EDO-851

50-440

December 28, 1995

Mr. Steve Gannis, Coordinator
Ohio Citizens Against A Radioactive
Environment
13511 Detroit Avenue, Apt. C-9
Cleveland, Ohio 44107

Dear Mr. Gannis:

I am responding to your letter of November 13, 1995, to Chairman Jackson, in which you expressed concern about a "crack" found in the bedrock at the Perry plant site in 1975, which was filled with concrete and allegedly kept a secret.

The "crack" was a glacially folded and faulted area of the bedrock that along with similar folded and faulted bedrock areas was intentionally overexcavated by the licensee and then filled in with concrete. The folded and faulted bedrock areas were inspected by geologists from the Nuclear Regulatory Commission (NRC), the U. S. Geological Survey, and the U. S. Army Corps of Engineers and were found to pose no potential hazard to the Perry plant (NUREG-0887, "Safety Evaluation Report Related to the Operation of Perry Nuclear Power Plant, Units 1 and 2," May 1982, pp 2-22, -23, -24, and -27, enclosed).

Following an earthquake on January 31, 1986, about 10 miles south of the Perry plant, the NRC staff reviewed its previous finding that accepted the faulted bedrock areas and found no reason to change its finding (NUREG-0887, Supplement No. 10, September 1986, pp 2-6, enclosed).

Also enclosed is an excerpt from Inspection Report No. 050-440 and 441/76-01, dated March 15, 1976, that documents the filling of voids in the bedrock with concrete by the Perry licensee in accordance with procedure as indicated in the inspection report. An NRC inspector witnessed this process.

In conclusion, we find that the overexcavated and concrete-filled-in bedrock areas do not endanger the public health and safety or the common defense and security.

I trust this reply responds to your concern.

Sincerely,
Original Signed By
WILLIAM T. RUSSELL
William T. Russell, Director
Office of Nuclear Reactor Regulation

Enclosures: 1. NUREG-0887, May 1982, pp 2-22, -23, -24, and -27
2. NUREG-0887, Supplement No. 10, September 1986, pp 2-6
3. NRC Inspection Report No. 050-440 and 441/76-01, March 15, 1976, and Transmittal Letter, pp 1 and 9

DOCUMENT NAME: G:\PERRY\GRN851.LTR *See Previous Concurrence

To receive a copy of this document, indicate in the box: "C" = Copy without attachment/enclosure "E" = Copy with attachment/enclosure "N" = No copy

OFFICE	PM:PDIII-3	E	TECH ED*		PD:PDIII-3		ADP/NRR		D/NRR	
NAME	JHopkins		BCalure		GMarcus GHM		RZimmerman		WRussell	
DATE	12/ /95		12/6/95		12/8 /95		12/ /95		12/ /95	

OFFICE	EDO		OCM	
NAME	JTaylor			
DATE	12/ /95		12/ /95	

9601030205 XA 1/25/96 DFO1

Official Record Copy

250204

DISTRIBUTION:
Docket File 50-440 (w/incoming)
PUBLIC (w/incoming)
EDO #0000851
EDO Reading
J. Taylor
J. Milhoan
H. Thompson
J. Blaha
W. Russell/F. Miraglia
PDIII-3 RF (w/incoming)
J. Roe
E. Adensam (EGA1)
J. Hopkins (w/incoming)
OGC
OPA
OCA
SECY #CRC-95-1034
NRR Mail Rooom (EDO #0000851 w/incoming)
C. Morris
N. Olson
D. Foster-Curseen
W. Axelson, RIII
D. Morrison, RES
H. Miller, RIII
A. Thadani
D. Crutchfield
K. Bohrer

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

December 28, 1995

Mr. Steve Gannis, Coordinator
Ohio Citizens Against A Radioactive
Environment
13511 Detroit Avenue, Apt. C-9
Cleveland, Ohio 44107

Dear Mr. Gannis:

I am responding to your letter of November 13, 1995, to Chairman Jackson, in which you expressed concern about a "crack" found in the bedrock at the Perry plant site in 1975, which was filled with concrete and allegedly kept a secret.

