PSEG Nuclear LLC
P.O. Box 236, Hancocks Bridge, New Jersey 08038-0236

PSEG Nuclear LLC

AUG 0 6 2001

LRN-01-254
LCR H01-002

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555-0001

Gentlemen:

**REQUEST FOR CHANGE TO TECHNICAL SPECIFICATIONS-
SUPPLEMENTAL INFORMATION
INCREASE IN ALLOWABLE MSIV LEAKAGE RATE AND
ELIMINATION OF MSIV SEALING SYSTEM
HOPE CREEK GENERATING STATION
FACILITY OPERATING LICENSE NPF-57
DOCKET NO. 50-354**

This letter forwards additional information in support of License Change Request (LCR) H-01-002. This information was requested by fax on July 12, 2001 and during a meeting between PSEG Nuclear LLC and the NRC Staff on July 18, 2001.

Attachment 1 to this letter provides a copy of the NRC questions forwarded by fax on July 12, 2001. In general, the responses to these questions were included during PSEG's presentation. Attachment 2 to this letter provides a copy of discussion items resulting from the July 18, 2001 meeting. As necessary, PSEG responses follow each question or discussion item. A copy of the presentation materials is provided as Attachment 3 to this letter.

Attachment 4 to this letter is a post accident containment water pH calculation performed by Polestar Corp. using the proprietary STARpH code. It is requested that this calculation be withheld from public disclosure in accordance with 10CFR 2.790 of the Commission's rules. An affidavit in support of withholding is also included as Attachment 5. Attachment 6 to this letter contains a redacted version of the Polestar Corp. calculation which is suitable for distribution to the Public Document Room.

Enclosed with this letter are copies of PSEG calculations H-1-ZZ-MDC-1886 Rev. 0, H-1-ZZ-MDC-1879 Rev. 0IR2, and H-1-ZZ-MDC-1880 Rev. 0IR2, as Attachments 4, 7, and 8 respectively. In addition, Table 1, Dose Analysis of our May 22, 2001 submittal was revised to account for analysis revision and an NRC identified typographical error. This is included as Attachment 12.

A017

This letter forwards Proprietary Information in accordance with 10CFR 2.7.90. The balance of this letter may be considered non-proprietary upon removal of Attachment 4.

In accordance with 10CFR50.91(b)(1), a copy of this submittal has been sent to the State of New Jersey.

Should you have any additional questions regarding this request, please contact Mr. Michael Mosier at (856) 339-5434.

Sincerely,

D. F. Garchow

D. Garchow
Vice President – Operations

Attachments:

1. NRC Questions of July 12, 2001
2. NRC Questions from July 18, 2001 Meeting
3. Presentations Materials
4. HCCALC H-1-ZZ-MDC-1886, Rev. 0,Hope Creek Post-Accident pH Calculation
5. Notarized Affidavit to withhold proprietary information in accordance with 10CFR 2.790
6. Redacted Calculation No. PSAT 224CT.QA.03
7. HCCALC H-1-ZZ-MDC-1879, Rev. 0IR2, Control Room and Technical Support Center X/Qs Using ARCON96 Code
8. HCCALC H-1-ZZ-MDC-1880, Rev 0, Post-LOCA EAB, LPZ, and CR Doses – Alternate Source Term Analysis
9. References
10. Figures
11. Radiation Dose Profiles
12. Dose Analysis

Enclosure:

1. Artificial Island PSEG Nuclear Meteorological Data – ARCON96 Data Files

This letter forwards Proprietary Information in accordance with 10CFR 2.7.90. The balance of this letter may be considered non-proprietary upon removal of Attachment 4.

C: w/o attachments 3 through 11 and enclosure 1

USNRC Senior Resident Inspector – HC (X24)

w/o attachment 4 and enclosure 1

Mr. H. Miller, Administrator – Region I
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Trenton, New Jersey 08625

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STATE OF NEW JERSEY)
) SS
COUNTY OF SALEM)

D. Garchow, being duly sworn according to law deposes and says:

I am Vice President – Operations of PSEG Nuclear LLC, and as such, I find the matters set forth in the above referenced letter, concerning Hope Creek Generating Station, Unit 1, are true to the best of my knowledge, information and belief.

