**FPL Energy**
**Seabrook Station**

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July 16, 2003
Docket No. 50-443

NYN-03049

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

References:
1. NYN-02089, "Changes to TS 3.9.4 Containment Building Penetrations," dated October 11, 2002
2. NYN-02103, "Revision to Technical Specifications Associated With Reduction of Decay Time for Core Offload," dated October 11, 2003
3. NYN-03043, "Revision to License Amendment Request 02-07, Changes TS 3.9.4 Containment Building Penetrations," dated May 30, 2003

Seabrook Station
Response to Request for Information
Regarding License Amendment Requests 02-06 and 02-07

Enclosed is the FPL Energy Seabrook, LLC response to the Nuclear Regulatory Commission request for additional information issued on March 5, 2003. The information requested pertains to a license amendment requested on October 11, 2002 regarding a change to Technical Specification 3.9.4, Containment Penetrations. Enclosure 1 contains the response to the specific NRC questions, Enclosure 2 contains a diagram of the Control Building Air Handling System and Enclosure 3 contains pages from Seabrook Calculation SBC-947, "Seabrook Post LOCA Control Room Radiological Habitability – Revised Control Room Flow Rates" that are applicable to the RAI response.

A001

Should you have any questions concerning this response, please contact Mr. James M. Peschel, Regulatory Programs Manager, at (603) 773-7194.

Very truly yours,
FPL Energy Seabrook, LLC

Gene F. St. Pierre
Station Director

cc: H. J. Miller, NRC Region I Administrator
V. Nerses, NRC Project Manager, Project Directorate I-2
G. T. Dentel, NRC Senior Resident Inspector

Mr. Donald Bliss , Director
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107 Pleasant Street
Concord, NH 03301

## Oath and Affirmation

I, Gene St.Pierre, Station Director of FPL Energy Seabrook, LLC, hereby affirm that the information and statements contained within this document are based on facts and circumstances which are true and accurate to the best of my knowledge and belief.

Sworn and Subscribed
before me this

16th day of July, 2003

Notary Public

JAMES W. CONNOLLY
MY COMMISSION EXPIRES SEPT. 4, 2007
NOTARY PUBLIC
NEW HAMPSHIRE

Gene F. St. Pierre
Station Director

**ENCLOSURE 1 TO NYN-03049**

Based on the Seabrook Station submittal dated October 11, 2002, the NRC requested the following additional information in a request dated March 5, 2003 and discussed in a conference call on May 15, 2003:

Request No. 1:

1. *License Amendment Request (LAR) 02-06, "Reduction of Decay Time for Core Offload," dated October 11, 2002, stated that the fuel handling accident (FHA) analyses for both the FHA in the fuel building and in the containment were revised to reflect a decay time of 80 hours. The analysis for the FHA occurring in the open containment building assumed an instantaneous release directly to the outside environment. Were the preceding the only analysis inputs or assumptions that were revised to arrive at the revised dose results? Please provide the inputs and assumptions used in the revised analyses of fuel handling accidents used to support LAR 02-06 and LAR 02-07. Include assumptions on control room ventilation system operation and unfiltered in-leakage.*

Response No. 1:

No. The following inputs and assumptions were used or revised from the current UFSAR Open Containment Analysis as described in Section 15.7.4.3:

- The Personnel airlocks and/or equipment hatch is assumed to be open.
- The control room modeling is revised (Seabrook Station Calculation SBC-947 – "Post LOCA Control Room Radiological Habitability – Revised Control Room Flow Rates) to eliminate initial Control Room filter bypass, to delay initiation of Control Room recirculation filters for 1 hour and to use revised Control Room flow rates.
- Inputs and Assumptions from Seabrook Station Calculation SBC-669 D2, "Fuel Handling Accident Inside Containment":

  a) Control Room Input Values:

     1. Credit for Control Room Recirculation at Time T

        Current Value in Calculation:

        T=1 hour

        Previous Value:

        Revised from previous value T=0 hours

2. CBA Fan Flow Rates – 1 Fan Operation Bounding Case (Worst Case)

Current Value in Calculation:

Intake air=600 cfm Recirculation Air=500 cfm

Previous Value:

Revised from UFSAR open containment Fuel Handling Accident (FHA) analysis values of 1200 cfm intake air and 800 cfm recirculation air assuming 2 fan operation as a bounding case

Discussion:

It was requested that a discussion be provided on why one fan operation is more bounding than two-fan operation from a radiological dose perspective.

