NRC Meeting with Exelon Generation Company on Request for Extension of the Containment Integrated Leak Rate Test at Peach Bottom Unit 3

Thursday, June 21, 2001
10:00 a.m. - 12:00 p.m.
Conference Room O-10B4
OWFN, Rockville, MD

Name	Organization
John Boska	NRC/NRR
Tom Loomis	Exelon / Licensing
DAVE HELKER	EXELON / LICENSING
JIM BERG	EXELON / PB SITE ENGINEERING
GREG KRUEGER	EXELON / CORPORATE PRA - ENGINEERING
DON VANOVER	EXELON / CONTRACTOR ERIN ENGINEERING
DOUG PORTREY	EXELON / PB SITE ENGINEERING
HANS ASHAR	NRC/NRR
DENNIS DYCKMAN	PA / BRP NUCLEAR SAFETY
Deana Raleigh	LIS, Scientech draleigh@scientech.com
Bill Bradley	NEI
FRED MADDEN	NEI
MICHAEL ADELIZZI	PPL SUSQUEHANNA / ENGINEERING
Jim Clifford	NRC/NRR
David Terao	NRC/NRR/EMEB
John Lehning	NRC / NRR / SPLB
PETER WEN	NRC/NRR/RGEB
MICHAEL SNODDERLY	NRC/NRR/SPSB
James C. Pulsipher	NRC/NRR/Plant Systems Branch
Mark Rubin	NRC/NRR/SPSB

Exelon SM

License Amendment Request for a One-Time Deferral of the Type A Containment Integrated Leak Rate Test

Peach Bottom Atomic Power Station, Unit 3

Enclosure 2

Exelon SM

Introduction

Tom Loomis

Licensing and Regulatory Affairs

Exelon SM

- Introduction (Tom Loomis – Licensing and Regulatory Affairs)
- Risk Assessment
  - Greg Krueger (Corporate Nuclear Engineering)
- Performance history
  - Jim Berg (PBAPS Site Engineering)
- Conclusion/Questions (Tom Loomis – Licensing and Regulatory Affairs)

Exelon SM

- The License Amendment Request submittal was provided in two parts on May 30, 2001
- Our submittal requests a one-time deferral of the Containment Integrated Leak Rate Test (ILRT) for PBAPS, Unit 3

Exelon SM

- Last ILRT was successfully performed December, 1991
- Requesting deferral to December, 2007
- Sixteen (16) years between tests
- Similar to other deferral requests

Exelon SM

- PBAPS, Unit 3 is a BWR, Mark I
- Licensed in 1974
- The PBAPS, Unit 2 risk analysis was used in NUREG-1493 ("Performance-Based Containment Leak-Test Program," September 1995) as the BWR evaluation plant
- NUREG-1493 provides the basis for the current one in ten year test

- Our License Amendment provides a risk impact assessment of the ILRT deferral
- Additionally, our License Amendment provides a discussion of:
  - ILRT performance history
  - On-line containment monitoring
  - Ongoing containment inspections (IWE)

Greg Krueger

Risk Assessment

ILRT Extension Request

Summary of the Risk Assessment

- » Background
- » Purpose
- » Methodology
- » Discussion
  - Data
  - Sensitivity Cases
  - Results
- » Summary
- » Conclusions

Risk Assessment Background

- PBAPS PRA consists of an integrated Level 1 and Level 2 analysis
- The PRA has been updated and enhanced since the IPE
  - » 1996-1997
  - » 1999-2000
- The PRA underwent 2 BWROG PSA Certification Reviews
  - » The updates incorporated the major issues highlighted by the review team
- The PBAPS specific Level 3 PRA, developed for the NUREG-1150 program, was used for this risk assessment

