Attachment 3 to 2.04.003

Entergy Nuclear Operations, Inc.
Pilgrim Nuclear Power Plant
Proposed Amendment to the Technical Specifications

Entergy Calculation No. PNPS-1-ERHS-II.B-4, Rev. 1, "Control Room and Technical Support Center Accident X/Qs Using ARCON96" (49 pages).

Entergy

# CALCULATION COVER PAGE

RType B4.01

| ☐IP-2 | ☐IP-3 | ☐JAF | ☒PNPS | ☐VY |
|---|---|---|---|---|
| Calculation No. PNPS-1-ERHS-II.B-4 | This revision incorporates the following MERLIN DRNs or Minor Calc Changes: | | Sheet 1 of 43 | |
| Title: Control Room and Technical Support Center Accident χ/Q's Using ARCON96 | | | ☒ QR ☐ NQR | |
| Discipline: Systems and Safety Analysis | | | Design Basis Calculation? ☒ Yes ☐ No | |

This calculation supercedes/voids calculation: ERHS-II.B-4, Revision 0

Modification No./Task No/ER No: N/A

☐ No software used
☐ Software used and filed separately (Include Computer Run Summary Sheet). If "YES", Code _____
☒ Software used and filed with this calculation. If "YES", Code: ARCON96

System No./Name: N/A

Component No./Name: N/A

(Attached additional pages if necessary)

**Print / Sign**

| REV # | STATUS (Prel. Pend, A, V, S) | PREPARER | REVIEWER/DESIGN VERIFIER | OTHER REVIEWER/ DESIGN VERIFIER | APPROVER | DATE |
|---|---|---|---|---|---|---|
| 1 | A | P. Compagnone P.Compagnone | P. T. Karatzas PTKaratzas | | S. Wollman S.Wollman | 4/1/04 |
| | | | | | | |
| | | | | | | |

SUBJECT: Control Room and Technical Support Center Accident χ/Q's Using ARCON96

## RECORD OF REVISIONS

Calculation No. PNPS-1ERHS-II .B-4

| Revision No. | Description of Change | Reason For Change |
|---|---|---|
| | | |
| 0 | New calculation | |
| 1 | Full revision | Addition of new release location; correction of release height input for 2 other release locations |
| | | |
| | | |

SUBJECT: Control Room and Technical Support Center Accident χ/Q's Using ARCON96

## CALCULATION SUMMARY PAGE



Calculation No. PNPS-1-ERHS-II.B-4 Revision No. 1

CALCULATION OBJECTIVE: To determine the atmospheric dispersion factors (χ/Q's) to the Control Room and Technical Support Center using the ARCON96 computer program and 5 years of meteorological data.

CONCLUSIONS: The atmospheric dispersion factors are as follows:

| To ⇒ | Control Room [Table 8-1] | | | | |
|---|---|---|---|---|---|
| From ⇒ | Main Stack | Turbine Bldg. | TB RFP Area | Reactor Bldg. Vent | Reactor Bldg. Trucklock |
| Time Interval | ($s/m^3$) | ($s/m^3$) | ($s/m^3$) | ($s/m^3$) | ($s/m^3$) |
| 0 – 2 hrs | 7.32E-07 | 3.44E-03 | 2.04E-03 | 1.85E-03 | 9.87E-04 |
| 2 – 8 hrs | 4.93E-07 | 2.79E-03 | 1.70E-03 | 1.45E-03 | 7.39E-04 |
| 8 – 24 hrs | 9.98E-08 | 1.05E-03 | 5.95E-04 | 5.19E-04 | 2.71E-04 |
| 1 – 4 days | 1.06E-07 | 8.86E-04 | 5.16E-04 | 4.21E-04 | 1.86E-04 |
| 4 – 30 days | 8.95E-08 | 7.82E-04 | 4.64E-04 | 3.81E-04 | 1.58E-04 |

| To ⇒ | Technical Support Center [Table 8-2] | | | | |
|---|---|---|---|---|---|
| From ⇒ | Main Stack | Turbine Bldg. | TB RFP Area | Reactor Bldg. Vent | Reactor Bldg. Trucklock |
| Time Interval | ($s/m^3$) | ($s/m^3$) | ($s/m^3$) | ($s/m^3$) | ($s/m^3$) |
| 0 – 2 hrs | 9.23E-07 | 1.71E-03 | 7.99E-04 | 7.26E-04 | 4.34E-04 |
| 2 – 8 hrs | 6.34E-07 | 1.44E-03 | 6.37E-04 | 5.61E-04 | 3.34E-04 |
| 8 – 24 hrs | 1.31E-07 | 5.09E-04 | 2.29E-04 | 1.98E-04 | 1.24E-04 |
| 1 – 4 days | 1.37E-07 | 4.51E-04 | 1.84E-04 | 1.60E-04 | 8.61E-05 |
| 4 – 30 days | 1.14E-07 | 3.79E-04 | 1.65E-04 | 1.46E-04 | 7.45E-05 |

ASSUMPTIONS: The methodology detailed in Regulatory Guide 1.194 is acceptable for determining atmospheric dispersion factor to the "control room".

DESIGN INPUT DOCUMENTS:

Calculation PNPS-1-ERHS-II.B-3, Rev. 0
Pilgrim Station Unit 1 Appendix I Evaluation

AFFECTED DOCUMENTS:

METHODOLOGY: The computer program ARCON96 was used to calculate the χ/Q's using the methodology incorporated in the program.

SUBJECT: Control Room and Technical Support Center Accident χ/Q's Using ARCON96

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SUBJECT: Control Room and Technical Support Center Accident χ/Q's Using ARCON96

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|---|---|
| 1 through 43 | 1 |
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SUBJECT: Control Room and Technical Support Center Accident χ/Q's Using ARCON96

## 1. BACKGROUND

Habitability of the main control room and other locations in the plant following design basis events must be evaluated. Atmospheric dispersion factors (χ/Q's) from radioactivity release points to receptor locations are needed for calculation of estimated radiological consequences following postulated accidents.

## 2. PURPOSE

To calculate the atmospheric dispersion coefficients to the Control Room and Technical Support Center for releases from the Main Stack, Turbine Building roof, Reactor Building vent, and Reactor Building truck lock using 5 years of PNPS meteorological data and the computer program ARCON96, "Atmospheric Relative Concentrations in Building Wakes".

## 3. METHOD OF SOLUTION

The χ/Q's to the Control Room and to the Technical Support Center are determined following the guidance provided in Regulatory Guide 1.194 [1]. The qualified computer program ARCON96 [2] is used with the PNPS meteorological data documented in calculation PNPS-1-ERHS-II.B-3 [3]. The methodology for calculating the χ/Q's is embodied in the ARCON96 computer program.

## 4. ASSUMPTIONS

The methodology described in Regulatory Guide 1.194, "Atmospheric Relative Concentrations For Control Room Radiological Habitability Assessments at Nuclear Power Plants," [1] is acceptable for determining atmospheric dispersion factors to the Control Room or similar locations.

## 5. INPUT AND DESIGN CRITERIA

The calculations of the χ/Q's are based on the following data. The specific computer program parameter input values for each release point and receptor location are listed in the following sections.

### 5.1 Meteorology

1. The meteorological data for the calendar years 1996, 1997, 1998, 1999, and 2000 are given in calculation PNPS-1-ERHS-II.B-3 [3]. The computer input files identified for use with ARCON96 are used. The files are as follows:

| Elevated Release (MS) | Ground-level Release (TB, RB) |
|---|---|
| AR96A.met | AR96B.met |
| AR97A.met | AR97B.met |
| AR98A.met | AR98B.met |
| AR99A.met | AR99B.met |
| AR00A.met | AR00B.met |

2. Wind speed measurement units = "mph" [3]
3. Height of lower wind speed measurement on 160-ft meteorological tower = 33 ft [3] [4, Section B, page B-1] = 10 m
4. Height of upper wind speed measurement on 160-ft tower = 160 ft [3] [4, Section B, page B-1] = 48.8 m
5. Height of lower wind speed measurement on 220-ft meteorological tower = 33 ft [3] [4, Section B, page B-2] = 10 m
6. Height of upper wind speed measurement on 220-ft tower = 220 ft [3] [4, Section B, page B-1] = 67.1 m

SUBJECT: Control Room and Technical Support Center Accident χ/Q's Using ARCON96

## 5. INPUT AND DESIGN CRITERIA (Continued)

### 5.2 Main Stack Release Point

1. Grade elevation of Main Stack (MS) = 65 ft [5]
2. Height of Main Stack above grade elevation = 335 ft [4, App. B, page B-15] = 102.1 m
3. Height of adjacent solid structures ≈ 15 ft [5]. The height of the MS is more than twice the height of adjacent solid structures. Therefore, releases from the MS are considered elevated releases [1].
4. Minimum MS accident flow rate from the Standby Gas Treatment System (SGTS) = (4000 – 10%) cfm [6; 7] = 1.70 $m^3/s$. Flow rate from the SGTS is used since in the event of an accident, the safety-related SGTS will be available.
5. Diameter of MS = 28.75 in [4, App. B, page B-15]. Radius = 0.365 m.

### 5.3 Turbine Building Release Point

1. Grade elevation at Turbine Building (TB) = 23 ft [8F]
2. Elevation of top of TB = 108 ft [8F].
3. Release height from the TB roof = (108 ft – 23 ft) = 85 ft = 25.9 m
   Releases from the TB roof are less than twice the height of adjacent solid structures (the TB). Consequently, releases from the TB during accident conditions are considered to be ground-level releases [1].
4. Release from the TB roof exhausters is assumed to occur from the roof exhausters closest to the receptor locations.
5. Vertical dimensions, above grade. of TB = 268 ft x 85 ft [8A, 8F].
   The vertical cross-sectional area of the TB = (268 x 85) $ft^2$ = 2116 $m^2$.

## 5. INPUT AND DESIGN CRITERIA (CONTINUED)

### 5.4 Turbine Building Reactor Feed Pump Area Release Point

1. Grade elevation at Turbine Building (TB) = 23 ft [8F]
2. Elevation of top of TB Reactor Feed Pump (RFP) area roof = 82 ft [8F].
3. Release height from the TB RFP area roof = (82 ft – 23 ft) = 59 ft = 18 m
   Releases from the RFP area roof are less than twice the height of adjacent solid structures (the TB). Consequently, releases from this point during accident conditions are considered to be ground-level releases [1].
4. Release from the TB RFP area roof exhausters is funneled to one release location.
5. Vertical dimensions, above grade, of the RFP area and adjacent building = 59 ft x 74 ft [8A, 8F]. The vertical cross-sectional area = (59 x 74) $ft^2$ = 406 $m^2$.

### 5.5 Reactor Building Vent Release Point

1. Grade elevation of Reactor Building (RB) = 23 ft [8E]
2. Elevation of top of RB vent = 182 ft [8D].
3. Release height from RB vent = (182 ft – 23 ft) = 159 ft = 48.5 m
4. Height of RB = 166 ft – 23 ft = 143 ft [8E].
   Releases from the RB vent are at a height less than twice the height of adjacent solid structures (the RB). Consequently, releases from the RB during accident conditions are considered to be ground-level releases [1].
5. Vertical dimensions of RB (vent side), above grade = 142 ft x 143 ft [8E, 8C].
6. The vertical cross-sectional area of the RB = (142 x 143) $ft^2$ = 1886 $m^2$

## 5. INPUT AND DESIGN CRITERIA (CONTINUED)

### 5.6 Reactor Building Trucklock Release Point

1. Grade elevation of Reactor Building (RB) = 23 ft [8E].
2. Elevation of top of RB trucklock opening ≅ 43 ft [8D].
3. Release height from RB trucklock = (43 ft – 23 ft) = 20 ft = 6.1 m
   Releases are conservatively assumed to be from top of opening.
4. Height of RB =143 ft [§5.5.4].
   Releases from the RB trucklock are at a height less than twice the height of adjacent solid structures (the RB). Consequently, releases from the RB trucklock during accident conditions are considered to be ground-level releases [1].
5. Vertical dimensions of RB (trucklock side), above grade = 104 ft x 143 ft [8E, 8C].
6. The vertical cross-sectional area of the RB = (104 x 143) $ft^2$ = 1382 $m^2$

### 5.7 Control Room Receptor Location

The control room (CR) receptor location is the location of the CR air intake.

1. Grade elevation of CR = 23 ft [8D]
2. Elevation of CR intake ≅ 73 ft [8B, 8G]
3. Distance of CR air intake from MS ≅ 800 ft [9] ≅ 244 m
4. Distance of CR air intake from main TB exhausters ≅ 138 ft [10] ≅ 42.1 m
   Distance measured perpendicular from the two TB roof exhausters closest to CR intake.
5. Distance of CR air intake from TB RFP area release point ≅ 186 ft [10] ≅ 56.7 m
6. Distance of CR air intake from RB vent ≅ 160 ft [10] ≅ 48.8 m
7. Distance of CR air intake from RB trucklock ≅ 248 ft [8B, 10] ≅ 75.6 m
8. Direction from CR intake to MS ≅ 303 degrees [9]
9. Direction from CR intake to TB ≅ 207 degrees [9, 10]

SUBJECT: Control Room and Technical Support Center Accident χ/Q's Using ARCON96

## 5. INPUT AND DESIGN CRITERIA (CONTINUED)

### 5.7 Control Room Receptor Location (Continued)

10. Direction from CR intake to RFP area ≅ 273 degrees [9, 10]
11. Direction from CR intake to RB vent ≅ 285 degrees [9,10]
12. Direction from CR intake to RB trucklock ≅ 315 degrees [9]

### 5.8 Technical Support Center Receptor Location

The Technical Support Center (TSC) receptor location is the location of the TSC air intake.

1. Grade elevation of TSC = 23 ft [9]
2. Height of TSC intake ≅ 10 ft above grade [11]
3. Distance of TSC air intake from MS ≅ 920 ft [9] ≅ 280 m
4. Distance of TSC air intake from TB ≅ 190 ft [9] ≅ 57.9 m
5. Distance of TSC air intake from TB RFP area ≅ 300 ft [9] ≅ 91.4 m
6. Distance of TSC air intake from RB vent ≅ 280 ft [9] ≅ 85.3 m
7. Distance of TSC air intake from RB trucklock ≅ 390 ft [9] ≅ 119 m
8. Direction from TSC intake to MS ≅ 304 degrees [9]
9. Direction from TSC intake to TB ≅ 256 degrees [9]
10. Direction from TSC intake to TB RFP Area exhaust ≅ 285 degrees [9]
11. Direction from TSC intake to RB vent ≅ 290 degrees [9]
12. Direction from TSC intake to RB trucklock ≅ 310 degrees [9]

## 6. REFERENCES

1. Regulatory Guide 1.194, "Atmospheric Relative Concentrations For Control Room Radiological Habitability Assessments at Nuclear Power Plants," June 2003.

2. S&SACP34, Computer Program ARCON96, Software Catalog No. 01811.

3. Calculation PNPS-1-ERHS-II.B-3, "PNPS Meteorological Data For Calculation of Accident Atmospheric Dispersion Factors," Revision 0.

4. Pilgrim Station Unit 1 Appendix I Evaluation, April 1977.

5. Drawing M28, Equipment Location Main Stack & Filter Building.

6. Drawing M289, Reactor Building Air Flow Diagram.

7. Technical Specification 3.7.B, Standby Gas Treatment System.

8. Drawings
   - A. M14, Equipment Location Turbine Building Plan El. 51'-0"
   - B. M18, Equipment Location Reactor Building Plan El. 51'-0"
   - C. M19, Equipment Location Reactor Building Plan El. 74'-3" & El. 91'-3"
   - D. M22, Equipment Location Reactor Building Section C - C
   - E. M23, Equipment Location Section D-D & L-L.
   - F. M24, Equipment Location Sections: E-E and F-F.
   - G. M26, Equipment Locations Sections H-H, J-J, & K-K.

9. Drawing C2, Site Plan.

10. Drawing A6, Turbine and Reactor Building Roof Plan.

11. Drawing M646, Technical Support Center Mechanical Floor Plan.

## 7. CALCULATION/ANALYSIS

The input to the ARCON96 computer program for determining the accident χ/Q values was derived from the input parameter values given in Section 5.

