VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

November 20, 2003

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555

Serial No. 03-464A
NL&OS/ETS R1
Docket Nos. 50-338
50-339
License Nos. NPF-4
NPF-7

VIRGINIA ELECTRIC AND POWER COMPANY
NORTH ANNA POWER STATION UNITS 1 AND 2
PROPOSED TECHNICAL SPECIFICATION CHANGES
IMPLEMENTATION OF ALTERNATE SOURCE TERM
REQUEST FOR ADDITIONAL INFORMATION

In a letter dated September 12, 2003 (Serial No. 03-464), Virginia Electric and Power Company (Dominion) requested amendments, in the form of changes to the Technical Specifications to Facility Operating Licenses Numbers NPF-4 and NPF-7 for North Anna Power Station Units 1 and 2, respectively. The proposed changes were requested based on the radiological dose analysis margins obtained by using an alternate source term consistent with 10 CFR 50.67. In an October 27, 2003 telephone conference call with the NRC Staff, additional information was requested regarding the meteorological data used to predict the dose consequence from a design basis accident. The requested information, including the input data and analysis methodology and assumptions are included as attachments to this letter.

Due to the number of program and procedure changes necessary to implement these changes, we continue to request ninety days from the issuance date of the amendments to implement the Technical Specifications changes. If you have any further questions or require additional information, please contact Mr. Thomas Shaub at (804) 273-2763.

Very truly yours,

Leslie N. Hartz
Vice President – Nuclear Engineering

Attachments
1. Request for Additional Information
2. Associated Sketches
3. CD Containing Met Data

Commitments made in this letter: None

A001

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SN: 03-464A
Docket Nos.: 50-338/339
SN: 03-464A
Docket Nos.: 50-338/339
Subject: AST RAI Meteorological Data

COMMONWEALTH OF VIRGINIA)
)
COUNTY OF HENRICO)

The foregoing document was acknowledged before me, in and for the County and Commonwealth aforesaid, today by Leslie N. Hartz who is Vice President – Nuclear Engineering of Virginia Electric and Power Company. She has affirmed before me that she is duly authorized to execute and file the foregoing document in behalf of that Company, and that the statements in the document are true to the best of her knowledge and belief.

Acknowledged before me this 20TH day of November, 2003.

My Commission Expires: May 31, 2006.

Vicki L. Hull
Notary Public

(SEAL)

Attachment 1

Virginia Electric and Power Company
North Anna Power Station Units 1 and 2
Proposed Technical Specification Changes
Implementation of Alternate Source Term
Request for Additional Information

North Anna Power Station
Units 1 and 2
Virginia Electric and Power Company
(Dominion)

NORTH ANNA ALTERNATIVE SOURCE TERM ARCON96 INPUTS, ASSUMPTIONS, MODELING OPTIONS AND RESULTS

The inputs to ARCON96 [Reference 1] consisted of meteorological and dimensional/directional data. In some cases the output from ARCON96 was adjusted based upon wind speed statistical and PORV steam thermodynamic data. The inputs and modeling options used and the data used to make adjustments to the ARCON96 output are discussed below in separate sections.

1) ARCON96 INPUTS

1.1) METEOROLOGICAL DATA

The first input required by the ARCON96 computer code is the site meteorological data. The North Anna site meteorological data is collected according to the guidance found in Regulatory Guide 1.23. Included with this letter is a CD with the raw meteorological data and the processed meteorological data ready for input into ARCON96.

The processed meteorological data is contained in the file "NA9701MET2". The raw meteorological data is written to 5 files – one for each year from 1997 through 2001. These file names are "North Anna 1997 Met Data.txt", "North Anna 1998 Met Data.txt", "North Anna 1999 Met Data.txt", "North Anna 2000 Met Data.txt" and "North Anna 2001 Met Data.txt".

Also included on the CD for convenience are the ARCON96 input files.

1.2) DIMENSIONAL DATA

The North Anna meteorological tower has its lower data collection sensors at 10.0 meters above grade and its upper data collection sensors at 48.4 meters above grade [Reference 5].

After generating ARCON96 readable meteorological data the next input data developed was dimensional data. The dimensional data consisted of the horizontal distances between the source points and receptor points, the elevation above grade (271') of the source points and receptor points and the area of one of the containment buildings above grade.

The location of each receptor and source are marked on Sketch No. 1, which is an attachment to this letter. The location designations for the receptors and sources on Sketch No. 1 are as follows:

NCR – normal control room intake
C4 - emergency control room intake close to column lines C and 4
C6 - emergency control room intake close to column lines C and 6
C10 – emergency control room intake close to column lines C and 10
C11 – emergency control room intake close to column lines C and 11
U1 - Unit 1 containment building

U2 - Unit 2 containment building
V - vent stacks A and B (vent stacks A and B are only 22' apart from each other)
E1 - Unit 1 equipment hatch
E2 - Unit 2 equipment hatch
P1 - Unit 1 PORVs
P2 - Unit 2 PORVs
R1 - Unit 1 RWST vent
R2 - Unit 2 RWST vent
EL - auxiliary building east louver
WL - auxiliary building west louver
B1 - Unit 1 primary ventilation blowout panel
B2 - Unit 2 primary ventilation blowout panel

The location and elevation of each receptor and source are displayed in Table 1. In Table 1 the locations were defined relative to the columns lines "C" and "9". That is, every receptor and source has an associated distance south of column line "C" and an associated distance east or west of column line "9". From these distances relative to columns lines "C" and "9", the horizontal distance between each source-receptor pair was calculated and is shown in Table 1.

The grade of the station is elevation 271' and the heights of each source and receptor above this elevation are also included in Table 1.

Sketch No. 2 shows the filter housings and intake ducting for the two F41 emergency control room fans. The intakes for these fans draw air from the turbine/service building air volume. One intake is close to column lines C and 10. The other intake is close to column lines C and 6.

Sketch No. 3 shows the filter housing and intake ducting for the Unit 1 F42 emergency control room fan. The intake takes suction on the Unit 1 air conditioning chiller room and not on the turbine/service building air volume. The air conditioning chiller room is within the control room concrete envelope (but not the control room pressure envelope) and communicates with the turbine/service building air volume via an exhaust fan and intake louver. The chiller room intake louver were was modeled as the intake point into the control room envelope for the Unit 1 F42 fan. This intake point is referred to as the C4 receptor because of its proximity to column lines C and 4. See the assumptions section for more information about the selection of the intake point.

Sketch No. 4 shows the filter housing and intake ducting for the Unit 2 F42 emergency control room fan. The intake takes suction on the Unit 2 air conditioning chiller room and not on the turbine/service building. The air conditioning chiller room is within the control room concrete envelope (but not the control room pressure envelope) and communicates with the turbine/service building air volume via an exhaust fan and intake louver. The chiller room intake louver was modeled as the intake point into the control room envelope for the Unit 2 F42 fan. This intake point is referred to as the C11 receptor because of its proximity to column lines C and 11. See the assumptions section for more information about the selection of the intake point.

According to Regulatory Guide 1.194 [Reference 3] the containment buildings will create wake effects as a function of their cross sectional areas. The wake effect of a large building increases the dispersion of any airborne effluents. In these ARCON96 runs only the cross sectional area of a single containment building is used. The cross sectional area of this containment building was computed in accordance with Regulatory Guide 1.194 [Reference 3]. This means that only the portion of the containment building above grade is considered. The outer radius of the dome portion of the containment building is 65.5' and the outer radius of the right circular cylinder portion of the containment building is 67.5'. The bend line where the transition between the right circular cylinder and hemisphere occurs is at elevation 342'. This makes the cross sectional area of the hemispherical dome (PI*R*R/2) or 6739.1 square feet or 626.1 square meters. The cross sectional area above grade of the right circular cylinder portion of the containment is ((342'-271')*67.5*2) or 9585 square feet or 890.5 square meters. The total cross sectional area of one of the containment buildings above grade is 626.1 square meters plus 890.5 square meters or 1516.6 square meters.

Distances from the containment buildings to the receptors were calculated by treating the point on the cylinder of the outside wall of the containment that was closest to the receptor as the source.

1.3) DIRECTIONAL DATA

The ARCON96 code requires the compass direction of the source point relative to the receptor point for each run. Expressed another way, this is the compass heading a person is facing when they are at the receptor and are looking at the source. This angle was calculated using the coordinates of the source and the coordinates of the receptor relative to column lines “C” and “9”. This calculation was done for each source-receptor pair. The results of this calculation for each source receptor pair is shown in Table 1. Included in these calculations is a correction for true north. The “Called North” arrow shown in Sketch No. 1 is for local references on site. The buildings on site are aligned 36 degrees off of true north by protractor measurement. Therefore, a 36-degree correction is incorporated into each source-receptor compass heading calculation.

