2.7.5 Short-Term Diffusion Estimates

Short-term diffusion estimates are developed in support of evaluating postulated accidental releases of radioactive material from the Clinch River (CR) Small Modular Reactor (SMR) Project. The consequence of a design basis accident in terms of personnel exposure is a function of the atmospheric dispersion conditions around the Clinch River Nuclear (CRN) Site. Atmospheric dispersion consists of two components: 1) atmospheric transport, or the downwind movement of effluents through the atmosphere; and 2) atmospheric diffusion, or the spread of effluents away from the plume centerline. Atmospheric dispersion conditions are represented by relative air concentration (*X*/Q) values. This subsection describes the development of conservative short-term atmospheric diffusion estimates for receptors located on the Exclusion Area Boundary (EAB) and the outer boundary of the Low Population Zone (LPZ).

2.7.5.1 Purpose and Background

According to Title 10 of the Code of Federal Regulations (10 CFR) 100.11, the limiting design basis fission product release and site meteorological conditions should be used to derive an exclusion area, low population zone, and a population center distance. To demonstrate compliance with 10 CFR Part 100, it is necessary to consider doses for various time periods immediately following the onset of a postulated accident at the EAB and for the duration of exposure for the LPZ.

As a result, estimates of atmospheric dispersion, expressed as *X*/Q, were calculated for accidental releases from the CRN Site for specified time intervals at the EAB and the LPZ, as required under 10 CFR 100 and 10 CFR 50.

2.7.5.2 Calculation Methodology and Assumptions

The atmospheric dispersion calculations were performed using the PAVAN computer program, NUREG/CR-2858, *PAVAN: An Atmospheric-Dispersion Program for Evaluating Design-Basis Accidental Releases of Radioactive Materials from Nuclear Power Stations,* which was developed and is used by the U.S. Nuclear Regulatory Commission (NRC). The PAVAN program implements the guidance provided in NRC Regulatory Guide (RG) 1.145, *Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants*. The PAVAN model calculates *X/Q* values based on the theory that material released to the atmosphere are normally distributed (Gaussian) about the plume centerline. Therefore, a straight-line trajectory is modeled between the point of release and distances for which *X*/Q values are calculated in accordance with NUREG/CR-2858 and NRC RG 1.145.

NRC RG 4.7, *General Site Suitability Criteria for Nuclear Power Stations,* states that for site approval, each applicant should collect at least one year of meteorological information that is representative of the site conditions for calculating radiation doses resulting from the release of fission products as a consequence of a postulated accident. NRC RG 1.23 recommends using meteorological data from a consecutive 24-month period. Two full years (June 1, 2011 through

May 31, 2013) of CRN Site-specific meteorological tower data were used as input to the PAVAN code. Meteorological data were input as joint frequency distributions (JFDs), in percent frequency, of wind direction and wind speed by atmospheric stability class. Stability classes were based on the classification system given in Table 1 of NRC RG 1.23, and are listed in Table 2.7.5-1 herein.

Validated data from the lower meteorological tower level (10-meters [m]) of the CRN Site's meteorological monitoring program were used to prepare JFDs for the PAVAN modeling. Of the 17,544 hours (hr) of possible data, 17,380 hr had valid data combinations of wind speed, wind direction, and stability class. The resulting data recovery was 99.07 percent, well above the 90 percent data recovery required by NRC RG 1.23. Calms hours were distributed into the first wind speed category in the JFDs, based on this PAVAN input option. Thirteen wind speed categories were defined in the JFDs and used in the modeling. The wind speed categories used in the PAVAN analysis are shown in the JFD tables; the JFD tables for each stability class are given in Tables 2.7.5-2 through 2.7.5-8. For the two years of data modeled, there were no hourly recordings of wind speed greater than 18.0 miles per hour (mph; 8.0 miles per second [m/s]). The percent occurrence of hours for each wind direction is shown in Table 2.7.5-9, and the percent occurrence of hours in each stability class is given in Table 2.7.5-10.

Using the JFDs, PAVAN provides the *X*/Q values as a function of direction for various time periods at the EAB and the LPZ. According to NRC RG 4.7, an applicant is required by Subpart A of 10 CFR Part 100 (100.11) and Subpart B of 10 CFR Part 100 (100.20) to designate an exclusion area and to have authority to determine all activities within that area, including removal of personnel and property. The exclusion area is required to be of such a size that an individual assumed to be located at any point on its boundary would not receive a radiation dose in excess of 25 rem total effective dose equivalent (TEDE) over any 2-hr period following a postulated fission product release. The required exclusion area size involves consideration of the atmospheric dispersion characteristics of the site as well as plant design.

