

October 10, 2000

LICENSEE: Commonwealth Edison Company

FACILITIES: Byron Station, Units 1 and 2
Braidwood Station, Units 1 and 2

SUBJECT: SUMMARY OF SEPTEMBER 20, 2000, MEETING WITH COMMONWEALTH EDISON COMPANY TO DISCUSS REQUEST FOR A POWER UPRATE FOR BYRON, UNITS 1 AND 2, AND BRAIDWOOD, UNITS 1 AND 2

On September 20, 2000, the U. S. Nuclear Regulatory Commission (NRC) staff met with members of the Commonwealth Edison Company (ComEd) staff to discuss ComEd's request for a power increase for Byron Station, Units 1 and 2, and Braidwood Station, Units 1 and 2. A list of those attending the meeting is provided as Enclosure 1. Additional ComEd and ComEd contractor personnel participated by telephone. Enclosure 2 is a copy of the meeting agenda. The handouts used by ComEd during the meeting are provided as Enclosure 3.

On July 5, 2000, ComEd submitted its power uprate request. The staff has the request under review. In order to expedite the time for the review, it was agreed with ComEd that they would meet with the staff to discuss the background and organization of their submittal and answer any staff questions that may have arisen to date during the review. ComEd presented a summary of the power uprate project and the organization of their submittal. Afterward, there were smaller group meetings to discuss specific sections of the submittal, during which the licensee answered staff questions.

As a result of the discussions, it was decided that the questions raised by the staff during the meeting will be issued to the licensee as a formal Request for Additional Information (RAI). In addition to submitting an RAI response, an additional licensing submittal will be required from ComEd.

/RA/

George F. Dick, Jr., Project Manager, Section 2
Project Directorate III
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. STN 50-454, STN 50-455,
STN 50-456, and STN 50-457

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Enclosures: 1. Meeting Attendees
2. Meeting Agenda
3. Handouts

cc w/encls: See next page

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NAME	GDICK	SMOORE	AMENDOLA
DATE	10/05/00	10/5/00	10/10/00

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UNITED STATES
NUCLEAR REGULATORY COMMISSION

WASHINGTON, D.C. 20555-0001

October 10, 2000

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FACILITIES: Byron Station, Units 1 and 2
Braidwood Station, Units 1 and 2

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On September 20, 2000, the U. S. Nuclear Regulatory Commission (NRC) staff met with members of the Commonwealth Edison Company (ComEd) staff to discuss ComEd's request for a power increase for Byron Station, Units 1 and 2, and Braidwood Station, Units 1 and 2. A list of those attending the meeting is provided as Enclosure 1. Additional ComEd and ComEd contractor personnel participated by telephone. Enclosure 2 is a copy of the meeting agenda. The handouts used by ComEd during the meeting are provided as Enclosure 3.

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BYRON AND BRAIDWOOD POWER UPRATE MEETING
SEPTEMBER 20, 2000
MEETING ATTENDEES

NRC

Cheng Ih Wu
David Shum
John Schiffgens
Rick Pelton
Kris Parczewski
Frank Orr
Duc Nguyen
James Medoff
William Koo
T. J. Kim
Cornelius Holden
Raj Goel
Bart Fu
George Dick
S. V. Athavale

ComEd

Ron Richards
Marcia Lesniak
Haksoo Kim
Russell Freeman
Joe Bauer

Stone & Webster

Jim Nicholson
Norman Hanley

Westinghouse

Richard Morrison

Note: NRC staff members attended those portions of the meeting related to their particular area of interest.