### 7.1 Meteorological Input

1. Number of meteorological data files = 5 [§5.1 #1]
2. Meteorological data file names [§5.1 #1]:
   A. Elevated release: AR96A, AR97A, AR98A, AR99A, AR00A
   B. Ground level release: AR96B. AR97B. AR98B. AR99B. AR00B
3. Lower measurement height = 10 m [§5.1 #3, #5]
4. Upper measurement height:
   A. 160-ft tower – 48.8 m [§5.1 #4]
   B. 220-ft tower - 67.1 m [§5.1 #6]
5. Wind speed units = "mph" [§5.1 #2]

### 7.2 Receptor Input

1. Distance to receptor:
   A. From Main Stack to
      i. CR = 244 m [§5.7 #3]
      ii. TSC = 280 m [§5.8 #3]
   B. From Turbine Building to
      i. CR = 42.1 m [§5.7 #4]
      ii. TSC = 57.9 m [§5.8 #4]
   C. From TB RFP area to
      i. CR = 56.7 m [§5.7 #5]
      ii. TSC = 91.4 m [§5.8 #5]
   D. From Reactor Building vent to:
      i. CR = 48.8 m [§5.7 #6]
      ii. TSC = 85.3 m [§5.8 #6]

SUBJECT: Control Room and Technical Support Center Accident χ/Q's Using ARCON96

## 7. CALCULATION/ANALYSIS (CONTINUED)

### 7.2 Receptor Input (Continued)

E. From Reactor Building trucklock to:

i. CR = 75.6 m [§5.7 #7]
ii. TSC = 119 m [§5.8 #7]

2. Intake height

A. CR [§5.7 #1, #2] = (73 ft – 23 ft) = 50 ft = 15.2 m

B. TSC [§5.8 #2] = 10 ft = 3.05 m

3. Elevation Difference = difference in grade elevation between release point and receptor location:

A. Main Stack to CR and TSC [§5.2 #1, 5.7 #1, 5.8 #1] = (65 ft – 23 ft) = 42 ft = 12.8 m

B. Turbine Building and CR and TSC [§5.3 #1, 5.7 #1, 5.8 #1] = 0 m

C. TB RFP Area and CR and TSC [§5.4 #1, 5.7 #1, 5.8 #1] = 0 m

D. Reactor Building vent and CR and TSC [§5.5 #1, 5.7 #1, 5.8 #1] = 0 m

E. Reactor Building trucklock and CR and TSC [§5.6 #1, 5.7 #1, 5.8 #1] = 0 m

4. Direction to source

A. From CR to

i. Main Stack = 303 degrees [§5.7 #8]
ii. Turbine Building = 207 degrees [§5.7 #9]
iii. TB RFP area = 273 degrees [§5.7 #10]
iv. Reactor Building vent = 285 degrees [§5.7 #11]
v. Reactor Building trucklock = 315 degrees [§5.7 #12]

B. From TSC to

i. Main Stack = 304 degrees [§5.8 #8]
ii. Turbine Building = 256 degrees [§5.8, #9]
iii. TB RFP area = 285 degrees [§5.8, #10]
iv. Reactor Building vent = 290 degrees [§5.8 #11]
v. Reactor Building trucklock = 310 degrees [§5.8 #12]

SUBJECT: Control Room and Technical Support Center Accident χ/Q's Using ARCON96

## 7. CALCULATION/ANALYSIS (CONTINUED)

### 7.3 Source Input

1. Release type:
   - A. From Main Stack = elevated [§5.2 #3]
   - B. From Turbine Building = ground [§5.3 #3]
   - C. From TB RFP are = ground [§5.4 #3]
   - D. From Reactor Building vent = ground [§5.5 #4]
   - E. From Reactor Building trucklock = ground [§5.6 #4]
2. Release height (above grade):
   - A. From Main Stack = 102.1 m [§5.2 #2]
   - B. From Turbine Building = 25.9 m [§5.3 #3]
   - C. From TB RFP area = 18 m [§5.4 #3]
   - D. From Reactor Building vent = 48.5 m [§5.5 #3]
   - E. From Reactor Building trucklock = 6.1 m [§5.6 #3]
3. Building area:
   - A. For Main Stack = 0.01 [1] (not applicable for elevated release)
   - B. For Turbine Building = 2116 $m^2$ [§5.3 #5]
   - C. For TB RFP area release = 406 $m^2$ [§5.4 #5]
   - D. For Reactor Building vent release = 1886 $m^2$ [§5.5 #6]
   - E. For Reactor Building trucklock release = 1382 $m^2$ [§5.6 #6]
4. Vertical velocity
   - A. For Main Stack vertical velocity (v) = 4.06 m/s [§5.2 #4, #5]

     v = stack flow/stack cross-sectional area

     $v = (1.70\ m^3/s)/(\pi r^2) = (1.70\ m^3/s)/\{\pi(0.365\ m)^2\}$

     v = 4.06 m/s
   - B. For Turbine Building = 0
   - C. For TB RFP area = 0

SUBJECT: Control Room and Technical Support Center Accident χ/Q's Using ARCON96

## 7. CALCULATION/ANALYSIS (CONTINUED)

### 7.3 Source Input (Continued)

D. For Reactor Building vent = 0

E. For Reactor Building trucklock = 0

5. Stack flow (for Main Stack) = 1.70 $m^3/s$ [§5.2 #4]
6. Stack radius (for Main Stack) = 0.365 m [§5.2 #5]

### 7.4 Values Input

1. Surface roughness lengtn = 0.20 [1]
2. Wind direction window = 90 degrees [1]
3. Minimum wind speed = 0.5 m/s [1]
4. Averaging sector width constant = 4.3 [1]
5. Initial diffusion coefficients (m) = 0 [1]

SUBJECT: Control Room and Technical Support Center Accident χ/Q's Using ARCON96

## 7. CALCULATION/ANALYSIS (CONTINUED)

### 7.5 ARCON96 Input

| | Main Stack | | Turbine Building Exhausters | | Turbine Building RFP Area | | Reactor Building Vent | | Reactor Building Trucklock | |
|---|---|---|---|---|---|---|---|---|---|---|
| | CR | TSC | CR | TSC | CR | TSC | CR | TSC | CR | TSC |
| **Meteorological Input** | | | | | | | | | | |
| | | | | | | | | | | |
| Number of Met Data Files | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Met Data File name | , Sec 7.1 #2A | | Sec 7.1 #2B | | | | | | | |
| Lower Measurement Height (m) | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 |
| Upper Measurement Height (m) | 67.1 | 67.1 | 48.8 | 48.8 | 48.8 | 48.8 | 48.8 | 48.8 | 48.8 | 48.8 |
| Wind Speed Units (mph, m/s, knots) | mph | mph | mph | mph | mph | mph | mph | mph | mph | mph |
| | | | | | | | | | | |
| **Receptor Input** | | | | | | | | | | |
| | | | | | | | | | | |
| Distance to Receptor (m) | 244 | 280 | 42.1 | 57.9 | 56.7 | 91.4 | 48.8 | 85.3 | 75.6 | 119 |
| Intake Height (m) | 15.2 | 3.05 | 15.2 | 3.05 | 15.2 | 3.05 | 15.2 | 3.05 | 15.2 | 3.05 |
| Elevation Difference (m) | 12.8 | 12.8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Direction to Source (degrees) | 303 | 304 | 207 | 256 | 273 | 285 | 285 | 290 | 315 | 310 |

SUBJECT: Control Room and Technical Support Center Accident χ/Q's Using ARCON96

## 7. CALCULATION/ANALYSIS (CONTINUED)

### 7.5 ARCON96 Input (Continued)

| | Main Stack | | Turbine Building Exhausters | | Turbine Building RFP Area | | Reactor Building Vent | | Reactor Building Trucklock | |
|---|---|---|---|---|---|---|---|---|---|---|
| | CR | TSC | CR | TSC | CR | TSC | CR | TSC | CR | TSC |
| **Source Input** | | | | | | | | | | |
| | | | | | | | | | | |
| Release Type | Stack | Stack | Ground | Ground | Ground | Ground | Ground | Ground | Ground | Ground |
| Release Height (m) | 102.1 | 102.1 | 25.9 | 25.9 | 18.0 | 18.0 | 48.5 | 48.5 | 6.1 | 6.1 |
| Building Area ($m^2$) | 0.01 | 0.01 | 2116 | 2116 | 406 | 406 | 1886 | 1886 | 1382 | 1382 |
| Vertical Velocity (m/s) | 4.06 | 4.06 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Stack Flow ($m^3/s$) | 1.70 | 1.70 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Stack Radius (m) | 0.365 | 0.365 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | | | | | | | |
| **Output Files** | | | | | | | | | | |
| Output File (name) {*.log} | mscr1 | mstsc1 | tbcr1 | tbtsc1 | rfpcr1 | rfptsc1 | rbcr1 | rbtsc1 | rbtlcr1 | rbtltsc1 |
| CFD File Name (*.cfd} | mscr1 | mstsc1 | tbcr1 | tbtsc1 | rfpcr1 | rfptsc1 | rbcr1 | rbtsc1 | rbtlcr1 | rbtltsc1 |
| Expanded Output (y or n) | n | n | n | n | n | n | n | n | n | n |
| | | | | | | | | | | |

SUBJECT: Control Room and Technical Support Center Accident χ/Q's Using ARCON96

## 7. CALCULATION/ANALYSIS (CONTINUED)

### 7.5 ARCON96 Input (Continued)

| | Main Stack | | Turbine Building Exhausters | | Turbine Building RFP Area | | Reactor Building Vent | | Reactor Building Trucklock | |
|---|---|---|---|---|---|---|---|---|---|---|
| | CR | TSC | CR | TSC | CR | TSC | CR | TSC | CR | TSC |
| Values | | | | | | | | | | |
| Surface roughness length (m) | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 |
| Wind Direction Window (degrees) | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 |
| Minimum Wind Speed (m/s) | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| Averaging Sector Width Constant | 4.3 | 4.3 | 4.3 | 4.3 | 4.3 | 4.3 | 4.3 | 4.3 | 4.3 | 4.3 |
| Initial Diffusion Coefficients (m) | 0.0, 0.0 | 0.0, 0.0 | 0.0, 0.0 | 0.0, 0.0 | 0.0, 0.0 | 0.0, 0.0 | 0.0, 0.0 | 0.0, 0.0 | 0.0, 0.0 | 0.0, 0.0 |
| Hours in Averages | 1, 2, 4, 8, 12 24, 96, 168, 360, 720 | | | | | | | | | |
| Minimum Number of Hours | 1, 2, 4, 8, 11, 22, 87, 152, 324, 648 | | | | | | | | | |

## 7.6 Computer Run Output

The above information is input to the ARCON96 computer program. The computer run output is provided as follows:

| | |
|---|---|
| Main Stack to Control Room | §7.6.1 |
| Main Stack to Technical Support Center | §7.6.2 |
| Turbine Building to Control Room | §7.6.3 |
| Turbine Building to Technical Support Center | §7.6.4 |
| TB RPB Area to Control Room | §7.6.5 |
| TB RFP Area Technical Support Center | §7.6.6 |
| Reactor Building Vent to Control Room | §7.6.7 |
| Reactor Building Vent to Technical Support Center | §7.6.8 |
| Reactor Building Trucklock to Control Room | §7.6.9 |
| Reactor Building Trucklock to Technical Support Center | §7.6.10 |

SUBJECT: Control Room and Technical Support Center Accident χ/Q's Using ARCON96

## 7.6 Computer Run Output (Continued)

### 7.6.1 Main Stack To Control Room

```
Program Title:  ARCON96.

 Developed For:  U.S. Nuclear Regulatory Commission
                 Office of Nuclear Reactor Regulation
                 Division of Reactor Program Management

 Date:           June 25, 1997    11:00 a.m.

 NRC Contacts:   J. Y. Lee        Phone: (301) 415 1080
                                  e-mail: jyl1@nrc.gov
                 J. J. Hayes      Phone: (301),415 3167
                                  e-mail: jjh@nrc.gov
                 L. A  Brown      Phone: (301) 415 1232
                                  e-mail: lab2@nrc.gov

 Code Developer: J. V. Ramsdell   Phone: (509) 372 6316
                                  e-mail: j_ramsdell@pnl.gov

 Code Documentation:  NUREG/CR-6331 Rev. 1

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employees, makes any warranty, expressed or implied, or assumes any legal
liability or responsibilities for any third party's use, or the results of such
use, of any portion of this program or represents that its use by such third
party would not infringe privately owned rights.

Program Run   3/23/2004  at  09:57:18

 ******* ARCON INPUT **********

    Number of Meteorological Data Files  =  5
    Meteorological Data File Names
      C:\ARCON96\METDATA\AR-A\AR96A.MET
      C:\ARCON96\METDATA\AR-A\AR97A.MET
      C:\ARCON96\METDATA\AR-A\AR98A.MET
      C:\ARCON96\METDATA\AR-A\AR99A.MET
      C:\ARCON96\METDATA\AR-A\AR00A.MET

    Height of lower wind instrument (m)  =    10.0
    Height of upper wind instrument (m)  =    67.1
    Wind speeds entered as miles per hour

    Elevated release
    Release height (m)                   =   102.1
    Building Area (m^2)                  =      .0
    Effluent vertical velocity (m/s)     =    4.06
    Vent or stack flow  (m^3/s)          =    1.70
    Vent or stack radius (m)             =     .37

    Direction .. intake to source (deg)  =     303
    Wind direction sector width (deg)    =      90
    Wind direction window (deg)          =  258 - 348
    Distance to intake (m)               =   244.0
    Intake height  (m)                   =    15.2
    Terrain elevation difference (m)     =    12.8
```

SUBJECT: Control Room and Technical Support Center Accident χ/Q's Using ARCON96

## 7.6 Computer Run Output (Continued)
## 7.6.1 Main Stack To Control Room (Continued)

```
Output file names
  chiq\mscr1.log
  chiq\mscr1.cfd

Minimum Wind Speed (m/s)              =       .5
Surface roughness length (m)          =       .20
Sector averaging constant             =      4.3

Initial value of sigma y              =       .00
Initial value of sigma z              =       .00

Expanded output for code testing not selected

Total number of hours of data processed =  43848
Hours of missing data                   =   1488
Hours direction in window               =  13121
Hours elevated plume w/ dir. in window  =   6701
Hours of calm winds                     =     16
Hours direction not in window or calm   =  29223
```

DISTRIBUTION SUMMARY DATA BY AVERAGING INTERVAL

| AVER. PER. | 1 | 2 | 4 | 8 | 12 | 24 | 96 | 168 | 360 | 720 |
|---|---|---|---|---|---|---|---|---|---|---|
| UPPER LIM. | 1.00E-05 | 1.00E-05 | 1.00E-05 | 1.00E-05 | 1.00E-05 | 1.00E-05 | 1.00E-05 | 1.00E-05 | 1.00E-05 | 1.00E-05 |
| LOW LIM. | 1.00E-09 | 1.00E-09 | 1.00E-09 | 1.00E-09 | 1.00E-09 | 1.00E-09 | 1.00E-09 | 1.00E-09 | 1.00E-09 | 1.00E-09 |
| ABOVE RANGE | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| IN RANGE | 4105. | 5107. | 6838. | 9897. | 13156. | 19852. | 34508. | 36911. | 38033. | 38529. |
| BELOW RANGE | 0. | 0. | 0. | 63. | 386. | 983. | 1186. | 511. | 0. | 0. |
| ZERO | 38255. | 37022. | 34859. | 30901. | 27932. | 20240. | 4375. | 1490. | 115. | 0. |
| TOTAL X/Qs | 42360. | 42129. | 41697. | 40861. | 41474. | 41075. | 40069. | 38912. | 38148. | 38529. |
| % NON ZERO | 9.69 | 12.12 | 16.40 | 24.38 | 32.65 | 50.72 | 89.08 | 96.17 | 99.70 | 100.00 |

95th PERCENTILE X/Q VALUES

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 7.32E-07 | 7.11E-07 | 6.50E-07 | 5.53E-07 | 4.19E-07 | 2.51E-07 | 1.42E-07 | 1.19E-07 | 1.05E-07 | 9.65E-08 |

95% X/Q for standard averaging intervals

| | |
|---|---|
| 0 to 2 hours | 7.32E-07 |
| 2 to 8 hours | 4.93E-07 |
| 8 to 24 hours | 9.98E-08 |
| 1 to 4 days | 1.06E-07 |
| 4 to 30 days | 8.95E-08 |

| | HOURLY VALUE RANGE | |
|---|---|---|
| | MAX X/Q | MIN X/Q |
| CENTERLINE | 9.73E-06 | 2.14E-42 |
| SECTOR-AVERAGE | 5.67E-06 | 8.38E-43 |

NORMAL PROGRAM COMPLETION

SUBJECT: Control Room and Technical Support Center Accident χ/Q's Using ARCON96

## 7.6 Computer Run Output (Continued)

### 7.6.2 Main Stack To Technical Support Center

```
Program Title:  ARCON96.

 Developed For:  U.S. Nuclear Regulatory Commission
                 Office of Nuclear Reactor Regulation
                 Division of Reactor Program Management

 Date:           June 25, 1997    11:00 a.m.

 NRC Contacts:   J. Y. Lee        Phone: (301) 415 1080
                                  e-mail: jyl1@nrc.gov
                 J. J. Hayes      Phone: (301) 415 3167
                                  e-mail: jjh@nrc.gov
                 L. A  Brown      Phone: (301) 415 1232
                                  e-mail: lab2@nrc.gov

 Code Developer: J. V. Ramsdell   Phone: (509) 372 6316
                                  e-mail: j_ramsdell@pnl.gov

 Code Documentation:  NUREG/CR-6331 Rev. 1

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 liability or responsibilities for any third party's use, or the results of such
 use, of any portion of this program or represents that its use by such third
 party would not infringe privately owned rights.

 Program Run   3/23/2004  at  09:51:26

  ******* ARCON INPUT **********

     Number of Meteorological Data Files  =  5
     Meteorological Data File Names
       C:\ARCON96\METDATA\AR-A\AR96A.MET
       C:\ARCON96\METDATA\AR-A\AR97A.MET
       C:\ARCON96\METDATA\AR-A\AR98A.MET
       C:\ARCON96\METDATA\AR-A\AR99A.MET
       C:\ARCON96\METDATA\AR-A\AR00A.MET

     Height of lower wind instrument (m)  =     10.0
     Height of upper wind instrument (m)  =     67.1
     Wind speeds entered as miles per hour

     Elevated release
     Release height (m)                   =    102.1
     Building Area (m^2)                  =      .0
     Effluent vertical velocity (m/s)     =     4.06
     Vent or stack flow  (m^3/s)          =     1.70
     Vent or stack radius (m)             =      .37

     Direction .. intake to source (deg)  =      304
     Wind direction sector width (deg)    =       90
     Wind direction window (deg)          =  259 - 349
     Distance to intake (m)               =    280.0
     Intake height  (m)                   =      3.0
     Terrain elevation difference (m)     =     12.8
```