NRC RG 1.145 requires that, for each of the 16 compass sectors, the distance to the EAB should be the minimum distance between the effluent release point and the EAB within a 45-degree sector centered on the compass direction of interest. For conservatism and simplicity, the effluent release point is evaluated as a circular effluent release boundary (ERB) that encloses potential release points from the nuclear island as shown in Figure 2.7.5-1. A circular analytical EAB is established 1100 ft (335 m) from the ERB. For X/Q modelling (Table 2.7.5-11), the analytical EAB is used as a bounding representative distance to the EAB.

To account for multiple units on site, nuclear islands are positioned at multiple locations within the power block area with associated ERBs and EABs as shown in Figure 2.7.5-2 (note that although the nuclear islands for vendors 1 and 4 are depicted in the figure, the nuclear islands, associated ERBs, and analytical EABs for vendors 1, 2, 3, and 4 fit within the EAB ellipse). The analytical EABs can be encompassed by an ellipse fixed completely within the CRN Property boundary, i.e. the actual EAB (Figure 2.7.5-2), which demonstrates that dispersion factor computations are conservative.

The site center point is determined as the centerline midpoint of the EAB ellipse (Figure 2.7.5-2). The ellipse has a short axis of 0.326 mi (524 m) from the site center point and long axis of 0.535 mi (864 m) from the center point.

According to NRC RG 4.7, an applicant is also required by 10 CFR Part 100 to designate an area immediately beyond the exclusion area as a LPZ. The size of the LPZ must be such that the distance to the nearest boundary of a densely populated center containing more than about 25,000 residents (population center distance) must be at least one and one-third times the distance from the reactor to the outer boundary of the LPZ. The boundary of the population center should be determined upon consideration of population distribution, not political boundaries. In addition, the LPZ must be of such a size that an individual located on its outer radius for the course of the postulated accident (assumed to be 30 days) would not receive a radiation dose in excess of 25 rem TEDE.

The LPZ is defined by a circular area with a radius of 1-mile (1609 m), centered on the site as shown in Figure 2.7.5-3.

Other plant specific data considered for PAVAN includes minimum building cross-sectional area, building height, and meteorological tower height at which the wind speed was measured (NUREG/CR-2858). These are listed in Table 2.7.5-12. The building height and minimum cross-sectional area are used in the determination of building wake effects. Building cross-sectional area is defined in NRC RG 1.145 as the smallest vertical-plane cross-sectional area of the containment structure, in square meters (sq m). NRC RG 1.111, *Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors,* identifies the tallest adjacent building, either up- or downwind from the release point(s), as appropriate for use. Because the dose calculations for the EAB and LPZ are both located beyond the building wake's significant zone of influence, the height and cross-sectional area have less effect on *X/Q* values. Therefore, for conservatism, no building wake credit was used in the PAVAN model (e.g., the building height and cross-sectional area were both set to zero in the model).

Based on NRC RG 1.145, a ground release includes release points that are effectively less than two and one-half times the height of adjacent solid structures. Compared to an elevated release, a groundlevel release usually results in higher groundlevel concentrations at downwind receptors due to the plume centerline being at groundlevel. Because the groundlevel release scenario provides a bounding case, elevated releases are not considered in this application.

The meteorological tower height used in PAVAN is the height above ground level at which the wind speed was measured (NUREG/CR-2858). For a groundlevel release, the lower wind speed and direction measurement height of 9.78 m is used (Table 2.7.5-12).

Because a groundlevel release scenario provides the most conservative *X/Q* values at the EAB, a groundlevel release was used in the modeling. As detailed in NRC RG 1.145, Section 1.3.1, for release modes that are effectively lower than two and one-half times the height of adjacent

solid structures (ground-release mode), two sets of meteorological conditions are treated differently in order to consider the effects of building wake mixing and plume meander (NUREG/CR-2858).

During neutral (D) or stable (E, F, or G) atmospheric stability conditions when the wind speed is less than 6 m/s, horizontal plume meander is considered. The PAVAN model (NUREG/CR-2858) calculates the relative concentration (*X*/Q) values through the selective use of the following set of equations for groundlevel relative concentrations at the plume centerline.

$$\frac{X}{Q} = \frac{1}{\bar{U}_{10}\left(\pi\sigma_y\sigma_z + \frac{A}{2}\right)} \quad \text{Equation 1}$$

$$\frac{X}{Q} = \frac{1}{\bar{U}_{10}(3\pi\sigma_y\sigma_z)} \quad \text{Equation 2}$$

$$\frac{X}{Q} = \frac{1}{(\bar{U}_{10}\pi\sum_y\sigma_z)} \quad \text{Equation 3}$$

Where:

- *X*/Q = centerline groundlevel relative concentration (sec/m^3).
- σ_y = lateral plume spread as a function of atmospheric stability and distance (m).
- σ_z = vertical plume spread as a function of atmospheric stability and distance (m).
- A = minimum building vertical-plane cross-sectional area (m^2).
- $\bar{U}_{10}$ = average wind speed at 10 m above plant grade (m/s).
- Σ_y = lateral plume spread with plume meander and building wake effects (m), as a function of atmospheric stability, wind speed, and distance.