**Byron Station and Braidwood Station
Power Uprate License Amendment Request
Informational Meeting**

**NRC Office
White Flint, MD
9:00am (EST) - 4:30pm (EST)
September 20, 2000**

- Introduction & Overview of Submittal (All Attendees)
 - Introduction (Bauer) 9:00 AM - 9:10 AM
 - Overview (Richards) 9:10 AM - 9:20 AM
 - Methodology/Interfaces (Freeman) 9:20 AM - 9:30 AM
 - NSSS Analyses (Morrison) 9:30 AM - 9:40 AM
 - BOP Analyses (Nicholson) 9:40 AM - 9:50 AM
 - Accident Analyses (Kim/Wong) 9:50 AM - 10:00 AM

- Discussion and Questions on: 10:00 AM - 10:30 AM
(Applicable NRC Reviewers)
 - Chapter 2.0 "NSSS Parameters"
 - Chapter 3.0 "NSSS Design Transients"

- Discussion and Questions on: 10:30 AM - 11:30 AM
(Applicable NRC Reviewers)
 - Chapter 4.0 "NSSS Systems"
 - Chapter 5.0 "NSSS Components"

- Discussion and Questions on: 11:30 AM - 12:15 PM
(Applicable NRC Reviewers)
 - Chapter 7.0 "Nuclear Fuel"

- Lunch Break 12:15 PM - 1:00 PM

- Discussion and Questions on: 1:00 PM - 4:00 PM
(Applicable NRC Reviewers)
 - Chapter 6.0 "NSSS Accident Analysis"
 - LOCA 1:00 PM - 1:30 PM
 - Non-LOCA 1:30 PM - 2:30 PM
 - Offsite Dose 2:30 PM - 3:00 PM
 - Containment Analysis 3:00 PM - 4:00 PM

- Discussion and Questions on: 1:00 PM - 3:00 PM
(Applicable NRC Reviewers)
 - Chapter 8.0 "Turbine Generator"
 - Chapter 9.0 "BOP Systems, Structures and Components"

- Discussion and Questions on: 3:00 PM - 4:00 PM
(Applicable NRC Reviewers)
 - Chapter 10.0 "Program Reviews"
 - Chapter 11.0 "Environmental Impacts Review"
 - Chapter 12.0 "Station Procedures Impact"

- Meeting Summary 4:00 PM - 4:30 PM
(Applicable NRC Reviewers)

- Adjourn Meeting 4:30 PM

Byron and Braidwood Stations
Power Uprate
License Amendment Request

ComEd/NRC
Informational Meeting
September 20, 2000

Meeting Format and ComEd Power Uprate Team Presenters

- One hour introduction/overview of submittal
 - Introduction/Licensing Joe Bauer
 - Project Overview Ron Richards
 - Methodology/Interfaces Russ Freeman
 - NSSS/BOP Analyses Russ Freeman
 - Accident Analyses Hak Soo Kim
- Discussions/Questions for each report chapter
 - Chapters 2 through 5 and 7 before lunch
 - Main session for Chapters 8 through 12 after lunch
 - Break-out session for Chapter 6 after lunch
- Meeting Summary

Introduction/Licensing

Joe Bauer

ComEd Nuclear Licensing
Administrator

Power Uprate Goals

- Maximize power output for Byron and Braidwood Stations
 - maintain original design basis
 - utilize existing margins
 - meet all existing regulatory requirements
- Power Uprate performed consistent with WCAP-10263, “A Review Plan for Uprating the Licensed Power of a Pressurized Water Reactor Power Plant”
- Increase reactor core thermal rating to 3585.6 MWt for each of the four units
- Provide increased electrical generation for Summer of 2001

Implementation Schedule

- Byron Unit 1
 - Full uprate of 72 MWe in May 2001
- Byron Unit 2
 - Full uprate of 41 MWe in May 2001
- Braidwood Unit 1
 - Limited uprate of 10 MWe in May 2001
 - Balance of uprate (62 MWe) after fall 2001 outage
- Braidwood Unit 2
 - Limited uprate of 10 MWe in May 2001
 - Balance of uprate (31 MWe) after spring 2002 outage

Development of Licensing Submittals and Schedules

- “Power Uprate” submitted to the NRC in two parts:
 - Power Uprate - submitted July 5, 2000
 - Best Estimate Loss of Coolant Accident (BELOCA) Analysis - submittal targeted for October 27, 2000
- Submittal consistent with WCAP-10263, “A Review Plan for Uprating the Licensed Power of a Pressurized Water Reactor Power Plant”
- Uprate submittal patterned after Farley’s submittal