David F. Garchow

Subscribed and Sworn to before me
this 6 day of August, 2001

Notary Public of New Jersey

My Commission expires on 10/13/02.

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Attachment 1

NRC Questions of July 12, 2001

Question 1 - Section 6.3.1, "Post-LOCA MSIV Leakage," and Section 7.4, "Plateout of Activity in Main Steam Lines," of Attachment 4 (pages 27 and 35 of 68)

As you stated in above sections, the major radioactive aerosol removal mechanism in main steam lines is primarily gravitational settling. To evaluate removal rate constant for settling (λ_s), you utilized a proper equation and acceptable aerosol settling velocity (u_s). However, you used the entire pipe inner surface area (πDL) of the main steam pipe as aerosol settling area instead of limiting it to only upward facing settling area (pipe diameter times length of pipe) of the main steam pipe. The aerosol will not deposit on the upper portions of the pipe against gravity. It is only subjected to the upward facing area of the pipe.

Therefore, the equation for Hope Creek becomes,

$\lambda_s = u_s A / V = u_s 4 DL / \pi D^2 L = u_s 4 / \pi D$ = 0.00081m/sec x 3600 sec/hr x 1.274 / 0.591 m = 6.28 per hour

This value is almost same as that used for Perry's which was 6.26 per hour (Perry may have the same pipe size). In addition, vertical main steam lines should not be included as volume of well-mixed region in determining the total volume of the main steam pipe. Consequently, your assertion that all aerosols in the MSIV leakage will deposit on the large area of the main steam line is not acceptable.

PSEG Response to Question 1

PSEG concurs that the approximations used in the original calculation may not have been sufficiently conservative. As discussed at the meeting, this assumption does not affect the outcome of the calculation. However, in order to assure that the calculation is as accurate as possible a revision that modifies the plate out assumptions has been completed. A copy of revised calculation H-1-ZZ-MDC-1880; Rev. 0IR2 is enclosed as Attachment 8.

Question 2 - Aerosol removal in Hope Creek drywell by natural deposition

Have you taken any aerosol removal credit by natural deposition (passive removal mechanism) in drywell using RADTRAD code?. You have not taken any fission product removal credit by safety-related drywell spray system consistent with the current licensing/ design basis. Why not?

PSEG Response to Question 2

PSEG took an aerosol removal credit by natural deposition in the drywell using RADTRAD 3.02 computer code (the Powers' model with the lowest percentile (10%)). The drywell spray is not credited for removal of fission products. This was done to be conservative.

Question 3 - MSIV Alternative Leakage Treatment (ALT) Pathway.

In a draft safety evaluation (SE) issued on November 14, 2000, for your earlier license amendment request on the same subject, the staff concluded, among other things, that upon completion of certain valve modifications, there is reasonable assurance that the main steam lines, main steam drain lines, and the main condenser will be seismically adequate to retain fission products leaked through the MSIVs. Since you have not requested the ALT pathway, we assume that you have not and will not modify certain valves identified in the draft SE.

As a defense-in-depth consideration, discuss the operability and reliability of the following valves in the ALT pathway:

- HV-F070A, B, C and D with its 1/8" bypass orifices (main steam drain valves)
- HV-F072 (main steam drain header valve)
- HV-F069 (main steam drain header bypass valve)

PSEG Response to Question 3

As you noted the ALT pathway will not be used, therefore, these valves will not play a role for defense-in-depth. However, the main steam lead drain located just before the main turbine stop valves provides a similar non-credited (defense-in-depth) pathway to the main condenser. This drain line is a continuously operating (passive) drain through a 0.3-inch orifice and would direct leakage to the condenser. This line is not credited in the dose analysis because the line is non-seismic and non-ASME (but is ANSI B31.1) piping. These questions were discussed at the meeting in connection with slide 8.

