



TVA Clinch River SMR Project

Meteorology Data and Exclusion Area Boundary

Agenda

Meteorology

- Onsite Meteorological Monitoring
- Local Topography
- Effects of Topography on Wind Flow
- Meteorological Conditions

Boundary Dose Conditions

- Exclusion Area Boundary
- Low Population Zone
- Short-term Diffusion Estimates
- Long-term Diffusion Estimates

Meteorology

Onsite Meteorological Monitoring (1/3)

Onsite meteorological monitoring conducted at Clinch River Nuclear (CRN) site during 3 distinct periods since 1973

- 1973-1978: 61-meter temporary tower operated near plant site prior to construction as part of Clinch River Breeder Reactor Project (CRBRP)
- 1977-1978 and 1982-1983: Two meteorological towers (primary 110-m tower south of plant site and 10-m supplemental tower north of plant site) operated during CRBRP construction
- 2011-2013: Primary tower reactivated for lowest two data levels to support small modular reactor (SMR) project

Data from above used in examining impacts of topographic conditions

ESPA dispersion meteorology uses data collected 2011-2013

Onsite Meteorological Monitoring (2/3)

Primary tower

- 110-m (360-ft) tower with wind, temperature, and dewpoint measurements at two lowest levels (10- and 60-m)
- Ground-based instrument for rainfall measurements
- Environmental data station
- Located approximately 830 m SSE of expected plant site, base elevation 5 m below plant grade

Data collected:

- Wind direction and speed at 10 and 60 m
- Temperature at 10 and 60 m
- Dewpoint at 10 and 60 m
- Rainfall at 1 m (collected but not used)

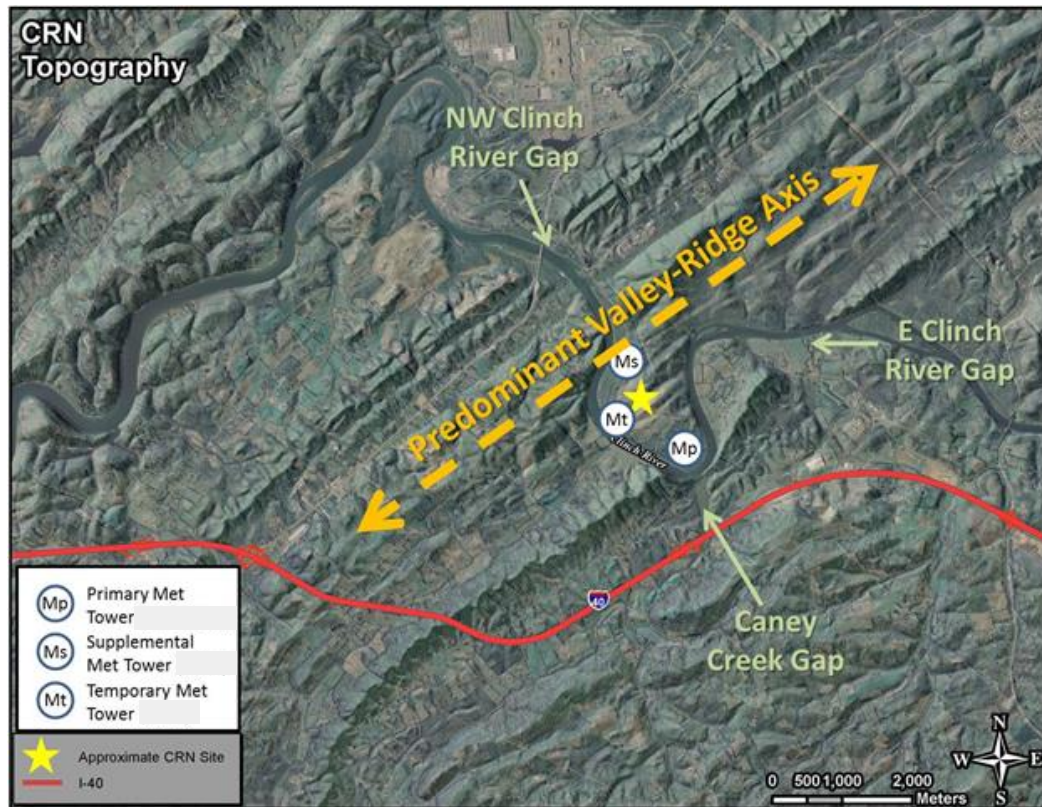
Onsite Meteorological Monitoring (3/3)

