



Tennessee Valley Authority, 1101 Market Street, Chattanooga, TN 37402

CNL-17-110

August 24, 2017

10 CFR 52, Subpart A

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Clinch River Nuclear Site
NRC Docket No. 52-047

Subject: Response to Request for Additional Information Number 4, eRAI-8857,
Regarding Population Distribution in Support of Early Site Permit Application
for Clinch River Nuclear Site

References: 1. Letter from TVA to NRC, CNL-16-081, "Application for Early Site Permit
for Clinch River Nuclear Site," dated May 12, 2016

2. NRC Electronic Mail, "Issuance of RAI pertaining to Section 2.1.3,
Population Distribution, RAI Number 4, eRAI-8857," dated July 25, 2017

By letter dated May 12, 2016 (Reference 1), Tennessee Valley Authority submitted an application for an early site permit for the Clinch River Nuclear (CRN) Site in Oak Ridge, TN. By electronic mail dated July 25, 2017 (Reference 2), Nuclear Regulatory Commission (NRC) issued a request for additional information (RAI) regarding population distribution associated with the CRN Site.

The Enclosure to this letter provides the response to the RAI including Site Safety Analysis Report (SSAR) markups. The SSAR markups will be incorporated in a future revision of the early site permit application.

There are no new regulatory commitments associated with this submittal. If any additional information is needed, please contact Dan Stout at (423) 751-7642.

I declare under penalty of perjury that the foregoing is true and correct. Executed on this 24th day of August 2017.

Respectfully,

J. W. Shea
Vice President, Nuclear Regulatory Affairs and Support Services

Enclosure
cc: See Page 2

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Enclosure:

Response to NRC Request for Additional Information Number 4, eRAI-8857

cc: (Enclosure)

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ENCLOSURE

Response to NRC Request for Additional Information Number 4, eRAI-8957

The Site Safety Analysis Report (SSAR) Subsection 2.1.3 discusses the population distribution surrounding the Clinch River Nuclear (CRN) Site. Regulatory requirements for population center distance are provided in 10 CFR 100.21(b). Based on the review of the population distribution information provided in the Clinch River Nuclear Site Early Site Permit Application (ESPA), the staff issued Request for Additional Information 02.01.03-01 (eRAI-8857).

NRC RAI 02.01.03-01

RG 1.206 provides guidance regarding the information that is needed to ensure that the information identified and evaluated to meet the siting criteria in 10 CFR 100.20(a) and 10 CFR 100.21(b). The applicant used USCB census-delineated urban areas in the region based on population density. The two urban areas identified are the Knoxville (4.8 mi southeast) urban area with the combination of smaller cities including Lafollette, Oak Ridge, Clinton, Loudon, Lenoir City, Alcoa, Maryville, Farragut, Rockwood, Seymour, and Knoxville; and the Cleveland (45 mi south-southwest) urban area with the combination of smaller cities including Calhoun, Charleston Hopewell, and Cleveland, Tennessee. The Knoxville and Cleveland urban areas had 2010 populations of 558,696 and 66,777 persons, respectively. The distances of these identified urban areas are much greater than the one and one-third times the distance from the site center point to the outer boundary of the LPZ.

The applicant considered meeting the population center distance requirement (10 CFR 100.21(b)), based on the distances from the site center point to the boundary of each of the two identified urban areas in Knoxville, Tennessee, which is 4.8 mi southeast and Cleveland, Tennessee, which is 45 mi south-southeast. Both of these population centers are much greater than the one and one-third times the distance from the site center point to the outer boundary of the LPZ. But the applicant followed an approach by using urban area designation with combination of smaller cities for complying with the population center distance of one and one-third times the distance from the reactor to the outer boundary of LPZ. This approach differs from the regulatory requirement, and could set a new precedent as it considers and combines various small cities of lesser than 25,000 people, rather than considers a city with a densely populated. This effectively changes the distances identified to meet the regulatory requirements. Although in this case the result may be more conservative, the analysis is still not in accordance with the regulatory definitions or requirements as specified in 10 CFR 100.21(b). Therefore, the staff requests the applicant in RAI 2.1.3-1 to revise the evaluation methodology in meeting the 10 CFR 100.21(b) regulatory requirement, solely based on considering the nearest city having population of 25,000 or more people.

