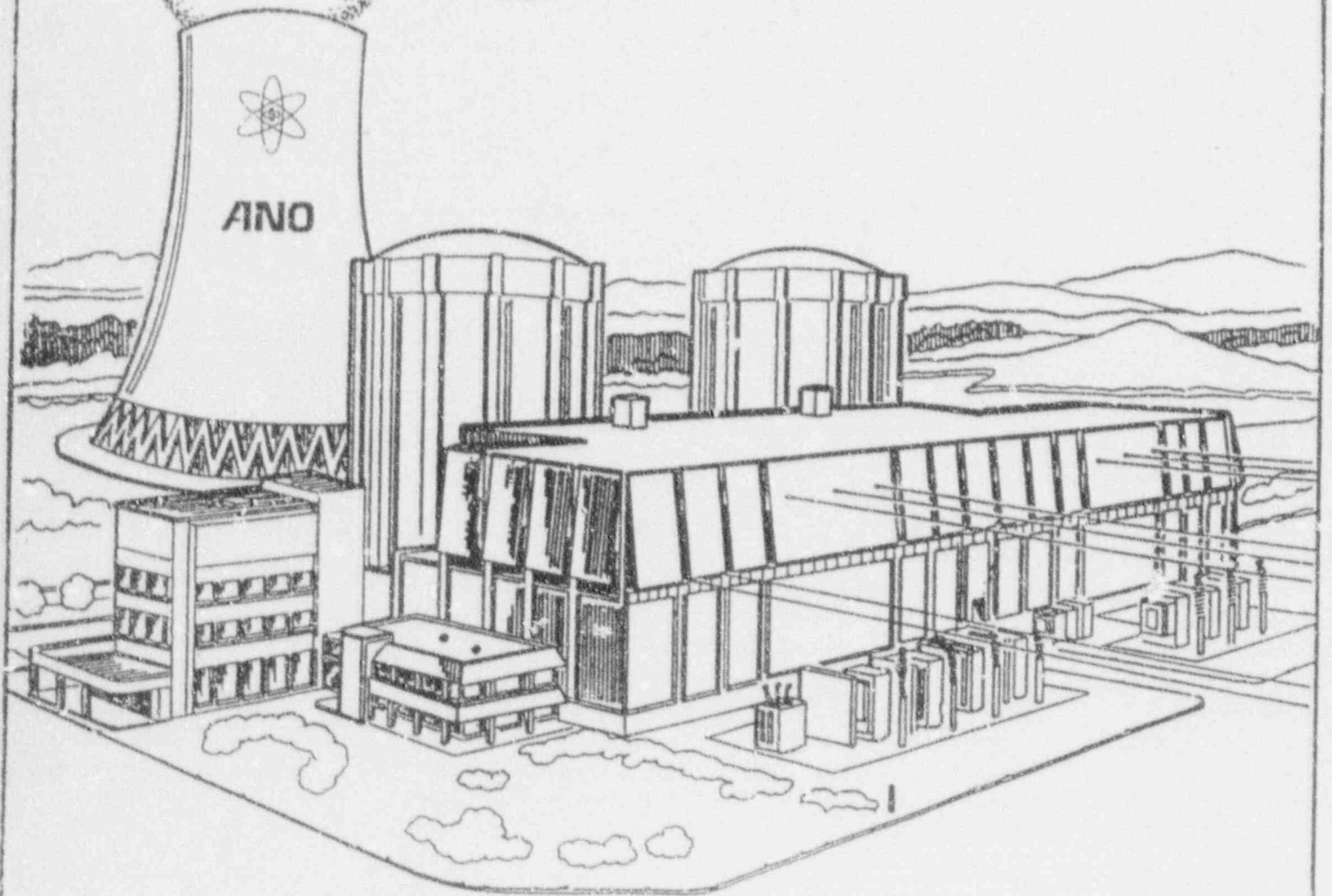
EXPERIENCE TO DATE

- INITIAL MODELS FOR BOTH A PWR AND A BWR
- PRELIMINARY COMPARISONS CONSISTENT WITH INDUSTRY EXPERIENCE
- VARIOUS VENDOR OVER CHECK CALCULATIONS HAVE IMPROVED OVERALL QUALITY AT ENTERGY OPERATIONS, INC.