The PAVAN model calculates *X*/Q values using Equations 1, 2, and 3. The model compares the values from Equations 1 and 2, and the higher value is selected. This value is then compared with the value from Equation 3, and the lower value of these two is selected as the appropriate *X*/Q value.

During unstable (A, B, or C) atmospheric stability and / or 10-m level wind speeds of 6 m/s or more, plume meander (Equation 3) is not considered. The higher value calculated from Equation 1 or 2 is used as the appropriate *X*/Q value.

NRC RG 1.145 requires that the *X/Q* values at the EAB and LPZ boundaries be calculated from the sector-independent, 50-percent overall site *X/Q*.

2.7.5.3 Results and Conclusions

The 50 percent *X/Q* results for the SMR release zone, based on the two years of CRN Site-specific meteorological data (June 2011 through May 2013), are given in Table 2.7.5-13.

Table 2.7.5-1
Classification of Atmospheric Stability

Stability Classification	Pasquill Categories	Temperature change with height (°C/100m)
Extremely unstable	A	$\Delta T \leq -1.9$
Moderately unstable	B	$-1.9 < \Delta T \leq -1.7$
Slightly unstable	C	$-1.7 < \Delta T \leq -1.5$
Neutral	D	$-1.5 < \Delta T \leq -0.5$
Slightly stable	E	$-0.5 < \Delta T \leq 1.5$
Moderately stable	F	$1.5 < \Delta T \leq 4.0$
Extremely stable	G	$\Delta T > 4.0$

Note: Based on Table 1 in NRC RG 1.23.

Table 2.7.5-2
Joint Frequency Distribution (Hours) of Wind Speed and Direction by Atmospheric Stability Class – Stability Class A
June 1, 2011 to May 31, 2013

WIND DIRECTION	WIND SPEED (MPH)														
	CALM	≤0.50	≤1.10	≤1.70	≤2.20	≤2.80	≤3.40	≤4.50	≤6.70	≤8.90	≤11.20	≤13.40	≤18.00	>18.00	TOTAL
N	0	0	0	1	0	3	3	9	16	2	0	0	0	0	34
NNE	0	0	0	1	1	4	10	23	23	0	0	0	0	0	62
NE	0	0	0	0	3	5	4	22	37	5	0	0	0	0	76
ENE	0	0	0	2	1	2	3	13	19	9	0	0	0	0	49
E	0	0	0	0	1	0	0	7	4	0	0	0	0	0	12
ESE	0	0	0	0	3	0	0	3	3	0	0	0	0	0	9
SE	0	0	0	0	0	2	0	1	0	0	0	0	0	0	3
SSE	0	0	0	1	0	0	1	0	2	1	0	0	0	0	5
S	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2
SSW	0	0	0	1	1	0	0	1	0	0	0	0	0	0	3
SW	0	0	0	0	1	1	1	1	1	1	0	0	0	0	6
WSW	0	0	0	1	1	3	0	8	9	9	2	0	0	0	33
W	0	0	0	0	0	1	1	4	14	6	4	4	1	0	35
WNW	0	0	0	0	0	0	0	1	9	18	5	3	1	0	37
NW	0	0	0	1	2	0	1	6	21	48	23	4	0	0	106
NNW	0	0	0	1	0	1	0	5	9	4	0	0	0	0	20
Subtotal	0	0	0	9	16	22	24	104	167	103	34	11	2	0	492

Notes:

1. JFDs based on 17380 total hours of valid wind direction-wind speed-stability observations.
2. Stability based on ΔT between 8.44 and 59.22 meters (ΔT ≤ -1.9°C/100 M).
3. Total hours of valid wind direction and wind speed in Stability Class A = 492.
4. Wind speed, direction measured at 9.78 meters; mean wind speed = 5.73 mph.
5. Totals and subtotals are obtained from unrounded numbers.

Table 2.7.5-3
Joint Frequency Distribution (Hours) of Wind Speed and Direction by Atmospheric Stability Class – Stability Class B
June 1, 2011 to May 31, 2013

WIND DIRECTION	WIND SPEED (MPH)														
	CALM	≤0.50	≤1.10	≤1.70	≤2.20	≤2.80	≤3.40	≤4.50	≤6.70	≤8.90	≤11.20	≤13.40	≤18.00	>18.00	TOTAL
N	0	0	0	0	1	3	7	9	9	0	0	0	0	0	29
NNE	0	0	0	0	0	1	12	20	5	0	0	0	0	0	38
NE	0	0	0	0	1	8	12	24	36	3	0	0	0	0	84
ENE	0	0	0	0	0	5	7	10	16	1	0	0	0	0	39
E	0	0	0	0	0	0	5	12	8	0	0	0	0	0	25
ESE	0	0	0	0	0	1	1	6	1	0	0	0	0	0	9
SE	0	0	0	0	0	1	2	1	0	0	0	0	0	0	4
SSE	0	0	0	0	0	0	2	7	5	0	0	0	0	0	14
S	0	0	0	0	0	0	3	5	10	0	1	2	0	0	21
SSW	0	0	0	0	0	0	1	2	4	1	0	0	0	0	8
SW	0	0	0	0	0	0	2	11	13	4	0	0	0	0	30
WSW	0	0	0	0	0	1	8	23	41	18	5	1	0	0	97
W	0	0	0	0	0	1	3	18	14	2	1	2	1	0	42
WNW	0	0	0	0	0	0	4	7	20	17	6	2	1	0	57
NW	0	0	0	0	0	0	5	12	26	31	10	1	0	0	85
NNW	0	0	0	0	0	0	4	10	11	3	0	0	0	0	28
Subtotal	0	0	0	0	2	21	78	177	219	80	23	8	2	0	610

