

Clinch River Nuclear Site Early Site Permit Application Environmental Audit Summary Report

1.0 Background

The U.S. Nuclear Regulatory Commission (NRC) is currently reviewing an application from Tennessee Valley Authority (TVA) for an early site permit (ESP) for a site, known as the Clinch River Nuclear (CRN) Site, on the Clinch River arm of the Watts Bar Reservoir in Roane County, Tennessee. As part of its review, the NRC is preparing an environmental impact statement (EIS). An audit was conducted, beginning on May 15, 2017, to support the environmental review of TVA's ESP application. This report presents a summary of the audit's objectives and activities, and includes a summary of the information that was obtained as a result of audit activities.

1.1 Application Background

TVA submitted its ESP application to the NRC by letter dated May 12, 2016, which included an environmental report (ER) that is located in NRC's Agencywide Document Management System (ADAMS) under Accession No. ML16144A145. TVA subsequently provided supplemental information in support of the application. TVA's submittals supplementing the ER are listed in the references section of this report (Section 7). Consistent with NRC guidance, the NRC staff completed an acceptance review to determine whether the ESP application for the CRN Site, as supplemented, contained sufficient technical information in scope and depth to allow the NRC staff to conduct its detailed technical safety and environmental reviews within a predictable timeframe. The staff determined that the application (with the supplemental submittals) was sufficient for docketing and issued a *Federal Register* notice notifying the public of the NRC's acceptance of the CRN Site ESP application on January 12, 2017 (82 FR 3812).

Under the NRC regulations in Title 10 of the Code of Federal Regulations (CFR) Part 52, and in accordance with the applicable provisions of 10 CFR Part 51, which are the NRC regulations implementing the National Environmental Policy Act of 1969, as amended (NEPA) (42 USC 4321 et seq.), the NRC is required to prepare an EIS as part of its review of an ESP application. On April 13, 2017, the staff issued a Notice of Intent to prepare an EIS and conduct scoping (82 FR 17885).

The proposed federal action is the NRC issuance of an ESP to TVA approving the CRN Site as suitable for the future demonstration of the construction and operation of two or more small modular reactors (SMRs). An ESP is a Commission approval of a site for one or more nuclear power facilities. The ESP application and review process provides for early evaluation and resolution of safety and environmental issues related to siting. An ESP does not, however, authorize construction and operation of a nuclear power plant. An additional application and NRC review is needed to approve reactor construction or operation. Although no reactor would be built at the CRN Site under the proposed federal action (issuance of an ESP), in order to assess environmental effects, the NRC staff assumes that two or more SMRs with characteristics presented in TVA's ESP application (designated as the plant parameter envelope or PPE) would be built and operated. TVA's application, as supplemented, provides TVA's analyses of the environmental impacts that could result from building and operating two or more SMRs,

with a maximum total electrical output of 800 megawatt electric (MWe), to demonstrate the capability of SMR technology.

1.2 Site Location and Alternative Sites

The CRN Site is located on the northern bank of the Clinch River arm of the Watts Bar Reservoir in Oak Ridge, Tennessee (Figure 1). The CRN Site consists of approximately 935 acres bounded on the east, south and west by the Watts Bar Reservoir and on the north by the U.S. Department of Energy's (DOE's) Oak Ridge Reservation (ORR).



CRN Site Location

In addition to the CRN Site, TVA has identified three alternative sites:

- Site ORR #2 (Oak Ridge Reservation, Tennessee)
- Site ORR #8 (Oak Ridge Reservation, Tennessee)
- Site Redstone #12 (Redstone Arsenal, Alabama)

1.3 Cooperating Agencies

The U.S. Army Corps of Engineers (USACE), Nashville District, is a cooperating agency with the NRC in preparing the EIS for TVA's CRN Site ESP application.

2.0 Audit Scope and Objectives

The audit was conducted by a team consisting of NRC environmental staff along with its contractor, the Pacific Northwest National Laboratory (PNNL) and staff from the USACE

(jointly referred to as the review team). In preparation for the audit, the team reviewed TVA's ER, as supplemented, and identified information needs that would promote a better understanding of TVA's analyses and bases underlying the application. The review team also identified certain information deficiencies. These information needs are outlined in the audit plan presented to TVA in advance (ADAMS Accession No. ML17088A728).

The objectives of the audit were to:

- become familiar with the proposed site and the environs that could be affected by the proposed project;
- interact with Federal and state agencies to discuss their concerns and understand their regulatory authorities for resources potentially affected by the project;
- obtain additional information as set forth in the information needs presented to TVA in the audit plan and any additional data identified during site tours and meetings with Federal and state agencies; and to
- identify whether subsequent requests for additional information would be needed to allow the staff to conduct a complete review of the CRN Site ER.

The tours, discussions, and document reviews conducted during the audit covered a wide range of environmental matters as presented in the audit plan. These activities assisted the review team and TVA in resolving many of the information needs that were outlined in the plan. For items that the review team was not able to resolve through document reviews and audit discussions, TVA submitted information to the CRN ESP docket, supplementing its ESP application to provide the necessary information for the review team to make impact determinations in the EIS.

Table 1 of Appendix A to this report presents a list of the review team members participating in the audit and the EIS review areas that constituted the scope of the audit. Table 2 of Appendix A presents a list of TVA staff and its contractors who participated in the audit. Representatives from other agencies and organizations participating in audit discussions at the request of the NRC are identified in Sections 4 and 5 which summarizes those discussions.

3.0 Audit Logistics

The audit consisted of two parts. The first part of the audit was held during the week of May 15-19, 2017, primarily at TVA offices at 400 Summit Hill Drive in Knoxville, Tennessee. In addition to discussions with TVA staff and their contractors and document reviews at the Knoxville office, staff participated in TVA led tours of the proposed CRN Site and surrounding areas, proposed locations for offsite transmission lines, and two alternative sites on the ORR in Oak Ridge, Tennessee. During the week, the review team also conducted several self-guided tours of the area and met with other Federal and state agencies in their local offices and at TVA headquarters. During the week, the socioeconomics reviewers conducted field tours and interviewed local officials and charitable organizations regarding economic and demographic conditions. Some of the review team members toured the surrounding area of alternative site Redstone #12

near Huntsville, Alabama. Table 1 of this report is a list of daily activities during the first part of the audit held in Tennessee. Section 4 of this report presents a list and summary of the tours that the review team participated during the week in Tennessee and Alabama. Section 5 of this report is a list and summary of all of the meetings and discussions that were held with other Federal and state agencies.

| Day | Summary of Activities |
|-----------------------------|--|
| Monday May 15 | Select review team staff participated in discussions with TVA (land use, aquatic ecology, socioeconomics and nonradiological health). Hydrologists met with Tennessee Department of Environment and Conservation (TDEC). Historic and cultural resources staff met with Tennessee Department of Archaeology (TDOA) and the Tennessee Historical Commission (THC) staff. |
| Tuesday May 16 | TVA held an entrance meeting at 8:00 AM. A majority of the staff representing most EIS review areas participated in discussions with TVA together with staff from select Federal and state agencies. Staff covering socioeconomics and environmental justice (EJ) met with various state and local agencies and other organizations offsite. |
| Wednesday May 17 | The review team and TVA staff participated in tours of the CRN site, alternative sites ORR #2 and ORR #8, and offsite areas. Staff covering socioeconomics and EJ met with various state and local agencies and other organizations offsite. |
| Thursday May 18 | Some of the review team members participated in a tour of the proposed underground transmission line. Staff for the remaining EIS review areas participated in discussions with TVA (fuel cycle, transportation; alternative systems and other review areas with remaining items not covered earlier in the week). Staff covering socioeconomics / EJ met with various state and local agencies and other organizations offsite. Project leads and managers discussed the status of information needs. |
| Friday May 19 | Project leads and managers conducted Part 1 close out discussions and held a status briefing with TVA. Socioeconomics / EJ staff traveled to Alabama to observe the area around Redstone Arsenal. |

Table 1. Summary of Daily Activities During Part 1 of CRN Environmental Audit

The audit plan outlined 150 information needs that the review team planned to cover during the audit. These were organized into 14 categories, which generally align with the EIS review areas presented in Table 1 of Appendix A. During the first part of the audit, the number of distinct information items increased to 158 due to the need to break down some of these into smaller parts to facilitate their resolution. One additional item was added in the nonradiological health review area, bringing the final count to 159. A status briefing was held on the morning of May 19 to ensure there was a common understanding between the review team and TVA as to the status of the information needs as the group prepared to transition to the subsequent phase of the audit. During this briefing, the NRC informed TVA that the review team was able to resolve 69 information items during the first part of the audit without the need for additional

applicant submittals. Of the 90 information needs remaining, 68 of those required additional action by TVA, either to submit information to the docket or to provide additional supporting information for examination by the review team. The NRC further stated that for the remaining 22 items, the review team would continue to examine supporting documents already provided and conduct internal deliberations before determining whether the item was resolved or if further action would be requested from TVA. NRC staff emphasized that although the review team had not at this time identified the need for any formal requests for additional information (RAIs), this did not preclude future identification of the need for this action.

The second part of the audit consisted of continued examination of supporting documents (available either publicly or through TVA's electronic reading room (ERR)), review of supplemental submittals by TVA to the CRN ESP docket, follow-up teleconference audit discussions, and additional interactions with other agencies. Due to the large number of information needs, the audit was extended beyond the originally planned closure date. The audit closed on August 11, 2017. During the second half of the audit, the staff was able to resolve and close 30 additional information needs through its continued interactions with other agencies and review of supporting documents, resulting in a total of 99 items closed without the need for supplemental submittals from TVA. Of the 60 information needs requiring additional information to be submitted to the docket, TVA provided information in its supplemental submittals sufficient to close 57 of these, leaving three items requiring post audit submittals. At the time of this report, TVA has provided the information to close the remaining three information needs and the review team has not identified the need for any RAIs to provide the necessary information to determine environmental impacts.

Section 6 of this report provides a narrative summary of the review team's information gathering through audit activities and Appendix B presents a tabular summary of the resolution for the information needs that were identified in the audit plan.

4.0 Tours

4.1 CRN Site Tour

On the morning of May 17, most of the review team members along with TVA staff and a representative from the Environmental Protection Agency (EPA), Larry Long, toured the CRN Site. Specific tour stops included: the former site of the now dismantled meteorological tower, the locations of an aquifer pump test, the proposed intake, the proposed discharge, the proposed barge landing, the old Clinch River Breeder Reactor (CRBRP) Site, and proposed storm water retention area. Cross-cutting items of interest related to the remaining excavation for the CRBRP were discussed.

Other points of interest pointed out by TVA staff included the following:

- the 161-kV transmission line that would need to be moved east to avoid the proposed main plant area,
- the wells used for the groundwater pump test (for characterizing aquifers in main plant area),
- the location of the crane pad left in place after the CRBRP construction, and

- the proposed locations of the powerblock may overlap portions of the remnant CRBRP excavation.

Noteworthy items specific to individual resource areas are discussed in Section 6 of this report.

4.2 Alternative Sites Tour (Sites ORR #2 and ORR #8)

In the afternoon of May 17, TVA staff led many review team members on a tour of nearby alternative sites to provide an orientation of the topography and potential indicators of prehistoric and historic land use. The review team learned that if TVA were to site on ORR land, the land would be transferred out of DOE ownership and into TVA ownership. In addition to the known Happy Valley Construction Camp, a Cold War Anti-Aircraft Artillery Site had been located on site ORR #2, but had been constructed over by water towers.

As part of the tour, the review team viewed historic sites en route to site ORR #8. The sites consisted of a historic “grave house”/grave marker and foundations/ stairways associated with historic land use prior to ORR being established in the 1940s. While neither of these historic sites were located at site ORR #8, seeing these provided the team with improved perspective on the types of historic and cultural resources that might be encountered at both alternative sites visited during the tour.

The topography of ORR #8 was noticeably more hilly than the CRN Site. Although road access to the sites would need to be constructed, both sites were in close proximity to nearby highways. Both ORR #2 and ORR #8 are crossed by existing 161-kV transmission lines; a new plant could be looped in onsite at both sites (similar to the CRN Site). These existing corridors could be used for placing a buried 69-kV line. The corridor crossing ORR #2 ties into the Bethel Valley Substation; the corridor crossing ORR #8 does not tie directly to the Bethel Valley substation; however, it crosses other existing transmission and/or road corridors that go to the Bethel Valley substation. Neither ORR #2 nor ORR #8 were crossed by 500-kV transmission lines.

4.3 Existing Stormwater Retention Pond

Immediately following the tour of the CRN Site (Section 4.1), a few review team members were given an extended tour of the large existing stormwater pond, visible from a plateau west of the remnant CRBRP excavation. TVA staff noted that future site drainage plans would use the existing pond locations, but that all ponds would be redesigned and rebuilt to accommodate runoff from the future plant design. The existing pond was used as an example of typical pond construction: an excavation with an impoundment structure on the downstream side, a large culvert through the impoundment structure, and a culvert carrying the discharge to the river.

4.4 Radiological Tour

Concurrent with the alternatives site tour (Section 4.2), TVA led a small group of review team members to tour points of interest related to radiological health and accident analyses. The tour focused on locations related to calculating potential impacts from routine emissions and postulated accidents, and the methodology TVA used in

identifying these locations. Tour stops included the “nearest” residence, garden, and beef cattle considering the worst case wind direction. Of note is that these locations are at a slightly higher elevation than the CRN Site, and that no milk cattle or goats were found within a 5-mi radius. Other stops included nearest boat ramp and accessible recreation area. The tour also covered select environmental radiological monitoring locations and the basis for choosing these spots. This tour was helpful in providing context and understanding in the assessment of impacts from low-level routine radiological emissions and postulated accident releases.

4.5 Transmission Line Tour on Oak Ridge Reservation

On the morning of May 18, TVA staff led review team members on a tour covering property on the ORR managed by Oak Ridge National Laboratory (ORNL). The tour included a stop at the Bethel Valley Substation, where TVA staff described the planned expansion (adding 40 to 60 ft to the west), equipment required for interconnections, and related construction activities. A second tour stop was at the location where the existing 500-kV transmission line crosses Highway 95; the proposed 69-kV buried line would be placed within this 500-kV corridor. TVA staff used the overhead towers, conductor, and jumpers of the existing line to illustrate their description of uprating and reconductoring activities that would be needed at various offsite locations. TVA staff also demonstrated use of a “sensitive resource area” map overlay to determine areas for further survey if such areas could not be avoided by future transmission installation or upgrade. Participants hiked west along a gravel access road within the transmission line corridor to view a perennial stream that would be disturbed during placement of the 69-kV underground line. The stream banks were covered in heavy brush, but appeared to be minimally incised. The valley sides were gently to moderately sloped. The transmission line would be shallowly buried and it appears that it could be constructed using conventional construction techniques.

4.6 Transmission Line Tour, Knox-Volunteer Line

In addition to tours led by TVA staff, review team members also participated in self-guided tours of areas of interest with public access. In late afternoon on May 16, review team members traversed the current routing of the one transmission line identified in the ER as likely to be reconstructed, which could include tower replacement or other activities that could result in ground disturbance and land-use changes or other related impacts. The tour included eight stops at representative points along the 12.5 mi corridor identified in the ER. These access points included residential areas, parklands, commercial areas, and largely undeveloped areas. The group observed baseline conditions for land use and terrestrial ecology resource areas. For land use, these conditions included residential road access that potentially could be interrupted during a reconstruction of the line, areas of potential clearing and grading (depending on the ultimate design of the line), and recreation area access that might be affected.

4.7 Geology Tour, Grainger County near Thornhill, Tennessee

In late afternoon on May 17, the review team hydrologists conducted a self-guided tour to improve understanding of the CRN Site geology by examining rock exposures of geologic units similar to those existing at the site. The group drove to a location in Grainger County to view road cuts along Hwy 25E with exposures of the corollary geologic units present at and in the vicinity of the CRN Site. The team members

stopped at three locations to examine the exposed rocks and take photographs. The first stop was near Copper Ridge, south of Indian Creek, where the Knox Group formations are exposed. The second stop was north of Indian Creek, near the location of Copper Creek Fault, where the Chickamauga Group formations are exposed. This was also the location of folded rock features and a small, well-defined thrust fault. Similar features were identified in the geologic characterization of the CRBRP excavation. The third stop was further north, along the Clinch River where Knox Group formations are extensively exposed. Examination of the rock face provided examples of extensive fracturing, which are evident both along and normal to the bedding planes. Preferential flow of water through fractures was observed. Evidence of some rock dissolution along fractures, particularly near the surface, is also apparent.

4.8 Socioeconomic / EJ Tour near Redstone Arsenal Site #12

Many review team members (including staff from the USACE) had participated in an on-base tour of the Redstone Arsenal Site #12 during pre-application readiness assessment activities; however, not all resource areas were represented on that tour. On May 19, review team members responsible for socioeconomics and EJ resource areas toured the area around Redstone Arsenal to examine demographic characteristics at the closest proximity to the site as base access restrictions would permit. Redstone #12 is located in close proximity to the western fence line of the arsenal. For about a half mile, single-family dwellings share a common boundary with the arsenal. There are two new (less than 10 years old) densely populated residential subdivisions (i.e., Riverwoods and Legacy Cove) directly adjacent to the western fence line or the Wheeler National Wildlife Refuge, which border the site. Several other recently added subdivisions are bordered on the east by Zierdt Road, south of Martin Road, in close proximity to the site.

Current access to Redstone #12 is via two-lane county roads approaching from the west, north, and south, into Gate 7 (Martin Road) on the western edge of the base. Zierdt Road is a narrow two-lane route with limited shoulders that serves as the principal egress for the new subdivisions contiguous to the arsenal property. Based on the improvements being suggested at the CRN Site, these roads would likely require upgrades to handle the projected construction traffic.

The locality in closest proximity to Redstone #12 is Triana, Alabama, a small town with a mix of older established modest homes on large lots, and large subdivisions of new modest homes on small lots. Triana provides access to both Indian Creek and the Tennessee River. Indian Creek provides the closest public access to the likely outfall location of a plant located at the site. While driving these areas during the middle of the day, no potential subsistence activities or other activities which might indicate a resource dependency were observed.

The Triana, Alabama census block groups flag as low income and also appear to be of lower income households compared to areas closer to Huntsville. However, the team observed, and subsequently confirmed, the subdivisions bordering the area contain many high value homes compared to other housing in the area. No specific environmental justice impact pathways were observed. It is doubtful that any traffic impacts would extend to the south of the Gate 7 entrance to the base, thus the Triana area likely would not experience traffic impacts.

