

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

OFFICE OF NUCLEAR REACTOR REGULATION
Thomas E. Murley, Director

In the Matter of

CLEVELAND ELECTRIC ILLUMINATING
COMPANY, ET AL.

(Perry Nuclear Power Plant,
Units 1 & 2)

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Docket Nos. 50-440
50-441

(10 CFR 2.206)

DIRECTOR'S DECISION UNDER 10 CFR 2.206

INTRODUCTION

On January 22, 1988, Ms. Susan L. Hiatt on behalf of Ohio Citizens for Responsible Energy, Inc. (Petitioner) filed with the Director of the Office of Nuclear Reactor Regulation of the Nuclear Regulatory Commission (NRC) a "Petition for Immediate Action to Relieve Undue Risk Posed by the Inadequate Seismic Design of the Perry Nuclear Power Plant" requesting a variety of relief including immediate suspension of the operating license (OL) for the Perry Nuclear Power Plant, Unit 1, and suspension of the construction permit (CP) for the Perry Nuclear Power Plant, Unit 2, of the Cleveland Electric Illuminating Company, et al. ^{1/} (Licensees).

^{1/} Cleveland Electric Illuminating Company is authorized to act as agent for Duquesne Light Company, Ohio Edison Company, Pennsylvania Power Company, and the Toledo Edison Company and has exclusive responsibility and control over the physical construction, operation, and maintenance of the facility.

The Petitioner also requested that, before reinstating the OL for Perry Unit 1 and the CP for Perry Unit 2, the Licensees should be required to engage in appropriate geologic and geophysical research, including but not limited to confirmatory studies recommended by Petitioner, to determine the appropriate safe-shutdown earthquake (SSE) for the PNPP.

Additionally, the Petitioner requested that the Licensees be required to evaluate whether applicable systems, structures, and components important to safety will remain functional throughout their design life and withstand the vibratory ground motion (and concurrent normal and accident loads) resulting from the earthquake which appropriate geologic and geophysical research reveals to be the proper SSE for the Perry facility. If any system, structure, or component were unable to withstand the appropriate SSE, corrective action should be taken and an adjudicatory hearing should be held to determine whether the corrective actions taken are sufficient. Should the corrective actions not be completed as specified, the Petitioner requested that the OL and CP for Perry Units 1 and 2, respectively, be revoked.

The Petitioner's allegations are based largely upon an analysis of data and evaluations that had been performed by other groups in response to the January 31, 1986 earthquake that occurred near the Perry facility. The analysis was performed for the Petitioner by Dr. Yash Aggarwal, and his affidavit and report (Aggarwal Report) are attached to the Petition.

The Aggarwal Report notes that, on January 31, 1986, an earthquake with a magnitude of 5.0 occurred with an epicenter about 10 miles south of the

PNPP. Dr. Aggarwal concluded (a) that the January 1986 earthquake and historical seismicity can be associated with a tectonic structure (fault) revealed by magnetic data; (b) that this fault passes within a few miles of the PNPP and is capable of generating much larger earthquakes; (c) that an earthquake with a magnitude of 6.5 is a realistic probability for the purposes of determining the proper SSE for Perry; and (d) that the present magnitude of 5.3 ± 0.5 for the SSE does not provide an adequate margin of safety required for the PNPP. The Petitioner alleges for these reasons that the Licensees are in noncompliance with various regulations of the Commission, specifically, 10 CFR Part 50, Appendix A, General Design Criterion 2, and 10 CFR Part 100, Appendix A, Parts IV, V, and VI.

On March 2, 1988, I acknowledged receipt of the Petition and explained to the Petitioner my reasons for declining to take any immediate actions. I indicated that I would issue a final decision in this matter in the reasonably near future. My decision in this matter follows.

DISCUSSION

The basis for the Petition is the Aggarwal Report. In his report, Dr. Aggarwal asserts that an earthquake with a magnitude of 6.5 or larger is probable on a "feature" that, at its closest approach, is approximately 10 kilometers southeast of the Perry site. This feature is a "boundary" in the magnetic map of Ohio which separates a region of relatively high magnetic relief to the northwest from a region of relatively low magnetic relief to the southeast. Weston Geophysical Corporation identified this boundary as the "Akron Magnetic Boundary" (AMB) (Reference 1, Figure 4-2). Dr. Aggarwal

concludes that correlations of magnetic data and "macroearthquakes" known to have occurred historically within 50 miles of the 1986 event strongly suggest that the AMB marks the locus of a pre-existing fault or fault zone which must be considered capable of generating an earthquake much larger than the magnitude 5.0 earthquake of January 31, 1986. Dr. Aggarwal concludes that a magnitude 6.5 earthquake is a reasonable possibility for purposes of determining the safe-shutdown earthquake for the Perry facility.