Question 4 - Standby Liquid Control System (SLCS)

The SLCS is described in the Hope Creek UFSAR Section 9.3.5. Discuss the design and operational features of the SLCS in more detail and provide the following additional information:

- estimated chloride-bearing cable inventory and the amounts routed in conduit or totally enclosed raceways in drywell
- radiation dose profiles (beta and gamma) in wetwell
- hydrochloric acid formation (radiolysis of chlorine-bearing cable jacketing)
- nitric acid formation (radiolysis of air in drywell)
- cesium hydroxide formation assumed in source term
- torus water pH transient during the entire period of accident (30 days)
- Hope Creek emergency and severe accident procedures governing the operation of the SLCS

PSEG Response to Question 4

Calculation H-1-ZZ-MDC-1886 Rev. 0, Attachment 4 addresses this question. A description of the radiation dose profiles is included as Attachment 11. These questions were discussed at the meeting in connection with slides 32 thru 37.

Question 5 - Bring with you the following reference materials:

- Reference Nos. 10.15 and 10.19 cited in Attachment 4. We may request to docket the pertinent portions of these references.

PSEG Response to Question 5

The requested information is provided as Attachment 9 to this letter.

Question 6 - Figure 3 in Attachment 5 (sheet 14 of 30), Relative Locations of Turbine Building Louver and Control Room Air Intake

As stated in (1) above, this pathway is the major source term release from the MSIV leakage for the control room operator dose. Discuss the followings:

- turbine building and its louver dimensions and configurations
- potential mixing of MSIV leakage within the turbine building before releasing through the louver
- relative location of steam tunnel, inboard and outboard MSIVs, main steam stop valves, and turbine stop valves.
- do you have turbine building roof vents?

PSEG Response to Question 6

UFSAR Figures 1.2-5 and 1.2-8 provide information relative to the cited locations. Copies of these figures are included as Attachment 10. The response to question 9 discusses the turbine building roof vents. These questions were discussed at the meeting in connection with slides 13 thru 15.

Question 7 - Quality of meteorological data

Attachment 11.2 to Attachment 5 of the submittal provides a discussion of the meteorological data used in the control room X/Q calculations. Page 2 references procedures used to QA the data. Did the measurement program also meet the guidelines of Regulatory Guide 1.23, "Onsite Meteorological Programs," including factors such as maintaining good siting, instruments within specifications, and adequate data recovery and quality assurance checks? If deviations occurred, describe such deviations from Regulatory Guide 1.23 guidance and why the data are still deemed to be adequate. What types of quality assurance checks were performed on the meteorological measurement systems prior to and during the periods of collection to assure that the data are of high quality? Were calibrations properly performed and systems found to be within guideline specifications for the use of the data? What

additional checks and at what frequency were the checks performed on the data following collection and prior to input into the atmospheric dispersion calculations to assure identifying any problems in a timely manner and flagging data of questionable quality? Were checks made to assure that any needed unit conversions were properly performed prior to using the data? Were data compared with other site historical or regional data and, if so, what were the findings? During the period of data collection, was the tower base area on the natural surface (e.g., short natural vegetation) and tower free from obstructions (e.g., trees, structures) and micro-scale influences to ensure that the data were representative of the overall site area? The intent of these questions is to assess the overall quality of the meteorological data. A detailed response for each individual data point is not expected.

PSEG Response to Question 7

The Salem/Hope Creek meteorological measurement program meets the guidelines of Regulatory Guide 1.23, "Onsite Meteorological Programs," without any deviations. Data quality is assured by collecting both analog and digital data. This data in conjunction with system calibrations, maintenance records, system surveillance records and the knowledge of an experienced meteorologist are used to validate all meteorological records. System calibration and PM's are performed on a quarterly basis and covered by approved plant procedures. Data is collected and validated using approved station procedures. During the Salem Unit 2 licensing process the meteorological data was evaluated with respect to regional data to assure its reasonableness. The meteorological monitoring site is maintained free of obstructions that could influence meteorological/ climatologically observations. Units of meteorological parameters were checked and validated. These questions were discussed at the meeting and are depicted on slides 20 thru 22.

Question 8 - Provide meteorological data:

Attachment 11.1 to Attachment 5 of the of the submittal cites diskettes containing ARCON96 and meteorological data files used in making the control room X/Q calculations. Sheet 11 of 30 also references an Appendix D. The NRC would like to discuss potential docketing of this information.