Development of Licensing Submittals and Schedules (Cont'd)

- BELOCA submittal to follow previously accepted methodologies
- Lessons learned from previous uprates incorporated into our submittal
- Requesting approval of Power Uprate and BELOCA submittals by May 7, 2001 to support increase in power production on all four units for the Summer of 2001

Requested Tech Spec Changes

- Increased the maximum power level specified in each unit's license
- Revised the value of rated thermal power (RTP) in the TS definitions
- Revised the reference source for conversion factors in the calculation of dose equivalent iodine (I) - 131 as noted in the TS definitions
- Added a Departure from Nucleate Boiling Ratio (DNBR) limit specifically for a thimble cell
- Increased the minimum limit for Reactor Coolant System (RCS) total flow
- Revised the SG laser welded sleeve plugging limit
- Reduced the peak calculated containment internal pressure P_a for the design basis Loss of Coolant Accident (LOCA)

Analyses Summary

- Analyses and evaluations have determined that all design basis criteria continue to be met at uprated power conditions. Analyses included:
 - SBLOCA Accidents
 - Non-LOCA Accidents
 - NSSS and BOP structures, systems and components
 - Control systems
 - Radiological dose limits
 - Containment response
- No changes necessary to TS reactor trip and engineered safety feature actuation setpoints

Project Overview

Ron Richards

ComEd Byron/Braidwood

Power Uprate Project Manager

Preliminary Feasibility Study (1998)

- Preliminary study conducted by ComEd to assess feasibility of uprating units and bound project costs
- Review industry experience with other PWR uprates
- Evaluate original plant design and operating margins
- Study concluded uprating NSSS power by 5% was feasible

Detailed Feasibility Study (1999)

- Contracted with NSSS Vendor and AE to perform detailed feasibility study to assess uprate limitations, required plant upgrades and costs
 - Siemens Westinghouse prepared heat balances for uprated conditions
- Goals of Detailed Feasibility Study:
 - Minimize physical modifications (take advantage of system/component margins)
 - Minimize changes to design and licensing bases
 - Take advantage of new analytical methodologies if justified

Division of Responsibility

- Westinghouse
 - NSSS performance parameters, design transients, systems, components, accidents, radiological, fuel
- Babcock & Wilcox Canada, Ltd.
 - Requalification of Unit 1 Replacement SGs
- Stone & Webster
 - BOP systems, components, radiological and environmental evaluations, special programs reviews, modification designs

Division of Responsibility (Cont'd)

- Siemens Westinghouse Power Corporation
 - Analyses of turbine generator and redesign of HP & LP components
 - Supply new HP & LP hardware
 - Develop heat balances/thermal kits
- Commonwealth Edison Company
 - Steam Generator Tube Rupture and T&D impact
 - Project Management/Licensing
 - Control of design processes

Previous Power Uprate Experience

- Westinghouse
 - Successfully uprated over 20 PWR units, including
 - Farley 1 & 2
 - Turkey Point 3 & 4
 - Vogtle 1 & 2
 - Salem 1 & 2
- Stone & Webster
 - Leader in nuclear plant BOP uprating
 - Experience with Westinghouse PWR uprating
 - Turkey Point 3 & 4
 - North Anna 1 & 2
 - Surry 1 & 2
 - Beaver Valley 1 & 2
 - Salem 1 & 2

Overview of Plant Changes Due To Power Uprate

- No NSSS modifications
- Minor BOP modifications
- Major HP turbine modifications
- Minor LP turbine modifications
- Various setpoint/scaling changes
- Various station procedure changes
- Training simulator changes

Methodology, Interfaces and NSSS/BOP Design Reviews

Russ Freeman

ComEd Byron/Braidwood

Power Uprate Project Engineer

Configuration Control

- Basis is ComEd procedure CC-AA-310 (Transmittal of Design Information)
- Data collected by team and independently verified
- Data sent from ComEd Project Team to contractors via Design Information Transmittal sheets
- Design outputs received from contractors reviewed / approved prior to acceptance