Notes:

1. JFDs based on 17380 total hours of valid wind direction-wind speed-stability observations.
2. Stability based on ΔT between 8.44 and 59.22 meters (-1.9 < ΔT ≤ -1.7°C/100 M).
3. Total hours of valid wind direction and wind speed in Stability Class B = 610.
4. Wind speed, direction measured at 9.78 meters; mean wind speed = 5.17 mph.
5. Totals and subtotals are obtained from unrounded numbers.

Table 2.7.5-4
Joint Frequency Distribution (Hours) of Wind Speed and Direction by Atmospheric Stability Class – Stability Class C
June 1, 2011 to May 31, 2013

WIND DIRECTION	WIND SPEED (MPH)														
	CALM	≤0.50	≤1.10	≤1.70	≤2.20	≤2.80	≤3.40	≤4.50	≤6.70	≤8.90	≤11.20	≤13.40	≤18.00	>18.00	TOTAL
N	0	0	0	0	3	7	15	6	13	0	0	0	0	0	44
NNE	0	0	0	1	0	13	12	21	3	0	0	0	0	0	50
NE	0	0	0	1	6	13	23	26	10	1	0	0	0	0	80
ENE	0	0	0	1	5	8	12	16	9	1	0	0	0	0	52
E	0	0	0	1	2	4	11	12	5	0	0	0	0	0	35
ESE	0	0	0	0	3	6	6	9	3	0	0	0	0	0	27
SE	0	0	0	0	2	8	2	6	5	0	0	0	0	0	23
SSE	0	0	0	0	1	3	10	4	2	1	0	2	0	0	23
S	0	0	0	0	1	4	4	13	15	4	2	1	0	0	44
SSW	0	0	0	0	1	6	9	12	12	3	0	0	0	0	43
SW	0	0	0	0	1	10	14	26	43	12	0	0	0	0	106
WSW	0	0	0	0	0	9	33	60	70	13	5	1	0	0	191
W	0	0	0	0	2	4	27	34	35	7	6	3	0	0	118
WNW	0	0	0	0	1	4	10	21	26	15	4	2	0	0	83
NW	0	0	0	0	0	1	11	14	38	20	7	0	0	0	91
NNW	0	0	0	0	2	4	4	9	8	4	3	0	0	0	34
Subtotal	0	0	0	4	30	104	203	289	297	81	27	9	0	0	1044

Notes:
1. JFDs based on 17380 total hours of valid wind direction-wind speed-stability observations.
2. Stability based on ΔT between 8.44 and 59.22 meters (-1.7 ≤ ΔT ≤ -1.5°C/100 M).
3. Total hours of valid wind direction and wind speed in Stability Class C = 1044.
4. Wind speed, direction measured at 9.78 meters; mean wind speed = 4.54 mph.
5. Totals and subtotals are obtained from unrounded numbers.

Table 2.7.5-5
Joint Frequency Distribution (Hours) of Wind Speed and Direction by Atmospheric Stability Class – Stability Class D
June 1, 2011 to May 31, 2013

WIND DIRECTION	WIND SPEED (MPH)														
	CALM	≤0.50	≤1.10	≤1.70	≤2.20	≤2.80	≤3.40	≤4.50	≤6.70	≤8.90	≤11.20	≤13.40	≤18.00	>18.00	TOTAL
N	0	1	14	57	33	27	17	22	21	2	0	0	0	0	194
NNE	0	0	6	53	49	39	25	42	11	0	0	0	0	0	225
NE	0	0	16	41	55	65	77	82	71	3	1	0	0	0	411
ENE	0	0	12	42	38	59	54	71	68	8	1	1	0	0	354
E	0	1	8	19	42	33	29	21	10	1	0	0	0	0	164
ESE	0	0	6	19	15	15	13	12	5	0	0	0	0	0	85
SE	0	0	6	10	17	21	19	10	1	1	0	1	0	0	86
SSE	0	0	4	9	12	25	11	12	10	4	7	1	0	0	95
S	0	0	3	13	23	37	44	51	56	30	25	7	3	0	292
SSW	0	1	8	16	23	39	41	44	49	6	0	0	0	0	227
SW	0	0	2	14	38	59	75	123	116	29	4	0	0	0	460
WSW	0	0	0	16	54	95	93	219	254	83	29	8	0	0	851
W	0	0	13	34	48	79	87	132	99	46	31	20	1	0	590
WNW	0	0	10	43	42	72	49	98	140	79	36	9	4	0	582
NW	0	0	19	48	43	58	48	85	139	75	35	6	0	0	556
NNW	0	0	16	41	30	33	30	27	35	11	4	0	0	0	227
Subtotal	0	3	143	475	562	756	712	1051	1085	378	173	53	8	0	5399