PSEG Response to Question 8

Meteorological data in ARCON96 format as requested, in the form of a CD-ROM, is enclosed with this letter.

Question 9 - Inputs, assumptions and bases not provided in Attachment 5

Are all directional inputs to the ARCON96 calculations defined in terms of true north? Was any "stack flow" (not "vertical velocity") assumed in the calculations, for example, for the South Plant Vent? If so, are fans safety grade? If not, what assurance is there that the flow can be maintained? For calculations assuming a diffuse release, what values of initial sigmas were used? Sheet 10 of 30 of Attachment 5 discussing the release through the turbine building louver notes that the release takes place over a large area. What and where are the assumed release locations within the turbine

building, such that they are over a wide area and of about the same magnitude of source term? Are there vents in the turbine building and if so, where are they located? If there are vents, is flow forced and safety related? This question is an attempt to confirm that it is more conservative to assume a diffuse release to the environment from the louver panel than from some other postulated, possibly point source, release location.

PSEG Response to Question 9

Calculation H-1-ZZ-MDC-1879 has been corrected to use true versus plant north. The stack flow is not used for the south plant vent. The south plant vent was not used because it would result in lower control room doses. An analysis is included in H-1-ZZ-MDC-1879, Rev. 0IR2 to show that a point source from the turbine building roof vent results in a lower control room dose. UFSAR Figure 1.2-8 and drawing A-0221-0, Sheet 1, Revision 0 together show the locations of both the Turbine Building louver and the roof vents. These questions were discussed at the meeting in connection with slides 12 thru 18.

Attachment 2

NRC Questions from July 18, 2001 Meeting

The page number reference noted in each of the following discussion questions pertains to the slide presentation handout that was provided by PSEG at a public meeting with the NRC on July 18, 2001.

Question 1

On Page 15 - PSEG notes that the turbine building roof vents are further from the control room air intake than the louver panel from which effluent is assumed to leak. However, the release from the louver panel is assumed to be a diffuse release, whereas the release from the vent might be considered as a point source and thus, for the same distance, the calculated relative concentration (X/Q) values for the vent would probably be higher. Have comparative calculations been made to demonstrate that the X/Q value for a release from a vent is lower than for the louver panel for the Hope Creek configuration because the vent is adequately far away?

PSEG Response to Question 1

A sensitivity study was done using the turbine building roof vents as a point source. The comparison of results is shown in calculation H-1-ZZ-MDC-1879, Rev. 0IR2, Attachment 7 to this letter. The comparison shows that the turbine building louver location is more conservative than the turbine building roof vent treated as a point source.

Question 2

On Page 16 - It is stated that ARCON96 calculations were based upon plant north, which a comparison showed resulted in higher X/Q values than using true north. Are wind directions based upon based upon true north or plant north in all calculations and is the release configuration grid that is based upon both true north and plant north or, for any single set of calculations, are all directions based upon either true north or plant north?

PSEG Response to Question 2

Calculation H-1-ZZ-MDC-1879 was revised to address the use of true north vs. plant north. The resulting X/Q's were subsequently incorporated to the dose analysis calculation H-1-ZZ-MDC-1880, Rev. 0IR2.

Question 3

On Page 17 - The assumed area width and height should both be divided by 6 to determine the initial diffusion coefficients when using the diffuse source option of the ARCON96 code rather than by 4.3 and 2. Therefore, the X/Q values for the assumed release from the louver panel should be recalculated and dose calculations revised appropriately.

PSEG Response to Question 3

Calculation H-1-ZZ-MDC-1879 was revised to address the issue stated above. The resulting X/Q's were subsequently incorporated to the dose analysis calculation H-1-ZZ-MDC-1880, Rev. 0IR2.

Question 4

On Page 18 - Is the wake area mentioned on page 18 the wake of equipment within the buildings or the turbine building wake with respect to the environment?

PSEG Response to Question 4

The turbine building wake is used in the analysis.