The team observed that the site itself is only large enough for the power block and major facilities, and that other facilities and laydown areas, etc., would be located in previously disturbed areas (including gravel and paved areas) elsewhere on Redstone.

5.0 Agency Meetings

5.1 Tennessee Department of Environment and Conservation (TDEC), Division of Remediation

On May 15, review team hydrologists and the NRC environmental project manager met with staff from TDEC's Division of Remediation and from the Office of Environmental Management at ORR (OREM) at TDEC offices in the city of Oak Ridge. Participants were as follows:

TDEC: Kristof Czartoryski and Eddie Worthington

OREM: Dennis Mayton

NRC / PNNL: Tamsen Dozier, Mohammad Haque, Dan Barnhurst, Philip Meyer

Topics discussed with TDEC and DOE-OREM included the history and current status of investigations of Bethel and Melton Valley groundwater quality, with an emphasis on the issue of potential offsite contamination from ORR activities. Discussion included the following specific topics.

- General hydrogeology of the local valleys were described.
- TDEC presented the history of waste disposal and groundwater contamination. Most waste disposal was in shallow disposal areas, but the hydrofracture grout disposal was at depths of greater than 700 ft below ground surface (bgs).
- The current ORR groundwater strategy includes development of a new regional groundwater model (approximate dimensions of 10 x 25 miles [mi]). Although the model has undergone some calibration, it is not expected to be operational until late summer 2018.
- Onsite and offsite groundwater-monitoring locations were identified. TDEC staff described their process of sampling offsite domestic wells and providing well owners with an opportunity to review the analytical results for their wells with TDEC staff.
- Regarding the potential for offsite contamination of groundwater, DOE is taking a risk-reduction approach by surveying offsite domestic groundwater users and offering to pay for these users to be connected to the local water utility, and to pay for their water costs (while the current users own their properties). Currently, DOE has offered utility water to residences in Melton Valley and in the Hood Ridge area. Not everyone has accepted the offer.
- The potential effect of the CRN Site aquifer pump test (conducted in March 2014) on water quality and contaminant concentrations measured in groundwater wells in the Hood Ridge area was discussed. TDEC staff stated that they generally saw concentrations increase during pump test, or new constituents appear in the well water that were not there before or after. NRC staff were directed to look at the 2014 monitoring information published in the annual environmental monitoring report (published in 2015).

- TDEC and DOE staff identified reports describing offsite groundwater monitoring. There is a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) report being published by DOE dealing directly with offsite groundwater; this report is currently under review and is not publicly available. TDEC provided the review team with a copy of the work plan, which is public. The review team participants were referred to the annual DOE remediation effectiveness reports (available from the DOE information center) and the annual TDEC environmental monitoring reports (the next update, due in October 2017, will cover monitoring from January 2016 to June 2017).
- TDEC and DOE staff described the history of monitoring for offsite contamination. Melton Valley picket well data was first obtained in 2005; most of these wells were installed at 500 ft bgs. In 2010 offsite wells were installed; the first samples, in 2011, picked up some contaminants in initial large pumping. Hood Ridge monitoring was initiated in 2014 in residential wells, all drilled to about 350 to 500 ft bgs. TDEC staff indicated that domestic wells in the area are typically 300 to 500 ft deep with a yield of 3 to 10 gpm. Wells at 300 ft deep are likely yielding water at about 200 ft. Wells at 500 ft are likely yielding water at 350 ft or so. These are open boreholes, with extra depth provided for storage so that the wells do not run dry.
- TDEC stated that it will require some kind of remediation for well 422-L, which has petroleum product in it and cannot just be abandoned.

5.2 Department of Energy, Oak Ridge Environmental Management (OREM)

In concert with the May 15 meeting at TDEC's offices in Oak Ridge (described in Section 5.1), the review team hydrologists, TDEC and OREM staff participated in a tour of various sites within Melton and Bethel Valleys, both on the ORR and offsite. Participants included:

TDEC: Eddie Worthington

OREM: Dennis Mayton and Ben Williams

NRC / PNNL: Mohammad Haque, Dan Barnhurst and Philip Meyer

Tour stops included the following locations and observations.

- White Oak Dam, which impounds White Oak Lake on the ORR is the structural support for Highway 95 over White Oak Creek; DOE monitors flow of the creek at this location. There is a 2 ft head difference between White Oak Lake and the downstream sedimentation basin. The sediment control dam is located at the mouth of White Oak Creek. Those on the tour were unable to view the dam, but were told that there is typically a 2 ft head difference between the sedimentation basin and Clinch River. These dams serve to reduce the transport of contaminated sediments to the Clinch River. DOE staff stated that during a flood in the sedimentation basin, the elevation in the basin and the Clinch River would be the same, thus limiting flow velocity; water would flow over the sediment control dam, which is an obstruction that

essentially provides no control of flow. DOE staff stated that they believe significant scouring and transport of sediments to the Clinch River during a flood is unlikely.

- DOE monitors a set of sentinel wells located along the ORR side of the Clinch River in the Melton Valley. Those on the tour were unable to view the locations of these wells due to a locked gate.
- Offsite groundwater-monitoring locations in the Melton Valley were toured. These included some of the residences with domestic wells that were sampled, as well as DOE-installed groundwater-monitoring wells located off Upper Jones Road. The review team also toured offsite residences in the Hood Ridge area.
- The review team toured DOE facilities in the Bethel and Melton Valleys. This tour included drive-by of many of the solid waste storage areas located along White Oak Creek in the Melton Valley.

5.3 Tennessee Department of Archaeology (TDOA)

On May 15, the review team archaeologists met with staff from the Tennessee Historical Commission (THC) and TDOA at TDOA offices in Nashville, TN. Participants included:

THC: David Calease
TDOA: Jennifer Barnett
NRC / PNNL: Jennifer Davis, Ellen Kennedy

Discussions focused on the following points related to the National Historic Preservation Act of 1966, as amended (NHPA) Section 106 and NEPA review process for an ESP of the CRN Site:

- The roles of TVA and the NRC, and how NRC will use the EIS process to comply with NHPA Section 106 and NEPA;
- TVA's executed Programmatic Agreement (PA) with the THC and United Keetoowah Band of Cherokee Indians in Oklahoma;
- Neither TDOA nor THC expressed any concerns about NRC's Section 106 review process, the PA, or TVA's process for amending the area of potential effects as project plans are finalized;
- The review team participants also confirmed with TDOA and THC (i.e., Tennessee State Historic Preservation Office (SHPO)) that THC no longer provides a list of Tribal consulting parties on its website;
- TDOA clarified that the THC no longer uses the TN NHPA Section 106 checklist and it is no longer available on their website; and
- The review team participants reviewed TDOA and THC's project file information and made copies of relevant TVA and THC correspondence pertaining to the CRN Site ESP.

During their visit to TDOA offices, the review team archaeologists also met with Paige Silcox, TDOA, to review and discuss archaeological site records and gather field report information. The review team examined files, maps and relevant site forms and reports

for the CRN Site, Melton Hill Dam area, and the alternative sites. The review team also visited THC offices and met with Peggy Nickell, THC, to review architectural resources files and maps and obtained copies of relevant architectural resource inventory files for the CRN Site, Melton Hill Dam area and the Oak Ridge alternative sites.

5.4 U.S. Fish and Wildlife Service (USFWS)

On May 16, members of the review team met with USFWS at TVA offices in Knoxville in the company of TVA staff. Participants included:

USFWS: Dustin Boles
USACE: Mark McIntosh and Casey Ehorn
NRC / PNNL: Peyton Doub, Jim Becker, Rebekah Krieg, and Kim Leigh
Numerous staff from TVA and its contractors were also in attendance.

Discussions focused on:

- Previous written communications between USFWS and TVA and NRC;
- How TVA would identify most of the Federally listed species that should be evaluated in the biological assessment (BA) and in the EIS to the satisfaction of USFWS;
- Other species that the BA should consider that would be identified by USFWS;
- How Endangered Species Act (ESA) consultation is separate and distinct from the NEPA process;
- That NRC would take the lead in the ESA consultation and how USFWS wanted to conduct business with the EIS review team;
- Building and operation activities the BA should consider;
- The effect determination in the BA;
- Obtaining additional bat data for the barge traffic area; and
- Explanations of the bat data already provided by TVA.

5.5 Tennessee Department of Environment and Conservation, Division of Water Resources

On May 16, members of the review team met with staff from TDEC's Division of Water Resources, in the company of TVA staff, at TVA offices in Knoxville to discuss issues related to CRN Site water use and water quality regulation and permits administered by TDEC. Participants included:

TDEC: Bob Alexander, Steven Brooks, Robert Ramsey
USACE: Mark McIntosh
NRC / PNNL: Mohammad Haque, Dan Barnhurst, Philip Meyer
Numerous staff from TVA and its contractors were also in attendance.

During the meeting, the following topics were notable:

- Permitting is staffed out of the TDEC Nashville office, with inspection staffed out of the field offices (Oak Ridge for the CRN Site).
- For stormwater management, TDEC would likely ask TVA to follow quantity-limiting green methods as described in their stormwater program. Water-quality requirements would be part of the National Pollutant Discharge Elimination System (NPDES) permit. A Tennessee multi-sector permit may be applicable.
- The NPDES stormwater construction permit would regulate any dewatering discharges and any potential impacts of groundwater dewatering on wetlands; however, no permit would be required for the water withdrawal. TDEC staff stated that water is pumped out of every fossil plant basement in the region, so operational dewatering may be of concern to some parties (including discharge of the water). The review team noted that no operational dewatering is described in the ER.
- Operational discharges, including likely mixing zone characteristics were discussed. TDEC would expect an analysis from TVA (and would expect to see that in the EIS), but it was stated that TDEC generally thought the 400 cubic feet per second (cfs) bypass would improve conditions for the discharge. TDEC has requirements for mixing zones and they directed the review team to the TDEC website, but stated that these are consistent with the conditions evaluated in the ER.
- An Aquatic Resource Alteration Permit (ARAP) applies to any construction from top of the bank into the river, or changes that would affect the aquatic habitat. The permit covers wetlands issues and would include the water withdrawal, but it does not cover the discharge. TDEC staff directed review team hydrologists to the TDEC website for the list of covered activities. This permit would be part of the Clean Water Act Section 401 Certification.
- Water withdrawal registration is mainly directed at smaller streams and reducing downstream impacts. Registration would apply to the CRN Site, and requires annual reporting to state of water withdrawal volumes.
- Regarding water-quality monitoring, TDEC provided a contact for current monitoring and stated that the best written source of information is the remediation effectiveness reports published by DOE. Regarding sediment monitoring, TDEC staff stated that this may be required for site permitting, but it is possible the state would rely on DOE data.
- TDEC staff discussed concern for the bioaccumulating contaminants, polychlorinated biphenyls, chlordane, and mercury with regard to the state's anti-degradation standard. The general permit is not applicable for contaminated sediment; therefore, TDEC anticipates that TVA would need an individual permit.
- TDEC staff informed the review team that the Watts Bar Interagency Working Group would be involved at the ARAP permit writing stage and would be specifically concerned about resuspension of contaminated sediment. The Clinch River/Poplar Creek Record of Decision (1997 Superfund action) covers the Clinch River adjacent to the CRN Site. TVA staff indicated that they have interacted with this group more broadly, but not specifically with respect to the CRN Site ESP.

5.6 City of Oak Ridge, Public Works Department

On May 18, the review team hydrologists met with staff of the Oak Ridge Public Works Department at that agency's office in Oak Ridge to discuss potable water supply and wastewater treatment for the CRN Site. Participants included:

City of Oak Ridge: Shira McWaters, Scott Jackson, Rick Irwin, Brian Mills, Roger Flynn, and Michael Brown
NRC / PNNL: Mohammad Haque, Dan Barnhurst, and Philip Meyer

City Public Works Department staff provided several maps of city water and wastewater infrastructure to the review team. The following topics were notable.

- The city obtains water from the Melton Hill Reservoir above the Melton Hill Dam. City staff stated that the current distribution system is probably the limiting factor for providing water to the CRN Site. The city operates a couple of tanks (4 million gallon total capacity) located north of Bear Creek Road, but the current refill rate is limited. There is land for a couple of large facilities in the East Tennessee Technology Park (ETTP) and they anticipate some significant water demand in the area at some point in the future. Currently, the city anticipates that construction water use could be served from these tanks (i.e., rate of refill would be sufficient given the current demand).
- The small water-treatment plant near the river in the area of the CRN Site is not currently active and would require a major upgrade to put it back in use for domestic service. This water-treatment plant has an intake on the Clinch River and is not served by the city's existing source of water.
- The city currently has a 24 in. main water line to serve the ORNL and DOE's Y-12 National Security Complex. There has been talk of extending this line west, which could potentially serve the CRN Site, but there are no current plans to do this. City staff stated that ORNL has responsibility for its own distribution. On a related note, city staff stated that ORNL has interest in additional water.
- City staff confirmed that there is an existing water line to the CRN Site. City staff stated that they are not sure that they would trust that line (i.e., construction and operational use may require that the line be rebuilt/upgraded).
- The Rarity Ridge subdivision (now called The Preserve at Clinch River) on the west side of the Clinch River is within the city limits and is served water by the city. The Rarity Ridge wastewater-treatment plant serves this subdivision, ETTP, and the Horizon Industrial Park. Wastewater from the CRN Site would be pumped under the river to the Rarity Ridge plant. Treatment capacity of the plant is sufficient to accommodate the CRN Site needs, but the existing pumping capacity (100 gpm) would need to be increased. The existing pumping facility is located on DOE property off Bear Creek Rd. and any construction would require a permit from DOE. City staff stated that they do not see any issues with increasing the pumping capacity or obtaining the required permit.

5.7 Tennessee Department of Transportation (TDOT) Region 1

On May 18, the review team staff covering socioeconomics met with staff from the Tennessee Department of Transportation (TDOT) to discuss TVA's plans to mitigate traffic impacts associated with access to the site during the construction phase. Participants included:

TDOT: Daniel Oliver (Director of Project Development) and John Barrett (Civil Engineer Manager, Region 1)
NRC/PNNL: Dan Mussatti and Dave Anderson

The following topics were notable.

- The TDOT staff indicated that the Region 1 office would handle the permitting for any road improvements associated with the CRN project.
- In reviewing the ER figures, the TDOT staff indicated that the situation appears similar to the intersection of Highway 11 and Highway 66 in Rogersville, Tennessee. TDOT expects that standard permitting would suffice and noted that there would be a process for obtaining controlled access modifications to Highway 58 that TVA would need to follow.
- Safety mitigation for preventing dangerous left turns likely would be required. Bridges in the area may need review for traffic loads. Highway 95 and Bear Creek Road would need agency review and coordination with the City of Oak Ridge.
- The review team participants asked about EJ populations and the TDOT process for identifying and addressing them. TDOT indicated that no EJ populations reside in the proposed area and, as such, there are no related EJ concerns.

5.8 City of Oak Ridge, City Manager's Office

On May 16, the review team socioeconomics staff met with staff from the City of Oak Ridge to discuss the CRN project and the NEPA review. Participants included:

City of Oak Ridge: Mark Watson (City Manager), Amy Fitzgerald (Government Affairs), and Jordan Clark (Senior Planner)
NRC / PNNL: Dan Mussatti and Dave Anderson

The city is supportive of the potential CRN Site development, but raised several issues they feel should be acknowledged or factored into NRC's review.

- The city boundaries entirely envelop the CRN Site and the ORR, and the city bridges the border of Anderson and Roane Counties.
- This geography creates challenges to the stability of revenue to the city. TVA and DOE are able to make payments in lieu of taxes that are far below what market property tax rates would be if the land were in private ownership. As time goes on, these below market tax rates have an increasing effect, as city and county jurisdictions surrounding Oak Ridge are receiving increasing revenues in relative terms.

- Housing is depreciating in Oak Ridge, but appreciating everywhere else. The housing stock in Oak Ridge has been limited for many years, as much of the available space to build within the city was developed at the time the city was created during World War II. Thus, small houses originally designed to be temporary quarters for Manhattan Project staff have remained the principal stock. This stock is increasingly being converted to rental housing, as the original residents move out or pass on. This has led to a general deterioration in the quality of local housing as rental housing is typically less carefully maintained than owner-occupied housing.
- The lack of middle income housing keeps a large number of ORR workers from locating in Oak Ridge, thus the city has become a limited service hub for ORR workers needing food and fuel along commuting routes. This tends to attract lower-income service and retail industry workers who can afford the aging and increasingly available rental housing stock and keeps the property tax base low relative to nearby communities.

Officials expressed concern with economic models that estimate impacts based on the economic region (using widely accepted standard approaches) and which do not distinguish or discuss the local impacts on the City of Oak Ridge. They estimate that 75 percent of the economic impact would accrue to the other counties and cities of the economic region due to the reasons already discussed. What would seem to be a generally positive economic impact would not be quite so noticeable in Oak Ridge.

It was noted that recent economic development strategies have resulted in landing additional private development in the city – providing some economic diversity and opportunity for revenue enhancement. These include the following:

- New regional airport (Metropolitan Knoxville Airport Authority)
http://www.oakridgeairport.org/Planning_Studies.html;
- CVM Technologies (makers of “3D ink” for 3D printing);
- LeMond Composites (Greg LeMond’s venture to make bicycle and rowing composites) spinoff from ORNL;
- Knox County overflow housing has provided a market driver to develop middle-market housing in Oak Ridge (move-in and build housing); and
- Ongoing construction of DOE’s Uranium Processing Facility, employing 1200+ workers and growing.

5.9 Other Entities Contacted

To gain additional understanding of socioeconomic conditions in the region of the proposed action, the review team socioeconomic staff met with a variety of other entities in the area, including providers of community services, social services providers, economic councils and others. Appendix C provides the field notes from those interactions.

6.0 Summary of Audit Activities and Issues Addressed by Technical Discipline

As described in Section 3 of this report, the review team participated in a variety of activities designed to meet audit objectives. In addition to the tours and agency meetings outlined in Sections 4 and 5, the team met with TVA staff and contractors to discuss the information needs as outlined in the audit plan which had been presented to TVA in advance. TVA had the appropriate staff available in person and on the phone to address the review team's information needs. TVA's responses to the review team included verbal answers to questions, references to existing documents, placing documents in the ERR for additional examination by the review team, development of new responses during the audit as a result of the discussions (which were provided to NRC in submittals to the CRN Site ESP docket), and agreements to provide additional information in future submittals.

Appendix B presents a tabulated summary of how the information needs presented to TVA in the audit plan were addressed during the audit. Presented below is additional information concerning review team activities, observations and discussions in each information need category (i.e. EIS review area).

