U.S. NUCLEAR REGULATORY COMMISSION

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Do not include proprietary materials.

DATE OF MEETING
2/21/02

The attached document(s), which was/were handed out in this meeting, is/are to be placed in the public domain as soon as possible. The minutes of the meeting will be issued in the near future. Following are administrative details regarding this meeting:

Docket Number(s)	50-413 & 50-414
Plant/Facility Name	Catawba Nuclear Station, Units 1 and 2
TAC Number(s) (if available)	MB3758 & MB3759
Reference Meeting Notice	February 6, 2002
Purpose of Meeting (copy from meeting notice)	To discuss the results of control room in-leakage testing at Catawba, and to discuss partial implementation of alternate source term application at Catawba

NAME OF PERSON WHO ISSUED MEETING NOTICE	TITLE
Chandu P. Patel	Project Manager

OFFICE NRR

DIVISION DLPM

BRANCH PD-II

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Docket File/Central File
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DF03

Agenda

Control Room Ventilation Testing

02/21/02
1:00 PM to 3:30 PM
Washington, DC

Meeting requested by:	Duke Energy
Type of meeting:	Working level
Attendees:	NRC: Chandu Patel Duke: Margaret Chernoff, Steve Schultz, Jim Kammer, Robert Banker

Agenda topics

1:00-1:10 PM	Meeting Overview	Jim Kammer
1:10-1:15 PM	Introductions	Jim Kammer
1:15-1:20 PM	Introductions	NRC
1:20-1:35 PM	Control Room Envelope and Control	Jim Kammer
1:35-1:50 PM	Control Room Ventilation System	Jim Kammer
1:50-2:15 PM	Control Room Unfiltered Inleakage	Jim Kammer
2:15-2:25 PM	Break	
2:25-2:45 PM	Component Testing	Jim Kammer
2:45-3:05 PM	Tracer Gas Testing	Jim Kammer
3:05-3:25 PM	General Discussion	
3:25-3:30 PM	Closing Comments	Jim Kammer
3:30 PM	Adjourn	

1:00-1:10 PM	Meeting Overview	Jim Kammer

Discussion:

July 2001 NRC/Duke Meeting on planned Control Room Unfiltered Inleakage Testing

Catawba LARS (Current)

- Fuel Handling Accident Analysis – Under Review
- Annulus Ventilation – Expected 9/2002 submittal
- Auxiliary Building Ventilation – Expected 9/2002 submittal

UFSAR Dose Analysis – reconstitution effort underway – Expected 9/2002 submittal

Discuss Catawba Control Room Unfiltered Inleakage Test Results

- Dose Analysis Reconstitution Assumptions for Unfiltered Inleakage have been validated.
- Current HVAC Ductwork Maintenance Programs are adequate with respect to maintaining ductwork integrity.
- Recommended ANSI N-510 type test frequency approximately 20 years.
- Unnecessary to perform periodic tracer gas test.

Conclusions:

Action items:	Person responsible:	Deadline:

1:20-1:35 PM	Control Room Envelope and Control	Jim Kammer

Discussion:

594 Auxiliary Building – Single elevation, very simple physical boundary, one room inside boundary doors typically open

Adjacent Areas

- Service Building – OAC Room, Security Computer Room, Hallways, Office Area (VJ, balanced)
- 594 Electrical Penetration Rooms (VC, balanced)
- Auxiliary Building – general areas (VA, slight vacuum)
- Cable Spreading Rooms – (VC, balanced)
- VC/YC Equipment Rooms – (VC, balanced)
- Outside – very short section of wall, no penetrations, roof (NA, ambient)

Major VC System Components located outside of Control Room

Non-Control Room Ductwork traverses Control Room in overhead, pressurized and negative pressure

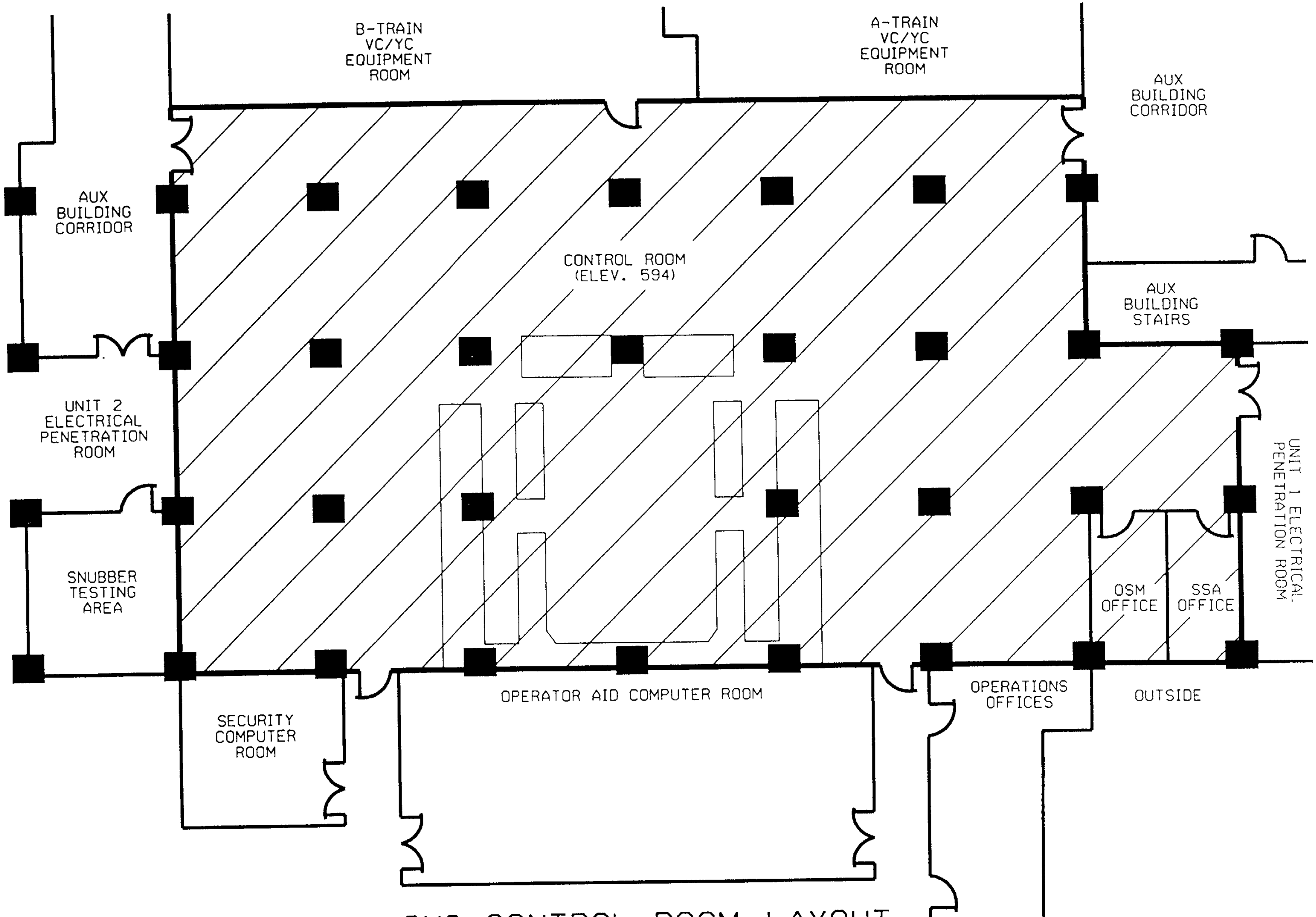
Instrument Air

Control Room Testing (Current)