The one-fan bounding case for the Seabrook Control Room dose was established in Seabrook Station Calculation SBC-947 for the hypothetical post LOCA source term using revised Control Room methodology as described in SBC-947. SBC-669 D2, "Fuel Handling Accident inside Containment," only evaluated the Control Room doses for the one-fan operation case since this bounding case was previously established in SBC-947 for the LOCA source term. The results of SBC-669 D2 have been reviewed and confirm that the one-fan case is indeed bounding for both the LOCA source term and the Fuel Handling Accident (FHA) source term (approximately 15% higher thyroid dose for the 1-fan case). The one-fan case is bounding (vs. the 2-fan case) due to the revised Control Room flow rates (SB calculation C-S-1-61036, Rev. No. 0, "CBA-Emergency Filter Fans Operating in Parallel,") of 600 cfm intake air with 500 cfm recirculated air flows for the 1-fan case and the 970 cfm intake flow rate and 1370 cfm recirculated airflow rates for the 2-fan case. The more than doubled recirculation flow rate is more efficient for cleaning up contaminated Control Room air versus the less than doubled intake air flow rate for the 2-fan case. The Seabrook Station Emergency Filter fans use the same efficiency filters for both intake air and recirculation air.

3. Assumed Control Room Unfiltered Infiltration Rate

Current Value in Calculation:

1 cfm for 30 days

Previous Value:

Unchanged from UFSAR (1 cfm for 30 days)

Discussion:

It was requested that a discussion be provided on the location of this assumption in the UFSAR and also the reason for the assumption.

The assumed 1 cfm of unfiltered infiltration air is the current design basis for the Control Room and has been used since the design stages and is based on only the assumed limited use of the Control Room kitchen door that exits into a stairway in the Control Building. The Control Room main entrance doors are double-door vestibule type and are assumed to limit unfiltered air entering the pressurized Control Room from this pathway to zero. A test of the Control Room, modified Control Room flow rates, and air tightness was performed on October 2 and 3, 1989 and the Control Room was inspected by the NRC staff. The results of this inspection are provided in NUREG 0896; Supplement No. 9, March 1990. The assumed 1 cfm infiltration flow rate is mentioned in the UFSAR for the Control Room post LOCA habitability analysis (Chapter 15, Section 15.6.5.4.e, page 15.6-35) which is referenced for the Containment Fuel Handling Accident (CFHA) Radiological Control Room Analysis in Section 15.7.4.3 (9).

4. Control Room Intake Filter Initial Bypass –Flow/Time

Current Value in Calculation:

0 cfm

Previous Value:

1200 cfm for 2 seconds

Discussion:

It was requested that a discussion be provided on why the Control Room Intake filter initial bypass assumption was changed from 2 seconds to 0 seconds. The original assumption of a control room intake filter initial bypass of 2 seconds assumed that the isolation valves for the remote air intake did not close quickly enough to prevent contaminated gases from entering the control room unfiltered.

Prior to performing the re-analysis for the Fuel Handling Accident inside an open containment, this assumption was revised by a separate calculation. This calculation determined the transit time for the contaminated gases and demonstrated that the makeup air isolation dampers are capable of closing in less time. The new assumption is based on the total available transit time between the radiation detectors and the control room is 8.6 seconds. The total time for closure of the makeup air isolation valves is six seconds. This number includes a 5 second stroke time and an assumed 1 second control loop response. Therefore, it is concluded that bypass of the Control Room Emergency Cleanup Filters will not occur. Therefore, the assumption of a 0 second bypass is valid.

5. Iodine removal credit for Control Room intake/recirculation filters

Current Value in Calculation:

Elemental=95%
Organic=95%
Particulate=99%

Previous Value:

Unchanged from UFSAR Section 15B.2.II.D.3

Discussion:

It was requested that a discussion be provided on the operation of the control room filtration process during the fuel handling accident in the open containment.

The Normal Makeup Air Subsystem consists of two 100 percent capacity vane axial fans with a flow capacity of 1000 CFM each at the system static pressure, and the associated dampers.

Air is drawn from two remote air intakes (east and west located more than 700 ft. apart).

Location of the air intakes was selected considering the plant configuration and the site-specific meteorological conditions to preclude contamination of both intakes at the same time by any type of pollutant. The location of the west air intake, at the southeast wall of the Cooling Tower is located at a distance great enough from the radiological release point and from the east air intake.

Air flows through two 12" heavy wall carbon steel pipes provided with radiation and smoke detecting devices, as well as a normally open manual isolation valve on each path.