SUBJECT: Control Room and Technical Support Center Accident χ/Q's Using ARCON96

## 7.6 Computer Run Output (Continued)
## 7.6.2 Main Stack To Technical Support Center (Continued)

```
Output file names
  chiq\mstscl.log
  chiq\mstscl.cfd

Minimum Wind Speed (m/s)              =      .5
Surface roughness length (m)          =      .20
Sector averaging constant             =     4.3

Initial value of sigma y              =      .00
Initial value of sigma z              =      .00

Expanded output for code testing not selected

Total number of hours of data processed =  43848
Hours of missing data                   =   1488
Hours direction in window               =  13056
Hours elevated plume w/ dir. in window  =   6653
Hours of calm winds                     =     16
Hours direction not in window or calm   =  29288

DISTRIBUTION SUMMARY DATA BY AVERAGING INTERVAL
```

| AVER. PER. | 1 | 2 | 4 | 8 | 12 | 24 | 96 | 168 | 360 | 720 |
|---|---|---|---|---|---|---|---|---|---|---|
| UPPER LIM. | 1.00E-04 | 1.00E-04 | 1.00E-04 | 1.00E-04 | 1.00E-04 | 1.00E-04 | 1.00E-04 | 1.00E-04 | 1.00E-04 | 1.00E-04 |
| LOW LIM. | 1.00E-08 | 1.00E-08 | 1.00E-08 | 1.00E-08 | 1.00E-08 | 1.00E-08 | 1.00E-08 | 1.00E-08 | 1.00E-08 | 1.00E-08 |
| ABOVE RANGE | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| IN RANGE | 4005. | 4746. | 6163. | 9003. | 12362. | 19498. | 33240. | 36008. | 37485. | 38346. |
| BELOW RANGE | 104. | 364. | 666. | 930. | 1109. | 1182. | 2259. | 1411. | 548. | 183. |
| ZERO | 38251. | 37019. | 34868. | 30928. | 28003. | 20395. | 4570. | 1493. | 115. | 0. |
| TOTAL X/Qs | 42360. | 42129. | 41697. | 40861. | 41474. | 41075. | 40069. | 38912. | 38148. | 38529. |
| % NON ZERO | 9.70 | 12.13 | 16.38 | 24.31 | 32.48 | 50.35 | 88.59 | 96.16 | 99.70 | 100.00 |
| 95th PERCENTILE X/Q VALUES | 9.23E-07 | 9.04E-07 | 8.27E-07 | 7.06E-07 | 5.41E-07 | 3.23E-07 | 1.84E-07 | 1.53E-07 | 1.33E-07 | 1.23E-07 |

```
95% X/Q for standard averaging intervals

0 to 2 hours        9.23E-07
2 to 8 hours        6.34E-07
8 to 24 hours       1.31E-07
1 to 4 days         1.37E-07
4 to 30 days        1.14E-07
```

| | HOURLY VALUE RANGE MAX X/Q | MIN X/Q |
|---|---|---|
| CENTERLINE | 1.26E-05 | 5.48E-43 |
| SECTOR-AVERAGE | 7.36E-06 | 2.12E-43 |

```
NORMAL PROGRAM COMPLETION
```

## 7.6 Computer Run Output (Continued)

### 7.6.3 Turbine Building To Control Room

```
Program Title:  ARCON96.

 Developed For:  U.S. Nuclear Regulatory Commission
                 Office of Nuclear Reactor Regulation
                 Division of Reactor Program Management

 Date:           June 25, 1997    11:00 a.m.

 NRC Contacts:   J. Y. Lee        Phone: (301) 415 1080
                                  e-mail: jyl1@nrc.gov
                 J. J. Hayes      Phone: (301) 415 3167
                                  e-mail: jjh@nrc.gov
                 L. A  Brown      Phone: (301) 415 1232
                                  e-mail: lab2@nrc.gov

 Code Developer: J. V. Ramsdell   Phone: (509) 372 6316
                                  e-mail: j_ramsdell@pnl.gov

 Code Documentation:  NUREG/CR-6331 Rev. 1

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 employees, makes any warranty, expressed or implied, or assumes any legal
 liability or responsibilities for any third party's use, or the results of such
 use, of any portion of this program or represents that its use by such third
 party would not infringe privately owned rights.

 Program Run   3/23/2004  at  09:22:10

  ******* ARCON INPUT **********

     Number of Meteorological Data Files  =  5
     Meteorological Data File Names
       C:\ARCON96\METDATA\AR-B\AR96B.MET
       C:\ARCON96\METDATA\AR-B\AR97B.MET
       C:\ARCON96\METDATA\AR-B\AR98B.MET
       C:\ARCON96\METDATA\AR-B\AR99B.MET
       C:\ARCON96\METDATA\AR-B\AR00B.MET

     Height of lower wind instrument (m)  =     10.0
     Height of upper wind instrument (m)  =     48.8
     Wind speeds entered as miles per hour

     Ground-level release
     Release height (m)                   =     25.9
     Building Area (m^2)                  =   2116.0
     Effluent vertical velocity (m/s)     =      .00
     Vent or stack flow  (m^3/s)          =      .00
     Vent or stack radius (m)             =      .00

     Direction .. intake to source (deg)  =      207
     Wind direction sector width (deg)    =       90
     Wind direction window (deg)          =   162 - 252
     Distance to intake (m)               =     42.1
     Intake height  (m)                   =     15.2
     Terrain elevation difference (m)     =       .0
```

SUBJECT: Control Room and Technical Support Center Accident χ/Q's Using ARCON96

## 7.6 Computer Run Output (Continued)
## 7.6.3 Turbine Building To Control Room (Continued)

```
Output file names
  chiq\tbcr1.log
  chiq\tbcr1.cfd

Minimum Wind Speed (m/s)              =       .5
Surface roughness length (m)          =       .20
Sector averaging constant             =      4.3

Initial value of sigma y              =       .00
Initial value of sigma z              =       .00

Expanded output for code testing not selected

Total number of hours of data processed =  43848
Hours of missing data                   =   1468
Hours direction in window               =  16627
Hours elevated plume w/ dir. in window  =      0
Hours of calm winds                     =    666
Hours direction not in window or calm   =  25087

DISTRIBUTION SUMMARY DATA BY AVERAGING INTERVAL

95% X/Q for standard averaging intervals

0 to 2 hours        3.44E-03
2 to 8 hours        2.79E-03
8 to 24 hours       1.05E-03
1 to 4 days         8.86E-04
4 to 30 days        7.82E-04

                          HOURLY VALUE RANGE
                        MAX X/Q              MIN X/Q
     CENTERLINE         4.17E-03             7.94E-05
     SECTOR-AVERAGE     2.43E-03             4.63E-05

NORMAL PROGRAM COMPLETION
```

SUBJECT: Control Room and Technical Support Center Accident χ/Q's Using ARCON96

## 7.6 Computer Run Output (Continued)

### 7.6.4 Turbine Building To Technical Support Center

```
Program Title:  ARCON96.

 Developed For:  U.S. Nuclear Regulatory Commission
                 Office of Nuclear Reactor Regulation
                 Division of Reactor Program Management

 Date:           June 25, 1997    11:00 a.m.

 NRC Contacts:   J. Y. Lee        Phone: (301) 415 1080
                                  e-mail: jyl1@nrc.gov
                 J. J. Hayes      Phone: (301) 415 3167
                                  e-mail: jjh@nrc.gov
                 L. A  Brown      Phone: (301) 415 1232
                                  e-mail: lab2@nrc.gov

 Code Developer: J. V. Ramsdell   Phone: (509) 372 6316
                                  e-mail: j_ramsdell@pnl.gov

 Code Documentation:  NUREG/CR-6331 Rev. 1

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 liability or responsibilities for any third party's use, or the results of such
 use, of any portion of this program or represents that its use by such third
 party would not infringe privately owned rights.

 Program Run   3/23/2004  at  09:23:05

  ******* ARCON INPUT **********

     Number of Meteorological Data Files  =  5
     Meteorological Data File Names
       C:\ARCON96\METDATA\AR-B\AR96B.MET
       C:\ARCON96\METDATA\AR-B\AR97B.MET
       C:\ARCON96\METDATA\AR-B\AR98B.MET
       C:\ARCON96\METDATA\AR-B\AR99B.MET
       C:\ARCON96\METDATA\AR-B\AR00B.MET

     Height of lower wind instrument (m)  =     10.0
     Height of upper wind instrument (m)  =     48.8
     Wind speeds entered as miles per hour

     Ground-level release
     Release height (m)                   =     25.9
     Building Area (m^2)                  =   2116.0
     Effluent vertical velocity (m/s)     =       .00
     Vent or stack flow  (m^3/s)          =       .00
     Vent or stack radius (m)             =       .00

     Direction .. intake to source (deg)  =      256
     Wind direction sector width (deg)    =       90
     Wind direction window (deg)          =   211 - 301
     Distance to intake (m)               =     57.9
     Intake height  (m)                   =      3.0
     Terrain elevation difference (m)     =       .0
```

SUBJECT: Control Room and Technical Support Center Accident χ/Q's Using ARCON96

## 7.6 Computer Run Output (Continued)
## 7.6.4 Turbine Building To Technical Control Center (Continued)

```
Output file names
  chiq\tbtsc1.log
  chiq\tbtsc1.cfd

Minimum Wind Speed (m/s)              =      .5
Surface roughness length (m)          =      .20
Sector averaging constant             =     4.3

Initial value of sigma y              =      .00
Initial value of sigma z              =      .00

Expanded output for code testing not selected

Total number of hours of data processed =  43848
Hours of missing data                   =   1468
Hours direction in window               =  15396
Hours elevated plume w/ dir. in window  =      0
Hours of calm winds                     =    366
Hours direction not in window or calm   =  26318
```

DISTRIBUTION SUMMARY DATA BY AVERAGING INTERVAL

| AVER. PER. | 1 | 2 | 4 | 8 | 12 | 24 | 96 | 168 | 360 | 720 |
|---|---|---|---|---|---|---|---|---|---|---|
| UPPER LIM. | 1.00E-02 | 1.00E-02 | 1.00E-02 | 1.00E-02 | 1.00E-02 | 1.00E-02 | 1.00E-02 | 1.00E-02 | 1.00E-02 | 1.00E-02 |
| LOW LIM. | 1.00E-06 | 1.00E-06 | 1.00E-06 | 1.00E-06 | 1.00E-06 | 1.00E-06 | 1.00E-06 | 1.00E-06 | 1.00E-06 | 1.00E-06 |
| ABOVE RANGE | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| IN RANGE | 16062. | 18516. | 22002. | 26602. | 30541. | 36304. | 40531. | 39644. | 39975. | 39150. |
| BELOW RANGE | 0. | 0. | 0. | 0. | 0. | 0. | 21. | 0. | 0. | 0. |
| ZERO | 26318. | 23678. | 19825. | 14496. | 11171. | 5399. | 267. | 0. | 0. | 0. |
| TOTAL X/Qs | 42380. | 42194. | 41827. | 41098. | 41712. | 41703. | 40819. | 39644. | 39975. | 39150. |
| % NON ZERO | 37.90 | 43.88 | 52.60 | 64.73 | 73.22 | 87.05 | 99.35 | 100.00 | 100.00 | 100.00 |

95th PERCENTILE X/Q VALUES

| 1 | 2 | 4 | 8 | 12 | 24 | 96 | 168 | 360 | 720 |
|---|---|---|---|---|---|---|---|---|---|
| 1.71E-03 | 1.69E-03 | 1.64E-03 | 1.51E-03 | 1.21E-03 | 8.42E-04 | 5.49E-04 | 4.98E-04 | 4.36E-04 | 4.02E-04 |

95% X/Q for standard averaging intervals

| | |
|---|---|
| 0 to 2 hours | 1.71E-03 |
| 2 to 8 hours | 1.44E-03 |
| 8 to 24 hours | 5.09E-04 |
| 1 to 4 days | 4.51E-04 |
| 4 to 30 days | 3.79E-04 |

| | HOURLY VALUE RANGE | |
|---|---|---|
| | MAX X/Q | MIN X/Q |
| CENTERLINE | 2.08E-03 | 8.73E-05 |
| SECTOR-AVERAGE | 1.21E-03 | 5.09E-05 |

NORMAL PROGRAM COMPLETION

SUBJECT: Control Room and Technical Support Center Accident χ/Q's Using ARCON96

## 7.6 Computer Run Output (Continued)

### 7.6.5 Turbine Building Reactor Feed Pump Area To Control Room

```
Program Title:  ARCON96.

Developed For:  U.S. Nuclear Regulatory Commission
                Office of Nuclear Reactor Regulation
                Division of Reactor Program Management

Date:           June 25, 1997    11:00 a.m.

NRC Contacts:   J. Y. Lee        Phone: (301) 415 1080
                                 e-mail: jyl1@nrc.gov
                J. J. Hayes      Phone: (301) 415 3167
                                 e-mail: jjh@nrc.gov
                L. A  Brown      Phone: (301) 415 1232
                                 e-mail: lab2@nrc.gov

Code Developer: J. V. Ramsdell   Phone: (509) 372 6316
                                 e-mail: j_ramsdell@pnl.gov

Code Documentation:  NUREG/CR-6331 Rev. 1

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employees, makes any warranty, expressed or implied, or assumes any legal
liability or responsibilities for any third party's use, or the results of such
use, of any portion of this program or represents that its use by such third
party would not infringe privately owned rights.

Program Run   3/26/2004  at  11:00:32

 ******* ARCON INPUT **********

    Number of Meteorological Data Files  =  5
    Meteorological Data File Names
      C:\ARCON96\METDATA\AR-B\AR96B.MET
      C:\ARCON96\METDATA\AR-B\AR97B.MET
      C:\ARCON96\METDATA\AR-B\AR98B.MET
      C:\ARCON96\METDATA\AR-B\AR99B.MET
      C:\ARCON96\METDATA\AR-B\AR00B.MET

    Height of lower wind instrument (m)  =     10.0
    Height of upper wind instrument (m)  =     48.8
    Wind speeds entered as miles per hour

    Ground-level release
    Release height (m)                   =     18.0
    Building Area (m^2)                  =    406.0
    Effluent vertical velocity (m/s)     =      .00
    Vent or stack flow  (m^3/s)          =      .00
    Vent or stack radius (m)             =      .00

    Direction .. intake to source (deg)  =      273
    Wind direction sector width (deg)    =       90
    Wind direction window (deg)          =  228 - 318
    Distance to intake (m)               =     56.7
    Intake height  (m)                   =     15.2
    Terrain elevation difference (m)     =       .0
```

SUBJECT: Control Room and Technical Support Center Accident χ/Q's Using ARCON96

## 7.6 Computer Run Output (Continued)

### 7.6.5 Turbine Building Reactor Feed Pump Area To Control Room (Continued)

```
Output file names
  chiq\rfpcr1.log
  chiq\rfpcr1.cfd

Minimum Wind Speed (m/s)              =      .5
Surface roughness length (m)          =      .20
Sector averaging constant             =     4.3

Initial value of sigma y              =      .00
Initial value of sigma z              =      .00

Expanded output for code testing not selected

Total number of hours of data processed =  43848
Hours of missing data                   =   1468
Hours direction in window               =  13719
Hours elevated plume w/ dir. in window  =      0
Hours of calm winds                     =    666
Hours direction not in window or calm   =  27995

DISTRIBUTION SUMMARY DATA BY AVERAGING INTERVAL
```

| AVER. PER. | 1 | 2 | 4 | 8 | 12 | 24 | 96 | 168 | 360 | 720 |
|---|---|---|---|---|---|---|---|---|---|---|
| UPPER LIM. | 1.00E-02 | 1.00E-02 | 1.00E-02 | 1.00E-02 | 1.00E-02 | 1.00E-02 | 1.00E-02 | 1.00E-02 | 1.00E-02 | 1.00E-02 |
| LOW LIM. | 1.00E-06 | 1.00E-06 | 1.00E-06 | 1.00E-06 | 1.00E-06 | 1.00E-06 | 1.00E-06 | 1.00E-06 | 1.00E-06 | 1.00E-06 |
| ABOVE RANGE | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| IN RANGE | 14385. | 16538. | 19647. | 23938. | 27871. | 34389. | 40463. | 39644. | 39975. | 39150. |
| BELOW RANGE | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| ZERO | 27995. | 25656. | 22180. | 17160. | 13841. | 7314. | 356. | 0. | 0. | 0. |
| TOTAL X/Qs | 42380. | 42194. | 41827. | 41098. | 41712. | 41703. | 40819. | 39644. | 39975. | 39150. |
| % NON ZERO | 33.94 | 39.20 | 46.97 | 58.25 | 66.82 | 82.46 | 99.13 | 100.00 | 100.00 | 100.00 |