Spent Fuel Storage Facility

Arkansas Nuclear One

Units 1 & 2



PROBLEM

- WITHIN THE NEXT FIVE YEARS, WE WILL START RUNNING OUT OF ROOM TO STORE SPENT FUEL...
- WHERE DO WE GO FROM HERE?

SOLUTIONS

- SHIP FUEL TO THE DEPARTMENT OF ENERGY
- INCREASE STORAGE CAPABILITY IN THE SPENT FUEL POOLS
- DRY STORAGE AWAY FROM THE AUXILIARY BUILDING

UNIT 1 FUEL INVENTORY PROJECTION

EXISTING SPACES (DESIGN)	968
LESS FULL CORE RESERVE (177)	791
*LESS UNUSABLE SPACES	756

CURRENT INVENTORY (JUNE '92)	625
EST. FOR CYCLE 12 (OCT. '93)	64
EST. FOR CYCLE 13 (APR. '95)	64

753

AFTER THE APRIL '95 REFUELING, PLACING NEW FUEL IN THE POOL TO PREPARE FOR THE NEXT REFUELING WOULD INCREASE THE INVENTORY OVER THE 756 SPACES AVAILABLE.

UNIT 2 FUEL INVENTORY PROJECTION

EXISTING SPACES (DESIGN)	988
LESS FULL CORE RESERVE (177)	811
LESS UNUSABLE SPACES	751

CURRENT INVENTORY (SEPT. '91)	489
EST. FOR CYCLE 10 (AUG. '92)	76
EST. FOR CYCLE 11 (FEB. '94)	76
EST. FOR CYCLE 12 (AUG. '95)	76

717

AFTER THE AUGUST '95 REFUELING, PLACING NEW FUEL IN THE POOL TO PREPARE FOR THE NEXT REFUELING WOULD PUSH THE INVENTORY OVER THE 751 SPACES AVAILABLE.

ACTION PLAN

SELECT VENDOR	MAR 1992
ISSUE DESIGN CONTRACT	MAY 1992
FINISH VENDOR DESIGN	MAR 1993
START FABRICATION OF MAJOR COMPONENTS	JUL 1993
START SITE CONSTRUCTION	MAY 1994
COMPLETE CONSTRUCTION START EQUIPMENT TESTING	DEC 1994
PROJECT COMPLETE - MOVE FUEL AS REQUIRED	FEB 1995

ANO STEAM GENERATORS

DESIGN ENGINEERING RESPONSIBILITIES

- **DESIGN ENGINEERING IS RESPONSIBLE FOR THE DEVELOPMENT AND SUPPORT OF THE STEAM GENERATOR INTEGRITY PROGRAM AT ANO**
 - CHAIR THE PROGRAM COMMITTEE
 - PROVIDE INPUTS TO OPERATIONS AND CHEMISTRY
 - INSPECTION PLANS AND RESULTS EVALUATION
 - INDUSTRY INVOLVEMENT

- **DESIGN ENGINEERING PROVIDES OUTAGE SUPPORT**
 - DEVELOPMENT OF OUTAGE SCOPES AND REPAIR PLANS
 - INSPECTION MANAGEMENT
 - DATA ANALYSIS AND REPORTS

- **DESIGN ENGINEERING PROVIDES RESOLUTION OF TECHNICAL ISSUES**
 - QUALIFICATION OF REPAIR TECHNIQUES
 - SPECIFICATIONS/REQUIREMENTS FOR NOZZLE DAMS
 - SPECIFICATIONS/REQUIREMENTS FOR MOCK UPS

ANO-1

- **ANO-1 HAS TWO B&W MODEL 177 STRAIGHT TUBE ONCE-THROUGH STEAM GENERATORS (OTSG)**
 - 15,531 TUBES PER GENERATOR
 - 5/8" OUTSIDE DIAMETER TUBE
 - TUBES MADE OF INCONEL 600
 - 15 TUBE SUPPORT PLATES