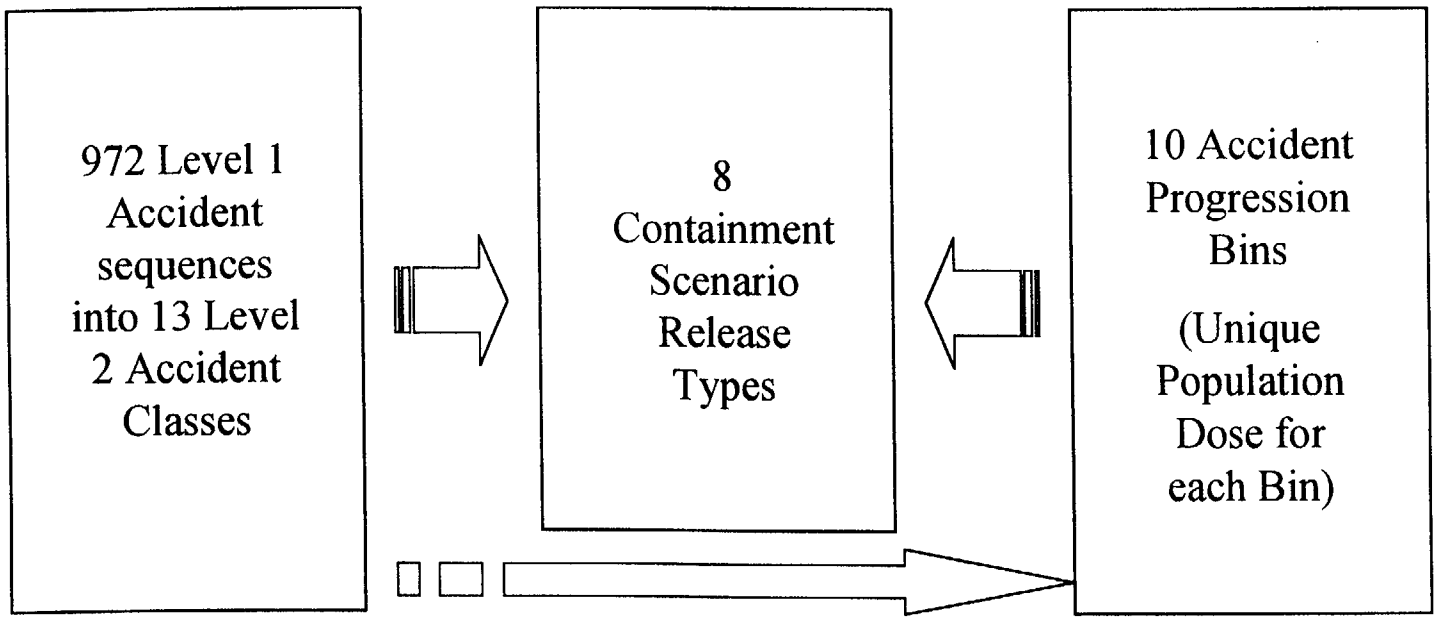
Risk Assessment Purpose

- Confirm conclusions from NUREG-1493 for PBAPS
- Update analysis with more recent data
- Apply guidance from Regulatory Guide 1.174 in evaluating the results
- Provide justification to defer the ILRT for 3 additional refueling outages for PBAPS Unit 3

Risk Assessment Methodology

- Consistent with NUREG-1493 and EPRI TR-104285
  - » Quantify baseline risk per EPRI Release Types
  - » Develop plant-specific population dose results
  - » Evaluate the risk impact of extending the ILRT interval in terms of change in postulated accident dose
  - » Determine the change in LERF and evaluate in accordance with Reg. Guide 1.174

Risk Assessment Mapping



Risk Assessment Discussion

- Data
  - » Only 3% of Containment Leakage Events would only be detected by an ILRT (NUREG-1273)
  - » PBAPS PSA Model references NUREG/CR-4220 in determining the probability of pre-existing failures (Note that only PWR failures occurred)
  - » Per EPRI and NUREG-1493, interval extension increases probability of pre-existing leak by $T_{1/2}$
  - » Per EPRI and NUREG-1493, a three day detection and correction time is assumed for inerted BWR containments

Risk Assessment Discussion

- Sensitivity Cases
  - » Best-estimate calculation of interval extension from 3 in 10 to 1 in 16 years
  - » Best-estimate upper bound pre-existing failure value based on NUREG/CR-4220 reported value
  - » Pessimistic upper bound value assuming a hundred-fold increase in the probability of a pre-existing isolation failure

Risk Assessment Discussion

- Results (Baseline Frequencies and Dose)