ENCLOSURE

Response to NRC Request for Additional Information Number 4, eRAI-8857

Response

Population Centers (25,000 or more people) near Clinch River Nuclear Site

There are no population centers located within the minimum population center distance required by 10 CFR 100 (e.g. one and one-third times the distance from the site center point to the outer boundary of the Low Population Zone (LPZ)). As described in the SSAR Subsection 2.1.3.5, there are only two urban areas within the region that meet the requirements to be considered population centers: Knoxville and Cleveland (Reference 1). These are located approximately 4.8 miles (mi) (southeast) and 45 mi (south southwest), respectively. As described in SSAR Subsection 2.1.3.5, the densely populated areas associated with the City of Oak Ridge and Lenoir City are included in the United States (U.S.) Census defined Knoxville Urban Area. Figures 1 and 2 illustrate the geographic relationship of the Knoxville Urban Area, the City of Oak Ridge and Lenoir City densely populated areas, and their distances to the CRN Site reactor. As noted in the figures, the densely populated portion of the Knoxville Urban Area attributed to the City of Oak Ridge is located approximately 5.9 miles north northeast. The portion of the Knoxville Urban Area attributed to the Lenoir City dense population areas is approximately 4.8 miles southeast. SSAR Figure 2.1-6 and Table 2.1-2 provide the population distribution surrounding the CRN Site by distance and direction. Both the table and the figure illustrate that the locations of the densely populated areas associated with these cities are beyond the distance required by 10 CFR 100.21(b) and satisfy Regulatory Guide 4.7, General Site Suitability Criteria For Nuclear Power Stations.

Compliance with regulatory requirements

10 CFR 100.21(b) states:

"The population center distance, as defined in § 100.3, must be at least one and one-third times the distance from the reactor to the outer boundary of the low population zone. In applying this guide, the boundary of the population center shall be determined upon consideration of population distribution. Political boundaries are not controlling in the application of this guide."

Because political boundaries are not controlling in the determination of population center distance, the U.S. Census Bureau-defined urban clusters (UCs) and urbanized area (UAs) data were used to evaluate the proximity of potential population centers. The U.S. Census Bureau defines UCs as a densely developed territory that has at least 2,500 people but fewer than 50,000 people and notes that they introduced the UC concept in the 2000 Census to provide a more consistent and accurate measure of urban population. For urban areas with populations greater than 50,000 persons, the Census Bureau define UAs, which are a "densely developed territory that contains 50,000 or more people." (Reference 2). The Census Bureau's delineation of UAs is designed to identify densely developed territory, and encompass residential, commercial, and other nonresidential urban land uses. The boundaries have been defined using measures based primarily on population counts and residential population density, but also through criteria that account for nonresidential urban land uses (Reference 3). Using data based on population counts and residential population density that account for nonresidential urban land uses ensures compliance with 10 CFR 100.21(b), because the delineated areas are based on the distribution of densely populated areas and are not limited by political boundaries.

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For the Clinch River region, all UAs and UCs having greater than 25,000 persons were identified as population centers and the distances reported in SSAR Subsection 2.1.3.5. None of the identified population centers were located within one and one-third times the distance from the site center point to the outer boundary of the LPZ.