- **ANO-1 DEFECT HISTORY**
 - SULFUR-INDUCED INTERGRANULAR ATTACK (IGA) (FIRST NOTED IN EARLY 1980'S)
 - DETERMINED FROM TUBE PULL SPECIMENS
 - PREDOMINANTLY 15th SUPPORT PLATE AND UP

- **ANO-1 REPAIRS TO DATE**
 - "A" STEAM GENERATOR - 470 PLUGS
 - "A" STEAM GENERATOR - 406 SLEEVES (187 were preventive)
 - "B" STEAM GENERATOR - 179 PLUGS
 - "B" STEAM GENERATOR - 489 SLEEVES (244 were preventive)

- **CORRECTIVE MEASURES TAKEN**
 - OXYGEN INGRESS CONTROL
 - PREVENTIVE SLEEVING
 - MORPHOLINE FOR SECONDARY CHEMISTRY CONTROL

- **ANO-1 STEAM GENERATOR CHEMICAL CLEANING**
 - POWER LIMITED DUE TO STEAM GENERATOR PRESSURE DROP
 - PRESSURE DROP DUE TO TUBE SUPPORT PLATE BROACHED HOLE BLOCKAGE (IRON OXIDE DEPOSITS)
 - CHEMICAL CLEANING PERFORMED DURING 1R9 (1990)
 - REMOVED 5800 LBS OF DEPOSITS FROM "A"
 - REMOVED 4950 LBS OF DEPOSITS FROM "B"
 - RESULTING STEAM GENERATOR PRESSURES AS GOOD AS NEW

- **ANO-1 FUTURE PLANS**
 - ADDITIONAL PREVENTIVE SLEEVING IN MOST LIKELY AREAS
 - ALTERNATE PLUGGING CRITERIA IS BEING PURSUED (A LARGE NUMBER OF REPAIRED DEFECTS WERE VERY LOW AMPLITUDE INDICATIONS)

ANO-2

- ANO-2 HAS TWO CE MODEL 2815 U-TUBE RECIRCULATING STEAM GENERATORS (RSG)
 - 8,411 TUBES PER GENERATOR
 - 3/4" OUTSIDE DIAMETER TUBING
 - TUBES MADE OF INCONEL 600
 - 7 FULL EGGCRATE SUPPORT PLATES, 2 PARTIAL EGGCRATE SUPPORT PLATES, 2 DRILLED SUPPORT PLATES, AND 5 BATWING SUPPORT PLATES

- ANO-2 DEFECT HISTORY
 - PRESERVICE DEFECTS
 - MINOR BATWING WEAR
 - DENTING (NOTED IN EARLY 1980'S)
 - INTERGRANULAR ATTACK AND STRESS CORROSION CRACKING AT FIRST AND SECOND EGGCRATE SUPPORT PLATES (NOTED DURING SPRING 1991)
 - CIRCUMFERENTIAL CRACKING AT TOP OF TUBE SHEET (NOTED IN SPRING 1992)
 - CIRCUMFERENTIAL CRACKING WAS FOUND PREDOMINANTLY IN "KIDNEY BEAN" SHAPED SLUDGE PILE REGION
 - CIRCUMFERENTIAL CRACKING WAS FOUND ONLY IN HOT LEG SIDE OF BOTH STEAM GENERATORS

- ANO-2 REPAIRS TO DATE
 - "A" STEAM GENERATOR - 44 PLUGS
 - "A" STEAM GENERATOR - 392 SLEEVES
 - "B" STEAM GENERATOR - 120 PLUGS
 - "B" STEAM GENERATOR - 56 SLEEVES

- CORRECTIVE MEASURES TAKEN

- BORIC ACID ADDITION IN 1983 TO ARREST DENTING
- SLUDGE LANCING EACH OUTAGE
- SLEEVING WHERE POSSIBLE, RATHER THAN PLUGGING
- T_{HOT} REDUCTION (IMPLEMENTATION TESTING ONGOING)
- 5 TUBES PULLED FOR ANALYSIS