95th PERCENTILE X/Q VALUES

| 2.04E-03 | 2.01E-03 | 1.95E-03 | 1.79E-03 | 1.44E-03 | 9.93E-04 | 6.35E-04 | 5.79E-04 | 5.14E-04 | 4.87E-04 |
|---|---|---|---|---|---|---|---|---|---|

```
95% X/Q for standard averaging intervals

0 to 2 hours        2.04E-03
2 to 8 hours        1.70E-03
8 to 24 hours       5.95E-04
1 to 4 days         5.16E-04
4 to 30 days        4.64E-04
```

| | HOURLY VALUE RANGE MAX X/Q | MIN X/Q |
|---|---|---|
| CENTERLINE | 2.54E-03 | 1.42E-04 |
| SECTOR-AVERAGE | 1.48E-03 | 8.29E-05 |

```
NORMAL PROGRAM COMPLETION
```

## 7.6 Computer Run Output (Continued)

### 7.6.6 Turbine Building Reactor Feed Pump Area To Technical Support Center

```
Program Title:  ARCON96.

Developed For:  U.S. Nuclear Regulatory Commission
                Office of Nuclear Reactor Regulation
                Division of Reactor Program Management

Date:           June 25, 1997    11:00 a.m.

NRC Contacts:   J. Y. Lee        Phone: (301) 415 1080
                                 e-mail: jyl1@nrc.gov
                J. J. Hayes      Phone: (301) 415 3167
                                 e-mail: jjh@nrc.gov
                L. A  Brown      Phone: (301) 415 1232
                                 e-mail: lab2@nrc.gov

Code Developer: J. V. Ramsdell   Phone: (509) 372 6316
                                 e-mail: j_ramsdell@pnl.gov

Code Documentation:  NUREG/CR-6331 Rev. 1

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employees, makes any warranty, expressed or implied, or assumes any legal
liability or responsibilities for any third party's use, or the results of such
use, of any portion of this program or represents that its use by such third
party would not infringe privately owned rights.

Program Run   3/26/2004  at  14:19:13

******* ARCON INPUT **********

   Number of Meteorological Data Files  =  5
   Meteorological Data File Names
     C:\ARCON96\METDATA\AR-B\AR96B.MET
     C:\ARCON96\METDATA\AR-B\AR97B.MET
     C:\ARCON96\METDATA\AR-B\AR98B.MET
     C:\ARCON96\METDATA\AR-B\AR99B.MET
     C:\ARCON96\METDATA\AR-B\AR00B.MET

   Height of lower wind instrument (m)  =    10.0
   Height of upper wind instrument (m)  =    48.8
   Wind speeds entered as miles per hour

   Ground-level release
   Release height (m)                   =    18.0
   Building Area (m^2)                  =   406.0
   Effluent vertical velocity (m/s)     =      .00
   Vent or stack flow  (m^3/s)          =      .00
   Vent or stack radius (m)             =      .00

   Direction .. intake to source (deg)  =     285
   Wind direction sector width (deg)    =      90
   Wind direction window (deg)          =  240 - 330
   Distance to intake (m)               =    91.4
   Intake height  (m)                   =     3.0
   Terrain elevation difference (m)     =      .0
```

SUBJECT: Control Room and Technical Support Center Accident χ/Q's Using ARCON96

## 7.6 Computer Run Output (Continued)

### 7.6.6 Turbine Building Reactor Feed Pump Area To Technical Support Center (Continued)

```
Output file names
  chiq\rfptsc1.log
  chiq\rfptsc1.cfd

Minimum Wind Speed (m/s)              =      .5
Surface roughness length (m)          =      .20
Sector averaging constant             =     4.3

Initial value of sigma y              =      .00
Initial value of sigma z              =      .00

Expanded output for code testing not selected

Total number of hours of data processed =  43848
Hours of missing data                   =   1468
Hours direction in window               =  12895
Hours elevated plume w/ dir. in window  =      0
Hours of calm winds                     =    666
Hours direction not in window or calm   =  28819
```

DISTRIBUTION SUMMARY DATA BY AVERAGING INTERVAL

| AVER. PER. | 1 | 2 | 4 | 8 | 12 | 24 | 96 | 168 | 360 | 720 |
|---|---|---|---|---|---|---|---|---|---|---|
| UPPER LIM. | 1.00E-02 | 1.00E-02 | 1.00E-02 | 1.00E-02 | 1.00E-03 | 1.00E-03 | 1.00E-03 | 1.00E-03 | 1.00E-03 | 1.00E-03 |
| LOW LIM. | 1.00E-06 | 1.00E-06 | 1.00E-06 | 1.00E-06 | 1.00E-07 | 1.00E-07 | 1.00E-07 | 1.00E-07 | 1.00E-07 | 1.00E-07 |
| ABOVE RANGE | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| IN RANGE | 13561. | 15559. | 18404. | 22351. | 26128. | 32882. | 40314. | 39644. | 39975. | 39150. |
| BELOW RANGE | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| ZERO | 28819. | 26635. | 23423. | 18747. | 15584. | 8821. | 505. | 0. | 0. | 0. |
| TOTAL X/Qs | 42380. | 42194. | 41827. | 41098. | 41712. | 41703. | 40819. | 39644. | 39975. | 39150. |
| % NON ZERO | 32.00 | 36.87 | 44.00 | 54.38 | 62.64 | 78.85 | 98.76 | 100.00 | 100.00 | 100.00 |

95th PERCENTILE X/Q VALUES

| 7.99E-04 | 7.79E-04 | 7.43E-04 | 6.77E-04 | 5.44E-04 | 3.78E-04 | 2.32E-04 | 2.06E-04 | 1.85E-04 | 1.74E-04 |
|---|---|---|---|---|---|---|---|---|---|

95% X/Q for standard averaging intervals

| | |
|---|---|
| 0 to 2 hours | 7.99E-04 |
| 2 to 8 hours | 6.37E-04 |
| 8 to 24 hours | 2.29E-04 |
| 1 to 4 days | 1.84E-04 |
| 4 to 30 days | 1.65E-04 |

| | HOURLY VALUE RANGE | |
|---|---|---|
| | MAX X/Q | MIN X/Q |
| CENTERLINE | 1.00E-03 | 3.88E-05 |
| SECTOR-AVERAGE | 5.86E-04 | 2.26E-05 |

NORMAL PROGRAM COMPLETION

## 7.6 Computer Run Output (Continued)

### 7.6.7 Reactor Building Vent To Control Room

```
Program Title:  ARCON96.

Developed For:  U.S. Nuclear Regulatory Commission
                Office of Nuclear Reactor Regulation
                Division of Reactor Program Management

Date:           June 25, 1997    11:00 a.m.

NRC Contacts:   J. Y. Lee        Phone: (301) 415 1080
                                 e-mail: jyl1@nrc.gov
                J. J. Hayes      Phone: (301) 415 3167
                                 e-mail: jjh@nrc.gov
                L. A  Brown      Phone: (301) 415 1232
                                 e-mail: lab2@nrc.gov

Code Developer: J. V. Ramsdell   Phone: (509) 372 631f
                                 e-mail: j_ramsdell@pnl.gov

Code Documentation:  NUREG/CR-6331 Rev. 1

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liability or responsibilities for any third party's use, or the results of such
use, of any portion of this program or represents that its use by such third
party would not infringe privately owned rights.

Program Run   3/23/2004  at  09:25:57

 ******* ARCON INPUT **********

    Number of Meteorological Data Files  =  5
    Meteorological Data File Names
      C:\ARCON96\METDATA\AR-B\AR96B.MET
      C:\ARCON96\METDATA\AR-B\AR97B.MET
      C:\ARCON96\METDATA\AR-B\AR98B.MET
      C:\ARCON96\METDATA\AR-B\AR99B.MET
      C:\ARCON96\METDATA\AR-B\AR00B.MET

    Height of lower wind instrument (m)  =     10.0
    Height of upper wind instrument (m)  =     48.8
    Wind speeds entered as miles per hour

    Ground-level release
    Release height (m)                   =     48.5
    Building Area (m^2)                  =   1886.0
    Effluent vertical velocity (m/s)     =      .00
    Vent or stack flow  (m^3/s)          =      .00
    Vent or stack radius (m)             =      .00

    Direction .. intake to source (deg)  =     285
    Wind direction sector width (deg)    =      90
    Wind direction window (deg)          =  240 - 330
    Distance to intake (m)               =    48.8
    Intake height  (m)                   =    15.2
    Terrain elevation difference (m)     =      .0
```

SUBJECT: Control Room and Technical Support Center Accident χ/Q's Using ARCON96

## 7.6 Computer Run Output (Continued)
## 7.6.7 Reactor Building Vent To Control Room (Continued)

```
Output file names
  chiq\rbcr1.log
  chiq\rbcr1.cfd

Minimum Wind Speed (m/s)              =       .5
Surface roughness length (m)          =      .20
Sector averaging constant             =      4.3

Initial value of sigma y              =      .00
Initial value of sigma z              =      .00

Expanded output for code testing not selected

Total number of hours of data processed =  43848
Hours of missing data                   =   1468
Hours direction in window               =  13429
Hours elevated plume w/ dir. in window  =      0
Hours of calm winds                     =    956
Hours direction not in window or calm   =  27995
```

DISTRIBUTION SUMMARY DATA BY AVERAGING INTERVAL

| AVER. PER. | 1 | 2 | 4 | 8 | 12 | 24 | 96 | 168 | 360 | 720 |
|---|---|---|---|---|---|---|---|---|---|---|
| UPPER LIM. | 1.00E-02 | 1.00E-02 | 1.00E-02 | 1.00E-02 | 1.00E-02 | 1.00E-02 | 1.00E-02 | 1.00E-02 | 1.00E-02 | 1.00E-02 |
| LOW LIM. | 1.00E-06 | 1.00E-06 | 1.00E-06 | 1.00E-06 | 1.00E-06 | 1.00E-06 | 1.00E-06 | 1.00E-06 | 1.00E-06 | 1.00E-06 |
| ABOVE RANGE | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| IN RANGE | 14385. | 16377. | 19232. | 23136. | 26836. | 33297. | 40258. | 39644. | 39975. | 39150. |
| BELOW RANGE | 0. | 0. | 0. | 0. | 0. | 0. | 2. | 0. | 0. | 0. |
| ZERO | 27995. | 25817. | 22595. | 17962. | 14876. | 8406. | 559. | 0. | 0. | 0. |
| TOTAL X/Qs | 42380. | 42194. | 41827. | 41098. | 41712. | 41703. | 40819. | 39644. | 39975. | 39150. |
| % NON ZERO | 33.94 | 38.81 | 45.98 | 56.29 | 64.34 | 79.84 | 98.63 | 100.00 | 100.00 | 100.00 |

95th PERCENTILE X/Q VALUES

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1.85E-03 | 1.80E-03 | 1.69E-03 | 1.55E-03 | 1.24E-03 | 8.61E-04 | 5.31E-04 | 4.69E-04 | 4.31E-04 | 4.01E-04 |

95% X/Q for standard averaging intervals

| | |
|---|---|
| 0 to 2 hours | 1.85E-03 |
| 2 to 8 hours | 1.45E-03 |
| 8 to 24 hours | 5.19E-04 |
| 1 to 4 days | 4.21E-04 |
| 4 to 30 days | 3.81E-04 |

HOURLY VALUE RANGE

| | MAX X/Q | MIN X/Q |
|---|---|---|
| CENTERLINE | 2.30E-03 | 6.35E-05 |
| SECTOR-AVERAGE | 1.34E-03 | 3.70E-05 |

```
NORMAL PROGRAM COMPLETION
```

SUBJECT: Control Room and Technical Support Center Accident χ/Q's Using ARCON96

## 7.6 Computer Run Output (Continued)

### 7.6.8 Reactor Building Vent To Technical Support Center

```
Program Title:  ARCON96.

Developed For:  U.S. Nuclear Regulatory Commission
                Office of Nuclear Reactor Regulation
                Division of Reactor Program Management

Date:           June 25, 1997    11:00 a.m.

NRC Contacts:   J. Y. Lee        Phone: (301) 415 1080
                                 e-mail: jyl1@nrc.gov
                J. J. Hayes      Phone: (301) 415 3167
                                 e-mail: jjh@nrc.gov
                L. A  Brown      Phone: (301) 415 1232
                                 e-mail: lab2@nrc.gov

Code Developer: J. V. Ramsdell   Phone: (509) 372 6316
                                 e-mail: j_ramsdell@pnl.gov

Code Documentation:  NUREG/CR-6331 Rev. 1

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employees, makes any warranty, expressed or implied, or assumes any legal
liability or responsibilities for any third party's use, or the results of such
use, of any portion of this program or represents that its use by such third
party would not infringe privately owned rights.

Program Run   3/26/2004  at  13:36:24

 ******* ARCON INPUT **********

    Number of Meteorological Data Files  =  5
    Meteorological Data File Names
      C:\ARCON96\METDATA\AR-B\AR96B.MET
      C:\ARCON96\METDATA\AR-B\AR97B.MET
      C:\ARCON96\METDATA\AR-B\AR98B.MET
      C:\ARCON96\METDATA\AR-B\AR99B.MET
      C:\ARCON96\METDATA\AR-B\AR00B.MET

    Height of lower wind instrument (m)  =     10.0
    Height of upper wind instrument (m)  =     48.8
    Wind speeds entered as miles per hour

    Ground-level release
    Release height (m)                   =     48.5
    Building Area (m^2)                  =   1886.0
    Effluent vertical velocity (m/s)     =      .00
    Vent or stack flow  (m^3/s)          =      .00
    Vent or stack radius (m)             =      .00

    Direction .. intake to source (deg)  =      290
    Wind direction sector width (deg)    =       90
    Wind direction window (deg)          =  245 - 335
    Distance to intake (m)               =     85.3
    Intake height  (m)                   =      3.0
    Terrain elevation difference (m)     =       .0
```

SUBJECT: Control Room and Technical Support Center Accident χ/Q's Using ARCON96

## 7.6 Computer Run Output (Continued)
## 7.6.8 Reactor Building Vent To Technical Control Center (Continued)

```
Output file names
  chiq\rbtsc1.log
  chiq\rbtsc1.cfd

Minimum Wind Speed (m/s)              =       .5
Surface roughness length (m)          =       .20
Sector averaging constant             =      4.3

Initial value of sigma y              =       .00
Initial value of sigma z              =       .00

Expanded output for code testing not selected

Total number of hours of data processed =  43848
Hours of missing data                   =   1468
Hours direction in window               =  13224
Hours elevated plume w/ dir. in window  =      0
Hours of calm winds                     =    956
Hours direction not in window or calm   =  28200
```

DISTRIBUTION SUMMARY DATA BY AVERAGING INTERVAL

| AVER. PER. | 1 | 2 | 4 | 8 | 12 | 24 | 96 | 168 | 360 | 720 |
|---|---|---|---|---|---|---|---|---|---|---|
| UPPER LIM. | 1.00E-03 | 1.00E-03 | 1.00E-03 | 1.00E-03 | 1.00E-03 | 1.00E-03 | 1.00E-03 | 1.00E-03 | 1.00E-03 | 1.00E-03 |
| LOW LIM. | 1.00E-07 | 1.00E-07 | 1.00E-07 | 1.00E-07 | 1.00E-07 | 1.00E-07 | 1.00E-07 | 1.00E-07 | 1.00E-07 | 1.00E-07 |
| ABOVE RANGE | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| IN RANGE | 14180. | 16133. | 18942. | 22793. | 26442. | 32919. | 40244. | 39644. | 39975. | 39150. |
| BELOW RANGE | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| ZERO | 28200. | 26061. | 22885. | 18305. | 15270. | 8784. | 575. | 0. | 0. | 0. |
| TOTAL X/Qs | 42380. | 42194. | 41827. | 41098. | 41712. | 41703. | 40819. | 39644. | 39975. | 39150. |
| % NON ZERO | 33.46 | 38.24 | 45.29 | 55.46 | 63.39 | 78.94 | 98.59 | 100.00 | 100.00 | 100.00 |

95th PERCENTILE X/Q VALUES

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 7.26E-04 | 7.02E-04 | 6.63E-04 | 6.03E-04 | 4.81E-04 | 3.33E-04 | 2.03E-04 | 1.79E-04 | 1.65E-04 | 1.54E-04 |

95% X/Q for standard averaging intervals

| | |
|---|---|
| 0 to 2 hours | 7.26E-04 |
| 2 to 8 hours | 5.61E-04 |
| 8 to 24 hours | 1.98E-04 |
| 1 to 4 days | 1.60E-04 |
| 4 to 30 days | 1.46E-04 |

HOURLY VALUE RANGE

| | MAX X/Q | MIN X/Q |
|---|---|---|
| CENTERLINE | 8.96E-04 | 2.54E-05 |
| SECTOR-AVERAGE | 5.22E-04 | 1.48E-05 |

```
NORMAL PROGRAM COMPLETION
```