Dr. Aggarwal based his findings, to a large extent, on his analysis of recent studies performed by Weston Geophysical Corporation (Reference 1) on behalf of the Licensees, by the U. S. Geological Survey (Reference 2) on behalf of the U. S. Nuclear Regulatory Commission (NRC), and on testimony before the U. S. House of Representatives by Dr. L. Seeber (Reference 3).

Since the occurrence of the earthquake on January 31, 1986 in the vicinity of the Perry site, numerous investigations have taken place to study that earthquake, its aftershocks, and the possible causative structure. The concerns enumerated by Dr. Aggarwal above regarding the adequacy of the SSE for the Perry facility have been discussed extensively in supplements to the Perry Safety Evaluation Report (SER) (Reference 4) prepared by the NRC Staff. The conclusions arrived at by the NRC Staff after reviewing all available pertinent information on the geological and geophysical characteristics of the northeastern region of Ohio were that no discernible geological structure had been identified that could be associated with the earthquake of January 31, 1986, that the earthquake by itself was not uncharacteristic of the general earthquake history of the tectonic province (Central Stable Region) in which the Perry Nuclear Power

Plant is located, and that SSE for Perry of magnitude 5.3 ± 0.5 remained appropriate. The Staff still considers these conclusions to be valid.

Since the publication of the above supplements to the Perry SER, the Licensees have continued monitoring the seismic activity in the vicinity of the Perry site. Five quarterly reports have been reviewed by the NRC (References 5-9). The cumulative activity recorded by the seismic monitoring network (Reference 9, Figure 4) exhibits some microseismic activity in the corridor covered by the network. The epicentral locations of these very small tremors (with a magnitude range of -0.7 to 1.3) form a small cluster, parallel to and slightly offset from the AMB. The experience of the NRC Staff indicates that the occurrence of recorded earthquakes of this size are typical of many locations within the Eastern United States. Further they are only detectable when a highly sensitive seismic network such as that employed by the Licensees is used. These events by themselves do not indicate potential for large and possibly damaging earthquakes.

The NRC has also received a Preliminary Report (Reference 10) that discusses the earthquake of July 13, 1987, at Ashtabula, Ohio, and its aftershock sequence. In addition to the discussions on the Ashtabula event of 1987, the Preliminary Report also mentions the earthquake of January 31, 1986 at Chardon, Ohio. The authors, including Dr. Seeber who originally provided testimony concerning the event (Reference 3), recognize, as Dr. Aggarwal did, the association of this event with the NNE trending AMB and suggest that the association may indicate that the magnetic feature could be an expression of a reactivated fault of considerable length on which earthquakes much larger than the 1986 event could occur. However, it should be pointed out that the

authors of this Preliminary Report themselves state that, because of the lack of any evidence of the extension of this postulated fault into the Paleozoic platform cover (upper 2 kilometers of rock strata), very large ruptures involving much of any postulated fault are unlikely. For reasons which are discussed below in response to Dr. Aggarwal's specific arguments, the Staff continues to be of the view that the existing seismic design at Perry is appropriate and in compliance with the requirements of 10 CFR Part 100, Appendix A.

Dr. Aggarwal raises two arguments to support his view that the present SSE for the Perry facility is inadequate. First, Dr. Aggarwal argues that the main shock and aftershock focal mechanisms of the January 31, 1986 earthquake indicate a fault approximately $N30^{\circ}E$ colinear with the AMB. While a general NNE trend of the main shock and aftershock focal mechanisms appears to be inferred, the uncertainty associated with Dr. Aggarwal's preferred orientation is larger than he indicates. For example, the most recent study of the 1986 earthquake (Reference 11) indicates that the northeast trending plane of the main shock could vary from $N22^{\circ}E$ to $N55^{\circ}E$ depending upon the type of seismic wave analyzed. Dr. Aggarwal appears to be incorrect in his assertion that Herrmann and Nguyen (Reference 12) defined a possible source of the earthquake as being a $N28^{\circ}E$ westward dipping fault (82°). Dr. Herrmann (Personal Communication 1988) indicated that this possible source would be a $N21^{\circ}E$ eastward dipping fault.