- ANO-2 FUTURE PLANS

- BEGIN USING MORPHOLINE FOR SECONDARY CHEMISTRY CONTROL DURING 2R9 (FALL 1992)
- N_{16} MONITORS
- ALTERNATE PLUGGING CRITERIA IS BEING PURSUED (A LARGE NUMBER OF REPAIRED DEFECTS WERE VERY LOW AMPLITUDE INDICATIONS)
- POSSIBLE PREVENTIVE SLEEVING OF EGGCRATE SUPPORT PLATES
- POSSIBLE FULL BUNDLE CHEMICAL CLEANING
- POSSIBLE REPLACEMENT OF COPPER/NICKEL TUBING IN CONDENSER AND MOISTURE SEPARATOR/REHEATER
- POSSIBLE SHOT PEENING OF HIGH STRESS TRANSITION AREA AT TOP OF TUBESHEET
- POSSIBLE FULL-FLOW POLISHING SYSTEM

PROCUREMENT ENGINEERING

ENERGY OPERATIONS, INC.

JULY 16, 1992

PROCUREMENT ENGINEERING

- ACTION TEAM CHARTERED IN MARCH 1991
 - DEFINE PROCUREMENT ENGINEERING RESPONSIBILITIES AND FUNCTIONS
 - EVALUATE THE NEED FOR A CENTRALIZED PROCUREMENT ENGINEERING FUNCTION
 - DOR BETWEEN PROCUREMENT ENGINEERING & MATERIALS TECHNICAL
 - ASSESS FUTURE ACTIVITIES TO ENHANCE DESIGN ENGINEERING INPUT INTO THE PROCUREMENT PROCESS

- INITIAL EVALUATION COMPLETED IN JULY 1991
 - SEPARATION OF MATERIALS TECHNICAL AND PROCUREMENT ENGINEERING FUNCTIONS

 - PROCUREMENT ENGINEERING RESOURCE NEEDS:

ANO 10

GGNS 8

W-3 8

ECHELON 1

Table 1

MATERIALS TECHNICAL /
PROCUREMENT ENGINEERING SPLIT

MATERIALS MANAGEMENT

ENGINEERING

MATERIALS TECHNICAL

PROCUREMENT ENGINEERING

Review engineering specifications, drawings, and technical manuals to incorporate appropriate technical and quality requirements for items to be procured, and develop Purchase Requisitions. Maintain MMIS standard procurement phrases.

Maintain CGI dedication evaluations database or files in MMIS or elsewhere.

Perform TERI equivalency evaluations on items where specific engineering guidelines exist.

Coordinate the development of Bills-of-Materials and spare parts specifications. Update and maintain MMIS BOM's.

Implement the Material Testing function. Manage testing lab. Maintain testing equipment. Contract periodic testing, as needed.

Manage the Shelf Life program. Assign shelf life to age sensitive materials based on Engineering specifications.

Implement Engineering Technical guidelines in various areas as authorized.

Develop cataloguing standards.

Maintain Where Used data in MMIS.

Perform technical review of material returned to stores and material transferred back to stores after rework.

Maintain MMIS technical and quality related data.

Develop Procurement Specifications

- Engineered items
- Specification revisions

Perform CGI dedications.

Perform TERI equivalency evaluations including updating design basis documents and SIMS.

Provide technical support to BCM analysis in area of component safety function, including updating design basis documents and SIMS.

Perform Material Engineering analysis for shelf life extensions and other material acceptability studies. Specify shelf life requirements.

Resolve supplier deviations and exceptions.

Provide technical input to supplier evaluation and QSL requests and performance based supplier audits.

Provide technical support for setting up the material testing function.

Develop technical guidelines for use by other organizations in the area of:

- Procurement Specification review
- Material Acceptability Receipt Inspection and Testing requirements.
- Bill-of-Material Development
- Safety Classifications
- Quality Level Determination
- Standard Procurement Phrases
- Equivalency Evaluations
- Shelf Life Assignment
- Where Used Data
- CGI dedication activities

Develop and maintain the Procurement Engineering Training Program for the sites.