TABLE 1 - ARCON96 INPUTS

LOCATION (grade elev 271') Point Sources	Elevation (feet)	Meters above grade	Feet South of C	Feet East Of 9	Feet West of 9	Meters To C-4	meters to C-11	Meters To C-10	Meters To C-6	meters to norm intake	Degrees from NCR intake to	Degrees from C-4 to	Degrees from C-11 to	Degrees From C-10 to	Degrees from C-6 to
Unit 1 PORV A	339.00	20.73	117.58	129.08		37.66	70.29	57.79	35.76	22.39	192.08	162.64	84.51	90.88	125.57
Unit 1 PORV C	339.00	20.73	117.58	140.58		36.69	73.33	60.63	37.01	19.92	185.33	157.45	83.12	88.89	120.42
Unit 1 PORV B	339.00	20.73	117.58	153.50		35.98	76.79	63.90	38.76	17.57	175.65	151.34	81.69	86.87	115.07
Unit 2 PORV C	339.00	20.73	117.58		153.25	104.38	43.86	52.81	82.09	103.80	225.71	214.01	179.55	192.95	209.59
Unit 2 PORV B	339.00	20.73	117.58		140.33	100.69	41.70	49.91	78.52	99.91	225.39	213.24	175.14	189.98	208.40
Unit 2 PORV A	339.00	20.73	117.58		128.83	97.42	40.00	47.45	75.37	96.44	225.08	212.51	170.84	187.04	207.25
U1 RWST vent	335.56	19.68	134.00	234.50		45.38	101.22	87.84	58.32	25.26	106.23	117.72	77.70	80.86	95.87
U2 RWST vent	335.56	19.68	134.00		234.50	129.42	64.67	75.81	106.86	129.04	225.10	215.68	195.01	202.43	212.64
Vent Stack B	386.75	35.28	7.50	78.00		27.69	45.03	30.68	4.28	37.21	263.98	229.58	56.72	56.11	229.07
Vent Stack A	386.75	35.28	7.50	56.00		34.38	38.34	23.98	10.98	43.15	259.52	230.44	56.70	56.70	232.08
U1 blowout panel	322.50	15.70	177.83	15.50		71.40	59.95	54.30	57.25	61.16	200.98	184.80	118.37	131.66	168.04
U2 blowout panel	322.50	15.70	161.67		33.21	78.72	50.36	48.23	60.82	71.97	210.76	195.39	131.28	147.85	182.86
E Aux Bld louver	301.22	9.21	119.73	50.00		51.25	51.47	41.69	36.87	43.65	213.04	188.85	98.91	111.95	164.32
W Aux Bld louver	301.22	9.21	119.37		50.00	75.84	36.72	36.20	55.33	72.91	221.72	205.46	134.64	157.35	195.47
U1 Equip Hatch	298.42	8.36	259.63	143.56		79.35	102.27	92.98	78.80	59.53	155.88	149.52	104.56	111.00	132.50
U2 Equip Hatch	298.42	8.36	231.22		191.79	130.42	79.58	86.40	110.37	124.75	210.57	201.37	171.91	180.65	195.60
Diffuse Sources	**Sigma-Y**	**Sigma-Z**													
U1 Cont Center			192.50	136.50		59.33	85.85	75.23	58.35	40.45	164.86	153.49	96.97	103.87	130.56
U1 Cont Wall	6.858m	6.143m				38.76	65.28	54.66	37.78	19.87					
U2 Cont Center			192.50		136.50	109.87	61.97	67.19	89.84	104.67	212.83	201.82	163.21	175.12	194.82
U2 Cont Wall	6.858m	6.143m				89.30	41.40	46.61	69.27	84.10					

Receptors

Receptors	Elevation (feet)	Meters above grade	Feet South of C	Feet East Of 9	Feet West of 9
C-4 ECR Intake	265.00	-1.83	0.50	168.58	
C-11 ECR intake	265.00	-1.83	0.50		69.58
C-10 ECR intake	292.00	6.40	3.79		22.58
C-6 ECR intake	286.92	4.85	6.29	92.00	
Normal CR intake	294.25	7.09	68.50	183.75	

	Meters Above Grade to NCR	Meters Below Grade to C-4	Meters Below Grade to C-11	meters above grade to C-10	Meters Above Grade to C-6
U1	7.09	-1.83	-1.83	6.4	4.71
U2	7.09	-1.83	-1.83	6.4	4.71

Lower met tower instrument level - 10.04 m
Upper met tower instrument level - 48.43 m

Containment area above grade - 1516.6 sq. m

1.4) WIND SPEED STATISTICAL DATA

According to Regulatory Guide 1.194 [Reference 3], releases from atmospheric relief valves which release effluent vertically at high velocity without obstruction qualify for a reduction in the atmospheric dispersion factors computed by ARCON96. This reduction by a factor of five is permitted as long as the vertical velocity of the effluent is at least five times the speed of the wind at the elevation of the release.

These ARCON96 runs modeled the six PORVs on top of the main steam valve house as sources. During a release from these PORVs the effluent stream would be propelled at a very high velocity straight up from these PORVs. To apply the factor of 5 reduction to the atmospheric dispersion factors for the PORVs the vertical velocity of the effluent stream has to be 5 times greater than the upper 95th percentile wind speed at the height of the PORVs. Thus, the 95th percentile wind speed at the height of the PORVs has to be computed from the meteorological data and the vertical velocity of the effluent flow has to be computed from the thermodynamics of the release.

The calculation of the 95th percentile wind speed at the height of the PORVs was done using a SAS program. The output from the SAS code is shown in Table 2 and Table 3.

Table 2 shows that the upper 95th percentile wind speed at the 33' level of the meteorological tower is 5.1 meters per second and Table 3 shows that the upper 95th percentile wind speed at the 159' level of the meteorological tower is 7.3 meters per second. The tops of the PORV exhaust stacks are 68' above the ground or an elevation of 339'. If you interpolate between the two 95th percentile wind speeds, the 95th percentile wind speed at the 68' level is 5.72 meters per second.

Table 2
Results of SAS Wind Speed Statistics Code

1997-2001 NORTH ANNA LOW WIND SPEED
FREQUENCY DISTRIBUTION OF WIND SPEED AT 33 FEET

WINDSLO	FREQUENCY	PERCENT	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT
0.1	3	0.0	3	0.0
0.2	24	0.1	27	0.1
0.3	87	0.2	114	0.3
0.4	361	0.8	475	1.1
0.5	560	1.3	1035	2.4
0.6	691	1.6	1726	4.0
0.7	895	2.1	2621	6.1
0.8	1569	3.7	4190	9.8
0.9	1294	3.0	5484	12.8
1	1356	3.2	6840	16.0
1.1	1274	3.0	8114	18.9
1.2	1361	3.2	9475	22.1
1.3	2085	4.9	11560	27.0
1.4	1328	3.1	12888	30.1
1.5	1347	3.1	14235	33.2
1.6	1342	3.1	15577	36.3
1.7	1832	4.3	17409	40.6
1.8	1177	2.7	18586	43.4
1.9	1152	2.7	19738	46.1
2	1174	2.7	20912	48.8
2.1	1658	3.9	22570	52.7
2.2	1037	2.4	23607	55.1
2.3	1047	2.4	24654	57.5
2.4	1022	2.4	25676	59.9
2.5	1412	3.3	27088	63.2
2.6	908	2.1	27996	65.3
2.7	815	1.9	28811	67.2
2.8	848	2.0	29659	69.2
2.9	768	1.8	30427	71.0
3	1107	2.6	31534	73.6
3.1	718	1.7	32252	75.2
3.2	675	1.6	32927	76.8
3.3	622	1.5	33549	78.3
3.4	896	2.1	34445	80.4
3.5	525	1.2	34970	81.6
3.6	558	1.3	35528	82.9
3.7	486	1.1	36014	84.0
3.8	668	1.6	36682	85.6
3.9	414	1.0	37096	86.6
4	383	0.9	37479	87.4
4.1	368	0.9	37847	88.3
4.2	526	1.2	38373	89.5
4.3	331	0.8	38704	90.3
4.4	321	0.7	39025	91.1
4.5	296	0.7	39321	91.7
4.6	396	0.9	39717	92.7
4.7	211	0.5	39928	93.2
4.8	208	0.5	40136	93.6
4.9	207	0.5	40343	94.1
5	215	0.5	40558	94.6
5.1	273	0.6	40831	95.3
5.2	147	0.3	40978	95.6
5.3	158	0.4	41136	96.0
5.4	137	0.3	41273	96.3

Table 2 (continued)
Results of SAS Wind Speed Statistics Code

1997-2001 NORTH ANNA LOW WIND SPEED
FREQUENCY DISTRIBUTION OF WIND SPEED AT 33 FEET

WINDSLO	FREQUENCY	PERCENT	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT
5.5	184	0.4	41457	96.7
5.6	116	0.3	41573	97.0
5.7	91	0.2	41664	97.2
5.8	88	0.2	41752	97.4
5.9	123	0.3	41875	97.7
6	63	0.1	41938	97.8
6.1	79	0.2	42017	98.0
6.2	63	0.1	42080	98.2
6.3	91	0.2	42171	98.4
6.4	48	0.1	42219	98.5
6.5	47	0.1	42266	98.6
6.6	46	0.1	42312	98.7
6.7	35	0.1	42347	98.8
6.8	59	0.1	42406	98.9
6.9	35	0.1	42441	99.0
7	35	0.1	42476	99.1
7.1	25	0.1	42501	99.2
7.2	33	0.1	42534	99.2
7.3	20	0.0	42554	99.3
7.4	19	0.0	42573	99.3
7.5	24	0.1	42597	99.4
7.6	26	0.1	42623	99.4
7.7	9	0.0	42632	99.5
7.8	13	0.0	42645	99.5
7.9	10	0.0	42655	99.5
8	33	0.1	42688	99.6
8.1	12	0.0	42700	99.6
8.2	9	0.0	42709	99.6
8.3	9	0.0	42718	99.7
8.4	19	0.0	42737	99.7
8.5	10	0.0	42747	99.7
8.6	7	0.0	42754	99.8
8.7	8	0.0	42762	99.8
8.8	5	0.0	42767	99.8
8.9	17	0.0	42784	99.8
9	3	0.0	42787	99.8
9.1	5	0.0	42792	99.8
9.2	4	0.0	42796	99.9
9.3	5	0.0	42801	99.9
9.4	5	0.0	42806	99.9
9.5	2	0.0	42808	99.9
9.6	3	0.0	42811	99.9
9.7	5	0.0	42816	99.9
9.8	1	0.0	42817	99.9
9.9	2	0.0	42819	99.9
10	3	0.0	42822	99.9
10.1	5	0.0	42827	99.9
10.2	3	0.0	42830	99.9
10.4	2	0.0	42832	99.9
10.5	4	0.0	42836	99.9
10.6	1	0.0	42837	99.9
10.7	4	0.0	42841	100.0
10.8	1	0.0	42842	100.0
10.9	1	0.0	42843	100.0