Meteorological data collection system meets or exceeds specifications for accuracy in RG 1.23

RG 1.23 recommends data recovery goal of 90% for meteorological instruments

- Data collection met requirements for all data except rainfall
 - Rainfall data unreliable owing to repeated problems with gauge
 - Hourly data collected from Oak Ridge Automated Surface Observing System (~12 miles NE of CRN site) used as alternative

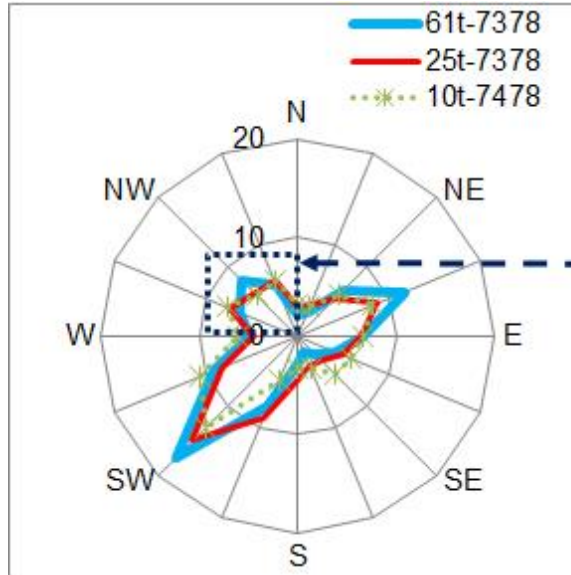
Local Topography



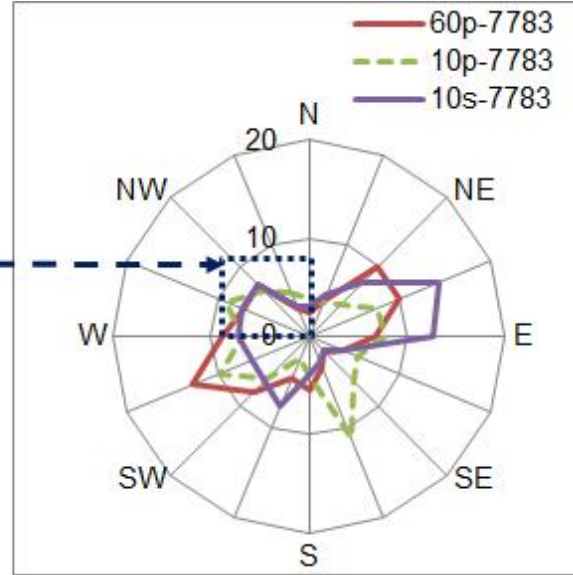
Geographic orientation of ridges and valleys generally aligns with prevailing regional winds from SW, but gaps in ridges permit wind flow from other directions as well

Effects of Topography on Wind Flow

Temporary Tower
(1973 – 1978)



Other Towers
(1978 – 1983)



*Radials are
percent
occurrence
(blowing
from the
indicated
direction)*

Historical data used for illustration. Consistent with current data collected.

Meteorological Conditions (1/2)

Atmospheric Stability

Neutral lapse conditions (class D) occur most frequently, stable lapse conditions (i.e., inversions) typically occur over 50 percent of the time

Most stable class (class G), occurs as much as 20 percent of the time

2011-2013 JFDs	Class A	Class B	Class C	Class D	Class E	Class F	Class G
Hours	492	610	1044	5399	4038	2840	2957

