



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

January 4, 1980

MEMORANDUM FOR: Olan D. Parr, Chief
Light Water Reactors Branch No. 3, DPM

FROM: Robert E. Jackson, Chief
Geosciences Branch, DSS

SUBJECT: STAFF RESPONSE TO WILLIAM H. WARD'S LETTER ON
SEISMIC ISSUES AT WOLF CREEK

Enclosed is the Staff response to William H. Ward's petition to the Commissioners requesting at least a partial suspension of the construction permit for the Wolf Creek Generating Station. This Staff response is an expanded background for the seismic issue mentioned in footnote 6 of the July 12, 1979 Director's Decision under 10 CFR 2.206. This Director's Decision by Victor Stello, Jr., IE, denied Mr. Ward's petition. It stated that the seismic issues contained in Mr. Ward's letter were previously considered by the Staff and do not alter the Safe Shutdown Earthquake at the Wolf Creek site. Based upon the enclosed evaluation of Mr. Ward's concerns and recent Staff licensing decisions, we conclude that the 0.12g Safe Shutdown Earthquake is adequately conservative and therefore recommend that Mr. Ward's request for at least a partial suspension of the construction permit for Wolf Creek be denied. Dr. Phyllis Sobel, Geophysicist, prepared this evaluation. She was assisted by Leon Reiter, Section Leader.

Original signed by
R. E. Jackson

Robert E. Jackson, Chief
Geosciences Branch
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Enclosure:
As stated

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STAFF RESPONSE TO WILLIAM H. WARD'S LETTER ON
SEISMIC ISSUES AT WOLF CREEK

On June 29, 1979, William H. Ward, Attorney for the Mid-America Coalition for Energy Alternatives, wrote the NRC Commissioners to advise them of several seismic issues affecting the Wolf Creek site and to request at least a partial suspension of the construction permit (Attachment). It is the purpose of this Staff response to address Mr. Ward's concerns.

Concern 1. A report by the Kansas State Geological Survey (KSGS), NUREG/CR-0294, concludes that the 1867 Manhattan earthquake was at least intensity VII-VIII (MM). Mr. Ward states that this earthquake was used as the basis for the Safe Shutdown Earthquake (SSE) and that the SSE was based on the assumption that the 1867 Manhattan earthquake could occur on the Nemaha Ridge at its closest approach to the Wolf Creek site, 50 miles. In light of the new information developed by the KSGS, the .12g horizontal acceleration SSE does not now appear to be conservative to Mr. Ward.

Response. The Staff has reviewed the report by KSGS and still finds the 1867 Manhattan earthquake to be intensity VII (MM). The assignment of intensity VII-VIII is based upon an 1877 report of liquefaction on a farm on the floodplain of the Kansas River. That observation was assigned intensity VIII and placed close to the epicenter by the Kansas Geological Survey. Liquefaction is very dependent upon local site conditions and may occur in isoseismal areas that may otherwise be associated with intensities less than VIII. The staff agrees with the standard references, such as Earthquake History of the United States (1973), which list this earthquake as an intensity VII (MM).

In the Safety Evaluation Report (SER) for the Wolf Creek site, the Staff chose a Safe Shutdown Earthquake (SSE) of intensity VII (MM). This intensity was based on:

1. The maximum earthquake that could occur in the Nemaha Uplift at its closest approach to the Wolf Creek site.
2. The maximum random earthquake in the region (for example, the 1956 Catoosa, Oklahoma earthquake).

The Staff's analysis did not involve the direct use of the 1867 Manhattan earthquake since a larger earthquake (intensity greater than VIII and less than X) was assumed to occur on the Nemaha Uplift. This larger earthquake was already assumed to occur at the closest approach of the Humboldt Fault to the Wolf Creek site. Therefore, the results of the Staff's analysis (an SSE of intensity VII) are not modified by the KSGS results.

Concern 2. The size of the appropriate Wolf Creek SSE can be determined by reference to the SER for another of the SNUPPS units, Tyrone. Both Tyrone and Wolf Creek are located in the Central Stable Region Tectonic Province. The Tyrone SSE is 0.2g horizontal acceleration.

Response. The Staff's assessment of the SSE at both Wolf Creek and Tyrone considered both the maximum random earthquake and the maximum earthquake that could occur on a nearby structure. The staff has evaluated the SSE at Wolf Creek and Tyrone in light of more recent licensing decisions. As a result of this evaluation we see no evidence that the SSE at Wolf Creek is unconservative or that it is inconsistent with recent licensing decisions.