Two 18" lines, each provided with a backdraft damper bypass the normal makeup air supply fans to supply makeup air to the filtration assemblies during the emergency mode of operation.

The Emergency Makeup Air and Filtration Subsystem consists of two filtration assemblies with a maximum capacity of 1210 CFM each. Each assembly includes a prefilter, an electric heater, a HEPA-Carbon-HEPA filter configuration, a vane axial fan, a centrifugal fan, manual inlet isolation damper, discharge isolation dampers and backdraft dampers. One of the two redundant normal makeup air subsystem fans supplies 1000 CFM of outside air from both remote intakes.

In the event of a Fuel Handling Accident with an open containment, if high radiation is detected in either remote air supply piping, the Emergency Makeup Air and Filtration Subsystem fans are actuated and their associated dampers (1-CBA-DP-27A and DP-27B) are opened. The normal makeup air fan automatically trips off and its associated discharge damper, is automatically closed. The isolation function of these dampers is safety-related.

When the normal makeup air flow path is isolated, air is drawn from the remote air intakes through the bypass lines provided with backdraft dampers. When the Emergency Makeup Air and Filtration Subsystem fans are actuated, they generate a Control Room Makeup Air Filter Recirculation Mode Signal.

Although the redundant filtration assembly fans are capable of operating simultaneously, plant operators may decide to shut down one of the fans during the course of the accident. Each filtration assembly has an average flow capacity of 1100 CFM consisting of 600 CFM of outside air (half of it from each intake), the remainder is recirculating air.

The operating filtration assembly draws makeup air into the suction plenum, through the prefilter and the heater and then mixes with recirculation air drawn from the Mechanical Equipment Room. The mixed air flows through the HEPA-carbon-HEPA filters before it is discharged into the Mechanical Equipment Room by the filter fan.

A drawing of the general ventilation system design and the layout of the associated buildings has been provided as Enclosure 1.

6. Dose Conversion Factors

Current Value in Calculation:

As provided in (1) Federal Guidance Report No. 11, "Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion and Ingestion"" dated September 1988 and (2) Federal Guidance Report No. 12, "External Exposure to Radionuclides in Air, Water and Soil", dated September 1993. (i.e. ICRP-30 Dose Conversion Factors)

Previous Value:

Unchanged for the Containment Fuel Handling Accident and as used for the current UFSAR Open Containment Fuel Handling Accident Analysis. Note: The analysis for the Fuel Handling Accident occurring within the Fuel Storage Building has been revised to use the newer ICRP-30 DCF's in support of revising the decay time to 80 hours.

b) Fuel Assembly Assumptions :

1. Highest rated fuel assembly gaseous inventory (RPF=1.65)

Current Value in Calculation:

UFSAR Table 15.7-20

Previous Value:

Unchanged - UFSAR value

2. Power Level

Current Value in Calculation:

3654 MWT

Previous Value:

Unchanged - UFSAR value

3. Fuel Assembly Gap Fractions

Current Value in Calculation:

10% Noble Gases (30% Kr-85)
10% Iodines (Ref. USFAR Table 15.7-20)

Previous Value:

Unchanged - UFSAR Table 15.7-20

4. Partitioning Factors

Current Value in Calculation:

| | |
|---|---|
| Elemental Iodine | 133 |
| Organic Iodine | 1 |
| Noble Gases | 1 |

Previous Value:

Unchanged - UFSAR Value

5. Number of ruptured fuel rods

Current Value in Calculation:

264 (1 complete assembly)

Previous Value:

Unchanged - UFSAR value

6. Decay time prior to fuel movement

Current Value in Calculation:

80 hours

Previous Value:

100 hours

c) Containment Assumptions:

1. Containment Release Path and Duration

Current Value in Calculation:

Open Personnel Air Lock (PAL) and/or equipment hatch – Puff release to atmosphere

Previous Value:

Timed release used for UFSAR Open Containment Fuel Handling Accident (FHA) analysis

d) Atmospheric Dispersion Factors ($\chi/Q$):

1. Standard Accident $\chi/Q$ Values

The following table illustrates the Standard $\chi/Q$ values used in Seabrook Station Calculation SBC-669 D2. Calculation SBC-669 D2 supports the current UFSAR Containment and Fuel Storage Building Fuel Handling Accident Analyses.