Methodology

- Utilize methodology originally established in Westinghouse WCAP-10263
 - Phased approach
 - Feasibility study of limiting areas
 - Implementation phase at plants
- Westinghouse PCWG established analytical limits based upon inputs from ComEd Asset Management Plan (T_{avg} range 575°F - 588°F and SGTP limits 5%/10%)
- Analysis methodology follows standard approach

Methodology (Cont'd)

- Conducted interviews of key plant design , maintenance, and operations personnel
- Evaluations and analyses grouped into three categories:
 - Bounded by existing design \Rightarrow stop
 - Bounded by design with reanalysis \Rightarrow perform reanalysis and stop
 - Not bounded by analysis or design \Rightarrow perform new analysis and/or modify plant

Conclusions of NSSS Design Reviews

- No system/component limitations
- No modifications
- Setpoint changes - used existing administrative margin - No TS allowable value changes requested

Conclusions of BOP Design Reviews

- Approached limits on main generator
- No major modifications
 - Turbine Gland Seal System piping mod (resolves existing problem)
 - Heater drain control valves
 - Switchyard stability modifications
- Setpoint changes - used existing administrative margin - No TS allowable value changes requested.

Safety Analyses

Hak Soo Kim

ComEd PWR Safety Analyses Supervisor

Safety Analysis

- Non-LOCA transient/accident analyses (UFSAR Chapter 15)
- LOCA analyses (UFSAR Chapter 15)
- Containment analyses, MSLB/LOCA (UFSAR Chapter 6), steam tunnel analysis (Chapter 3)
- Radiological dose consequences (UFSAR Chapter 15)

Safety Analysis (Cont'd)

- Minimize Operational Impact
- Satisfy All Safety Analysis Acceptance Criteria

Minimize Operational Impact

- Minimize Reactor Protection System (RPS) and Engineered Safety Feature (ESF) setpoint changes
- Minimize procedure changes
- Minimize training impact

Minimize Operational Impact (Cont'd)

- No Tech Spec RPS and ESF actuation setpoints have been changed
- Some safety analysis input assumptions have been changed (i.e. low steamline pressure from 364 psia to 450 psia, OTΔT $f(\Delta I)$ penalty function, etc.) using existing margins
- No significant change for EOPs, AOPs, and OPs

Comparison of Key NSSS Parameters

<u>Variables</u>	<u>Current</u>	<u>Uprate</u>
Core Power (MWt)	3411	3586.6
Min Measured RCS Flow (gpm)	371,400	380,900
Tavg Window (°F)	569.1-588.4	575-588
SG Tube Plugging (Unit 1/Unit 2)	20/24	5/10

Discussions & Questions for Individual Licensing Report Chapters

Chapter 2.0 Discussions (NSSS Parameters)

- Performance Capability Working Group (PCWG)
- Formal process requiring ComEd approval prior to use
- Standard methodology
- Verified inputs received from ComEd
 - [tube plugging, temperature range, etc.]
- Used by entire team

Chapter 3.0 Discussions (NSSS Design Transients)

- Consists of NSSS and auxiliary equipment design transients
- No changes to auxiliary equipment design transients
- Evaluated original NSSS design transients
- Verified In Chapter 5.0 of Licensing Report
- Standard methodology used

Chapter 4.0 Discussions (NSSS Systems)

- Included systems such as RCS, RHRS, and ECCS
- Includes BOP/NSSS interface with systems such as Main Steam, Steam Dump, Auxiliary Feedwater Systems
- Includes valve sizing confirmation
- Includes Cold Overpressure Mitigation (COMS)
- Verify acceptability vs. original design bases or provide revised results (e.g., LTOPS)
- Standard methodology utilized
- Acceptable results

Chapter 5.0 Discussions (NSSS Components)

- Addresses Major Components
 - Reactor Vessel
 - Steam Generator
 - Reactor Coolant Pump
 - Pressurizer
- Where Appropriate
 - Listed methodology, results, code edition, and criteria
- Methodology Consistent with Previous Submittals
- Acceptable Results