Table 2 (continued)
Results of SAS Wind Speed Statistics Code

1997-2001 NORTH ANNA LOW WIND SPEED
FREQUENCY DISTRIBUTION OF WIND SPEED AT 33 FEET

WINDSLO	FREQUENCY	PERCENT	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT
11.1	2	0.0	42845	100.0
11.2	4	0.0	42849	100.0
11.4	2	0.0	42851	100.0
11.5	1	0.0	42852	100.0
11.6	1	0.0	42853	100.0
11.7	1	0.0	42854	100.0
11.8	1	0.0	42855	100.0
11.9	2	0.0	42857	100.0
12	1	0.0	42858	100.0
12.1	1	0.0	42859	100.0
12.2	1	0.0	42860	100.0

Table 3
Results of SAS Wind Speed Statistics Code

1997-2001 NORTH ANNA HIGH WIND SPEED
FREQUENCY DISTRIBUTION OF WIND SPEED AT 159 FEET

WINDSHI	FREQUENCY	PERCENT	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT
0.1	1	0.0	1	0.0
0.2	6	0.0	7	0.0
0.3	5	0.0	12	0.0
0.4	44	0.1	56	0.1
0.5	65	0.2	121	0.3
0.6	142	0.3	263	0.6
0.7	179	0.4	442	1.0
0.8	453	1.1	895	2.1
0.9	386	0.9	1281	3.0
1	452	1.1	1733	4.0
1.1	496	1.2	2229	5.2
1.2	519	1.2	2748	6.4
1.3	866	2.0	3614	8.4
1.4	592	1.4	4206	9.8
1.5	700	1.6	4906	11.4
1.6	675	1.6	5581	13.0
1.7	1073	2.5	6654	15.5
1.8	762	1.8	7416	17.3
1.9	756	1.8	8172	19.1
2	775	1.8	8947	20.9
2.1	1237	2.9	10184	23.8
2.2	808	1.9	10992	25.6
2.3	812	1.9	11804	27.5
2.4	857	2.0	12661	29.5
2.5	1250	2.9	13911	32.5
2.6	822	1.9	14733	34.4
2.7	825	1.9	15558	36.3
2.8	877	2.0	16435	38.3
2.9	862	2.0	17297	40.4
3	1223	2.9	18520	43.2
3.1	851	2.0	19371	45.2
3.2	817	1.9	20188	47.1
3.3	779	1.8	20967	48.9
3.4	1215	2.8	22182	51.8
3.5	804	1.9	22986	53.6
3.6	757	1.8	23743	55.4
3.7	757	1.8	24500	57.2
3.8	1141	2.7	25641	59.8
3.9	722	1.7	26363	61.5
4	735	1.7	27098	63.2
4.1	692	1.6	27790	64.8
4.2	1046	2.4	28836	67.3
4.3	653	1.5	29489	68.8
4.4	674	1.6	30163	70.4
4.5	608	1.4	30771	71.8
4.6	909	2.1	31680	73.9
4.7	559	1.3	32239	75.2
4.8	540	1.3	32779	76.5
4.9	507	1.2	33286	77.7
5	491	1.1	33777	78.8
5.1	704	1.6	34481	80.5
5.2	412	1.0	34893	81.4
5.3	453	1.1	35346	82.5
5.4	350	0.8	35696	83.3

Table 3 (continued)
Results of SAS Wind Speed Statistics Code

1997-2001 NORTH ANNA HIGH WIND SPEED
FREQUENCY DISTRIBUTION OF WIND SPEED AT 159 FEET

WINDSHI	FREQUENCY	PERCENT	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT
5.5	569	1.3	36265	84.6
5.6	354	0.8	36619	85.4
5.7	333	0.8	36952	86.2
5.8	321	0.7	37273	87.0
5.9	468	1.1	37741	88.1
6	313	0.7	38054	88.8
6.1	253	0.6	38307	89.4
6.2	261	0.6	38568	90.0
6.3	338	0.8	38906	90.8
6.4	240	0.6	39146	91.3
6.5	211	0.5	39357	91.8
6.6	194	0.5	39551	92.3
6.7	193	0.5	39744	92.7
6.8	263	0.6	40007	93.3
6.9	162	0.4	40169	93.7
7	140	0.3	40309	94.0
7.1	134	0.3	40443	94.4
7.2	192	0.4	40635	94.8
7.3	120	0.3	40755	95.1
7.4	101	0.2	40856	95.3
7.5	108	0.3	40964	95.6
7.6	142	0.3	41106	95.9
7.7	92	0.2	41198	96.1
7.8	82	0.2	41280	96.3
7.9	88	0.2	41368	96.5
8	140	0.3	41508	96.8
8.1	66	0.2	41574	97.0
8.2	59	0.1	41633	97.1
8.3	58	0.1	41691	97.3
8.4	98	0.2	41789	97.5
8.5	54	0.1	41843	97.6
8.6	52	0.1	41895	97.7
8.7	58	0.1	41953	97.9
8.8	59	0.1	42012	98.0
8.9	73	0.2	42085	98.2
9	41	0.1	42126	98.3
9.1	42	0.1	42168	98.4
9.2	34	0.1	42202	98.5
9.3	60	0.1	42262	98.6
9.4	34	0.1	42296	98.7
9.5	19	0.0	42315	98.7
9.6	32	0.1	42347	98.8
9.7	34	0.1	42381	98.9
9.8	28	0.1	42409	98.9
9.9	25	0.1	42434	99.0
10	31	0.1	42465	99.1
10.1	33	0.1	42498	99.2
10.2	17	0.0	42515	99.2
10.3	24	0.1	42539	99.3
10.4	23	0.1	42562	99.3
10.5	26	0.1	42588	99.4
10.6	12	0.0	42600	99.4
10.7	18	0.0	42618	99.4
10.8	17	0.0	42635	99.5

Table 3 (continued)
Results of SAS Wind Speed Statistics Code

1997-2001 NORTH ANNA HIGH WIND SPEED

FREQUENCY DISTRIBUTION OF WIND SPEED AT 159 FEET

WINDSHI	FREQUENCY	PERCENT	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT
10.9	19	0.0	42654	99.5
11	24	0.1	42678	99.6
11.1	15	0.0	42693	99.6
11.2	15	0.0	42708	99.6
11.3	8	0.0	42716	99.7
11.4	13	0.0	42729	99.7
11.5	9	0.0	42738	99.7
11.6	13	0.0	42751	99.7
11.7	10	0.0	42761	99.8
11.8	8	0.0	42769	99.8
11.9	5	0.0	42774	99.8
12	2	0.0	42776	99.8
12.1	1	0.0	42777	99.8
12.2	8	0.0	42785	99.8
12.3	2	0.0	42787	99.8
12.4	3	0.0	42790	99.8
12.5	7	0.0	42797	99.9
12.6	3	0.0	42800	99.9
12.7	2	0.0	42802	99.9
12.8	5	0.0	42807	99.9
12.9	3	0.0	42810	99.9
13	1	0.0	42811	99.9
13.1	3	0.0	42814	99.9
13.3	1	0.0	42815	99.9
13.4	3	0.0	42818	99.9
13.5	3	0.0	42821	99.9
13.6	5	0.0	42826	99.9
13.7	3	0.0	42829	99.9
13.8	2	0.0	42831	99.9
13.9	2	0.0	42833	99.9
14	3	0.0	42836	99.9
14.1	3	0.0	42839	100.0
14.2	3	0.0	42842	100.0
14.3	3	0.0	42845	100.0
14.4	1	0.0	42846	100.0
14.6	5	0.0	42851	100.0
14.8	1	0.0	42852	100.0
15	3	0.0	42855	100.0
15.2	2	0.0	42857	100.0
15.3	1	0.0	42858	100.0
15.8	1	0.0	42859	100.0
17.4	1	0.0	42860	100.0

2) ASSUMPTIONS

The louvers on the east and west faces of the auxiliary building normally flow 16,000 cfm into the 291'10" level of the auxiliary building from outside air. The only accident for which effluents would be expected to potentially egress out of these louvers is the fuel handling accident. In the fuel handling accident, portions of the gap inventory are postulated to escape the reactor pool and migrate from the containment into the auxiliary building 291'10" level via the personnel access hatch. It would be expected that the louvers closest to the containment (the source of the effluent) would flow an effluent concentration higher than the louvers furthest from the containment. Thus, both louvers on the western face of the auxiliary building were modeled as one louver located halfway between and the two louvers on the eastern face of the auxiliary building were modeled as one louver located halfway between.

When the control room is isolated the locations for air inlet to the control room concrete envelope are the emergency control room fan intakes. The emergency control room intakes designated C11 and C4 in this calculation are at the inlet or supply ducts for the Unit 2 and Unit 1 air conditioning chiller rooms respectively. As can be seen in Sketches No. 3 and 4, the actual emergency fans for C11 and C4 are inside another compartment within the control room envelope and the supply ducts for these fans take suction on the air conditioning chiller rooms. It was assumed that the majority of the air entering into the chiller rooms is provided through the chiller room supply ducts which take suction from the Turbine building / Service building air volume.

When determining the source to receptor distances, the turbine building and service building walls and floors were ignored. By ignoring the turbine/service building walls and floors the distances from the sources to the emergency control room fan receptors would include short runs inside the turbine/service building. The portion of the total source-to-receptor distances that are inside a building are very small compared to the overall source-to-receptor distances. The alternative to ignoring the turbine/service building walls and floors in measuring the source-to-receptor distances is to measure the source-to-receptor distances to the turbine building supply louvers on the southern face of the turbine building. The equilibrium concentration of an effluent inside the turbine building would be approximated with an average atmospheric dispersion factor based on all the openings into the turbine building weighted by their cross sectional area. Therefore, the assumption was made that the small decrease in the atmospheric dispersion factors caused by including short inside distances would be less than the decreases in the atmospheric dispersion factors which would be applied if a cross sectional area weighted average atmospheric dispersion factor were used.