Notes:
1. JFDs based on 17380 total hours of valid wind direction-wind speed-stability observations.
2. Stability based on ΔT between 8.44 and 59.22 meters (-1.5 < ΔT ≤ -0.5°C/100 M).
3. Total hours of valid wind direction and wind speed in Stability Class D = 5399.
4. Wind speed, direction measured at 9.78 meters; mean wind speed = 4.01 mph.
5. Totals and subtotals are obtained from unrounded numbers.

Table 2.7.5-6
Joint Frequency Distribution (Hours) of Wind Speed and Direction by Atmospheric Stability Class – Stability Class E
June 1, 2011 to May 31, 2013

WIND DIRECTION	WIND SPEED (MPH)														
	CALM	≤0.50	≤1.10	≤1.70	≤2.20	≤2.80	≤3.40	≤4.50	≤6.70	≤8.90	≤11.20	≤13.40	≤18.00	>18.00	TOTAL
N	0	0	86	73	27	14	9	3	3	0	0	0	0	0	215
NNE	0	3	84	58	29	14	4	3	1	0	0	0	0	0	196
NE	0	3	79	63	30	27	16	24	7	1	1	0	0	0	251
ENE	0	2	57	60	34	39	22	17	12	1	0	0	0	0	244
E	0	2	67	55	29	23	15	7	7	0	0	0	0	0	205
ESE	0	5	54	58	18	10	9	3	2	0	0	0	0	0	159
SE	0	1	46	68	16	12	5	2	2	1	0	0	0	0	153
SSE	0	0	43	32	21	19	11	11	12	4	2	0	0	0	155
S	0	2	22	43	34	24	21	12	8	7	0	0	0	0	173
SSW	0	0	18	41	28	17	17	16	5	1	1	0	0	0	144
SW	0	1	26	44	30	35	33	16	12	5	0	0	0	0	202
WSW	0	2	39	52	44	51	54	49	39	12	3	0	0	0	345
W	0	2	54	63	65	65	47	59	50	8	1	1	1	0	416
WNW	0	3	90	118	60	48	35	54	68	29	5	2	0	0	512
NW	0	3	111	96	36	40	29	46	57	20	4	0	0	0	442
NNW	0	2	82	66	21	24	11	16	4	0	0	0	0	0	226
SUBTOTAL	0	31	958	990	522	462	338	338	289	89	17	3	1	0	4038

Notes:

1. JFDs based on 17380 total hours of valid wind direction-wind speed-stability observations.
2. Stability based on ΔT between 8.44 and 59.22 meters (-0.5 < ΔT ≤ 1.5°C/100 M).
3. Total hours of valid wind direction and wind speed in Stability Class E = 4038.
4. Wind speed, direction measured at 9.78 meters; mean wind speed = 2.32 mph.
5. Totals and subtotals are obtained from unrounded numbers.

Table 2.7.5-7
Joint Frequency Distribution (Hours) of Wind Speed and Direction by Atmospheric Stability Class – Stability Class F
June 1, 2011 to May 31, 2013

WIND DIRECTION	WIND SPEED (MPH)														
	CALM	≤0.50	≤1.10	≤1.70	≤2.20	≤2.80	≤3.40	≤4.50	≤6.70	≤8.90	≤11.20	≤13.40	≤18.00	>18.00	TOTAL
N	0	14	90	12	1	1	1	0	0	0	0	0	0	0	119
NNE	0	14	83	23	2	3	2	1	0	0	0	0	0	0	128
NE	0	10	97	24	2	2	0	0	0	0	0	0	0	0	135
ENE	0	17	138	29	14	5	2	0	1	0	0	0	0	0	206
E	0	14	187	74	15	2	2	0	1	0	0	0	0	0	295
ESE	0	15	185	87	22	2	4	0	0	0	0	0	0	0	315
SE	0	14	153	76	15	3	1	1	0	0	0	0	0	0	263
SSE	0	5	79	32	8	4	1	1	0	0	0	0	0	0	130
S	0	11	49	29	6	5	3	2	1	0	0	0	0	0	106
SSW	0	7	32	23	11	0	2	0	2	0	0	0	0	0	77
SW	0	2	38	26	12	4	2	3	0	0	0	0	0	0	87
WSW	0	5	42	24	10	3	8	3	1	0	0	0	0	0	96
W	0	1	91	39	15	17	4	5	3	0	0	0	0	0	175
WNW	0	10	131	101	33	9	4	6	4	2	0	0	0	0	300
NW	0	16	156	59	15	13	3	2	1	0	0	0	0	0	265
NNW	0	14	99	25	3	2	0	0	0	0	0	0	0	0	143
SUBTOTAL	0	169	1650	683	184	75	39	24	14	2	0	0	0	0	2840