Chapter 7.0 Discussions (Nuclear Fuel)

- Fuel evaluation
- Heat generation rates/neutron fluences
 - Evaluated in Chapter 5
- Radiation source terms
 - Evaluated in Chapter 6
- Methodologies used were the same as in previous applications (most recently Farley)
- Acceptable results

Break-Out Session

NSSS Accident Analyses

Chapter 6.0 Discussions (NSSS Accident Analysis)

LOCA Analysis

- LBLOCA - Large Break Loss of Coolant Accident
- SBLOCA - Small Break Loss of Coolant Accident

LOCA Analysis

- LBLOCA
 - NRC approved BELOCA method (WCAP-12945-P)
 - All calculations will be finished by October 1, 2000
 - Licensing Report will be submitted to NRC by October 27, 2000

LOCA Analysis (Cont'd)

- SBLOCA
 - NRC approved SBLOCA method based on Westinghouse NOTRUMP evaluation model (WCAP-10054-P-A)
 - Byron/Braidwood Unit 1 (BWI Steam Generators) Peak Clad Temperature (PCT) changed from 1695 °F to 1602 °F
 - Byron/Braidwood Unit 2 (Westinghouse D-5 Steam Generators) PCT changed from 1806 °F to 1614 °F

Non-LOCA Computer Codes

- Utilize same codes for reanalyses as for current analyses:
 - LOFTRAN
 - FACTRAN
 - TWINKLE
 - RETRAN
 - THINC IV

Non-LOCA Methods

- Same Methods as current analyses, except
 - RCS thick metal mass assumed for feed line break
- Revised Thermal Design Procedure (RTDP) as defined in WCAP-11397-P-A
- Standard Thermal Design Procedure (STDP) used where RTDP is not applicable
- WRB-2 and W-3 DNBR correlations used

Non-LOCA Analyses

- Reanalyze all Chapter 15 transients
- Re-define design limit DNBR

Non-LOCA Results

- Maximum primary pressure 2742 psia
- Maximum secondary pressure 1317.7 psia
- Maximum linear rod power 21.78 kw/ft
- Minimum DNBR
 - Rods in DNB predicted for locked rotor (0.1%)
 - All other events meet limit

Design Basis Accident Radiological Consequences Computer Codes

- Offsite releases use same code as current analyses
 - TITAN5
 - RETRAN
- Uprate analyses use TITAN5 for control room dose
- Current analyses use POSTDBA for control room dose

DBA Radiological Consequences Methods

- Use same applicable Regulatory Guide and Standard Review Plan as current analyses, except:
 - Dose Conversion Factors (DCF) for thyroid dose
 - DCF for whole body dose and beta skin dose from noble gas

DBA Radiological Consequences Analyses

- Reanalyze all current DBA radiological consequences
- Locked rotor with failed open PORV
- Small break LOCA

DBA Radiological Consequences Results

- LOCA exclusionary boundary thyroid dose 260 rem
- Rod eject EAB thyroid dose 57 rem
- Locked rotor with failed open PORV EAB thyroid dose 19.2 rem
- LOCA control room thyroid dose 18 rem

LOCA Containment Analysis Computer Codes

- Same codes as current analysis
 - SATAN
 - WREFLOOD
 - COCO

LOCA Containment Analysis Methods

- Mass and Energy Release - methodology described in WCAP-10325-P-A, which has been found to satisfy guidance specified in NUREG-0800, Section 6.2.1.3, subsection II
- Containment pressure and temperature profiles calculated per methodology described in WCAP-8327 using Westinghouse code COCO

LOCA Containment Analysis Results

- Peak pressures (psig):

	<u>Current</u>	<u>Uprate</u>
Unit 1	47.8	42.8
Unit 2	44.4	38.4

MSLB Containment Analysis Computer Codes

- Same codes as current analysis
 - LOFTRAN
 - COCO

MSLB Containment Analysis Methods

- Mass and energy releases analyzed using LOFTRAN code per NRC approved methodology described in WCAP-8822
- Containment pressure and temperature calculated using COCO code. There are no significant changes in this methodology for uprate project