Attachment 3

Presentation Materials

Hope Creek Generating Station Main Steam Isolation Valve Sealing System Deletion Meeting

NRC – PSEG
Nuclear, LLC

July 18, 2001

Agenda

- Overview – Robert DeNight (10 min)
- X/Q Methodology – John Duffy (10 min)
- Meteorological Data – Bob Yewdall (5 min)
- Dose Analysis – NUCORE – Gopal Patel (15 min)
- Containment Water PH – Barry Barkley (10 min)
- Summary – Robert DeNight (5 min)

MSIV Sealing System Deletion Background

- Original MSIVSS Deletion LCR submitted Dec. 28, '98
- Staff issued a draft SER dated November 14, '00, with identification of open issue – control room habitability.
- PSEG withdrew LCR based on concerns with Control Room (CR) inleakage basis and upcoming Generic Letter 99-02 – Charcoal filter testing Methods.
- PSEG submitted revised LCR for deletion of KP system employing the use of the Alternate Source Term (AST) methodology May 16, '01.

Current Licensing Basis

- Control Room Habitability – UFSAR 6.4
- MSIVSS (Leakage Control System) – UFSAR 6.7
- FRVS (Filtration, Recirculation & Ventilation System) – UFSAR 6.8
- MSIV System Testing per Tech. Spec. 4.7.2.e.1, 4.7.2.e.2 & 4.7.2.e.3
- SLC (Standby Liquid Control) System Description – UFSAR 9.3.5

Licensing Background

- Control room dose initially evaluated in NRC SER, October 1984
  - design met SRP 6.4 Guidelines
- Amendment No. 30 granted August 7, 1989
  - Tech Spec Surveillance and Testing Requirements for the Filtration, Recirculation, and Ventilation System (FRVS) recirculation filter efficiencies.
- PSEG recalculated Amendment No. 30 control room doses based on TID 14844 Source Term as follows:
  - < 1 Rem Thyroid
  - <<1 Rem Whole Body
  - <1 Rem Skin

MSIV Sealing System Current Design Basis

- Limits fission product leakage through Main Steam lines during DBA / LOCA scenarios.
  - Tech. Spec Limit for MSIV Leakage = 46 scfh
- MSIVSS manual initiation within 20 mins. post LOCA
- Pressurizes MS lines between inboard-outboard MSIVs and outboard MSIVs-MSSVs.
- Sealing system supplied by Primary Containment Instrument and Gas (PCIG) System
- Seismic / Single Failure Proof / 1E power

MSIVSS Deletion LCR

- Deletion of the MSIV steam sealing system
  - Delete MSIVSS from T.S. Section 3.6.1.4 & Table 3.6.3-1
- **Revise T.S. Section 3.6.1.2 for an MSIV leak rate**
  - Currently 46 scfh total
  - New value – total of 250 scfh for all four main steam lines with no one line exceeding 150 scfh.
- Reconstituted Post-LOCA on-site and off-site dose analyses using new methodology.

MSIVSS System Deletion LCR

- SR MSIV-Leakage Treatment Path not credited
- MS Stop Valves Not Closed
- MSLs Beyond the MSSV Credited
  - Safety Related / Seismically Qualified
- Main Steam Lead Drain provides defense-in-depth
  - Continuous, passive line
  - Non-safety-related / non-seismic drain to condenser
  - Not credited in the analyses

Revised Dose Calculation Methodology

- DBA dose calculations reconstituted
  - Release pathways conservative
  - System response times validated
  - Limiting single failures investigated
  - Verified limiting flow rates, volumes
  - Met GL 99-02 requirements
  - X/Q values reconstituted
- AST versus TID source term assumed
- Calculation Methodology – RADTRAD V 3.02

Use of Regulatory Guide 1.183

- Full Scope Application
  - Non-LOCA Accidents reviewed
  - LOCA scenario shown to be bounding
  - EQ Dose Profile Reviewed
    - Equipment Qualified life not impacted by change.
  - Vital Access areas being reviewed
    - Several areas are being reconstituted.
- No exceptions to Reg Guide 1.183

X/Q Value Reconstitution

John Duffy

X/Q Methodology

- **Current methodology – Modified-Halitsky**
- **Updated methodology – ARCON96**
  - $\chi/Q_{ARCON96} > 10\ \chi/Q_{modified\text{-}Halitsky}$