SUBJECT: Control Room and Technical Support Center Accident χ/Q's Using ARCON96

## 7.6 Computer Run Output (Continued)

### 7.6.9 Reactor Building Trucklock To Control Room

```
Program Title:  ARCON96.

 Developed For:  U.S. Nuclear Regulatory Commission
                 Office of Nuclear Reactor Regulation
                 Division of Reactor Program Management

 Date:           June 25, 1997    11:00 a.m.

 NRC Contacts:   J. Y. Lee        Phone: (301) 415 1080
                                  e-mail: jyl1@nrc.gov
                 J. J. Hayes      Phone: (301) 415 3167
                                  e-mail: jjh@nrc.gov
                 L. A  Brown      Phone: (301) 415 1232
                                  e-mail: lab2@nrc.gov

 Code Developer: J. V. Ramsdell.  Phone: (509) 372 6316
                                  e-mail: j_ramsdell@pnl.gov

 Code Documentation:  NUREG/CR-6331 Rev. 1

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 employees, makes any warranty, expressed or implied, or assumes any legal
 liability or responsibilities for any third party's use, or the results of such
 use, of any portion of this program or represents that its use by such third
 party would not infringe privately owned rights.

 Program Run   3/23/2004  at  09:28:27

  ******* ARCON INPUT **********

    Number of Meteorological Data Files  =  5
    Meteorological Data File Names
      C:\ARCON96\METDATA\AR-B\AR96B.MET
      C:\ARCON96\METDATA\AR-B\AR97B.MET
      C:\ARCON96\METDATA\AR-B\AR98B.MET
      C:\ARCON96\METDATA\AR-B\AR99B.MET
      C:\ARCON96\METDATA\AR-B\AR00B.MET

    Height of lower wind instrument (m)  =     10.0
    Height of upper wind instrument (m)  =     48.8
    Wind speeds entered as miles per hour

    Ground-level release
    Release height (m)                   =      6.1
    Building Area (m^2)                  =   1382.0
    Effluent vertical velocity (m/s)     =       .00
    Vent or stack flow  (m^3/s)          =       .00
    Vent or stack radius (m)             =       .00

    Direction .. intake to source (deg)  =      315
    Wind direction sector width (deg)    =       90
    Wind direction window (deg)          =   270 - 360
    Distance to intake (m)               =     75.6
    Intake height  (m)                   =     15.2
    Terrain elevation difference (m)     =       .0
```

SUBJECT: Control Room and Technical Support Center Accident χ/Q's Using ARCON96

## 7.6 Computer Run Output (Continued)
## 7.6.9 Reactor Building Trucklock To Control Room (Continued)

```
Output file names
  chiq\rbtlcr1.log
  chiq\rbtlcr1.cfd

Minimum Wind Speed (m/s)              =       .5
Surface roughness length (m)          =       .20
Sector averaging constant             =      4.3

Initial value of sigma y              =       .00
Initial value of sigma z              =       .00

Expanded output for code testing not selected

Total number of hours of data processed =  43848
Hours of missing data                   =   1468
Hours direction in window               =  10322
Hours elevated plume w/ dir. in window  =      0
Hours of calm winds                     =    666
Hours direction not in window or calm   =  31392

DISTRIBUTION SUMMARY DATA BY AVERAGING INTERVAL

95% X/Q for standard averaging intervals

0 to 2 hours        9.87E-04
2 to 8 hours        7.39E-04
8 to 24 hours       2.71E-04
1 to 4 days         1.86E-04
4 to 30 days        1.58E-04

                          HOURLY VALUE RANGE
                        MAX X/Q              MIN X/Q
     CENTERLINE         1.42E-03             5.54E-05
     SECTOR-AVERAGE     8.27E-04             3.23E-05

NORMAL PROGRAM COMPLETION
```

SUBJECT: Control Room and Technical Support Center Accident χ/Q's Using ARCON96

## 7.6 Computer Run Output (Continued)

### 7.6.10 Reactor Building Trucklock To Technical Support Center

```
Program Title:  ARCON96.

 Developed For:  U.S. Nuclear Regulatory Commission
                 Office of Nuclear Reactor Regulation
                 Division of Reactor Program Management

 Date:           June 25, 1997    11:00 a.m.

 NRC Contacts:   J. Y. Lee        Phone: (301) 415 1080
                                  e-mail: jyl1@nrc.gov
                 J. J. Hayes      Phone: (301) 415 3167
                                  e-mail: jjh@nrc.gov
                 L. A  Brown      Phone: (301) 415 1232
                                  e-mail: lab2@nrc.gov

 Code Developer: J. V. Ramsdell   Phone: (509) 372 6316
                                  e-mail: j_ramsdell@pnl.gov

 Code Documentation:  NUREG/CR-6331 Rev. 1

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 employees, makes any warranty, expressed or implied, or assumes any legal
 liability or responsibilities for any third party's use, or the results of such
 use, of any portion of this program or represents that its use by such third
 party would not infringe privately owned rights.

 Program Run   3/23/2004  at  09:29:13

  ******* ARCON INPUT **********

     Number of Meteorological Data Files  =  5
     Meteorological Data File Names
       C:\ARCON96\METDATA\AR-B\AR96B.MET
       C:\ARCON96\METDATA\AR-B\AR97B.MET
       C:\ARCON96\METDATA\AR-B\AR98B.MET
       C:\ARCON96\METDATA\AR-B\AR99B.MET
       C:\ARCON96\METDATA\AR-B\AR00B.MET

     Height of lower wind instrument (m)  =     10.0
     Height of upper wind instrument (m)  =     48.8
     Wind speeds entered as miles per hour

     Ground-level release
     Release height (m)                   =      6.1
     Building Area (m^2)                  =   1382.0
     Effluent vertical velocity (m/s)     =       .00
     Vent or stack flow  (m^3/s)          =       .00
     Vent or stack radius (m)             =       .00

     Direction .. intake to source (deg)  =      310
     Wind direction sector width (deg)    =       90
     Wind direction window (deg)          =  265 - 355
     Distance to intake (m)               =    119.0
     Intake height  (m)                   =      3.0
     Terrain elevation difference (m)     =       .0
```

SUBJECT: Control Room and Technical Support Center Accident χ/Q's Using ARCON96

## 7.6 Computer Run Output (Continued)

### 7.6.10 Reactor Building Trucklock To Technical Support Center (Continued)

```
Output file names
  chiq\rbtltsc1.log
  chiq\rbtltsc1.cfd

Minimum Wind Speed (m/s)              =       .5
Surface roughness length (m)          =       .20
Sector averaging constant             =      4.3

Initial value of sigma y              =       .00
Initial value of sigma z              =       .00

Expanded output for code testing not selected

Total number of hours of data processed =  43848
Hours of missing data                   =   1468
Hours direction in window               =  11066
Hours elevated plume w/ dir. in window  =      0
Hours of calm winds                     =    666
Hours direction not in window or calm   =  30648
```

DISTRIBUTION SUMMARY DATA BY AVERAGING INTERVAL

| AVER. PER. | 1 | 2 | 4 | 8 | 12 | 24 | 96 | 168 | 360 | 720 |
|---|---|---|---|---|---|---|---|---|---|---|
| UPPER LIM. | 1.00E-03 | 1.00E-03 | 1.00E-03 | 1.00E-03 | 1.00E-03 | 1.00E-03 | 1.00E-03 | 1.00E-03 | 1.00E-03 | 1.00E-03 |
| LOW LIM. | 1.00E-07 | 1.00E-07 | 1.00E-07 | 1.00E-07 | 1.00E-07 | 1.00E-07 | 1.00E-07 | 1.00E-07 | 1.00E-07 | 1.00E-07 |
| ABOVE RANGE | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| IN RANGE | 11732. | 13535. | 16259. | 20185. | 23962. | 30976. | 40223. | 39635. | 39975. | 39150. |
| BELOW RANGE | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| ZERO | 30648. | 28659. | 25568. | 20913. | 17750. | 10727. | 596. | 9. | 0. | 0. |
| TOTAL X/Qs | 42380. | 42194. | 41827. | 41098. | 41712. | 41703. | 40819. | 39644. | 39975. | 39150. |
| % NON ZERO | 27.68 | 32.08 | 38.87 | 49.11 | 57.45 | 74.28 | 98.54 | 99.98 | 100.00 | 100.00 |

95th PERCENTILE X/Q VALUES

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 4.34E-04 | 4.27E-04 | 4.04E-04 | 3.59E-04 | 2.90E-04 | 2.03E-04 | 1.15E-04 | 1.03E-04 | 8.93E-05 | 7.99E-05 |

95% X/Q for standard averaging intervals

| | |
|---|---|
| 0 to 2 hours | 4.34E-04 |
| 2 to 8 hours | 3.34E-04 |
| 8 to 24 hours | 1.24E-04 |
| 1 to 4 days | 8.61E-05 |
| 4 to 30 days | 7.45E-05 |

HOURLY VALUE RANGE

| | MAX X/Q | MIN X/Q |
|---|---|---|
| CENTERLINE | 6.08E-04 | 2.46E-05 |
| SECTOR-AVERAGE | 3.54E-04 | 1.44E-05 |

```
NORMAL PROGRAM COMPLETION
```

## 8. RESULTS

The results of the ARCON96 computer runs are provided below.

**Table 8-1 Control Room Atmospheric Dispersion Factors (χ/Q's)**

| | χ/Q (s/m$^3$) to Control Room From | | | | |
|---|---|---|---|---|---|
| Time Interval | Main Stack | TB | TB RFP Area | RB Vent | RB Trucklock |
| 0 – 2 hrs | 7.32E-07 | 3.44E-03 | 2.04E-03 | 1.85E-03 | 9.87E-04 |
| 2 – 8 hrs | 4.93E-07 | 2.79E-03 | 1.70E-03 | 1.45E-03 | 7.39E-04 |
| 8 – 24 hours | 9.98E-08 | 1.05E-03 | 5.95E-04 | 5.19E-04 | 2.71E-04 |
| 1 – 4 days | 1.06E-07 | 8.86E-04 | 5.16E-04 | 4.21E-04 | 1.86E-04 |
| 4 – 30 days | 8.95E-08 | 7.82E-04 | 4.64E-04 | 3.81E-04 | 1.58E-04 |

**Table 8-2 Technical Support Center Atmospheric Dispersion Factors (χ/Q's)**

| | χ/Q (s/m$^3$) to Tecnnical Support Center From | | | | |
|---|---|---|---|---|---|
| Time Interval | Main Stack | TB | TB RFP Area | RB Vent | RB Trucklock |
| 0 – 2 hrs | 9.23E-07 | 1.71E-03 | 7.99E-04 | 7.26E-04 | 4.34E-04 |
| 2 – 8 hrs | 6.34E-07 | 1.44E-03 | 6.37E-04 | 5.61E-04 | 3.34E-04 |
| 8 – 24 hours | 1.31E-07 | 5.09E-04 | 2.29E-04 | 1.98E-04 | 1.24E-04 |
| 1 – 4 days | 1.37E-07 | 4.51E-04 | 1.84E-04 | 1.60E-04 | 8.61E-05 |
| 4 – 30 days | 1.14E-07 | 3.79E-04 | 1.65E-04 | 1.46E-04 | 7.45E-05 |

Entergy

**Attachment 1 – Calculation Design Verification**

**ATTACHMENT 9.1** **DESIGN VERIFICATION COVER PAGE**

**DESIGN VERIFICATION COVER PAGE**

| | | | | |
|---|---|---|---|---|
| ☐ IP-2 | ☐ IP-3 | ☐ JAF | ☒ PNPS | ☐ VY |
| Document No. ERHS-II.B-4 | | | Revision 1 | Page 1 of 6 |
| Title: Control Room and Technical Support Center Accident χ/Q's Using ARCON96 | | | | |
| DV Method: | ☒ Quality Related | ☐ Non Quality Related | | |
| | ☐ Design Review | ☐ Alternate Calculation | ☐ Qualification Testing | |

| VERIFICATION REQUIRED | DISCIPLINE | VERIFICATION COMPLETE AND COMMENTS RESOLVED (DV print, sign, and date) |
|---|---|---|
| | Electrical | |
| | Mechanical | |
| | Instrument and Control | |
| | Civil/Structural | |
| | Nuclear | |
| X | Systems and Safety Analysis | PHILLIP T. KARATZAS Phillip T. Karatzas 3/31/04 |

Print/Sign After Comments Have Been Resolved

| | |
|---|---|
| Originator: PHILLIP T. KARATZAS Phillip T. Karatzas | Date: 3/31/04 |

P. Compagnone / P. Compagnone 3/31/04

Entergy

Subject: Control Room and Technical Support Center Accident χ/Q's Using ARCON96

**Attachment 1 – Calculation Design Verification**

**ATTACHMENT 9.7** **CALCULATION DESIGN VERIFICATION CHECKLIST**



| IDENTIFICATION: | | | | DISCIPLINE: |
|---|---|---|---|---|
| Document Title: | Control Room and Technical Support Center Accident χ/Q's Using ARCON96 | | | ☐ Civil/Structural |
| Doc. No.: | PNPS-1-ERHS-II.B-4 | Rev. 1 | QA Cat. Q | ☐ Electrical |
| Verifier: | P. T. KARATZAS (Print) | P.T. Karatzas (Sign) | 3/31/04 (Date) | ☐ I & C |
| | | | | ☐ Mechanical |
| Manager authorization for supervisor performing verification. ☒ N/A | Print | Sign | Date | ☐ Nuclear |
| | | | | ☒ Other – S&SA |

METHOD OF VERIFICATION:

Design Review ☒ Alternate Calculations ☐ Qualification Test ☐

1. **Design Inputs** – Were the inputs correctly selected and incorporated into the design?

   Design inputs include design bases, plant operational conditions, performance requirements, regulatory requirements and commitments, codes, standards, field data, etc. All information used as design inputs should have been reviewed and approved by the responsible design organization, as applicable.

   All inputs need to be retrievable or excerpts of documents used should be attached.

   See site specific design input procedures for guidance in identifying inputs.

   Yes ☒ No ☐ N/A ☐

   **Reference**
   Page No. C
   **OR**
   Paragraph No. ____

   Completion of the Reference Boxes is optional for all questions.

   **Verifier Comments:** none.

   **Resolution:** ____

Entergy

Subject: Control Room and Technical Support Center Accident χ/Q's Using ARCON96

**Attachment 1 – Calculation Design Verification**

| | Reference |
|---|---|
| **2. Assumptions – Have the assumptions been verified?** Where necessary, are assumptions identified for subsequent re-verification when the detailed activities are completed? | Page No. _____ OR Paragraph No. _____ |

Yes ☒ No ☐ N/A ☐

**Verifier Comments:** none

**Resolution:**

| | Reference |
|---|---|
| **3. Quality Assurance** – Is the quality level correct? | Page No. _____ OR Paragraph No. _____ |

Yes ☒ No ☐ N/A ☐

**Verifier Comments:** none

**Resolution:**

| | Reference |
|---|---|
| **4. Codes, Standards and Regulatory Requirements** – Are the applicable codes, standards and regulatory requirements, including issue and addenda properly identified and are their requirements for design met? | Page No. _____ OR Paragraph No. _____ |

Yes ☒ No ☐ N/A ☐

**Verifier Comments:** none

**Resolution:**

**Attachment 1 – Calculation Design Verification**

| | | Reference |
|---|---|---|
| 5. | **Construction and Operating Experience** – Has applicable operating experience been considered? | Page No. _____ OR Paragraph No. _____ |

Yes ☐ No ☐ N/A ☒

**Verifier Comments:** none

**Resolution:**

| | | Reference |
|---|---|---|
| 6. | **Interfaces** – Have the design interface requirements been satisfied and documented? | Page No. _____ OR Paragraph No. _____ |

Yes ☐ No ☐ N/A ☒

**Verifier Comments:** none

**Resolution:**

| | | Reference |
|---|---|---|
| 7. | **Methods** – Was an appropriate analytical method used? | Page No. _____ OR Paragraph No. _____ |

Yes ☒ No ☐ N/A ☐

**Verifier Comments:** as described in calc.

**Resolution:**

Entergy

**Attachment 1 – Calculation Design Verification**

| | | |
|---|---|---|
| 8. | **Design Outputs** – Is the output reasonable compared to the inputs?<br>Yes ☒ No ☐ N/A ☐<br>**Verifier Comments:** none<br>**Resolution:** | **Reference**<br>Page No. ____<br>**OR**<br>Paragraph No. ____ |
| 9. | **Acceptance Criteria** – Are the acceptance criteria incorporated in the calculation sufficient to allow verification that design requirements have been satisfactorily accomplished?<br>Yes ☐ No ☐ N/A ☒<br>**Verifier Comments:** none<br>**Resolution:** | **Reference**<br>Page No. ____<br>**OR**<br>Paragraph No. ____ |
| 10. | **Records and Documentation** – Are requirements for record preparation, review, approval, retention, etc., adequately specified?<br>Are all documents prepared in a clear legible manner suitable for microfilming and/or other documentation storage method? Have all impacted documents been identified for update?<br>Yes ☒ No ☐ N/A ☐<br>**Verifier Comments:** none<br>**Resolution:** | **Reference**<br>Page No. ____<br>**OR**<br>Paragraph No. ____ |

Entergy

**Attachment 1 – Calculation Design Verification**

| | Reference |
|---|---|
| 11. **Software Quality Assurance-** For a calculation that utilized software applications (e.g., GOTHIC, SYMCORD), was it properly verified and validated in accordance with ENN IT-104 or previous site SQA Program? | Page No. _____ OR Paragraph No. _____ |

Yes ☒ No ☐ N/A ☐

**Verifier Comments:** none

**Resolution:**

OTHER COMMENTS

RESOLUTIONS

none

**All comments for "NO" answers have been resolved satisfactorily.**

Attachment 4 to 2.04.003

Entergy Nuclear Operations, Inc.
Pilgrim Nuclear Power Plant
Proposed Amendment to the Technical Specifications

Proposed Changes to the
Pilgrim Technical Specifications

Marked-Up and Insert Pages (13 pages)

TS Page 3/4.2-24
TS Page 3/4.7-11
TS Page 3/4.7-12
TS Page 3/4.7-13
TS Page 3/4.7-14
TS Page 3/4.7-15
TS Page 3/4.7-16

TS Bases Pages
B3/4.7-10
B3/4.7-11
B3/4.7-12
Insert A to page B3/4.7-10 and
Insert B to page B3/4.7-12
B3/4.7-13
Inserts C to page B3/4.7-13

PNPS
TABLE 3.2.D

## RADIATION MONITORING SYSTEMS THAT INITIATE AND/OR ISOLATE

| Minimum # of Operable Instrument Channels Per Trip system (1) | Trip Function | Trip Level Setting | Action (2) |
|---|---|---|---|
| 2 | Refuel Area Exhaust Monitors | Upscale, <100 mr/hr | A or B |
| 2 | Refuel Area Exhaust Monitors | Downscale | A or B |

NOTES FOR TABLE 3.2.D

1. Whenever the systems are required to be operable, there shall be two operable or tripped trip systems. If this cannot be met, the indicated action shall be taken.

