



State of Vermont

Vermont Geological Survey
1 National Life Drive
Montpelier, VT 05602-3902
Laurence R. Becker, State Geologist, Phone - 802-522-5165

Department of Fish and Wildlife
Department of Forests, Parks, and Recreation
Department of Environmental Conservation
State Geologist
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Jon Ake
U. S. Nuclear Regulatory Commission
Office of Nuclear Regulatory Research
Division of Engineering
Structural, Geotechnical and Seismic Engineering Branch
Mail Stop 5A24CS
11555 Rockville Pike
Rockville, MD 20852-2738

Dear Mr. Ake:

The Entergy Vermont Yankee Nuclear Power Facility in Vernon, Vermont is to follow Nuclear Regulatory Commission (NRC) guidance to conduct Post-Fukushima seismic reevaluations. A series of documents guide the review. Two documents integral to the guidance are:

- NUREG 2115 - Central and Eastern U.S Seismic Source (CEUS) Characterization for Nuclear Facilities
- Electric Power Research Institute (EPRI)-1025287, "Seismic Evaluation Guidance: Screening, Prioritization and Implementation Details (SPID) for the Resolution of Fukushima Near-Term Task Force Recommendation 2.1: Seismic"

This letter is a request to include an historic earthquake event that does not appear in the NUREG 2115 event catalogue as well as to identify the need for site specific soils and depth to bedrock data beneath the condensate storage tank at Entergy Vermont Yankee (ENVY) facility. If the public is to expect a defensible Ground Motion Response Spectra (GMRS) result at ENVY, site specific data are fundamental to the analysis.

FEDERAL REGISTER NOTICE – February 15, 2013

Nuclear Regulatory Commission [NRC-2013-0038] Electric Power Research Institute; Seismic Evaluation Guidance provides notice of an NRC issuance of an endorsement letter with clarifications for the SPID document. In the notice, a clarification addresses new information coming to light.

Updating the Central and Eastern United States (CEUS)-Seismic Source Characterization (SSG) model

".....If a significant earthquake in the CEUS were to occur or new information were to emerge during the reevaluation period that could require an update of the CEUS-SSC model, the staff expects licensees to evaluate the significance of the new information to determine if the CEUS-SSC model needs to be updated in order to appropriately respond to the 50.54(f) request."

Site Response

... "Where limited site response data exists, information from core borings and data collected from site and regional evaluations should be used to develop the site response amplification. Section 4 of the SPID report states that licensees should provide the basis for the site responses used in the reevaluations. The NRC staff expects site-specific geology, geotechnical, and geophysical information to be a significant part of the basis."

New Information CEUS Earthquake Catalogue

A significant 1638 historic event identified in Central New Hampshire does not appear in the earthquake catalogue in the CEUS Seismic Source Characterization document. A description of this event does appear in a September 2012 document delivered to the Federal Emergency Management Agency Region I entitled: HAZUS Analyses of Eleven Scenario Earthquakes. The report was prepared for FEMA by the URS Corporation of Oakland, California. Authors: Ivan Wong and Fabia Terra et al.

The report indicates that most of the damaging earthquakes in the northeastern U.S. have been in the range of moment magnitude (**M**) 5 to 6 but larger events are possible such as the 1638 Central NH earthquake, in a projected range between **M** 6.5 to 7.0. The report indicates that the 1638 Central New Hampshire and for other events in the report, the magnitudes are probably not the largest earthquakes that can occur at those sites. They are instead the “most likely” damaging scenario earthquakes.

NUREG-2115 focuses on seismic sources and on paleoseismic evidence for the occurrence of Repeated Large-Magnitude Earthquakes (RLMEs), defined as two or more earthquakes with $M \geq 6.5$. However, NUREG-2115 document indicates no paleoseismic studies have been done in Central NH while other locations have received such treatment, most notably in the Newburyport, Massachusetts area. Without paleoseismic studies, it is not known whether a corresponding single event of 6.5 magnitude or multiple events occurred.