JFD = Joint Frequency Distribution

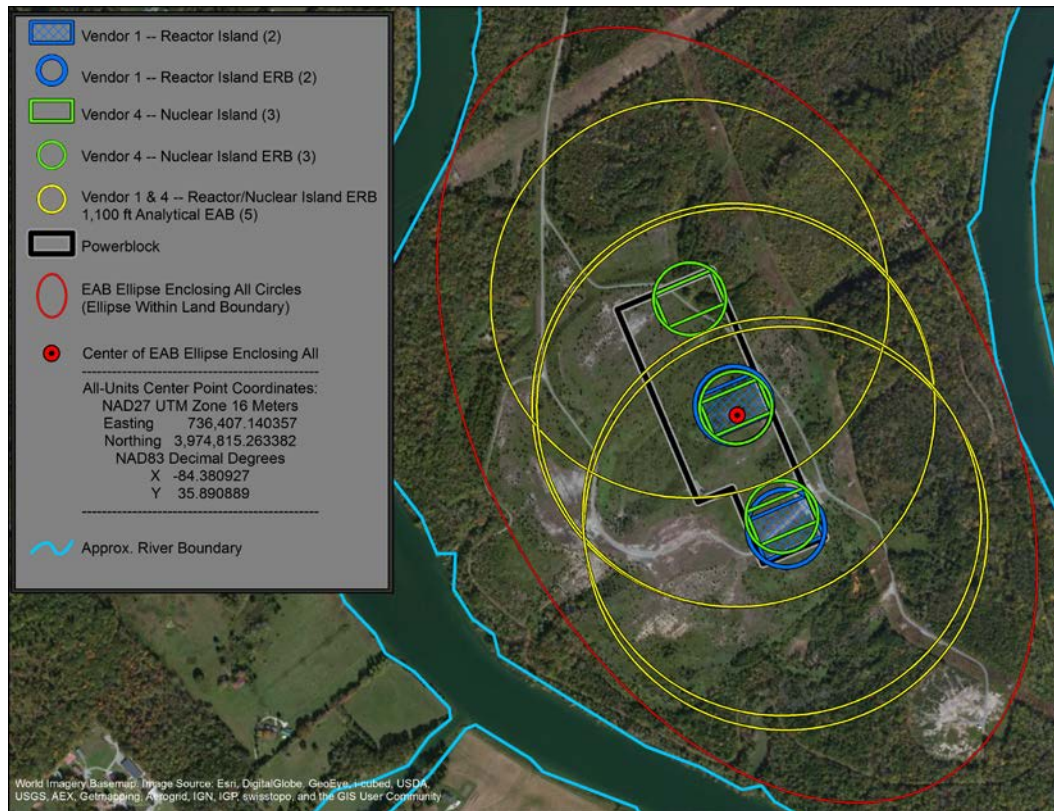
Meteorological Conditions (2/2)

Inversion Persistence
Longest contiguous
period of inversion
conditions was 19 hours

10 meters WD Sector	Maximum Hours of WD Persistence		
	Same Sector	± 1 Sector	± 2 Sectors
N	6	15	59
NNE	7	15	35
NE	10	29	39
ENE	8	26	32
E	6	17	31
ESE	6	17	26
SE	6	13	25
SSE	10	17	25
S	8	14	23
SSW	4	14	39
SW	7	33	44
WSW	15	36	55
W	19	36	106
WNW	11	43	86
NW	15	46	67
NNW	7	45	69

