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

April 17, 1986

Alan S. Rosenthal, Chairman
Atomic Safety and Licensing
Appeal Board
U.S. Nuclear Regulatory Commission
Washington, DC 20555

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Atomic Safety and Licensing
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Washington, DC 20555

In the Matter of
CLEVELAND ELECTRIC ILLUMINATING COMPANY, ET AL.
(Perry Nuclear Power Plant, Units 1 and 2)
Docket Nos. 50-440 OL, 50-441 OL

Dear Members of the Appeal Board:

In reviewing the copies of written testimony presented at the April 8, 1986 hearing before the Subcommittee on Energy and Environment of the House Committee on Interior and Insular Affairs provided to the Appeal Board and parties by Mr. Silberg by letter dated April 9, 1986, (which inadvertently omitted listing testimony by NRC Staff), I noted the copy of the NRC Staff's testimony was incomplete. The copy provided by Mr. Silberg was an advance copy and does not include the opening summary presented at the hearing by Dr. Robert Bernero, Director of the Division of BWR Licensing. By means of this letter I am providing the Appeal Board and parties with a complete copy of the Staff's prepared testimony.

Sincerely,

Colleen P. Woodhead

Colleen P. Woodhead
Counsel for NRC Staff

Enclosure: As stated

cc w/encl: Ms. Hiatt
Mr. Silberg
Mr. Lodge

cc w/o encl: Rest of Service List

D507

STATEMENT

OF THE

UNITED STATES NUCLEAR REGULATORY COMMISSION

BEFORE THE

SUBCOMMITTEE ON ENERGY AND THE ENVIRONMENT

OF THE

COMMITTEE ON INTERIOR AND INSULAR AFFAIRS

UNITED STATES HOUSE OF REPRESENTATIVES

CONCERNING

PERRY EARTHQUAKE

SUBMITTED: APRIL 8, 1986

MR. CHAIRMAN AND MEMBERS OF THE COMMITTEE, WITH YOUR PERMISSION, I WOULD LIKE TO SUMMARIZE FOR YOU TODAY NRC'S TECHNICAL FINDINGS RELATIVE TO THE EARTHQUAKE WHICH OCCURRED IN THE VICINITY OF THE PERRY NUCLEAR POWER PLANT (PERRY) ON JANUARY 31, 1986, AND THE EFFECTS OF THAT EARTHQUAKE ON THE PERRY PLANT.

I WISH TO NOTE BEFORE PRESENTING MY ORAL SUMMARY THAT A DETAILED STATEMENT OF THE NRC'S FINDINGS, PREPARED FOR THE RECORD, IS PROVIDED AS ATTACHMENT 1 TO THIS SUMMARY STATEMENT.

A. <u>STATUS OF PERRY LICENSING ON JANUARY 31, 1986</u>

THE NRC STAFF'S SAFETY REVIEW WAS ESSENTIALLY COMPLETE AT THE TIME OF THE EARTHQUAKE ON JANUARY 31, 1986 AND DOCUMENTED IN THE SAFETY EVALUATION REPORT (SER), NUREG-0887 AND IN SUPPLEMENTS 1 THROUGH 8 TO NUREG-0887. THE OCCURRENCE OF THE RECENT EARTHQUAKE HAS REQUIRED A REEXAMINATION OF THE SEISMIC DESIGN BASES FOR THE PLANT.

ALL PUBLIC HEARINGS FOR THE PERRY PLANT WERE COMPLETE WITH FAVORABLE BOARD DECISIONS RENDERED PRIOR TO SEPTEMBER 1985. THE PRINCIPAL HEARING ISSUES INCLUDED: 1) QUALITY ASSURANCE; 2) EMERGENCY PLAN; 3) TRANSAMERICA DELAVAL DIESEL GENERATORS; AND 4) HYDROGEN CONTROL FOR DEGRADED CORE ACCIDENTS.

THE CONSTRUCTION AND TESTING ACTIVITIES AT THE PERRY PLANT WERE SUBSTANTIALLY COMPLETE IN EARLY DECEMBER 1985. READINESS FOR LOW POWER LICENSING WAS EXPECTED IN EARLY FEBRUARY OF 1986.

B. CHRONOLOGY OF EVENTS

A CHRONOLOGY OF THE EVENTS FROM THE DATE OF THE EARTHQUAKE OCCURRENCE (1/31/86) THROUGH THE END OF MARCH 1986 IS ITEMIZED IN ATTACHMENT 1 TO THIS SUMMARY STATEMENT.

C. DESCRIPTION OF THE JANUARY 31 EARTHQUAKE AND THE IMMEDIATE ACTIONS AND INVESTIGATIONS

1. CEI PLANT INSTRUMENTATION RECORDINGS

STRUCTURAL RESPONSE TO THE EARTHQUAKE AT THE PERRY PLANT WAS MEASURED WITH ACTIVE AND PASSIVE INSTRUMENTS. THE ACTIVE INSTRUMENTS CONSIST OF TWO ACCELEROMETERS, ONE IS MOUNTED ON THE CONTAINMENT BASEMAT AND THE OTHER IS MOUNTED APPROXIMATELY 110 FEET ABOVE ON THE CONTAINMENT STEEL SHELL. FOUR SETS OF PASSIVE 3-DIMENSIONAL RESPONSE SPECTRA RECORDERS ARE INSTALLED AT FOUR DIFFERENT LOCATIONS TO MEASURE THE RESPONSE SPECTRA AT DIFFERENT FREQUENCIES OF MOTIONS IN EACH OF THREE DIRECTIONS. THE RECORDER THAT IS MOUNTED ON THE CONTAINMENT BASEMAT LIGHTS AN AMBER LAMP ON THE CONTROL ROOM PANEL AT EACH OF THE FREQUENCIES IF 70% OF THE OPERATING

BASIS EARTHQUAKE (OBE) LEVEL IS REACHED OR EXCEEDED; OR A RED LAMP IF 100% OF THE OBE LEVEL IS REACHED OR EXCEEDED.

SEVEN LAMPS FOR THE PASSIVE INSTRUMENTATION, FIVE IN THE NORTH-SOUTH DIRECTION AND TWO IN THE EAST-WEST DIRECTION, WERE LIT IN THE CONTROL ROOM AS A RESULT OF THE EARTHQUAKE MOTION, FOR FREQUENCIES OF 16, 20.2 AND 25.4 Hz, THE HIGH FREQUENCY END OF THE SPECTRUM MEASURED.

2. PRELIMINARY USGS EARTHQUAKE ESTIMATES

THE U.S. GEOLOGICAL SURVEY (USGS) PRELIMINARY ESTIMATES OF THE EPICENTER AND MAGNITUDE OF THE EARTHQUAKE WERE BASED ON WORLDWIDE SEISMOGRAPH STATIONS, INCLUDING THOSE IN OHIO, PENNSYLVANIA, NEW YORK AND ONTARIO (THE CLOSEST STATION TO THE JANUARY 1986 OHIO EARTHQUAKE WHICH OCCURRED IN THE CLEVELAND AREA). THE EARTHQUAKE WAS REPORTED AS A MAGNITUDE 5.0 (RICHTER), OCCURRING AT 11:46 A.M. (EST)

3. CEI PLANT INSPECTIONS IMMEDIATELY FOLLOWING THE EARTHQUAKE, PLANT OPERATIONS PERSONNEL WERE DISPATCHED INTO THE PLANT TO SURVEY FOR MAJOR DAMAGE. THE INITIAL REPORTS INDICATED NO DAMAGE. SUBSEQUENTLY, A TEAM OF APPROXIMATELY 65 ENGINEERS AND TECHNICIANS WAS ORGANIZED TO PERFORM A DETAILED WALKDOWN OF ALL PLANT AREAS. THESE INSPECTIONS FOUND NO SIGNIFICANT DAMAGE TO ANY SYSTEMS, STRUCTURES OR

COMPONENTS. THE HAIRLINE CRACKS IN CONCRETE WALLS THAT WERE OBSERVED HAVE BEEN REVIEWED AND FOUND TO BE TYPICAL OF REINFORCED CONCRETE STRUCTURES WHICH HAVE NOT EXPERIENCED SEISMIC EVENTS.

