UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

May 3, 2018

MEMORANDUM TO: Adrian Muñiz, Acting Branch Chief
Licensing Branch 3
Division of New Reactor Licensing
Office of New Reactors

FROM: Mallecia Sutton, Project Manager **/RA/**
Licensing Branch 3
Division of New Reactor Licensing
Office of New Reactors

SUBJECT: MAY 7, 2018 THROUGH MAY 11, 2018, AUDIT OF CLINCH RIVER NUCLEAR SITE EARLY PERMIT APPLICATION – COMPARING OFFSITE ATMOSPHERIC DISPERSION USING VECTOR AND SCALAR WIND DIRECTION

By letter dated May 12, 2016, Tennessee Valley Authority (TVA) submitted an application to the U.S. Nuclear Regulatory Commission (NRC) for an early site permit (ESP) for the Clinch River Nuclear (CRN) Site located in Oak Ridge, Tennessee. TVA subsequently provided supplemental information in support of the application and the NRC staff accepted the application for docketing and detailed review on December 30, 2016.

The NRC staff has identified the need for an audit to support the basis for a finding of reasonable assurance of no undue risk to the public health and safety related to the use of vector transport wind direction in calculating atmospheric dispersion in support of the applicant's Chapter 15, "Accident Analysis," of Part 2, "Site Safety Analysis Report" of the CRN Site ESP application. A regulatory audit will commence on May 7, 2017, and be carried out as an online audit via the TVA Electronic Reading Room. During this audit the NRC staff will examine the calculation packages and supporting documents that comprise the development of atmospheric dispersion and deposition factors and the resulting normal operation doses to the members of the public as they relate to the ESP application Part 2 of the Site Safety Analysis Report. The audit is scheduled to conclude by May 11, 2018. The NRC may elect to hold a public exit meeting at the end of the audit to discuss technical topics related to the audit findings. Portions of this meeting may be closed due to proprietary nature of the technical topics. If needed, the NRC may request to have a public meeting with you in the future to discuss related topics.

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A copy of the audit plan is enclosed.

Docket No.: 52-047

Enclosure:
As stated

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DATED: May 3, 2018

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DATE	05/03/18	05/03/18	05/03/18	05/03/18	05/03/18

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CLINCH RIVER NUCLEAR SITE EARLY SITE PERMIT APPLICATION

A. Background

The information presented in Chapter 15, "Accident Analysis," of Part 2, "Site Safety Analysis Report" of Tennessee Valley Authority's (TVA) Clinch River Nuclear (CRN) Site early site permit (ESP) application describes the radiological consequences of design basis accidents (DBAs) to show that reactor units could be sited at the proposed ESP Site without having undue risk to the health and safety of the public, in compliance with the requirements in Title 10 of the *Code of Federal Regulations* (10 CFR) 52.17, "Contents of applications; technical information," and 10 CFR Part 100, "Reactor Site Criteria." The consequence of a DBA in terms of personnel exposure is a function of the atmospheric dispersion conditions at the site. In Site Safety Analysis Report (SSAR) Section 2.3.4, "Short-Term (Accident) Diffusion Estimates," describes the development of conservative short-term atmospheric diffusion estimates for receptors located on the Exclusion Area Boundary and the outer boundary of the Low Population Zone.

The information presented in SSAR Section 11.3.3, "Gaseous Radioactive Releases," describes the gaseous radioactive effluent releases (i.e., normal plant parameter envelope [PPE] gaseous effluent release source terms), exposure pathways, and projected offsite radiological doses to demonstrate that reactor units could be sited at the proposed CRN Site without undue risk to the health and safety of the public, in compliance with the relevant requirements in 10 CFR Part 20, "Standards for Protection Against Radiation," 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," Appendix I, "Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criterion 'As Low As is Reasonably Achievable' for Radioactive Material in Light-Water-Cooled Nuclear Power Reactor Effluents," 10 CFR 52.17, 10 CFR Part 100, and the Environmental Protection Agency's (EPA's) 40 CFR Part 190, "Environmental Radiation Protection Standards for Nuclear Power Operations." In SSAR Section 2.3.5, "Long-Term (Routine) Diffusion Estimates," describes the development of the long-term diffusion and deposition estimates.