Relative Location of MSIV Leakage Release and Control Room Air Intake

- Center Turbine Building air intake louver selected for conservatism
  - On the west side of the building
  - Nearest to control room air intake
  - 28 ft wide X 6 ft high
- Mixing within the Turbine Building is not credited

MS Valve Locations

- Inboard MSIVs - inside drywell
- Outboard MSIVs - in Reactor Building steam tunnel
- Main steam stop valves - in Auxiliary Building steam tunnel
- Main stop valves - in Turbine Building (release location)

Roof Vents

Turbine Building roof vents are further from the control room air intake than the center air intake louver (release to environment location)

ARCON96

- ARCON96 directional inputs are based on plant north
- True North is 5°-30'-01" east of Plant North
  - $\theta_{true} = \theta_{plant} - 5°\text{-}30'\text{-}01"$
  - $\chi/Q_{true} < \chi/Q_{plant}$
- No stack flow was assumed

Diffuse Release

- Center louver: 28 ft wide X 6 ft high (columns H and 23)
  - σ_y = (28 ft)/4.3 = 6.512 ft = 1.985 m
  - σ_z = (6 ft)/2 = 3 ft = 0.914 m
- Vent area = (28 ft)(6 ft) = 168 ft^2

Release Locations

- 4 main stop valves (columns F and 24)
  - 6'-6" separation
- Equivalent release area ~ $4\pi(3.25\ ft)^2 = 133\ ft^2$
- Other release points are farther from the control room air intake with larger wake areas

Meteorological Data

Bob Yewdall

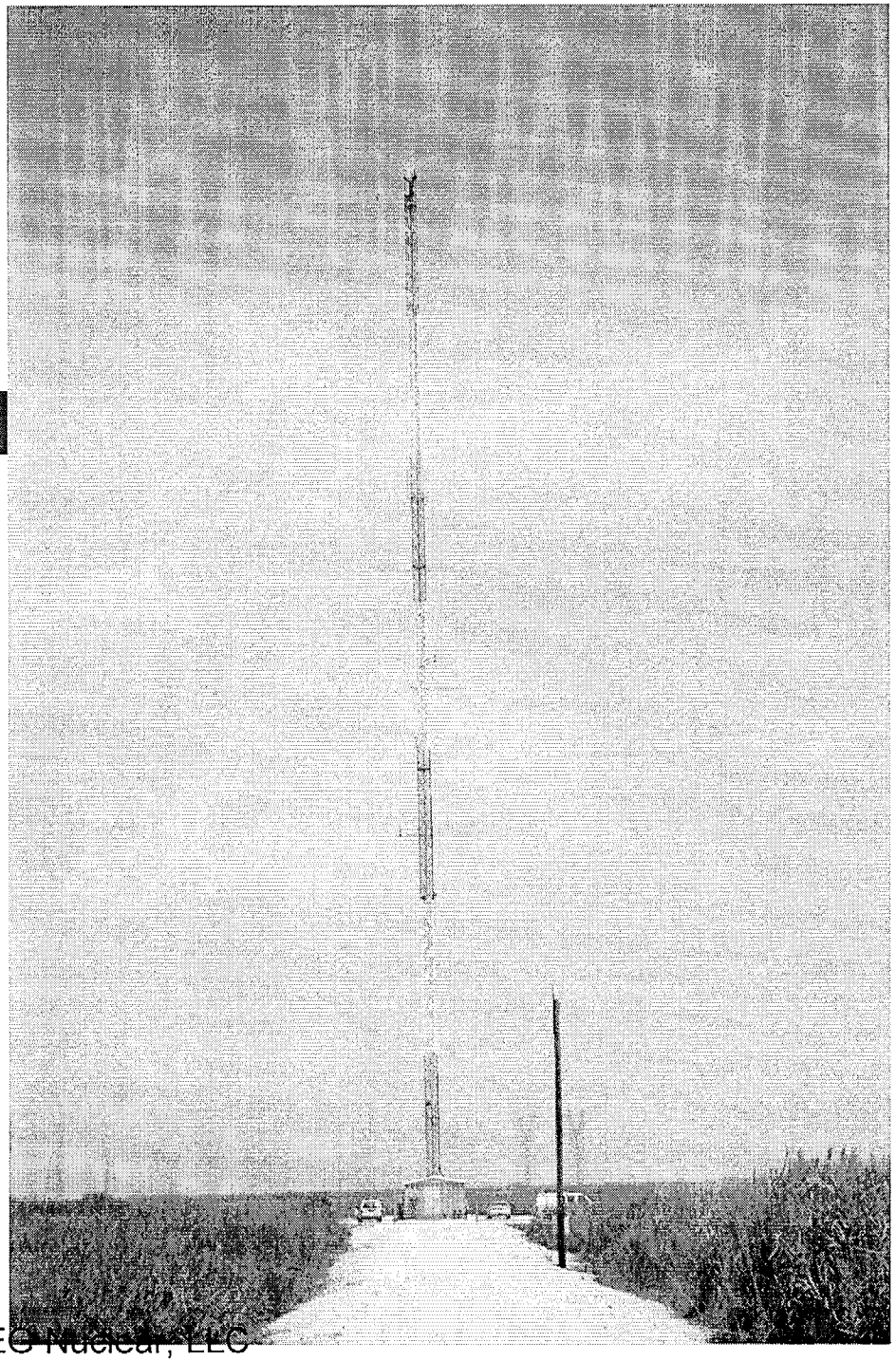
Meteorological Monitoring Program Data Quality