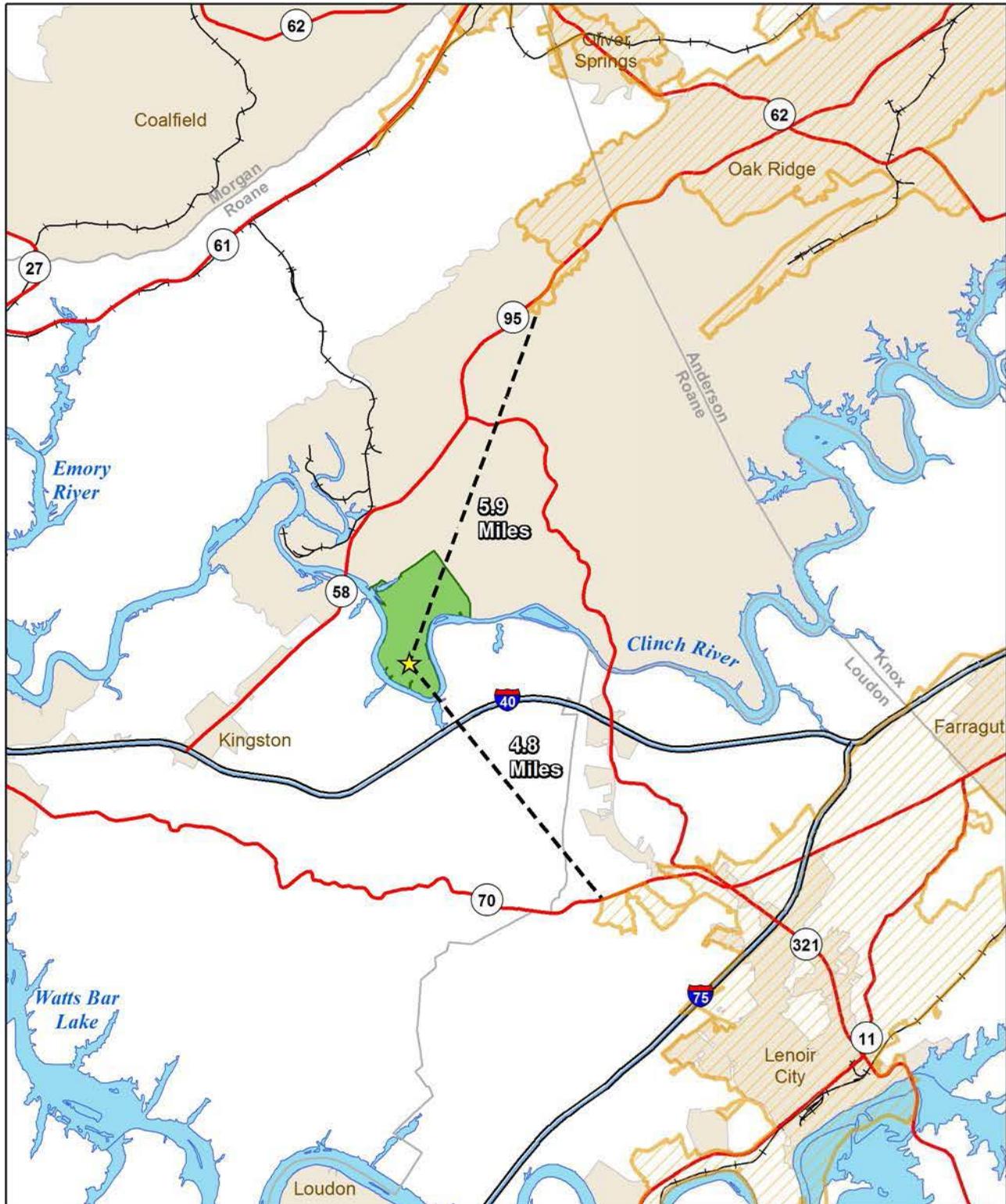
Other Combined License Application (COLA) submittals, such as the Bellefonte Nuclear Station, Units 3 and 4 COLA, have used similar methodologies to identify population centers (Reference 4). Therefore, the use of U.S. Census defined UAs and UCs data as an input for the population center assessment both meets the regulatory requirement and does not set a new precedent. The evaluation methodology described in the SSAR to assess meeting the population center distance requirement in 10 CFR 100.21(b)) is not being revised. However, SSAR Subsection 2.1.3.5 is being updated to provide a discussion of the population in the vicinity of the CRN Site. The SSAR markups will be incorporated in a future revision of the SPA.