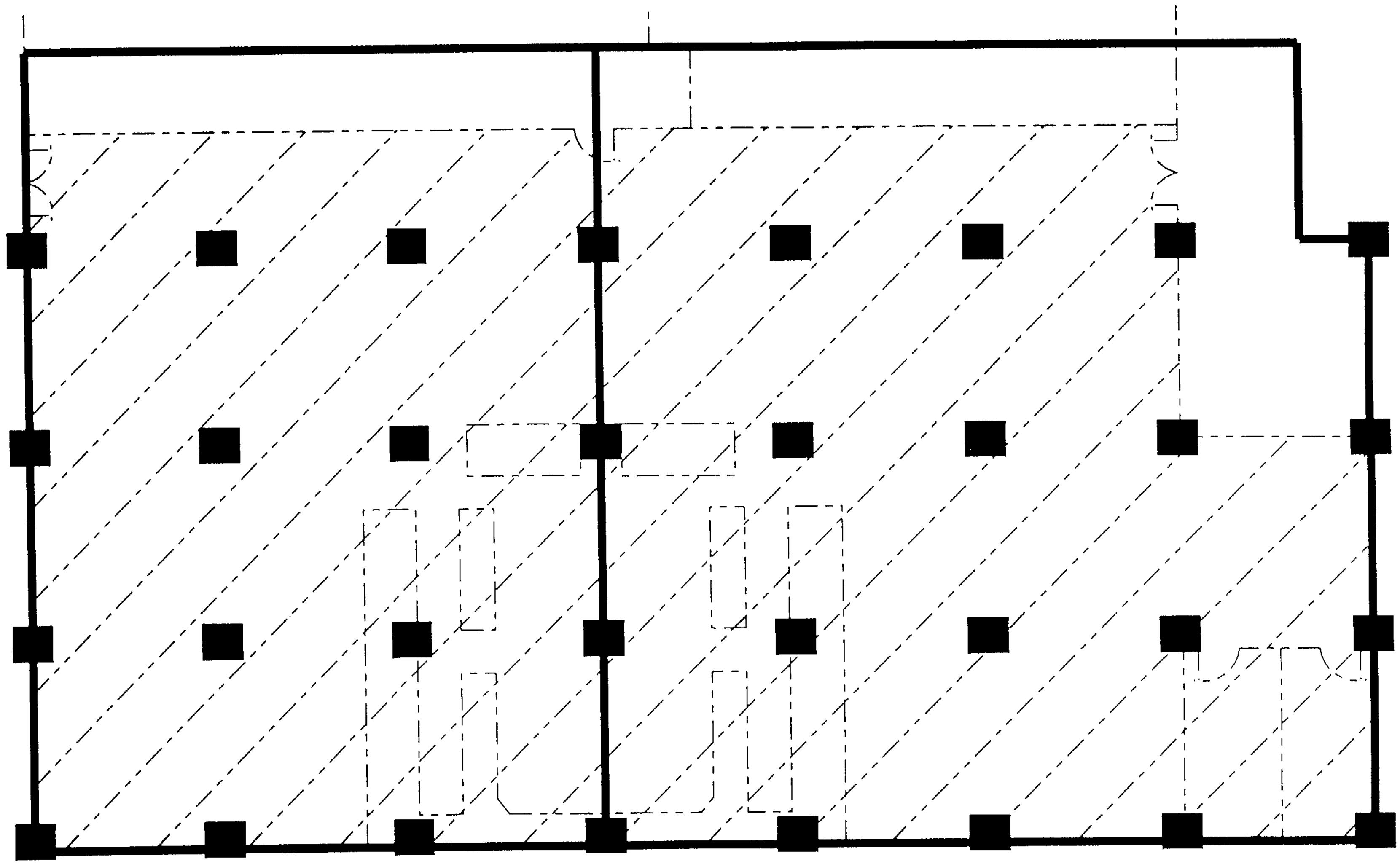
- Technical Specification Filter and Flow Testing
- Technical Specification Pressure verified to adjacent areas
- Pressure trended to identify need for corrective maintenance
- Periodic system inspections

Conclusions:

Action items:	Person responsible:	Deadline:



CNS CONTROL ROOM LAYOUT

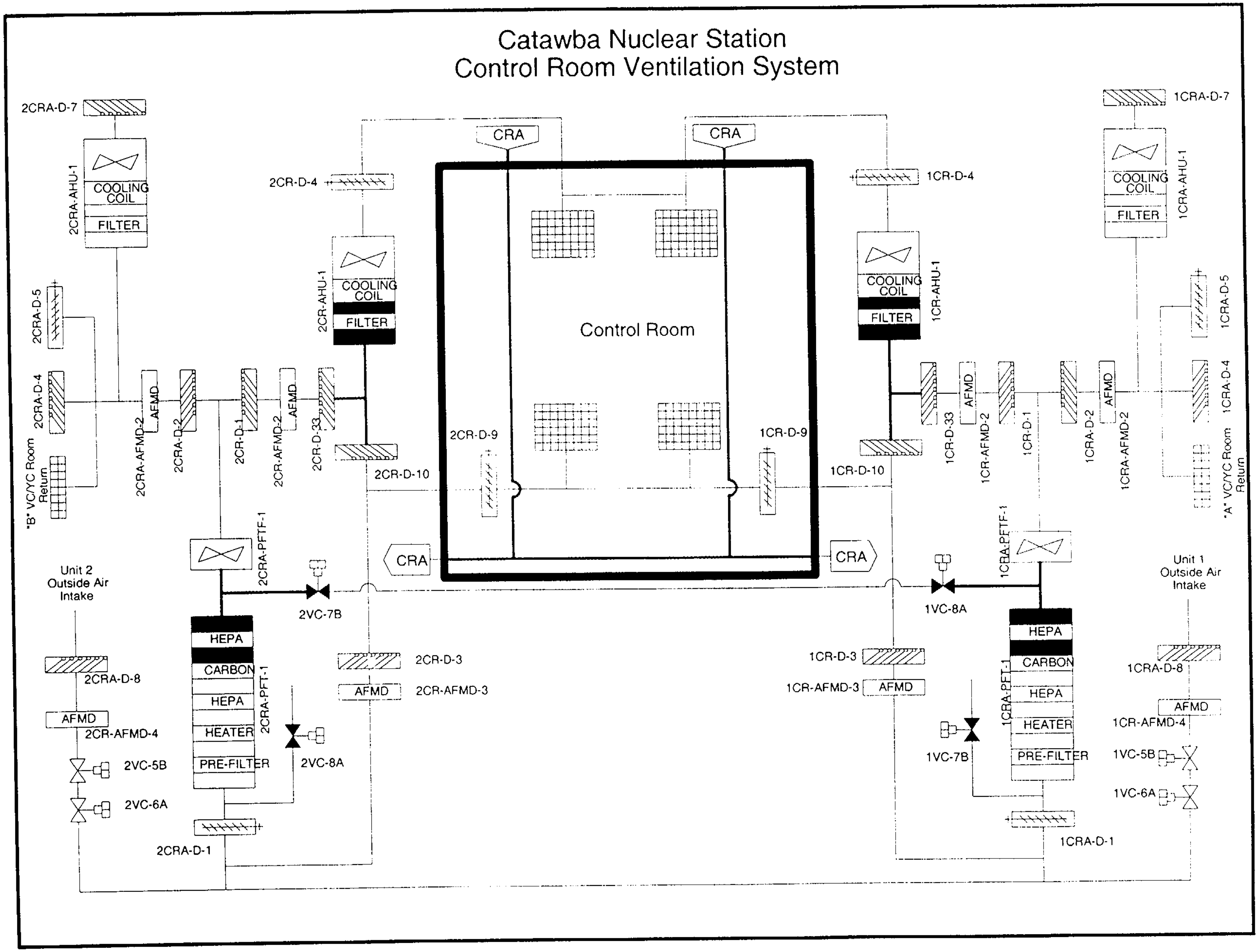


FLOOR BENEATH
CNS CONTROL ROOM
(CABLE ROOMS ELEV. 574)