ALL OF THE SAFETY RELATED SYSTEMS IN OPERATION OR ON STANDBY READINESS AT THE TIME THE EVENT OCCURRED, CONTINUED TO OPERATE WITHOUT INCIDENT. A LARGE NUMBER OF NON-SAFETY RELATED SYSTEMS WAS ALSO OPERATING OR IN THE STANDBY MODE AT THE TIME OF THE EVENT. TWO NON-SAFETY RELATED ITEMS TRIPPED ON PROTECTIVE SIGNALS AS INTENDED BY THE DESIGN. THESE WERE THE UNIT 1 INSTRUMENT AIR COMPRESSOR, WHICH TRIPPED ON HIGH VIBRATION, AND THE AUXILIARY STEAM BOILER, WHICH TRIPPED ON CHANGE IN WATER LEVEL. THESE FUNCTIONS WERE SUCCESSFULLY RESTARTED AFTER THE EVENT.

4. NRC PLANT INSPECTIONS

AN NRC INSPECTION TEAM WAS SENT TO THE PERRY FACILITY ON FEBRUARY 1 TO REVIEW PRELIMINARY SEISMIC RECORDINGS AND TO CONDUCT A WALKTHROUGH INSPECTION OF BUILDINGS AND EQUIPMENT. NO OBSERVABLE DAMAGE OF ANY SIGNIFICANCE WAS IDENTIFIED AT THE PLANT.

IN ADDITION, A SPECIAL SAFETY INSPECTION WAS CONDUCTED BY THE NRC'S REGION III INSPECTION STAFF ON FEBRUARY 5-7, 1986. THIS INCLUDED A POST-EARTHQUAKE WALKDOWN AND VISUAL INSPECTION OF AN EXTENSIVE LIST OF SAFETY-RELATED SYSTEMS AND

COMPONENTS. THE SCOPE OF THE WALKDOWN AND VISUAL INSPECTION INCLUDED AN ASSESSMENT OF SYSTEMS FOR EVIDENCE OF DAMAGE OR MOVEMENT AND EXAMINATION OF PIPING, PIPE SUPPORTS, EMBEDDED PLATES AND BOLTING, ELECTRICAL EQUIPMENT INCLUDING BATTERIES AND ELECTRICAL INSTRUMENTATION FOR EVIDENCE OF DAMAGE, OR SIGNIFICANT MOVEMENT. NO DAMAGE OR SIGNIFICANT MOVEMENT ATTRIBUTED TO SEISMIC ACTIVITY WAS IDENTIFIED DURING THE WALKDOWN OR THE DETAILED VISUAL INSPECTIONS CONCLUDED AT THE PERRY FACILITY.

D. QUESTIONS RAISED BY THE EARTHQUAKE

TWO FUNDAMENTAL QUESTIONS WERE RAISED BY THIS EVENT: (1) WAS THIS EVENT A DAMAGING EVENT; DID IT CAUSE EVIDENT OR LATENT DAMAGE TO THE PLANT; IF THERE IS DAMAGE, WHAT CORRECTIVE ACTIONS ARE NECESSARY? AND (2) DOES THIS EVENT INDICATE FLAWS IN THE SEISMIC DESIGN BASIS USED FOR DESIGNING THE PLANT?

THERE WERE REPORTS OF DAMAGE NEAR THE EPICENTER OF THE EARTHQUAKE SUCH AS CRACKED WALLS, FALLING ROOF TILES AND SHATTERED WINDOWS, BUT THE INTENSITY AT THE PLANT SITE IS ESTIMATED TO HAVE BEEN MODIFIED MERCALLI IV TO V. THE CONTROLLING EARTHQUAKE FOR THE PERRY SEISMIC DESIGN IS A LARGER EVENT OF MAGNITUDE 5.3 OR ABOUT INTENSITY VII-VIII. THERE WAS NO EVIDENCE OF SIGNIFICANT PLANT DAMAGE CAUSED BY THE EARTHQUAKE. FROM THE REEVALUATIONS OF PLANT EQUIPMENT

SEISMIC QUALIFICATION AND STRUCTURES SEISMIC DESIGN USING RECORDED MOTIONS FROM THE EARTHQUAKE, THE ORIGINAL PLANT DESIGN ALLOWABLE STRESSES WERE NOT EXCEEDED. THESE ANALYSES CONSIDERED THE COMBINED EFFECTS OF THE EARTHQUAKE AND OTHER POSTULATED ACCIDENT LOADS. FURTHERMORE, THE EVENT WAS OF TOO SHORT A DURATION TO RENDER LOW CYCLE FATIGUE A SIGNIFICANT ITEM OF CONCERN.

THERE IS NECESSARY CONFIRMATORY WORK STILL TO BE DONE, BUT THE PREPONDERANCE OF THE EVIDENCE EVALUATED INDICATES THAT THERE ARE NO FLAWS IN THE SEISMIC DESIGN. TO DATE THERE HAS BEEN NO ASSOCIATION ESTABLISHED WITH A KNOWN GEOLOGICAL STRUCTURE. THIS EVENT IS SIMILAR TO OTHERS WHICH HAVE OCCURRED IN THE CENTRAL STABLE REGION. THE CONTROLLING EARTHQUAKE USED IN THE DESIGN BASIS FOR THIS SITE IS A ARGER EVENT OF MAGNITUDE 5.3.

BASED ON OUR REVIEW TO DATE AND OUR OWN PHYSICAL INSPECTIONS AND ENGINEERING ANALYSIS, THE NRC STAFF FOUND THAT THE PLANT WAS NOT DAMAGED AND THAT THE SAMPLED STRUCTURES, EQUIPMENT AND PIPING REMAINED WITHIN THE ORIGINAL DESIGN LIMIT, EVEN CONSIDERING THE HIGH FREQUENCY EXCEEDENCE OF THE DESIGN RESPONSE SPECTRUM, AND THEREFORE CONCLUDED THAT THE SEISMIC DESIGN BASIS WAS ACCEPTABLE.

IT IS NOT UNUSUAL IN AN EARTHQUAKE TO HAVE HIGH-AMPLITUDE, HIGH FREQUENCY PEAK ACCELERATIONS OF SHORT DURATION. AS AT PERRY, HIGH FREQUENCY GROUND MOTIONS RECORDED IN EARLIER EVENTS DID NOT RESULT IN ANY SIGNIFICANT DAMAGE. DESIGN SPECTRA ARE CHARACTERIZED BY A PEAK GROUND ACCELERATION (G-VALUE) WHICH IS USED TO SCALE A RESPONSE SPECTRUM DERIVED FROM ACCELEROMETER RECORDS WHICH RECORD STRONG GROUND MOTION FROM EARTHQUAKES. HIGH-FREQUENCY PEAK ACCELERATIONS HAVE NOT BEEN USED IN SCALING AND APPLYING DESIGN SPECTRA BECAUSE THEY ARE OF SHORT DURATION, IMPART LITTLE ENERGY AND ARE NOT REPRESENTATIVE OF SPECTRAL RESPONSE AT THE LOWER, MORE SIGNIFICANT FREQUENCIES.