Below is the projected magnitude for the most likely damaging 1638 event. The event below meets one of the 6.5 magnitude criteria to be included as a RLME event. In the absence of paleoliquefaction studies this event cannot meet the 2nd event criteria but is very significant none the less. This letter is a request to include the Central NH projected 6.5 M event in the catalogue for inclusion in the probabilistic seismic hazard assessment that Entergy Vermont Yankee will employ in the GMRS analysis. The alternative is to conduct paleoliquefaction studies in Central NH before any calculations are done by Entergy Vermont Yankee so as to have a complete picture of the probabilistic seismic hazard in Vernon, VT.

Earthquake Scenario: Projected 1638 Central New Hampshire (**M** 6.5-7.0)

Epicenter Latitude: 43.39°

Epicenter Longitude: -71.61°

Focal Depth (km): 5

Magnitude (M): 6.5

Fault Strike: N-S

Fault Dip: 45°W

Fault Style: Reverse

Depth to Top of Fault (km): 1

Depth to Bottom of Fault (km): 8.8

Subsurface Rupture Length₂ (km): 25

Subsurface Rupture Width₃ (km): 11

Point Source (PS)/Finite Fault (FF): FF

Reference: Brown and Ebel (EQ Notes, 1985); Ebel and Bouck (SRL, 1988); Ebel (unpublished) –

http://earthquake.usgs.gov/earthquakes/shakemap/global/shake/CentralNewHampshire1638M6.5_se/

Site Response at the Entergy Vermont Yankee Condensate Storage Tank

The Vermont Yankee Condensate Storage Tank (CST) is a seismically classified component and is integral to reactor core isolation cooling. The CST and Condensate Transfer System (lines tied to Engineering Safety Systems) are Class I Equipment. A report “Hydrogeologic Investigation of Tritium in Groundwater” for the Vermont Yankee Nuclear Power Station” by GZA GeoEnvironmental, Inc, May 2011, indicates that the CST is in the vicinity of a thickness of unconsolidated material over bedrock and likely resides on such material. Unconsolidated material over bedrock has the potential to amplify earthquake waves and lead to liquefaction effects. As per the federal register notice, the NRC staff

expects site-specific geology, geotechnical, and geophysical information to be a significant part of the basis for determining Post-Fukushima seismic safety.

Site specific analysis is needed so that, a defensible GMSR can be conducted. Soil boring and geophysical data are necessary for determining the thickness and nature of the materials that are crucial to understanding the seismic amplification and liquefaction hazard and the related risk to structures. As the condensate storage tank is integral to the safe operation of ENVY, a detailed program of subsurface investigation directed as seismic safety issues is warranted for integration into a defensible GMRS. To reiterate, this letter states the need for detailed site information to support a fully realized GMRS result.

Thank you for consideration of the above



Sincerely,

Laurence R Becker

Vermont State Geologist and Director Vermont Geological Survey

cc: Deborah Markowitz, Secretary of the Agency of Natural Resources
Christopher Recchia, Commissioner of the Department of Public Service
Justin Johnson, Deputy Secretary Agency of Natural Resources
Alyssa Schuren, Deputy Commissioner, DEC
Uldis Vanags, Vermont State Nuclear Engineer
William Irwin, Radiological and Toxicological Sciences Chief
Joseph Flynn, Director of the Division of Emergency Management and Homeland Security
Perry Plummer, Acting Director of the New Hampshire Div of Emergency Management
Frederick Chormann, New Hampshire State Geologist
Kurt Schwartz, Director Massachusetts Emergency Management
Stephen Mabee, Massachusetts State Geologist
Doug Tiff, NRC liaison, King of Prussia, Pennsylvania
Bernard Buteau, Entergy Vermont Yankee
Edward Fratto, Executive Director, Northeastern States Emergency Consortium