Dr. Aggarwal next argues that several of the earthquakes that occurred in recent history have a sufficient error band in their epicentral location that they also can be associated with the AMB and that this correlation

implies the existence of a fault on which the occurrence of an earthquake much larger than the earthquake of January 31, 1986 must be considered a realistic possibility. The Staff disagrees with this assertion and bases its conclusion on this matter on the following observations:

1. The earthquake of January 31, 1986 itself is not uncharacteristic of the general earthquake history of the tectonic province, which includes the 1937 earthquake at Anna, Ohio; the 1982 earthquake at Sharpsburg, Kentucky; and many other earthquakes in the range of magnitude of 5.0 to 5.3.
2. The nature and depth of the geologic feature or features manifested by the AMB have not been determined. Throughout the Eastern United States, there are many magnetic features and many earthquakes the size of the 1986 Ohio event. Some of these earthquakes are near anomalous magnetic features, and others are not. Magnetic boundaries indicate changes in rock properties. However, these changes in rock properties do not necessarily indicate faults or support that the indicated faults are active and capable of large ruptures.
3. Dr. Aggarwal is of the opinion that the macroseismicity criterion in Appendix A to 10 CFR Part 100 can be used to identify the AMB as a capable fault. Past use of macroseismicity to identify capable faults has proven to be a difficult process. Macroseismicity has been considered to be a level of seismicity that implies significant, sustained, and coherent tectonic activity representative of a major deformational movement within the earth's crust (Reference 13). Aside from the well-located 1986 earthquake, Dr. Aggarwal has identified six other

earthquakes, one with a magnitude of 4.7 and five in the magnitude range of 2.7 to 3.8, that have occurred since 1885 that, because of location uncertainties, could conceivably be associated with the AMB. Such correlations based upon historic earthquakes, many of which are demonstrably associated with large uncertainties in location, have not in the past proven to be definitive indicators of earthquake sources. Moreover, the statement by Dr. Aggarwal that the data strongly suggest a causal relationship between earthquakes and the AMB is questionable because he ignores the fact that there are other earthquake occurrences in nearby northeastern Ohio whose locations cannot be associated with the AMB. For example, several earthquakes have occurred to the west of the AMB, between that feature and the city of Cleveland. Most recently, the earthquake of July 13, 1987, with a magnitude of 3.6, discussed in Reference 10, a very well-located event, occurred some 25 kilometers east of the AMB on an east-west trending fault. Therefore, the small number of earthquakes used by Dr. Aggarwal to support his correlation, most of which are less than a magnitude of 4, the uncertainties in their location, and the occurrence of earthquakes in areas not associated with the AMB do not, in the Staff's opinion, support use of macroseismicity to identify a capable fault.

4. Dr. Aggarwal argues that even if the AMB cannot be identified as a capable fault, a higher SSE than presently assigned to Perry is needed since Appendix A to 10 CFR Part 100 indicates that if seismological and geological data warrant, the SSE shall be larger than that derived by the normal procedures outlined in the regulations. In the procedures

provided by Appendix A, the SSE is determined by assuming the reoccurrence at the site of the largest historic earthquake that has occurred in the tectonic province within which the site is located. In Dr. Aggarwal's view, the seismological and geological data he presented imply the existence of a fault which could cause a significantly larger earthquake. As discussed above, the NRC staff does not believe the data warrant the existence of such a fault and the need to use an SSE larger than that defined by normal licensing procedures.

The Staff has determined that the arguments presented in the Aggarwal Report indicating the presence of a large fault that could generate an earthquake with a magnitude of 6.5 or greater in the vicinity of the Perry Nuclear Power Plant are not persuasive. The Staff reaffirms its conclusion that the seismic design for the Perry facility is appropriate. Therefore, the request for a suspension of the Perry licenses until additional geological and geophysical studies and engineering evaluations are completed is unwarranted.

Also, given the continued acceptability of the SSE for the Perry facility, the allegations by Petitioner that the Perry facility is in noncompliance with the Commission's regulations in the area of seismic design are unwarranted. In particular, the Petitioner calls into question the seismic capability of the 8x8 fuel spacer utilized at the Perry facility. The allegation is based upon the occurrence of a near-field magnitude 6.5 earthquake and exposure of the spacer to the resultant acceleration in excess of 0.3 g. Our above evaluation indicates that consideration of such an earthquake is inappropriate, therefore concerns related to the seismic capability are unwarranted.