E. SUMMARY OF THE STAFF ANALYSIS

IN SUMMARY, THE NRC STAFF'S ASSESSMENT OF THE OHIO EARTHQUAKE OF JANAURY 31, 1986 AND ITS EFFECT ON THE PERRY PLANT, DOCUMENTED IN SSER No. 9, CONCLUDES THAT NO SIGNIFICANT PLANT DAMAGE WAS SUSTAINED BY THE PLANT DUE TO THE EARTHQUAKE, AND THAT THE PREPONDERANCE OF EVIDENCE INDICATES THAT THERE IS NO BASIS TO REVISE THE SEISMIC DESIGN BASES FOR THE PLANT. HOWEVER, IT HAS BEEN DETERMINED FROM THIS REVIEW THAT THE CEPTAIN ITEMS MUST BE CONFIRMED BEFORE THE PLANT WILL BE PERMITTED TO OPERATE AT POWER LEVELS EXCEEDING 5% OF RATED THERMAL POWER:

F. ACRS Review and Advice The NRC staff briefed the ACRS Subcommittee on Extreme External Phenomena and the ACRS Full Committee on the staff's findings as documented in SER Supplement No. 9 on March 12 and 13, 1986, respectively. CEI also presented its findings, and comments were made relative to the earthquake by members of the USGS during that briefing. The USGS is under contract to the NRC to assist in the confirmatory work identified in SER Supplement No. 9, which is to be completed before a decision will be made to authorize Perry Unit 1 to operate beyond 5% of rated thermal power.

In a report to the Chairman of the NRC dated March 17, 1986, the ACRS agreed with the NRC staff's findings on the significance of the earthquake and its effect on the Perry plant designs, and with the confirmatory work described in SER Supplement No. 9. The points enumerated in that letter are addressed in Attachment 1.

G. Conclusion

Issuance of the low power operating license for Perry 1 on March 18, 1986 was essentially predicated on the staff's evaluation reports, including the SSER which addresses the staff's findings relative to the effect of the 1986 Ohio earthquake on the Perry plant design. In SSER No. 9, the staff identified the items, discussed earlier, that must be confirmed prior to authorizing operation of Perry Unit 1 at

POWER LEVELS EXCEEDING 5% OF RATED THERMAL POWER. ONE OF THE ITEMS TO BE CONFIRMED CONCERNS THE POSSIBLE CAUSAL EFFECT OF CHEMICAL WASTE INJECTION WELLS LOCATED IN THE VICINITY OF THE PERRY PLANT.

IN RELATION TO THE 1986 OHIO EARTHQUAKE. ON THE BASIS OF CONCERNS EXPRESSED WITH RESPECT TO THESE INJECTION WELLS BY THE USGS, THE NRC STAFF AND THE ACRS, CEI HAS AGREED TO PURSUE LONG-TERM MONITORING OF THESE INJECTION WELLS. IN ADDITION, CEI IS IN THE PROCESS OF DEVELOPING A WORKING AGREEMENT WITH JOHN CARROLL UNIVERSITY FOR PROVIDING A SEISMIC NETWORK CONCENTRATING ON THE EARTHQUAKE EPICENTRAL AREA. DEFINITIVE ARRANGEMENTS ARE EXPECTED IN APRIL 1986.

LASTLY, FROM OUR DIALOGUE WITH CONGRESSIONAL STAFF ON THIS SUBJECT WE HAVE DEVELOPED A SET OF QUESTIONS AND ANSWERS RELATED TO THE NRC TESTIMONY PRESENTED TODAY WHICH I BELIEVE FURTHER ENHANCES THE DETAILS CONTAINED IN ATTACHMENT 1. THE QUESTIONS AND ANSWERS ARE CONTAINED IN ATTACHMENT 2 TO THIS ORAL SUMMARY.

THANK YOU FOR THIS OPPORTUNITY TO APPEAR BEFORE THE COMMITTEE. THIS CONCLUDES MY ORAL SUMMARY. IF THERE ARE ANY QUESTIONS, I WILL BE PLEASED TO RESPOND TO THEM.

A. Status of Perry Licensing on January 31, 1986

1. Status of Safety Review:

The NRC staff's safety review was essentially complete at the time the earthquake occurred on January 31, 1986. SER Supplement No. 8 to the Perry Safety Evaluation Report (SER), NUREG-0887, dated January 1986, documented the resolution of all outstanding issues to support the issuance of a low power operating license for Perry, Unit 1. In SSER No. 8, the staff added one confirmatory issue that needed to be addressed prior to licensing any operation above 5% rated thermal power, resolved all the remaining SER confirmatory issues, and clarified and/or deleted all the proposed license conditions to permit the issuance of the low power operating license for Perry, Unit 1.

2. Summary of the seismic design basis in that review

Based on an evaluation of all available geologic and seismologic information, the staff reached the following conclusions (which are documented in the Perry SER, NUREG-0887 [May, 1982]).

a. The results of geologic and seismologic investigations and other related information presented by the applicant (CEI), as required by 10 CFR 50, 10 CFR 100 and Appendix A to 10 CFR 100, provide an adequate basis to conclude that no capable fault exists in the plant area.

b. No evidence has been found to indicate that the intake and discharge tunnel fault(s) are capable, or that the potential exists for future movement of the faults.

c. The controlling earthquake for this site is the largest earthquake that is not associated with a tectonic structure in the Central Stable Region tectonic province, and is a magnitude 5.3 earthquake. Based on the site specific spectra, which are enveloped by the design spectra, the acceleration of 0.15g anchored to a Regulatory Guide 1.60 spectrum for the safe shutdown earthquake (SSE) is adequately conservative.

3. Status of Hearings

All hearings were complete with Board decisions rendered prior to September, 1985. The principal hearing issues were:

- QUALITY ASSURANCE
  - Proper Controls Over Electrical Contractor
    - Hearings Held in May 1983
    - Partial Initial Decision in December 1983
    - Appeal Board Decision in May 1985

- EMERGENCY PLAN
  - Nine Contentions Admitted dealing with Emergency Procedures
    - Hearings Held in April 1985
    - Partial Initial Decision in September 1985

- TRANSAMERICA DELAVAL DIESEL GENERATORS
  - Reliability of Diesel-Generators for Standby Power Supply
    - Hearings Held in April 1985
    - Partial Initial Decision in September 1985

- HYDROGEN CONTROL FOR DEGRADED CORE ACCIDENTS
  - Hydrogen Control Ignition System can accommodate large amounts of hydrogen postulated from a degraded core accident
    - Hearings Held in April/May 1985
    - Partial Initial Decision in September 1985

4. Status of Construction And Test

The design, construction and testing of Perry Unit 1 was substantially completed in early December, 1985. There was a limited number of items that were not to be completed prior to fuel load and these items were identified to the NRC staff in CEI letters dated October 11, 1985, November 11, 1985 and November 20, 1985. These deferred items were reviewed and approved by the NRC staff with the understanding that they would be completed prior to the issuance of a full power license.