Boundary Dose Conditions

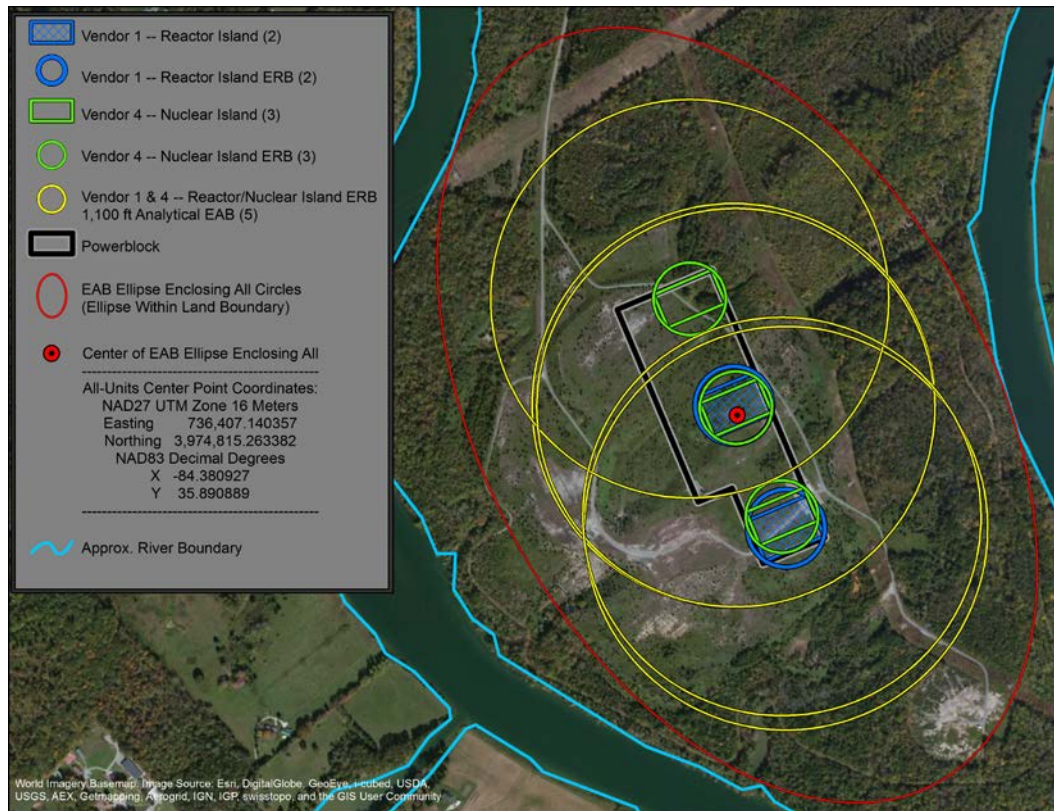
Exclusion Area Boundary (1/2)



Circular analytical Exclusion Area Boundaries (EABs) defined at fixed distance from release zones for conservatism and simplicity

Release zones based on circular effluent release boundaries (ERBs) determined as composite of proposed reactor and engineering structures from four vendors

Exclusion Area Boundary (2/2)

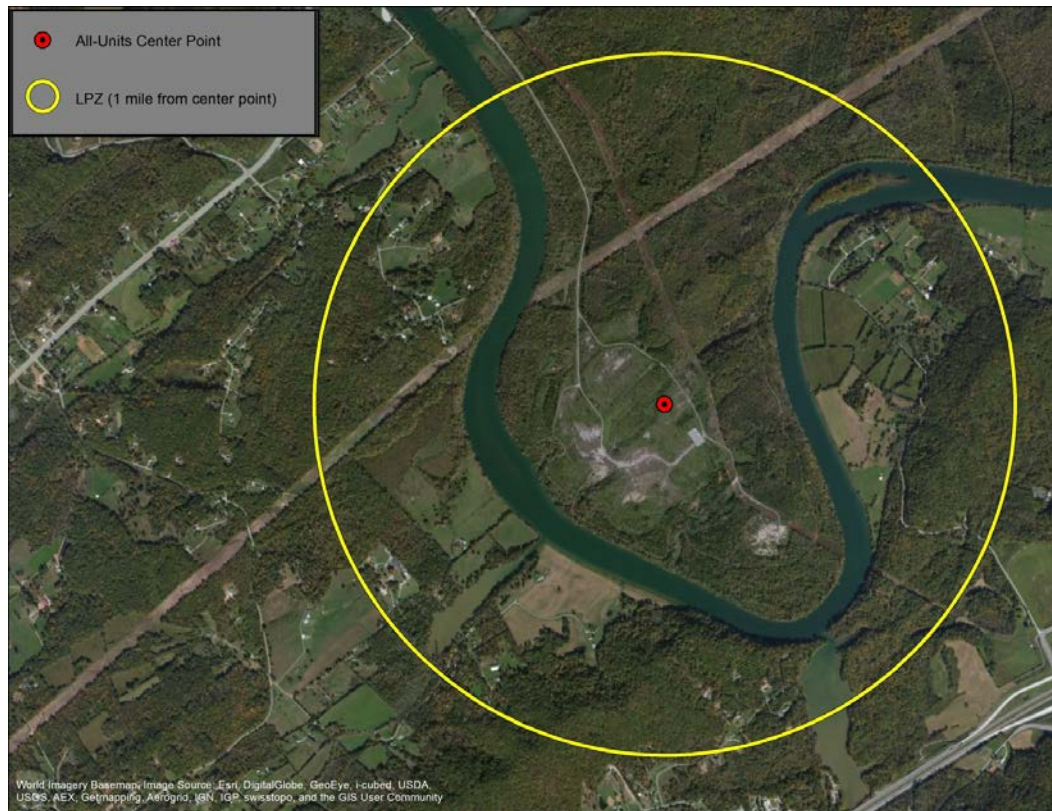


Various analytical EABs (enclosed by single ellipse) demonstrate site EAB (property boundary) is acceptable for radiation dose considerations