6.1 Accidents

The review team met with the TVA staff and contractors involved in developing the ER section involving postulated accidents and projected impacts. Areas of particular focus included vendor provided probabilistic risk assessment (PRA) information, source terms, MACCS2 input values and assumptions (e.g., projected 2067 population, economic values, site use data, meteorology), and the rationale for applying evacuation assumptions based on a 2 mi Emergency Planning Zone (EPZ). One key document discussed was the Nuclear Energy Institute's position paper on SMR source terms.

There were 17 information needs presented and discussed during the audit (item ACC-12 was divided into two separate discussion items – see Appendix B). Sixteen of these items were addressed and resolved as a result of audit discussions. The remaining item, information need, ACC-11, is related to TVA's request for an exemption for the size of the EPZ.

TVA has submitted EPZ size exemption requests in Part 6 of the ESP application (exemption requests include those reliefs from regulatory requirements resulting from a potential site boundary EPZ in addition to a 2 mile EPZ size). In their ER, TVA applied a 2-mi EPZ in performing their population dose calculation from a postulated severe accident, while current NRC regulations require a 10 mi EPZ. Whereas the NRC will assess the exemption requests under the safety review, the NRC staff's environmental analysis of the EPZ exemption requests is under further evaluation. While further staff deliberations may be necessary relating to this issue, the staff is not requesting additional information from the applicant. Therefore, ACC-11 is considered closed for the audit.

6.2 Aquatic Ecology

The review team met with the pertinent TVA staff and contractors to discuss the five aquatic ecology information needs. Three items were addressed through audit activities and information provided by USFWS (see Appendix B). TVA staff responded to specific

and general questions related to sampling studies, the ER and the potential impacts to aquatic biota and habitats from building and operating the CRN project. A brief discussion was held regarding TVA interactions with the USFWS regarding federally listed important species and habitats. Additional discussions related to federally listed important species and habitats included USFWS staff (see Section 5.4). Information item AE-3 was closed following receipt of a letter dated July 20, 2017, from the USFWS addressing the regarding federally listed important species and habitats (ADAMS Accession No. ML17205A342).

Items AE-2 and AE-4 have been addressed by TVA in submissions to the CRN ESP docket. To address item AE-2, TVA discussed the process used to minimize the impacts to aquatic species and habitats during placement of new transmission lines (including underground lines) or work on existing transmission lines. TVA has provided to the docket a brief description of how the Transmission Capital Project Plan addresses avoidance and minimization of aquatic impacts (included in ADAMS Accession No. ML17206A091). The synopsis presents methods to minimize the impact on streams.

6.3 Alternatives

6.3.1 Alternative Sites

The review team met with the TVA core team who authored the Alternatives Sites section of the ER for the CRN Site ESP Application. TVA's team included staff from McCallum-Turner who helped author the Revision 2 TVA Site Selection Report (siting study) dated November 2016 (ADAMS Accession No. ML16350A429). Six information needs related to alternative sites were presented and discussed during the audit (items Alt-1 through Alt-5 covered alternative sites and Alt-4 was divided into two separate discussion items during the audit – see Appendix B). Items of discussion included the approach TVA employed to select its preferred site, minimum sizing requirements, population density, coordination with USACE regarding any future review to determine the least environmentally damaging practicable alternative, and site selection scoring for topography and water supply. Five information needs were closed as a result of audit activities.

For Information Need Alt-1, TVA clarified that the alternative siting process they employed followed an approach where the preferred CRN Site was selected, and was then followed up with an alternative site selection process, which included the CRN Site for comparison. In a submittal dated July 7, 2017 (ADAMS Accession No. ML17206A091), TVA presented additional information related to the alternative site scoring and ranking process that satisfactorily addressed portions of Information Need Alt-1.

The remaining portion of Information Need Alt-1 relates to impacts associated with additional land that would be needed outside the Redstone Arsenal alternative site #12 boundary for facilities such as construction and outage laydown areas, etc. TVA provided a reconnaissance level assessment of the potential impacts associated with this additional land in the vicinity of Redstone #12 in a submittal dated August 01, 2017 (ADAMS Accession No. ML17234A003).

6.3.2 Alternative Systems

The review team and TVA staff and contractors discussed the information needs related to alternative systems. Information Need Alt-6 presented review team inquiries related to alternative systems and this was divided into three distinct information needs to facilitate discussion points at the audit (Appendix B). TVA provided an expert to discuss the design alternatives and clarified some confusing language in the ER, informing the review team that it used the terms "wet natural draft cooling tower" and "natural draft cooling tower" synonymously in the ER. TVA provided an analysis of the heat-dissipation system alternatives in response to the information need, and stated that the analysis was based on information from public documents. The review team examined these public documents and determined that they were adequate to resolve the information needs.

6.4 Cultural and Historic Resources

During the May 17 site tour, the review team was able to view archaeological resource 40RE124 (Late Woodland period mound site) and noted that this site will not be impacted by proposed project activities. En route to the discharge location, the integrity of the perimeter road was discussed and examined. The road likely dates to the Manhattan Project and future modifications are potentially necessary. At the discharge area, the review team discussed with TVA the potential impacts to archaeological sites, along with how those sites will be addressed by its PA described in Section 5.3. Discussions also included TVA's protective measures for archaeological resources during transmission line maintenance activities and the internal review process for assuring their protection. While there were no National Register of Historic Places (NRHP)-eligible archaeological resources located at the intake location, it was noted that deeply buried archaeological deposits are likely present in this area. Per the stipulations in its PA, TVA staff confirmed that additional investigations would occur in this area prior to ground disturbing activities commencing. No archaeological sites will be impacted in the holding pond because this area was previously disturbed during construction of CRBRP project.

There were nine information needs presented and discussed during the audit (items CR-1 and CR-5 were divided into four separate discussion items during the audit, see Appendix B). Two of these items were addressed and closed as a result of audit discussions and seven items were addressed in submittals to the CRN Site ESP docket. During discussions with TVA, the review team developed an understanding about how the PA would apply to possible impact areas where deeply buried archaeological deposits are likely to occur. The review team confirmed that this is an issue TVA will be addressing through the implementation of stipulations identified in the PA.

There is a potential issue with secondary impacts to archaeological sites located downstream as a result of modifications to Melton Hill Dam and increased water flow. TVA confirmed that when impacts associated with modifications to the dam are understood, it would address potential impacts to downstream archaeological resources as part of the PA. There is no additional information needed at this time, but the review team confirmed that this is an issue TVA will be addressing through the implementation of stipulations identified in the PA.

TVA confirmed that, as federal land managers, they have a robust cultural resources compliance program. TVA has cultural resources processes and programs in order to ensure compliance with NHPA, NEPA, the Archaeological Resources Protection Act of 1979 (ARPA), and the Native American Graves Protection and Repatriation Act (NAGPRA), etc. Review team members were able to examine the related program material and spoke extensively with TVA staff involved with the ARPA and NAGPRA programs. As a result of review team discussions during the audit, TVA provided a summary of its guidance on the docket (CR-06).

6.5 Cumulative Impacts

The review team did not identify any information needs relative to cumulative impacts. However, team members met with TVA staff to discuss NRC's process for determining cumulative impacts and methods of identify other projects in the geographic area of interest around the project site and the alternate sites. TVA was not aware of any new projects that should be considered in cumulative impacts.

6.6 Hydrology

6.6.1 Groundwater

There were 17 groundwater information needs presented and discussed during the audit (HY-GW-3 was divided into two separate items to facilitate audit discussions). Thirteen of these items were addressed and closed as a result of audit activities and three items have been addressed in submittals to the docket. One item (HY-GW-15) had not been resolved at the end of the audit, but TVA had agreed to provide the requested information within 30 days thereafter (see Appendix B).

Information needs which were closed through the review of public documents (including the Site Safety Analysis Report from TVA's application) addressed groundwater recharge estimates, the conceptual basis for the groundwater flow and transport model, the applicability of groundwater characterization data from the ORR to the CRN Site, and the disposition of CRBRP wells. TVA also provided clarification of several site characterization descriptions in the ER.

TVA provided supplemental information on the docket addressing local groundwater use, including well locations, yields, and geologic units accessed. This supplemental information was consistent with the information the review team gathered during meeting with TDEC and DOE, discussed in sections 5.1 and 5.2 of this audit summary report. TVA also provided supplemental information removing language from the ER regarding the prevalence of groundwater wells that interact with surface water, stating that this issue is not applicable to the CRN Site. For the remaining item (HY-GW-15), TVA agreed to providing post-audit supplemental information on the docket to address an alternative conceptual model of groundwater flow that recognizes recent TDEC and DOE activities discussed during the review team's meetings with these agencies, and discussed with TVA at the audit. TVA's submittal should also address the potential effects of excavation dewatering during construction on existing offsite groundwater contamination and on nearby domestic groundwater users. NRC safety review staff participated by phone during discussions of some of the groundwater information needs because of the related information needs from an earlier safety audit.

For alternative sites, the review team discussed reconnaissance-level information on site differences in groundwater conditions, potential differences in impacts of excavation dewatering, and information on groundwater users within the vicinity of the alternative sites.

6.6.2 Surface Water

There were 17 surface water information needs presented and discussed during the audit. Six of these items were addressed and closed as a result of audit activities and ten items were addressed in submittals to the docket (see Appendix B). One item (HY-SW-11) had not been resolved at the end of the audit, but TVA had agreed to provide the requested information within 30 days thereafter.

Issues addressed at the audit included the characterization of long-term variability in Watts Bar Reservoir elevation and velocities at the CRN Site discharge location, the navigation and recreation use of the Clinch River near the site, and the required permitting (as described in the review team's meeting with TDEC in section 5.5 of this report). Docketed supplemental information provided by TVA included a revised description of the floodplain as part of updated procedures for floodplain management, a statement of reasonable assurance regarding availability of the plant cooling water supply during a drought (including for the alternative sites), descriptions of any required dredging and disposal of materials from underwater excavation or dredging (given the potential presence of contaminated sediments), and an estimate of water use for the concrete batch plant. TVA agreed to providing post-audit supplemental information describing the White Oak Creek control structures and the potential for future radionuclide contaminant releases from the creek (e.g., during flooding) (HY-SW-11).

The review team also discussed hydrologic information needed for the alternative sites descriptions. TVA provided information on water resources affected by pipeline and transmission line construction, water users in the vicinity of the alternative sites, and a discussion of regulations applicable to the Wheeler National Wildlife Refuge.

6.7 Land Use

The review team met with the pertinent TVA staff and contractors to discuss the land use information needs. TVA staff responded to specific and general questions related to land use issues and transmission line activities. Issues addressed included but were not limited to land use history at the site, zoning, sensitive lands, prime farmland, and compatibility with surrounding land uses. There were 8 information needs presented and discussed during the audit. Two of these items were addressed and closed as a result of audit activities and six items required supplemental information to be provided to the docket (see Appendix B).

The review team conducted a self-guided tour of the Knox-Volunteer transmission line corridor segment (as described in section 3.6 of this report) and noted that a possible rebuild of this line could affect several land uses. This is the only segment of offsite overhead transmission line that TVA identified for rebuild in connection with the project. Residential road access could be interrupted. Commercial and recreation area access might be temporarily affected. As noted in interactions with TVA, the provisions of property easements disclose the potential for TVA to access and work in the corridor.

The impacts would be short duration and are not likely to alter the existing impacts from the initial construction of the corridor.

6.8 Meteorology and Air Quality

During the May 17 tour of the CRN Site, the review team visited the site of the now dismantled meteorological tower and discussed with TVA their plans for constructing a new tower prior to operations at the same location. The team observed that the vegetation remains largely as it did during tower operation (i.e. open field surrounded at distance by forest).

Following the tour, the review team held discussions with TVA and contractors covering the five meteorology and air-quality information needs (Appendix B). Further discussions were held regarding the meteorological tower which had been used for onsite meteorological measurements, including the structure of the tower, the instrument booms, and the sensor characteristics. Photos taken of the tower when it was still standing were provided showing the triangular lattice structure, guy wires and surrounding vegetation. TVA described the future meteorological tower at the CRN Site, which is expected to be very similar to the previous tower, with the exception that the total height for a future tower will be 60 m rather than 110 m. Monthly summaries of atmospheric stability were requested, which the review team examined.

Discussions surrounding the different modeling runs performed to support the ER provided clarity concerning the different exclusion area boundary distances that were used in the PAVAN and CALPUFF simulations. Mixing height data were also discussed, and the data source (from the 1980s) was confirmed. Monthly mixing height was not provided, but the team concluded it could be computed from the available daily data.

All information needs related to the environmental review were addressed as part of the audit and no additional information beyond that which has already been provided to the docket by TVA was requested.

6.9 Nonradiological Human Health / Nonradiological Waste

The review team met with the pertinent TVA staff and contractors to discuss the three information needs that had been presented in the audit plan and one additional item identified by team members after the audit plan had been finalized (Appendix B). Areas of particular focus included the estimates of sanitary and solid waste, the waste minimization plan, worker safety procedures, and noise. One item required a submittal from TVA to address the information deficiency. For NR-01, the review team requested estimates for sanitary waste and asked TVA to provide amounts generated at nearby Watts Bar Nuclear Plant that could be used as a bounding value.

Two information needs were met through review team's examination of supporting documents (NR-02 and NR-03). With regards to worker safety procedures, TVA provided numerous documents which the review team examined and determined to be sufficient to close the information need NR-03. Regarding offsite waste disposal, TVA provided a copy of their procedures for offsite waste disposal and their Waste Minimization Plan which the review team examined and determined to be sufficient to close information need NR-02.

After the audit plan had been finalized, the review team identified an additional information need regarding noise (NR-04). Discussions took place regarding the adequacy of the ambient noise assessment to represent ambient noise at suitable locations and conditions and regarding the PPE value for the noise level from the mechanical draft cooling towers. The review team determined that there was sufficient information in the ER and supporting documents.

6.10 Radiological Health

There were 12 information needs presented and discussed during the audit. Ten of these items were addressed and closed as a result of audit activities and two items were addressed in submittals to the docket (see Appendix B). The NRC and PNNL environmental staff have coordinated with NRC safety staff to obtain information from the earlier safety audits. During the audit, areas of particular focus included clarification discussions related to the routine emissions source term and adjustments made to it, methodology in computing the direct dose to construction workers, and bases for input assumptions for calculating doses to the public from the normal gaseous and liquid effluents using the GASPARE and LADTAP models. Discussions with TVA staff also covered cumulative radiological impacts.

There were two notable items that were clarified during the audit. The first clarification item (RH-06) was related to calculating the 50-mile population dose from drinking water. The TVA approach was to calculate a ratio between Clinch River versus Clinch River watershed drinking water usage, then applying that ratio to the current 50-mile population and then scaling that result to the projected population in 2067. The second clarification item (RH-09) was related to public receptors. TVA described that the nearest resident (to the southwest) is not the maximum exposed individual (MEI) location (to west northwest) due to prevailing winds. The nearest resident to WNW is the MEI location and was assumed to consume from the maximum garden and maximum beef cattle, both also to WNW, but not collocated with the MEI.

For two information needs related to the calculation of direct dose to construction workers and whether construction workers are considered “radiological workers” or “members of the public” (RH-3 and RH-4), TVA submitted a clarification of its methods and assumptions used to calculate construction worker dose.

6.11 Site and Technical Overview

The review team met with the TVA staff and contractors involved in developing the project overview and description for the ER to discuss site and technical overview information needs. Topics of particular interest that were addressed by TVA staff included excavation depth on site, water pipelines, concrete batch plant activities, stormwater management, plant water balance, and transmission system changes. TVA staff provided important clarifications regarding the source of water for the concrete batch plant (municipal water from the City of Oak Ridge) and for the plant ultimate heat sink (Clinch River arm of the Watts Bar Reservoir, via the plant demineralized water system), as well as the extent that offsite construction activities would occur within existing rights-of-way or previously disturbed areas.

There were 13 information needs presented and discussed during the audit. Three of these items were addressed and closed as a result of audit activities and ten items were

addressed in submittals to the docket. Nine of the docketed information need responses were sufficient to close the related information need, while responses related to spatial data (STO-6) required additional interactions with TVA to resolve after the audit was completed (see Appendix B).

6.12 Socioeconomics / Environmental Justice

The review team met with the pertinent TVA staff and contractors to discuss the two socioeconomic information needs (Appendix B). During the first part of the audit, TVA agreed to provide updated information being requested in information need SE-01 regarding clarifications of timing and size of peak staffing during construction. This information was received and the review team determined the information was adequate to close this information request.

Regarding information need SE-2, as a result of discussions with TVA, it was determined that the review team would conduct their own regional analysis to assess the local versus non-local project expenditure impacts from construction and operations. It was also determined that the updated information being requested regarding TVA's payments in lieu of taxes was publicly available and easily accessible to the review team.

The economic impact region for the CRN Site will be the four-county area suggested by TVA and confirmed by recognized local economic experts. It also is noted that this economic region may have characteristics that would cause a greater proportion of plant construction and operations expenditures to be made locally, as opposed to importing as would typically be expected.

The Redstone alternative site raises questions as the lands immediately adjacent to the Redstone Arsenal's fence line bordering the site were built up with residential subdivisions in recent years, making the area relatively densely populated. Roadway access to the western entry to the base likely would see substantial traffic impacts, without considerable upgrading and widening.

The tour of the four-county economic region did not reveal specific environmental justice concerns. While there are pockets of low-income and minority populations, no specific populations were encountered for which specific impact pathways are likely to be identified. No local subsistence or other resource dependent behaviors were observed.

6.13 Terrestrial Ecology

There were 24 information needs presented and discussed during the audit. Nineteen of these items were addressed and closed as a result of audit activities and five items were addressed in submittals to the docket (Appendix B). Discussions were held regarding the offsite underground 69-kV transmission line proposed for the CRN Site; the need for an offsite underground transmission line for the alternative sites; the offsite transmission lines that would be uprated, reconducted, or rebuilt; the need for offsite transmission line improvements for the alternative sites; and the need for additional land at Redstone to accommodate equipment laydown, parking, and other preconstruction activities. In addition to the site and alternative site tours, the review team participated in a TVA-led transmission line tour, a self-guided tour of the Knox-Volunteer line identified for possible rebuild, and a TVA-led tour of the stormwater retention ponds near the main plant area.

NRC and PNNL staff engaged USACE staff regarding wetland issues, including 1) the status of the jurisdictional determination (JD) for the CRN Site and Barge/Traffic Area (BTA); 2) the wetland permit type envisioned; 3) possible provision by the USACE of a preliminary JD and a conservative estimate of wetland impacts and conceptual mitigation; 4) differences in USACE and TDEC jurisdiction over wetlands and wetland impacts; and 5) needing a Section 10 permit to span wetlands with transmission lines.