In SSAR Section 2.3.3, "Onsite Meteorological Measurements Program," provides a description of the onsite meteorological monitoring program used to collect the meteorological data used to derive the atmosphere dispersion and deposition factors (X/Q and D/Q values, respectively) presented in SSAR Sections 2.3.4 and 2.3.5, respectively. In SSAR Section 2.3.3.2.4 includes a description of the meteorological monitoring system data acquisition system, including software data processing routines and data averaging techniques.

In the ESP application, TVA identified compliance with Regulatory Guide (RG) 1.23, "Meteorological Monitoring Programs for Nuclear Power Plants," which references ANSI/ANS-3.11-2005, "Determining Meteorological Information at Nuclear Facilities." Section 5.3.1 of ANSI/ANS-3.11-2005 states that the transport wind direction for straight-line Gaussian models should be based on the scalar mean (or unit vector) wind direction.

TVA's ESP application uses straight-line Gaussian models for the development of X/Q and D/Q values and the transport wind direction used in those models is based on vector wind direction. During a December 2017 public meeting, the NRC identified that the transport wind direction TVA used for development of the X/Q and D/Q values presented in the CRN Site ESP application is based on vector wind direction and stated that the use of vector wind direction in straight-line Gaussian models did not conform to best practices provided in RG 1.23 and ANSI/ANS-3.11-2005 that such models should be using scalar wind direction. The NRC staff requested TVA to explain how the methodology used follows regulatory guidance or provide justification for deviating from the guidance. In response to this request, TVA voluntarily submitted a response to the NRC question dated April 9, 2018, "Comparing Offsite Atmospheric Dispersion Using Vector and Scalar Wind Direction" (Agencywide Documents Access and Management System (ADAMS) Accession No. ML18100A950).

TVA response recognizes the recommendation in ANSI/ANS-3.11-2005 and presents the results of an evaluation regarding the use of vector versus scalar wind direction as the transport wind direction for development of X/Q and D/Q values for the CRN Site. TVA's analysis has shown that the X/Q and D/Q values are greater in some directions and lower in others when comparing the different transport wind directions.

For the accidental gaseous release described in SSAR Chapter 15, TVA found that the limiting X/Q value based on vector wind direction (which is in the west northwest [WNW] sector) is larger than for the scalar wind direction. Therefore, for the accidental gaseous release, TVA determined that using vector wind direction for the development of atmospheric dispersion values and resulting doses is conservative.

For the normal gaseous release described in SSAR Section 11.3.3, the Maximally Exposed Individual and population doses are evaluated. This analysis uses X/Q and D/Q factors from different compass directions. Since the X/Q and D/Q values based on scalar wind directions are greater in some directions and lower in others, TVA reanalyzed the resulting doses. TVA's reanalysis shows that the doses for the normal gaseous release using the vector wind direction are greater than those computed using the scalar wind direction input.

Based on its analyses described above, TVA concluded that the existing accident and normal gaseous release analyses included in the ESP application, which is based on vector wind direction, is conservative and remains the basis of the ESP application.

The NRC staff will audit TVA's documentation supporting applicant's conclusions stated above.

B. Regulatory Audit Scope or Methodology

The purpose of this audit is for the staff to examine and evaluate information related to TVA's comparison of offsite atmospheric dispersion and resulting doses using vector versus scalar wind direction. In particular, the staff is looking to:

1. gain a better understanding of TVA's recalculation of X/Q and D/Q values using scalar versus vector wind direction data and the resulting conclusion that the routine release doses computing using vector wind direction data are greater than those computed using scalar wind direction data, and

2. identify any information needed on the docket to support the basis for a finding of reasonable assurance of no undue risk to the public health and safety.