- Ellipse ~0.3 mi (~520 m) by ~0.5 mi (~860 m), measured from site centerpoint
- Site centerpoint determined by centerline midpoint of Release Zone EABs

1,100-ft (335-m) Release Zones

Low Population Zone



Low Population Zone (LPZ): circular area with 1-mile radius from site centerpoint

Short-term Diffusion Estimates (1/2)

Short-term (accident) diffusion estimates based on atmospheric dispersion calculations performed using PAVAN computer program

- Using site-specific meteorological data covering 2-year period from June 1, 2011 through May 31, 2013

Short-Term Exclusion Area Boundary Accident Release X/Q Values

0.5% and 5% X/Q Values (sec/m ³) at the EAB				
Release Zone to Analytical EAB	Time Period	Direction-Dependent X/Q		Direction Independent X/Q
		0.5% Maximum	Sector	5% Site Limit
Release Zone 1 (335 m)	0-2 Hours	4.96E-03	WNW	4.33E-03

Notes:

(1) All values are preliminary

Short-term Diffusion Estimates (2/2)

Short-Term Low Population Zone Accident Release X/Q Values

0.5% and 5% X/Q Values (sec/m ³) at the LPZ			
Time Period	Direction-Dependent X/Q		Direction Independent X/Q
	0.5% Maximum	Sector	5% Site Limit
0-8 Hours	3.08E-04	WNW	2.75E-04
8-24 Hours	2.25E-04	WNW	2.03E-04
1-4 Days	1.13E-05	WNW	1.05E-05
4-30 Days	4.22E-05	WNW	4.05E-05

Notes:

(1) All values are preliminary

Long-term Diffusion Estimates (1/3)

Long-term (routine release) diffusion estimates based on atmospheric dispersion calculations performed using XOQDOQ-82 (XOQDOQ) modeling program

Complex terrain adjustments made by comparison of results with variable trajectory model

- TVA used EPA's advanced, non-steady-state, meteorological and air quality modeling system CALPUFF Version 6.42

TVA concluded XOQDOQ model did not underestimate annual average X/Q values; no nonlinear adjustment factors applied to annual average X/Q and D/Q values

Long-term Diffusion Estimates (2/3)

Long-Term Exclusion Area Boundary Routine Release X/Q Values

EAB Sector	Long-Term Average X/Q Values (sec/m ³)								
	Undepleted			2-Day Decay			8-Day Decay		
	XOQDOQ	CALPUFF	Ratio	XOQDOQ	CALPUFF	Ratio	XOQDOQ	CALPUFF	Ratio
S	2.70E-05	2.01E-06	0.07	2.70E-05	2.01E-06	0.07	2.50E-05	2.01E-06	0.08
SSW	2.40E-05	1.95E-06	0.08	2.40E-05	1.95E-06	0.08	2.30E-05	1.95E-06	0.08
SW	2.80E-05	1.32E-06	0.05	2.80E-05	1.32E-06	0.05	2.60E-05	1.32E-06	0.05
WSW	4.20E-05	1.17E-06	0.03	4.10E-05	1.17E-06	0.03	3.80E-05	1.17E-06	0.03
W	6.70E-05	1.15E-06	0.02	6.60E-05	1.14E-06	0.02	6.10E-05	1.15E-06	0.02
WNW	9.10E-05	6.51E-07	0.01	9.10E-05	6.49E-07	0.01	8.40E-05	6.51E-07	0.01
NW	7.80E-05	1.38E-06	0.02	7.70E-05	1.38E-06	0.02	7.20E-05	1.38E-06	0.02
NNW	4.60E-05	3.01E-06	0.07	4.50E-05	3.01E-06	0.07	4.20E-05	3.01E-06	0.07
N	3.10E-05	2.93E-06	0.09	3.10E-05	2.92E-06	0.09	2.90E-05	2.92E-06	0.10
NNE	2.20E-05	3.75E-06	0.17	2.20E-05	3.74E-06	0.17	2.00E-05	3.75E-06	0.19
NE	2.20E-05	2.11E-06	0.10	2.20E-05	2.11E-06	0.10	2.00E-05	2.11E-06	0.11
ENE	3.30E-05	2.26E-06	0.07	3.30E-05	2.26E-06	0.07	3.10E-05	2.26E-06	0.07
E	4.10E-05	2.78E-06	0.07	4.10E-05	2.77E-06	0.07	3.80E-05	2.78E-06	0.07
ESE	5.70E-05	3.68E-06	0.06	5.60E-05	3.67E-06	0.07	5.20E-05	3.68E-06	0.07
SE	4.60E-05	2.23E-06	0.05	4.60E-05	2.23E-06	0.05	4.20E-05	2.23E-06	0.05
SSE	2.90E-05	2.57E-06	0.09	2.90E-05	2.57E-06	0.09	2.70E-05	2.57E-06	0.10