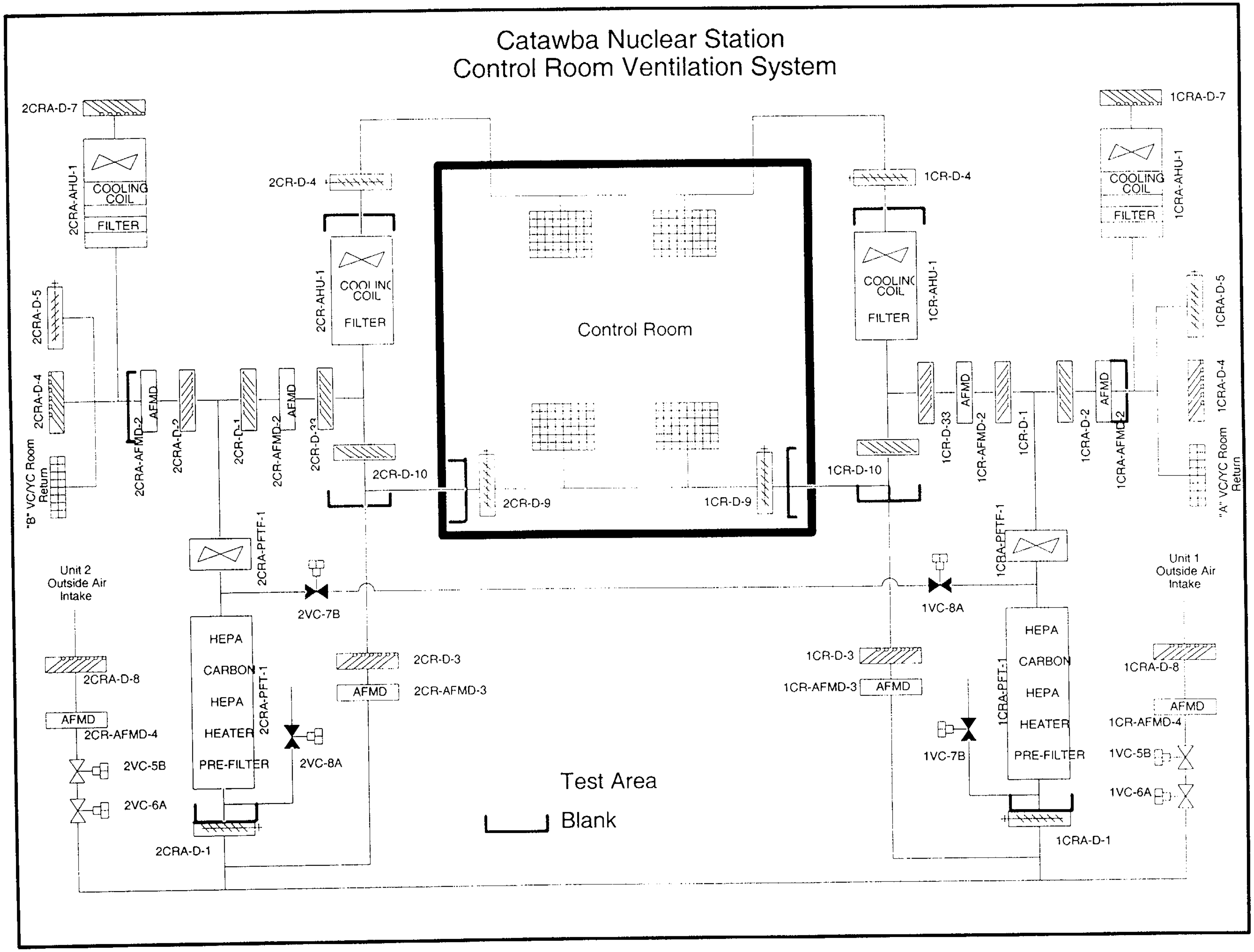
1:35-1:50 PM	Control Room Ventilation System	Jim Kammer
Discussion:		
Basic Components		
PFT – Pre-filter/Moisture removal, HEPA, Heater, Carbon Bed, HEPA, loop seals with non-essential makeup		
PFT Fan – 6,000 cfm nominal, essential power, Vaneaxial Fan (no shaft seals)		
CR-AHU – 26,000 cfm nominal, essential power, internal fan (no shaft seals), loop seals - condensation makeup		
CRA-AHU – 75,000 cfm nominal, essential power, not in Control Room Envelope		
Ductwork is welded seam design with bolted flange connections		
Normal Operation		
Continuously pressurized		
Continuously filtered		
One complete VC Train inservice		
Maintenance Alignment		
Design Basis Accident Operation		
Outside Air Intakes – Recent Chlorine Amendment		
Maintenance Testing Requirements		
Control Room Pressure verified any time maintenance alignment is performed		
Smoke Test VC Components any time VC Pressure Boundary is opened.		
Conclusions:		

Action items:	Person responsible:	Deadline:

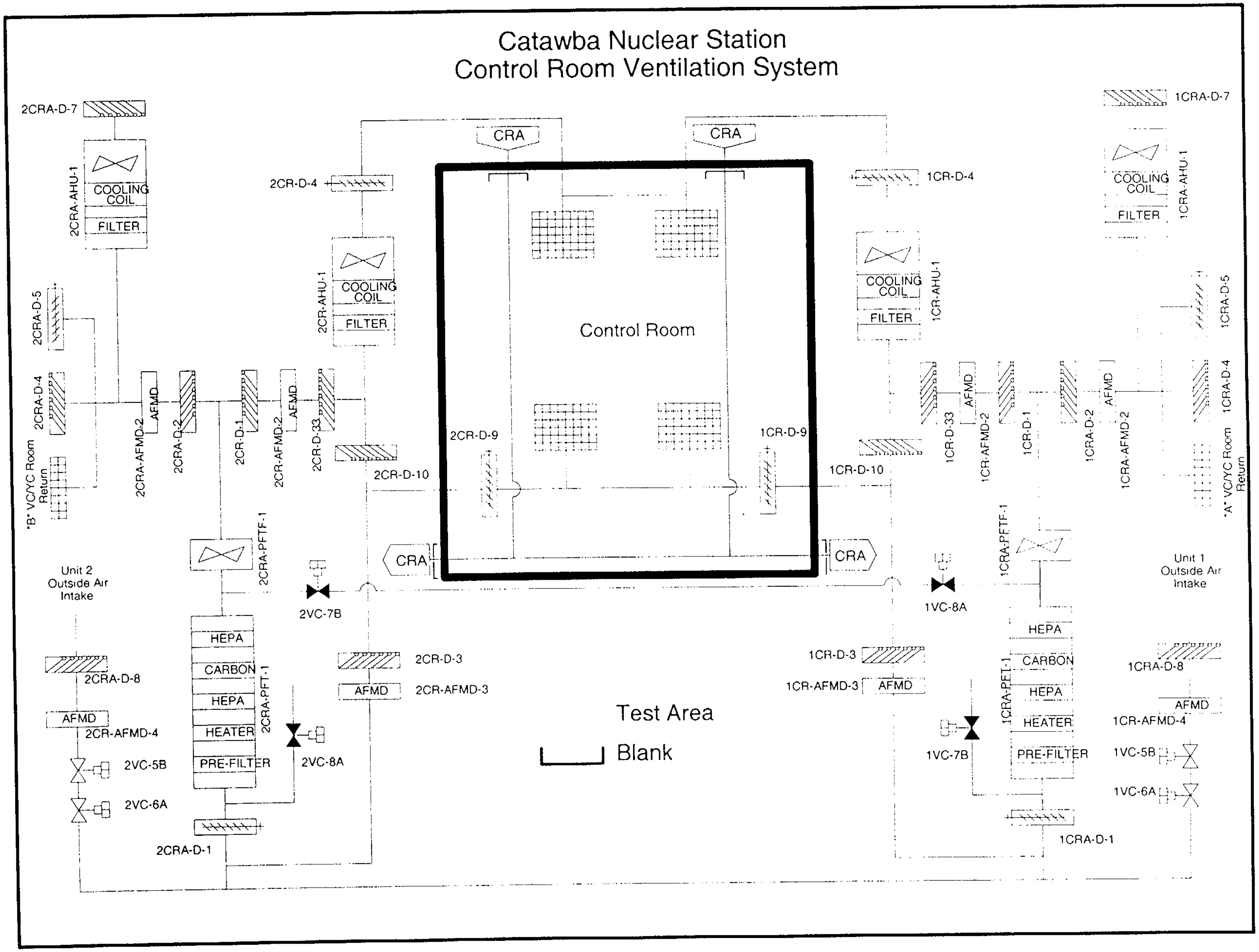
Potential Unfiltered Inleakage Sources



"A" Train & "B" Train
Inleakage Test Boundary



Control Room Area
Inleakage Test Boundary



1:50-2:15 PM	Control Room Unfiltered Inleakage	Jim Kammer

Discussion:

Control Room Unfiltered Inleakage

Dose Analysis Reconstitution Value	100 cfm
10 cfm Door Opening (SRP)	Assumed value
30 cfm Instrument Air	Calculated value based on calculated air consumption plus margin
60 cfm VC System Leakage	Measured Value ≈ 40 scfm

No leakage assumed through doors, walls, etc due to control room pressure

Calculation/walkdown has determined Instrument Air Leakage in Control Room ≈ 30 scfm

Calculated Consumption	≈ 15 scfm
Aging Margin	2X

Measurement not considered to be necessary based on low dose impact of this inleakge path due to flow path.

- Air Compressor – Washout
- Air Dryers
- Long tubing runs
- Tight clearances in final devices located in control room

Catawba Testing

4/11/01	Pressure mapping of "A" Train
7/25/01	Pressure mapping of "B" Train
8/06/01	"A" Train Component Testing (ANSI N-510)
8/13/01	"B" Train Component Testing (ANSI N-510)
8/28/01	Integrated Tracer Gas Test
9/3/01	Investigation onto "B" Train Intake Low Flow
9/9/01	"A" Train flow balance to address AFMD error
9/12/01	"B" Train flow balance to address AFMD error
12/3/01	"CRA" Duct Component Testing, "B" Train pressure mapping
1/10/02	"A" Train flow balance, "A" Train pressure mapping

Conclusions:

Action items:	Person responsible:	Deadline:

2:25-2:45 PM	Component Testing	Jim Kammer

Discussion:

Test Method ANSI N-510

- Re-balance recirculation line flows for single recirculation line
- Isolate Test Boundary
- Install blanks in ductwork
- Draw constant negative (CRA duct will be positive) pressure on ductwork
- Identify leaks and repair
- Measure flow
- Remove Blanks
- Unisolate Test Boundary
- Re-balance recirculation line to "As-Found"

Three test sections

"A" Train	13.0 ± 0.4 scfm @ 7.0 inwc	≈16 scfm @ 10.0 inwc
"B" Train	15.5 ± 0.4 scfm @ 7.0 inwc	≈19 scfm @ 10.0 inwc
CRA Ductwork	19.5 ± 0.4 scfm @ 2.5 inwc	≈ 19.5 scfm @ 2.5 inwc
Total Duct Inleakage		≈ 40 scfm (maximum of "A" or "B" Train + CRA)

Test Findings

"A" Train Minor leakage found/repaired on discharge of PFT fan. Would not have resulted in unfiltered inleakage.

"B" Train Leakage found/repaired at PFT Discharge damper. Attributed to inadequate damper repair in 1980's.

(Not unfiltered inleakage. Prior to establishment of current HVAC Duct maintenance program)

"CRA" Leakage found and repaired at electrical heater box (design deficiency), damper shafts. (Unfiltered inleakage)

Conclusions:

Test adequate to quantify unfiltered inleakage

Perform Component Test at 20 year intervals based on:

- Test was conducted "As-Found" (ie no preconditioning).
- Current Maintenance Program validated as adequate to maintain duct integrity.
- Conservatively 50% margin to Dose Reconstitution Unfiltered Inleakage Assumptions.

Action items:	Person responsible:	Deadline:

2:45-3:05 PM	Tracer Gas Testing	Jim Kammer

Discussion:

Test Vendor	Nucon
Recommended test method:	Continuous Injection
Estimated test accuracy (Best Case)	± 90 cfm.
Actual test error	± 280 scfm

	Envelope Leak Flow	Outside Air	Est CRA Recirculation	Unfiltered Leakage
"A" Normal	2946 ± 100 scfm	2803 scfm	505 scfm	-360 scfm
"A" Maintenance	3219 ± 93 scfm	2709 scfm	480 scfm	30 scfm
"B" Normal	2647 ± 92 scfm	2494 scfm	386 scfm	-230 scfm
"B" Maintenance	3020 ± 110 scfm	2536 scfm	588 scfm	-100 scfm
"A" + "B" (ESF No Failures)	5168 ± 180 scfm	3826 scfm	1390 scfm	-48 scfm

Engineering Issues with Tracer Gas Test

- PFT to CRA Flow Path complicates test conduct and requires numerous flow rates to be measured.
- Several flows could not be measured accurately due to either injection point location or inadequate mixing.
- Limited Control Room Access to ensure best possible results
- Poor Test Accuracy

Conclusions:

Action items:	Person responsible:	Deadline:

3:05-3:25 PM	General Discussion	

Discussion:

Conclusions:

Action items:	Person responsible:	Deadline:

3:25-3:30 PM	Closing Comments	

Discussion:

Dose Analysis Reconstitution Assumptions for Unfiltered Inleakage have been validated.

Current HVAC Ductwork Maintenance Programs a' : adequate with respect to maintaining ductwork integrity.

Recommended ANSI N-510 type test frequency approximately 20 years.

Unnecessary to perform periodic tracer gas test.