- Meets the guidance of Regulatory Guide 1.23 "Onsite Meteorological Programs"
- Incorporates recommendations of ANSI/ANS 3.11-2000 "Determining Meteorological Information at Nuclear Facilities"
- System calibration / PMs performed quarterly

Meteorological Monitoring Program Data Quality

- Data quality is assured by collecting both analog and digital meteorological data.
- Past evaluation of reasonableness of data collection program with respect to regional data performed as part of the initial Salem Unit 2 licensing process.
- Only validated meteorological data was used within ARCON96 dispersion calculations.
- All units were verified.

Met Tower



On-site / Off-site Dose Analyses

Gopal Patel

Calculation Methodology

- RADTRAD 3.02 Utilized
- Parametric Studies Performed
  - Determined Compatibility With Current Design Inputs
  - Determined variation of design inputs/ESF functions with respect to dose consequences and variation of doses from current to proposed licensing basis analyses
- Inputs Validated and Verified
- Release Paths Verified
  - Only safety related ESF components credited for dose mitigation
  - SSE design based MS piping credited for MSIV leakage and single active component failures and limiting design values used to maximize dose consequences

Analysis Parameters

- Core isotopic source inventory
  - ORIGEN 2.1
  - 1.05 times licensed power level
- Release Fractions & Timing
  - By radionuclide group
  - Gap and Early In-Vessel releases
- Chemical Form
  - Iodines (A = 95%, E = 4.85%, O = 0.15%)
  - Sump pH >7 (including radiolysis of hypalon)
- Atmospheric Dispersion Factors (χ/Qs)
  - CR χ/Qs from reconstitution effort
  - Site boundary per RG 1.145

Dose Calculation Critical Inputs / Assumptions

- Control Room unfiltered inleakage value of 900 cfm used versus previously assumed 10 cfm.
- GL 99-02 charcoal filter efficiencies assumed
- Plate-out within seismically qualified MS lines, no plate-out assumed in condenser

Release Pathways

- Containment Leakage
  - TS Leak Rate (0.5 V%/day) reduced after 24 Hrs
  - Directly released to environment before drawdown
  - Released to Reactor Building after drawdown
  - 50% Mixing in Reactor Building
  - Ground Level Release via FRVS Vent
- ESF Leakage
  - Two times administrative limit
  - Directly released to environment before drawdown
  - Released to Reactor Building after drawdown
  - Ground Level Release via FRVS Vent
  - 10% Iodine Flashing Factor per RG 1.183

Release Pathways (Continued)

- **MSIV Leakage**
  - 150 scfh In MSIV Failed Line
  - 100 scfh In Other Lines
  - Aerosol Deposition Based on 40% Monte Carlo Distribution of Settling Velocity Used For Perry Plant
  - Elemental Iodine Deposition Based JE Cline Model For Deposition & Re-suspension Rates
  - Post-LOCA Containment Airborne Activity Released
  - Ground Level Release Via Turbine Building Louvers
- **Containment Purge Release**
  - Containment Not Purged During Full Power
  - Purge Release Path Not Analyzed