Facilitate sharing of Procurement Engineering Evaluations and Specifications among sites.

Facilitate consistency in policies and direction in Procurement Engineering among sites.

Resolve common problems facing the sites.

Facilitate joint procurement.

Participate and represent the sites in industry groups.

Maintain cognizance of site, regulatory, and industry issues and initiate appropriate action.

Coordinate Procurement Engineering Peer Group.

PROCUREMENT ENGINEERING PEER GROUP

- **CONTINUATION OF THE ACTION TEAM**
 - **ENSURE TECHNICAL CONSISTENCY**
 - **MONITOR INDUSTRY ACTIVITIES AND ADJUST AS NECESSARY**
 - **IDENTIFY SAVINGS THROUGH RESOURCE SHARING**

- **PAST ACTIVITIES**
 - **SQA INVOLVEMENT**
 - **SAFETY CLASSIFICATION**
 - **PROCEDURE ENHANCEMENTS**

- **FUTURE ACTIVITIES**
 - **POSITION PAPERS**
 - **TRAINING PROGRAM**
 - **IN-HOUSE ASSESSMENT**
 - **INDUSTRY INVOLVEMENT**

BWR CORE STABILITY

JULY 16, 1992

BY

C. B. FRANKLIN

ENERGY INITIATIVES/ACCOMPLISHMENTS

- **BWROG STABILITY COMMITTEE**
 - **ACTIVE PARTICIPATION SINCE INCEPTION**
 - **SIGNIFICANT CONTRIBUTION IN OPTIONS IDENTIFICATION AND DEVELOPMENT**
 - **MAJOR CONTRIBUTIONS**
 - **PERIOD-BASED DETECTION ALGORITHM FOR THE DETECT & SUPPRESS SOLUTIONS**
 - **RECOGNIZED THE NEED FOR EARLY DETECTION AND THE LIMITATIONS OF THE BWROG/GE APPROACH**
 - **DEVELOPED AND TESTED A NEW APPROACH INDEPENDENT OF BWROG/GE**
 - **VALUE NOT RECOGNIZED AT THAT TIME BY BWROG/GE**

ENERGY INITIATIVES/ACCOMPLISHMENTS (CONT'D)

- **BWROG STABILITY COMMITTEE**
 - **NEW APPROACH FULLY ADOPTED BY THE COMMITTEE WHEN LIMITATIONS/BENEFITS RECOGNIZED**
 - **EXTENSIVE TESTING BY GE CONFIRMED ENERGY POSITION**
 - **SIGNIFICANT SIMPLIFICATION IN APPLICATION METHODOLOGY (GENERIC SETPOINT EXPECTED)**
 - **SIGNIFICANT MARGIN TO SAFETY CRITERIA DUE TO EARLY DETECTION**
 - **DEVELOPMENT OF ALTERNATIVE OPTION**
 - **PROPOSED TWO FOR THE FOUR OPTIONS WHICH ARE APPLICABLE TO BWR/4-6 PLANTS**
 - **ONLY ALTERNATIVE TO THE ORIGINAL D&S SOLUTION (III-A)**

ENERGY INITIATIVES/ACCOMPLISHMENTS (CONT'D)

- GGNS OPERATIONAL SUPPORT
 - STABILITY MAPPING BASED ON OPERATIONAL DATA THROUGH CYCLE 5 USING OFF-LINE DATA
 - MONITOR TRANSITION FROM 8 X 8 TO 9X9-5 CORE
 - CONTINUE ASSESSMENT AS APPROPRIATE

I. G. S. C. C.

INTERGRANULAR

STRESS

CORROSION

CRACKING

IN

BWR'S

WHAT IS IT?