The review team engaged USFWS regarding threatened and endangered species issues, including 1) the disposition of previous communications between USFWS and TVA and NRC (see TVA's September 2016 letter to FWS and USFWS's May 2017 letter to TVA); 2) ESA consultation as separate and distinct from NEPA; 3) NRC taking the lead on ESA consultation; 4) future interaction between TVA and USFWS to determine the federally listed species to be evaluated by NRC in its biological assessment (BA); 5) the type of consultation expected by USFWS; and 6) the scope of the BA.

6.14 Transportation

There were 16 information needs presented and discussed during the audit. These information needs encompassed the shipment of unirradiated fuel, irradiated fuel, and radioactive waste. Specific areas discussed included normalization of shipments to electrical generation, transportation cask capacity, decay heat, transportation routing, alternative sites, accident rates, transportation accident release fractions and respirable fractions, the WebTragis transportation routing computer code, and the RADTRAN transportation risk assessment computer code. Five of the information needs were addressed and closed as a result of audit activities and eleven information needs were addressed in submittals to the docket (Appendix B). Resolution of some information needs required additional RADTRAN and WebTragis computer code runs to provide the data needed to revise the transportation impact calculations.

6.15 Uranium Fuel Cycle and Decommissioning

There was one information need presented, discussed, and resolved during the audit (Appendix B). TVA clarified that scaling Table S-3 values (10 CFR 51.51) by 0.98 was based on MWe value for the site of 800 MWe (see item 16.6 of TVA ER Table 3.1-2) and maximum station capacity factor proposed by reactor vendors of 98 percent (see item 16.4 of TVA ER Table 3.1-2). No additional information needs were identified as a result of audit activities.

7.0 References

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TVA (Tennessee Valley Authority). 2016. Letter from J.W. Shea to NRC, dated June 23, 2016, regarding "Submittal of Calculation Input and Output Files in Support of Early Site Permit Application for Clinch River Nuclear Site." CNL-16-103, Chattanooga, Tennessee. Accession No. ML16180A307.

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TVA (Tennessee Valley Authority). 2016. Letter from J.W. Shea to NRC, dated December 2, 2016, regarding "Submittal of Supplemental Information Regarding Meteorology in Support of Early Site Permit Application for Clinch River Nuclear Site." CNL-16-186, Chattanooga, Tennessee. Accession No. ML16340A256.

TVA (Tennessee Valley Authority). 2016. Letter from J.W. Shea to NRC, dated December 2, 2016, regarding "Submittal of Supplemental Information Regarding Cumulative Radiological Health Impacts in Support of Early Site Permit Application for Clinch River Nuclear Site." CNL-16-171, Chattanooga, Tennessee. Accession No. ML16340A259.

TVA (Tennessee Valley Authority). 2016. Letter from J.W. Shea to NRC, dated December 8, 2016, regarding "Submittal of Supplemental Information Alternate Cooling Water Systems in Support of Early Site Permit Application for Clinch River Nuclear Site." CNL-16-198, Chattanooga, Tennessee. Accession No. ML16344A061.

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TVA (Tennessee Valley Authority). 2016. Letter from J.W. Shea to NRC, dated December 15, 2016, regarding "Submittal of Supplemental Information Related to Site Selection in Support of Early Site Permit Application for Clinch River Nuclear Site." CNL-16-190, Chattanooga, Tennessee. Accession No. ML16350A429.

TVA (Tennessee Valley Authority). 2016. Letter from J.W. Shea to NRC, dated December 16, 2016, regarding "Submittal of Supplemental Information Regarding Aquatic Ecology in Support of Early Site Permit Application for Clinch River Nuclear Site." CNL-16-201, Chattanooga, Tennessee. Accession No. ML16356A485.

TVA (Tennessee Valley Authority). 2016. Letter from J.W. Shea to NRC, dated December 27, 2016, regarding "Submittal of Supplemental Information Regarding the Environmental Protection Plan in Support of Early Site Permit Application for Clinch River Nuclear Site." CNL-16-202, Chattanooga, Tennessee. Accession No. ML16363A378.

Appendix A. Audit Participants

Table 1. Review Team Members for the Preparation of the EIS

| Role or Technical Resource Area | NRC (or USACE as indicated) | PNNL |
|--|-------------------------------------|---------------------------------------|
| Environmental Project Managers (NRC) ; Team Leads (PNNL) | Tamsen Dozier Patricia Vokoun | Bruce McDowell Kimberly Leigh |
| USACE Team Leads | Mark McIntosh Casey Ehorn | |
| Site and Technical/Regulatory Overview | Tamsen Dozier Patricia Vokoun | Bruce McDowell Kimberly Leigh |
| Chapter Three (Plant Description) | Jack Cushing | Nancy Kohn |
| Alternative Sites | Andy Kugler | Katie Cort |
| Alternative Systems | Andy Kugler | Philip Meyer |
| Land Use | Peyton Doub | Dave Anderson |
| Hydrology (Surface Water) | Mohammad Haque | Philip Meyer |
| Hydrology (Groundwater) | Daniel Barnhurst | Philip Meyer |
| Aquatic Ecology | Peyton Doub | Becky Krieg |
| Terrestrial Ecology | Peyton Doub | Jim Becker |
| SocioEconomics and Environmental Justice | Daniel Mussatti | Dave Anderson |
| Cultural/Archaeological | Jennifer Davis | Ellen Kennedy |
| Meteorology/Air Quality | Laura Quinn-Willingham ¹ | Julia Flaherty ¹ |
| Nonradiological Human Health and Nonradiological Waste | Daniel Mussatti | Lara Aston ¹ |
| Radiological Human Health | Eva Hickey | Michael Smith Eva Mart |
| Fuel Cycle and Decommissioning | Eva Hickey Don Palmrose | Michael Smith Eva Mart |
| Transportation of Nuclear Material | Donald Palmrose | Steve Maheras ¹ |
| Accidents | Donald Palmrose | Bruce Napier ² Eva Mart |
| Chapter Seven (Cumulative Impacts) | Jack Cushing | Bruce McDowell |
| NRC Management Observers | Kenneth Erwin Andy Campbell | |

¹ Participated in Part 1 of the audit via phone

² Did not participate in Part 1 of the audit

Table 2. Audit Participants Representing TVA and its Contractors

| Name | Affiliation |
|--------------------|---------------------------|
| Alex Young | TVA |
| Amanda Bowen | TVA |
| Archana Manoharan | TVA |
| Carrie Williamson | TVA |
| Colleen Montgomery | TVA |
| Dan Stout | TVA |
| David Burrell | TVA |
| David Deloach | TVA |
| Emily Willard | TVA |
| Harrison Bogema | TVA |
| Jack Brellenthin | TVA |
| James (Tony) Cross | TVA |
| Jeff Perry | TVA |
| Jerry Fouse | TVA |
| Jim Nabors | TVA |
| John (Bo) Baxter | TVA |
| John Thomas | TVA |
| Kelvin Montague | TVA |
| Ken Hickerson | TVA |
| Ken Wastrack | TVA |
| Kevin Casey | TVA |
| Kim Pilarski-Hall | TVA |
| Liz Hamrick | TVA |
| Marianne Shuler | TVA |
| Mike Stiefel | TVA |
| Nicole Berger | TVA |
| Peter Hastings | TVA |
| Ray Schiele | TVA |
| Rhonda Hooper | TVA |
| Roger Scott | TVA |
| Ruth Horton | TVA |
| Shandon Smith | TVA |
| Sherri Buchanan | TVA |
| Spencer Klein | TVA |
| Stephen Cole | TVA |
| Stuart Doss | TVA |
| Toree Cook | TVA |
| John Holcomb | TVA |
| Marvin Morris | Enercon |
| Tim Cahill | Bechtel Power Corporation |
| Rebecca Carr | Bechtel Power Corporation |
| Alice Carson | Bechtel Power Corporation |
| Hillol Guha | Bechtel Power Corporation |
| Sharad Jha | Bechtel Power Corporation |
| Mary Richmond | Bechtel Power Corporation |

| Name | Affiliation |
|------------------|----------------------------|
| Mark Reimnitz | Bechtel Power Corporation |
| Stewart Taylor | Bechtel Power Corporation |
| Alan Troup | Bechtel Power Corporation |
| Kimberly Hummer | Bechtel Power Corporation |
| Bobbie Hurley | AECOM |
| Steve Dillard | AECOM |
| Erika Grace | AECOM |
| Bob Dover | AECOM |
| Susan Provenzano | AECOM |
| Carol Freeman | AECOM |
| Kevin Taylor | AECOM |
| Ryan Eckenrode | AECOM |
| Fred Polaski | AECOM |
| Dr. Ruth Weiner | Boston Government Services |

Appendix B: Summary of Audit Information Need Resolution

| Info Need ID | Information Need Description | Resolution | Comments |
|------------------|--|-----------------------------------|---|
| Accidents | | | |
| ACC-01 | Make available a knowledgeable expert to discuss and describe the small modular reactor (SMR) loss-of-cooling accident (LOCA), including how the SMR LOCA differs from a standard pressurized-water reactor (PWR) LOCA. | Resolved through audit activities | NRC staff reviewed the NEI position paper and PPE basis documents. |
| ACC-02 | Provide, for staff examination, the vendor design-basis accident (DBA) calculation that forms the basis for the surrogate SMR dose calculation (via a scaling factor). | Resolved through audit activities | NRC staff reviewed PPE documents. |
| ACC-03 | Make available a knowledgeable expert to discuss the basis for the DBA dose calculation assumptions including those related to breathing rates and uncertainties (e.g., whether the vendor DBA doses were calculated for the reactor design-power level plus a margin for uncertainty). The Environmental Report (ER) does not discuss the dose calculation assumptions other than stating that the doses were obtained by scaling vendor DBA results. | Resolved through audit activities | NRC staff reviewed PPE documents. |
| ACC-04 | Provide, for staff examination, the various vendor probabilistic risk assessment (PRA) documents that were used as the basis for the PRA results presented in ER Section 7.2 to help the staff understand the PRA results. | Resolved through audit activities | NRC staff reviewed TVA documents related to PRA information. |
| ACC-05 | Make available a knowledgeable expert to discuss the various vendor-supplied PRA documents to help the staff understand the PRA assumptions and bases, including the core damage frequency (CDF) of 4.65E-08 per Ryr, the relative frequencies for the release categories, and the how the six release categories were developed. | Resolved through audit activities | NRC staff reviewed TVA documents related to PRA information. |
| ACC-06 | Make available a knowledgeable expert to discuss the analyses and measures the Tennessee Valley Authority (TVA) has taken, or will take at the combined license (COL) submittal stage, to address other at-power and low-power/shutdown initiating events. The ER only evaluates internally initiated events. | Resolved through audit activities | NRC staff clarified its understanding of this topic through audit discussions and document reviews. |

| Info Need ID | Information Need Description | Resolution | Comments |
|---------------------|--|-----------------------------------|---|
| ACC-07 | Make available a knowledgeable expert to discuss externally initiated events (e.g., external flooding and seismic events). TVA's ER does not address potential probability-weighted consequences (i.e., risk) from externally initiated events. | Resolved through audit activities | NRC staff clarified its understanding of this topic through audit discussions and document reviews. |
| ACC-08 | Provide sources of information for the input parameters in ATMOS and make available a knowledgeable expert to discuss the computation of severe accident consequences using MACCS to help the staff understand the bases for the input parameters in ATMOS (including release fractions, deposition velocities, reactor building geometries, and weather). | Resolved through audit activities | Discussions with TVA staff provided the rationale for the MACCS ATMOS file parameters applied. |
| ACC-09 | Provide sources of information for input parameters in EARLY and make available a knowledgeable expert to discuss the computation of severe accident consequences using MACCS to help the staff understand the bases for the input parameters in EARLY (including emergency response measures assumed). | Resolved through audit activities | Discussions with TVA staff provided the rationale for the MACCS EARLY file parameters applied. |
| ACC-10 | Provide sources of information for the meteorological input file and make available a knowledgeable expert to discuss the meteorological data, the basis for selecting mid-2012 through mid-2013 as a representative year, and how this time period compares to other years. | Resolved through audit activities | Discussions with TVA staff provided the rationale for the MACCS meteorological input file parameters applied. |
| ACC-11 | Make available a knowledgeable expert to discuss emergency planning and assumed response scenarios applied in the MACCS input including the basis for the assumption of a 2 mi emergency planning zone (EPZ) when current U.S. Nuclear Regulatory Commission (NRC) guidance is for a 10 mi EPZ. Note that the environmental finding for severe accidents is derived in part from a comparison of the offsite risks of a severe accident at the current generation of reactors with a 10 mi EPZ to the offsite risks for the proposed action. | Closed for Audit ³ | This issue is under further NRC staff evaluation. |

³ "closed for audit" signifies those items where additional deliberations for the issue may be necessary by the staff, but at this time, no additional information is being requested from the applicant.

| Info Need ID | Information Need Description | Resolution | Comments |
|---------------------|---|-----------------------------------|--|
| ACC-12a | Provide sources of information for input parameters in the MACCS site file and make available a knowledgeable expert to discuss population inputs, their bases, and the source of the information (e.g., latest version of SECPOP applying 2010 U.S. Census Bureau data) to help the staff understand whether the values are consistent with those provided in ER Chapter 2. | Resolved through audit activities | Discussions with TVA staff provided the rationale for the MACCS SECPOP input file parameters applied. |
| ACC-12b | Provide sources of information for input parameters in the MACCS site file and make available a knowledgeable expert to discuss land-use values in SITE, to help the staff understand the values, including whether they are consistent with the info in ER Chapter 2 and whether the values were adjusted for any potential land-use changes | Resolved through audit activities | Discussions with TVA staff provided the rationale for the MACCS SITE input file parameters applied. |
| ACC-13 | Provide sources of information and make available a knowledgeable expert to discuss the individual economic input values used in input file CHRONIC for MACCS and their bases to help the staff understand the severe accident cost impacts, including evacuation costs, values of crops contaminated and condemned, value of milk contaminated and condemned, cost of property decontamination, and indirect costs resulting from loss of property. The ER provides one economic risk value (29.3 \$/Ryr) but does not provide a justification for the values assumed. | Resolved through audit activities | Based on discussions with TVA, the NRC staff understands the rationale for the CHRONIC input parameters applied by TVA. The NRC staff will conduct sensitivity analyses as part of the confirmatory calculation process. |
| ACC-14 | Make available a knowledgeable expert to discuss the locations of nearby bodies of water and potential locations where water is withdrawn from the Clinch River for both drinking water and crop irrigation. | Resolved through audit activities | TVA identified locations of nearby water bodies through discussions and during the site tour. |
| ACC-15 | Make available a knowledgeable expert to discuss if TVA is considering any additional sensitivity calculations such as those discussed in CLI-16-07. | Resolved through audit activities | Based on discussions with TVA, the NRC staff understands the rationale for the CHRONIC input parameters applied by TVA. The staff will conduct sensitivity analyses as part of the confirmatory calculation process. |

| Info Need ID | Information Need Description | Resolution | Comments |
|------------------------|---|--|---|
| ACC-16 | Make available a knowledgeable expert to discuss the MACCS calculation results. | Resolved through audit activities | Based on discussions with TVA, the NRC staff understands the MACCS methodology used by TVA and the generated results. |
| Aquatic Ecology | | | |
| AE-01 | Provide a knowledgeable expert to discuss potential impacts to aquatic biota and habitats in the vicinity of the proposed locations for the intake and discharge structures and the barge/traffic area on the Clinch River. | Resolved through audit activities | Review team confirmed understanding of the background description and the potential impacts from these project features. |
| AE-02 | Provide a knowledgeable expert to discuss the process (if any) that TVA uses to avoid bodies of water and aquatic species and habitats during placement of new transmission lines (including underground lines) or work on existing transmission lines. For those areas where perennial, intermittent, and ephemeral streams and ponds will be subject to permanent or temporary disturbance on the CRN site and barge/traffic area from placement of new transmission lines or work on existing transmission line corridors, identify the location and provide a description of disturbance and any technology or procedures used to limit the disturbance to aquatic. | Resolved through TVA submittal to the NRC on the CRN Site ESP docket | TVA provided a description of transmission capital project process and a description of the methods used to minimize impacts on streams (ML17206A091) |
| AE-03 | This is same as TE-08. Provide a knowledgeable expert who can discuss the status of TVA's correspondence with U.S. Fish and Wildlife Service (FWS) regarding Federally listed important species and habitats and TDEC – Division of Natural Heritage and Tennessee Wildlife Resources Agency regarding State-listed important species and habitats. Provide any correspondence to or from these agencies. | Resolved through USFWS submittal to NRC on the CRN Site ESP docket | USFWS provided a letter containing the necessary information (ML17205A342). |

| Info Need ID | Information Need Description | Resolution | Comments |
|---------------------|--|---|---|
| AE-04 | ER Section 6.5.2.3 states that TVA would repeat aquatic field studies following construction in order to collect at least 1 year of preoperational and/or operational data for comparison to the baseline data. Provide a knowledgeable expert to discuss the purpose, location and objectives of these proposed studies that are characterized in the ER as being a "subset of the site preparation field studies". | Resolved through TVA submittal to NRC on the CRN Site ESP docket | TVA indicated that conducting field studies to compare with baseline data was not necessary. Any monitoring studies following construction would be performed at the request of and in accordance with Federal and State agency requirements (ML17206A091). |
| AE-05 | Provide a knowledgeable expert who can accompany staff to ORR Sites 2 and 8 to discuss aquatic ecology issues in the field for those two alternative sites. The staff does not consider it necessary to revisit the Redstone site but would still like to meet with a knowledgeable expert to discuss aquatic ecology issues associated with the Redstone site. This is related to TE-20. | Resolved through audit activities | Review team confirmed their understanding of the issues related to potential impacts at alternative sites. |
| Alternatives | | | |
| ALT-01 | Provide a knowledgeable expert on the alternative siting process who can discuss "key criteria" (definitions and application) used to assess candidate areas, potential sites, and candidate sites. | Resolved through audit activities and TVA submittal to NRC on the CRN Site ESP docket | Review team clarified understanding of ER description of siting process through audit discussions and review of supplemental information provided to the CRN Site ESP docket (ML17206A091 and ML17233A298). |
| ALT-02 | Table A.5 of the Site Selection Report states that candidate area, Columbus Air Force Base, was "Deferred from further consideration due to inadequate cooling water availability" which is reported to be "LESS THAN 1,300 cfs" in the same table. It would appear in Figure A.6, however, that multiple gaging stations near Columbus Air Force Base have water availability >1,300 cfs. Please provide a knowledgeable expert who can discuss water availability in this region and process that went into eliminating Columbus Air Force Base as a candidate area. | Resolved through audit activities | Review team clarified understanding of ER statements through audit discussions and review of a more detailed map showing gage station locations. |

