ClinchRiverESPHFNPEm Resource

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Sent: Friday, November 03, 2017 2:29 PM
To: Fetter, Allen
Subject: [External_Sender] CNL-17-142 Submittal of TVA Discussions Provided during the October 11, 2017 Public Meeting
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CNL-17-142 Submittal of TVA Discussions Provided during the October 11, 2017 Public Meeting

On behalf of
Joe Shea
VP Nuclear Regulatory Affairs & Support Services

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TVA

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

CNL-17-142

November 3, 2017

10 CFR 52, Subpart A

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

Clinch River Nuclear Site
NRC Docket No. 52-047

Subject: Submittal of TVA Discussions Provided During October 11, 2017 Public Meeting in Support of Early Site Permit Application for Clinch River Nuclear Site

References:

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

2. NRC Electronic Mail, "Issuance of RAI pertaining to Section 2.5.1, Basis Geologic and Seismic Information (RAI Number 5, eRAI-8991)," dated August 1, 2017

3. Letter from TVA to NRC, CNL-17-099, "Response to Request for Additional Information Number 5, Questions 02.05.01-01 and 02.05.01-02, Regarding Basis Geologic and Seismic Information and RAI Number 6, Questions 02.05.04-01 and 02.05.04-02, Regarding Stability of Subsurface Materials and Foundations in Support of Early Site Permit Application for Clinch River Nuclear Site," dated September 15, 2017

4. NRC Electronic Mail, "NRC-TVA Public Meeting 20171011_Topics for Discussion.docx," dated October 5, 2017

5. Notice of Forthcoming Meeting Between the U.S. Nuclear Regulatory Commission and Tennessee Valley Authority To Discuss Topics Associated With Tennessee Valley Authority's Early Site Permit Application For The Clinch River Nuclear Site, dated October 5, 2017

6. NRC Electronic Mail, "Request for TVA text used to support the NRC-TVA Public Meeting on October 11, 2017," dated October 18, 2017

By letter dated May 12, 2016 (Reference 1), Tennessee Valley Authority (TVA) submitted an application for an early site permit for the Clinch River Nuclear (CRN) Site in Oak Ridge, TN. By electronic mail dated August 1, 2017 (Reference 2), Nuclear Regulatory Commission (NRC) issued requests for additional information (RAIs) regarding basic geologic and seismic information and subsurface materials and foundations associated with the CRN Site. By letter

dated September 15, 2017 (Reference 3), TVA submitted responses to RAI Number 5, Questions 02.05.01-01 and 02.05.01-02. By electronic mail dated October 5, 2017 (Reference 4), the NRC provided four topics for discussion in support an October 11, 2017 NRC-TVA public meeting. During a public meeting held on October 11, 2017 (Reference 5), TVA provided verbal responses to the discussion topics provided in Reference 4. By electronic mail dated October 18, 2017 (Reference 6), the NRC requested that TVA submit the text of the TVA discussions of the four topics during the October 11, 2017 public meeting.

The enclosure to this letter provides the text of the TVA discussions of the NRC-published, "Topics for Discussion," during the NRC-TVA public meeting held on October 11, 2017.

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

I declare under penalty of perjury that the foregoing is true and correct. Executed on this 3rd day of November 2017.

Respectfully,

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

Enclosure:

Discussions Provided by TVA During the NRC-TVA Public Meeting held on October 11, 2017

cc (enclosure):

A. Fetter, Project Manager, Division of New Reactor Licensing, USNRC (2 copies)

cc (without enclosure):

V. Ordaz, Acting Director, Office of New Reactors, USNRC
F. Akstulewicz, Director, Division of New Reactor Licensing, USNRC
J. Colaccino, Branch Chief, Division of New Reactor Licensing, USNRC
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P. Vokoun, Project Manager, Division of New Reactor Licensing, USNRC
T. Dozier, Project Manager, Division of New Reactor Licensing, USNRC
M. M. McIntosh, Regulatory Specialist, Eastern Regulatory Field Office, Nashville District, USACE