2. Action

   A. Cease operation of the refueling equipment movement of recently irradiated fuel assemblies and operations with potential to drain the reactor vessel (OPDRVs) during
   B. Isolate secondary containment and start the standby gas treatment system.

## LIMITING CONDITIONS FOR OPERATION

3.7 CONTAINMENT SYSTEMS (Cont.)

A. Primary Containment (Cont.)
With no $H_2$ analyzer operable, reactor operation is allowed for up to 48 hours. If one of the inoperable analyzers is not made fully operable within 48 hours, the reactor shall be in at least Hot Shutdown within the next 12 hours.

B. Standby Gas Treatment System and Control Room High Efficiency Air Filtration System

1. Standby Gas Treatment System

a. Except as specified in 3.7.B.1.c or 3.7.B.1.e below, both trains of the standby gas treatment shall be operable when in the Run, Startup, and Hot Shutdown MODES, during movement of irradiated fuel assemblies in the secondary containment, and during movement of new fuel over the spent fuel pool, and during CORE ALTERATIONS, and during operations with a potential for draining the reactor vessel (OPDRVs),

or

the reactor shall be in cold shutdown within the next 36 hours.

b. 1. The results of the in-place cold DOP tests on HEPA filters shall show ≥99% DOP removal. The results of halogenated hydrocarbon tests on charcoal adsorber banks shall show ≥99.9% halogenated hydrocarbon removal.

## SURVEILLANCE REQUIREMENTS

4.7 CONTAINMENT SYSTEMS (Cont.)

B. Standby Gas Treatment System and Control Room High Efficiency Air Filtration System

1. Standby Gas Treatment System

a. 1. At least once per operating cycle, it shall be demonstrated that pressure drop across the combined high efficiency filters and charcoal adsorber banks is less than 8 inches of water at 4000 cfm.

2. At least once per operating cycle, demonstrate that the inlet heaters on each train are operable and are capable of an output of at least 20 kW.

3. The tests and analysis of Specification 3.7.B.1.b. shall be performed at least once per operating cycle or following painting, fire or chemical release in any ventilation zone communicating with the system while the system is operating that could contaminate the HEPA filters or charcoal adsorbers.

4. At least once per operating cycle, automatic initiation of

## LIMITING CONDITIONS FOR OPERATION

3.7 CONTAINMENT SYSTEMS (Cont.)

B. Standby Gas Treatment System and Control Room High Efficiency Air Filtration System (Cont.)

b. 2. The results of the laboratory carbon sample analysis shall show each carbon adsorber bank is capable of ≥97.5% methyl iodide removal at 70% R.H. and 86°F. The carbon sample shall be obtained in accordance with Regulatory Position C.6.b of Regulatory Guide 1.52, Revision 2, March 1978 and tested in accordance with ASTM D3803-1989. The analysis results are to be verified as acceptable within 31 days after sample removal, or declare that train inoperable and take the actions specified in 3.7.B.1.c.

c. From and after the date that one train of the Standby Gas Treatment System is made or found to be inoperable for any reason, continued reactor operation, irradiated fuel handling, or new fuel handling over the spent fuel pool is permissible only during the succeeding seven days providing that within 2 hours all active components of the other standby gas treatment train are verified to be operable and the diesel generator associated with the operable train is operable.

If the system is not made fully operable within 7 days, reactor shutdown shall be initiated and the reactor shall be in cold shutdown within the next 36 hours and fuel handling operations shall be terminated within 2 hours.

Fuel handling operations in progress may be completed.

## SURVEILLANCE REQUIREMENTS

4.7 CONTAINMENT SYSTEMS (Cont.)

B. Standby Gas Treatment System and Control Room High Efficiency Air Filtration System (Cont.)

each branch of the standby gas treatment system shall be demonstrated, with Specification 3.7.B.1.d satisfied.

5. Each train of the standby gas treatment system shall be operated for at least 15 minutes per month.

6. The tests and analysis of Specification 3.7.B.1.b.2 shall be performed after every 720 hours of system operation.

b. 1. In-place cold DOP testing shall be performed on the HEPA filters after each completed or partial replacement of the HEPA filter bank and after any structural maintenance on the HEPA filter system housing which could affect the HEPA filter bank bypass leakage.

2. Halogenated hydrocarbon testing shall be performed on the charcoal adsorber bank after each partial or complete replacement of the charcoal adsorber bank or after any structural maintenance on the charcoal adsorber housing which could affect the charcoal adsorber bank bypass leakage.

| LIMITING CONDITIONS FOR OPERATION | SURVEILLANCE REQUIREMENTS |
|---|---|
| 3.7 CONTAINMENT SYSTEMS (Cont.) | 4.7 CONTAINMENT SYSTEMS (Cont.) |
| B. Standby Gas Treatment System and Control Room High Efficiency Air Filtration System (Cont.) | B. Standby Gas Treatment System and Control Room High Efficiency Air Filtration System (Cont.) |
| d. Fans shall operate within ± 10% of 4000 cfm. | |
| e. From and after the date that one train of the Standby Gas Treatment System is made or found to be inoperable for any reason during Refuel Outages, refueling operations are permissible only during the succeeding 7 days providing that within 2 hours all active components of the other train are verified to be operable and the diesel generator associated with the operable train is operable.<br><br>If the system is not made fully operable within 7 days,<br><br>i) place the operable train in operation immediately<br><br>or<br><br>ii) suspend movement of irradiated fuel assemblies in secondary containment or new fuel handling over the spent fuel pool or core.<br><br>Any fuel assembly movement in progress may be completed. | |

replace with the following

, movement of recently irradiated fuel assemblies and operations with a potential for draining the reactor vessel (OPDRVs)

recently

and initiate actions to suspend OPDRVs.

## LIMITING CONDITIONS FOR OPERATION

3.7 CONTAINMENT SYSTEMS (Cont.)

B. Standby Gas Treatment System and Control Room High Efficiency Air Filtration System (Cont.)

2. Control Room High Efficiency Air Filtration System

a. Except as specified in Specification 3.7.B.2.c or 3.7.B.2.e below, both trains of the Control Room High Efficiency Air Filtration System used for the processing of inlet air to the control room under accident conditions shall be operable when in the Run, Startup, and Hot Shutdown MODES, during movement of irradiated fuel assemblies in the secondary containment, and during movement of new fuel over the spent fuel pool, and during CORE ALTERATIONS, and during operations with a potential for draining the reactor vessel (OPDRVs),

or

the reactor shall be in cold shutdown within the next 36 hours.

b. 1. The results of the in-place cold DOP tests on HEPA filters shall show ≥99% DOP removal. The results of the halogenated hydrocarbon tests on charcoal adsorber banks shall show ≥99.9% halogenated hydrocarbon removal when test results are extrapolated to the initiation of the test.

2. The results of the laboratory carbon sample analysis shall show ≥97.5% methyl iodide removal at 70% R.H. and 86°F. The carbon sample shall be obtained in accordance with Regulatory Position C.6.b of Regulatory Guide 1.52, Revision 2, March 1978 and tested in accordance with ASTM D3803-1989. The analysis results are to be verified as acceptable within 31 days after sample removal, or declare that train inoperable and take the actions specified in 3.7.B.2.c.

## SURVEILLANCE REQUIREMENTS

4.7 CONTAINMENT SYSTEMS (Cont.)

B. Standby Gas Treatment System and Control Room High Efficiency Air Filtration System (Cont.)

2. Control Room High Efficiency Air Filtration System

a. At least once per operating cycle the pressure drop across each combined filter train shall be demonstrated to be less than 6 inches of water at 1000 cfm or the calculated equivalent.

b. 1. The tests and analysis of Specifications 3.7.B.2.b shall be performed once per operating cycle or following painting, fire or chemical release in any ventilation zone communicating with the system while the system is operating.

2. In-place cold DOP testing shall be performed after each complete or partial replacement of the HEPA filter bank or after any structural maintenance on the system housing which could affect the HEPA filter bank bypass leakage.

3. Halogenated hydrocarbon testing shall be performed after each complete or partial replacement of the charcoal adsorber bank or after any structural maintenance on the system housing which could affect the charcoal adsorber bank bypass leakage.

4. Each train shall be operated with the heaters in automatic for at least 15 minutes every month.

## LIMITING CONDITIONS FOR OPERATION

3.7 CONTAINMENT SYSTEMS (Cont.)

B. Standby Gas Treatment System and Control Room High Efficiency Air Filtration System (Cont.)

c. From and after the date that one train of the Control Room High Efficiency Air Filtration System is made or found to be inoperable for any reason, reactor operation, irradiated fuel handling, or new fuel handling over the spent fuel pool is permissible only during the succeeding 7 days providing that within 2 hours all active components of the other CRHEAF train are verified to be operable and the diesel generator associated with the operable train is operable. If the system is not made fully operable within 7 days, reactor shutdown shall be initiated and the reactor shall be in cold shutdown within the next 36 hours and fuel handling operations shall be terminated within 2 hours. Fuel handling operations in progress may be completed.

d. Fans shall operate within ± 10% of 1000 cfm.

e. From and after the date that one train of the Control Room High Efficiency Air Filtration System is made or found to be inoperable for any reason during Refuel Outages, refueling operations are permissible only during the succeeding 7 days providing that within 2 hours all active components of the other train are verified to be operable and the diesel generator associated with the operable train is operable.

If the system is not made fully operable within 7 days,

## SURVEILLANCE REQUIREMENTS

4.7 CONTAINMENT SYSTEMS (Cont.)

B. Standby Gas Treatment System and Control Room High Efficiency Air Filtration System (Cont.)

5. The test and analysis of Specification 3.7.B.2.b.2 shall be performed after every 720 hours of system operation.

c. At least once per operating cycle demonstrate that the inlet heaters on each train are operable and capable of an output of at least 14 kw.

d. Perform an instrument functional test on the humidistats controlling the heaters once per operating cycle.

replace with the following

movement of recently irradiated fuel assemblies and operations with a potential for draining the reactor vessel (OPDRVs)

Revision 193

Amendment No. ~~42, 50, 51, 57, 112, 144, 151, 161, 170~~

| LIMITING CONDITIONS FOR OPERATION | SURVEILLANCE REQUIREMENTS |
|---|---|
| 3.7 CONTAINMENT SYSTEMS (Cont.) | 4.7 CONTAINMENT SYSTEMS (Cont.) |

i) perform surveillance 4.7.B.2.b.4 for the operable CRHEAF every 24 hours or

ii) suspend movement of irradiated fuel assemblies in secondary containment or new fuel handling over the spent fuel pool or core.

Any fuel assembly movement in progress may be completed.

recently

and initiate actions to suspend OPDRVs.

C. Secondary Containment

1. Secondary containment shall be OPERABLE when in the Run, Startup and Hot Shutdown MODES, during movement of irradiated fuel assemblies in the secondary containment, and during movement of new fuel over the spent fuel pool, and during CORE ALTERATIONS, and during operations with a potential for draining the reactor vessel (OPDRVs).

2. a. With Secondary Containment inoperable when in the Run, Startup and Hot Shutdown MODES, restore Secondary Containment to OPERABLE status within 4 hours.

b. Required Action and Completion Time of 2.a not met, be in Hot Shutdown in 12 hours AND Cold Shutdown within 36 hours.

c. With Secondary Containment inoperable during movement of irradiated fuel assemblies in the secondary containment, and during movement of new fuel over the spent fuel pool, and during CORE ALTERATIONS, and during OPDRVs, immediately

1. Suspend movement of irradiated fuel assemblies in the secondary containment.

AND

2. Suspend movement of new fuel over the spent fuel pool.

AND

3. Suspend CORE ALTERATIONS.

AND

2/4. Initiate action to suspend OPDRVs.

C. Secondary Containment

1. Each refueling outage prior to refueling, secondary containment capability shall be demonstrated to maintain 1/4 inch of water vacuum under calm wind (5 mph) conditions with a filter train flow rate of not more than 4000 cfm.

**BASES:**

**3/4.7 CONTAINMENT SYSTEMS (Cont.)**

Tests of impregnated charcoal identical to that used in the filters indicate that a shelf life of five years leads to only minor decreases in methyl iodide removal efficiency. Hence, the frequency of laboratory carbon sample analysis is adequate to demonstrate acceptability. Since adsorbers must be removed to perform this analysis this frequency also minimizes the system out of service time as a result of surveillance testing. In addition, although the halogenated hydrocarbon testing is basically a leak test, the adsorbers have charcoal of known efficiency and holding capacity for elemental iodine and/or methyl iodide, the testing also gives an indication of the relative efficiency of the installed system. The 31 day requirement for the ascertaining of test results ensures that the ability of the charcoal to perform its designed function is demonstrated and known in a timely manner.

The required Standby Gas Treatment System flow rate is that flow, less than or equal to 4000 CFM which is needed to maintain the Reactor Building at a 0.25 inch of water negative pressure under calm wind conditions. This capability is adequately demonstrated during Secondary Containment Leak Rate Testing performed pursuant to Technical Specification 4.7.C.1.c.

The test frequencies are adequate to detect equipment deterioration prior to significant defects, but the tests are not frequent enough to load the filters or adsorbers, thus reducing their reserve capacity too quickly. The filter testing is performed pursuant to appropriate procedures reviewed and approved by the Operations Review Committee pursuant to Section 6 of these Technical Specifications. The in-place testing of charcoal filters is performed by injecting a halogenated hydrocarbon into the system upstream of the charcoal adsorbers. Measurements of the concentration upstream and downstream are made. The ratio of the inlet and outlet concentrations gives an overall indication of the leak tightness of the system. A similar procedure substituting dioctyl phthalate for halogenated hydrocarbon is used to test the HEPA filters.

Pressure drop tests across filter and adsorber banks are performed to detect plugging or leak paths though the filter or adsorber media. Considering the relatively short times the fans will be run for test purposes, plugging is unlikely and the test interval of once per operating cycle is reasonable.

System drains and housing gasket doors are designed such that any leakage would be inleakage from the Standby Gas Treatment System Room. This ensures that there will be no bypass of process air around the filters or adsorbers.

Only one of the two Standby Gas Treatment Systems (SBGTS) is needed to maintain the secondary containment at a 0.25 inch of water negative pressure upon containment isolation. If one system is made or found to be inoperable, there is no immediate threat to the containment system performance and reactor operation or refueling activities may continue while repairs are being made. In the event one SBGTS is inoperable, the redundant system's active components will be verified to be operable within 2 hours. This substantiates the availability of the operable system and justifies continued reactor or refueling operations.

During refueling outages, if the inoperable train is not restored to operable status within the required completion time, the operable train should immediately be placed in operation. This action ensures that the remaining train is operable, that no failures that could prevent automatic actuation have occurred, and that any other failure would be readily detected. An alternative is to suspend fuel movement, thus, placing the plant in a condition that minimizes risk.

INSERT A

BASES:

3/4.7 CONTAINMENT SYSTEMS (Cont)

If both trains of SBGTS are inoperable, the plant is brought to a condition where the SBGTS is not required.

INSERT A

B.2 Control Room High Efficiency Air Filtration System

The Control Room High Efficiency Air Filtration System is designed to filter intake air for the control room atmosphere during conditions when normal intake air may be contaminated. Following manual initiation, the Control Room High Efficiency Air Filtration System is designed to position dampers and start fans which divert the normal air flow through charcoal adsorbers before it reaches the control room.

High Efficiency Particulate Air (HEPA) filters are installed before the charcoal adsorbers to prevent clogging of the iodine adsorbers. The charcoal adsorbers are installed to reduce the potential intake of radioiodine to the control room. A second bank of HEPA filters is installed downstream of the charcoal filter.

The in-place test results should indicate a system leak tightness of less than 0.1% bypass leakage for the charcoal adsorbers and a HEPA efficiency of at least 99% removal of cold DOP particulates. The laboratory carbon sample test results should indicate a methyl iodide removal efficiency of at least 97.5% for expected accident conditions. Tests of impregnated charcoal identical to that used in the filters indicate that a shelf life of five years leads to only minor decreases in methyl iodine removal efficiency. Hence, the frequency of laboratory carbon sample analysis is adequate to demonstrate acceptability. Since adsorbers must be removed to perform this analysis, this frequency also minimizes the system out of service time as a result of surveillance testing. In addition, although the halogenated hydrocarbon testing is basically a leak test, the adsorbers have charcoal of known efficiency and holding capacity for elemental iodine and/or methyl iodide, the testing also gives an indication of the relative efficiency of the installed system. The 31 day requirement for the ascertaining of test results ensures that the ability of the charcoal to perform its designed function is demonstrated and known in a timely manner.