- COMBINATION OF STRESSES AND CORROSION RESULTING IN CRACKS

- REQUIRES:
 - SUSCEPTIBLE MICROSTRUCTURE
 - TENSILE STRESSES
 - ENVIRONMENT

I. G. S. C. C.

- **SENSITIZED STAINLESS STEEL (or INCONEL)**
 - **CARBON BEARING MATERIAL**
 - **HIGH TEMPERATURES (1000° F - 1550° F)**
 - **CHROMIUM COMBINES WITH CARBON**
 - **DEPLETED AREAS ARE BASE FOR CORROSION**
 - **HEAT AFFECTED ZONE OF WELDS**

- **TENSILE STRESS**
 - **MUST CONSIDER ALL STRESS (PRIMARY & SECONDARY)**
 - **RESIDUAL FABRICATION STRESSES IMPORTANT**

- **ENVIRONMENT**
 - **ELEVATED TEMPERATURES (> 200° F)**
 - **DISSOLVED OXYGEN**
 - **TYPICAL BWR CONTENT 0.2 PPM. OPERATING**
 - **CREVICE DIFFERS FROM BULK**

HISTORY

- FIRST OBSERVED IN 1966 - HEAT AFFECTED ZONE OF A WELD ON 6" RECIRC LINE.

- NDE DISCOVERED OTHER CRACKING IN LATE 1960'S.

- 1975 NRC/GE INVESTIGATION ISSUED IN NUREG 75/067

- 1978 NRC ISSUED NUREG 0313.
 - USE OF LOW CARBON CORROSION RESISTANT MATERIAL
 - SOLUTION ANNEALED WELDMENTS

- ALSO IN 1978
 - FIRST LARGE BORE CRACKING
 - FIRST INCONEL 690 CRACK

- 1988 NRC ISSUED GL-88-01 AND NUREG 0313, REV. 2
 - BETTER INFORMATION ON SERVICE CONDITIONS
 - SPECIFICALLY ADDRESSED REACTOR COOLANT SYSTEMS
 - IDENTIFIED MEASURES OF RESISTANCE TO IGSCC

***MITIGATION MEASURES**

- **SELECTION AND TREATMENT OF MATERIAL**
 - **LOW CARBON (<0.035%) OR ENHANCED CHEMISTRY STAINLESS STEEL**
 - **SOLUTION HEAT TREATMENT RESTORES STRUCTURE**
 - **CORROSION RESISTANT CLADDING**

- **STRESS ENHANCEMENT**
 - **HEAT SHRINK WELDING (HSW)**
 - **INDUCTIVE HEATING STRESS IMPROVEMENT (IHSI)**
 - **MECHANICAL STRESS IMPROVEMENT (MSIP)**

- **ENVIRONMENTAL CONTROLS**
 - **REDUCE OXYGEN**
 - **HYDROGEN INJECTION**

- **REDESIGN TO ELIMINATE CREVICES**

GGNS HISTORY

- MOST RCB PIPING FABRICATED IN 1978

- BASED ON EXISTING KNOWLEDGE GGNS USED:
 - LOW CARBON STEEL
 - SOLUTION ANNEALED MATERIALS

- MANY SUB ASSEMBLIES RETURNED TO SUPPLIER FOR SOLUTION ANNEALING OR WELD OVERLAY

- SOME INSTALLED PIPING WAS WELD OVERLAYED

- REMAINING WELDS USED IIIISI

- FURNACE SENSITIZED SAFE ENDS REPLACED WITH LOW CARBON STAINLESS STEEL

- THERMAL SLEEVES REDESIGNED WITH "TUNING FORK" TO REMOVE CREVICE DESIGN

**CURRENT CONDITION BASED ON
GL 88-01 CRITERIA**

- **CATEGORY A - MADE OF RESISTANT MATERIAL OR ARE SOLUTION HEAT TREATED AFTER WELDING - 210 WELDS**

- **CATEGORY B - NOT OF RESISTANT MATERIAL AND IHSI PERFORMED PRIOR TO SERVICE OR WITHIN TWO YEARS OF SERVICE - 24 WELDS**

- **CATEGORY C - NOT OF RESISTANT MATERIAL AND IHSI PERFORMED AFTER MORE THAN TWO YEARS OF SERVICE - 34 WELDS**

- **THERE ARE NO CATEGORY D, E, F OR G WELDLETS AT GGNS.**