| Info Need ID | Information Need Description | Resolution | Comments |
|--------------|---|-----------------------------------|---|
| ALT-03 | Section 5.1 of the TVA Site Selection Report refers to Electric Power Research Institute's (EPRI's) Advanced Nuclear Technology: Site Selection and Evaluation Criteria for New Nuclear Power Generation Facilities (2015), as the basis for criteria used to evaluate the alternatives. Because this document is not publically available, NRC staff cannot view it. A copy of this guide should be available for review during the site audit. | Resolved through audit activities | TVA provided the requested document for review team examination during the audit. |
| ALT-04a | To help facilitate our discussion of the site-selection process and to provide additional perspective related to the selection of candidate sites, it would be helpful to have a map that identifies the location of Potential Redstone Site 13 (which scored the highest under ecological criteria for Redstone area) in proximity to Redstone Site 12. Likewise, it would be helpful to view a map that identifies the location of potential Oak Ridge Reservation (ORR) Site 10 (which tied for the highest ecological) relative to ORR candidate sites. | Resolved through audit activities | TVA provided the requested maps for review team examination during the site audit. |
| ALT-04b | Likewise, it would be helpful to view a map that identifies the location of potential Oak Ridge Reservation (ORR) Site 10 (which tied for the highest ecological) relative to ORR candidate sites. | Resolved through audit activities | TVA provided the requested maps for review team examination during the site audit. |
| ALT-05 | Section 2.5.1.5 "Population Density," of the Clinch River ER defines population density in terms of the NUREG-1437 sparseness classifications using a 20-mi radius around the site, or a 1,247 square mile (sq. mi) area. Text from this section of the ER is as follows: "A total of 331,238 people live within 20 mi of the CRN Site (Tables 2.5.1-3 and 2.5.1-5). A 20-mi radius area contains 1257 sq. mi; therefore the population density is approximately 264 persons per sq. mi. This population density is classified as a Category 4 sparseness (greater than or equal to 120 persons per sq. mi within 20 mi)." To facilitate a similar comparison of population density around the alternatives sites, it would be helpful to have a similar calculation (i.e., calculation of persons per sq. mi in the 1,257 sq. mi around the site) of population density available for ORR Site 8 (assuming adjacent Site 2 would be similar to the CRR calculations) and Redstone Site 12. | Resolved through audit activities | Review team has performed the necessary population calculation using SECPOP and has informed TVA that it intends to use this information for Redstone site. |

| Info Need ID | Information Need Description | Resolution | Comments |
|--------------------|--|-----------------------------------|---|
| ALT-06a | Provide a knowledgeable expert able to discuss more detailed characteristics of alternative heat dissipation system alternatives, as described in ESRP 9.4.1 review procedures. | Resolved through audit activities | TVA provided the appropriate expert at the audit. See Alt-06c. |
| ALT-06b | Clarify the difference between Natural Draft Cooling Towers and Wet Natural Draft Cooling Towers discussed in ER Sections 9.4.1.2 and 9.4.1.2.2. | Resolved through audit activities | TVA clarified that these terms are synonymous. |
| ALT-06c | <p>ESRP 9.4.1 directs the staff's analysis of alternatives to the applicant's proposed heat dissipation system. Factors the staff is directed to consider in an initial screening of alternatives are land use, water use, and legislative or regulatory restrictions. Economic factors are not considered in the staff's initial screening. For alternatives that are not obviously unsuitable for use at the proposed site, and thus not eliminated by the initial screening, the staff considers more detailed characteristics of the alternatives' land use and water use as well as other environmental factors, including atmospheric effects, thermal and physical effects, noise levels, and aesthetic and recreational benefits. For any alternative that is shown to be environmentally preferable, the staff considers economic-cost factors. To facilitate the staff's analysis, provide the following information for the specified alternative heat dissipation systems.</p> <ul style="list-style-type: none"> • wet natural draft cooling towers: land use required, water use required, and any legislative or regulatory restrictions for the use of this alternative • dry cooling towers: land use required, water use required, and any legislative or regulatory restrictions for the use of this alternative • wet/dry (hybrid) cooling towers: land use required, water use required (unless one-third to one-half of a wet cooling tower is the most precise estimate available), and any legislative or regulatory restrictions for the use of this alternative • spray ponds: water use required, and any legislative or regulatory restrictions for the use of this alternative. | Resolved through audit activities | The review team examined an analysis of alternative heat dissipation systems provided by TVA and the public documents on which this analysis was based. |

| Info Need ID | Information Need Description | Resolution | Comments |
|---------------------------|--|---|--|
| Cultural Resources | | | |
| CR-01a | Provide a knowledgeable TVA archaeologist to discuss the historic and cultural resources located within the onsite and offsite archaeological and architectural APEs, as described in Section 2.5.3 of the ER and in the Programmatic Agreement (PA). Staff would also like to discuss potential impacts to historic and cultural resources from the proposed action as they are currently understood and as described in Sections 4.1.7 and 5.1.3 of the ER. Be prepared to discuss associated NHPA Section 106 consultation activities conducted by TVA. | Resolved through audit activities | Review team was able to gain an understanding of historic and cultural resources located at the CRN Site, the PA and potential impacts to historic and cultural resources during the site audit. |
| CR-01b | The staff would also like to discuss additional offsite areas that have not been addressed in the ER or the PA (e.g., transmission lines, borrow pit areas, and other areas) to understand the process TVA will use for assessing impacts to historic and cultural resources for these areas. NRC staff will be meeting with TN SHPO and may have follow-on questions for TVA. | Resolved through audit activities and through TVA submittal to NRC on the CRN Site ESP docket | Review team clarified understanding of how PA will address impacts to historic and cultural resources located in offsite areas through audit discussions and review of supplemental information provided to the CRN Site ESP docket (ML17234A002). |
| CR-02 | The Programmatic Agreement (PA) provides a process for adjusting the undertaking and the APE. Provide a knowledgeable expert who can discuss the process TVA will implement to keep NRC informed of updates concerning its Section 106 consultation specifically changes in the undertaking, modifications to the APE, updated and ongoing correspondence with SHPO and Tribes, historic and cultural resource updates such as the Melton Hill NRHP paperwork. Copies of any updated documentation, not previously submitted to NRC, should be made available for review during the site audit. This includes, but it not limited to, correspondence with consulting parties, any changes to the APE, maps and cultural resource investigations. | Resolved through audit activities and TVA submittal to NRC on the CRN Site ESP docket | Review team clarified understanding of TVA's ongoing NHPA Section 106 and PA compliance process and related consultation process through audit discussions and review of supplemental information provided to the CRN Site ESP docket (ML17234A002). |

| Info Need ID | Information Need Description | Resolution | Comments |
|--------------|---|---|--|
| CR-03 | <p>Please make available copies of the following reports and references for review during the site audit:</p> <ul style="list-style-type: none"> • Appendix E of the PA (Reed et. al 2011) • Complete TRC 2011 architectural resources letter report (Karpynek 2011) referenced and enclosed in TVA's May 20, 2015 letter to Tennessee Historical Commission. A management summary consisting of the first three pages of this report were provided to the staff. • Reference 2.5.3-67. Tennessee Valley Authority, "Clinch River Small Modular Reactors Project, APE Expansion to Include Melton Hill Dam, Roane County, Tennessee," August 18, 2016. • Schroedl 1990 Archaeological Research at 40RE107, 40RE108, and 40RE124. University of Tennessee Dept of Anthropology Report of Investigations 49 and Tennessee Valley Authority Publications in Anthropology 53. | Resolved through audit activities | Review team gained clarity and reviewed identified documents during the site audit. |
| CR-04 | <p>TVA's May 20, 2015, letter to the Tennessee Historical Commission (referenced in Appendix A of the ER, pages A47-54), describes a desk top and field study to identify architectural resources located within the architectural APE. Provide a knowledgeable expert to discuss the methods and results of this study.</p> <ul style="list-style-type: none"> • Did TVA notify or engage interested persons as part of this study and make the documentation available to the public? According to Tennessee Historical Commission's May 27, 2015 response to TVA (referenced in Appendix A of the ER page A-55), the Tennessee Historical Commission states that TVA should do this. • Did TVA conduct a records search of the TN Historical Commission files to confirm if previously identified architectural resources are located within the architectural APE? • Confirm if Resource 1 and 2 are the same as 40RE1439 (Smith Place), located on the THC above-ground resources viewer. • Will historic roads described in Section 2.5.3.5 of the ER be evaluated formally as part of the architectural resources analysis in the PA? • Clarify why an architectural APE was defined only as a half mile around land clearing areas and not around the archaeological APE for both the CRN site and the barge area. | Resolved through audit activities and TVA submittal to NRC on the CRN Site ESP docket | Review team clarified their understanding of TVA's architectural resources identification and impacts assessment through audit discussions and review of supplemental information provided to the CRN Site ESP docket (ML17234A002). |

| Info Need ID | Information Need Description | Resolution | Comments |
|--------------|---|---|---|
| CR-05a | <p>TVA has executed a PA for the Clinch River SMR project which addresses TVA's NHPA Section 106 responsibilities for the CRN ESP. Provide a knowledgeable expert to discuss the following:</p> <ul style="list-style-type: none"> • The PA does not cover operational impacts. Does TVA have operational procedures in place such as inadvertent discovery plans or management plans to avoid impacts to historic and cultural resources during operation? If so, please make available a copy of plans or procedures for review during the site audit. | Resolved through audit activities and TVA submittal to NRC on the CRN Site ESP docket | Review team clarified understanding of TVA's NHPA Section 106 compliance and inadvertent discovery procedures through audit discussions and review of supplemental information (ML17234A002). |
| CR-05b | <p>The Hensley Cemetery (40RE588), determined ineligible, is located in the archaeological APE but is not included in the PA as a site recommended for avoidance. Provide a knowledge expert to describe any additional procedures TVA may have in place to protect impacts to the Hensley Cemetery during construction and operation.</p> | Resolved through audit activities and TVA submittal to NRC on the CRN Site ESP docket | Review team clarified understanding of TVA's cemetery protection procedures specifically as they relate to impacts to the Hensley Cemetery through audit discussions and review of supplemental information (ML17234A002). |
| CR-06 | <p>Pursuant to NEPA, as a federal land managing agency, TVA has the responsibility to comply with other federal cultural resource protection laws such as AIRFA, ARPA, AHPA, NAGPRA and NHPA Section 106 and 110 during the course of operation of the CRN. Provide a knowledgeable expert to discuss the following:</p> <ul style="list-style-type: none"> • Clarify current location disposition of human remains associated with archeological site 40RE124 and any plans for inventory and repatriation under NAGPRA. Make available a copy of NAGPRA procedures during the audit. • Clarify current location and curation of archaeological artifacts associated with archaeological sites located on the CRN Site. Clarify if TVA has procedures in place regarding curation of artifacts recovered during past and present archaeological investigations. Make available a copy of curation procedures during the site audit. • Make available a copy of ARPA procedures (e.g. archaeological site protection, looting prevention, public education) during the audit. • Make available a copy of NHPA compliance procedures during the audit. | Resolved through audit activities and through TVA submittal to NRC on the CRN Site ESP docket | Review team clarified their understanding of TVA's process for compliance with ARPA, NAGPRA and curation requirements as they relate to operational impacts through audit discussions and review of supplemental information provided to the CRN Site ESP docket (ML17234A002). |

| Info Need ID | Information Need Description | Resolution | Comments |
|--------------------------------|---|---|---|
| CR-07 | Provide a knowledgeable expert to discuss historic and cultural resource investigations and any historic and cultural resources located on the alternative sites at Oak Ridge. Make available copies of the architectural and archaeological resource survey reports referenced in Johnson 2016 that have not been previously provided. | Resolved through audit activities and through TVA submittal to NRC on the CRN Site ESP docket | Review team clarified understanding of historic and cultural resources located on the alternative sites through audit discussions and review of supplemental information provided to the CRN Site ESP docket (ML17234A002). |
| Hydrology - Groundwater | | | |
| HY-GW-01 | Average annual precipitation is given as 50 in./yr, with average annual runoff of 25 to 30 in./yr. Provide information related to and a knowledgeable expert to discuss estimates of average annual evapotranspiration and groundwater recharge in vicinity of the site. | Resolved through audit activities | Review team examined public documents used by TVA as the basis for water budget estimates. |
| HY-GW-02 | The estimate of well yields in the region is a very wide range (1 to 2,500 gpm). Provide information related to and a knowledgeable expert to discuss an estimate of well yields in the vicinity of the CRN Site and the basis for that estimate. | Resolved through TVA submittal to NRC on the CRN Site ESP docket | TVA submitted local water use data (ML17200C887). |
| HY-GW-03a | The conceptual model of groundwater flow describes 90 percent of subsurface flow occurring in a shallow stormflow zone and less than 2 percent of flow occurring in the deeper aquifer (as shown in Figure 2.3.1-23). Provide a knowledgeable expert to explain how this conceptual model is consistent with the regional well yield estimates of up to 2,500 gpm, whether this conceptual model of groundwater flow is consistent with the well yield estimates for the vicinity of the CRN Site, and the estimated thickness of the stormflow zone across the CRN Site and the basis for this estimate. | Resolved through audit activities | Review team discussions with TDEC and DOE staff provided information on local well yields. |

| Info Need ID | Information Need Description | Resolution | Comments |
|---------------------|---|-----------------------------------|--|
| HY-GW-03b | The ER states that the primary differences between the ORR and CRN Sites are in the stormflow and vadose zones at the CRN Site. The extensive excavation and reworking of unconsolidated and weathered bedrock materials associated with the Clinch River Breeder Reactor Project (CRBRP) site preparation has either significantly modified or obliterated these zones at the CRN Site. Provide a knowledgeable expert to explain how the ORR conceptual model of groundwater flow was revised to reflect the modification or obliteration of the stormflow and vadose zones at the CRN Site. | Resolved through audit activities | Review team examined the relative information in SSAR 2.4.12 Appendix C. |
| HY-GW-04 | Provide for staff examination at the audit a figure of the data presented in Figure 2.3.1-24, but broken out by type of test (e.g., slug, packer, pump, and tracer) instead of all lumped together. The ORR data appears to be mainly from the Conasauga Group hydrogeologic units, which do not seem to play a major role in the CRN Site groundwater. Provide a knowledgeable expert to explain how the ORR data from the Conasauga Group are relevant to the CRN Site characterization of the Chickamauga and Knox Groups. Provide for staff examination at the audit a data report, if available, with graphical fits of test analysis results for borehole packer, and slug tests for CRN Site data. | Resolved through audit activities | TVA provided the requested figure for review team examination at the audit. |
| HY-GW-05 | Provide a knowledgeable expert to clarify what geologic units on ER Figure 2.3.1-22 are indicated by the use of the term "ORR aquitards". | Resolved through audit activities | Review team clarified their understanding of ER description through discussions with TVA, and in meetings with TDEC and DOE. |
| HY-GW-06 | ER Section 2.3.1.2.1.3.1 refers to CRBRP wells likely to have been destroyed or removed. Provide a knowledgeable expert to explain what is meant by destroying or removing wells, and to explain whether the destroyed or removed wells could provide preferential pathways for contaminant transport and whether that would be of concern. | Resolved through audit activities | Review team clarified understanding of ER statements through audit discussions and review of supporting documents (in particular, the CRBRP remediation report). |
| HY-GW-07 | Provide a knowledgeable expert to explain the bearing designations used in ER Section 2.3.1.2.1.3.1, and elsewhere (e.g., N25degW 80degSW). | Resolved through audit activities | An explanation of ER information was provided by TVA. |

| Info Need ID | Information Need Description | Resolution | Comments |
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| HY-GW-08 | ER Section 2.3.1.2.1.3.1 refers to fluctuations in groundwater levels of as much as 20 ft. Provide a knowledgeable expert to identify the period of data to which these observed fluctuations correspond. | Resolved through audit activities | TVA stated that the period of data was Dec. 1973 to April 1974. |
| HY-GW-09 | Provide for examination at the audit available CRBRP documentation: an original copy of the Preliminary Safety Analysis Report (with sharp/readable figures), and any available site investigation reports or construction reports showing photos of the excavation. | Resolved through audit activities | Review team examined supporting documents including the CRBRP PSAR (publicly available). |
| HY-GW-10 | Lincolnshire and Blackford formations are both said to be aquitards in Fig. 2.3.1-22. Provide a knowledgeable expert to explain why the pumping test was conducted in units that are aquitards. | Resolved through audit activities | TVA stated that the location represents an appropriate transport pathway from the excavation. |
| HY-GW-11 | The ORR tests resulted in an average effective porosity of 4 percent. Provide a knowledgeable expert to discuss whether the same value of effective porosity was assumed for the CRN Site, and whether the porosity value represents the effective porosity of the rock matrix, or the effective porosity of the rock matrix + fractures. Most of the porosity measurements cited in the ER were from the Conasauga Group. Provide a knowledgeable expert to explain how these measurements are relevant to the CRN Site which appears to consist primarily of the Chickamauga and Knox Groups. | Resolved through audit activities | TVA stated that effective porosity at the site was not measured; the value of 4.76% used for the SSAR 2.4.13 analysis was based on mercury porosimetry data from the ORR, which included samples from both the Conasauga and Knox Groups. TVA stated that these represent matrix porosity, and are relevant for the CRN Site since they include the Knox Group. TVA stated that the effective porosity of the matrix+fractures would be higher and therefore less conservative in terms of travel time for the SSAR 2.4.13 analysis. |