B. Chronology of Events

DATE	EVENT
1/31/86	Earthquake occurred (11:46 a.m. EST); Site Area Emergency initiation by CEI 12:06 p.m. and terminated 14:25 p.m.; formation of earthquake recovery team and detailed site walkdowns by CEI
2/1/86	CEI geological/seismological consultants installed temporary seismographs in the area around the site.
2/1/86	On site meeting conducted by the NRC's Region III and Nuclear Reactor Regulation (NRR) staff's to initiate an Augumented Inspection Team's (AIT) investigation of the Perry Plant response to the earthquake. The team of six people was led by Dr. C. J. Paperiello of NRC's Region III office.
2/1-3/86	Plant walkdowns, inspections and preliminary raw data interpretations/reviews by the AIT.

2/3/86	10 CFR 2.206 Petition filed by Ohio Citizens for Responsible Energy (OCRE) and Western Reserve Alliance (WRA) to not license the plant; and a Motion filed by OCRE to reopen the Atomic Safety Licensing Board (ASLB) hearing record.
2/3/86	NRR contacted Dr. Okrent of the Advisory Committee for Reactor Safeguards (ACRS) with a proposal for ACRS review of the significance of the seismic event.
2/4/86	Region III follow-up letter to Confirmatory Action Letter, CAL-RIII-86-01 establishing allowable activities by CEI
2/5/86	CEI provided initial seismic event overview and schedule in a written report which included responses to CAL-RIII-86-01.
2/11/86	Presentation of CEI's preliminary findings to the NRC staff at plant site in a public meeting.
2/12/86	CEI submitted a detailed Seismic Evaluation Report on its earthquake evaluation findings.

2/12-13/86	NRC/CEI presentation of earthquake review preliminary findings to ACRS Subcommittee on Reactor Operations and the ACRS Full Committee.
2/28/86	CEI submitted supplemental report of information on CEI planned geological studies, equipment qualification evaluations, seismic instrumentation reviews, and suppression pool level instrumentation. (Included a preliminary report on CEI's geological/seismological field evaluations)
3/3/86	CEI submits supplemental report on relocating the platform 630' seismic instrument, addressing stress comparisons, future generic plant evaluations, earthquake aftershocks and injection well related data
3/2/86	Report issued by Region III on Augumented Inspection Team findings relative to the earthquake event. (Report No. 50-440/86005)

3/5/86	NRC issued SSER No. 9 which reaffirmed the adequacy of the plant seismic design, concluding that the plant can be licensed for operation without undue risk to the health and safety of the public; operation can be authorized up to power levels of 5% of thermal rated power until the confirmatory work identified in SSER No. 9 is completed. A copy of SSER No. 9 was provided to the ACRS for review.
3/5/86	NRC staff filed a response to OCRE's Motion to reopen the hearing record.
3/11/86	CEI provided additional information related to equipment qualification noted in its 3/3/86 supplemental report.
3/12/86	The NRC staff, the staff's consultants (the US Geological Survey (USGS)) and Structural Management Associates (SMA) and CEI discussed the earthquake event and their findings with the ACRS Subcommittee on Extreme External Phenomena.

3/13/86 NRC staff and its consultants (the USGS and SMA) and CEI independently briefed the ACRS Full Committee on the earthquake event and their findings. The Full Committee unanimously agreed with the NRC's plan to issue a low power operating license for Perry Unit 1 while the earthquake related confirmatory work proceeds.

3/17/86 ACRS Report to NRC Chairman concurring with NRC staff findings; the ACRS recommends seismic monitoring in plant area be continued.

3/17/86 NRC Director's Decisions denying OCRE/WRA 10 CFR 2.206 Petitions.

3/18/86 NRC staff issued low power operating license authorizing CEI to load fuel and operate Perry 1 up to 5% of rated thermal power.

3/19/86 CEI commenced loading fuel in the reactor (fuel loading scheduled to be completed by April 10, 1986).

3/20/86 Memorandum and Order issued by the Licensing Appeal Board (ASLAB) to hold a hearing to determine whether to reopen the ASLB record and admit OCRE's proposed new contention issue for the earthquake (inadequate plant seismic design basis is alleged).

C. Description of the January 31 Earthquake and the Immediate Actions and Investigations.

1. CEI Plant Instrumentation Recording

Two types of instruments are used to measure the structural response to the earthquake which are identified as active and passive instruments. The active instruments require electrical power to record the earthquake motion, whereas the passive instruments do not require any outside power to measure earthquake motion, but do require a power source to provide indication of the earthquake in the control room.

The active instruments consist of two orthogonal accelerometers (Kinemetrics Model D51-N101). One is mounted on the containment basemat and a similar unit is mounted on the containments steel shell, approximately 110 feet above the basemat instrument. The structural motion measured by these accelerometers is recorded on magnetic tape in a centralized location in the control room building. The recordings are actuated at 0.005g containment basemat acceleration by two triaxial triggers located on the containment basemat approximately 90 degrees apart. Either of the triggers will start the system recording and annunciate in the control room. A third triaxial accelerometer, which is mounted on the reactor containment basemat, switches on a light on the instrument recording panel and annunciates in the control

room if the acceleration equals or exceeds the OBE in any of the three directions. The triaxial accelerometer recorders were triggered by the January 31, 1986 earthquake.

CEI reported that the active instrument recorded data were removed from the recorders beginning approximately 30 minutes after the January 31, 1986 earthquake. The recorded data were played back through the playback unit incorporated into the system. This playback produced a permanent recording of the acceleration-versus-time record of the earthquake motion measured at the two locations. The magnetic tapes were then transported to the manufacturer's facilities and the records were digitized. These digitized records were put into a computer program that scaled the records to acceleration units and plotted the records. The records were then corrected and used to produce plots of acceleration, velocity and displacement time history for each component of the recorded data. The acceleration time-histories were used to produce response spectra for comparison with the design response spectra. CEI provided copies of these records were provided to the NRC staff for evaluation.

Four sets of passive triaxial response spectra recorders (Engdahl Model PSR1200) are installed at four different locations to measure the response spectra at 12 specific frequencies in each of three orthogonal directions (N-S, E-W, and Vertical). The earthquake motion causes a reed to vibrate and a diamond stylus inscribes a permanent record that is proportional to

the acceleration on a plate inside the instrument. Additionally, the tri-axial response spectra recorder that is mounted on the containment basemat lights an amber lamp on the control room panel at each of the frequencies (12 frequencies in 3 directions) if 70% of the OBE level is reached or exceeded; or a red lamp if 100% of the OBE level is reached or exceeded. This panel is located in an equipment rack in the control room. Seven of these lamps were lit during the January 31, 1986 earthquake, five in the North-South direction and two in the East-West direction. No lamps were lit in the vertical direction, indicating that 70% of the OBE level was not reached for the vertical direction. Three North-South (N-S) amber lamps were lit at frequencies of 16, 20.2 and 25.4 Hz, indicating 70% of the OBE had been reached for a sensing instrument located on the reactor containment basemat. Two of the North-South (N-S) red lamps were lit at 20.2 and 25.4 Hz, indicating that the OBE level had been reached or exceeded. Both the amber and red lamps for the 20.2 Hz reed in the East-West (E-W) direction were lit indicating the OBE level had been reached at that frequency. The passive response spectra recorders produced records on the recording plates and were read by CEI's personnel and a representative of the seismic instrument manufacturer at the plant on January 31, 1986; these were later read and verified by the seismic instrument manufacturer on February 2, 1986.