Conclusions:

Action items:	Person responsible:	Deadline:

CATAWBA NUCLEAR STATION
FHA AND WEIR GATE DROP ACCIDENT
REG GUIDE 1.183 APPENDIX B ANALYSIS
PRESENTATION TO NRC
FEBRUARY 21, 2002

DETAIED DISCUSSION MATERIAL RECOMMENDED BY STAFF ON FEBRUARY 19, 2002

METEOROLOGICAL DATA AND ANALYSIS
DOSE ANALYSIS
DISPERSION FACTOR ANALYSIS

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General Features of the AST FHA Analyses

DOSE ANALYSIS
DISPERSION FACTOR ANALYSIS

- Regulatory Guide 1.183 approach with detailed information provided in the LAR – additional detail to follow today
- FHA analysis represents first of the CNS AST submittals based on substantial analysis effort
    - Dose analysis methodology by Duke Power
    - X/Q analysis by Duke Power Environmental
    - FHA calculation origination by DE&S
    - Isotopic evaluations by NISYS & Duke Power
    - LOCADOSE dose analysis software (Bechtel)
- Full Systems evaluation and failure analysis
- Traditional assumptions for assembly failures in FHA and weir gate drop event
- Results of analyses within Regulatory guidelines for offsite and control room dose
- Analysis submittal addition will address pool DF of 200
- Results will continue to be acceptable

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METEOROLOGICAL QUESTIONS

Some questions were asked by the NRC Staff meteorologist (2/19/02) concerning the calculation of atmospheric dispersion factors for transport of radioactivity to the control room outside air intakes. These questions and responses are as follows:

1. *Provide justification that, overall, the meteorological data used in the assessment are of high quality and suitable for use in the assessment of atmospheric dispersion to which it was applied. For example, during the periods of data collection did the measurement program meet the guidelines of Regulatory Guide 1.23, "Onsite Meteorological Programs," including factors such as maintaining good siting, instruments within specifications, and adequate data recovery and quality assurance checks?*

The Catawba Nuclear Station meteorological system is maintained to comply with Regulatory Guide 1.23. The meteorological equipment in use is of high quality, has been maintained within operating specifications to ensure accurate data collection and the tower sensor instruments are free of obstructions. Annual meteorological data recoveries for the period 1994 through 1998 were approximately 96.8%, 95.7%, 95.4%, 96.5%, and 95.1% respectively. Weekly meteorological system checks are performed to ensure all data channels are operating within tolerance. Semi-annual meteorological system calibrations are performed during which all tower-mounted sensors are replaced with newly certified sensors. The precipitation gauge is the only sensor not located on the tower and is calibrated in place, without replacement. All collected meteorological data are reviewed, validated, edited and archived. Prior to the archival process, the meteorological data is reviewed and approved by the Certified Consulting Meteorologist in-house.

a. *During the periods of data collection, was the tower area free from obstructions (e.g. trees, structures) and micro-scale influences to ensure that the data were representative of the overall site area?*

The meteorological tower area has been maintained free of obstructions. The original tower (40m) in use through 6/10/96 was replaced with a new tower (60m), which began operation on 6/11/96 at 1900 hours. These towers are located on a hill south of the station, which offers the best siting available.

b. *If deviations occurred, describe such deviations from Regulatory Guide 1.23 guidance and why the data are still deemed to be adequate.*

During the meteorological data quality assurance process, if meteorological data did not satisfy Regulatory Guide 1.23, then the meteorological data would be deleted. Missing data values (e.g. 999s) would be inserted in the historical/archive database. No data values were maintained that did not satisfy regulatory criteria.

c. *What quality assurance checks were performed on the meteorological measurement systems prior to and during the periods of collection to assure that the data are of high quality?*

Weekly meteorological system checks were performed to ensure all data channels were operating within tolerance. Semi-annual meteorological system calibrations were performed during which all tower-mounted sensors were replaced with newly certified sensors. The precipitation gauge is the only sensor not located on the tower and was calibrated in place, without replacement. All collected meteorological data were reviewed, validated, edited and archived. Prior to the archival process, the meteorological data was reviewed and approved by the Certified Consulting Meteorologist in-house.

d. *Were calibrations properly performed and instruments found to be within guideline specifications for the use of the data?*

Weekly checks and semi-annuals calibrations assured that instruments were operating within tolerance. Any out-of-tolerance conditions would prompt data deletion.

e. *What additional checks and at what frequency were the checks performed on the data following collection and prior to input into the atmospheric dispersion calculations to assure identifying any problems in a timely manner, flagging data of questionable quality, and assuring that data were correctly formatted for the calculations?*

Routine quality assurance checks were performed on the meteorological system and collected data as described above. Meteorological data were retrieved from the quality assured archive and provided for use in the air dispersion calculations. The format of the hourly data files and missing data values were considered in the calculation, when the data was converted to the required format for input into ARCON96.

Hourly stability classes were calculated based on the vertical temperature gradient (i.e. delta-T) measurements, and the data was converted and formatted utilizing an in-house SAS program and MS EXCEL. Input to ARCON96 treated missing data as blanks. **Per NRC Staff request (2/19/02), the data will be provided in Arcon96 format with missing data fields filled in with 9's to verify conservative results were obtained (Computer CD).**

2. *During the 1994 through 1998 time period, there appear to be some intermittent measurements of very unstable lapse rates (A and B stability classes) during the night and very stable lapse rated (F and G stability classes) during the day. Typically, neutral or stable lapse rates occur at night and neutral or unstable conditions during the day. Did Duke observe such occurrences during their review of the data? If so, to what is this attributed?*

Response:
Duke will re-examine the data to identify these occurrences (approximately 30 occurrences) and determine their validity.

3. *When using ARCON96 are distances the shortest distance from postulated release location to the intake location?*

Response: All distances entered into the ARCON96 input files were the shortest (crow's flight) horizontal distances. Elevation differences between the release points and the intake locations were entered as appropriate.

Additional Meteorological and Calculation Information

1. All sources are treated as "ground-level" releases in this calculation.

Table 1 Sources

	Source
1	Equipment Hatch (EQ)
2	Fuel Building (FUEL)
3a	Unit Vent – with VA flow rate (UV)
3b	Unit Vent – with VF flow rate during fuel handling accident (UVF)

Table 2 Source Characteristics and Arcon96 Inputs

Source Type:	**EQ**	**FUEL**	**UV**	**UVF**
Vertical Point			X	X
Horizontal or Capped Point	1-CR2 2-CR1			
Horizontal Area Source		X		
Vertical Area Source	1-CR1 2-CR2			
Release Height	6.32 m 0 m	20 m	38 m	38 m
Flow Rate (m^3/s)	0	0	2.83	15.64
Sigma-Y	0 m 1 m	3.2 m	0 m	0 m
Sigma-Z	0 m 1 m	3.3 m	0 m	0 m
Bldg Cross-sectional Area	1592 m^2	1592 m^2	1592 m^2	1592 m^2
Source/Stack Radius* (m)	0	0	0	0
Vertical Vel.*	0 m/s	0 m/s	0 m/s	0 m/s
1-CR1 Distance_WD	46 m_{arc} 90° arc	80 m 83°	43 m 53°	43 m 53°
1-CR2 Distance_WD	125 m 165°	128 m 142°	109 m 163°	109 m 163°
2-CR1 Distance_WD	125 m 17°	128 m 40°	109 m 20°	109 m 20°
2-CR2 Distance_WD	46 m_{arc} 90° arc	80 m 97°	43 m 129°	43 m 129°

- Values of zero are assumed for the vertical velocity and stack radius parameters, in order to treat the release as a ground-level release in ARCON96.