3) MODELING OPTIONS

3.1) RELEASES AND RECEPTORS

The three types of releases that can be specified in ARCON96 are ground, vent and elevated or stack releases. However, Regulatory Guide 1.194 [Reference 3] requires

that no vent releases should be modeled with ARCON96. Therefore, only ground and elevated releases can be modeled with ARCON96. In the case of the North Anna site, none of the sources is at an elevation two and half times the height of the buildings on site. Therefore, there are no sources that qualify for the elevated release option of ARCON96. This means that all the source-receptor pairs were modeled as ground level releases in the ARCON96 runs.

The auxiliary building louvers being modeled as sources were treated as point sources. The only accident in which these louvers could be sources is the fuel handling accident where the portion of the gap inventory which escapes the core pool migrates into the auxiliary building 291'10" level via the personnel access hatch.

The equipment hatches were treated as point sources. The location of the point source was modeled as the center of each equipment hatch.

The containment buildings were modeled as diffuse sources. The distance between the containment buildings and the receptors was determined in accordance with Regulatory Guide 1.194. That is, the minimum distance from the receptor to the containment outer wall was used. This was determined for each receptor individually. The results are presented in Table 1. The use of the diffuse source option of ARCON96 also requires the calculation of sigma-y and sigma-z. Sigma-z and sigma-y were computed in accordance with Regulatory Guide 1.194 by dividing the width and height of the containment building by 6. In this case the containment is a right circular cylinder topped by a hemispherical dome. So the area of the hemisphere (626.08 square meters) was added to the area of the right circular cylinder (890.48 square meters) and the resulting total area was assumed to be a right circular cylinder with the same radius as the lower part of the containment (20.57 meters). This results in a height above grade of 36.86 meters and a width of 41.15 meters. So the sigma-y value is the containment width divided by 6 (6.86) and the sigma-z value is the height of the re-configured containment building divided by 6 (6.14).

For all the ARCON96 runs the cross sectional area of one of the containment buildings above grade was used to model a wake effect. As was discussed in Section 1.2, the area of the containment building entered was 1516.6 square meters.

The remaining sources were all modeled as point sources. These remaining sources were the RWST vents, the PORV exhaust stacks, the vent stacks and the primary ventilation blowout panels.

3.2) PORV STEAM FLOW

According to Regulatory Guide 1.194, atmospheric dispersion factors computed by ARCON96 for atmospheric relief valves can be reduced by a factor of 5 if two conditions are met. First, the flow from the valve must be vertical and must not be impeded. Second, the vertical velocity of the flow must be at least 5 times the 95th percentile wind speed at the elevation of the release. In the case of the PORVs for North Anna the

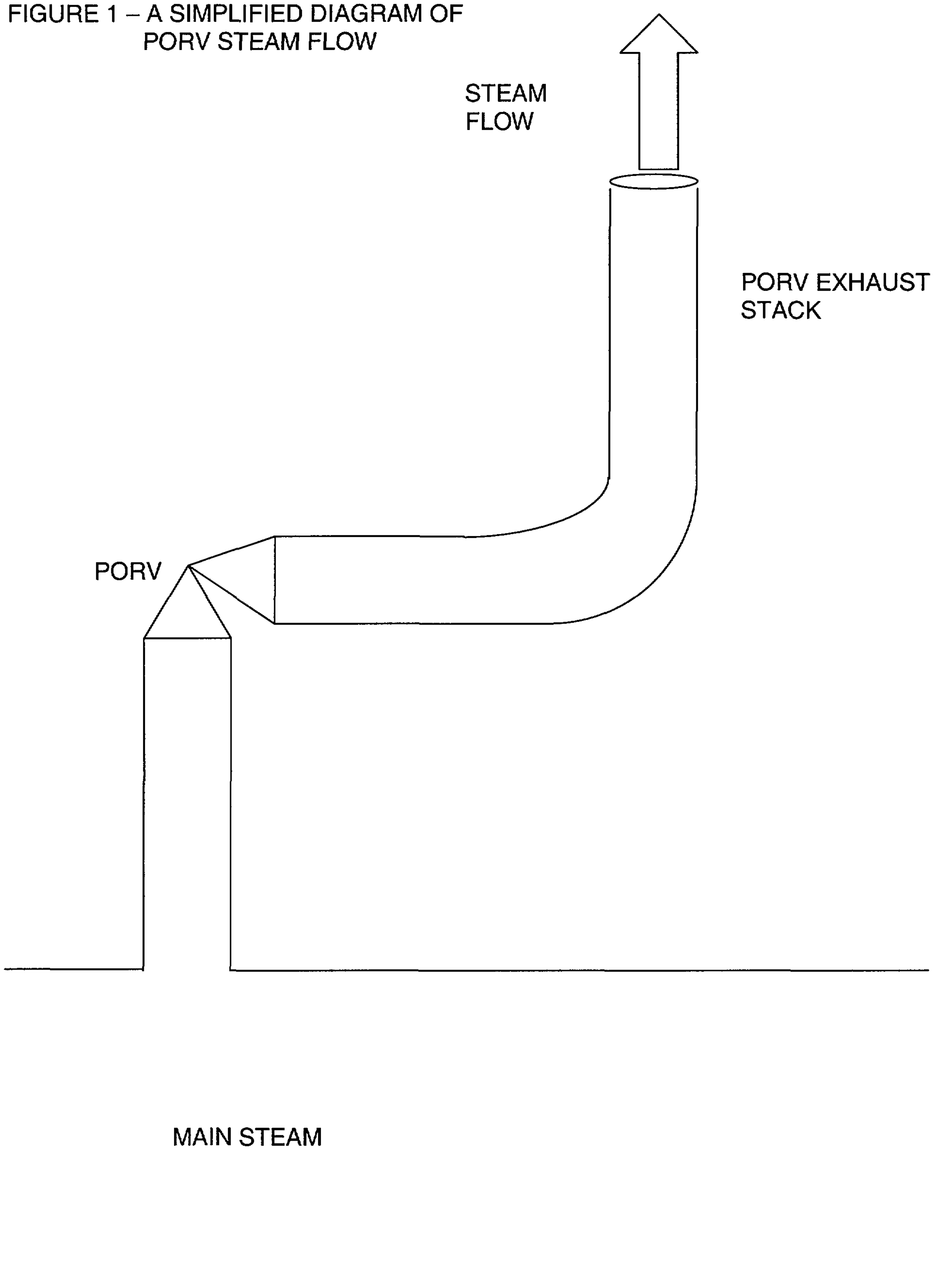
steam flow from these valves is vertical and unimpeded. See Figure 1 for a simplified arrangement of the steam flow path through a PORV. The vertical velocity of the steam exhausting these valves is conservatively estimated in the discussion below for the steam generator tube rupture (SGTR) accident.

The highest density of steam is at saturated conditions (versus superheated steam). The steam exiting the PORV exhaust stack was assumed to be saturated steam since this would yield a lower vertical velocity than treating the steam as superheated. The vertical velocity of the steam exiting the PORV exhaust stack is limited to being no higher than the choked flow velocity. The following background information on choked flow is from the ASME Steam Tables for Industrial Use [Reference no. 2]:

> "An important industrial problem is the flow of fluid through nozzles, with reduction of pressure across the nozzle. Often, these flows can be considered to be isentropic. For a given upstream pressure, decreasing the downstream pressure increases the flow rate until a certain point; after that point (sometimes known as the "critical pressure," not to be confused with the critical pressure associated with the end of the vapor-liquid saturation curve), further decreases in downstream pressure do not produce more flow. At this state, the flow is said to be "choked"; the velocity of the flow at that point is called the *choking velocity*.
>
> The determination of choked flow involves finding a condition where the velocity divided by the specific volume (a ratio proportional to the mass flow rate) is maximized. The velocity used in this maximization is determined by assuming that the change in enthalpy in isentropic expansion from stagnant upstream conditions to the choked state is converted to kinetic energy of the fluid. For expansions taking place without any phase change, the choking velocity is simply equal to the speed of sound at the choked conditions."

According to the ASME Steam Tables for Industrial Use [Reference no. 2], the choked flow velocity of saturated steam at atmospheric pressure is 1547 feet per second. The lowest mass flow out of the affected steam generator PORV – 84.9 pounds mass per second – occurs at 30 minutes after the accident just before operator action isolates the steam generator. The pressure of the steam as it leaves the PORV exhaust stack is unknown. Saturated steam at atmospheric pressure has a density of 0.037 pounds per cubic foot. The exhaust stack for the PORV is a 10" diameter vertical pipe. The cross sectional area of a 10" diameter pipe is 0.545 square feet. If the steam at the end of the PORV exhaust stack reached equilibrium with atmospheric pressure (14.7 pounds per square inch) it would have a density of 0.037 pounds per cubic foot. At a density of 0.037 pounds per cubic foot, the steam would have to have a vertical velocity of about 4200 feet per second to flow 84.9 pounds per second through an area of 0.545 square feet. This far exceeds the choked flow velocity of saturated steam at atmospheric pressure – 1547 feet per second. Therefore, the steam at the end of the PORV exhaust stack must be at a pressure higher than atmospheric pressure so that it has a density high enough to meet the mass flow rate requirement. However, the pressure of the steam at the end of the PORV exhaust stack cannot be at an arbitrarily high value.