There are also three peak recording accelerometers (Engdahl Model PAR400). These instruments measure the maximum acceleration in three orthogonal directions. These instruments use a vibrating reed and a diamond stylus that scribes a line on a metal plate that is proportional to the maximum

acceleration. These instruments are located on the auxiliary building basemat, in the reactor containment building on the reactor recirculation pump motor and on the reactor recirculation pipe discharge line. The recording plates were also removed and read by CEI's personnel and the instrument manufacturer's representative.

2. Preliminary USGS Earthquake Estimates

The U.S. Geological Survey (USGS) preliminary estimates of the epicenter and magnitude of the earthquake were based on worldwide seismograph stations, including those in Ohio, Pennsylvania, New York and Ontario (the closest station to the 1986 Ohio earthquake which occurred in the Cleveland area). The earthquake was reported as a magnitude 5.0 (Richter), occurring at 11:46 a.m. (EST) had a maximum Modified Mercalli (MM) Intensity VI; and was located at 41.644N, 81.813W (See Exhibit A). The USGS has published an Open-File Report (86-181) on the aftershock recordings, which are being reviewed as part of the staff's confirmatory program.

3. CEI Plant Inspections

Plant Response and Assessments

Immediately following the earthquake, plant operations personnel were dispatched into the plant to survey for major damage. The initial reports indicated no damage. Subsequently, a team of approximately 65 engineers

and technicians was organized to perform a detailed walkdown of all plant areas. These inspections found no significant damage to any systems, structures or components. The hairline cracks in concrete walls that were observed have been reviewed and found to be typical of reinforced concrete structures which have not experienced seismic events.

All of the safety related systems in operation or on standby readiness at the time the event occurred, continued to operate without incident. A large number of non-safety related systems were also operating or in the standby mode at the time of the event. Two non-safety related items tripped on protective signals as intended by the design. These were the Unit 1 instrument air compressor, which tripped on high vibration, and the auxiliary steam boiler, which tripped on change in water level. These functions were successfully restarted after the event. The only other non-safety related items of equipment that tripped during the event were the Unit 1 main and auxiliary transformers, which tripped due to the closing of the generator protection relays. The closing occurred because there was no voltage applied to the relays as a result of an ongoing outage. Laboratory testing of these relays since the event has confirmed that the presence of voltage on the relays significantly increases the force required to close these relays. CEI has concluded that, had the voltage been supplied to these relays, they would not have been closed during the event.

4. NRC Plant Inspections

An NRC Inspection Team was sent to the Perry facility on February 1 to review preliminary seismic recordings and to conduc* a walkthrough inspection of buildings and equipment. No observab e damage of any significance was identified at the plant.

A member from the original Seismic Qualification Review Team and a member of the NRC staff, subsequently conducted another site audit on February 6, 1986, primarily to investigate the effect of the earthquake on the safety-related equipment of the station. They performed a walkdown and observed some representative equipment items that were a part of the detailed review in the team's audit conducted on August 1984. The equipment inspected included H13-680 Unit Control Console, Division 1 battery and rack, motor control center, and RCIC turbine and its related pipings and accessories. No damage that could be attributed to the January 31, 1986 earthquake was observed on equipment, the equipment supports, or the mounting configuration. Furthermore, no apparent structural damage was observed during the walkdown.

In addition, a special safety inspection was conducted by the NRC's Region III inspection staff on February 5-7, 1986. This included a post-earthquake walkdown and visual inspection of an extensive list of safety-related systems and components. The scope of the walkdown and visual inspection included:

a. Assessment of the general condition of the systems and components selected for inspection to determine whether there was visible evidence of damage or significant movement as a result of seismic activity.

b. Examination for bent or deformed pipe support structures or components.

c. Inspection for loose bolts or cracked concrete associated with anchor bolts and embedded plates.

d. Inspection for signs of significant movement such as damaged pipe insulation and scraped or cracked paint at support locations.

e. Examination of pipe snubbers and spring cans for changes in initial settings.

f. Examination of exterior and interior of electrical and control panels for cracks in frames, integrity of terminals, instrument damage, and glass breakage.

g. Inspection of components for misalignment, foundation cracks, and fluid leakages.

h. Inspection for movement and cracks in battery racks, and batteries and for leakage of cell jars.

No damage or significant movement attributed to seismic activity was identified during the walkdown or the detailed visual inspections concluded at the Perry facility.

D. Questions Raised by the Earthquake

Two fundamental questions were raised by this event: (1) Was this event a damaging event; Did it cause evident or latent damage to the plant; If there is damage, what corrective actions are necessary? and (2) Does this event indicate flaws in the seismic design basis used for designing the plant?

There were reports of damage near the epicenter of the earthquake such as cracked walls, falling roof tiles and shattered windows, but the intensity at the plant site is estimated to have been MM IV to V. The controlling earthquake for the Perry seismic design is a larger event of magnitude 5.3 or about intensity VII-VIII. There was no evidence of significant plant damage caused by the earthquake. From the reevaluations of plant equipment seismic qualification and structures seismic design using recorded motions from the earthquake, the original plant design allowable stresses were not exceeded. These analyses considered the combined effects of the earthquake and other postulated accident loads. Furthermore, the event was of too short a duration to render low cycle fatigue a significant item of concern.

There is necessary confirmatory work still to be done, but the preponderance of the evidence evaluated indicates that there are no flaws in the seismic design. To date there has been no association established with a known geological structure. This event is similar to others which have occurred in the Central Stable Region. The controlling earthquake used in the design basis for this site is a larger event of magnitude 5.3.

Based on our review to date and our own physical inspections and engineering analysis, the NRC staff found that the plant was not damaged and that the sampled structures, equipment and piping remained within the original design limit, even considering the high frequency exceedence of the design response spectrum, and therefore concluded that the seismic design basis was acceptable.

Some of the recorded motions at the Perry plant exceeded the design spectra at high frequencies (See Exhibit B). The earthquake motion was of short duration (about 1 second). It is not unusual in an earthquake to have high-amplitude, high frequency peak accelerations of short duration. As at Perry, high frequency ground motions recorded in earlier events did not result in any significant damage. Design spectra are characterized by a peak ground acceleration (g-value) which is used to scale a response spectrum derived from accelerometer records which record strong ground motion from earthquakes. High-frequency peak accelerations have not been used in scaling and applying design spectra because they are of short duration, impart little energy and are not representative of spectral response at lower, more significant frequencies.

E. Summary of the Staff Safety Analysis

In summary, the NRC staff's assessment of the Ohio earthquake of Janaury 31, 1986 and its effect on the Perry plant, documented in SSER No. 9, concludes that no significant plant damage was sustained by the plant due to the earthquake, and that the preponderance of evidence indicates that there is no basis to revise the seismic design bases for the plant. However, it has been determined from this review that the following items must be confirmed before the plant will be permitted to operate at power levels exceeding 5% of rated thermal power:

1. CEI is examining geological, geophysical and seismic data in the epicentral area for any possible structure associated with the January 31 earthquake. Evidence available indicates no association has been established with a known geological structure.