- **<u>Figure 1 from the calculation is being provided in hardcopy, showing the plot plan of Catawba Nuclear Station.</u>**

In this calculation, all distances are the straight-line horizontal distances from source to receptor, except for releases from the equipment hatch to receptor intakes on the same unit, in which case the flow must go around the containment building to reach the closest air intake. For the flows around containment, wind directions are also different from the straight down-wind directions.

All distances and directions are rounded to whole numbers. For horizontal and vertical area sources, the distance to the closest edge of the source is input as the horizontal distance. Note that the distance to the equipment hatch deviates from this practice, as the distance is measured from the equipment hatch centerline. ARCON96 uses the horizontal distance to calculate an effective distance to the area source, which it treats as a virtual point source farther upwind.

All wind directions are measured from True North. The difference between station north and True North is noted on **Figure 1** as 1 degree 11 minutes and 5 seconds west of station north at CNS.

Table 3 Summary of ARCON96 Default Settings for CNS

Parameters	Default Values Used
Surface Roughness Length	0.2 m
Wind Direction Window (degrees)	90 degrees
Minimum Wind Speed (m/s)	0.5 m/s
Averaging Sector Width Constant	4.3
Initial Diffusion Coefficients *	* Source-specific. See above table. *
Hours in Averages	1, 2, 4, 8, **10**, 24, 96, 168, 360, 720
Minimum Number of Hours	1, 2, 4, 8, **9**, 22, 87, 152, 324, 648

2. (X/Q)s for the non-standard averaging periods were obtained from the ARCON96 output. This is done by interpolating between the results for the bounding time periods (e.g. (0-a) and (0-b)) to obtain the desired averaging period (e.g. "a to b hours"), as in the equation below.

$$(X/Q) \text{ for period } [a \text{ to } b] = [\, b(X/Q)_b - a(X/Q)_a \,] / (b-a)$$

where

a, b	hours bounding the desired averaging period
$(X/Q)_a$, $(X/Q)_b$	95th percentile (X/Q)s for the time periods "0-a" & "0-b"
(X/Q) for period [a to b]	interpolated, average (X/Q) for the period [a-b hours].

Thus, the following equations are used to determine the (X/Q)s from the ARCON96 output for the desired time intervals.

Table 3 (X/Q) Determination from ARCON96 for Desired Averaging Intervals

CNS Time after Accident	X/Q Determination
0-2 hours	max of 1-hour or (0-2 hour) modeled X/Q
0 - 8 hours	(0-8 hour) modeled X/Q
8 - 10 hours	$[\, 10(X/Q)_{0\text{-}10} - 8(X/Q)_{0\text{-}8} \,] / 2$
10 - 24 hours	$[\, 24(X/Q)_{0\text{-}24} - 10(X/Q)_{0\text{-}10} \,] / 14$
1 - 4 days	95th percentile (1 - 4 days) modeled X/Q
4 - 30 days	95th percentile (4-30 days) modeled X/Q

3. During the multi-year meteorological period used as input to the ARCON96 model (1994-1999), the height of the upper measurement level at Catawba Nuclear Station increased from approximately 40m to 60 m. A taller tower became operational at CNS on June 11, 1996 at hour 1900. This increased the separation distance for the delta-T measurements used for stability class classification from 30m to 50 m (e.g. 60m - 10m = 50m). Therefore, in processing the meteorological data, the changes in the delta-T ranges for the stability classes were considered.

For the "Upper Measurement Height" parameter in ARCON96, a value of 60m was entered for the multi-year run. Since all releases were specified to be “ground-level” this does not affect the results, as the model uses the lower level winds (e.g. 10m level). Even if the release type is later changed, this will still be a conservative compromise between the tower heights, as the model would then assume lower wind speeds at greater heights within the surface boundary layer, and thus interpolate lower wind speeds for modeling at the release height.

Other input parameters to ARCON96 also provide assumptions about the meteorological conditions. The surface roughness length has a default value of 0.1m in the model, but this was changed in this calculation to be 0.2m per the draft NRC guidance. The wind direction window width was input as the default, a 90 degree sector within which the plume is assumed to travel directly from source to receptor. The default minimum wind speed of 0.5 m/s was also used. Below this speed, winds are treated as calm by ARCON96 and wind direction is ignored; it is then assumed by the model that the receptor is directly downwind of the source during calms.

4. The following information details the initial format and processing of Hourly Meteorological Data performed prior to input into ARCON96 (Computer CD).

A.1 Format of Archived Meteorological Data for Duke Power Nuclear Stations

Hourly meteorological data from the nuclear station's onsite meteorological tower is routinely archived after quality assurance reviews have been performed. The format of this data is shown in **Table A-1**. Missing data is denoted by filling the variable's digits with nines. Lower level winds are measured at approximately 10 m above ground level. Upper level winds are measured at the top of the meteorological tower (e.g. approximately 40m and 60m historically). Wind direction is the direction from which the wind is blowing and is measured in degrees clockwise from True North. Delta-T is the difference in temperature between the two measurement heights (i.e. upper temperature - lower temperature) and can be used to derive an atmospheric stability classification. Sigma Theta is the standard deviation of the lower level wind direction. Note that the dewpoint temperature is only measured at Catawba Nuclear Station for this time period.

Table A-1 Format of Meteorological Data for Catawba Nuclear Station

Column	Variable	Example	Missing Data
1 - 10	Date and Time (YYMMDDhhhh)	9401010100	N/A
12 - 16	Upper Level Wind Speed (mph)	006.3	999.9
18 - 20	Upper Level Wind Direction (degrees)	216	999
22 - 26	Lower Level Wind Speed (mph)	003.3	999.9
28 - 30	Lower Level Wind Direction (degrees)	226	999
32 - 38	Sigma-Theta (degrees)	+0011.1	+9999.9
40 - 48	Delta-T (Celsius)	+00002.97	+09999.99
50 - 57	Lower Level Temperature (^oC)	+00001.2	+09999.9
59 - 66	Lower Level Dew Point Temperature (^oC)	+00000.2	+09999.9
68 - 74	Precipitation (inches)	0000.05	9999.99

A.2 Input Format of Meteorological Data for ARCON96

Multiple years of hourly meteorological data can be input to the ARCON96 model. The required format is listed in **Table A-2** below. Julian day is the day of the year and ranges from 1 to 366. The hour is entered using a 24-hour clock with midnight being zero (i.e. 00-23). Atmospheric stability classes A-G are input numerically as classes 1 to 7, respectively. Wind speeds are entered to the nearest tenth of a reporting unit, but without the decimal point (e.g. 5.3 mph would be input as 53). Either m/s or mph measurement units can be used for wind speed; units are selected in the run specification file for ARCON96 (*.rsf).