The "crack" was a glacially folded and faulted area of the bedrock that along with similar folded and faulted bedrock areas was intentionally overexcavated by the licensee and then filled in with concrete. The folded and faulted bedrock areas were inspected by geologists from the Nuclear Regulatory Commission (NRC), the U. S. Geological Survey, and the U. S. Army Corps of Engineers and were found to pose no potential hazard to the Perry plant (NUREG-0887, "Safety Evaluation Report Related to the Operation of Perry Nuclear Power Plant, Units 1 and 2," May 1982, pp 2-22, -23, -24, and -27, enclosed).

Following an earthquake on January 31, 1986, about 10 miles south of the Perry plant, the NRC staff reviewed its previous finding that accepted the faulted bedrock areas and found no reason to change its finding (NUREG-0887, Supplement No. 10, September 1986, pp 2-6, enclosed).

Also enclosed is an excerpt from Inspection Report No. 050-440 and 441/76-01, dated March 15, 1976, that documents the filling of voids in the bedrock with concrete by the Perry licensee in accordance with procedure as indicated in the inspection report. An NRC inspector witnessed this process.

In conclusion, we find that the overexcavated and concrete-filled-in bedrock areas do not endanger the public health and safety or the common defense and security.

I trust this reply responds to your concern.

Sincerely,

W. Russell

William T. Russell, Director
Office of Nuclear Reactor Regulation

Enclosures: 1. NUREG-0887, May 1982, pp 2-22, -23, -24, and -27
2. NUREG-0887, Supplement No. 10, September 1986, pp 2-6
3. NRC Inspection Report No. 050-440 and 441/76-01, March 15, 1976, and Transmittal Letter, pp 1 and 9

earlier conclusions regarding the suitability of the Perry Site should now be modified.

The principal relevant geological/geophysical information which has been developed since issuance of the CP-SER Supplement No. 3 has been derived from the following sources:

(1) Geologic mapping and photographing of the excavations for Category I structures, including the safety-related tunnels beneath Lake Erie.

(2) Investigations associated with the identification, analyses, and resolution of the nature (noncapability) of the fault(s) encountered in the offshore (Lake Erie) portion of the two cooling water tunnels.

(3) Analysis of the significance of lineaments interpreted from Earth Resources Technology Satellite (Landsat) imagery within the site region.

The principal post CP-SER reference sources used by the staff in assessing the geologic and tectonic environment of the near-site area consisted of:

(1) Geological and geophysical data sources, Lake Erie (Hutchinson and Wold, 1969).

(2) A tectonic overview of the Central Midcontinent (Hinze and others, 1977, NUREG-0382).

(3) Regional basement geology of Lake Huron (O'Hara and Hinze, 1980).

(4) State of stress in the conterminous United States (Zoback and Zoback, 1980).

(5) General geology of the International Salt Mine, Cleveland, Ohio (Heimlich, Manus, and Jacoby, 1974).

Deformation--Plant Foundations

Geologic mapping and photographing of the plant site excavations was initiated by the applicant in August 1975. As a result of this mapping and inspection, a series of minor folds and shallow faults were identified within the then-available (as of August 25, 1975) excavations for the plant's main structures. On September 9, 1975 these features were examined in the field by USGS geologists, the U.S. Army Corps of Engineers (Corps of Engineers), and the NRC staff. This combined field examination, coupled with supporting documentation submitted shortly thereafter, in the staff's view, supported the applicant's position that the shallow faulting and associated limited surficial deformation, which was underlain by horizontal, undeformed bedrock, was of nontectonic glacial origin and consequently presented no hazard to the Perry facilities. The combined findings (USGS, Corps of Engineers, and NRC) attesting to the noncapability of the faults was included in Supplement No. 3 of the CP-SER*. Folds