2. The NRC staff will examine the effect of the new information on previous assessments of faults at the site, which were believed to be induced by Pleistocene glaciation. Preliminary stress directions derived from the earthquake data are consistent with the average stress direction observed in earlier studies for this region.

3. The NRC's consultant (the USGS) and CEI's consultants are exploring the possibility that injection of chemical wastes in two wells about 3 miles south of the Perry plant and about 7 miles north of the recent

earthquake epicenter may have been related. At this time the staff finds any association between the wells and the earthquake does not appear unlikely due to the lack of earlier seismicity associated with the wells, and the fact that the recent earthquake was about 7 miles from the wells. In addition, seismicity was observed in this region prior to the construction of the wells.

4. CEI, the NRC staff and the USGS are assessing all available ground motion records from the January 31 event and its aftershocks. These data will be compared with the worldwide data base, especially for Eastern U.S. sites, and will help determine the extent to which high frequency content needs to be considered with respect to seismic design.

5. The procedures for operators to determine if the OBE acceleration limits have been exceeded were not clear. Also the action required when exceedance occurs is not clear. These procedures will be amplified by CEI to include more explicit instructions.

6. CEI will perform further quantitative assessments on the seismic qualification of a comprehensive sample of equipment types.

7. CEI and the NRC staff will independently evaluate the potential safety significance of high-frequency short-duration earthquakes for equipment and structures at Perry. Using the results obtained from this analysis,

CEI and the NRC staff will assess the seismic capability of the Perry plant for other earthquakes of similar characteristics, but with higher magnitude and/or longer duration, occurring near the site.

CEI has committed to provide the above information by June 1986 and the NRC staff will report the results of its review of these confirmatory items in a future supplement to the SER.

F. ACRS Review and Advice

In a letter to the Chairman of the NRC dated March 17, 1986, the Advisory Committee for Reactor Safeguards (ACRS) concurred with the NRC staff's evaluation findings and conclusions, documented in SSER No. 9, that the January 1986 Ohio earthquake did not damage the Perry plant and/or provide bases for requiring the plant seismic design basis to be revised; and agreed that a low power operating license can be issued for the operation of Perry. The comments contained in the ACRS letter can be enumerated as follows:

1. This earthquake which occurred near Leroy, Ohio, was characterized by relatively low energy, low velocities, small displacements, a short duration, and a response spectrum rich in high frequencies. Except at the relatively less significant higher frequencies, the excitation of the plant structures and equipment was much less than that considered in the seismic design basis.

2. No significant damage was observed at the Perry plant in the inspections which were performed by CEI and the NRC staff. CEI, by using analysis

and comparisons with prior qualification testing, found that all of the structures and equipment analyzed thus far have substantial margins of safety relative to the loads and stresses induced by the earthquake. ACRS consultants concur in that conclusion.

3. The ACRS supports the NRC staff's proposed confirmatory action program which includes the analyses of a large sample of plant equipment, and which will involve several actions (discussed previously) to be taken by CEI prior to authorizing plant operation above 5% of thermal rated power.

4. There currently exists some possibility that the January 31, 1986 earthquake is related to deep well injection activities that took place between the Perry plant site and the town of Leroy, or due to past solution mining. The NRC staff has engaged the services of USGS to evaluate these hypotheses to see if there really may be a causal connection, and, if so, whether there is any likelihood of substantially larger earthquakes in the future.

5. One of the ACRS consultants suggested that monitoring with sensitive seismological instruments over the next few years would be helpful in assessing the possible causal connection between the deep well injection and the January 31, 1986 earthquake. The USGS representatives agreed that such seismic monitoring would be valuable. Therefore, unless the USGS and the NRC staff are able to decide that there is no

causal connection, or that earthquakes of a magnitude sufficient to be of concern can be ruled out from this cause, the ACRS recommended that CEI assure that appropriately sensitive monitoring be continued over the next few years.

6. The ACRS agreed with the NRC staff that the January 31, 1986 earthquake is unlikely to lead to any requirements that would significantly change the design of the Perry plant's structure or its equipment, and finds no reason to alter the conclusions stated in the ACRS report dated July 13, 1982 regarding operation of this nuclear plant.

G. Conclusion

Issuance of the low power operating license for Perry 1 on March 18, 1986 was essentially predicated on the staff's evaluation reports, including the SSER which addresses the staff's findings relative to the affect of the 1986 Ohio earthquake on the Perry plant design. In SSER No. 9, the staff identified several items, discussed earlier, that must be confirmed prior to permitting Perry Unit 1 to operate at power levels exceeding 5% of rated thermal power. Three items will be reported in a future supplement to the SER. One of the items to be confirmed concerns the possible causal affect of chemical waste injection wells located in the vicinity of the Perry plant, in relation to the 1986 Ohio earthquake. On the basis of concerns expressed with respect to these injection wells by the USGS, the NRC staff and the ACRS, CEI has

agreed to pursue long-term monitoring of these injection wells. In addition, CEI is in the process of developing a working agreement with John Carroll University for providing a seismic network concentrating on the earthquake epicentral area. Definitive arrangements are expected in April 1986.

Lastly, all procedural modifications required as a result of lessons learned from the January 1986 earthquake, (one of the items requiring confirmation in SSER No. 9), have already been completed by CEI and found acceptable by the NRC staff.

Attachment 2

QUESTION

1. Since there are so many confirmatory items still under study, why did you issue the license now rather than wait until they are completed?

ANSWER

The items that need to be confirmed are considered necessary confirmatory work but unlikely to develop into requirements that would significantly change the design of the Perry plant structures or its equipment. Evidence available from the re-review of the overall plant seismic design performed by CEI and the NRC staff reaffirmed the adequacy of the original design. Before the plant is authorized to operate at levels above 5% of rated thermal power, the items identified in SSER No. 9 will be confirmed.

QUESTION

2. What general knowledge do you have of the relationship between injection wells and seismic activity?

ANSWER

The NRC staff routinely examines man-made conditions near nuclear power plant sites. The staff considers the possibility of subsidence or collapse caused by withdrawal of fluids or mineral extraction and induced seismicity and fault movement caused by reservoir impoundment and fluid injection or withdrawal.

The possibility that injection wells may induce seismicity was first considered in the 1960s when a series of earthquakes were associated with deep well waste disposal operations at the Rocky Mountain Arsenal near Denver, Colorado. Since that time seismicity has been associated with injection or extraction of fluid in other wells, including the Rangely Oil Field in Colorado, the Wilmington, California oil field, and various oil fields in Texas. Virtually all of these earthquakes were small; the largest induced earthquakes were three magnitude 5 to 5½ events at the Rocky Mountain Arsenal.

QUESTION

3. What regulatory action will you take if the confirmatory investigation shows a linkage between the injection wells and the earthquake?

ANSWER

If a significant safety concern arose from a linkage between the triggering of earthquakes in the plant vicinity and the injection wells, licensing of the plant for operation of the facility above 5% power level could be affected. If such a causal relationship is established, further consideration and investigation may be necessary to determine if a larger earthquake or an event similar in size to the January 31, 1986 earthquake but closer to the plant needs to be assessed for possible effect on the seismic design of the plant.

QUESTION

4. Have some of these analyses shown a possible fault running SW-NE through or near the Perry site? What is the significance of that

ANSWER

Various researchers are assessing the location of the January 31, 1986 earthquake and its aftershocks. They have found the events occur in a cluster around the epicenter. Some preliminary determination by Lamont Doherty Geological Observatory found a possible northeast trend to the epicenter locations. There is, however, no evidence that a fault running SW-NE passes through or near the Perry plant site.