References:

- 1) U.S. Census Bureau, "2010 Census Urban and Rural Classification and Urban Area Criteria." Available at <http://www.census.gov/geo/reference/ua/urban-rural-2010.html>, accessed December 6, 2013.
- 2) U.S Census Bureau, "2010 Census Summary File 1 Technical Documentation", September 2012).
- 3) Department of Commerce, "Urban Area Criteria for the 2010 Census; Notice," Federal Register, Vol. 76, No. 164, August 24, 2011.
- 4) Letter from TVA to NRC, "Bellefonte Combined License Application – Required Updates for Safety Analysis and Departures Reports," dated January 21, 2009 (ML090290406).

ENCLOSURE

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Legend

- ★ Center Point
- County
- Knoxville Urban Area
- Highway
- Interstate
- +— Railroad
- Clinch River Property
- Rivers and Lakes

0 1.25 2.5 5 7.5 Kilometers

0 0.5 1 2 3 Miles



Figure 1, Distance to Urban Areas Near CRN Site

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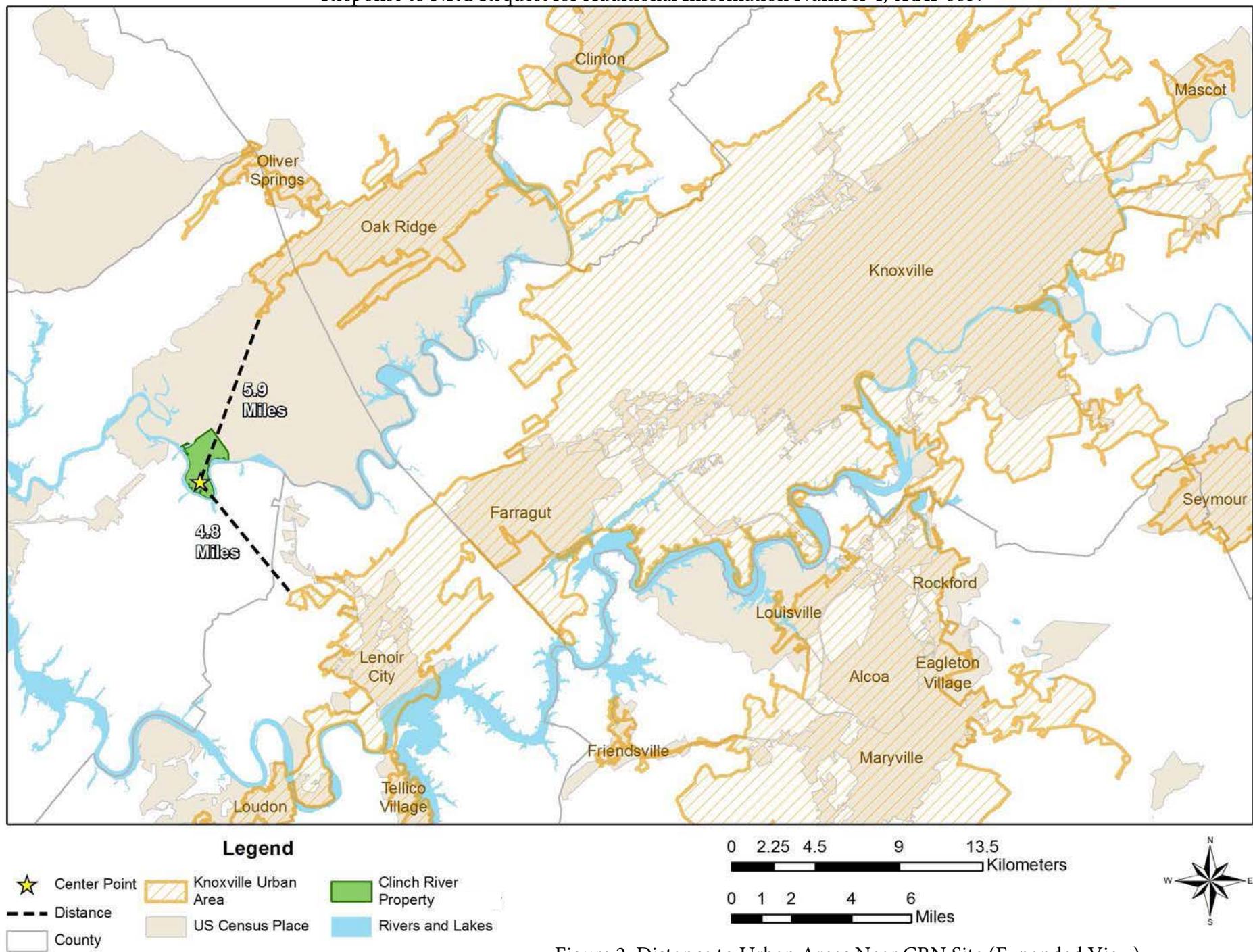