FIGURE 1 – A SIMPLIFIED DIAGRAM OF PORV STEAM FLOW



The steam leaving the PORV exhaust stack will tend to come into equilibrium with atmospheric pressure as quickly as possible. This means that the steam pressure at the end of the PORV exhaust stack will be at the lowest possible pressure for which the steam velocity does not exceed the choked flow velocity. The steam at the end of PORV exhaust stack must be at choked flow conditions and at a pressure higher than atmospheric pressure.

By using the ASME Steam Tables for Industrial Use [Reference no. 2] in an iterative fashion, it was determined that saturated steam at a pressure of approximately 41 pounds per square inch flows 84.9 pounds of steam per second through a cross sectional area of 0.545 square feet at it's choked flow velocity of about 1590 feet per second.

This is the lowest saturated steam pressure that would flow 84.9 pounds of steam per second at choked flow velocity through a cross sectional area of 0.545 square feet.

During an SGTR, the unaffected steam generators flow for 8 hours and are not isolated at 30 minutes like the affected steam generator. Furthermore, the unaffected PORVs are not modeled as being stuck open and would open only when their setpoint pressure is reached. The setpoint pressure is adjustable and would be reduced by the operators to maximize the steam flow and hence the cool down rate during the post-accident recovery effort. The calculation of the mass flow rates out of the unaffected steam generators is broken into two time intervals. For the first 30 minutes the mass flow is calculated at specific times up to 30 minutes. For the first 30 minutes the lowest mass flow out of one of the unaffected steam generators is 34.6 pounds per second. Using the ASME Steam Tables for Industrial Use [Reference no. 2] iteratively, it was found that the lowest pressure which would allow a mass flow rate of 34.6 pounds of saturated steam per second through a cross sectional area of 0.545 square feet at choked flow velocity is approximately 16.1 pounds per square inch. At this pressure the choked flow velocity of the saturated steam is about 1550 feet per second.

The second time interval for the calculation of the mass flow of the unaffected steam generators is from 30 minutes to 8 hours. For this second time interval an integrated mass flow over the 7.5 hours was calculated. There are no mass flow rates at specific times. The average mass flow rate was computed by dividing the integrated mass flow over 7.5 hours by the number of seconds in 7.5 hours. The lowest integrated mass flow between the loss-of-offsite power and no loss-of-offsite power scenarios over the 7.5 hours is 892,000 pounds mass. This flow occurred over 27,000 seconds to yield an average mass flow rate of 16.52 pounds mass per second per steam generator. Again, this mass flow rate does not reflect the actual mass flow rates since the unaffected PORVs are only going to flow when their pressure setpoint is reached. This means that they will open and shut frequently over the 7.5 hours and that the actual mass flow rate when they are open will be much higher than the time average mass flow rate. Based on the ASME Steam Tables for Industrial Use, a mass flow rate of 16.52 pounds of saturated steam per second through a cross sectional area of 0.545 square feet is not at choked flow conditions at atmospheric pressure. The density of saturated steam at

atmospheric pressure is 0.037 pounds per cubic foot. At this density, the vertical velocity required to pass 16.52 pounds per second through a 0.545 square foot area is 812 feet per second. This is approximately 248 meters per second.

For the SGTR accident the minimum vertical velocity of the steam exiting a PORV exhaust stack is about 812 feet per second or about 248 meters per second. The 95th percentile wind speed at the elevation of the top of the PORVs exhaust stack is 5.72 meters per second. Five time's 5.72 meters per second is 28.6 meters per second. Thus, the minimum vertical velocity of the steam at the point where it exits the PORVs exhaust stack is far in excess of the threshold needed to qualify for the factor of 5 reduction in ARCON96 calculated atmospheric dispersion factors.

For the lock rotor accident (LRA) the core / decay heat driving the steam flows out of the steam generators is identical to the core / decay heat driving the releases for the SGTR. The primary difference between the SGTR and LRA is that after 30 minutes only two steam generators are exhausting steam in the SGTR and in the LRA all three steam generators flow steam to the environment for 8 hours. This means that the steam flow rates in the LRA will be about 2/3 of the steam flow rates in the SGTR. However, the minimum PORV exhaust velocity for the SGTR is nearly 10 times the 28.6 meters per second threshold needed to qualify for the reduction in the atmospheric dispersion factors. Thus, the PORV steam flows for the LRA will have vertical velocities high enough to allow the use of the reduced PORV atmospheric dispersion factors in the LRA dose analysis.

For the main steam line break (MSLB), the information available about the steam flow out of the PORVs was not sufficient to determine the vertical velocity of the steam. Therefore, the reduction factor of 5 was not applied to the PORV atmospheric dispersion factors used to model the MSLB.

4) RESULTS

The results of the ARCON96 runs are shown in Table 4. The Units of the atmospheric dispersion factors in Table 4 and also in Table 5 are (Curies / cubic meter)/ (Curies / second) or (seconds / cubic meter) after simplification. The results of the PORV runs in Table 4 do not include the reduction factor of 5 for vertical exhaust velocity. The values of the atmospheric dispersion factors for the Vent Stack B to C-6 control room intake are not shown in Table 4. This is because the C-6 control room intake is less than 10 meters from the base of Vent Stack B. According to Nuclear Regulatory Commission guidance on the use of ARCON96, these atmospheric dispersion factor values cannot be used because the distance from the source to the receptor is less than 10 meters. Because of this restriction, C-6 will be procedurally precluded from functioning as an emergency control room intake. This will be accomplished with emergency procedures that will stipulate that the fan associated with the C-6 intake can only be operated in re-circulation mode. In re-circulation mode the C-6 fan takes suction on the air inside the control room envelope and does not draw on the outside air.

Table 4 – Results of ARCON96 Runs

LOCATION Point Sources		X/Q to C-4	X/Q To C-11	X/Q to C-10	X/Q to C-6	X/Q to norm intake
Unit 1 PORV A	0-2 hours	2.94E-03	1.05E-03	1.53E-03	3.35E-03	7.51E-03
	2-8 hours	2.18E-03	6.62E-04	9.78E-04	2.06E-03	6.41E-03
	8-24 hours	8.34E-04	2.33E-04	3.41E-04	7.51E-04	2.51E-03
	24-96 hours	5.88E-04	1.91E-04	2.73E-04	5.62E-04	1.76E-03
	96-720 hours	4.36E-04	1.57E-04	2.21E-04	3.96E-04	1.31E-03
Unit 1 PORV C	0-2 hours	3.11E-03	9.64E-04	1.39E-03	3.15E-03	8.93E-03
	2-8 hours	2.14E-03	6.19E-04	8.98E-04	2.02E-03	7.29E-03
	8-24 hours	8.26E-04	2.18E-04	3.10E-04	7.12E-04	2.93E-03
	24-96 hours	5.66E-04	1.74E-04	2.55E-04	5.49E-04	2.01E-03
	96-720 hours	4.29E-04	1.47E-04	2.06E-04	3.87E-04	1.51E-03
Unit 1 PORV B	0-2 hours	3.14E-03	8.93E-04	1.27E-03	2.95E-03	1.04E-02
	2-8 hours	2.08E-03	5.66E-04	8.16E-04	1.93E-03	8.20E-03
	8-24 hours	7.87E-04	2.03E-04	2.85E-04	6.44E-04	3.23E-03
	24-96 hours	5.59E-04	1.60E-04	2.31E-04	5.19E-04	2.25E-03
	96-720 hours	4.36E-04	1.36E-04	1.90E-04	3.67E-04	1.68E-03
Unit 2 PORV C	0-2 hours	5.49E-04	2.42E-03	1.86E-03	8.30E-04	5.66E-04
	2-8 hours	4.68E-04	1.94E-03	1.57E-03	7.35E-04	4.71E-04
	8-24 hours	1.84E-04	7.73E-04	6.24E-04	2.87E-04	1.84E-04
	24-96 hours	1.35E-04	5.36E-04	4.37E-04	2.08E-04	1.37E-04
	96-720 hours	1.02E-04	4.04E-04	3.26E-04	1.56E-04	1.06E-04
Unit 2 PORV B	0-2 hours	5.75E-04	2.59E-03	2.06E-03	9.08E-04	6.10E-04
	2-8 hours	5.02E-04	2.05E-03	1.72E-03	7.95E-04	5.08E-04
	8-24 hours	1.95E-04	8.12E-04	6.85E-04	3.09E-04	1.96E-04
	24-96 hours	1.44E-04	5.64E-04	4.77E-04	2.26E-04	1.48E-04
	96-720 hours	1.08E-04	4.22E-04	3.56E-04	1.68E-04	1.13E-04
Unit 2 PORV A	0-2 hours	6.23E-04	2.71E-03	2.23E-03	9.88E-04	6.37E-04
	2-8 hours	5.27E-04	2.12E-03	1.87E-03	8.48E-04	5.47E-04
	8-24 hours	2.09E-04	8.28E-04	7.45E-04	3.35E-04	2.08E-04
	24-96 hours	1.53E-04	5.88E-04	5.14E-04	2.41E-04	1.58E-04
	96-720 hours	1.15E-04	4.33E-04	3.85E-04	1.81E-04	1.19E-04
U1 RWST vent	0-2 hours	2.18E-03	5.50E-04	7.19E-04	1.51E-03	6.36E-03
	2-8 hours	1.42E-03	3.46E-04	4.52E-04	9.67E-04	4.16E-03
	8-24 hours	4.89E-04	1.29E-04	1.66E-04	3.42E-04	1.39E-03
	24-96 hours	3.84E-04	9.82E-05	1.28E-04	2.67E-04	1.09E-03
	96-720 hours	2.72E-04	8.43E-05	1.09E-04	2.08E-04	8.13E-04
U2 RWST vent	0-2 hours	3.63E-04	1.28E-03	9.85E-04	5.23E-04	3.73E-04
	2-8 hours	3.22E-04	1.06E-03	8.39E-04	4.56E-04	3.21E-04
	8-24 hours	1.26E-04	4.26E-04	3.34E-04	1.78E-04	1.23E-04
	24-96 hours	9.24E-05	3.01E-04	2.37E-04	1.32E-04	9.31E-05
	96-720 hours	6.96E-05	2.25E-04	1.77E-04	9.84E-05	7.14E-05
Vent Stack A	0-2 hours	2.64E-03	2.06E-03	3.75E-03	5.69E-03	2.24E-03
	2-8 hours	2.20E-03	1.46E-03	2.60E-03	4.60E-03	1.60E-03
	8-24 hours	8.21E-04	5.77E-04	1.03E-03	1.74E-03	6.02E-04
	24-96 hours	6.46E-04	3.92E-04	7.03E-04	1.35E-03	4.45E-04
	96-720 hours	4.73E-04	3.11E-04	5.52E-04	9.96E-04	3.56E-04
Vent Stack B	0-2 hours	3.21E-03	1.72E-03	2.91E-03	-	2.67E-03
	2-8 hours	2.65E-03	1.22E-03	2.13E-03	-	1.88E-03
	8-24 hours	9.96E-04	4.80E-04	8.25E-04	-	7.17E-04
	24-96 hours	7.77E-04	3.26E-04	5.66E-04	-	5.11E-04
	96-720 hours	5.70E-04	2.59E-04	4.47E-04	-	4.05E-04