Table A-2 Required ARCON96 Meteorological Data Input Format

Column	Fortran Format	Variable
1	1X	Blank
2 – 6	**A5**	Site ID (alphanumeric)
7 – 9	3X	Blank
10 – 12	**I3**	Julian Day (ddd)
13 -14	**I2**	Julian Hour (hh)
15 – 16	2X	Blank
17 -19	**I3**	Lower Wind Direction
20 – 23	**I4**	Lower Wind Speed
24	1X	Blank
25 – 26	**I2**	Stability Class
27 – 28	2X	Blank
29 – 31	**I3**	Upper Wind Direction
32 – 35	**I4**	Upper Wind Speed

A.3 Conversion of Meteorological Data to ARCON96 Input Format

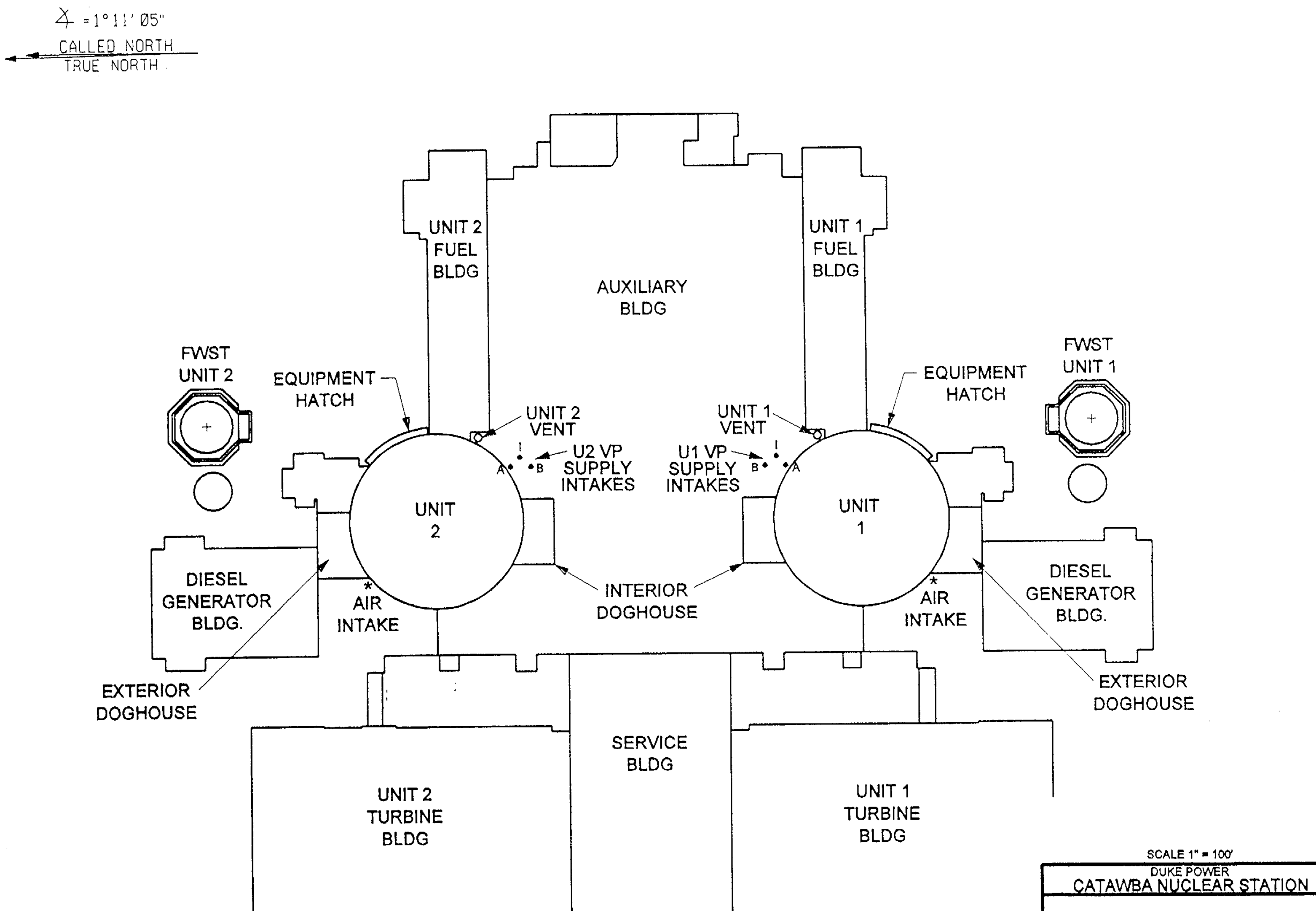
Before onsite meteorological data from a Duke Power Nuclear Station can be used as input to ARCON96, it must be processed to determine stability class, add Julian day and time, and remove the decimal point from the wind speeds. Missing data flags (i.e. variables filled with 9's) must also be eliminated and replaced with blanks.

Onsite meteorological data for the years 1994-1999 were used for Catawba Nuclear Station. Note that during this period, the old measurement system located on a 40m tall microwave tower was replaced by a new 60m meteorological tower located nearby. The new tower became operational at CNS on June 11, 1996 at hour 1900. The change in height of the upper level measurement system was factored into the stability class determination, as discussed below (see **Table A-3**). Also note that 1996 was a leap year.

For preprocessing, each year of hourly meteorological data was read into an EXCEL spreadsheet in order to add the Julian day and corresponding hour. The data was then saved in text files (i.e. *.prn) for input into a user-written SAS program, "ARCONMET". The SAS program converted the Delta-T measurements into associated stability classes, per the criteria listed in **Table A-3** below, based on a standard classification scheme for a 100m vertical separation. The SAS program also removes the decimal point from the wind speed data by multiplying by 10. Missing data flags are replaced by decimal points or dots (i.e. "."). A Site ID is also added to each line of hourly data. The text output files from the SAS program were then read into EXCEL to replace the missing data "points" with blanks. The EXCEL file was again saved as a text file (i.e. *.prn) for input into the ARCON96 model.

Table A-3 CNS Delta-T Ranges for Determining Stability Class

Stability Class	CNS 40m Tower Delta-T (C)	CNS 60m Tower Delta-T (C)
A = 1; Extremely Unstable	dT ≤ - 0.57	dT ≤ - 0.97
B = 2; Moderately Unstable	- 0.57 < dT ≤ - 0.51	- 0.97 < dT ≤ - 0.87
C = 3; Slightly Unstable	- 0.51 < dT ≤ - 0.45	- 0.87 < dT ≤ - 0.76
D = 4; Neutral	- 0.45 < dT ≤ - 0.15	- 0.76 < dT ≤ - 0.25
E = 5; Slightly Stable	- 0.15 < dT ≤ 0.45	- 0.25 < dT ≤ 0.76
F = 6; Moderately Stable	0.45 < dT ≤ 1.2	0.76 < dT ≤ 2.04
G = 7; Extremely Stable	1.2 < dT	2.04 < dT



DUKE POWER
CATAWBA NUCLEAR STATION

PLOT PLAN FOR CONTROL ROOM HABITABILITY ASSESSMENT

FIGURE: 1

DOSE ANALYSIS / DISPERSION FACTOR ANALYSIS QUESTIONS

The following information is provided to document and supplement questions and responses relayed in a telecom with the NRC Staff meteorologist (02/19/02) pertaining to the Catawba Nuclear Station Equipment Hatch / Personnel Air Lock (EQH/PAL) License Amendment Request. These questions and responses are as follows:

1) *Provide docketed references to the X/Q's used for calculations of radiation doses to the Exclusion Area Boundary (EAB).*

Response: The EAB X/Q appears in two docketed documents listed below. The EAB X/Q listed in both submitted analyses is 4.78E-04 sec/m^3.