Figure 2, Distance to Urban Areas Near CRN Site (Expanded View)

Attachment 1
SSAR Subsection 2.1.3.5 Markups

SSAR Subsection 2.1.3.5 is being revised as indicated. Underlines indicates text to be added.

2.1.3.5 Population Center

Population centers, as defined by 10 CFR 100.3, are densely populated clusters containing more than 25,000 people. To identify population centers within the site region, the USCB census-delineated urban areas are used ([Reference 2.1-9](#)). Rather than being based on political boundaries, census-defined urban areas are based largely on population density ([Reference 2.1-4](#)). Of the urban areas located within the region, only two met the requirements to be classified as population centers in 2010: Knoxville (558,696 persons) and Cleveland (66,777 persons), Tennessee. The Knoxville urban area is a combination of several smaller cities, including Lafollette, Oak Ridge, Clinton, Loudon, Lenoir City, Alcoa, Maryville, Farragut, Rockwood, Seymour, and Knoxville, Tennessee. The Cleveland urban area is a combination of four smaller cities: Calhoun, Charleston, Hopewell, and Cleveland, Tennessee ([Reference 2.1-10](#)). The population center distances from the site center point to the nearest boundaries of Knoxville and Cleveland urban areas are approximately 4.8 mi (southeast) and 45 mi (south southwest), respectively. These distances are greater than one and one-third times the distance from the site center point to the boundary of the LPZ.

The City of Oak Ridge, with a 2010 population of 29,330, is the closest city to the CRN Site that exceeds 25,000 people, based on political boundaries ([Reference 2.1-10](#)). The CRN Site is located within the southern extent of the City of Oak Ridge, with the city's territory primarily extending to the northeast of the CRN Site. The densely populated portions of the City of Oak Ridge are located in these northeast portions. This is illustrated in Figure 2.1-6 and Figure 2.1-9, which portray the distribution of population by sector and distance from the CRN Site. In these figures, the sectors in the northeast directions have low populations from 0 to 6 mi. Therefore, densely populated portions of the City of Oak Ridge are located beyond the distance required by 10 CFR 100.21(b). This is further supported by the U.S. Census Bureau, which has delineated the densely populated portions of the City of Oak Ridge as part of the greater Knoxville urban area at approximately 5.9 mi from the CRN Site ([Reference 2.1-9](#)).

Using the county population projection ratios, the populations of two additional urban areas are anticipated to meet the population center criteria by 2067: Crossville, Tennessee, and Sevierville, Tennessee. The distance from the site center point to the nearest boundary of these two urban areas is approximately 34 and 43 mi, respectively. At the end of the projection period, Knoxville remains the largest and closest population center to the site with an estimated 2067 population of 933,806.

The transient population is not considered in these calculations because 10 CFR 100.3 defines a population center as “the distance from the reactor to the nearest boundary of a densely populated center containing more than about 25,000 residents.” Transient populations by nature are not considered to be part of the resident population.