| Time Period (hr) | At the Control Room* | At the West Intake | At East Intake | Worst Intake Value ** divided by 2 |
|---|---|---|---|---|
| 0-1 | 4.08E-03 | 1.57E-03 | 1.42E-03 | 7.85E-04 |
| 1-2 | 3.18E-03 | 9.81E-04 | 1.14E-03 | 5.70E-04 |
| 2-8 | 2.04E-03 | 4.59E-04 | 6.95E-04 | 3.48E-04 |
| 8-24 | 1.44E-03 | 2.53E-04 | 4.67E-04 | 2.34E-04 |
| 24-96 | 9.78E-04 | 1.49E-04 | 3.05E-04 | 1.53E-04 |
| 96-720 | 7.51E-04 | 7.77E-05 | 2.00E-04 | 1.00E-04 |

* Used for 1 CFM infiltration contribution to Control Room dose.

** Worst remote intake value divided by two to dual remote intakes approximately 180 degrees apart with both intakes open

2) Composite $\chi/Q$ values used for UFSAR Fuel Handling Accident (FHA) analyses

The calculations make use of the effective atmospheric dispersion factors and associated intake filter bypass fractions, which combine the introduction of contaminated air from either of the remote intakes and the local infiltration. Seabrook Station Calculation SBC-947 has detailed equations of this methodology. The equations are based on the fact that the product of intake flow times the atmospheric dispersion factor represents the fraction of the atmospheric release of radioactivity which enters the control room.

The following illustrates the Composite $\chi/Q$ values used in Seabrook Station Calculation SBC-669 D2 for 1 fan operating at 600 cfm and 1 cfm unfiltered air:

| Time Period, hrs | East $\chi/Q$ sec/m3 | West $\chi/Q$ Sec/m3 | Control Room $\chi/Q$ sec/m3 | E+W flow, CFM | Unfiltered CFM | Composite $\chi/Q$, sec/m3 | 1 cfm bypass values for Composite $\chi/Q$s |
|---|---|---|---|---|---|---|---|
| 0-1 | 1.4E-03 | 1.6E-03 | 4.1E-03 | 6.0E+02 | 1.0E+00 | 7.905E-04 | 8.588E-03 |
| 1-2 | 1.1E-03 | 9.8E-04 | 3.2E-03 | 6.0E+02 | 1.0E+00 | 5.743E-04 | 9.213E-03 |
| 2-8 | 7.0E-04 | 4.6E-04 | 2.0E-03 | 6.0E+02 | 1.0E+00 | 3.503E-04 | 9.689E-03 |
| 8-24 | 4.7E-04 | 2.5E-04 | 1.4E-03 | 6.0E+02 | 1.0E+00 | 2.355E-04 | 1.017E-02 |
| 24-96 | 3.1E-04 | 1.5E-04 | 9.8E-04 | 6.0E+02 | 1.0E+00 | 1.539E-04 | 1.058E-02 |
| 96-720 | 2.0E-04 | 7.8E-05 | 7.5E-04 | 6.0E+02 | 1.0E+00 | 1.011E-04 | 1.236E-02 |

*Discussion:*

*Provide a brief description of the Composite $\chi/Q$'s used for Control Room Habitability for the Containment Fuel Handling Accident (CFHA).*

Response:

The composite $\chi/Q$'s are simply weighted (by flow rate) $\chi/Q$'s for different Control Room contaminated air intake pathways (i.e. intake of contaminated air of either the remote intakes and the local infiltration or Diesel Generator Building, if applicable). Pages 14-16 from SBC-947, describing application of the composite $\chi/Q$ methodology, are attached as Enclosure 2. The composite $\chi/Q$'s simply allow for evaluation of the Control Room doses from various pathways in one computer application.

2. *LAR 02-07, "Changes to TS 3.9.4, Containment Building Penetrations," dated October 11, 2002, also refers to the revised FHA dose analyses as discussed in the submittal letter for LAR 02-06 as well as the current UFSAR Chapter 15.7.4 FHA dose analyses. The current UFSAR FHA dose analyses use atmospheric dispersion factors (X/Qs) for the control room dose calculation that are based on radioactivity release due to containment leakage. Seabrook UFSAR Appendix 15B documents that these X/Qs were determined based on Equation 6 of Murphy and Campe (Ref. 1) which is applicable to a diffuse source with a point receptor. Since the equipment hatch/proposed containment outage door is a much smaller release area than the entire containment building, how do these control room X/Qs remain acceptable for use for the case where the containment is open to the outside environment?*

Response:

Atmospheric dispersion factors ($\chi$/Q values) for two source-receptor combinations were used to evaluate Control Room doses: Equipment Hatch/Personnel Airlock leakage to the Control Room building and Equipment Hatch/Personnel Airlock leakage to the two Control Room remote air intakes. The use of Equation 6 of Murphy and Campe to model both these source-receptor combinations is justified as follows.