C. Regulatory Audit Bases

This regulatory audit is based on the following:

- 10 CFR 20.1301, "Dose limits for individual members of the public," 10 CFR 20.1302, "Compliance with dose limits for individual members of the public" and Table 2, Columns 1 and 2 and Note 4 of Appendix B to 10 CFR Part 20, as they relate to radioactivity in liquid and gaseous effluents released to unrestricted areas and doses to offsite receptors located in unrestricted areas;

- 10 CFR 50.34, "Contents of applications; technical information," as it relates to a description and safety assessment of the site and safety assessment of facility.

- 10 CFR Part 50, Appendix I, Sections II.B, II.C, and II.D, as they relate to the numerical guidelines for As Low As is Reasonably Achievable design objectives and limiting conditions for operation;

- 10 CFR 52.17, as it relates to the assessment that must contain analysis and evaluation of the major structures, systems, and components of the facility that bear significantly on the acceptability of the site under the radiological consequence evaluation factors identified in paragraphs (a)(1)(ix)(A) and (a)(1)(ix)(B) of this section;

- 10 CFR 100.21(c),"Non-seismic siting criteria," as it relates to the requirement that site atmospheric dispersion characteristics be evaluated and dispersion parameters established such that (1) radiological effluent release limits associated with normal operation from the type of facility to be located at the site can be met for any individual located offsite; and (2) the radiological dose consequences of postulated accidents shall meet the criteria set forth in 10 CFR 50.34(a)(1) for type of facility proposed to be located at the site

- 40 CFR Part 190 (the U.S. Environmental Protection Agency's (EPA)) generally applicable environmental radiation standards), as implemented under 10 CFR 20.1301(e), as it relates to limits on annual doses from all sources of radioactivity contained in liquid and gaseous effluents and external radiation from site buildings and facilities (with single or multiple reactor units).

- NUREG–0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants (LWR Edition)," as it relates to providing guidance to staff to perform safety reviews of applications to construct or operate nuclear power plants and the review of applications to approve standard designs and sites for nuclear power plants, to assure the quality and uniformity of staff safety review.

    - Standard Review Plan (SRP) Section 2.3.3

    - SRP Section 2.3.4

    - SRP Section 2.3.5

    - SRP Section 11.3, "Gaseous Waste Management System"

    - SRP Section 15.0.3, "Design Basis Accident Radiological Consequences of Analyses for Advanced Light Water Reactors"

- RG 1.23

- RG 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I"

- RG 1.111, "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors"

- RG 1.145, "Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants"

- RG 1.183, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors"

- RG 1.206, "Combined License Applications for Nuclear Power Plants"

D. Information and Other Background Material for the Regulatory Audit

The TVA should make available documents in the Electronic Reading Room (eRR) pertaining to the topic areas within the scope, as listed below.

- Calculation packages that support the April 9, 2018, submittal related to comparing offsite atmospheric dispersion and resulting doses using vector versus scalar wind direction.

E. Audit Team

The following are the audit team members:

Mallecia Sutton, NRC Project Manager
Brad Harvey, NRC Audit Leader
Michael Mazaika, NRC Technical Reviewer
Kevin Quinlan, NRC Technical Reviewer
Richard Clement, NRC Technical Reviewer
Seshagiri Tammara, NRC Technical Reviewer

F. Logistics

The audit will consist of review of online documents in TVA eRR. The audit may be followed up by a public meeting, either as part of the audit's conclusion. The audit will conclude on or about May 11, 2018. The audit team plans to issue an audit report within 90 days after completing the audit.

The proposed schedule for the audits are as follows:

Date: **Monday, May 7, 2018 through Friday, May 11, 2018**

Location: TVA eRR

G. Audit Exit

To Be Determined (on or around May 14, 2018)

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