ENCLOSURE

Discussions Provided by TVA During the NRC-TVA Public Meeting held on October 11, 2017

NRC Topic 1

Discussion of modifications to paragraph 5 of Section 2.5.1.2.6.7 made in response to Question 02.05.01-02 in RAI 5 (eRAI-8991). Specifically, paragraph 5 states that current tectonic stresses, the associated broad stress regime of the southeastern U.S., and residual stresses are not expected in the rock mass at shallow depths (i.e., hundreds of feet). NRC staff needs clarification as to why these stresses related to the regional stress field, in which the site is located, are not expected at shallow depths. Alternatively, if they exist at shallow depths, their magnitude is such that they will not pose a hazard for foundation stability or construction.

TVA Response

(a) Tectonic stresses in the region of the Clinch River site are exhibited primarily as earthquakes in the regional seismicity data. As noted in Section 2.5.1.2.6.6, instrumentally located epicenters in the area *(considered part of the ETSZ)* indicate that the vast majority of earthquake hypocenters are located beneath the Appalachian fold and thrust belt and basal decollement about 3 km below the site region. Evidence for shallow tectonic stresses such as surface faulting or shallow seismicity are not evident in the site area above the basal decollement.

(b) In specific regard to RAI 2.5.1-02, Researchers such as (Zoback and Zoback, 1989) note that the consistent NE-SW orientation of the primary principal stress axis (σ_1) across very large areas of the interior of the North American plate implies relatively uniform forces acting on its boundaries, and proposes that the dominant source of stress for the mid-plate stress province is ridge-push force from the Mid-Atlantic Ridge. (Fyi - *Orientation of principal stress directions are derived from measurement of instantaneous strain data gathered from hydraulic fracturing, and borehole breakouts, and earthquake focal mechanisms.*). To explain the subvertical orientation of the intermediate principal stress axis (σ_2) Biryol et al., 2016 proposed that subcontinental lithospheric mantle foundering beneath the southern Appalachians, is the driving mechanism for Miocene buoyant uplift in this area that is described by others (Gallen et al., 2013; Pazzaglia et al., 2013; Prowell and Christopher, 2006). As such, gravitational body forces acting on the uplifted lithospheric column predictably would generate local horizontal buoyancy forces and tensile stresses in the crust and indeed we see a subvertical orientation of the intermediate principal stress axis (σ_2) in the southern Appalachians around Tennessee. The sentence in paragraph 5 of Section 2.5.1.2.6.7 is meant to indicate that these regional stresses acting on the broader crust (including ridge push and lithospheric uplift) are not considered a hazard at the site for foundation stability or construction due to the relatively shallow excavation depths that will not be influenced by crustal forces, however, these forces do occur at greater depth.

(c) Additionally, as noted in the Drakulich (1984) report on the CRBRP excavation, there are no mentions of regional strain-related features affecting the excavation. However,

there is discussion of settlement cracks and compression fractures associated with the excavation.

NRC Topic 2

Discussion of modifications to SSAR Section 2.5.1.2.6.3 (“Fracture Zones”) that are part of the response to Question 02.05.04-01 in RAI 6 (eRAI-9035). Specifically, this section refers to calcite- and dolomite-filled fractures and bedding planes. That type of filling is also mentioned in SSAR Section 2.5.1.2.6.3 under modifications to SSAR Sections 2.5.4.1.3.3 (“Weathered and Fracture Zones”) and 2.5.4.10.1.2 (“Allowable Bearing Capacity”). NRC staff needs clarification on whether or not the calcite and dolomite minerals, described as filling and “healing” fracture zones, fractures, and bedding planes, show any evidence of tectonic deformation (e.g., due to fault displacement along or across these features) that is younger than the mineralization.