The Equipment Hatch/Personnel Airlock leakage to the Control Room Building represents a release to a volume receptor, where the volume receptor is exemplified by the isolated Control Room with infiltration occurring at many locations. Murphy and Campe state that the use of Equation 6 is appropriate for this case. The resulting $\chi$/Q values were used to assess the 1 cfm infiltration contribution to the Control Room dose.

The Equipment Hatch/Personnel Airlock leakage to the two remote air intakes represents a release to a dual air inlet design. Section III.3.d(4) of Standard Review Plan (NUREG-0800) Chapter 6.4 states that Equation 6 of Murphy and Campe may be used with respect to the least favorable inlet location to estimate $\chi$/Q values for dual inlet designs without manual or automatic selection control. The estimated value can then be reduced by a factor of two to account for dilution effects associated with a dual inlet configuration. This approach was used to derive the $\chi$/Q values for the two remote air intakes which were assumed to be functional during the duration of the accident.

As further justification for the use of Murphy/Campe Equation 6, a new set of atmospheric dispersion factors were calculated using ARCON96, along with the following:

(a) Five years' worth of hourly meteorological data collected on site (1998-2002),
(b) Representation as point-release to point-receptor geometries for releases from the personnel hatch to the various control room intakes, with no initial values assigned to the dispersion coefficients ($\sigma_y$ and $\sigma_z$), and
(c) No building wake effects (an overly conservative assumption).

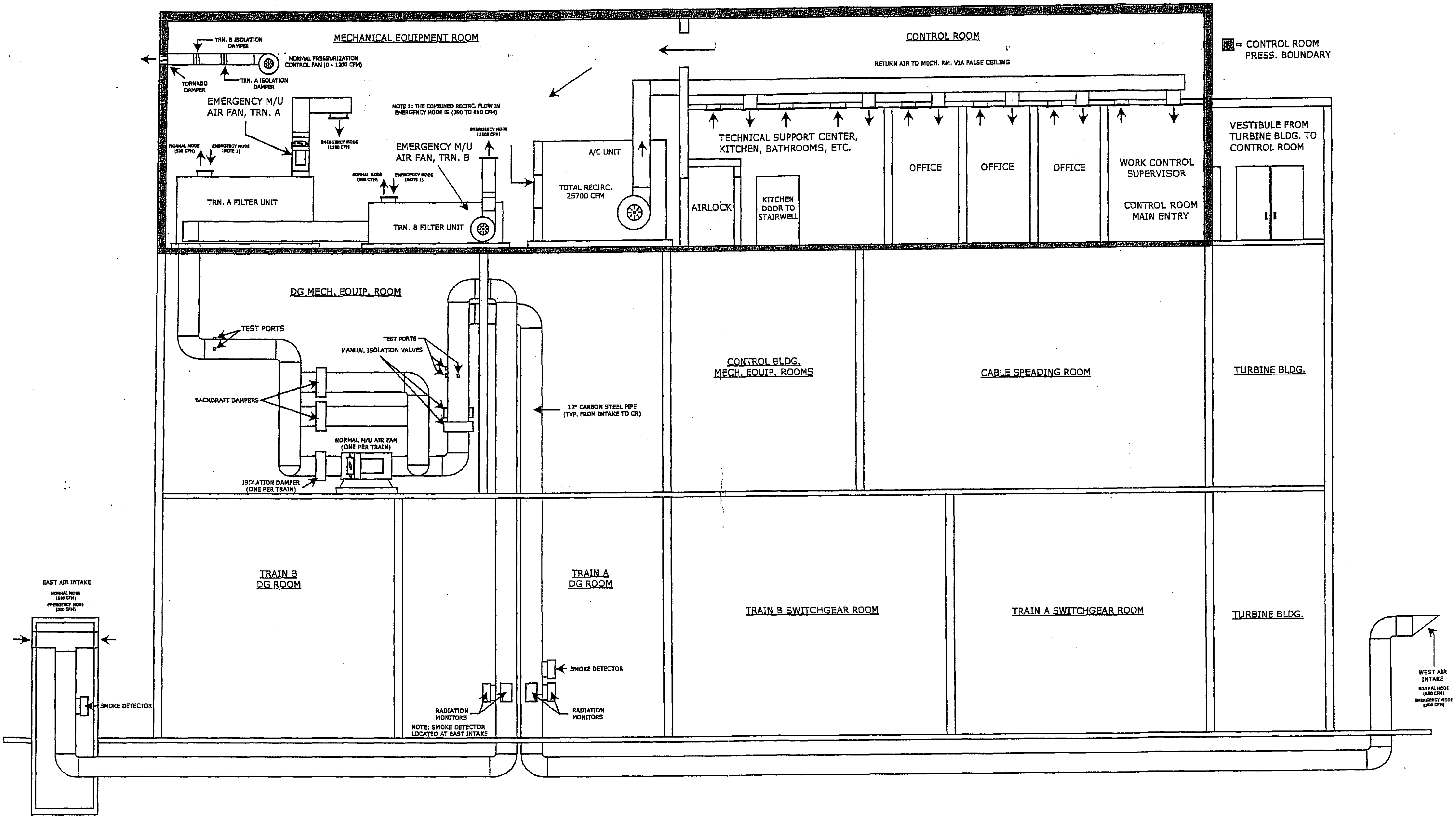
Comparison of the ($\chi$/Q)s is presented in the table which follows. It is seen that, in general, the ARCON96 dispersion values are lower, with only a single exception, the Local Intake ($\chi$/Q) from 2 to 8 hrs. The composite ($\chi$/Q)s are lower during all time intervals.