Notes:

1. JFDs based on 17380 total hours of valid wind direction-wind speed-stability observations.
2. Stability based on ΔT between 8.44 and 59.22 meters ($1.5 < \Delta T \leq 4.0$°C/100 M).
3. Total hours of valid wind direction and wind speed in Stability Class F = 2840.
4. Wind speed, direction measured at 9.78 meters; mean wind speed = 1.16 mph.
5. Totals and subtotals are obtained from unrounded numbers.

Table 2.7.5-8
Joint Frequency Distribution (Hours) of Wind Speed and Direction by Atmospheric Stability Class – Stability Class G
June 1, 2011 to May 31, 2013

WIND DIRECTION	WIND SPEED (MPH)														
	CALM	≤0.50	≤1.10	≤1.70	≤2.20	≤2.80	≤3.40	≤4.50	≤6.70	≤8.90	≤11.20	≤13.40	≤18.00	>18.00	TOTAL
N	0	10	34	3	2	0	0	0	0	0	0	0	0	0	49
NNE	0	5	27	1	0	0	0	1	0	0	0	0	0	0	34
NE	0	7	31	5	2	1	1	0	0	0	0	0	0	0	47
ENE	0	10	103	15	5	2	0	1	0	0	0	0	0	0	136
E	0	27	226	53	13	0	0	0	1	0	0	0	0	0	320
ESE	0	32	372	164	14	0	0	1	0	0	0	0	0	0	583
SE	0	21	334	139	7	1	2	1	0	0	0	0	0	0	505
SSE	0	17	209	41	4	1	0	0	0	0	0	0	0	0	272
S	0	15	101	21	5	0	0	0	0	0	0	0	0	0	142
SSW	0	5	73	19	5	1	0	1	0	1	0	0	0	0	105
SW	0	9	46	13	2	1	0	1	0	0	0	0	0	0	72
WSW	0	7	94	21	5	0	1	0	0	0	0	0	0	0	128
W	0	8	104	56	2	4	2	1	1	0	0	0	0	0	178
WNW	0	15	120	65	16	5	2	2	0	0	0	0	0	0	225
NW	0	9	73	19	1	1	0	0	0	0	0	0	0	0	103
NNW	0	12	40	6	0	0	0	0	0	0	0	0	0	0	58
Subtotal	0	209	1987	641	83	17	8	9	2	1	0	0	0	0	2957

Notes:
1. JFDs based on 17380 total hours of valid wind direction-wind speed-stability observations.
2. Stability based on ΔT between 8.44 and 59.22 meters (ΔT > 4.0°C/100 M).
3. Total hours of valid wind direction and wind speed in Stability Class G = 2957.
4. Wind speed, direction measured at 9.78 meters; mean wind speed = 1.00 mph.
5. Totals and subtotals are obtained from unrounded numbers.

Table 2.7.5-9
Percent Occurrence for Each Wind Direction
June 1, 2011 to May 31, 2013

Direction	Percent
N	3.936
NNE	4.217
NE	6.237
ENE	6.214
E	6.076
ESE	6.830
SE	5.967
SSE	3.993
S	4.488
SSW	3.493
SW	5.541
WSW	10.017
W	8.941
WNW	10.334
NW	9.482
NNW	4.235

Table 2.7.5-10
Percent in Each Stability Class
June 1, 2011 to May 31, 2013

2011 to 2013 Data	Class A	Class B	Class C	Class D	Class E	Class F	Class G
Hours	2.831	3.510	6.007	31.064	23.234	16.341	17.014

Note: Stability class is based on ΔT between 10 and 60 meters; wind speed and direction measured at 10 meters.

Table 2.7.5-11
Distances for the EAB and LPZ at the 16 Wind Direction Sectors

Wind Direction Sector	Distance from ERB to Analytical EAB		LPZ Distance	
	(feet)	(meters)	(miles)	(meters)
S	1100	335	1	1609
SSW	1100	335	1	1609
SW	1100	335	1	1609
WSW	1100	335	1	1609
W	1100	335	1	1609
WNW	1100	335	1	1609
NW	1100	335	1	1609
NNW	1100	335	1	1609
N	1100	335	1	1609
NNE	1100	335	1	1609
NE	1100	335	1	1609
ENE	1100	335	1	1609
E	1100	335	1	1609
ESE	1100	335	1	1609
SE	1100	335	1	1609
SSE	1100	335	1	1609

Notes:
1. The Effluent Release Boundary (ERB) includes the nuclear island, which consists of the reactor service building and all associated buildings.
2. The LPZ was determined as an area with a 1-mi (1609 m) radius from the CRN Site center point.