*Questions on the nature of the geologic anomalies were raised in the CP-stage proceedings. The Appeal Board confirmed the conclusion of the staff that these faults were glacial and nontectonic in nature. Cleveland Electric Illuminating Co., et al. (Perry Nuclear Power Plant, Units 1 and 2), ALAB-449, 6 NRC 884 (1977).

and faults, similar to those first reported to the NRC were mapped at other locations within the plant foundations area. These additional features were evaluated by the USGS, Corps of Engineers, and the staff and were determined to also represent nontectonic, glacially induced deformation constituting no hazard to the Perry facilities.

2.5.1.1 Intake and Discharge Tunnel Faults

Minor, low-angle thrust faults were exposed in the two cooling water system tunnels of Perry Units 1 and 2 during the excavation phase of the tunnels. This offshore faulting was first observed by the applicant in the intake tunnel and was reported to the staff on April 26, 1978. Subsequent excavation in the nearby discharge tunnel in late August-early September 1978 exposed two faults, less than 61 m (200 ft) apart. No other faults were exposed in either of the tunnels--the longest of which (the intake tunnel) is about 945 m (3100 ft) in length. In the faulted areas, the tunnels are about 213 m (700 ft) apart.

Evidence within the faulted zones indicates that the dip slip faults were generated by northwesterly directed compressive forces following lithification of the Devonian Chagrin shale. Displacement of the intake tunnel fault ranges from 0.5 m to 0.8 m (1.6 ft to 2.5 ft), and the offset of the two faults in the discharge tunnel ranges from about 0.2 m to 0.6 m (0.5 ft to 2.0 ft).

Numerous, extensive geological and geophysical investigations were conducted by the applicant's consultants in an attempt to define the nature, extent, origin, and age of the tunnel faults, in order to determine and to define the hazard (if any) to the facilities that may be associated with the faults. Those investigations, undertaken to define the tunnel fault geometry, included: (1) detailed mapping of the tunnel walls; (2) reconnaissance mapping of the lake bottom; (3) lake shore reconnaissance; (4) exploratory borings; (5) new geophysical surveys, including borehole logging and offshore and onshore magnetic surveys; (6) review of all available existing geophysical data, including offshore seismic reflection surveying, shipborne magnetic data, aeromagnetic data and gravity data; and (7) isotopic analyses of Lake Erie and fault seepage water. In an attempt to date the fault, several investigations of the material within fault zones and adjacent country rock were conducted. These studies include, but were not limited to, (1) X-ray diffraction, (2) clay mineralogical determinations; (3) microcrack analysis; and (4) consolidation tests of the fault gouge. Miscellaneous investigations included (1) borehole stress measurements made in order to determine the magnitude and orientation of the existing stress field, (2) structural contour maps, and (3) interviews with persons knowledgeable about Ohio geology.

Numerous geologic models have been suggested by the applicant in an attempt to define the origin and possible age of the tunnel faults. These hypotheses include processes possibly active during either the Paleozoic, on the Mesozoic-Tertiary or the Pleistocene-Recent. Reactivating of an older fault is also offered as a possibility. Four of the applicant's five geologic consultants (Gilbert Associates, Dr. Barry Voight, Mr. James Murphy, and Dr. Robert LaFleur) agreed that the faults are genetically related and that the last movement is most likely related to glacial tectonics. Dr. Gene Simmons, the fifth consultant, offered no origin model for the tunnel faults. There is some division of opinion, however, as to the time of most recent movement along the faults.

