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

NRC – PSEG Nuclear, LLC

July 18, 2001

Enclosure 2

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

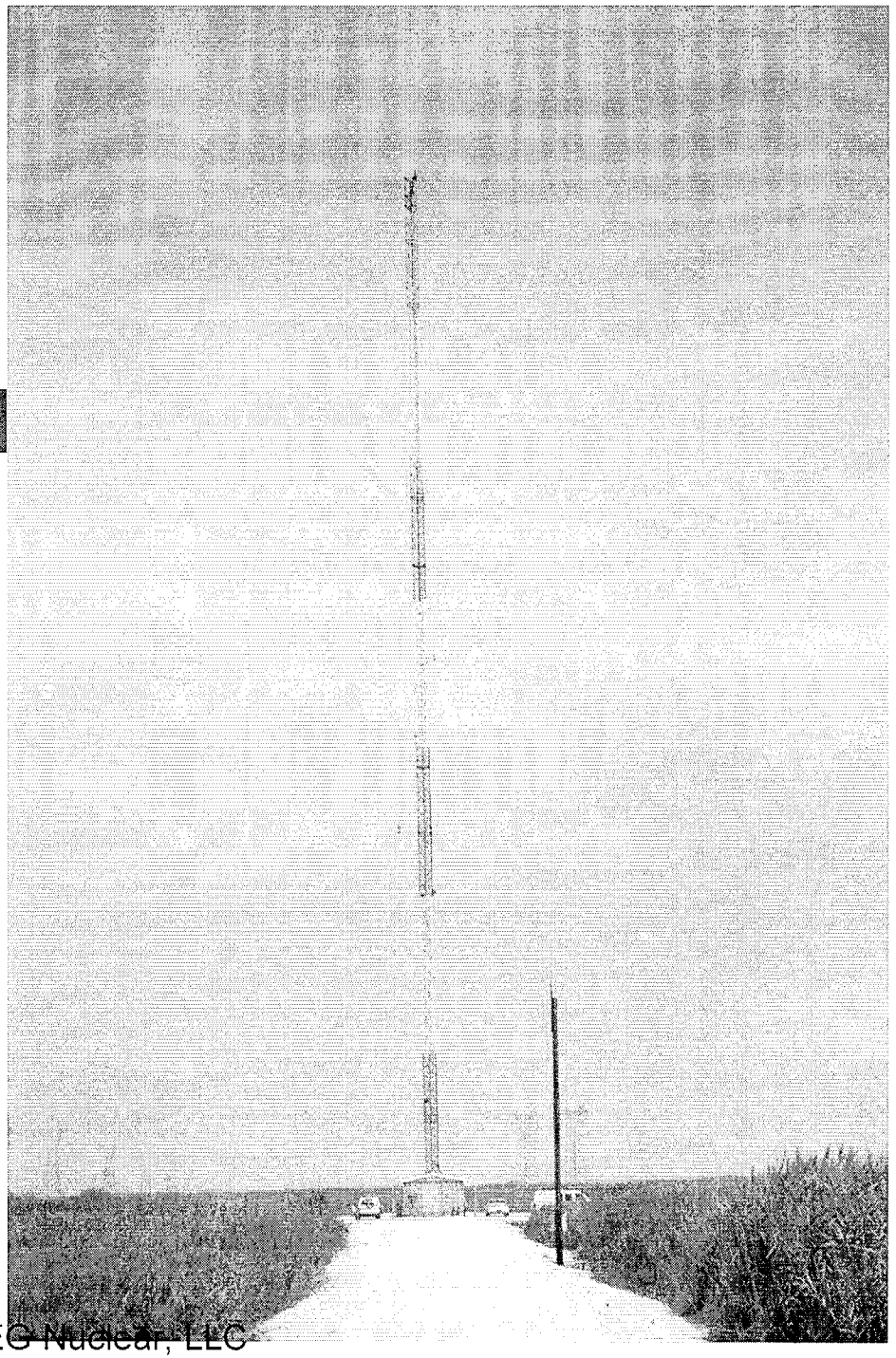
Meteorological Monitoring Program Data Quality

- 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