| Time Interval (hours) | CR East Intake | CR West Intake | CR Local Intake | Composite* |
|---|---|---|---|---|
| **A - Atmospheric Dispersion Factor (sec/m$^3$) Based on Murphy Campe Eq. 6** | | | | |
| 0.0 | 1.42E-03 | 1.57E-03 | 4.08E-03 | 7.905E-04 |
| 1.0 | 1.14E-03 | 9.81E-04 | 3.18E-03 | 5.743E-04 |
| 2.0 | 6.95E-04 | 4.59E-04 | 2.04E-03 | 3.503E-04 |
| 8.0 | 4.67E-04 | 2.53E-04 | 1.44E-03 | 2.355E-04 |
| 24.0 | 3.05E-04 | 1.49E-04 | 9.78E-04 | 1.539E-04 |
| 96.0 | 2.00E-04 | 7.77E-05 | 7.51E-04 | 1.011E-04 |
| **B - Atmospheric Dispersion Factor (sec/m$^3$) Based on ARCON96 (Point Source & Point Receptor)** | | | | |
| 0.0 | 5.68E-04 | 3.05E-04 | 2.84E-03 | 2.883E-04 |
| 1.0 | 5.68E-04 | 3.05E-04 | 2.84E-03 | 2.883E-04 |
| 2.0 | 4.95E-04 | 2.48E-04 | 2.30E-03 | 2.509E-04 |
| 8.0 | 2.07E-04 | 9.58E-05 | 8.67E-04 | 1.048E-04 |
| 24.0 | 1.30E-04 | 6.11E-05 | 5.87E-04 | 6.587E-05 |
| 96.0 | 1.02E-04 | 3.58E-05 | 3.70E-04 | 5.153E-05 |
| **Ratio of Atmospheric Dispersion Factors (A/B)** | | | | |
| 0.0 | 2.50 | 5.15 | 1.44 | 2.74 |
| 1.0 | 2.00 | 3.22 | 1.12 | 1.99 |
| 2.0 | 1.40 | 1.85 | **0.89** | 1.40 |
| 8.0 | 2.26 | 2.64 | 1.66 | 2.25 |
| 24.0 | 2.35 | 2.44 | 1.67 | 2.34 |
| 96.0 | 1.96 | 2.17 | 2.03 | 1.96 |

* See response to RAI #1

An overall evaluation of the conservatism associated with use of the Murphy/Campe Eq. 6 was arrived at by recalculating the CR doses for the FHA with open containment using the ARCON96 ($\chi$/Q)s in the above table. The calculated thyroid dose is 3.03 rem, a factor of 2.44 lower than the 7.38 rem (the calculation of record).