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| HY- GW- 12 | Table 2.3.1-3 lists Newala as one of the geologic units. This unit does not appear to be in Figure 2.3.1-22 or described in the ER. This unit is discussed in the site safety analysis report (SSAR). Provide a knowledgeable expert to confirm the identification of the Newala unit, and to describe how the ER was reviewed for consistency with the SSAR. | Resolved through audit activities | TVA confirmed that the Newala formation refers to the upper part of the Knox Group. |
| HY- GW- 13 | Provide for staff examination at the audit the results of the survey TVA conducted (completed in June 1973) to locate wells and springs within a two-mile radius of the site (Reference 2.3.2-8). Provide a knowledgeable expert to explain how this survey is adequate to describe current and anticipated future groundwater use within the vicinity of the CRN Site. Provide a knowledgeable expert to discuss the locations (including well depths) and rates of use for present and known future offsite groundwater users within the vicinity of the CRN Site, including individual domestic users. | Resolved through TVA submittal to NRC on the CRN Site ESP docket | TVA submitted an accurate list of wells near site that are in use as domestic wells (ML17200C887). |
| HY- GW- 14 | ER Section 2.3.2.2.2 cites reference 2.3.2-14 in stating, Approximately 2/3 of the community public water systems using ground water in Middle and East Tennessee have had at least one source determined under the direct influence of surface water. This means that these sources of groundwater are located close enough to a source of surface water to receive direct surface water recharge and are thus considered at risk from surface water contaminants and pathogens. Provide a knowledgeable expert to discuss whether TVA considers this issue to be a concern for any groundwater users located in the vicinity of the CRN Site. | Resolved through TVA submittal to NRC on the CRN Site ESP docket | TVA provided a clarification to the ER section 2.3.2 (ML17206A091). |

| Info Need ID | Information Need Description | Resolution | Comments |
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| HY-GW-15 | Provide a knowledgeable expert to discuss estimates of excavation dewatering flow rates, and the magnitude/extent of dewatering effects on groundwater levels and on groundwater discharge to springs, streams, ponds, and wetlands. | Unresolved at time of audit closure; however information submitted after the audit resolved this item | TVA plans to provide either ER revision or white paper regarding alternate conceptual model of groundwater flow beneath river and potential dewatering impacts that recognizes TDEC and DOE reports. <i>On Aug 25, after the audit closed, TVA provided a response to this information need. (ML17237C084)</i> |
| HY-GW-16 | Provide a knowledgeable expert to discuss TVA's plans for following the groundwater monitoring guidance of NEI 07-07. | Resolved through audit activities | The review team clarified understanding of ER statements through audit discussions and review of supporting documents (in particular, TVA's groundwater protection plan and procedures). |
| Hydrology – Surface Water | | | |
| HY-SW-01 | Provide information related to and a knowledgeable expert to discuss whether Figure 2.3.1-10 (based on 2004-2013 data) is reflective of the long-term variability of the Watts Bar reservoir elevation, and to discuss a long-term characterization of Clinch River elevation at the CRN Site. | Resolved through audit activities | TVA stated that 2007 was the drought year of record and that 2013 was either the wettest, or the second wettest year (based on over 100 years of record), thus representing long-term variability. |

| Info Need ID | Information Need Description | Resolution | Comments |
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| HY-SW-02 | Provide information related to and a knowledgeable expert to explain how TVA is addressing the floodplain management requirements described in Executive Order 11988, as amended by EO13690. | Resolved through TVA submittal to NRC on the CRN Site ESP docket | TVA published proposed changes to their procedures for implementing NEPA, including revisions to the Floodplains and Wetlands section of the procedures that incorporate EO 13690, and provided revised ER text/figures (ML17234A003). |
| HY-SW-03 | Provide information related to and a knowledgeable expert to discuss statistical characterization of the direction and magnitude of Clinch River flow at the CRN discharge location based on long-term data. | Resolved through audit activities | The review team examined the Hydrothermal task force report. |
| HY-SW-04 | Provide, for staff examination at the audit, a copy of the hydrothermal task force report. | Resolved through audit activities | The review team examined the Hydrothermal task force report. |
| HY-SW-05 | Provide for staff examination at the audit a non-redacted copy of reference 2.3.2-1, Regional Surface Water Use Study. | Resolved through audit activities | TVA provided the requested document for review team examination during the audit. |
| HY-SW-06 | Provide a knowledgeable expert to: <ul style="list-style-type: none"> • describe the Tennessee Department of Environment and Conservation (TDEC) state water registration requirements mentioned in ER Section 2.3.2.1.2, • discuss any issues or concerns that may arise that would challenge the reasonable assurance that water from the Clinch River arm of the Watts Bar reservoir would be available for the proposed plant, and • discuss TVA's plan to manage severe drought conditions and explain what triggers drought management plan implementation. | Resolved through TVA submittal to NRC on the CRN Site ESP docket | The review team examined TVA's drought management plans and TVA submitted a description of water availability (ML17234A003). |
| HY-SW-07 | Provide information related to and a knowledgeable expert to discuss use rates for recreation and navigation. Provide information on navigation regulations/ requirements/ restrictions. | Resolved through audit activities | TVA's expert described navigation and recreation use and regulations. |

| Info Need ID | Information Need Description | Resolution | Comments |
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| HY-SW-08 | ER Table 2.3.3-16 (Sheet 1 or 3) provides a maximum dissolved oxygen value of 359 mg/L. Provide a knowledgeable expert to confirm whether this is an error and to provide a correct value. | Resolved through TVA submittal to NRC on the CRN Site ESP docket | TVA submitted a corrected value of dissolved oxygen and corrected other water quality parameters that were in error (ML17234A003). |
| HY-SW-09 | The ER states that no dredging during building will be required, but underwater excavation would be required. Provide information related to and a knowledgeable expert to explain the difference between these activities, whether there will be any spoils produced as a result of the underwater excavation, the estimated volume of any excavated materials (if spoils would be produced), and the estimated duration of in-water construction. Provide information related to and a knowledgeable expert to discuss the potential for non-rad and rad contaminants in the excavated sediments, TDEC sediment monitoring requirements, required actions if contamination is detected, anticipated control measures to minimize sediment disturbance/water-quality degradation, and the disposal of any spoils. | Resolved through TVA submittal to NRC on the CRN Site ESP docket | TVA provided a description of underwater excavation for the project and the associated permitting and monitoring that is anticipated (ML17234A003). |
| HY-SW-10 | Provide information related to and a knowledgeable expert to discuss estimates of water use during building for concrete batch plant use and for potable/sanitary water use, and to compare plant construction water use to City of Oak Ridge water supply capacity and current/future demands on that supply | Resolved through TVA submittal to NRC on the CRN Site ESP docket | TVA submitted information concerning water use for concrete batch plant and total water use from the City supply (ML17234A003). |
| HY-SW-11 | Whiteoak Dam is listed in Table 4.7-1. Provide a knowledgeable expert to discuss whether there is any potential cumulative impact with building or operating the plant in the event of an uncontrolled release from Whiteoak Dam (e.g., flooding that washes water and contaminated sediments into the Clinch River). | Unresolved at time of audit closure; however information submitted after the audit resolved this item | TVA plans to submit information describing the White Oak Creek control structures and the potential for future radionuclide contaminant releases from the creek. <i>On Aug 21, after the audit closed, TVA provided a response to this information need (ML17233A298).</i> |

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| HY-SW-12 | <p>Provide information related to and a knowledgeable expert to discuss the following with respect to water use.</p> <ul style="list-style-type: none"> • Plant water-use impacts will be local to the CRN Site; thus, evaluating plant water use with respect to water use over the entire Tennessee River watershed is less important than evaluating it with respect to uses in the vicinity of the CRN Site. Provide a knowledgeable expert to discuss potential local impacts. • Consumptive use is of equal or greater importance to impacts than withdrawals. Provide a knowledgeable expert to describe consumptive water use in the vicinity of the site. The stated transition from once-through cooling to closed-cycle cooling for thermoelectric power generation will increase consumptive demand in the region. Provide a knowledgeable expert to discuss whether this is reflected in the future consumptive-use estimates. • Projected changes in water use are provided to 2030 based on 2000 data. Provide a knowledgeable expert to discuss longer-term projections in water use based on more recent data, if available. • Flow conditions are variable; thus, impacts will also be variable. Provide a knowledgeable expert to discuss the effects of low-flow conditions on water-use impacts | Resolved through TVA submittal to NRC on the CRN Site ESP docket | TVA submitted a summary of potential local impacts to water availability on the Clinch River (ML17234A003). |
| HY-SW-13 | ER Section 5.2.2 states, "the characteristics and constituents of the plant discharge still are proposed to be managed within the water quality criteria specified in the plant National Pollutant Discharge Elimination System (NPDES) permit." Provide a knowledgeable expert to explain whether this is an assertion, a commitment, or the result of an analysis. | Resolved through audit activities | TVA stated that the ER text is an assertion based on regulatory requirements for such discharges and TVA's policy of complying with such requirements. |
| HY-SW-14 | Provide information related to and a knowledgeable expert to discuss whether any maintenance dredging for the intake or discharge will be required during operation, the required permitting for such dredging, and the location where dredged spoils would be disposed. | Resolved through TVA submittal to NRC on the CRN Site ESP docket | TVA submitted additional information concerning potential maintenance dredging and the role of the Watts Bar Interagency Agreement Working Group (ML17234A003). |

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| HY-SW-15 | Provide for staff examination at the audit any discharge thermal effects modeling report(s) (hydrodynamic model, CORMIX, CE-QUAL-W2). | Resolved through audit activities | TVA provided the requested documents which review team examined. |
| HY-SW-16 | (Alternatives) Provide a knowledgeable expert to discuss the water-related aspects of the alternative sites, including such issues as: <ul style="list-style-type: none"> • Water resources affected by transmission line and pipeline construction, intake and discharge construction, and operational dredging. • Site-specific hydrogeological differences, differences in recharge, and site-specific groundwater discharge areas. • Local surface-water and groundwater users, including individual domestic users. • Past, present, and reasonably foreseeable future projects at each site potentially contributing to cumulative water-use and water-quality impacts. • Site-specific recreational and navigational water use. • Any specific water-related regulations/restrictions related to the Wheeler National Wildlife Refuge. | Resolved through audit activities and through TVA submittal to NRC on the CRN Site ESP docket | The review team clarified their understanding of these topics during audit discussions with TVA experts and TVA submitted additional information on the docket addressing hydrogeologic differences between sites and water users (ML17234A003). |
| HY-SW-17 | ER Sections 4.7.3 and 5.11.3 state that climate change effects on site hydrology may result in induction of groundwater flow beneath the Clinch River. Provide a knowledgeable expert to explain how the identified climate change effects are anticipated to change groundwater flow sufficiently to result in flow beneath the river. Provide for staff examination at the audit any report(s) or other documentation of TVA's evaluation of future climate change within the Tennessee River Valley and the potential effects of future climate change on TVA operations. | Resolved through audit activities and through TVA submittal to NRC on the CRN Site ESP docket | TVA provided links to public documents discussing the impacts of climate change in the region. TVA also provided revised ER text eliminating the statement regarding climate change effects on groundwater flow (ML17234A003). |
| Land Use | | | |
| LU-01 | Provide high-resolution digital scans of aerial photographs of the original Clinch River Breeder Reactor construction site and areas adjoining areas of the ORR, including what is now designated as the BTA. The photos would ideally illustrate the full extent of land disturbance from that activity, including development of the associated barge and rail facilities and access/haul roads. | Resolved through TVA submittal to NRC on the CRN Site ESP docket | TVA provided photos that represent site conditions prior to site prep for breeder reactor construction (ML17206A091). |

| Info Need ID | Information Need Description | Resolution | Comments |
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| LU-02 | Provide information describing floodplain mapping and characteristics for the site and for offsite affected land areas including transmission line corridors. Describe the expected impacts of any preconstruction activities to floodplains. | Resolved through TVA submittal to NRC on the CRN Site ESP docket | TVA submitted flood plain maps for the site and BTA and also a statement on the capital project process for T-lines (ML17234A002). |
| LU-03 | Provide a knowledgeable expert who can discuss land use, regional planning, and zoning issues for the City of Oak Ridge, TN and Anderson and Roane Counties, TN. Has the city or either of the counties established zoning for the site or adjoining lands, including lands opposite the site on the Clinch River? Is the site addressed in other regional land use plans (e.g., ORR Ten-Year Plan)? | Resolved through audit activities | The review team confirmed availability of any additional information sources related to land use impacts. |
| LU-04 | Provide information regarding special land-use classifications (e.g., Native American or military reservations, wild and scenic rivers, state and national parks, national forests, wildlife refuges, and wilderness areas) on or adjacent to proposed transmission line corridors or routes or locations for other proposed offsite facilities. This includes transmission line segments subject to being rebuilt, re-conducted, or uprated. Also, please address the Redstone and ORR 2 and 8 alternative sites. | Resolved through TVA submittal to NRC on the CRN Site ESP docket | TVA submitted T-line maps showing land use classification (ML17234A002). |
| LU-05 | Discuss encroachment by the project into TVA Zone 3 – Sensitive Resource Management along the Clinch River and associated conflicts with TVA land use policy. Is a zoning change or a variance needed? | Resolved through audit activities | The review team clarified their understanding of the ER description of potential for project impacts to TVA Zone 3. |
| LU-06 | Provide a knowledgeable expert who can discuss potential land disturbing activities associated with rebuilding, reconducting, and uprating offsite transmission lines, including access issues and effects on existing land uses. | Resolved through audit activities and through a TVA submittal to NRC on the CRN Site ESP docket | The review team clarified their understanding of the processes for rebuilding, reconducting, and uprating transmission lines. TVA provided a written synopsis of how they plan to minimize environmental impacts (ML17206A091). |

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| LU-07 | Provide electronic copy of GIS layers used to develop Figures 2.1-2, 2.2-1, 2.2-2, 2.2-3, 2.2-4, 2.2-5, and 4.1-1. | Resolved through TVA submittal to NRC on the CRN Site ESP docket | TVA submitted the necessary GIS files (ML17206A091). |
| LU-08 | ER Page 2.2-3 discusses the "Farmland Conversion Impact Rating" and Form AD-1006, which is included in Appendix A of the ER, page A-11. That form indicates that 1131 acres of land at the CRN site are expected to be converted as a result of the Clinch action. That is an area larger than the site itself (935 ac). Please clarify the acreage of CRN site areas expected to be disturbed. | Resolved through TVA submittal to NRC on the CRN Site ESP docket | TVA provided a written clarification regarding acreage addressed in its farmland analysis (ML17206A091). |
| Meteorology and Air Quality | | | |
| MET-01 | Provide a knowledgeable expert to discuss onsite meteorological data collection. | Resolved through audit activities | Review team confirmed its understanding of ER description of meteorological and air quality data collection. |
| MET-02 | Provide a knowledgeable expert to discuss dispersion modeling with PAVAN, XOQDOQ, and CALPUFF. | Resolved through audit activities | Review team gained understanding of input parameters and assumptions related to the atmospheric dispersion modeling. |
| MET-03 | Provide monthly mixing height data, including frequency and duration of inversion conditions and the methods used to provide the estimates and an assessment of these values relative to their effect on air quality and/or dispersion. | Resolved through audit activities | Review team acquired mixing height data from SACTI input as well as from other publicly available sources. |
| MET-04 | Provide monthly summaries of atmospheric stability. | Resolved through audit activities | Review team gained access to monthly summaries of atmospheric stability through the electronic reading room. |
| MET-05 | Provide the reactor-specific and site-specific greenhouse gas emissions estimates for different stages of the complete plant lifecycle. No construction/preconstruction estimates are in the application. (Per ISG-26 Attachment 1). | Resolved through audit activities | Review team discussed comparing estimates based on ISG-26 with the information provided by the applicant. |

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| Nonradiological Health and Nonradiological Waste | | | |
| NR-01 | Provide a knowledge expert and supporting documentation to discuss quantities of nonradiological waste that would be generated by the proposed project. | Resolved through TVA submittal to NRC on the CRN Site ESP docket | TVA submitted additional information concerning nonradiological waste (ML17234A002). |
| NR-02 | Provide a knowledgeable expert and supporting documentation to discuss existing TVA procedures for offsite waste disposal. Also, provide a copy of the TVA Waste Minimization Plan. | Resolved through audit activities | The review team examined TVA procedures for offsite waste disposal and the Waste Minimization Plan and determined they supported ER statements concerning anticipated impacts. |
| NR-03 | Provide a knowledgeable expert and supporting documentation to discuss existing TVA worker safety procedures (i.e., Environmental Safety and Health [ES&H] plan) for protecting workers during construction and operation (ex. for digging around live underground transmission lines). | Resolved through audit activities | The review team examined TVA procedures for worker safety and determined they supported ER statements concerning anticipated impacts. |
| NR-04 | On pg 3.1-6 of the ER in Table 3.1-6, there is a reference to mechanical cooling towers putting out 70 dBA at 1000 ft. Does that 70 dBA represent 1 cooling tower? | Resolved through audit activities | TVA clarified that the value in Table 3.1-6 is the PPE value. The review team determined the information in the ER was sufficient. |
| Radiological Health | | | |
| RH-01 | Make available a knowledgeable expert to describe the liquid and gaseous radioactive waste-management and effluent-control systems, including sources of liquid and gaseous waste material, principal release points for radioactive materials to the environment, and identification of direct radiation sources. | Resolved through audit activities | Staff gained an understanding of waste-management and effluent-control systems through audit discussions and a review of PPE basis documents. |

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| RH-02 | To help the NRC staff understand the basis for the normal liquid and gaseous effluent source terms, make available a knowledgeable expert to discuss the basis for the source term given in ER Tables 3.5-1 to 3.5-5 (and expanded upon in the Supplement CNL-16-191 Attachment 2) including: 1) basis for lowering activity of certain radionuclides when deemed overly conservative; 2) maximum number of units and power assumed in source term generation for each of the four SMR technologies considered; and 3) basis for increasing the liquid effluents from one vendor by 10 percent. | Resolved through audit activities | Staff clarified understanding of effluent source terms described in ER statements through audit discussions and review of supporting documents, including PPE basis documents. |
| RH-03 | Make available a knowledgeable expert to clarify whether construction workers are considered members of the public or radiation workers, because there appears to be conflicting information in Sections 4.5.2.1 and 4.5.5. Section 4.5.2.1 states: "Personnel installing additional NuScale reactor units after the initial units start up are not considered construction workers for the purpose of this analysis." Section 4.5.5 states: "Therefore, for the purposes of radiation protection, the CRN Site construction workers are considered to be members of the general public." | Resolved through TVA submittal to NRC on the CRN Site ESP docket | Following an audit discussion, TVA provided clarification on NuScale construction workers in a submittal of supplemental information (ML17206A091). |
| RH-04 | Make available a knowledgeable expert to discuss the basis for the assumptions related to computation of direct doses to the construction workers, including assumed distances, operating reactor configurations, and shielding. | Resolved through audit activities and TVA submittal to NRC on the CRN Site ESP docket | Staff reviewed supporting documents during audit and TVA submitted clarification of methods used to calculate construction worker dose in its July 7, 2017 submittal of supplemental information (ML17206A091). |