Table 4 – Results of ARCON96 Runs (continued)

LOCATION Point Sources		X/Q To C-4	X/Q to C-11	X/Q to C-10	X/Q to C-6	X/Q to norm intake
U1 blowout panel	0-2 hours	1.06E-03	1.40E-03	1.70E-03	1.59E-03	1.47E-03
	2-8 hours	8.78E-04	8.99E-04	1.05E-03	1.18E-03	1.24E-03
	8-24 hours	3.54E-04	3.13E-04	3.94E-04	4.69E-04	4.95E-04
	24-96 hours	2.44E-04	2.46E-04	2.89E-04	3.30E-04	3.53E-04
	96-720 hours	1.83E-04	1.73E-04	2.06E-04	2.45E-04	2.63E-04
U2 blowout panel	0-2 hours	8.90E-04	1.90E-03	2.12E-03	1.44E-03	1.08E-03
	2-8 hours	7.59E-04	1.15E-03	1.38E-03	1.18E-03	9.37E-04
	8-24 hours	3.03E-04	4.36E-04	5.29E-04	4.76E-04	3.67E-04
	24-96 hours	2.12E-04	3.19E-04	3.76E-04	3.26E-04	2.67E-04
	96-720 hours	1.58E-04	2.28E-04	2.93E-04	2.44E-04	2.01E-04
E Aux Bld louver	0-2 hours	1.96E-03	1.92E-03	2.86E-03	3.54E-03	2.78E-03
	2-8 hours	1.58E-03	1.23E-03	1.82E-03	2.53E-03	2.30E-03
	8-24 hours	6.44E-04	4.37E-04	6.37E-04	1.01E-03	9.16E-04
	24-96 hours	4.39E-04	3.40E-04	5.07E-04	6.95E-04	6.59E-04
	96-720 hours	3.29E-04	2.62E-04	3.55E-04	5.17E-04	4.97E-04
W Aux Bld louver	0-2 hours	9.59E-04	3.38E-03	3.66E-03	1.73E-03	1.05E-03
	2-8 hours	8.05E-04	2.05E-03	2.46E-03	1.42E-03	8.74E-04
	8-24 hours	3.29E-04	7.96E-04	9.87E-04	5.78E-04	3.50E-04
	24-96 hours	2.29E-04	5.77E-04	6.80E-04	3.98E-04	2.52E-04
	96-720 hours	1.72E-04	4.12E-04	5.02E-04	2.99E-04	1.90E-04
U1 Equipment Hatch	0-2 hours	8.15E-04	5.34E-04	6.37E-04	8.35E-04	1.43E-03
	2-8 hours	5.34E-04	3.47E-04	4.08E-04	5.06E-04	9.54E-04
	8-24 hours	2.10E-04	1.22E-04	1.43E-04	1.96E-04	3.83E-04
	24-96 hours	1.47E-04	9.43E-05	1.14E-04	1.42E-04	2.63E-04
	96-720 hours	1.14E-04	6.90E-05	8.03E-05	1.01E-04	1.95E-04
U2 Equipment Hatch	0-2 hours	3.50E-04	8.47E-04	7.38E-04	4.77E-04	3.84E-04
	2-8 hours	2.98E-04	6.41E-04	5.92E-04	3.98E-04	3.28E-04
	8-24 hours	1.22E-04	2.66E-04	2.45E-04	1.62E-04	1.33E-04
	24-96 hours	8.61E-05	1.84E-04	1.67E-04	1.14E-04	9.54E-05
	96-720 hours	6.48E-05	1.36E-04	1.25E-04	8.53E-05	7.20E-05
Diffuse Sources						
U1 Containment	0-2 hours	1.23E-03	6.26E-04	8.01E-04	1.25E-03	2.61E-03
	2-8 hours	8.87E-04	4.23E-04	5.20E-04	7.68E-04	1.83E-03
	8-24 hours	3.49E-04	1.52E-04	1.83E-04	2.87E-04	7.72E-04
	24-96 hours	2.46E-04	1.17E-04	1.44E-04	2.14E-04	5.69E-04
	96-720 hours	1.87E-04	8.79E-05	1.05E-04	1.57E-04	4.35E-04
U2 Containment	0-2 hours	4.38E-04	1.15E-03	1.02E-03	6.16E-04	4.79E-04
	2-8 hours	3.82E-04	9.02E-04	8.34E-04	5.40E-04	4.14E-04
	8-24 hours	1.69E-04	3.57E-04	3.51E-04	2.41E-04	1.83E-04
	24-96 hours	1.16E-04	2.55E-04	2.49E-04	1.64E-04	1.27E-04
	96-720 hours	8.81E-05	1.91E-04	1.90E-04	1.25E-04	9.72E-05

For each accident analysis the largest applicable atmospheric dispersion factors were selected to calculate the limiting dose consequences. For most of the sources, there was one source-receptor geometry that produced the largest values for each of the five time intervals. For the MSLB, LRA and SGTR accident analyses the largest PORV to normal control room intake set of atmospheric dispersion factors was used to calculate the limiting doses. For the SGTR and LRA accidents the atmospheric dispersion factors were divided by 5 because of the high vertical steam exhaust velocity. For the LOCA containment leakage dose contribution calculation, a composite set of atmospheric dispersion factors was used. This composite set of atmospheric dispersion factors consisted of the largest atmospheric dispersion factor for each of the five time intervals chosen from all the possible source-receptor combinations with either the Unit 1 or Unit 2 containment as the source and either the C-4, C-11 or C-10 emergency control room intake as the receptor. The C-6 emergency control room intake was excluded as a receptor for the LOCA since the control room will be isolated and the fan associated with the C-6 intake would be aligned in re-circulation mode by procedure. Similarly, for the LOCA ECCS leakage dose calculation, a composite set of atmospheric dispersion factors was used which consisted of the largest atmospheric dispersion factor for each of the five time intervals chosen from all possible source-receptor combinations with either vent stack A or B as the source and either the C-4, C-11 or C-10 emergency control room intakes as the receptor. The atmospheric dispersion factors used to calculate the limiting dose consequences are shown in Table 5 below.

TABLE 5 – CONTROL ROOM ATMOSPHERIC DISPERSION FACTORS USED TO CALCULATE THE LIMITING DOSES

ACCIDENT	SOURCE	RECEPTOR POINT	ATMOSPHERIC DISPERSION FACTOR (sec/m^3)		Source of X/Q Values Selected
LOCA	Vent Stack	Emergency Control Room Intake	3.75E-3	0-2 hr	Vent A to C-10
			2.65E-3	2-8 hr	Vent B to C-4
			1.03E-3	8-24 hr	Vent A to C-10
			7.77E-4	24-96 hr	Vent B to C-4
			5.70E-4	96-720 hr	Vent B to C-4
	RWST Vent	Emergency Control Room Intake	2.18E-3	0-2 hr	U1 RWST to C-4
			1.42E-3	2-8 hr	U1 RWST to C-4
			4.89E-4	8-24 hr	U1 RWST to C-4
			3.84E-4	24-96 hr	U1 RWST to C-4
			2.72E-4	96-720 hr	U1 RWST to C-4
	Containment	Emergency Control Room Intake	1.23E-3	0-2 hr	U1 Cont to C-4
			9.02E-4	2-8 hr	U2 Cont to C-11
			3.57E-4	8-24 hr	U2 Cont to C-11
			2.55E-4	24-96 hr	U2 Cont to C-11
			1.91E-4	96-720 hr	U2 Cont to C-11
FHA	E Aux Building Louver (Personnel Access Hatch)	Normal Control Room Intake	2.78E-3	0-2 hr	E AuxLvr to NCR
			2.30E-3	2-8 hr	E AuxLvr to NCR
			9.16E-4	8-24 hr	E AuxLvr to NCR
			6.59E-4	24-96 hr	E AuxLvr to NCR
			4.97E-4	96-720 hr	E AuxLvr to NCR
SGTR (divided by 5)	PORV	Normal Control Room Intake	2.08E-3	0-2 hr	U1 PorvB to NCR
			1.64E-3	2-8 hr	U1 PorvB to NCR
			6.46E-4	8-24 hr	U1 PorvB to NCR
			4.50E-4	24-96 hr	U1 PorvB to NCR
			3.36E-4	96-720 hr	U1 PorvB to NCR
MSLB	PORV	Normal Control Room Intake	1.04E-2	0-2 hr	U1 PorvB to NCR
			8.20E-3	2-8 hr	U1 PorvB to NCR
			3.23E-3	8-24 hr	U1 PorvB to NCR
			2.25E-3	24-96 hr	U1 PorvB to NCR
			1.68E-3	96-720 hr	U1 PorvB to NCR
LRA (divided by 5)	PORV	Normal Control Room Intake	2.08E-3	0-2 hr	U1 PorvB to NCR
			1.64E-3	2-8 hr	U1 PorvB to NCR
			6.46E-4	8-24 hr	U1 PorvB to NCR
			4.50E-4	24-96 hr	U1 PorvB to NCR
			3.36E-4	96-720 hr	U1 PorvB to NCR

REFERENCES

1. Computer Code ARCON96, "Atmospheric Relative Concentrations in Building Wakes", NUREG/CR-6331, PNNL-10521, Rev.1, May 1997.