1. Random earthquake at Tyrone.

The Tyrone site is near the town of Durand in western Wisconsin. The site is in the Central Stable Region Tectonic Province. In the Tyrone SER (1975), the Staff considered the intensity VII-VIII Anna, Ohio earthquake of 1937 as the largest earthquake in the Central Stable Region which could not be reasonably associated with known geologic structure. Using the Trifunac-Brady (1975) empirical relation between intensity and ground acceleration, the mean vibratory ground acceleration corresponding to MM intensity VII-VIII is 0.2g. This evaluation of the largest random earthquake near the Tyrone site is conservative and similar to recent licensing decisions made for other sites in the Central Stable Region. The Staff, however, recognizes significant variations in the historic seismicity among subregions of this large structural tectonic province. Based on the low level of seismicity in the vicinity of the Tyrone site, and had the licensee given sufficient supportive bases, the Staff may have considered an intensity lower than VII-VIII (MM) more appropriate for the random earthquake.

2. Maximum earthquake on the Midcontinent Geophysical Anomaly and its effects at the Tyrone site.

For the purpose of establishing the SSE at the Tyrone site, the Staff evaluated the effects of the maximum earthquake associated with the Midcontinent Geophysical Anomaly (MGA) on the Tyrone site (SER, 1975). The Staff assumed that an intensity VIII earthquake could occur on structures associated with the MGA. In the SER the Staff assumed that at its closest approach to the site, i.e. 45 miles, the intensity at the site due to attenuation would be reduced to intensity VII-VIII. Using current intensity-attenuation relationships for the Central Stable Region (Gupta and Nuttli, 1976) attenuation of the effects of the intensity VIII event at the closest point on the MGA to the Tyrone site, i.e. 45 miles, results in a site intensity less than VII. Using the Trifunac - Brady (1975) empirical relation between intensity and ground acceleration, the mean

Vibratory ground acceleration corresponding to MM intensity VII is 0.12g.

3. Random earthquake at Wolf Creek.

The Wolf Creek site lies in southeast Kansas in the Central Stable Region Tectonic Province. In the Wolf Creek SER, the Staff considered the maximum random earthquake to be intensity VII (MM). This position was reiterated in a more recent Staff decision in the same region--the Black Fox site in eastern Oklahoma (SER, 1977). The Staff recognized the low level of seismicity in the vicinity of the Black Fox site and considered the maximum random earthquake to be intensity VII.

4. Maximum earthquake on the Nemaha Uplift and its effects at the Wolf Creek site.

For the purpose of establishing the SSE at the Wolf Creek site, the Staff evaluated the effects of the maximum earthquake associated with the Nemaha Uplift (NU) on the Wolf Creek site (SER, 1975). The Staff assumed that intensities greater than VIII and less than X could occur on the Nemaha Uplift. In a more recent Staff decision for the Black Fox site (SER, 1977), the Staff found that an earthquake of intensity VIII was a more reasonable maximum event on the NU, based on similarity with other structures in the Central Stable Region which have associated seismicity. (This Staff decision was supported by the Black Fox Licensing Board Decision "Partial Initial Decision Authorizing Limited Work Authorization," LBP-78-26, 8 NRC 102, 111 (1978), Aff'd ALAB - 573, Slip Op. at 40 (Dec. 7, 1979)). Using current intensity-attenuation relationships for the Central Stable Region (Gupta and Nuttli, 1976), attenuation of the effects of the intensity VIII event at the closest point on the NU to the Wolf Creek site, i.e. 50 miles, results in a site intensity less than VII.

Conclusion

Therefore, based upon our evaluation of the SER's for the most recent licensing decisions, we conclude that it is not necessary to have the same SSE at the Tyrone and Wolf Creek sites. Applying a current intensity-attenuation relation at both sites, a site intensity of VII is an adequately conservative value for the effects of the maximum earthquake on significant nearby structures. At the Tyrone site the maximum random earthquake was conservatively chosen to be intensity VII-VIII but the Staff could have considered a lower intensity based on the low level of seismicity in the vicinity of the site. At the Wolf Creek site credit was given for the lower level of seismicity in the vicinity of the site and the maximum random earthquake was considered to be intensity VII.

Analysis of NRC Sponsored Research Programs Affecting the Wolf Creek Site

The KSGS report mentioned in Ward's letter is part of a cooperative geologic, seismic, and geophysical research program by several state geological surveys that is seeking to define the structural setting and tectonic history of the Nemaha Uplift and the Midcontinent Geophysical Anomaly in order to provide the bases for a more realistic appraisal of the earthquake risks in the siting of nuclear facilities in the North American Mid-Continent. This information is used as a basis for continuing research and as input to the evaluation of seismic risk in the region within and around the Nemaha Uplift. The research effort thus far has increased our current data base and our understanding of earthquake phenomena in the vicinity of the Nemaha Uplift; however, this information has not indicated a need to modify any previous licensing decisions.

As part of this cooperative research program, the NRC is funding a five year detailed study of the sources of seismicity in the Nemaha Uplift area. The results of work completed in Phase I is currently being reviewed. Therefore, it is too early to assess the impact on nuclear power plant licensing. The total impact of the five year study cannot be assessed until the overall program is completed and synthesized with seismic monitoring data. The preliminary results are being considered in the development of a tectonic province or seismic zoning map of the eastern U. S.