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| RH-05 | To help the NRC staff understand the basis for the selected input values in GASPAR, make available a knowledgeable expert to discuss the basis for the various input parameters used in GASPAR in computing construction worker dose. Also provide any sources of information outside of NRC RG 1.109 that support the basis for GASPAR input parameters. | Resolved through audit activities | TVA staff answered questions about GASPAR input parameters. TVA stated that ingestion rates for milk, meat, and vegetable were based on production rates taken from a Tennessee Dept. of Agriculture report that were scaled based on arable lands within Clinch River 50-mile radius. |
| RH-06 | To help the NRC staff understand the basis for the selected input values in GASPAR and LADTAP in computing public doses, make available a knowledgeable expert to discuss the basis for the various input parameters used in computing doses to the public including why ingestion of goat's milk was not considered. Also provide a list of any sources of information outside of NRC RG 1.109 that support the basis for GASPAR and LADTAP input parameters. | Resolved through audit activities | Staff gained better understanding of GASPAR input parameters and the calculation of 50-mile population dose from drinking water through audit discussions and a review of supporting documents, including PPE basis documents. |
| RH-07 | Provide what the present and known future locations are from which a person can obtain aquatic food, drinking water, and nearest present and future Clinch River shoreline locations for recreational use. | Resolved through audit activities | Staff clarified understanding of receptor locations and pathways through audit discussion and during the Radiological Health Site Tour on May 17, 2017. |
| RH-08 | Provide a knowledgeable expert to explain which X/Q values from Table 2.7.6-10 were applied in the computation of Table 5.4-10 doses and whether the entire plume was assumed to deplete in the determination of ground deposition for the computation of external doses. | Resolved through audit activities | Staff clarified understanding of X/Qs and plume depletion through audit discussion. Based on increased understanding, staff determined that remaining questions could be resolved internally. |

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| RH-09 | Make available a knowledgeable expert to discuss the dose results to each of the public receptors and discuss the population doses. | Resolved through audit activities | Staff gained an understanding of dose results to public receptors through audit discussions. |
| RH-10 | Make available a knowledgeable expert to discuss the status and plans for a Radiological Environmental Monitoring Program (REMP). | Resolved through audit activities | TVA stated that it intends to prepare REMP in accordance with current approach/protocol used for its existing nuclear power plants in conjunction with COL application. There is no requirement for a REMP to be developed at the ESP stage. |
| RH-11 | Organize a brief driving tour (1-2 hours) for up to four individuals to visit areas of interest to radiation health specialists, for example, the maximally exposed individual (MEI) location and other assumed receptor locations at least 5 mi from the site (i.e., nearest residence, milk animals if in 5 mi, meat animal, vegetable gardens larger than 50 sq m), nearby water recreational areas, and proposed locations for environmental radiation monitors. | Resolved through audit activities | The requested radiological health tour was conducted May 17, 2017. |
| RH-12 | Make available a knowledgeable expert to discuss impacts from facilities that could contribute to radiological cumulative impacts including: 1) what type of facility "American Nuclear Corporation" operates; 2) which facilities did not respond to DOE's request for information regarding the potential radiation doses to the public from their operations; 3) distinctions made in CNL-16-171 between ORR facilities; and 4) details in CNL-16-171 Table 4.7-1. | Resolved through audit activities | Based on what was learned through audit discussions regarding TVA's supplemental submittal on Dec 2, 2016 (ML16340A259) and from information available in ORR Annual Site Environmental Report, staff determined it had sufficient understanding and information regarding cumulative impacts. |

| Info Need ID | Information Need Description | Resolution | Comments |
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| Site and Technical Overview | | | |
| STO-01 | Provide a knowledgeable expert who can describe the site-related design parameters of the plant parameter envelope (PPE). For example, ER Table 3.1-2, Site-Related Design Parameters, includes structure heights, but not embedment or excavation depths. Table 3.1-2 does not include any values for “acreage” line items (cooling towers, operational plant, laydown areas). Provide the maximum (bounding) excavation depth relative to the site grade and the bounding acreage values for the listed items. | Resolved through TVA submittal to NRC on the CRN Site ESP docket | TVA submitted information verifying maximum excavation depth vs. embedment depth and provided an updated Table 3.1-2 (ML17234A003). |
| STO-02 | Provide a knowledgeable expert who can describe the plans for construction-related facilities and activities (e.g., concrete batch plants, stormwater management, laydown areas). The expert should be prepared to discuss possible locations and size(s), timeframe of use, water needs, permitting needs. | Resolved through audit activities and TVA submittal to NRC on the CRN Site ESP docket | Review team learned more about stormwater management, laydown areas, and other site utilization during audit discussions and tours of the site. TVA submitted the water source and bounding estimate of water use for concrete batch plant (ML17234A003). |
| STO-03 | Provide a knowledgeable expert who can describe the railroad refurbishments that would be necessary to support the CRN project. The expert should be prepared to describe nature and extent of refurbishment activities, as well as anticipated use of rail transportation during construction and operation. | Resolved through TVA submittal to NRC on the CRN Site ESP docket | TVA submitted information clarifying potential use of railroad and potential refurbishments (ML17234A003). |

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| STO-04 | <p>Provide a knowledgeable expert who can describe the site- preparation/ construction activities, including affected areas, general durations and sequencing, and erosion- and sediment-control best management practices (BMPs). Information is needed, to the extent known, regarding the following:</p> <ul style="list-style-type: none"> • new roads that would be constructed vs. utilization/upgrade of existing roads on the site (e.g., to intake, discharge, and laydown areas), including the locations of routes, culverts, and bridges and whether the area required is accounted for in the disturbed acreage total; • the approximate length, location, and degree of disturbance associated with the potable-water and municipal wastewater pipelines, and excavation dewatering rates and discharge method. <p>Provide a knowledgeable expert who can describe the site- preparation/construction activities, including affected areas, general durations and sequencing, and erosion- and sediment-control best management practices (BMPs). Information is needed, to the extent known, regarding the following:</p> <ul style="list-style-type: none"> • new roads that would be constructed vs. utilization/upgrade of existing roads on the site (e.g., to intake, discharge, and laydown areas), including the locations of routes, culverts, and bridges and whether the area required is accounted for in the disturbed acreage total; • the approximate length, location, and degree of disturbance associated with the potable-water and municipal wastewater pipelines, and excavation dewatering rates and discharge method. | Resolved through TVA submittal to NRC on the CRN Site ESP docket | TVA submitted additional information regarding construction and preconstruction activities (ML17234A003). |
| STO-05 | Provide a knowledgeable expert who can describe the plant water sources and use during construction and operation. The expert should be prepared to discuss the assumptions behind the PPE (ER Table 3.1-2) and water-use diagram (ER Figure 3.3-1). Clarification is needed regarding "normal" (Table 3.1-2) or "average" (Figure 3.3-1) use rates, whether "miscellaneous raw water users" includes service water system/ultimate heat sink use (Figure 3.3-1), and the "negligible" consumptive uses (ER Section 3.3.1). | Resolved through TVA submittal to NRC on the CRN Site ESP docket | TVA submitted clarification and corrections to the water use diagram and associated text (ML17234A003). |

| Info Need ID | Information Need Description | Resolution | Comments |
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| STO-06 | Provide a knowledgeable expert to discuss the maps and figures in the ER. Of particular interest are those related to plant layout, offsite structures, offsite transmission lines, and the associated affected areas. Publication-quality files of selected ER figures are needed for reproduction in the environmental impact statement (EIS) (sized for 8.5 x 11 in. page, resolution at least 300 dpi, in .png or .tif format). The geographic information system (GIS) shapefiles that were used for certain analyses and/or to generate certain early site permit (ESP) application figures are also needed. | Unresolved at time of audit closure; however information submitted after the audit resolved this item | TVA submitted publication quality files of ER Rev 0 figures, and GIS shapefiles (ML17206A091). However, additional information is required for verification of source data and to correct an error in data set. <i>On Aug 14, after the audit closed, the review team held a public meeting to discuss insufficiencies with the earlier submittal. On Sep 05, TVA provided additional response to this information need (ML118010A067).</i> |
| STO-07 | Provide a knowledgeable expert who can describe the transmission system changes that would be necessary to support a nuclear plant on the CRN Site. The expert should be prepared to discuss the affected segments (e.g., reconcile segments listed in ER Table 3.7-1 with those shown on Figure 3.7-7) and the types of upgrade activities that are planned. | Resolved through TVA submittal to NRC on the CRN Site ESP docket | TVA provided corrected text, figures, and tables related to the transmission system upgrades (ML17234A003). |
| STO-08 | Provide a knowledgeable expert who can describe the effluent discharge system, including the holding pond (i.e., construction/lining materials and estimated evaporation rates). | Resolved through TVA submittal to NRC on the CRN Site ESP docket | TVA provided a brief clarification of the purpose of the effluent discharge holding pond holding pond and its operation in accordance with NPDES permits (ML17234A003). |

| Info Need ID | Information Need Description | Resolution | Comments |
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| STO-09 | Provide a knowledgeable expert to discuss the connection between the Clinch River Site and the Bethel Valley Substation. Section 3.7.1 states that the Clinch River project includes installation of an underground 69-kV transmission line at the Cinch River Site to the Bethel Valley Substation. Chapter 1 includes the statement “A new 69-kV underground transmission line (approximately 5 mi) could be constructed to connect the CRN Site switchyard via 500-kV to 69- kV transformers to the Bethel Valley Substation.” The underground transmission line is critical to TVA’s stated objectives. | Resolved through audit activities. | TVA confirmed that the proposed project includes the 69-kv underground transmission line. |
| STO-10 | Provide a knowledgeable expert to discuss TVA’s criteria for choosing alternative sites including supplying federal mission-critical loads with reliable power from generation and transmission that is less vulnerable to supply disruption from intentional destructive acts and natural phenomena. | Resolved through audit activities | The review team and TVA staff discussed the connection between the purpose and need of the proposed action and the site selection criteria. |
| STO-11 | Provide a knowledgeable expert to discuss Table 1.2-1 and 1.2-2. These sections list authorizations required for ESP and authorizations required for preconstruction, construction, and operation. The tables list the responsible agency and the applicable regulation. Table 1.2-1 lists ESP authorizations required prior to NRC issuance of an ESP [emphasis added]. Provide a knowledgeable expert to discuss: State or local authorization need for transportation infrastructure (i.e., road, rail, and barge); Migratory Bird Act/Executive Order 13186 - Responsibility of Federal Agencies to Protect Migratory Birds; permit for sewage to Oak Ridge Public Works; emergency response plan; county permits; other authorizations prior to issuance of an ESP. Discuss the authorizations required at each stage of the project, ESP, preconstruction, construction, and operation. | Resolved through TVA submittal to NRC on the CRN Site ESP docket | TVA revised Table 1.2-2 (ML17234A003). |
| STO-12 | Provide a knowledgeable expert to discuss the Environmental Protection Plan (EPP) submitted in December 2016. In addition, provide a knowledgeable expert to discuss controls the measures and controls to limit potential impacts during construction, particularly with regard to terrestrial, cultural, and historic resources. | Resolved through audit activities | The review team discussed with TVA the regulatory requirements for submittal of proposed license conditions. |

| Info Need ID | Information Need Description | Resolution | Comments |
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| STO-13 | Provide a knowledgeable expert to discuss a list that separates the preconstruction and construction impacts (10 CFR 51.45(c)) and assigns to each type of impact (e.g., land use and surface water) an approximate percentage of the overall impacts and the basis for this estimation. | Resolved through TVA submittal to NRC on the CRN Site ESP docket | TVA provided a revised Section 4.6 and new Table 4.6-2 which address separation of preconstruction and construction impacts (ML17234A003). |
| Socioeconomics and Environmental Justice | | | |
| SE-01 | Provide a knowledgeable expert able to discuss and clarify supplemental information to the ER, presented in TVA correspondence CL-16-190, dated Dec 15, 2016. Specifically, clarify onsite workforce estimates with respect to the potential for operations staff, outage staff, and construction staff all being employed simultaneously. This information is needed to estimate the peak onsite workforce expected. | Resolved through TVA submittal to NRC on the CRN Site ESP docket | TVA submitted onsite workforce estimates. (ML17167A155). |
| SE-02 | Provide updated quantitative information describing the tax equivalent payments as a proportion of county revenues for the affected counties. Provide updated characterization of expected local expenditures for construction and operations activities to provide context for local versus nonlocal purchases of products and services. Describe the expected sales and use tax impacts of the local-area and Tennessee-based project expenditures. | Resolved through audit activities | The review team determined it could make the necessary calculations without additional information from TVA. |
| Terrestrial Ecology | | | |
| TE-01 | Provide GIS layers used to create ER Figures 2.4.1-1 and 4.3-1. Provide habitat layers for the BTA, as they do not appear in ER Figure 4.3-1. | Resolved through TVA submittal to NRC on the CRN Site ESP docket | TVA provided GIS layer data. |
| TE-02 | Provide a knowledgeable terrestrial resources expert to discuss TVA's planning assumptions for uprating, reconductoring, and rebuilding offsite transmission lines, and available information on important species and habitats from TVA's Natural Heritage Database. The expert should be prepared to discuss any need for additional clearing or widening of rights-of-way, possible effects on wetlands or other waterways within or adjacent to rights-of-way, and possible effects on plants and wildlife using affected right-of-way lands. | Resolved through audit activities | Review team examined data from TVA natural heritage database. |

| Info Need ID | Information Need Description | Resolution | Comments |
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| TE-03 | Provide a copy of TVA's document titled A Guide for Environmental Protection and Best Management Practices for Tennessee Valley Authority Transmission Construction and Maintenance Activities | Resolved through audit activities | Review team examined the requested document which is publically available. |
| TE-04 | Provide a knowledgeable terrestrial resources expert who can discuss the timing of botanical surveys on the CRN Site and BTA. Also provide, if available, the possible prior plant surveys in the BTA that were alluded to in ER Section 2.4.1.1 on page 2.4.1-4 | Resolved through TVA submittal to NRC on the CRN Site ESP docket | TVA provided an explanation on the docket (ML17206A091). |
| TE-05 | Provide a knowledgeable expert who can discuss the following statement made in the results section of the CRN terrestrial animal study on page 22, "Although studies on use of [bat] habitat during summer are few (but currently underway)..." Provide information on any bat studies on or offsite referred to by the above statement (in addition the two TVA studies on the CRN Site and the BTA). | Resolved through audit activities | Review team clarified its understanding of summer bat surveys. |
| TE-06 | Provide a knowledgeable expert who can discuss the status of TVA's correspondence with the U.S. Army Corps of Engineers (USACE) and TVA's eventual plans for obtaining a USACE jurisdictional determination and submitting a joint permit application for wetland impacts. The staff understands that such plans may not be developed in detail until an application is made for a COL. | Resolved through audit activities | Review team clarified its understanding that TVA will keep USACE and NRC informed as to their continuing pursuit of 404 permits and TDEC permits. |
| TE-07 | ER Section 2.4.1.6 states that "Federally or state-listed plant species are not known to occur in the terrestrial communities within this ROW." This refers to the approximate 5 mi length where a 69 kV underground line would be installed within the existing 500 kV right-of-way (ROW) between the CRN Site and the Bethel Valley Substation. There is no reference for this statement. Provide a knowledgeable expert who can provide a reference for the absence (or alternatively presence) of important species and/or habitats and wetlands in this 500 kV ROW | Resolved through audit activities | The requested information is publicly available from ORNL (which the review team examined to resolve info need). |

| Info Need ID | Information Need Description | Resolution | Comments |
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| TE-08 | Provide a knowledgeable expert who can discuss the status of TVA's correspondence with U.S. Fish and Wildlife Service (FWS) regarding Federally listed important species and habitats, TDEC – Division of Natural Heritage, and Tennessee Wildlife Resources Agency regarding State-listed important species and habitats. Provide any correspondence to or from these agencies. | Resolved through USFWS submittal to NRC on the CRN Site ESP docket | USFWS provided a letter containing the necessary information (ML17205A342). |
| TE-09 | The 2006 Oak Ridge Reservation document titled "Physical Characteristics and Natural Resources" (by Patricia Dreyer Parr and Joan F. Hughes) identifies a large area in the northeast portion of the CRN Site as having a very high biological significance ranking (BSR-2) (Figure 12 in the document) and as providing confirmed and potential habitat for rare plants and wildlife (Figure 13 in the document). Provide a knowledgeable expert who can discuss and map this area. | Resolved through audit activities | TVA explained history during audit. |
| TE-10 | ER Section 4.3.1.1 generically speaks to TVA's construction BMPs but provide no reference for these, nor does it describe them in detail. Identify and briefly describe each specific BMP and provide the reference for TVA's construction BMPs. | Resolved through audit activities | Review team obtained the information from publically available sources. |
| TE-11 | Provide a copy of the report of the offsite bat study TVA was involved in and which was underway during pre-application meetings with the NRC. This study was investigating the potential effects of human disturbance on summer roosting gray bats. If the report is unavailable because the study is still ongoing, provide a knowledgeable expert who can discuss the study's status and the future availability of the report. | Resolved through audit activities | Review team determined that the data collected was not relevant and report not needed. |
| TE-12 | ER Section 2.4.1.6 states, "The new 161-kV ROW overlaps areas to be cleared for facility construction except for approximately 1200 ft at the southern end of the new ROW." It appears in ER Figures 3.7-1 and 4.3-1 that the southern 1,200 ft of disturbance for the new 161 kV ROW may not have been accounted for. Provide a knowledgeable expert who can confirm whether the disturbance footprint of the southern 1,200 ft of the new 161 kV ROW is accounted for in Table 4.3-1. | Resolved through audit activities | Review team clarified its understanding of ER description of project details related to the 161 kV ROW. |

| Info Need ID | Information Need Description | Resolution | Comments |
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| TE-13 | Expand ER Table 4.3-1 to quantify permanent and temporary land area disturbances by habitat type for the BTA and for the footprint of disturbance for the underground transmission line to the Bethel Valley Substation. Although Page 4.3-5 of the ER states that there are no wetlands present along the route for the underground transmission line, topography suggests the possible presence of multiple small streams and associated wetlands in swales along the route. | Resolved through TVA submittal to NRC on the CRN Site ESP docket | TVA provided upland habitat disturbance information for BTA in ML17206A091. The review team will conservatively estimate wetland impacts for BTA and underground transmission line, recognizing that more precise quantification will not be possible until a wetland delineation is ultimately completed at the COL stage. |
| TE-14 | ER Section 3.7.1 indicates expansion of the 161 kV Bethel Valley Substation to receive 69 kV underground transmission line. The substation expansion is not accounted for in the terrestrial ecology impacts in ER Section 4.3.1. Provide a knowledgeable expert who can discuss the 161 kV Bethel Valley Substation expansion and any associated terrestrial ecology impacts. | Resolved through audit activities | Review team clarified its understanding of ER description of project details related to the Bethel Valley Substation Expansion. |
| TE-15 | ER Sections 2.4.1.6 and 3.7.3.7 do not describe the specific upland and wetland habitats affected offsite by building the 69-kV underground line within the existing 500 kV corridor from the CRN Site to the Bethel Valley Substation. Provide the affected acreage for each upland and wetland habitat affected. If a wetland delineation is not available, other wetland data sources may be suitable for the NRC staff's review. | Resolved through audit activities | Through audit discussions, the review team determined it will be able to use TVA's response to TE-13 to conservatively estimate wetland acreage in the corridor. |
| TE-16 | ER Section 3.6.2 indicates the CRN Site currently has a stormwater-management system consisting of stormwater-runoff/collection ponds and piping, and that this system is to be modified to support the CRN SMR Project. Stormwater will be managed in accordance with a site-specific Stormwater Pollution Prevention Plan (SWPPP), which will be developed and may use existing ponds and include one or more new ponds. Provide a knowledgeable expert who can discuss TVA's plan for a SWPPP and how this may affect wetlands, streams, uplands, etc. | Resolved through audit activities | Review team clarified its understanding of TVA's stormwater management plan. |