2. "ASME Steam Tables for Industrial Use", The American Society of Mechanical Engineers Press, 2000, based on the IAPWS Industrial Formulation 1997 for the Thermodynamic Properties of Water and Steam, CRTD-Vol.58.

3. REGULATORY GUIDE 1.194, "Atmospheric Relative Concentrations for Control Room Radiological Habitability Assessments at Nuclear Power Plants", U.S. Nuclear Regulatory Commission, Office of Nuclear Regulatory Research, June 2003.

4. Letter from W.R. Matthews to the NRC, Serial No. 00-123B, "Virginia Electric and Power Company Surry Power Station Units 1 and 2 Request for Additional Information Alternate Source Term – Proposed Technical Specification Change", November 20, 2000.

5. North Anna UFSAR Section 2.3.3.2 "Upgraded Onsite Meteorological Measurements Program for Station Operation", Sub-section 2.3.3.2.1 "General Program Description".

6. System Design Basis Document for Auxiliary Building Ventilation System North Anna Power Station, SDBD-NAPS-HA, Rev. 1, October 31, 2002.

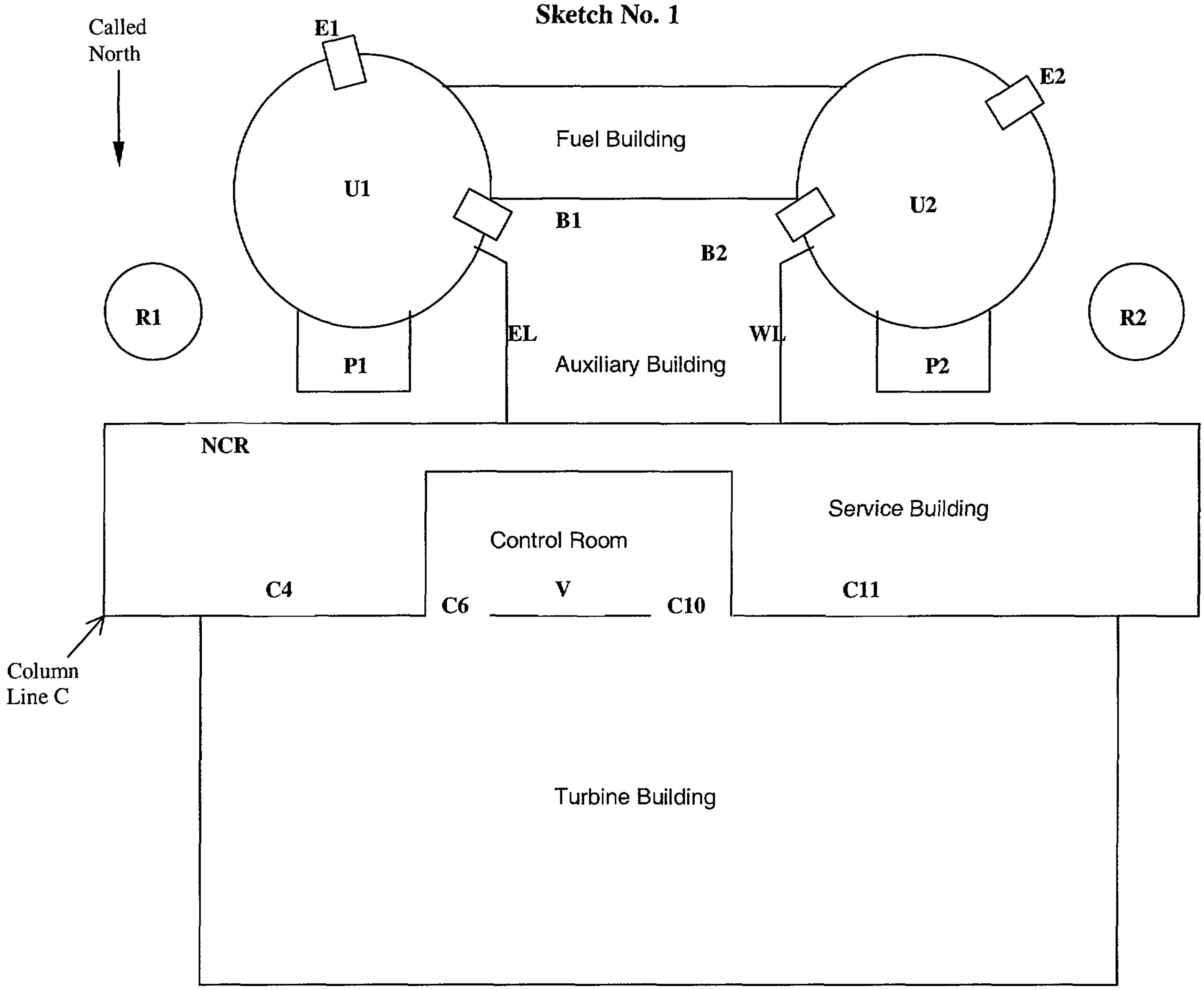
Attachment 2

**Virginia Electric and Power Company
North Anna Power Station Units 1 and 2
Proposed Technical Specification Changes
Implementation of Alternate Source Term
Request for Additional Information**

Sketches

**North Anna Power Station
Units 1 and 2
Virginia Electric and Power Company
(Dominion)**

Sketch No. 1



Legend

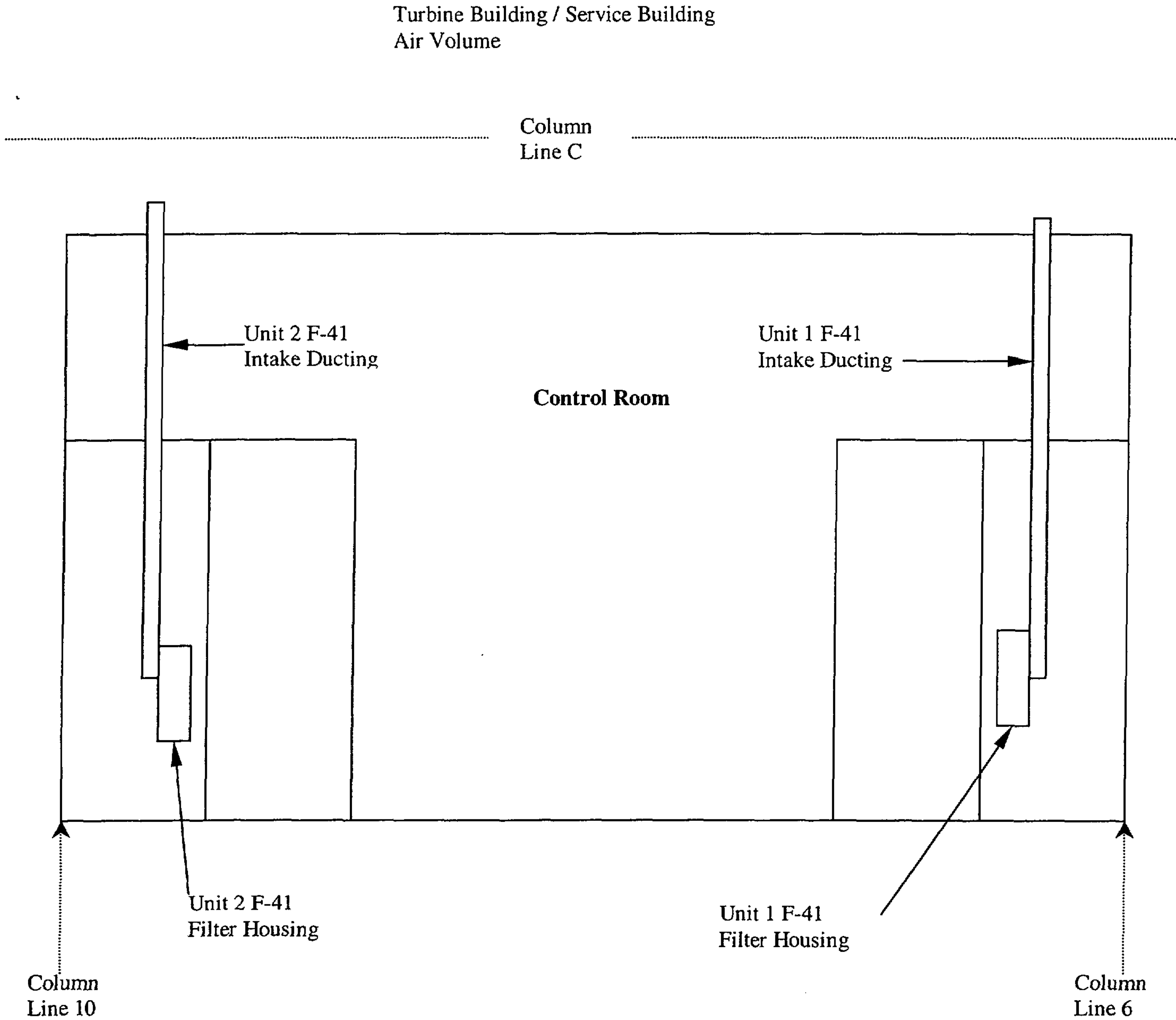
Source

U1	Unit 1 containment (diffuse)
U2	Unit 2 containment (diffuse)
V	vent stacks A and B (only 22' apart)
R1	Unit 1 RWST
R2	Unit 2 RWST
E1	Unit 1 equipment hatch
E2	Unit 2 equipment hatch
P1	Unit 1 PORVs
P2	Unit 2 PORVs
B1	Unit 1 primary ventilation blowout panel
B2	Unit 2 primary ventilation blowout panel
EL	auxiliary building east louver
WL	auxiliary building west louver