TVA Response

SSAR Section 2.5.1.2.6.3 describes “Fracture Zones” encountered in the core borings that often contain calcite and dolomite-filled fractures. The origin and geometry of these fractures are described in Section 2.5.1.2.4.3.3. The calcite- filled fractures represent portions within the carbonate stratigraphic section that accumulated strain and formed as a result of pressure solution prior to (diagenetically) and during Alleghanian shortening and emplacement of Valley and Ridge thrust sheets. It is important to note that most veins in the stratigraphic section are not related to tectonic deformation but are instead diagenetic, especially veins that are normal to bedding. Fractures encountered in core borings that contained calcite and dolomite did not show any evidence of tectonic deformation such as fault offset, fault gouge or brecciation, evidence for brittle cataclasis, omission or repetition of stratigraphy, stratigraphic displacement, or deflected markers rotated into a distinct shear zone.

Hatcher et al., 1992 provide an extensive review of fractures throughout the Oak Ridge area that attributes fracture development prior to Alleghanian shortening and Valley and Ridge thrust sheet emplacement. (*Evidence includes: (1) fractures parallel to bedding indicate their orientation is controlled by bedding orientation; (2) fractures are crosscut by bedding-parallel slip surfaces that likely formed during Alleghanian shortening; (3) fractures are offset by mesoscopic faults; and (4) commonly twinned calcite vein fill within fractures throughout the region.)* In addition, the orientation of the fracture sets consistently rotates with bed orientation, which provides further evidence for their development prior to Alleghanian thrust faulting (Hatcher et al., 1992 and Lemiszki, 1995.).

Finally, SSAR Section 2.5.1.2.4.3.4 describes “shear-fracture zones” which are also a result of Alleghanian shortening and emplacement of Valley and Ridge thrust sheets

that formed as a result of accumulated strain, facilitated by pressure solution. However, these "shear fracture zones" exhibit some evidence for limited bedding parallel slip, which is not evident along fractures.

NRC Topic 3

Discussion of modifications to SSAR Section 2.5.1.2.6.3 ("Fracture Zones") that are included in the response to Question 02.05.04-01 in RAI 6 (eRAI-9035). Specifically, this section state fractures zones that occur along bedding planes or fractures likely represent early dissolution of limestone. Modifications to SSAR Section 2.5.4.1.3.3 ("Weathered and Fracture Zones") also make this statement. NRC staff needs clarification regarding the field evidence used to conclude that the fracture zones are related to dissolution and are not tectonic in nature, or if they are tectonic features, they are associated with older Alleghanian (> 252.17 Ma) deformation.

TVA Response

The discussion in Section 2.5.1.2.6.3 is describing the presence of weathered or fracture zones encountered in the borings drilled at the CRN Site. The statement "The weathered or fracture zones typically occur along bedding planes or fractures and likely represent early dissolution of the limestone" is taken from the Karst Evaluation Report (CRP001-PR-04) and is based on a review of geotechnical coring logs, rock core examination, and rock core photographs that typically show dissolved calcite coating fractures or irregular fracture margins (as opposed to planar) resulting from water penetration that has dissolved and sometimes enlarged the fracture space. The fractures with evidence for dissolution are interpreted to have initially formed by accumulated tectonic strain prior to and during Alleghanian shortening and emplacement of Valley and Ridge thrust sheets, and which subsequently have been exploited by the presence of ground water and accompanying dissolution.

The fractures are described in SSAR Table 2.5.1-16 and they do not show any evidence for tectonic deformation such as fault offset, fault gouge or brecciation, evidence for brittle cataclasis, omission or repetition of stratigraphy, stratigraphic displacement, or deflected markers rotated into a distinct shear zone. However, Table 2.5.1-17 provides a summary of shear fracture zones that <u>do</u> show evidence of tectonic deformation including some folding/rotation of bedding, slickensides, and brecciated zones. Shear fracture zones are distinct from the fracture zones described in Section 2.5.1.2.6.3 and are described in detail in Sections 2.5.1.2.4.3.4 and 2.5.3.2.2. There is additional information and description of shear fracture zones that is forthcoming in a response to RAI 2.5.1-04.

ENCLOSURE

Discussions Provided by TVA During the NRC-TVA Public Meeting held on October 11, 2017

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