In the absence of a substantial health and safety issue, I decline to grant relief requested by Petitioner pursuant to 10 CFR 2.206. See Consolidated Edison Co. of New York (Indian Point, Units 1, 2, and 3), CLI-75-8, 2 NRC 173, 176 (1975); Washington Public Power Supply System (WPPSS Nuclear Project No 2), DD-84-7, 19 NRC 899, 923 (1984). The northeastern Ohio region is an area of continuing investigation by the NRC, university groups, and the Licensees, which, as indicated previously, are monitoring microseismicity in the vicinity of the Perry plant. The Staff is keeping abreast of studies being performed in the region and will evaluate the resulting reports with respect to any changes that might be required in the above conclusions and any effect such changes might have upon the seismic safety of the Perry plant. ^{2/}

CONCLUSION

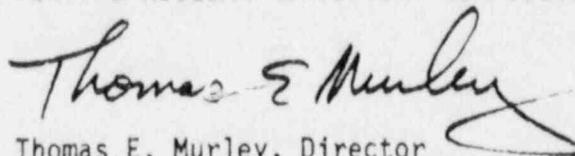
For the reasons discussed above, I have concluded that no adequate basis exists for suspend the OL for Perry Unit 1 and the CP for Perry Unit 2. I have also concluded that the geologic and geophysical research and studies requested of the Licensees by the Petitioner also are unnecessary.

^{2/}The Staff has recently received a June 8, 1988 response to the Petition filed by the Licensees. The response contains an enclosure, "Analyses of North-eastern Ohio Seismicity and Tectonics," dated June 1988, prepared by Weston Geophysical Corporation. A review of the Licensees' response indicates that it contains information that supports the Staff's conclusions with regard to the Petition. Since the Staff does not intend to study this document further it is not basing its conclusions in whole or in part upon this response by the Licensees.

I have further concluded that, because the Staff does not consider the SSE for the Perry Nuclear Power Plant to be in question, corrective actions and an adjudicatory hearing to judge the adequacy of those corrective actions are unwarranted. Accordingly, the Petitioner's request for action pursuant to 10 CFR 2.206 is denied.

As provided in 10 CFR 2.206(c), a copy of this decision will be filed with the Secretary of the Commission for the Commission's review.

FOR THE NUCLEAR REGULATORY COMMISSION

A handwritten signature in cursive script that reads "Thomas E. Murley". The signature is written in dark ink and is positioned above the typed name and title.

Thomas E. Murley, Director
Office of Nuclear Reactor Regulation

Dated at Rockville, Maryland
this 22nd day of June 1988

References

1. Weston Geophysical Corporation: "Investigations of Confirmatory Seismological and Geological Issues. Northeastern Ohio Earthquake of January 31, 1986," dated June 1986.
2. U.S. Geological Survey: "Studies of the January 31, 1986 Northeastern Ohio Earthquake." Open File Report 86-331, 1986.
3. Leonardo Seeber: "Testimony before the Subcommittee on Energy and the Environment Committee on Interior and Insular Affairs of the U.S. House of Representatives." April 8, 1986.
4. Safety Evaluation Report Related to the Operation of Perry Nuclear Power Plant, Units 1 and 2, NUREG-0887, Supplements No. 9, March 1986, and No. 10, September 1986.
5. Weston Geophysical Corporation: "Quarterly Progress Report," Cleveland Electric Illuminating Company, et al. (CEI) Seismic Monitoring Program for Northeastern Ohio, October 15, 1986 - January 15, 1987.
6. Weston Geophysical Corporation: "Second Quarterly Report," CEI Seismic Monitoring Network, January 15 - April 15, 1987.
7. Weston Geophysical Corporation: "Third Quarterly Report," CEI Seismic Monitoring Network, April 16 - July 15, 1987.
8. Weston Geophysical Corporation: "Fourth Quarterly Report," CEI Seismic Monitoring Network, July 16 - October 15, 1987, issued December 1987.
9. Weston Geophysical Corporation: "Fifth Quarterly Report," CEI Seismic Monitoring Network, October 16 - December 31, 1987, issued February 1988.
10. L. Seeber and J. G. Armbruster, Lamont-Doherty Geological Observatory of Columbia University: "Recent and Historic Seismicity in Northeastern Ohio: Reactivation of Precambrian Faults and the Role of Deep Fluid Injection," Preliminary Report to the U.S. NRC.
11. C. Nicholson, E. Rocloffs, and R. L. Wesson: "The Northeastern Ohio Earthquake of 31 January 1986: Was It Induced?" Bulletin of the Seismological Society of America, Volume 78, No. 1, February 1988.
12. Herrmann, R. B., and B. V. Nguyen: "Focal Mechanism Studies of the January 31, 1986 Perry Ohio Earthquake" (abstract), Earthquake Notes, Volume 57, page 107, October 1986.
13. SECY-97-300. Identification of issues pertaining to seismic and geologic siting regulation, policy, and practice for nuclear power plants. April 27, 1979.