**ENCLOSURE 2 TO NYN-03049**



MECHANICAL EQUIPMENT ROOM
TRN. B ISOLATION DAMPER
NORMAL PRESSURIZATION CONTROL FAN (0 - 1200 CFM)
TORNADO DAMPER
TRN. A ISOLATION DAMPER
EMERGENCY M/U AIR FAN, TRN. A
NOTE 1: THE COMBINED RECIRC. FLOW IN EMERGENCY MODE IS (390 TO 610 CFM)
EMERGENCY MODE (1100 CFM)
NORMAL MODE (500 CFM)
EMERGENCY MODE (NOTE 1)
EMERGENCY M/U AIR FAN, TRN. B
TRN. A FILTER UNIT
TRN. B FILTER UNIT
A/C UNIT
TOTAL RECIRC. 25700 CFM
CONTROL ROOM
RETURN AIR TO MECH. RM. VIA FALSE CEILING
= CONTROL ROOM PRESS. BOUNDARY
TECHNICAL SUPPORT CENTER, KITCHEN, BATHROOMS, ETC.
AIRLOCK
KITCHEN DOOR TO STAIRWELL
OFFICE
OFFICE
OFFICE
WORK CONTROL SUPERVISOR
CONTROL ROOM MAIN ENTRY
VESTIBULE FROM TURBINE BLDG. TO CONTROL ROOM
DG MECH. EQUIP. ROOM
TEST PORTS
TEST PORTS
MANUAL ISOLATION VALVES
BACKDRAFT DAMPERS
NORMAL M/U AIR FAN (ONE PER TRAIN)
ISOLATION DAMPER (ONE PER TRAIN)
12" CARBON STEEL PIPE (TYP. FROM INTAKE TO CR)
CONTROL BLDG. MECH. EQUIP. ROOMS
CABLE SPEADING ROOM
TURBINE BLDG.
EAST AIR INTAKE
NORMAL MODE (500 CFM)
EMERGENCY MODE (300 CFM)
SMOKE DETECTOR
TRAIN B DG ROOM
RADIATION MONITORS
NOTE: SMOKE DETECTOR LOCATED AT EAST INTAKE
TRAIN A DG ROOM
SMOKE DETECTOR
RADIATION MONITORS
TRAIN B SWITCHGEAR ROOM
TRAIN A SWITCHGEAR ROOM
TURBINE BLDG.
WEST AIR INTAKE
NORMAL MODE (500 CFM)
EMERGENCY MODE (300 CFM)

**ENCLOSURE 3 TO NYN-03049**

evaluate the potential of filtered infiltration air (at 40 and 100 cfm), from the DGB area. In addition one vs. two fan operation will be reviewed to insure that the 1-fan case is bounding and also evaluate CR unfiltered infiltration at 10 cfm (vs. 1 cfm) for informational purposes on the maximum allowable infiltration rate. All of the above will be performed using the ELISA computer code and "composite X/Q" modeling to combine all CR filtered intake air and unfiltered infiltration air into one computer run. The composite X/Q technique is describe below and will be used for the two source term pathways, 1) post LOCA Containment Leakage, and 2) post LOCA ESF area leakage.

1-CFM of infiltration is due to an assumed 1/10 usage of the single door emergency exit that may be used for access to the Diesel Generator Building stairwell and to the switch gear room and V9 access for manual alignment of CR-CBA System. The Standard Review Plan (SRP) reference to 10 cfm (Reference No. 2) is for main CR ingress/egress for single door vestibules, i.e.; 1/10 usage for emergency exit is an engineering judgement and may require administrative control for the emergency exit. The ELISA/RASCAL intake/exhaust fractional flow rates are calculated below for one and two-fan operation.

Control Room Intake/Exhaust Rate Mulipliers;

* Two – Fans – Operating;

$$\frac{971\frac{ft^3}{\min} x 1440 \frac{\min}{day}}{2.46 x 10^5\ ft^3} = 5.684\text{E}+00 \text{ per day}$$

* One Fan Operating;

$$\frac{601\frac{ft^3}{\min} x 1440 \frac{\min}{day}}{2.46 x 10^5\ ft^3} = 3.518\text{E}+00 \text{ per day}$$

Simular analyses as above apply for 10 cfm infiltration.

## 5.3 Normal and Effective Atmospheric Dispersion Factors and Filter Bypass Fractions

Atmospheric Dispersion Factors (X/Q) from References No. 15 & 16 are presented in Table 5.1. These values are consistent with the original analysis (Reference No. 1) and include the revised West intake values based on relocation of this intake as described in Appendix G to Reference No. 1. Composite X/Q's (and associated infiltration flow

rates) used in this analysis are presented in Table 5.2 (A, through F) and were derived using the equations presented below.