Table 2.7.5-12
PAVAN Modeling Inputs

PAVAN Model Input Variable	Value
Number of Wind Speed Categories (NVEL)	13
Type of Release	Ground
Building Min. Cross Sectional Area (A)	0.0 m^2
Containment Building Height (D)	0.0 m
Release Height (HS)	10.0 m
Wind Sensor Height (TOWERH)	9.78 m
Conversion Correction Factor (UCOR)	150
Lower-T Sensor Height	8.44 m
Upper-T Sensor Height	59.22 m
Distance from Effluent Release Boundary to Analytical EAB	335 m
Distance to LPZ	1609 m

Note: According to NUREG/CR-2858, for a groundlevel release, a release point height (HS) of 10 m is to be used.

Table 2.7.5-13
CRN Site SMR 50 Percent Probability Level *X*/Q Values

50% Probability Level *X*/Q Values (sec/m^3) at the EAB and LPZ					
Location	**0-2 Hours**	**0-8 Hours**	**8-24 Hours**	**1-4 Days**	**4-30 Days**
Release Zone to EAB	5.58E-04	NA	NA	NA	NA
LPZ	NA	4.27E-05	3.80E-05	2.94E-05	2.04E-05

Notes:
1. A circular, analytical EAB was defined at a fixed distance from the effluent release boundary. The distance used from the effluent release boundary to the analytical EAB was 1100 ft (335 m).
2. The LPZ was determined as an area with a 1-mi (1609-m) radius, centered on the site.