Several consultants favored an age no younger than 10,000-15,000 ybp (years before present); others attribute the most recent faulting to earlier glacial processes. Based on his microcrack studies, Dr. Gene Simmons suggested a minimum age of 800,000 years and a maximum age of 5 million years for the tunnel faults. All of the applicant's consultants agree that the geologic process(es) responsible for the latest and possibly only movement on the tunnel faults was nontectonic and is no longer operative, and that the tunnel faults are not capable. Extensive investigations conducted by the applicant and by others, in the immediate vicinity of the Perry cooling water system tunnels underlying Lake Erie, have demonstrated, to the satisfaction of the staff, that the tunnel faults are not capable within the meaning of Appendix A to 10 CFR 100. The USGS's letter report describing the bases for reasonable assurance that the faults are not capable is reproduced in Appendix D of this SER. In the staff's view, noncapability is based principally upon the applicant's investigations which indicate that the tunnel faults apparently are (1) most likely of glacial origin, (2) probably confined to the Devonian Chagrin shale, (3) of limited lateral and vertical extent, (4) not known to intercept or offset either the bedrock floor of the lake or the Pleistocene sediments forming the lake shoreline, and (5) Pleistocene or older, based on in situ stress measurements, which indicate that the faults originated under a stress field different from the present one. The noncapable intake and discharge tunnel faults present no hazard to the plant.

2.5.1.2 Lineament Analysis

The applicant's interpretation of Earth Resources Technology Satellite (ERTS; later Landsat) imagery has resulted in the identification of a number of lineaments within the site region. The applicant's report encompasses the area within a 121-km (75-mi) radius of the Perry site, including parts of Ohio and Pennsylvania, but not encompassing the parts of Ontario, Canada, bordering Lake Erie. No lineaments were identified within an 8-km (5-mi) radius of the Perry site. The two lineaments closest to the Perry site [within 11 km (7 mi)] are of apparent geomorphic origin. One lineament is associated with incision of meandering streams into underlying bedrock; the second lineament is associated with glacially produced features, such as moraines or glacial lake shorelines. There is no correlation between these lineaments and known tectonic structure. The lineament analysis has identified no tectonic structure within the near-site region [8 km (5 mi)]. The ERTS (Landsat) imagery analysis has identified only one near-site lineament having an alignment partially coincident with a geophysical anomaly trend (Perry FSAR, 1981, App. F). The coincidental feature (ERTS [Landsat] geophysical) approaches no closer than 16 km (10 mi) to the Perry site, has no known subsurface structural association, and presents no known hazard to the Perry facilities.

2.5.2 Seismology

2.5.2.1 Vibratory Ground Motion

During the CP review for Perry, the staff followed the tectonic province approach to determine the vibratory ground motion corresponding to the safe shutdown earthquake (SSE). Earthquake activity around the vicinity of the site is not substantially different from that of the Central Stable Region.

by the Perry SSE design spectra. Based on its review of this site spectra, the staff finds that the design spectrum of 0.15 g for the SSE anchor in Regulatory Guide 1.60 is a conservative representation of the free field ground motion for the Perry plant.

2.5.2.5 Operating Basis Earthquake

The applicant has proposed 0.075 g for the acceleration level corresponding to the OBE. This represents half the SSE acceleration (0.15 g) and is consistent with the design response spectra Regulatory Guide 1.60 and with Appendix A to 10 CFR 100.

2.5.3 Surface Faulting

Post-CP site and near-site subsurface information reinforces the previous staff opinion that there is no known evidence at the Perry site, or within 8 km (5 mi) of the plant site, to indicate surface or near-surface tectonic faulting. The staff also sees no potential for renewed movement of the nontectonic faults encountered in the plant foundation area onshore or in the offshore cooling water tunnels. The new information consists of (1) the detailed geologic mapping, photographic coverage, and the inspection of the major onshore site excavations by the NRC staff and by its advisors, the USGS, and the Corps of Engineers; (2) the extensive onshore and offshore geological and geophysical investigations conducted by the applicant while attempting to define the nature and origin of the cooling water tunnel faults; and (3) a seismic reflection-fathometer survey conducted in Lake Erie by the Coastal Engineering Research Center of the Department of the Army (Hutchinson and Wold, 1979).