Receptor

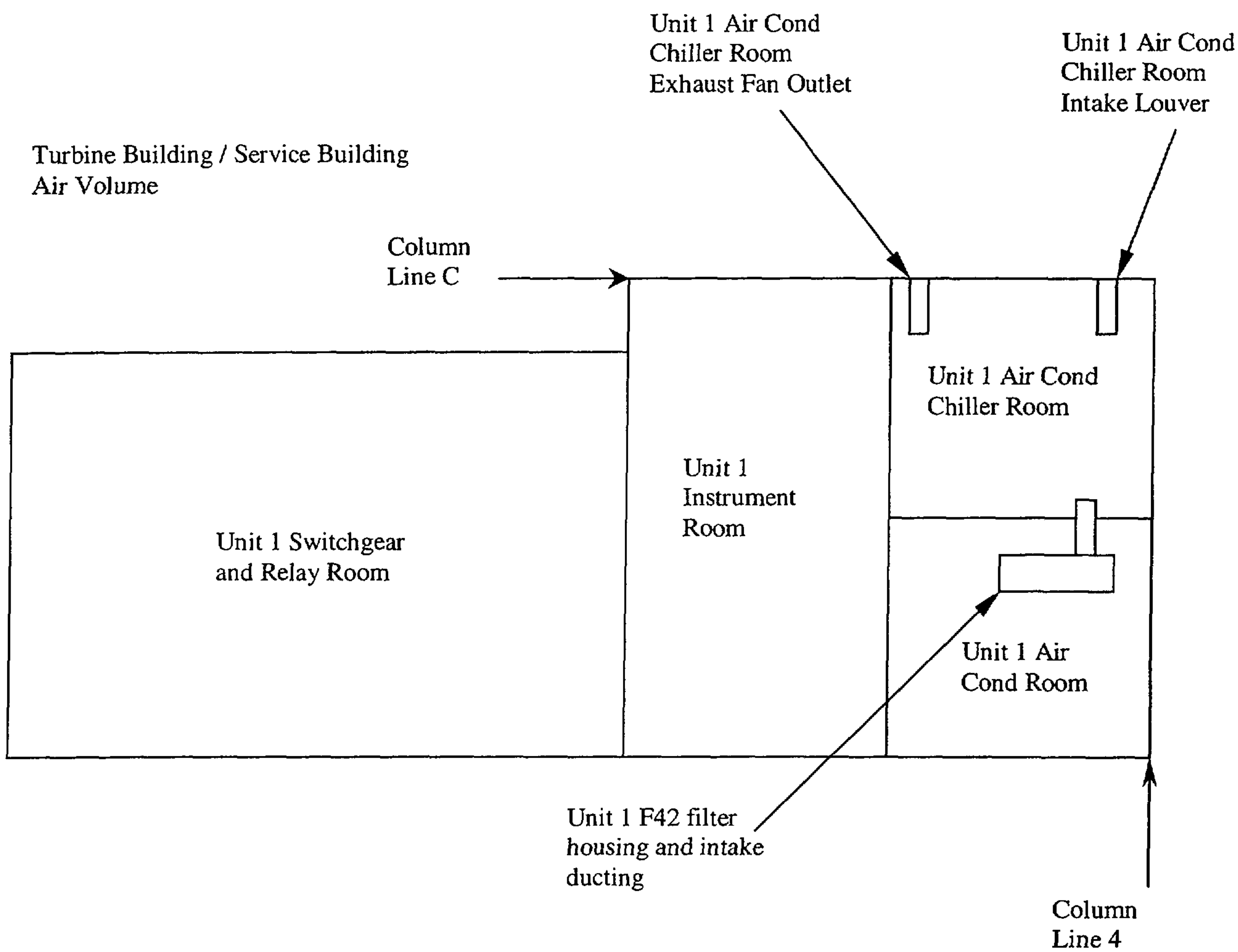
NCR	normal control room (CR) intake
C10	emergency CR intake by column lines C and 10
C11	emergency CR intake by column lines C and 11
C6	emergency CR intake by column lines C and 6
C4	emergency CR intake by column lines C and 4

Sketch No. 2



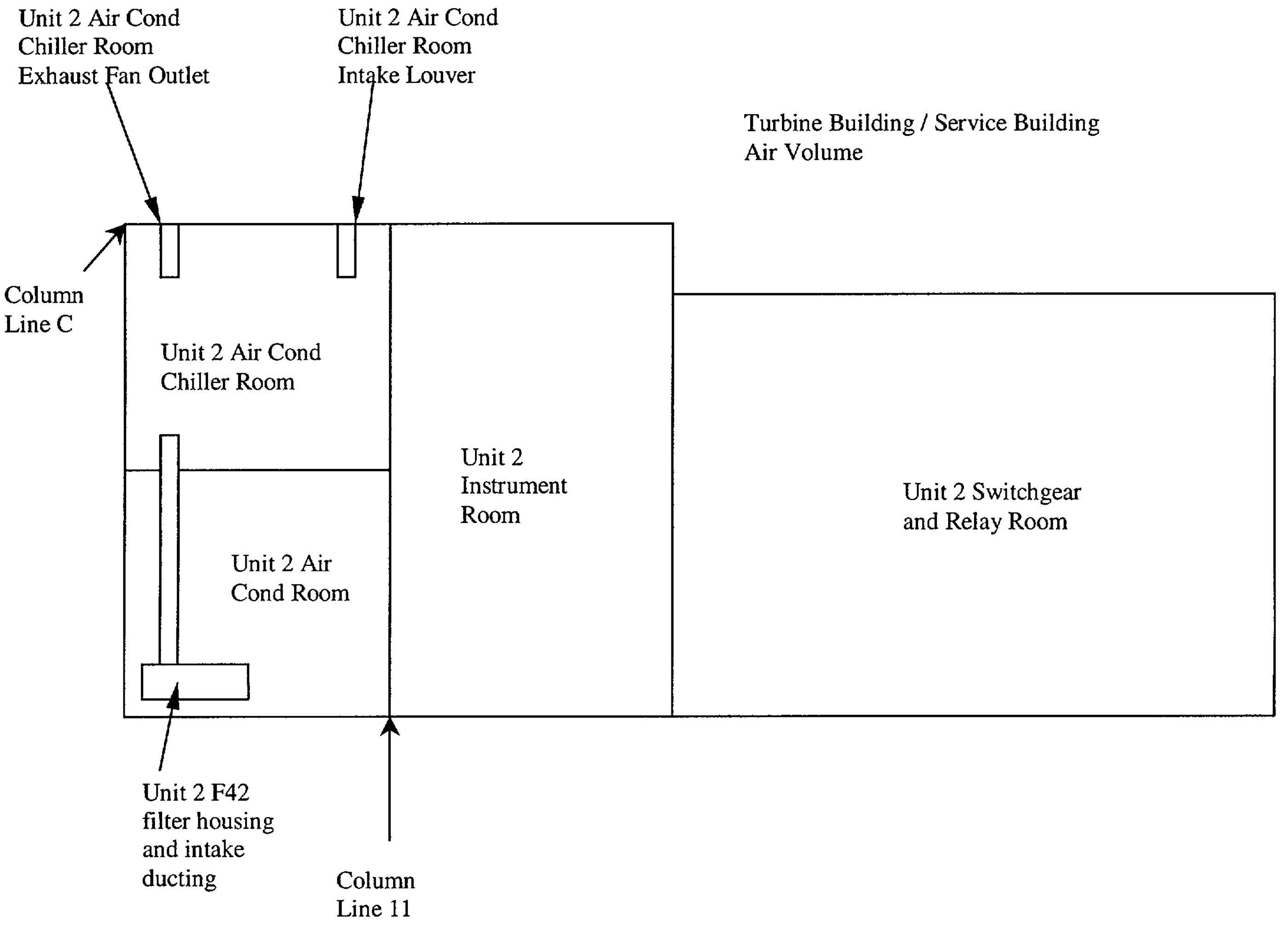
Turbine Building / Service Building
Air Volume
Column
Line C
Unit 2 F-41
Intake Ducting
Unit 1 F-41
Intake Ducting
Control Room
Unit 2 F-41
Filter Housing
Unit 1 F-41
Filter Housing
Column
Line 10
Column
Line 6

Sketch No. 3



Unit 1 Air Cond
Chiller Room
Exhaust Fan Outlet
Unit 1 Air Cond
Chiller Room
Intake Louver
Turbine Building / Service Building
Air Volume
Column
Line C
Unit 1 Air Cond
Chiller Room
Unit 1
Instrument
Room
Unit 1 Switchgear
and Relay Room
Unit 1 Air
Cond Room
Unit 1 F42 filter
housing and intake
ducting
Column
Line 4

Sketch No. 4


Unit 2 Air Cond
Chiller Room
Exhaust Fan Outlet
Unit 2 Air Cond
Chiller Room
Intake Louver
Turbine Building / Service Building
Air Volume
Column
Line C
Unit 2 Air Cond
Chiller Room
Unit 2
Instrument
Room
Unit 2 Switchgear
and Relay Room
Unit 2 Air
Cond Room
Unit 2 F42
filter housing
and intake
ducting
Column
Line 11