NA = Not Applicable

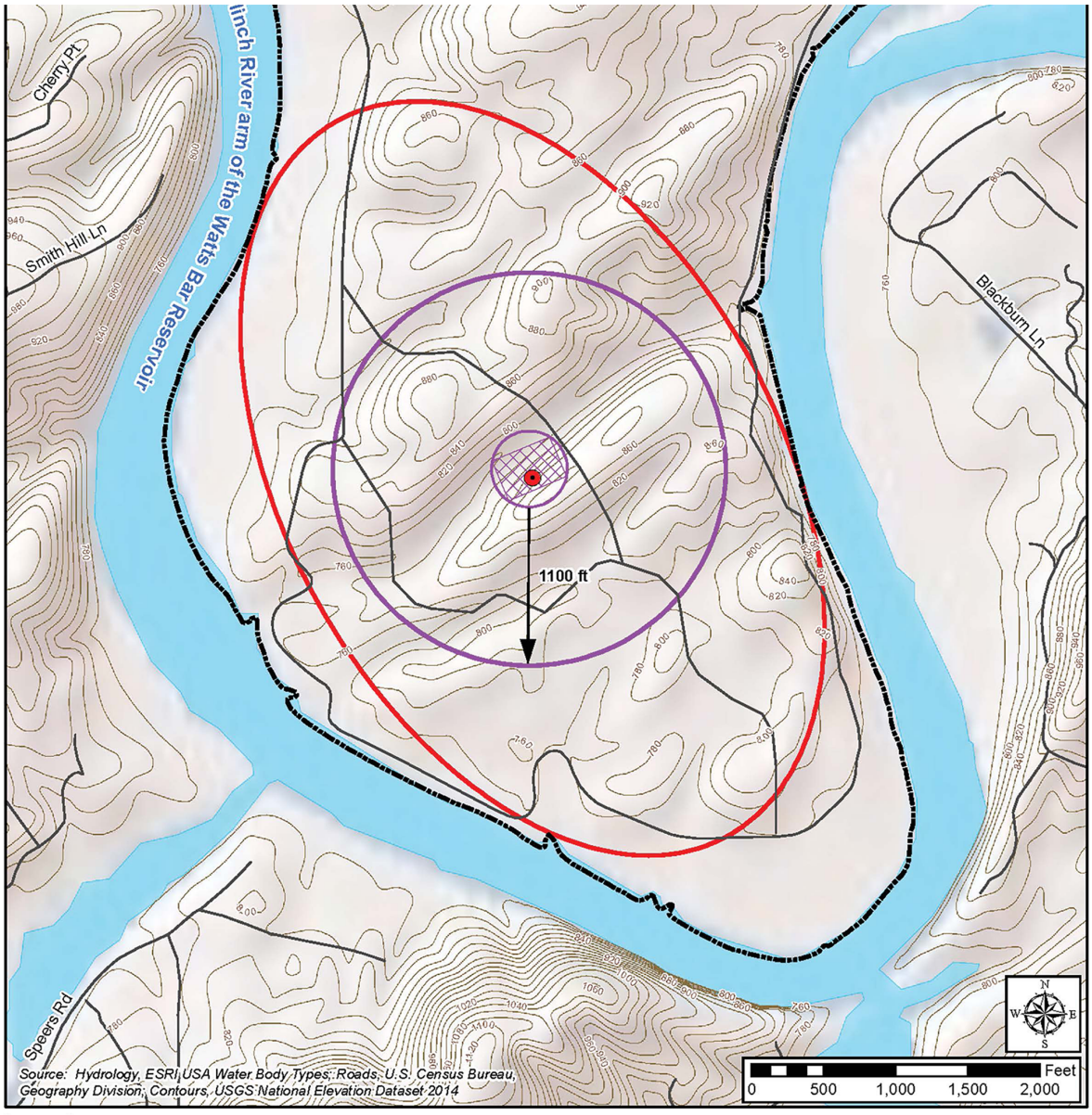

Figure 2.7.5-1. Effluent Release Boundary with Analytical EAB

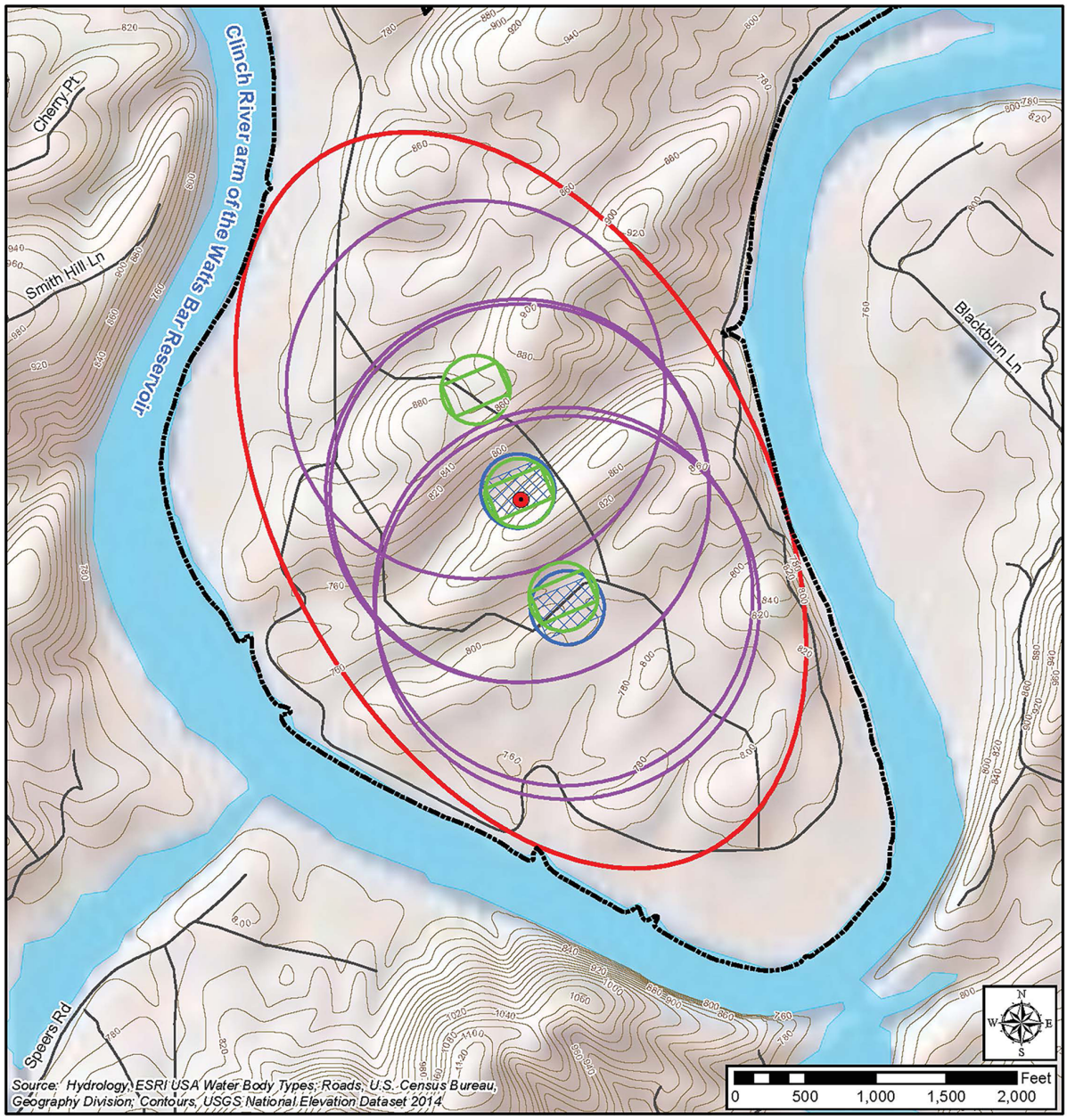

Figure 2.7.5-2. Effluent Release Boundaries (ERBs), Analytical EAB, and Site EAB

Figure 2.7.5-3. Site Center Point and Distance to the LPZ