MSLB Containment Analysis Results

- Peak Temperature (°F)

	<u>Current</u>	<u>Uprate</u>
Unit 1	333	333
Unit 2	331	331

MSLB Steam Tunnel Analysis

- Mass and energy release calculated using LOFTRAN per WCAP-10961, based on NRC approved methodology of WCAP-8822 including resolution of NRC Information Notice 84-90 (superheated steam)
- Temperature profile calculated using Westinghouse COMPACT code
- Previous analysis used combination of RELAP5 (M&E) and RELAP4 (steam tunnel temperature)

Main Session

Turbine Generator & BOP

Chapter 8.0 Discussions (Turbine Generator)

- Major HP turbine modifications to account for increased steam flows
- LP turbine modifications to install mid-span stiffeners for improved reliability
- HP turbine re-designs are different for Units 1 & 2 due to different steam generator conditions
- Turbine missile reports re-done

Chapter 8.0 Discussions (cont'd)

(Turbine Generator)

- No modifications required to :
 - Generator and exciter
 - Moisture separator reheaters
 - Turbine generator coolers
 - Main turbine lube oil system
 - Turbine control system
- Modification required to:
 - Gland steam system

Chapter 9.0 Discussions (BOP Systems, Structures & Components)

BOP system, structure, and component evaluations

- Demonstrates that each unit can operate safely & reliably, and meet existing regulatory requirements at NSSS rating of 3600.6 MWt
- Identify impacts and changes required to plant documentation and hardware/software

BOP Evaluations

The BOP uprate evaluations included the following general topics:

- Steam & Power Conversion Systems
- NSSS Support Systems
- Miscellaneous Water Systems
- Structures
- Piping and Supports
- Electrical Systems
- Instrumentation and Controls
- HVAC Systems
- Equipment Qualification
- Radiological

Technical Approach

Miscellaneous Activities

- Performed data collection
- Established current design and licensing bases
- Conducted interviews of key plant design, maintenance, and operations personnel
- Conducted plant walkdowns to verify current 100% power level operating parameters and conditions
- Performed calculations and analyses in accordance with approved ComEd Procedures
- Identified off normal conditions/observations to ComEd

BOP Calculations

- New calculations or revisions were prepared to document the evaluations or analyses that were performed
- These calculations fall into one of three groups:
 - Calculations that document that an evaluation was done to assess the impact of power uprate, and that the conclusions of the original analysis are still valid
 - Calculations that document a generic review and show adequacy of multiple items
 - Calculations, which evaluate specific items and reach new conclusions

Document Updates

- UFSAR, Procedures and Program Reports
 - Mark-ups of these documents were prepared and reviewed and issued to ComEd for document revision
- Design basis information generated as a result of this work scope was identified and transmitted to the Stations

Chapter 10.0 Discussions (Program Reviews)

- Reviewed both the Technical Specification and other programs
 - Administrative controls (procedures etc.) and the inputs to the program
- Programs impacted by power uprate include:
 - Slight increase in area temps - EQ program
 - Post LOCA containment pressures decrease
 - Plant simulator, GL 89-13, flow accelerated corrosion

Chapter 11.0 Discussions (Environmental Impacts Review)

NPDES Permits

- The National Pollutant Discharge Elimination System Permits (NPDES) cover discharge limitations, monitoring and reporting requirements for the two stations
- Include restrictions on various normal plant operations and effluent limitations including cooling tower blowdown, wastewater treatment, and operation of the radwaste treatment system
- Minor increases in heat duty, flow, and discharge temperatures will remain within permit limits

Chapter 12.0 Discussions (Station Procedures Impact)

- Reviews performed of all Station procedures
- ComEd Station personnel review proposed revs
- Approximately 150 affected procedures per unit:
 - Emergency procedures
 - Operating/system engineering procedures
 - Chemistry procedures
 - Contingency actions
 - Annunciator response procedures
 - Operating/instrument maintenance/engineering surveillances