QUESTION

5. How does the Perry case compare with the situation at Diablo Canyon or San Onofre, where new information led to revision of the seismic design basis?

ANSWER

It should be noted that the occurrence of earthquakes near Perry is a different situation than seismicity in California. California is on tectonic plate boundary where scientists are continually performing research on the geology

and tectonics. New information becomes available continuously. The earthquakes near Diablo Canyon and San Onofre are related to tectonic plate boundaries, unlike the January 31 earthquake in Ohio, which is at least a thousand miles from a plate boundary.

At the Diablo Canyon plant, following the Construction Permit application (CP) review, a new fault was discovered 3 miles offshore. The USGS evaluation of this fault determined that it was capable of a magnitude 7.5 earthquake. Ground motion estimates from this size event at a distance of 3 miles significantly exceeded the Diablo Canyon design basis. Therefore a reanalysis of the plant was performed based on this new ground motion estimate and, where necessary, modifications were made.

San Onofre 1 is an older plant, licensed before Appendix A to 10 CFR 100. This plant was subject to a seismic reanalysis under the NRC's SEP program. At about the same time San Onofre Units 2 and 3 were being reviewed for operating licenses. The new information assessed in these reviews was the estimation of a magnitude associated with an Offshore Zone of Deformation (OZD) and revised ground motion estimates for the site based on this event occurring at the closest approach of the OZD to the site. There was no change in the seismic design at Units 2 and 3, but Unit 1 is being reanalyzed using this new information.

QUESTION

6. What did you learn from the Perry events and analysis that might have generic implications such as changing 10 CFR 100, Appendix A, or Regulatory Guide 1.60?

ANSWER

The staff has noted the following generic implications:

1. The staff will assess the extent to which high frequency content needs to be considered with respect to seismic design spectra.

2. The staff feels there is a need to clarify procedures used by operators to ascertain if the OBE has been exceeded. Furthermore, it appears that more definitive guidance for defining the assessment methods required of the operator when seismic exceedances occur would be useful.

QUESTION

6A. Has the NRC staff evaluated reservoir-induced seismicity near nuclear power plant sites?

ANSWER

The staff has evaluated the occurrence or the potential for occurrence of earthquakes associated with reservoir impoundment and its significance to the design basis earthquakes of nuclear power plants. This issue was considered at the North Anna, Shearon Harris, Summer and Oconee reactor plant sites. All of these sites are in the Piedmont physiographic province in the southeastern United States, and there has been seismic monitoring at all these sites.

For sites near reservoirs, the staff examines seismicity, geologic structures and tectonic history. Then, if induced earthquakes are expected, seismic monitoring must begin before reservoir filling. Otherwise, we may not be able to discriminate between induced events and background seismicity. Geologic mapping before reservoir filling should be sufficient to assess whether induced earthquakes are associated with fault zones. If reservoir-induced seismicity occurs, the staff assesses the maximum earthquake expected and how close to the plant that event could occur.

QUESTION

7. Have you followed up on recently discovered quality allegation concerning the Perry plant?

ANSWER

In mid-February 1986, the NRC Region III Office inspection staff initiated an investigation of the quality assurance related allegations documented in a 10 CFR 2.206 Petition submitted by the Western Reserve Alliance, in cooperation with the Government Accountability Project or GAP. Since that time the regional inspection staff has attempted by telephone to discuss the release of additional information, and to also obtain affidavits from allegers, with the GAP representative (Ms. Bille Garde), to determine if further investigation of the allegations will be required. A record of that telephone conversation was documented in a letter to the Western Reserve Alliance dated March 10, 1986. Specifically being sought in written documentation in GAP's possession verifying the basis for the allegations, as well as the arrangement of interviews with persons having information bearing on the allegations. To date, GAP has not provided the information requested by the regional inspection staff.

QUESTION

8. Indicate what the instrument line valves are used for and describe the root cause of the valve misposition problem discovered in the plant instrumentation lines just prior to plant low power operation licensing, and what action is being taken to correct the problem.

ANSWER

The valves in the instrument lines are used to isolate various instruments such as pressure transmitters.

The root cause of the event was inadequate procedural controls for the period following completion of the preoperational test program and prior to jurisdictional turnover from the Test Group to the Plant Operations Department. (Approximately 50-60 valves are involved.) Instrument valves (i.e., unnumbered valves) were not as strictly controlled by accountability procedures as would be the case after turnover. Prior to turnover, work performed on instrument lines provided for retest, such as leak test or hydrostatic test, but did not ensure that the valves were returned to their normal operating positions.

Upon jurisdictional turnover, and as a result of CEI's System Operability Checklist efforts, the Valve Lineup Instructions were performed, as well as verification of the completion of instrument calibration or Surveillance Testing as required. In neither case was the verification of instrument valve lineup procedurally required.

It is apparent from this evidence that there was no violation of Plant Operational Procedures. The most plausible cause for the discrepancies was the inadequate control of instrument valve positions following completion of the preoperational test program, and prior to turnover to the Plant Operation organization. This problem area was further compounded by the failure to include numbers for all instrument valves in the Operational Program.

During its investigation, CEI examined the possibility of tampering as a potential cause for the incorrect valve positions. None of the findings in this effort indicate that any tampering occurred. CEI's ongoing evaluation of conditions, consistent with past practices, will investigate tampering as a possible cause for discrepant conditions. In the future, should any findings or actual occurrences indicate malicious tampering or misconduct, CEI will immediately carry out our responsibilities in accordance with 10 CFR 50.72, 50.73 and 10 CFR 73 reporting requirements.

CEI has implemented a special action plan to determine specific valve lineup discrepancies on a case-by-case basis. The action plan will be completed in accordance with the schedule should in Table 1. Resolution of this matter prior

to exceeding 5% of rated thermal power operation has been included as a part of the regional inspection staff post-licensing follow-up work in Attachment 1 to the Perry Unit 1 low power operating license, issued on March 18, 1986.

TABLE 1 - CEI ACTION PLAN--INSTRUMENT VALVE MISPOSITION

	ACTIONS	MILESTONE
1.	Loop walkdown and completion of engineerig-approved interim as-built drawings which show instrument valves and piping:	
	a) Technical Specification Condition 5 instruments and SOI Fuel Load system instruments	Fuel Load
	b) Remaining Fuel Load Systems Operability Verification (SOV) checklist systems (i.e., required by Special Project Plan 1028)	Initial Criticality
	c) Technical Specification Condition 4, 3, 2 or 1 related instruments will be complete prior to entry into applicable condition.	Condition Changes
	d) Non-Technical Specification SOV/Inservice systems (Condition 4, 3, 2, & 1 BOP)	As scheduled by SPP 1028 SOV/Inservice Checklist sign-off
2.	Tags to be placed on those instrument valves identified in 1, above.	Prior to exceeding 5% power
3.	Completion of controlled final as-built 803 series drawings	Prior to startup after first refueling outage

QUESTION

9. Does the January 31 earthquake imply a capable fault exists near Perry?

ANSWER

No capable fault has been found associated with the January 31 earthquake. On the basis of the information received to date, the staff has not been able to associate a tectonic structure with these earthquakes. Based on past experience in the eastern U.S., the staff regards the identification in the epicentral area of an active tectonic structure with an estimated earthquake potential greater than the SSE as unlikely. Both the staff and the applicant, however, will be examining all available data and will report on this confirmatory effort in a future supplement to the Perry SER. (NUREG-0887)

The term "capable fault" defined in Appendix A was unique to the regulation, i.e., it was not previously used in the earth science profession. It was established as a measure of the likelihood that a fault could cause surface rupture and/or localize earthquake activity. Four basic elements are used in 10 CFR 100, Appendix A to establish whether or not a fault is a "capable fault." These are (a) movement on a fault within the past 35,000 years or multiple movements within the past 500,000 years, (b) a correlation with "macro-seismicity," (c) a relationship to a known "capable fault," and, for non-capability, (d) a structural association with geologically old structures.