In Rev. 0 of the present calculation, the CR doses due to filtered air entering the control room via the remote vents and due to the 1-cfm local infiltration were analyzed separately. The resulting doses from each pathway were then added to obtain the total dose. The analysis was conservative in that the CR cleanup rate of the local infiltration was also set equal to 1 cfm, whereas, in reality, the cleanup rate would correspond to the total exhaust from the CR (filtered and unfiltered intake flows). To eliminate this conservatism, the present calculation makes use of effective atmospheric dispersion factors, and associated intake filter bypass fractions, which combine the introduction of contaminated air from either of the remote intakes and from the DGB and the local infiltration. The application equations are as follows:

$$(X/Q)_{eff} = [0.5\, F_{remote}\, (X/Q)_{remote} + F_{DGB}\, (X/Q)_{DGB} + F_{local}\, (X/Q)_{local}] \,/\, [F_{remote} + F_{DGB} + F_{local}] \qquad \text{(Eq. 1)}$$

$$f_{bypass} = F_{local}\, (X/Q)_{local} \,/\, [0.5\, F_{remote}\, (X/Q)_{remote} + F_{DGB}(X/Q)_{DGB} + F_{local}\, (X/Q)_{local}] \qquad \text{(Eq. 2)}$$

where

$(X/Q)_{eff}$ = effective atmospheric dispersion factor (sec/m$^3$), for air entering the control room through the remote intakes, potential inleakage (filtered by CR intake filters) from the DGB, and local unfiltered infiltration,

$(X/Q)_{remote}$ = atmospheric dispersion factor (sec/m$^3$) for the worst-case remote intake (east or west), during the interval analyzed,

$(X/Q)_{local}$ = atmospheric dispersion factor (sec/m$^3$) for local infiltration,

$(X/Q)_{DGB}$ = atmospheric dispersion factor (sec/m$^3$), for air entering the control room through the potential inleakage from the DGB (filtered by CR intake filters) conservatively assumed to be equal to $(X/Q)_{local}$ above,

$F_{remote}$ = air intake through the remove intakes (m$^3$/sec) (equal to 600 cfm for the bounding configuration, i.e., 1-fan operation, drawing 300 cfm from each intake),

$F_{DGB}$ = potential DGB intake air (m$^3$/sec) through potential equipment failures, evaluated for two cases 40 cfm (from Ref. No. 18) and 100 cfm (upper limit),

$F_{local}$ = local infiltration (m$^3$/sec) (equal to 1 cfm, or 10 cfm for information), and

0.5 = adjustment factor to account for the clean air drawn in by one of the remote intakes (the one with the least restrictive atmospheric dispersion factor), and

$f_{bypass}$ = control room intake filter bypass fraction (fraction of total air intake which bypasses filtration).

These equations were based on the fact that the product of intake flow times the atmospheric dispersion factor [for instance, $F_{local}$ $(X/Q)_{local}$], which is unitless, represents that fraction of the atmospheric release of radioactivity which enters the control room.

Application of these equations (with $F_{remote}$ = [600 cfm - $F_{DGB}$,], $F_{DGB}$ = (40 or 100 cfm) and $F_{local}$ equal to 1 cfm (or 10 cfm), and the atmospheric dispersion factors from Table 5.1) leads to the results summarized in Table 5.2 Note that the flow rates in Eqs. (1) and (2) may be in any units; in Table 5.2, use was made of the flows in cfm, for simplicity.

Calculated composite X/Q's (Table 5.2) are also provided below for use in the following 6 cases;

1. Two-fan operation with 970 cfm of intake air, 0 cfm from the DGB and 1 cfm of CR unfiltered infiltration (used for comparative purposes to show that the 1-fan operating mode is conservative).

2. One fan operation with 600 cfm of intake air, 0 cfm from the DGB area and 1 cfm of CR unfiltered infiltration.

3. One fan operation with 560 cfm of intake air, 40 cfm from the DGB area and 1 cfm of CR unfiltered infiltration.

4. One fan operation with 500 cfm of intake air, 100 cfm from the DGB area and 1 cfm of CR unfiltered infiltration.

5. One fan operation with 600 cfm of intake air, 0 cfm from the DGB area and 10 cfm of CR unfiltered infiltration (used for informational purpose to estimate the maximum allowable CR leakage rate of unfiltered infiltration air).

6. Two-fan operation with 970 cfm of intake air, 0 cfm from the DGB and 10 cfm of unfiltered infiltration air (used to estimate the maximum allowable unfiltered air into the CR).