| Info Need ID | Information Need Description | Resolution | Comments |
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| TE-17 | ER Section 4.3.1.2 indicates potential impacts to wetlands in the BTA and postpones quantification of impacts to the COL stage. Provide a knowledgeable expert to discuss any additional information on wetland impacts in the BTA. | Resolved through audit activities | TVA provided information on upland habitats in the BTA on the docket in response to TE-13 (ML17206A091) but it does not address wetland impacts in the BTA – this must either be left to COL or conservatively estimated by the USACE. |
| TE-18 | Provide the Seasonal and Annual Cooling Tower Impact (SACTI) report. | Resolved through audit activities | NRC will utilize salt deposition data in the ER. Report not needed. |
| TE-19 | ER Section 5.3.3.1.3 and Table 5.3-5 indicate that damaging levels of salt deposition occur out to 200 to 300 m west of the cooling towers, within which natural vegetation (forest and herbaceous) occurs. Provide a figure of salt deposition isopleths depicting where salt deposition drops to below damaging levels (1,000 kg/km ² /mo), overlay that information on site vegetation, and derive area estimates of affected habitat types. | Resolved through audit activities | The review team determined that it will utilize salt deposition data in the ER and create the figure. |
| TE-20 | ER Section 6.5.1.2 indicates additional monitoring of terrestrial plant and animal communities during construction and preoperational phases is not proposed. However, it also states that TVA would repeat field studies performed during the site-preparation monitoring program for the period following construction in order to collect at least 1 year of preoperational and/or operational data for comparison to the baseline data. Provide a knowledge expert that can resolve this apparent contradiction and discuss planned preoperational/operational monitoring. | Resolved through audit activities | TVA provided a revised statement regarding their terrestrial monitoring program (ML17206A091). |

| Info Need ID | Information Need Description | Resolution | Comments |
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| TE-21 | ER Section 4.3.1.6 states that relocation of the 161 kV onsite transmission line is likely to displace an osprey nest that has been built on a tower in this area. ER Section 6.5.1.2 calls for monitoring the nest if active during construction. Provide a knowledgeable expert to discuss how monitoring comports with Executive Order 13186 – Responsibilities of Federal Agencies to Protect Migratory Birds (cited in ER Section 6.5.1.2 in support of monitoring the osprey nest) given that the nest will be displaced. | Resolved through TVA submittal to NRC on the CRN Site ESP docket | TVA provided a statement on the docket (ML17206A091). |
| TE-22 | ER Section 9.3.5 describes terrestrial resources generically across large spatial scales without providing site-specific information on habitat presence or disturbance at each alternative site. TVA provided in its December 15, 2016 "Submittal of Supplemental Information Related to Site Selection in Support of the Early Site Permit Application for Clinch River Nuclear Site" figures which depict some infrastructure associated with the alternative sites, ORR Site 2 (Figure 9.3-6), ORR Site 8 (Figure 9.3-7), and Redstone Arsenal (Figure 9.3-8). These figures depict potential cooling water connectors at all 3 alternative sites, and a potential offsite transmission line at Redstone Arsenal. Provide a knowledgeable expert who can discuss whether these figures depict all major offsite appurtenances that would be needed (e.g., to connect to the local electric grid and satisfy heavy-haul needs [e.g., roads, railway, barge]) and that would be required by local site conditions if the SMR project from the CRN Site were to be located there. Once all offsite appurtenances have been identified, overlay the footprint of each alternative site on habitat types and calculate anticipated acreages for upland and wetland habitats that would be disturbed at each site. | Resolved through TVA submittal to NRC on the CRN Site ESP docket | TVA provided a statement on the docket regarding offsite appurtenances at the alternative sites (ML17206A091). |
| TE-23 | Provide a knowledgeable expert to discuss how the terrestrial ecology criteria fit into the site-selection process. | Resolved through audit activities | Review team clarified its understanding of TVA's consideration of terrestrial ecology criteria in site selection. |

| Info Need ID | Information Need Description | Resolution | Comments |
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| TE-24 | The 2006 Oak Ridge Reservation document titled "Physical Characteristics and Natural Resources" (by Patricia Dreyer Parr and Joan F. Hughes) identifies a large area in the northeast portion of the CRN Site as having a very high biological significance ranking (BSR-2) (Figure 12 in the document) and as providing confirmed and potential habitat for rare plants and wildlife (Figure 13 in the document). Provide a knowledgeable expert who can discuss these designations relative to the identified area on the CRN Site. | Resolved through audit activities | Review team clarified its understanding of biological rankings relative to the CRN site. |
| Transportation of Spent Fuel | | | |
| TR-01 | Make available a knowledgeable expert to discuss the estimate of the heat load in a spent fuel shipping cask and to compare the result to 10 CFR 51.52 Table S-4 conditions (i.e., 250,000 Btu/hr [~ 73 kW]). | TVA submittal to NRC on the CRN Site ESP docket | Provided in TVA submittal (ML17234A003). |
| TR-02 | Make available a knowledgeable expert to discuss the estimate of 492 shipments of unirradiated fuel listed in Table 5.7-6 of the ER. | Resolved through audit activities | Closed by examining unirradiated fuel shipping calculations in supporting documents. |
| TR-03 | Make available a knowledgeable expert to discuss the estimate of 46 shipments of irradiated fuel listed in Table 5.7-7 of the ER. | Resolved through audit activities | Staff examined supporting documents. |
| TR-04 | Make available a knowledgeable expert to discuss the normalization of shipments discussed in Section 3.8, and in Tables 5.7-6 and 5.7-7 of the ER. | TVA submittal to NRC on the CRN Site ESP docket | Provided in TVA submittal (ML17234A003). |
| TR-05 | Make available a knowledgeable expert to discuss the respirable fractions applied in the RADTRAN computer code runs used to estimate radiological transportation accident risks. | TVA submittal to NRC on the CRN Site ESP docket | Provided in TVA submittal (ML17234A003). |
| TR-06 | Make available a knowledgeable expert to discuss the accident, fatality, and injury rates in Table 7.4-1 of the ER. | TVA submittal to NRC on the CRN Site ESP docket | Provided in TVA submittal (ML17234A003). |
| TR-07 | Make available a knowledgeable expert to discuss the distances and population densities used in the RADTRAN computer code runs used to estimate routine transportation impacts and transportation accident risks. | TVA submittal to NRC on the CRN Site ESP docket | Provided in TVA submittal (ML17234A003). |

| Info Need ID | Information Need Description | Resolution | Comments |
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| TR-08 | Make available a knowledgeable expert to discuss the incorporation of doses at stops into calculation of routine radiation doses to the general public-onlookers and radiation doses to the general public-along the route. For example, see Section 6.2.2.1 and Figure 6-2 in the Environmental Impact Statement for an Early Site Permit (ESP) at the PSEG Site (ML15316A072). | TVA submittal to NRC on the CRN Site ESP docket | Provided in TVA submittal (ML17234A003). |
| TR-09 | Make available a knowledgeable expert to discuss the references for data quoted in the Sections 5.7.2 and 7.4 of the ER. | TVA submittal to NRC on the CRN Site ESP docket | Provided in TVA submittal (ML17234A003). |
| TR-10 | Make available a knowledgeable expert to discuss the estimates of routine doses from radioactive waste shipments. | TVA submittal to NRC on the CRN Site ESP docket | Provided in TVA submittal (ML17234A003). |
| TR-11 | Make available a knowledgeable expert to discuss the package dimensions used in the RADTRAN computer code runs used to estimate routine doses from unirradiated fuel and radioactive waste. | TVA submittal to NRC on the CRN Site ESP docket | Provided in TVA submittal (ML17234A003). |
| TR-12 | Make available a knowledgeable expert to discuss the traffic density data used in the RADTRAN computer code runs used to estimate routine doses from unirradiated fuel and irradiated fuel. | Resolved through audit activities | Resolved by examining traffic density data referenced in supporting documents. |
| TR-13 | Make available a knowledgeable expert to discuss the amounts of construction materials that would be used to construct the four SMRs considered in the ER. | Resolved through audit activities | Construction material amounts are available from a publicly available version of "DOE NP2010 Nuclear Power Plant Construction Infrastructure Assessment," MPR-2776, Rev. 0. |
| TR-14 | Make available a knowledgeable expert to discuss transportation routing and the routine transportation impacts and transportation accident risks for the four alternative sites. | TVA submittal to NRC on the CRN Site ESP docket | Provided in TVA submittal (ML16350A429). |
| TR-15 | Make available a knowledgeable expert to discuss all nearby existing/proposed projects or activities that could potentially contribute to cumulative impacts of traffic and transportation if a new nuclear power plant is constructed at the Clinch River site or at the alternative sites. | Resolved through audit activities | DOE Waste Information Management System (http://www.emwims.org) and the DOE Manifest Information Management System (http://mims.doe.gov/) will be used. |

| Info Need ID | Information Need Description | Resolution | Comments |
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| TR-16 | Make available a knowledgeable expert to discuss the estimate of 61 shipments of radioactive waste listed in Table 5.7-7 of the ER. | TVA submittal to NRC on the CRN Site ESP docket | Provided in TVA submittal (ML17234A003). |
| Uranium Fuel Cycle and Decommissioning | | | |
| UFC-01 | Make available a knowledgeable expert to discuss the basis for scaling Table S-3 of 10 CFR 51.51 by 0.98 for the surrogate SMR plant. The basis is given in Section 5.7.1 where it provides two MWe powers for the Table S-3 reference plant. It states, "As provided in Table 3.1-2, Item 16.6, the maximum net power output of the SMRs at the CRN Site is 800 MWe. Table 3.1-2, Item 16.4, provides a station capacity factor of 98 percent resulting in an effective net power output 784 MWe. The ratio of the effective net power output value for the SMRs described by the PPE (784 MWe) to the net electrical output for the 1000 MWe reference plant (800 MWe) provides a scaling factor of 0.98 to convert reference plant values to project-specific values at the CRN Site." | Resolved through audit activities | TVA clarified that scaling Table S-3 values by 0.98 was based on MWe value for the site of 800 MWe (see item 16.6 of TVA ER Table 3.1-2) and maximum station capacity factor proposed by reactor vendors of 98%. |

Appendix C. Socioeconomic/Environmental Justice Field Notes*
Clinch River Nuclear Early Site Permit

Environmental Audit, May 15 – August 11, 2017
Daniel Mussatti (NRC), David Anderson (PNNL)

May 16, 2017

Meeting with United Way of Anderson County, Oak Ridge, TN: Naomi Asher, Executive Director

Serves 40 local agencies and works in concert with Roane County's United Way. Its community needs assessment identified three principal focus areas for their services:

- youth development
- senior services
- self-sufficiency

United Way noted that the free and reduced lunch percentage as 60 percent and rising locally and noted that worker skills training in anticipation of nuclear construction might be worth pursuing locally.

In a discussion regarding the existence of local EJ populations, United Way described the Scarboro community, a mostly African American enclave within the southern Oak Ridge urban area off of Tuskegee Drive. United Way described the Woodland area as a mostly Hispanic neighborhood, suggested areas to drive to see these areas, and also described an area of concern in the now-condemned Applewood Apartments, a sprawling complex of two-story apartment houses along Hunters Circle in the Woodland area.

United Way stated there was little evidence of any subsistence activities in the area, but that United Way was involved with community gardening, canning, and street fair sales of produce.

May 17, 2017

Meeting with Roane Alliance, Kingston, TN: Wade Creswell, President

The TVA property lies within Roane County. Roane Alliance noted that planned development of the CRN Site was consistent with the plans and goals of the county and confirmed that, for the most part, any local impact would be from construction and operations workers choosing to locate in Roane County. But they also confirmed that the great majority would choose to live closer to Knoxville, due to the lack of middle income housing near the site. Roane Alliance stated there would be adequate local resources for any workers wanting to locate temporarily (i.e., parks, campgrounds, and rentals), but that the wider economic region would absorb the workforce easily.

* Additional meetings with local and state governmental agencies are documented in the main body of the report.

Regarding general economic conditions in Roane County, Roane Alliance noted that tourism brings roughly \$65 million per year in tourist expenditures. There are various industrial parks in the county with sites available in various states of construction readiness. Roane Alliance noted in today's market for commercial and industrial sites, the expectation is for turn-key readiness (pad sites with all utilities ready to be activated for construction), and that there is an economic development master plan available for Roane County at roaneallowance.org.

Roane Alliance identified the current activities of the UPF and the planned Manhattan Project National Park as areas of potential cumulative impacts.

Meeting with Roane County Sherriff, Kingston, TN: Garvin Morris, Chief Deputy

The Sherriff's Office provided general background about the history of the area, including the towns of Kingston, Harriman, and Rockwood. The Sherriff's Office did not identify any issues with the capacity of local emergency services apart from some extra police patrols. The Sherriff's Office indicated that cooperation with the City of Oak Ridge police would be needed to monitor expected traffic impacts during construction.

The Sherriff's Office also identified a potential cumulative impact from a proposed Mercedes Benz plant in the area, and that there is current construction in Rockwood on a new high school for Roane that will service three school districts.

Meeting with Loudon County Economic Development, Loudon, TN: Jack Qualls, Executive Director, Stephanie Myers, Assistant Director

Staff of the Economic Development office confirmed that the workforce impacts from construction would likely be split 25-75 between Anderson County and the other counties of the economic region, with Roane and Loudon Counties getting equal shares and the majority going to Knox County, given the easy access to the site and availability of middle income housing. They suggested Loudon County might be more likely to be a construction supplier, given the diversity of related industries located there.

Loudon County has fully recovered from the 2009 recession. The economy is diverse, relying upon large- and moderate-scale manufacturing plants, outdoor recreation (i.e., golf, boating, and fishing), and large-scale retirement villages. The Economic Development staff note that 40 to 45 percent of the housing stock in the cities of Lenoir and Loudon is rental housing. They did not identify issues with community services capacities, including schools.

Most of the county flags as low-income or minority populations. They did not identify particular concentrations other than noting that the Monterrey mushroom plant workers were mostly Hispanic.

Jack Qualls identified Tellico Reservoir Development as a mixed use (domestic, commercial, and industrial) property and as a cumulative impact.

Meeting with Anderson County Chamber of Commerce, Clinton, TN: Rick Meredith, President

Staff of Anderson County Chamber of Commerce addressed the economic climate in Clinton and "the other Anderson County" apart from conditions in Oak Ridge. Anderson County comprises three economies: Oak Ridge, Clinton, and the rest of the county.

Outside of Oak Ridge, the Anderson County economy is booming, similar to Loudon County. The area has become a hub of automotive parts manufacturing. A total of 3,000 new jobs are expected over the next few years as manufacturing continues to expand.

The lodging industry reports annual average occupancy of 78% (relatively high for the industry), many of the patrons being workers for the UPF, but increasingly for the automotive sector and visitors for fishing tournaments. The economic growth, coupled with the expansion of outdoor recreation and tourism bringing several fishing tournaments to the area is leading to additional growth. Local dams also provide for growth in high-end waterfront housing, which is highly attractive to northern retirees.

Rick Meredith stated the local housing market outside Oak Ridge is healthy, with the average house staying on the market for five months or less. He identified North Clinton as a low-income area. Chamber of Commerce staff did not see any issues accommodating the proportion of the temporary workforce expected to locate in Anderson County. The additional population would be well within the capacity of the local emergency services, including the Tenova and Covenant Hospitals.

Chamber of Commerce staff indicated that establishing certified training programs for nuclear construction skills expected by contractors would be easy to arrange and also confirmed that the current expected timing of the UPF construction and the TVA construction would be complementary to each other – leading to steady employment of construction workers over many years.

May 18, 2017

Meeting with University of Tennessee Baker Center for Public Policy, Knoxville, TN: Dr. Matthew Murray, Director; Dr. Bill Fox, Emeritus Director

University of Tennessee staff (UT) have authored numerous studies on the economic impact of DOE and related activities associated with the ORR. The purpose of this meeting was to elicit insight into assessing the economic impact of the Clinch River project.

One specific request involved defining the economic region associated the scale of the planned construction. Dr. Murray and Dr. Fox indicated that there would be no reason to expand the economic region beyond the four-county region (i.e., Anderson, Knox, Loudon, and Roane) suggested by TVA in the ER and the review team's analysis of the laborshed. They indicated that recent UT campus construction activities have averaged about \$1 billion/year, and that, because a sufficient construction workforce was not available locally, UT had recruited outside workers to the area to support the construction activities.

They also provided insights based on the economic history of the region and indicated that the region traditionally had grown up as a nondurable (hosiery and apparel) manufacturing center. With time, those industries moved overseas, giving way to durable (automotive parts) manufacturing. The economy represented both by the UT and the ORR activities really came into being with the advent of WWII and have grown with time. The outdoor recreation/retirement economy has grown up very recently into a major contributor.

Local versus nonlocal procurement expectations that could be associated with the TVA action were discussed. UT staff confirmed that most of the expected labor force would

not locate in close proximity to the site due to the lack of available housing and services. They did indicate that, unlike other rural areas where nuclear construction has occurred or would occur, the defined economic region is home to many supply chain industries and specialized labor. UT staff speculated that this unique aspect of the area might indicate TVA could exploit a larger local proportion of project expenditures than might be expected in other parts of the country for the same project.

UT staff also confirmed that all input-output based study methodologies would yield roughly the same results for a standard multi-year large-scale construction activity, and that special attention should be paid to the expected local versus nonlocal expenditures and related acquisition of labor resources. All recent studies of ORR expenditures and investment have relied upon the Regional Industrial Multiplier (RIM) methodology.