The capable fault concept is derived from observations of highly active faults located in the western United States a tectonic plate boundary, where three is relatively high, ongoing tectonic activity represented by rugged topography, high rates of crustal deformation, and large and frequent earthquakes. Although it was developed with western geology in mind, 10 CFR 100, Appendix A applies this concept uniformly across the entire United States, including the area east of the Rockies which is an intraplate region where rates of tectonic activity are relatively low.

The term macro-seismicity is unique to 10 CFR 100, Appendix A and is used in Appendix A as if it were a clearly defined term in the earth sciences. The term is undefined in 10 CFR 100, Appendix A and is not a generally reccgnized term. Macro-seismicity means either large (with respect to earthquake size and/or rate of earthquake activity) or long (in terms of persistency) earthquake activity. No specific earthquake magnitude is stated in 10 CFR 100, Appendix A as a threshold in defining macro-seismicity.

10 CFR 100, Appendix A further states that a fault that can be demonstrated to be structurally associated with other structural features that are geologically old is not capable. It appears that this statement was intended to apply mainly to the eastern U. S. The statement implies that faults that can be shown to have formed in response to a tectonic regime that has ceased to exist, or has been substantially modified.

The concept of tectonic province was developed to provide an appropriate design basis for earthquake, such as the January 31 event, whose cause is presently indeterminate. The staff interprets tectonic provinces to be regions of uniform earthquake potential. The most important factors for the determinations tectonic provinces are (1) the development and characteristics of the current tectonic regione of a region, which is most likely reflected in the neotectonics (about 5 million years and yonger geologic history) and (2) the pattern and level of historical seismicity.

For the Perry site the controlling earthquake for the seismic design basis was the largest event not associated with geologic structure in the Central Stable Region Tectonic province - a magnitude 5.3 event. The consideration of the largest event nor associated with geologic structure ensures consideration as of yet undefined structures which might cause earthquakes in the vicininty of a site. This was the case with the January 31 event near the Perry site.

CHRONOLOGY OF EVENTS

DATE	EVENT
1/31/86	Earthquake occurred (11:46 a.m. EST); Site Area Emergency initiation by CEI 12:06 p.m. and terminated 14:25 p.m.; formation of earthquake recovery team and detailed site walkdowns by CEI
1/31/86	Confirmatory Action Letter (CAL-RIII-86-01 issued by Region III inspection staff and telefaxed to the Perry Site for immediate implementation.
2/1/86	CEI geological/seismological consultants established temporary seismographs in the area.
2/1/86	On site meeting conducted by the NRC Region III and NRR staffs to initiate an Augumented Inspection Team (AIT) investigation of the Perry Plant response to the earthquake. The Team of six people was led by Dr. C. J. Papariello of NRC's Region III office.
2/1-3/86	Plant walkdowns, inspections and preliminary raw data interpretations/reviews by the AIT
2/2/86	CEI consultants commenced initial geological surface surveys.
2/3/86	10 CFR 2.206 Petition filed by OCRE and WRA to not license the plant, and a Motion filed by OCRE to reopen the ASLB hearing record.
2/3/86	NRR contacted Dr. Okrent of the ACRS with a proposal for ACRS review of the significance of the seismic event.
2/4/86	Region III follow-up letter to CAL-RIII-86-01 establishing allowable activities by CEI.
2/4/86	Request from U.S. Congressional Representatives Dennis Eckart and John Seiberling that the ACRS review the Perry earthquake evaluation.

2/5/86	CEI provided initial written seismic event overview and schedule for a full written report to include responses to CAL-RIII-86-01.
2/11/86	Presentation of CEI's preliminary findings to the NRC staff at plant site in a public meeting.
2/12/86	CEI submitted a detailed Seismic Evaluation Report (responding to CAI-RIII-86-01) on its earthquake evaluation findings.
2/12-13/86	NRC/CEI presentation of earthquake review preliminary findings to ACRS Subcommittee on Reactor Operations and the ACRS Full Committee.
2/28/86	CEI submitted supplemental report of information on CEI planned geological studies, equipment qualification evaluations, seismic instrumentation reviews, and suppression pool level instrumentation. (Included a preliminary report on CEI's geological/seismological field evaluations).
3/3/86	CEI submits further supplemental report information on relocating the platform 630' seismic instrument, addressing stress comparisons, future generic plant evaluations, earthquake aftershocks and injection well related data.
3/5/86	NRC issued SSER No. 9 which reaffirmed the adequacy of the plant seismic design, concluding that the plant can be licensed for operation without undue risk to health and safety of public; operation can be authorized to power levels up to 5% of thermal rated power until confirmatory work identified in SSER No. 9 is completed. Copy of SSER No. 9 provided to the ACRS for review.
3/5/86	NRC staff filed response to OCRE Motion to reopen the Hearing record.
3/11/86	Congressman Seiberling (D-Akron, OH) and Eckart (D-Mentor, OH) announced that the House Subcommittee on Energy and the Environment will hold a hearing on April 8 related to Perry and the earthquake.
3/11/86	CEI provided additional information related to equipment qualification noted in the 3/3/86 supplemental report submittal.

3/12/86	The NRC staff, the staff's consultants (the USGS and SMA) and CEI discussed the earthquake event and their findings with the ACRS Subcommittee on Extreme External Phenomena.
3/13/86	NRC staff, the staff's consultant (the USGS and SMA), and CEI briefed the ACRS Full Committee on the earthquake event and findings. The Full Committee unanimously agreed with the NRC's plan to issue a low power operating license for Perry Unit 1 while the earthquake related confirmatory work proceeds.
3/13/86	CEI informally agrees to facilitate and execute a working agreement with John Carroll University to gather and disseminate seismological data from the Perry plant area on an ongoing basis.
3/17/86	ACRS Report to NRC Chairman concurring with the NRC staff's findings and recommends seismic monitoring in plant area.
3/17/86	NRC Director's Decision denying OCRE/WRA 10 CFR 2.206 Petitions.
3/18/86	NRC staff issued Low Power Operating License authorizing CEI to load fuel and operate Perry Unit 1 up to 5% of rated thermal power.
3/19/86	CEI commenced loading fuel in the reactor (fuel loading scheduled to be completed by April 10, 1986).
3/20/86	Memorandum and Order issued by the Licensing Appeal Board (ASLAB) to hold a hearing in the Cleveland area to aid in the determination on whether to reopen the ASLB record and admit (3/5/86) OCRE proposed new contention issue for the earthquake (inadequate plant seismic design basis is alleged).
3/24/86	Report issued by Region III of Augmented Team investigation findings relative to the earthquake event.