Numerous instances of nontectonic (glacially induced) deformation consisting of shallow thrust faults were encountered in the foundations for the Perry plant excavations. This deformation was inspected by geologists representing the NRC staff, the USGS, and the Corps of Engineers and was determined to pose no potential hazard to the Perry plant since the folding and faulting was caused by a geologic process no longer operative--glacial shove. The Atomic Safety and Licensing Appeal Board, in conjunction with the CP proceedings, found that this deformation was the result of glacial activity and constituted no basis for reevaluating the design of the Perry plant. Although the actual mode of origin of the minor northwesterly directed thrust faults encountered in the intake and discharge tunnels is not completely understood, the faults are most likely of glacial origin (probably crustal rebound associated with the retreat of the continental glaciers). Both the staff and the USGS agree that the faults are not capable, and were most likely generated by processes (glacially induced and regional stresses) no longer prevailing in the site region.

2.5.4 Stability of Subsurface Materials and Foundations

2.5.4.1 Site Conditions

2.5.4.1.1 General Plant Description

The Perry Nuclear Power Plant is located in Lake County, Ohio, approximately 7 mi northwest of Painesville. The plant site is on nearly level terrain; the main plant is about 800 ft landward of the toe of a 45-ft-high, steep bluff

wells, the licensee also recognized the potential for induced seismicity and is developing a seismic monitoring network around the injection wells. This network would permit detection of small events (as low as magnitude 0). The staff believes this network would provide data to assess any possible connection between deep well injection and future seismicity and to possibly identify any causative structures for earthquakes in this region. The licensee's network will be operated through 1988, at which time the licensee and the staff will reevaluate its continued operation.

Assessment of Faults at the Plant Site

The Perry reactor building foundation is Devonian shale bedrock. During the plant site excavations, faults were mapped in the foundation excavation and intake and discharge tunnels under Lake Erie. These faults were discussed in the SER and judged to be noncapable. One of the bases for reaching this conclusion was that the faults were not properly oriented to fail in the present stress regime. Stress directions from fault plane solutions of the January 31, 1986, earthquake and its aftershocks are generally consistent with those previously assumed. The staff sees no reason to change its judgment as to the noncapability of the foundation and tunnel faults, as a result of the January 31, 1986, earthquake.

Consideration of the Effect of Enriched High-Frequency Content

The January 31, 1986, earthquake activated the in-plant seismic monitoring instruments. Some of the recorded ground motions exceeded the operating-basis earthquake and safe shutdown earthquake design spectra at high frequencies (above 15 Hz). The earthquake motion recorded at the reactor building foundation was of short duration (about 1 sec) and predominantly at high frequencies. However, the earthquake was not recorded in the free field outside the plant. The licensee and the USGS assessed all available ground motion recordings from the main shock and aftershocks to determine whether the high-frequency exceedance recorded at the Perry plant was due to the earthquake source, path effects, local site conditions, or building response effects. The possible effect of the building response is discussed in Section 3.7; the in-plant recordings were judged to be similar in frequency content to the free-field ground motion.

The USGS deployed analog and broad-band digital instrumentation (GEOS) to record aftershocks. The GEOS time histories and corresponding spectra are shown in USGS Open-File Report 86-181 (Borcherdt, 1986). The high sampling rate of 400 samples per second used to record the GEOS time histories resulted in accurate resolution of peak amplitudes and spectra plots up to 200 Hz. The recorded aftershock time histories are relatively rich in high-frequency content (up to 30 to 70 Hz and even some recorded ground motions above 100 Hz). Spectra computed for the aftershocks show amplified 20-Hz ground motion at a GEOS site near the Perry plant compared with sites closer to the hypocenters. Spectra computed for the main shock recorded in the plant also show amplified 20-Hz shaking. The observation of amplified 20-Hz motion outside the plant suggests that some combination of earthquake source, travel path, or site effects may be responsible for the high-frequency exceedance recorded in the plant.

The staff examined the spectra computed from the GEOS aftershock data. In general there was little attenuation in the recorded ground motions out to a