Single Failure Assumptions

- **Four Out of Six FRVS Recirc Trains Maximize Dose / One of Two FRVS Vent Units Utilized**
  - Remove Activity From Reactor Building Slower
  - Reduce Mixing of Activity In Reactor Building (100% to 50%)
- **One Out of Two CREFS Trains Maximizes Dose**
  - Removal of CR Airborne Residual Activity By Recirculation Filter Is Faster Than Increase In Activity From Intake Flow
  - CR Activity Equilibrium Reaches Faster With Higher Recirc Filter Removal Rate

HCGS Dose Results

Post-LOCA Activity Release Path	Post-LOCA TEDE Dose (Rem)		
	Receptor Location		
	Control Room	EAB	LPZ
Containment Leakage	4.50E-01	3.41E-01	1.10E-01
ESF Leakage	2.85E-01	3.51E-02	1.19E-02
MSIV Leakage	3.48E+00	1.92E+00	3.67E-01
CR Filter Shine	2.46E-03	0.00E+00	0.00E+00
Total	**4.22E+00**	**2.30E+00**	**4.89E-01**
Allowable TEDE Limit	**5.00E+00**	**2.50E+01**	**2.50E+01**

pH Calculation Results

Barry Barkley

pH Methodology

- **STARpH code (Polestar) used for pH calculation**
- **HNO_3 from radiolysis of water calculated per NUREG/CR-5732**
  - Radiation field in pool based on energy deposition rates of fission product groups excluding noble gases; fission product group releases based on Reg. Guide 1.183
  - Include decay of fission products with time after reactor shutdown
- **HCl from radiolysis of cable insulation calculated per NUREG/CR-5950**
  - Gamma and beta radiation fields based on energy release rates per unit reactor thermal power as a function of time after reactor shutdown from NUREG/CR-2367, modified to reflect Reg. Guide 1.183 source term
  - Gamma radiation leakage from containment taken into account
  - Shielding of beta radiation by cable tray and conduit taken into account

pH Methodology (Continued)

- **pH calculated taking into account total HNO_3 and HCl added as a function of time and buffer strength in pool (from SLCS actuation) using NUREG/CR-5950**
  - Effect of pool temperature on buffer dissociation constants taken into account

pH Calculation Inputs

- **Material type, mass, and dimensions of chloride-bearing cable insulation (both the hypalon jacket and the EPR insulation contain chloride)**
  - 12,000 lbs total
  - 75% of mass attributed to non-copper (i.e., 9000 lbs)
- **Extent and dimensions of conduit materials**
  - 38% in conduit
- **Buffer content of SLCS**

pH Calculation Assumptions

- Organic acids from paints can be neglected as the $[H^+]$ added from this source is a small fraction of that from HNO_3 and HCl
- No credit is taken for cesium in the buffer calculation
- Unbuffered pH of the pool should remain above 7 for at least several hours even if it is assumed that no cesium exists as CsOH and that only a portion of the cesium exists as $CsBO_2$
- Hypalon jacket and EPR insulation are modeled as a single unit with a thickness of 0.401 cm and a density of 1.40 g/cm^3 (NUREG 1081)

pH Results

- pH of the containment water pool for the Hope Creek plant radiological DBA LOCA is above 8 over a period of 30 days following accident initiation

pH results vs. time

Time	pH
1 h	>8
2h	>8
5h	8.4
12h	8.4
1d	8.4
3d	8.3
10d	8.3
20d	8.3
30d	8.3

SLC Operation

- SAG-1, "Primary Cont. Flooding"
  - Entered Upon Failure to Maintain Adequate Core Cooling in Emergency Ops Procedures
- SAG-1 Initiates SLCS
- SAG-1 Re-established Full Core Submergence

Schedule

- LCR Submittal - Complete
- CR Boundary Envelope Integrity Walkdown - Complete
- Tracer Gas Testing - July 23-28
- Complete RF-10 Mods. – Oct 29

KP System Deletion LCR

Question / Answers