NOTE: The baseline represents the 3 in 10 year ILRT Type A frequency

Release Type	Description	Frequency (per Rx-yr)	Person-rem (50-miles)	Person-rem/yr (50-miles)
1	No Containment Failure (Including successful venting)	2.94E-6	1.11E5	0.328
2	Large Isolation Failures (Failure to Close)	Negligible (<1E-11)	4.98E6	Negligible
3, 4, 5	Small Isolation Failures (Failure to Seal)	2.87E-11	4.98E6	1.43E-4
6	Other Isolation Failures (e.g., dependent failures)	Negligible	4.98E6	Negligible
7	Failures Induced by Phenomena (Early and Late)	1.59E-6	3.70E6	5.87
8	Bypass (Interfacing System LOCA)	2.30E-9	3.78E6	8.70E-3
CDF	All CET End states	4.53E-6		6.21

Risk Assessment Discussion

- Sensitivity Case Results

Case: Description	LERF	LERF Increase	Person-Rem/yr (50 miles-2000)
Case 0: Base Case (No ILRT Extension) (3 in 10 year frequency)	6.167E-8	0	6.21
Case 1: Best Estimate (ILRT Extension to sixteen years leads to an assumed increase in the probability of a pre-existing undetected leak)	6.168E-8	1.0E-11	6.21
Case 2: Best Estimate Upper Bound (Probability of pre-existing leak is at the NUREG/CR-4220 upper bound value)	6.173E-8	6.0E-11	6.21
Case 3: Upper Bound Sensitivity (ILRT extension leads to an assumed hundred fold increase in the probability of a pre-existing undetected leak)	7.127E-8	9.6E-9	6.26

Risk Assessment Summary

- Calculated Population Dose
  - » Best-estimate increase in population dose at 50-miles due to interval extension is 2E-4 with upper bound at 4.3E-4 and pessimistic upper bound at 0.06 person-rem/yr
- Large Early Release Frequency (LERF)
  - » Best-estimate increase in LERF due to interval extension is 1.0E-11 with upper bound at 6.0E-11 and pessimistic upper bound at 9.6E-09
- Core Damage Frequency (CDF) not impacted

Risk Assessment Conclusions

- Consistent with the conclusions in NUREG-1493 and in EPRI TR-104285, the ILRT extension leads to a negligible increase in the calculated risk at PBAPS.
- Based on the application guidelines from Regulatory Guide 1.174, the ILRT extension is of very low risk significance with a calculated increase in LERF << 1E-7.

Conditional Containment Failure Probability

- CCFP w/vent = [All APBs from NUREG/CR-4551 except Bin 8 (No CF, No vent)] / CDF

  - » Base case CCFP [2.364E-06-1.424E-08]/ 4.53E-06 = .51869
  - » Best Estimate CCFP = .51870
  - » Best Estimate Upper Bound CCFP = .51871
  - » Pessimistic Upper Bound CCFP = .52126

EPRI Release Type Comparison

Release Type [1]	Description	A Previous Submittal	PB Submittal
1	No Containment Failure	Frequency reduces with increases in Type 3 releases, and also assumes that leakages increase to $2L_a$ and higher	Frequency reduces with increases in Type 3 releases, but assumes no increase above $1L_a$
2	Large Isolation Failures (Failure to Close)	No change from baseline consequence measures	Represented by "Large" isolation failures (Base case failure rate = 3E-6)
3, 4, 5	Small Isolation Failures (Failure to Seal)	Categorized as Release types 3a ("Small") and 3b ("Large"). Small and Large Failure probabilities developed from 95th percentile of the χ^2 distribution of data from NUREG-1493. (0.064 and 0.021, respectively)	Represented by "Small" isolation failures (Base case failure probability = 4E-5 from the NUREG/CR-4220 mean reported value of 5E-3 assuming a 3-day detection time)
6	Other Isolation Failures (e.g., dependent failures)	No change from baseline consequence measures	No change from baseline consequence measures
7	Failures Induced by Phenomena (Early and Late)	No change from baseline consequence measures	No change from baseline consequence measures
8	Bypass	Characterized by SGTR scenarios – not impacted by ILRT extension	Characterized by ISLOCA scenarios – not impacted by ILRT extension