Determination of the system pressure drop once per operating cycle provides indication that the HEPA filters and charcoal adsorbers are not clogged by excessive amounts of foreign matter and that no bypass routes through the filters or adsorbers had developed. Considering the relatively short times the systems will be operated for test purposes, plugging is unlikely and the test interval of once per operating cycle is reasonable.

INSERT "A" TO PAGE B3/4.7-10

*As discussed in Bases Section B3/4.7.C "Secondary Containment", SGTS is not required to be operable during movement of irradiated fuel assemblies that have been allowed to decay for the minimum specified decay period i.e., no longer "recently irradiated".*

*During movement of recently irradiated fuel, if one train of SGTS is made or found to be inoperable and the inoperable train is not restored to operable status within the required completion time, the operable train should immediately be placed in operation. This action ensures that the remaining train is operable, that no failures that could prevent automatic actuation have occurred, and that any other failure would be readily detected. An alternative is to suspend movement of recently irradiated fuel, thus, placing the plant in a condition that minimizes risk. If both trains of SBGTS are inoperable, the plant is brought to a condition where the SBGTS is not required.*

INSERT "B" TO PAGE B3/4.7-12

*As discussed in Bases Section B3/4.7.C "Secondary Containment", CRHEAFS is not required to be operable during movement of irradiated fuel assemblies that have been allowed to decay for the minimum specified decay period i.e., no longer "recently irradiated".*

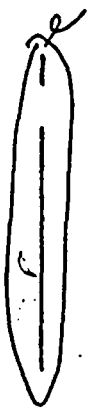
**BASES:**

3/4.7 CONTAINMENT SYSTEMS (Cont.)

B.2 Control Room High Efficiency Air Filtration System (Cont.)

The test frequencies are adequate to detect equipment deterioration prior to significant defects, but the tests are not frequent enough to load the filters or adsorbers, thus reducing their reserve capacity too quickly. The filter testing is performed pursuant to appropriate procedures reviewed and approved by the Operations Review Committee pursuant to Section 6 of these Technical Specifications. The in-place testing of charcoal filters is performed by injecting a halogenated hydrocarbon into the system upstream of the charcoal adsorbers. Measurements of the concentration upstream and downstream are made. The ratio of the inlet and outlet concentrations gives an overall indication of the leak tightness of the system. A similar procedure substituting dioctyl phthalate for halogenated hydrocarbon is used to test the HEPA filters.

Air flow through the filters and charcoal adsorbers for 15 minutes each month assures operability of the system. Since the system heaters are automatically controlled, the air flowing through the filters and adsorbers will be ≤70% relative humidity and will have the desired drying effect.



If one train of the system is made or found to be inoperable, there is no immediate threat to the control room, and reactor operation or fuel handling may continue for a limited period of time while repairs are being made. In the event one CRHEAF train is inoperable, the redundant system's active components will be verified to be operable within 2 hours. During refueling outages, if the inoperable train is not restored to operable status within the required completion time, refueling operations may continue provided the operable CRHEAF train is placed in the pressurization mode daily. This action ensures that the remaining train is operable, that no failures that would prevent actuation will occur, and that any active failure will be readily detected. An alternative is to suspend activities that present a potential for releasing radioactivity that might require isolation of the control room. If both trains of the CRHEAF system are inoperable, the reactor will be brought to a condition where the Control Room High Efficiency Air Filtration System is not required.

INSERT B

BASES:

3/4.7 CONTAINMENT SYSTEMS (Cont)

C. Secondary Containment

INSERT C

The secondary containment is designed to minimize any ground level release of radioactive materials which might result from a serious accident. The reactor building provides secondary containment during reactor operation, when the drywell is sealed and in service; the reactor building provides primary containment when the reactor is shutdown and the drywell is open, as during refueling. Because the secondary containment is an integral part of the complete containment system, secondary containment is required at all times that primary containment is required as well as during refueling.

There are two principal accidents for which credit is taken for secondary containment operability. These are a loss of coolant accident (LOCA) and a fuel handling accident inside [secondary] containment. The secondary containment performs no active function in response to each of these limiting events; however, its leak tightness is required to ensure that the release of radioactive materials from the primary containment is restricted to those leakage paths and associated leakage rates assumed in the accident analysis and that fission products entrapped within the secondary containment structure will be treated by the SGT System prior to discharge to the environment.

An operable secondary containment provides a control volume into which fission products that bypass or leak from primary containment, or are released from the reactor coolant pressure boundary components located in secondary containment, can be diluted and processed prior to release to the environment. For the secondary containment to be considered operable, it must have adequate leak tightness to ensure that the required vacuum can be established and maintained.

If secondary containment is inoperable (when required to be operable), it must be restored to operable status within 4 hours. The 4 hour completion time provides a period of time to correct the problem that is commensurate with the importance of maintaining secondary containment during Run, Startup, and Hot Shutdown modes. This time period also ensures that the probability of an accident (requiring secondary containment operability) occurring during periods where secondary containment is inoperable is minimal.

If secondary containment cannot be restored to operable status within the required completion time, the plant must be brought to a mode in which the LCO does not apply. To achieve this status, the plant must be brought to at least Hot Shutdown within 12 hours and to Cold Shutdown within 36 hours. The allowed completion times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems.

Movement of irradiated fuel assemblies in the secondary containment, movement of new fuel over the spent fuel pool, core alterations, and OPDRVs can be postulated to cause fission product release to the secondary containment. In such cases, the secondary containment is the only barrier to release of fission products to the environment. Core alterations, movement of irradiated fuel assemblies, and movement of new fuel over the spent fuel pool must be immediately suspended if the secondary containment is inoperable.

Suspension of these activities shall not preclude completing an action that involves moving a component to a safe position. Also, action must be immediately initiated to suspend OPDRVs to minimize the probability of a vessel draindown and subsequent potential for fission product release. Actions must continue until OPDRVs are suspended.

Initiating reactor building isolation and operation of the standby gas treatment system to maintain at least a 1/4 inch of water negative pressure within the secondary containment provides an adequate test of the operation of the reactor building isolation valves, leak tightness of the reactor building and performance of the standby gas treatment system. Functionally testing the initiating sensors and associated trip channels demonstrates the capability for automatic actuation. Performing these tests prior to refueling will demonstrate secondary containment capability prior to the time the primary containment is opened for refueling. Periodic testing gives sufficient confidence of reactor building integrity and standby gas treatment system performance capability.

INSERT "C" TO PAGE B3/4.7-13

*The secondary containment is designed to minimize any ground level release of radioactive materials that might result from a serious accident. The reactor building provides secondary containment during reactor operation, when the drywell is sealed and in service; the reactor building provides primary containment during periods when the reactor is shutdown, the drywell is open, and activities are ongoing that require secondary containment to be operable. Because the secondary containment is an integral part of the complete containment system, secondary containment is required at all times that primary containment is required as well as during movement of "recently irradiated" fuel and during operations with the potential to drain the reactor vessel (OPDRV).*

*There are two principal accidents for which credit is taken for secondary containment operability. These are a loss of coolant accident (LOCA) and a fuel handling accident involving "recently irradiated" fuel. The secondary containment performs no active function in response to each of these limiting events; however, its leak tightness is required to ensure that the release of radioactive materials from primary containment is restricted to those leakage paths and associated leakage rates assumed in the accident analysis and that fission products entrapped within the secondary containment structure will be treated by the Standby Gas Treatment System (SGTS) prior to discharge to the environment.*

*In addition to these limiting accidents, OPDRVs can be postulated to cause a fission product release. During movement of recently irradiated fuel and OPDRVs, secondary containment would be the only barrier to a release to the environment. Therefore, movement of recently irradiated fuel and OPDRVs must be immediately suspended if the secondary containment is inoperable. Suspension of these activities shall not preclude completing an action that involves moving a component to a safe position. Also, action must be immediately initiated to suspend OPDRVs to minimize the probability of a vessel drain down and subsequent potential for fission product release. Actions must continue until OPDRVs are suspended.*

*An operable secondary containment provides a control volume into which fission products that bypass or leak from primary containment, or are released from the reactor coolant pressure boundary components located in secondary containment can be diluted and processed prior to release to the environment. For the secondary containment to be considered operable, it must have adequate leak tightness to ensure that the required vacuum can be established and maintained.*

*If secondary containment is inoperable (when required to be operable), it must be restored to operable status within 4 hours. The 4-hour completion time provides a period of time to correct the problem that is commensurate with importance of maintaining secondary containment during Run, Startup, and Hot Shutdown modes. This time period also ensures that the probability of an accident (requiring secondary containment operability) occurring during periods where secondary containment is inoperable is minimal.*

*If secondary containment cannot be restored to operable status within the required completion time, the plant must be brought to a mode in which the LCO does not apply. To achieve this status during power operation, the plant must be brought to at least Hot Shutdown within 12 hours and to Cold Shutdown within 36 hours. The allowed completion times are reasonable, based on operating experience, to reach the required plant conditions from full power condition in an orderly manner and without challenging plant systems.*

*The Fuel Handling Accident (FHA) analysis is based on 10 CFR 50.67 and R.G. 1.183 Alternate Source Term Methodology. This parametric analysis concluded that the calculated TEDE values to the control room occupants, the exclusion area boundary, and the low population zone are well below the allowable TEDE limits established in 10 CFR 50.67 without crediting Secondary Containment, SGTS and CRHEAFS as long as a the fuel is allowed to decay for at least 48 hours following reactor shutdown.*

*As a result, "Recently irradiated" fuel is defined as fuel that has occupied part of a critical reactor core within the previous 48 hours, i.e. reactor fuel that has decayed less than 48 hours following reactor shutdown. Each fuel cycle, prior to the refueling outage, the decay period that must elapse prior to movement of irradiated fuel in the core will be re-evaluated to ensure the appropriate, minimum decay period is enforced to maintain the validity of the FHA dose consequence analysis.*

*Therefore, SGTS, CRHEAFS and Secondary Containment are not required to be operable during movement of decayed irradiated fuel that is no longer is considered "recently irradiated". Conversely, Secondary Containment, SGTS, and CRHEAFS are required to be operable during movement of recently irradiated fuel assemblies*

Attachment 5 to 2.04.003

Entergy Nuclear Operations, Inc.
Pilgrim Nuclear Power Plant
Proposed Amendment to the Technical Specifications

Retyped Technical Specifications and Bases
Pages (12 pages)

TS Page 3/4.2-24
TS Page 3/4.7-11
TS Page 3/4.7-12
TS Page 3/4.7-13
TS Page 3/4.7-14
TS Page 3/4.7-15
TS Page 3/4.7-16

TS Bases Pages
B3/4.7-10
B3/4.7-11
B3/4.7-12
B3/4.7-13
B3/4.7-14

PNPS
TABLE 3.2.D

RADIATION MONITORING SYSTEMS THAT INITIATE AND/OR ISOLATE

| Minimum # of Operable Instrument Channels Per Trip System (1) | Trip Function | Trip Level Setting | Action (2) |
|---|---|---|---|
| 2 | Refuel Area Exhaust Monitors | Upscale, <100 mr/hr | A or B |
| 2 | Refuel Area Exhaust Monitors | Downscale | A or B |

NOTES FOR TABLE 3.2.D

1. Whenever the systems are required to be operable, there shall be two operable or tripped trip systems. If this cannot be met, the indicated action shall be taken.

2. Action

   A. Cease movement of recently irradiated fuel assemblies and operations with potential to drain the reactor vessel (OPDRVs).

   B. Isolate secondary containment and start the standby gas treatment system during movement of recently irradiated fuel assemblies and operations with potential to drain the reactor vessel (OPDRVs).

**LIMITING CONDITIONS FOR OPERATION**

3.7 CONTAINMENT SYSTEMS (Cont.)

A. Primary Containment (Cont.)
With no $H_2$ analyzer operable, reactor operation is allowed for up to 48 hours. If one of the inoperable analyzers is not made fully operable within 48 hours, the reactor shall be in at least Hot Shutdown within the next 12 hours.

B. Standby Gas Treatment System and Control Room High Efficiency Air Filtration System

1. Standby Gas Treatment System

a. Except as specified in 3.7.B.1.c or 3.7.B.1.e below, both trains of the standby gas treatment shall be operable when in the Run, Startup, and Hot Shutdown MODES, during movement of recently irradiated fuel assemblies in the secondary containment, and during operations with a potential for draining the reactor vessel (OPDRVs),

or

the reactor shall be in cold shutdown within the next 36 hours.

b. 1. The results of the in-place cold DOP tests on HEPA filters shall show ≥99% DOP removal. The results of halogenated hydrocarbon tests on charcoal adsorber banks shall show ≥99.9% halogenated hydrocarbon removal.

**SURVEILLANCE REQUIREMENTS**

4.7 CONTAINMENT SYSTEMS (Cont.)

B. Standby Gas Treatment System and Control Room High Efficiency Air Filtration System

1. Standby Gas Treatment System

a. 1. At least once per operating cycle, it shall be demonstrated that pressure drop across the combined high efficiency filters and charcoal adsorber banks is less than 8 inches of water at 4000 cfm.

2. At least once per operating cycle, demonstrate that the inlet heaters on each train are operable and are capable of an output of at least 20 kW.

3. The tests and analysis of Specification 3.7.B.1.b. shall be performed at least once per operating cycle or following painting, fire or chemical release in any ventilation zone communicating with the system while the system is operating that could contaminate the HEPA filters or charcoal adsorbers.

4. At least once per operating cycle, automatic initiation of

**LIMITING CONDITIONS FOR OPERATION**

3.7 CONTAINMENT SYSTEMS (Cont.)

B. Standby Gas Treatment System and Control Room High Efficiency Air Filtration System (Cont.)

b. 2. The results of the laboratory carbon sample analysis shall show each carbon adsorber bank is capable of ≥97.5% methyl iodide removal at 70% R.H. and 86°F. The carbon sample shall be obtained in accordance with Regulatory Position C.6.b of Regulatory Guide 1.52, Revision 2, March 1978 and tested in accordance with ASTM D3803-1989. The analysis results are to be verified as acceptable within 31 days after sample removal, or declare that train inoperable and take the actions specified in 3.7.B.1.c.

c. From and after the date that one train of the Standby Gas Treatment System is made or found to be inoperable for any reason, continued reactor operation is permissible only during the succeeding seven days providing that within 2 hours all active components of the other standby gas treatment train are verified to be operable and the diesel generator associated with the operable train is operable.

If the system is not made fully operable within 7 days, reactor shutdown shall be initiated and the reactor shall be in cold shutdown within the next 36 hours.

**SURVEILLANCE REQUIREMENTS**

4.7 CONTAINMENT SYSTEMS (Cont.)

B. Standby Gas Treatment System and Control Room High Efficiency Air Filtration System (Cont.)

each branch of the standby gas treatment system shall be demonstrated, with Specification 3.7.B.1.d satisfied.

5. Each train of the standby gas treatment system shall be operated for at least 15 minutes per month.

6. The tests and analysis of Specification 3.7.B.1.b.2 shall be performed after every 720 hours of system operation.

b. 1. In-place cold DOP testing shall be performed on the HEPA filters after each completed or partial replacement of the HEPA filter bank and after any structural maintenance on the HEPA filter system housing which could affect the HEPA filter bank bypass leakage.

2. Halogenated hydrocarbon testing shall be performed on the charcoal adsorber bank after each partial or complete replacement of the charcoal adsorber bank or after any structural maintenance on the charcoal adsorber housing which could affect the charcoal adsorber bank bypass leakage.

**LIMITING CONDITIONS FOR OPERATION**

3.7 CONTAINMENT SYSTEMS (CONT)

B. Standby Gas Treatment System and Control Room High Efficiency Air Filtration System (Cont)

d. Fans shall operate within ± 10% of 4000 cfm.

e. From and after the date that one train of the Standby Gas Treatment System is made or found to be inoperable for any reason, movement of recently irradiated fuel assemblies and operations with a potential for draining the reactor vessel (OPDRVs) are permissible only during the succeeding 7 days providing that within 2 hours all active components of the other train are verified to be operable and the diesel generator associated with the operable train is operable.

If the system is not made fully operable within 7 days,

i) place the operable train in operation immediately

OR

ii) suspend movement of recently irradiated fuel assemblies in secondary containment and initiate actions to suspend OPDRVs. Any fuel assembly movement in progress may be completed.

**SURVEILLANCE REQUIREMENTS**

4.7 CONTAINMENT SYSTEMS (Cont)

B. Standby Gas Treatment System and Control Room High Efficiency Air Filtration System (Cont)

## LIMITING CONDITIONS FOR OPERATION

3.7 CONTAINMENT SYSTEMS (Cont.)

B. Standby Gas Treatment System and Control Room High Efficiency Air Filtration System (Cont.)

2. Control Room High Efficiency Air Filtration System

a. Except as specified in Specification 3.7.B.2.c or 3.7.B.2.e below, both trains of the Control Room High Efficiency Air Filtration System used for the processing of inlet air to the control room under accident conditions shall be operable when in the Run, Startup, and Hot Shutdown MODES, during movement of recently irradiated fuel assemblies in the secondary containment, and during operations with a potential for draining the reactor vessel (OPDRVs),

or

the reactor shall be in cold shutdown within the next 36 hours.

b. 1. The results of the in-place cold DOP tests on HEPA filters shall show ≥99% DOP removal. The results of the halogenated hydrocarbon tests on charcoal adsorber banks shall show ≥99.9% halogenated hydrocarbon removal when test results are extrapolated to the initiation of the test.