Notes:

(1) All values are preliminary

Long-term Diffusion Estimates (3/3)

Long-Term Low Population Zone Routine Release X/Q Values

Long-Term Average X/Q Values (sec/m ³)									
LPZ Sector	Undepleted			2-Day Decay			8-Day Decay		
	XOQDOQ	CALPUFF	Ratio	XOQDOQ	CALPUFF	Ratio	XOQDOQ	CALPUFF	Ratio
S	3.80E-06	4.52E-07	0.12	3.70E-06	4.50E-07	0.12	3.30E-06	4.52E-07	0.14
SSW	3.40E-06	6.31E-07	0.19	3.40E-06	6.28E-07	0.19	3.00E-06	6.30E-07	0.21
SW	4.00E-06	6.86E-07	0.17	3.90E-06	6.82E-07	0.18	3.50E-06	6.85E-07	0.19
WSW	5.80E-06	3.71E-07	0.06	5.70E-06	3.68E-07	0.06	5.10E-06	3.70E-07	0.07
W	9.30E-06	3.38E-07	0.04	9.10E-06	3.36E-07	0.04	8.10E-06	3.38E-07	0.04
WNW	1.30E-05	2.28E-07	0.02	1.20E-05	2.26E-07	0.02	1.10E-05	2.28E-07	0.02
NW	1.10E-05	2.35E-07	0.02	1.10E-05	2.33E-07	0.02	9.40E-06	2.34E-07	0.02
NNW	6.30E-06	5.51E-07	0.09	6.20E-06	5.48E-07	0.09	5.50E-06	5.50E-07	0.10
N	4.40E-06	8.74E-07	0.20	4.30E-06	8.69E-07	0.20	3.80E-06	8.72E-07	0.23
NNE	3.10E-06	4.92E-07	0.16	3.00E-06	4.90E-07	0.16	2.70E-06	4.91E-07	0.18
NE	3.10E-06	6.10E-07	0.20	3.00E-06	6.08E-07	0.20	2.70E-06	6.09E-07	0.23
ENE	4.60E-06	6.05E-07	0.13	4.60E-06	6.03E-07	0.13	4.00E-06	6.05E-07	0.15
E	5.80E-06	6.55E-07	0.11	5.70E-06	6.52E-07	0.11	5.00E-06	6.54E-07	0.13
ESE	7.90E-06	5.65E-07	0.07	7.80E-06	5.62E-07	0.07	6.90E-06	5.64E-07	0.08
SE	6.50E-06	8.66E-07	0.13	6.40E-06	8.63E-07	0.14	5.60E-06	8.65E-07	0.15
SSE	4.20E-06	5.96E-07	0.14	4.10E-06	5.94E-07	0.15	3.60E-06	5.95E-07	0.16

Notes:

(1) All values are preliminary

Summary

Dispersion meteorology data collected 2011-2013

Meteorological data collection system satisfied RG 1.23 accuracy and data collection requirements

Stable lapse conditions (i.e., inversions) typically occur over 50 percent of the time

Circular analytical EABs defined at fixed distance from release zones bounded by ellipse within site boundary

Short-term diffusion estimates calculated using PAVAN

Long-term diffusion estimates calculated using XOQDOQ

Clinch River site boundary is suitable for EAB

Closing

Questions?

Follow-up Action Review