Isolation Failure Probability Comparison

- Chi-squared versus Pessimistic Upper Bound

Isolation Failure Type	χ^2 Distribution 95th Percentile Values (+16% from interval extension)	PBAPS Assessment for Pessimistic Upper Bound Values
"Small"	0.064 * 3/365 = 5.3E-4 * 1.16 = 6.1E-4	100 * PBAPS Base Value = 100 * 5E-3 * 3/365 = 4E-3
"Large"	0.021 * 3/365 = 1.7E-4 * 1.16 = 2.0E-4	100 * PBAPS Base Value = 100 * 3E-6 = 3E-4

Exelon℠

Jim Berg

ILRT History

Exelon SM

PBAPS Unit 3 ILRT HISTORY

ILRT Test Date	Acceptance Limit (Percent Containment Air Weight/day)	Leakage Rate (Percent Containment Air Weight/day
February 1974 (Pre-Operational)	0.500	0.116
April 1977 (Leak on Torus Water Level Instrument)	0.500	1.129
Retest	0.500	0.322
September 1981 (Leak on Drywell Pressure Transmitter)	0.500	0.389
Retest	0.500	0.185
August 1983 (Leak on RHR Valve Packing)	0.500	0.784
Retest	0.500	0.105
January 1986	0.500	0.088
November 1989	0.500	0.229
December 1991	0.500	0.139

Technical Specification Leakage Limit for Unit Startup – 0.375 % Containment Air Weight/day

Exelon SM

- PBAPS Unit 3 has undergone six operational ILRTs in addition to the pre-operational test
- Recent test results demonstrate that the PBAPS Unit 3 containment remains an essentially leak-tight barrier
- Early ILRT failures were attributable to activity based degradation.
- Improved work practices and procedural controls have minimized the potential for maintenance related degradation

Exelon SM

- Containment Inspections
  - Inspections provide a high degree of assurance that any degradation of containment structure is identified and corrected prior to introducing a leak path
  - ASME Section XI (IWE) Inspections
  - Maintenance Rule Inspections
    - Structural
    - Containment Coatings
- On-Line Monitoring
  - Inherent to Inerted BWR Containments
  - Allows for detection of gross containment leakage during power operation

Exelon SM

Conclusion/Questions

Tom Loomis – Licensing and Regulatory Affairs

Reproduction of Crystal River calculation to extend Type A Test Interval
From 1 in 10 Years to 1 in 15 Years Using Peach Bottom Plant Specific Data

From Table 5-1 of Peach Bottom's May 30, 2001 submittal

CDF = 4.53E-06
No containment failure frequency = 2.94E-06

Table 1 - Baseline Mean Consequence Measures

Class	Description	Frequency per Rx-yr	Persn-Rem	Persn-Rem per year
1	No Containment Failure (including suc venting)	2.55E-06	1.11E+05	2.84E-01
2	Large Cont Isolation Failures (failure to close)	n/a	6.58E+05	0.00E+00
3a	Small Isolation Failure (Type A test)	2.90E-07	1.11E+06	3.22E-01
3b	Large Isolation Failure (Type A test)	9.51E-08	3.89E+06	3.70E-01
6	Other Isolation Failures (dependent failures)	n/a	4.98E+06	0.00E+00
7	Severe Accident Phenomena (Early and Late)	1.59E-06	3.70E+06	5.88E+00
8	Containment Bypassed (Event V)	2.30E-09	3.78E+06	8.69E-03
CDF		4.53E-06		6.866685

Class 1 frequency = D7-Class3a-Class3b =	2.55E-06
Class 2 frequency = From Table 5-1 =	n/a
Class 3a frequency = .064*CDF=	2.90E-07
Class 3b frequency = .021*CDF =	9.51E-08
Class 6 frequency = From Table 5-1 =	n/a
Class 7 frequency = From Table 5-1 =	1.59E-06
Class 8 frequency = From Table 5-1 =	2.30E-09

Class 1 dose = From Table 5-2 =	1.11E+05
Class 2 dose = From Table 5-2 =	6.58E+05
Class 3a dose = 1.11E+05 person-rem*10La =	1.11E+06
Class 3b dose = 1.11E+05 person-rem*35La =	3.89E+06
Class 6 dose = From Table 5-2 =	4.98E+06
Class 7 dose = From Table 5-2 =	3.70E+06
Class 8 dose = From Table 5-2 =	3.78E+06