2. The results of the laboratory carbon sample analysis shall show ≥97.5% methyl iodide removal at 70% R.H. and 86°F. The carbon sample shall be obtained in accordance with Regulatory Position C.6.b of Regulatory Guide 1.52, Revision 2, March 1978 and tested in accordance with ASTM D3803-1989. The analysis results are to be verified as acceptable within 31 days after sample removal, or declare that train inoperable and take the actions specified in 3.7.B.2.c.

## SURVEILLANCE REQUIREMENTS

4.7 CONTAINMENT SYSTEMS (Cont.)

B. Standby Gas Treatment System and Control Room High Efficiency Air Filtration System (Cont.)

2. Control Room High Efficiency Air Filtration System

a. At least once per operating cycle the pressure drop across each combined filter train shall be demonstrated to be less than 6 inches of water at 1000 cfm or the calculated equivalent.

b. 1. The tests and analysis of Specifications 3.7.B.2.b shall be performed once per operating cycle or following painting, fire or chemical release in any ventilation zone communicating with the system while the system is operating.

2. In-place cold DOP testing shall be performed after each complete or partial replacement of the HEPA filter bank or after any structural maintenance on the system housing which could affect the HEPA filter bank bypass leakage.

3. Halogenated hydrocarbon testing shall be performed after each complete or partial replacement of the charcoal adsorber bank or after any structural maintenance on the system housing which could affect the charcoal adsorber bank bypass leakage.

4. Each train shall be operated with the heaters in automatic for at least 15 minutes every month.

**LIMITING CONDITIONS FOR OPERATION**

3.7 CONTAINMENT SYSTEMS (CONT)

B. Standby Gas Treatment System and Control Room High Efficiency Air Filtration System (Cont)

c. From and after the date that one train of the Control Room High Efficiency Air Filtration System is made or found to be inoperable for any reason, reactor operation is permissible only during the succeeding 7 days providing that within 2 hours all active components of the other CRHEAF train are verified to be operable and the diesel generator associated with the operable train is operable. If the system is not made fully operable within 7 days, reactor shutdown shall be initiated and the reactor shall be in cold shutdown within the next 36 hours.

d. Fans shall operate within ± 10% of 1000 cfm.

e. From and after the date that one train of the Control Room High Efficiency Air Filtration System is made or found to be inoperable for any reason, movement of recently irradiated fuel assemblies and operations with a potential for draining the reactor vessel (OPDRVs) are permissible only during the succeeding 7 days providing that within 2 hours all active components of the other train are verified to be operable and the diesel generator associated with the operable train is operable.

If the system is not made fully operable within 7 days,

**SURVEILLANCE REQUIREMENTS**

4.7 CONTAINMENT SYSTEMS (Cont)

B. Standby Gas Treatment System and Control Room High Efficiency Air Filtration System (Cont)

5. The test and analysis of Specification 3.7.B.2.b.2 shall be performed after every 720 hours of system operation.

c. At least once per operating cycle demonstrate that the inlet heaters on each train are operable and capable of an output of at least 14 kw.

d. Perform an instrument functional test on the humidistats controlling the heaters once per operating cycle

**LIMITING CONDITIONS FOR OPERATION**

3.7 CONTAINMENT SYSTEMS (CONT)

i) perform surveillance 4.7.B.2.b.4 for the operable CRHEAF every 24 hours

OR

ii) suspend movement of recently irradiated fuel assemblies in secondary containment and initiate actions to suspend OPDRVs. Any fuel assembly movement in progress may be completed.

C. Secondary Containment

1. Secondary containment shall be OPERABLE when in the Run, Startup and Hot Shutdown MODES, during movement of recently irradiated fuel assemblies in the secondary containment, and during operations with a potential for draining the reactor vessel (OPDRVs).

2. a. With Secondary Containment inoperable when in the Run, Startup and Hot Shutdown MODES, restore Secondary Containment to OPERABLE status within 4 hours.

b. *Required Action and Completion Time* of 2.a not met, be in HOT Shutdown in 12 hours AND Cold Shutdown within 36 hours.

c. With Secondary Containment inoperable during movement of recently irradiated fuel assemblies in the secondary containment and during OPDRVs, immediately:

1. Suspend movement of recently irradiated fuel assemblies in the secondary containment.

AND

2. Initiate actions to suspend OPDRVs.

**SURVEILLANCE REQUIREMENTS**

4.7 CONTAINMENT SYSTEMS (Cont)

C. Secondary Containment

1. Each refueling outage prior to refueling, secondary containment capability shall be demonstrated to maintain 1/4 inch of water vacuum under calm wind (5 mph) conditions with a filter train flow rate of not more than 4000 cfm.

Tests of impregnated charcoal identical to that used in the filters indicate that a shelf life of five years leads to only minor decreases in methyl iodide removal efficiency. Hence, the frequency of laboratory carbon sample analysis is adequate to demonstrate acceptability. Since adsorbers must be removed to perform this analysis this frequency also minimizes the system out of service time as a result of surveillance testing. In addition, although the halogenated hydrocarbon testing is basically a leak test, the adsorbers have charcoal of known efficiency and holding capacity for elemental iodine and/or methyl iodide, the testing also gives an indication of the relative efficiency of the installed system. The 31 day requirement for the ascertaining of test results ensures that the ability of the charcoal to perform its designed function is demonstrated and known in a timely manner.

The required Standby Gas Treatment System flow rate is that flow, less than or equal to 4000 CFM which is needed to maintain the Reactor Building at a 0.25 inch of water negative pressure under calm wind conditions. This capability is adequately demonstrated during Secondary Containment Leak Rate Testing performed pursuant to Technical Specification 4.7.C.1.c.

The test frequencies are adequate to detect equipment deterioration prior to significant defects, but the tests are not frequent enough to load the filters or adsorbers, thus reducing their reserve capacity too quickly. The filter testing is performed pursuant to appropriate procedures reviewed and approved by the Operations Review Committee pursuant to Section 6 of these Technical Specifications. The in-place testing of charcoal filters is performed by injecting a halogenated hydrocarbon into the system upstream of the charcoal adsorbers. Measurements of the concentration upstream and downstream are made. The ratio of the inlet and outlet concentrations gives an overall indication of the leak tightness of the system. A similar procedure substituting dioctyl phthalate for halogenated hydrocarbon is used to test the HEPA filters.

Pressure drop tests across filter and adsorber banks are performed to detect plugging or leak paths though the filter or adsorber media. Considering the relatively short times the fans will be run for test purposes, plugging is unlikely and the test interval of once per operating cycle is reasonable.

System drains and housing gasket doors are designed such that any leakage would be inleakage from the Standby Gas Treatment System Room. This ensures that there will be no bypass of process air around the filters or adsorbers.

Only one of the two Standby Gas Treatment Systems (SBGTS) is needed to maintain the secondary containment at a 0.25 inch of water negative pressure upon containment isolation. If one system is made or found to be inoperable, there is no immediate threat to the containment system performance and reactor operation or refueling activities may continue while repairs are being made. In the event one SBGTS is inoperable, the redundant system's active components will be verified to be operable within 2 hours. This substantiates the availability of the operable system and justifies continued reactor or refueling operations.

As discussed in Bases Section B3/4.7.C "Secondary Containment", SGTS is not required to be operable during movement of irradiated fuel assemblies that have been allowed to decay for the minimum specified decay period i.e., no longer "recently irradiated".

**BASES:**

3/4.7 CONTAINMENT SYSTEMS (Cont)

B.1 Standby Gas Treatment System (Cont)

During movement of recently irradiated fuel, if one train of SGTS is made or found to be inoperable and the inoperable train is not restored to operable status within the required completion time, the operable train should immediately be placed in operation. This action ensures that the remaining train is operable, that no failures that could prevent automatic actuation have occurred, and that any other failure would be readily detected. An alternative is to suspend movement of recently irradiated fuel, thus, placing the plant in a condition that minimizes risk. If both trains of SBGTS are inoperable, the plant is brought to a condition where the SBGTS is not required.

B.2 Control Room High Efficiency Air Filtration System

The Control Room High Efficiency Air Filtration System is designed to filter intake air for the control room atmosphere during conditions when normal intake air may be contaminated. Following manual initiation, the Control Room High Efficiency Air Filtration System is designed to position dampers and start fans which divert the normal air flow through charcoal adsorbers before it reaches the control room.

High Efficiency Particulate Air (HEPA) filters are installed before the charcoal adsorbers to prevent clogging of the iodine adsorbers. The charcoal adsorbers are installed to reduce the potential intake of radioiodine to the control room. A second bank of HEPA filters is installed downstream of the charcoal filter.

The in-place test results should indicate a system leak tightness of less than 0.1% bypass leakage for the charcoal adsorbers and a HEPA efficiency of at least 99% removal of cold DOP particulates. The laboratory carbon sample test results should indicate a methyl iodide removal efficiency of at least 97.5% for expected accident conditions. Tests of impregnated charcoal identical to that used in the filters indicate that a shelf life of five years leads to only minor decreases in methyl iodine removal efficiency. Hence, the frequency of laboratory carbon sample analysis is adequate to demonstrate acceptability. Since adsorbers must be removed to perform this analysis, this frequency also minimizes the system out of service time as a result of surveillance testing. In addition, although the halogenated hydrocarbon testing is basically a leak test, the adsorbers have charcoal of known efficiency and holding capacity for elemental iodine and/or methyl iodide, the testing also gives an indication of the relative efficiency of the installed system. The 31-day requirement for the ascertaining of test results ensures that the ability of the charcoal to perform its designed function is demonstrated and known in a timely manner.

Determination of the system pressure drop once per operating cycle provides indication that the HEPA filters and charcoal adsorbers are not clogged by excessive amounts of foreign matter and that no bypass routes through the filters or adsorbers had developed. Considering the relatively short times the systems will be operated for test purposes, plugging is unlikely and the test interval of once per operating cycle is reasonable.

The test frequencies are adequate to detect equipment deterioration prior to significant defects, but the tests are not frequent enough to load the filters or adsorbers, thus reducing their reserve capacity too quickly. The filter testing is performed pursuant to appropriate procedures reviewed and approved by the Operations Review Committee pursuant to Section 6 of these Technical Specifications. The in-place testing of charcoal filters is performed by injecting a halogenated hydrocarbon into the system upstream of the charcoal adsorbers. Measurements of the concentration upstream and

downstream are made. The ratio of the inlet and outlet concentrations gives an overall indication of the leak tightness of the system. A similar procedure substituting dioctyl phthalate for halogenated hydrocarbon is used to test the HEPA filters.

B.2 Control Room High Efficiency Air Filtration System (Cont)

Air flow through the filters and charcoal adsorbers for 15 minutes each month assures operability of the system. Since the system heaters are automatically controlled, the air flowing through the filters and adsorbers will be $\leq$70% relative humidity and will have the desired drying effect.

If one train of the system is made or found to be inoperable, there is no immediate threat to the control room, and reactor operation may continue for a limited period of time while repairs are being made. In the event one CRHEAF train is inoperable, the redundant system's active components will be verified to be operable within 2 hours. During movement of recently irradiated fuel in a refueling outage, if the inoperable train is not restored to operable status within the required completion time, movement of recently irradiated fuel may continue provided the operable CRHEAF train is placed in the pressurization mode daily. This action ensures that the remaining train is operable, that no failures that would prevent actuation will occur, and that any active failure will be readily detected. An alternative is to suspend movement of recently irradiated fuel. If both trains of the CRHEAF system are inoperable, the reactor will be brought to a condition where the Control Room High Efficiency Air Filtration System is not required.

As discussed in Bases Section B3/4.7.C "Secondary Containment", CRHEAFS is not required to be operable during movement of irradiated fuel assemblies that have been allowed to decay for the minimum specified decay period i.e., no longer "recently irradiated".

C. Secondary Containment

The secondary containment is designed to minimize any ground level release of radioactive materials that might result from a serious accident. The reactor building provides secondary containment during reactor operation, when the drywell is sealed and in service; the reactor building provides primary containment during periods when the reactor is shutdown, the drywell is open, and activities are ongoing that require secondary containment to be operable. Because the secondary containment is an integral part of the complete containment system, secondary containment is required at all times that primary containment is required as well as during movement of "recently irradiated" fuel and during operations with the potential to drain the reactor vessel (OPDRVs).

There are two principal accidents for which credit is taken for secondary containment operability. These are a loss of coolant accident (LOCA) and a fuel handling accident involving "recently irradiated" fuel. The secondary containment performs no active function in response to each of these limiting events; however, its leak tightness is required to ensure that the release of radioactive materials from primary containment is restricted to those leakage paths and associated leakage rates assumed in the accident analysis and that fission products entrapped within the secondary containment structure will be treated by the Standby Gas Treatment System (SGTS) prior to discharge to the environment.

**BASES:**

3/4.7 CONTAINMENT SYSTEMS (Cont)

In addition to these limiting accidents, OPDRVs can be postulated to cause a fission product release. During movement of recently irradiated fuel and OPDRVs, secondary containment would be the only barrier to a release to the environment. Therefore, movement of recently irradiated fuel and OPDRVs must be immediately suspended if the secondary containment is inoperable. Suspension of these activities shall not preclude completing an action that involves moving a component to a safe position.

C. Secondary Containment (Cont)

Also, action must be immediately initiated to suspend OPDRVs to minimize the probability of a vessel drain down and subsequent potential for fission product release. Actions must continue until OPDRVs are suspended.

An operable secondary containment provides a control volume into which fission products that bypass or leak from primary containment, or are released from the reactor coolant pressure boundary components located in secondary containment can be diluted and processed prior to release to the environment. For the secondary containment to be considered operable, it must have adequate leak tightness to ensure that the required vacuum can be established and maintained.

If secondary containment is inoperable (when required to be operable), it must be restored to operable status within 4 hours. The 4 hour completion time provides a period of time to correct the problem that is commensurate with importance of maintaining secondary containment during Run, Startup, and Hot Shutdown modes. This time period also ensures that the probability of an accident (requiring secondary containment operability) occurring during periods where secondary containment is inoperable is minimal.

If secondary containment cannot be restored to operable status within the required completion time, the plant must be brought to a mode in which the LCO does not apply. To achieve this status during power operation, the plant must be brought to at least Hot Shutdown within 12 hours and to Cold Shutdown within 36 hours. The allowed completion times are reasonable, based on operating experience, to reach the required plant conditions from full power condition in an orderly manner and without challenging plant systems.

The Fuel Handling Accident (FHA) analysis is based on 10 CFR 50.67 and R.G. 1.183 Alternate Source Term Methodology. This parametric analysis concluded that the calculated TEDE values to the control room occupants, the exclusion area boundary, and the low population zone are well below the allowable TEDE limits established in 10 CFR 50.67 without crediting Secondary Containment, SGTS and CRHEAFS as long as a the fuel is allowed to decay for at least 48 hours following reactor shutdown.

As a result, "recently irradiated" fuel is defined as fuel that has occupied part of a critical reactor core within the previous 48 hours, i.e. reactor fuel that has decayed less than 48 hours following reactor shutdown. Each fuel cycle, prior to the refueling outage, the decay period that must elapse prior to movement of irradiated fuel in the core will be re-evaluated to ensure the appropriate, minimum decay period is enforced to maintain the validity of the FHA dose consequence analysis.

Therefore, SGTS, CRHEAFS, and Secondary Containment are not required to be operable during movement of decayed irradiated fuel that is no longer is considered "recently irradiated". Conversely, Secondary Containment, SGTS, and CRHEAFS are required to be operable during movement of recently irradiated fuel assemblies.

**BASES:**

3/4.7 CONTAINMENT SYSTEMS (Cont)

Initiating reactor building isolation and operation of the standby gas treatment system to maintain at least a 1/4 inch of water negative pressure within the secondary containment provides an adequate test of the operation of the reactor building isolation valves, leak tightness of the reactor building and performance of the standby gas treatment system. Functionally testing the initiating sensors and associated trip channels demonstrates the capability for automatic actuation. Performing these tests prior to refueling will demonstrate secondary containment capability prior to the time the primary containment is opened for refueling. Periodic testing gives sufficient confidence of reactor building integrity and standby gas treatment system performance capability.

Attachment 6 to 2.04.003

Entergy Nuclear Operations, Inc.
Pilgrim Nuclear Power Plant
Proposed Amendment to the Technical Specifications

Summary of Commitments

| Commitment ID | Description | Due Date |
|---|---|---|
| 1. | Entergy will revise the Pilgrim guidelines for assessing systems removed from service during the handling of non-recently irradiated fuel assemblies or core alterations to implement the provisions of Section 11.3.6.5 of NUMARC 93-01, Revision 3. | Completed prior to the implementation of this license amendment. |
| 2. | Revise Pilgrim UFSAR to reflect revised fuel handling analyses and alternate source term. | Completed in accordance with next scheduled FSAR update after approval of this application. |