In 1996, Duke Power sent the following LAR to the NRC Staff: W.R. McCollum to U.S. Nuclear Regulatory Commission, "Catawba Nuclear Station, Unit 1 Docket No. 50-413, Technical Specification Change," January 26, 1996. This LAR requested a one time allowance to operate the Containment Purge Ventilation System for Unit 12 in Mode 3 immediately following the Steam Generator (S/G) Replacement Outage. In response to a Telecon request from the Staff, Duke Power sent one copy of three calculations supporting the technical justification in this LAR. One of them, CNC-1227.00-00-0066, lists the EAB X/Q (Attachment 4 - pg. 3, 12, Attachment 8, pg. 4).

In 1997, Duke Power sent the following LAR to the NRC Staff: W.R. McCollum to U.S. Nuclear Regulatory Commission, "Catawba Nuclear Station, Units 1 and 2 Docket Nos. 50-413 and 50-414 Request for Facility Operating License Amendment Steam Generator Tube Rupture Evaluation," March 7, 1997. This LAR requested a change to TS 3.7.4 (then TS 3.7.1.6) to require all four S/G Power Operated Relief Valves be operable and also requested approval to credit local manual operation of one failed closed S/G PORV following a Steam Generator Tube Rupture (SGTR). The Staff made one official Request for Additional Information and also made several telecom requests for more information. In response to the official RAI, we provided input for the dose analysis of the SGTR in question, including a citation of the EAB X/Q. This information is found in the letter "W.R. McCollum to U.S. Nuclear Regulatory Commission, "Catawba Nuclear Station, Units 1 and 2 Docket Nos. 50-413 and 50-414 (TAC M98107 and M98108) Request for Additional Information Regarding the License Amendment for the Steam Generator Tube Rupture Evaluation," April 2, 1997.

The Staff wrote Safety Evaluation Reports in approving these LARs. In the SER related to the 1996 submittal, the NRC Staff described a calculated value for X/Q of 3.8E-04 sec/m^3. In the SER related to the 1997 submittal, the NRC Staff quoted the submittal calculated value for X/Q of 4.78E-04 sec/m^3.

The current value reported in the CNS UFSAR in Table 15-29 is 4.78E-04 sec/m^3. A historical value of 5.5E-04 sec/m^3 appears elsewhere in the UFSAR. These values will be updated or removed as the Alternative Source Term analyses are completed and the dose analyses are updated.

DOSE ANALYSIS / DISPERSION FACTOR ANALYSIS QUESTIONS

2) *Show that you have the limiting control room X/Q for the design basis (DB) fuel handling accident (FHA) and weir gate drop (WGD). This control room X/Q is associated with releases from the unit vent stack for all of the above design basis accidents. Discuss the effects of loss of offsite power and single failure in your control room X/Q.*

Response: Only three release paths are associated with the Fuel Handling Accidents and Weir Gate as follows:

Fuel Handling Accident in Containment: (1) Release from the equipment hatch and/or (2) Release from the unit vent stack.

Fuel Handling Accident in the Fuel Building or Weir Gate Drop: (2) Release from the unit vent stack and/or (3) Release from the fuel building louvers.

The control room X/Q associated with the unit vent stack exceeds the control room X/Q for the equipment hatch by approximately 9% and the X/Q for the fuel building by a factor of 4. Some additional details are as follows:

Fuel Handling Accident in Containment: Credit is not taken for any safety related system except for the Control Room Ventilation System (CRAVS). However, the accident may occur with either the Containment Purge Exhaust System (CPES) on or off, with offsite power available or with loss of offsite power (LOOP). The CPES is non safety related.

For a FHA in containment with offsite power available and the CPES in operation, outflow from the containment will be drawn by the CPES fans into the unit vent stack. **Note:** no credit is taken for the CPES filters in the dose analysis supporting this LAR. If the CPES is not in operation at the time of the initiating event, the containment outflow will pass through either the personnel air lock doorway into the Auxiliary Building and thus to the environment through the unit vent stack or it will pass through the open equipment hatch directly to the environment.

If offsite power is lost with the initiating event, then the CPES containment isolation valves will fail closed. The sequence proceeds in a manner similar to the FHA in containment with CPES off. That is, the release is through the personnel airlock doorway to the Auxiliary Building and out the unit vent stack or directly to the environment through the equipment hatch doorway.

Fuel Handling Accident in the Fuel Building and Weir Gate Drop: Again, credit is not taken for any safety related system except for the CRAVS. However, the accident may occur with either the Fuel Handling Ventilation Exhaust System (FHVES) on or off, with offsite power available or with LOOP. The FHVES is a safety related system. It may be operated in the bypass mode or in the filtered mode. (Currently, the FHVES is operated in the filtered mode during fuel handling operations in the fuel building or during weir gate movement.)

For a FHA in the fuel building or WGD with FHVES in operation, outflow from the fuel building will be blown by FHVES fans into the unit vent stack. **Note:** Credit is not taken for the FHVES filters in the dose analysis. If the FHVES is not in operation at the time of the initiating event, fuel building outflow will escape to the environment primarily through the louvers and doorway penetrations in the back of the fuel building.

If offsite power is lost with the initiating event, one FHVES train will auto start. Then the release will be passed the fans of that FHVES train and out the unit vent stack.

DOSE ANALYSIS / DISPERSION FACTOR ANALYSIS QUESTIONS

3) Analysis assumptions related to control room intake configuration and availability:

Catawba is equipped with two CRAVS outside air intakes. The Class 1E motor operated isolation valves in these intakes are open for normal plant operations. With the recent removal of the interfaces with the CRAVS chlorine detectors, there are no credible design basis failure modes which would cause any of these valves to fail close. However, one CRAVS intake could be closed for maintenance activity. The only restriction on the activity is that the valve be capable of being opened within 2 hours. As a result, only one intake was assumed to be available during the 2 hour releases following either a FHA or WGD in calculating the TEDE's reported in the LAR.

In the Duke Power Company review of DG-1111, we anticipated that Section 2.3.2 would contain Staff guidance regarding the treatment of unavailability for dual intakes. Currently, there is no Staff position or discussion pertaining either to failure modes which could cause unwanted closure of an intake or maintenance activity which could leave an intake closed at the initiation of a design basis event. Duke Power Company will include this among its comments on DG-1111, which will be sent either as part of industry comments or separately.

4) Consideration of the Reactor Building as a potential release source:

How has the Reactor Building, being a distance of only 2 meters from the outside air intakes, been considered as a potential release source for the FHA in containment?

The Catawba Nuclear Station containment design and operation, which includes dual containment barriers with an annulus ventilation system, was examined in the containment FHA with the following conclusions. The only potential releases from the containment to the environment are through the following release points:

1) Annulus - Annulus Ventilation System - unit vent stack. This is not a release pathway for the FHA as the Annulus Ventilation System is not in operation for this accident.

2) Bypass leakage through containment penetrations into the Auxiliary Building. This pathway releases to the environment through the unit vent stack.

3) Bypass leakage into the Steam Generator Doghouses and into the yard near the outside air intakes.

4) Bypass leakage through the intake vents of the Containment Purge Exhaust System (CPES). If the CPES is in operation, there is no outflow, only inflow. If the CPES is not in operation or if a LOOP occurs, the containment isolation valves for these penetrations are closed.

The out leakage through paths (2), (3), and (4) is credible only for LOCA and Rod Ejection when the containment may be pressurized. In particular, outflow through these paths are not credible for the FHA in containment. They are not relevant for the FHA in the fuel building or the WGD.