CCFP = 1 minus (Class 1 plus Class 3a/CDF) = 3.723E-01

Table 2 - Mean Consequence Measures for 10 Year Test Interval

Class	Description	Frequency per Rx-yr	Persn-Rem	Persn-Rem per year
1	No Containment Failure (including suc venting)	2.52E-06	1.11E+05	2.79E-01
2	Large Cont Isolation Failures (failure to close)	n/a	6.58E+05	0.00E+00
3a	Small Isolation Failure (Type A test)	3.19E-07	1.11E+06	3.54E-01
3b	Large Isolation Failure (Type A test)	1.05E-07	3.89E+06	4.07E-01
6	Other Isolation Failures (dependent failures)	n/a	4.98E+06	0.00E+00
7	Severe Accident Phenomena (Early and Late)	1.59E-06	3.70E+06	5.88E+00

8	Containment Bypassed (Event V)	2.30E-09	3.78E+06	8.69E-03
CDF		4.53E-06		6.93155

Class 1 frequency = D7-Class3a-Class3b =	2.52E-06
Class 2 frequency = From Table 5-1 =	n/a
Class 3a frequency = .064*CDF*1.1=	3.19E-07
Class 3b frequency = .021*CDF*1.1 =	1.05E-07
Class 6 frequency = From Table 5-1 =	n/a
Class 7 frequency = From Table 5-1 =	1.59E-06
Class 8 frequency = From Table 5-1 =	2.30E-09

CCFP = 1 minus (Class 1 plus Class 3a/CDF) = 3.744E-01

Table 3 - Mean Consequence Measures for 15 Year Test Interval

Class	Description	Frequency per Rx-yr	Persn-Rem	Persn-Rem Per Year
1	No Containment Failure (including suc venting)	2.50E-06	1.11E+05	2.77E-01
2	Large Cont Isolation Failures (failure to close)	n/a	6.58E+05	0.00E+00
3a	Small Isolation Failure (Type A test)	3.33E-07	1.11E+06	3.70E-01
3b	Large Isolation Failure (Type A test)	1.09E-07	3.89E+06	4.25E-01
6	Other Isolation Failures (dependent failures)	n/a	4.98E+06	0.00E+00
7	Severe Accident Phenomena (Early and Late)	1.59E-06	3.70E+06	5.88E+00
8	Containment Bypassed (Event V)	2.30E-09	3.78E+06	8.69E-03
CDF		4.53E-06		6.963982

Class 1 frequency = D7-Class3a-Class3b =	2.50E-06
Class 2 frequency = From Table 5-1 =	n/a
Class 3a frequency = .064*CDF*1.15 =	3.33E-07
Class 3b frequency = .021*CDF*1.15 =	1.09E-07
Class 6 frequency = From Table 5-1 =	n/a
Class 7 frequency = From Table 5-1 =	1.59E-06
Class 8 frequency = From Table 5-1 =	2.30E-09

CCFP = 1 minus (Class 1 plus Class 3a/CDF) = 3.755E-01

Delta LERF going from 3 in 10 year test interval to 1 in 15 year test interval =
Difference in Class 3b frequency = 1.43E-08

Delta LERF going from 3 in 10 year test interval to 1 in 15 year test interval =
Using IP3 Methodolgy = Class3bBase*.12 = 1.14E-08

Delta LERF going from 1 in 10 year test interval to 1 in 15 year test interval =
Difference in Class 3b frequency = 4.76E-09

Delta LERF going from 1 in 10 year test interval to 1 in 15 year test interval =
Using IP3 Methodolgy = Class3b10*.05 = 5.23E-09

Delta person-rem/year going from 3 in 10 year test interval to 1 in 15 year interval = 0.097298
Percentage increase = ((Total15 - Total Base)/Total Base)*100 = 1.42%

Delta person-rem/year going from 1 in 10 year test interval to 1 in 15 year interval = 0.032433
Percentage increase = ((Total15 - Total10)/Total10)*100 = 0.47%

Delta increase in CCFP going from 3 in 10 year test interval to 1 in 15 year interval = 0.31%

Delta increase in CCFP going from 1 in 10 year test interval to 1 in 15 year interval = 0.10%