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ILLINOIS POWER COMPANY

CLINTON POWER STATION, P.O. BOX 678, CLINTON, ILLINOIS 61727

July 10, 1988

Reg. Guide 1.12

Docket No. 50-461

Document Control Desk
Nuclear Regulatory Commission
Washington, D.C. 20555

Subject: Response to Request for Additional Information Regarding Seismic Instrumentation and Plant Reaction Procedures

Dear Sir:

In a letter dated April 5, 1988, the NRC requested additional information regarding actions which have either been taken, or are contemplated, to improve the reliability of the seismic instrumentation and the plant reaction procedures in the event of a future significant earthquake event. The attachment to this letter addresses the specific actions taken to improve the Clinton Power Station (CPS) earthquake procedures and the reliability of CPS seismic instrumentation.

If there are any further questions please contact me.

Sincerely yours,

D. L. Holtzscher for

F. A. Spangenberg, III
Manager - Licensing and Safety

GSL/krm

Attachment

cc: NRC Clinton Licensing Project Manager
NRC Region III, Regional Administrator
NRC Resident Office
Illinois Department of Nuclear Safety

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Note: The below quoted information is taken from the NRC's letter of April 5, 1988.

Potential problems observed by the NRC during the inspection tour:

1) "Metal boxes enclosing the seismic sensors constitute, structurally, an integral part of the baseplate to which the sensors are attached. Thus, any severe accidental impact with these boxes caused by plant personnel action would be recorded by the sensors. Partial protective railings have been provided for sensors mounted on or near the floor. However, most sensor units can be accessed from the side which, in some cases, is necessary because the electrical (switch) boxes are mounted above the sensor units. Therefore, sensors are susceptible to falling objects and other impact type disturbances. A solution to this type of accidental excitation would be to protect the units with free standing box-type enclosures."

IP Response:

A plant modification has been initiated to place protective covers around any seismic instrumentation that is susceptible to non-seismic disturbances. It is anticipated that this modification will be completed in 1989.

2) "The anomalously high accelerations recorded by the (passive) peak recording accelerographs ($\geq$1g) could not be attributed to accidental impact. All three peak accelerographs installed in the plant are mounted in relatively remote areas where accidental impact related disturbances are unlikely. Readings obtained after the units had been equipped with new recording plates showed similarly high accelerations which could not be attributed to any physical phenomenon except perhaps inadvertent recording during plate installations (a problem reported by other utilities as well as the manufacturer)."

IP Response:

IP has not determined the cause for the anomalously high accelerations recorded by the (passive) peak reading accelerographs. IP has reviewed the calibration procedure for these instruments and has concluded that the procedure contains adequate guidance regarding recorder plate installation. These instruments are calibrated on an 18 month frequency as required by CPS Technical Specifications. IP has not planned any additional action in this area.

Significant Findings:

1) "The activation of the entire (active) seismic monitoring system depends on the signal generated by one sensor located in the Fuel Building at elevation 712'. Although the system has the option for multiple starts from any number of sensors, the present configuration does not provide for redundancy in the case of malfunctioning of one sensor unit. During the earthquake occurrence of June 10, 1987, all seismic sensors were in an operational mode, although the recording unit had malfunctioned and was not operational at the time. If the system had been equipped with a redundant trigger option, the Response Spectrum Analyzer (RSA) could have been turned on by the system and a response spectrum of the motion recorded could have been obtained from the "on-line" sensor. In that case, only the information from sensors feeding into the recording unit would have been lost."

IP Response:

The seismic monitoring system meets the guidelines of Regulatory Guide 1.12, "Instrumentation for Earthquakes." Redundant logic circuitry for multiple triggering of the seismic recorder system has been evaluated and based upon the benefits which would be achieved, a modification is not being considered at this time.

2) "Spurious alarm signals from the seismic monitoring equipment which were not related to earthquake induced motion caused several alarm conditions on the seismic alarm panel in the control room. Since the system had been declared "not operational" because of malfunctions in the recording unit, the control room operator turned off the entire active system which prevented any data acquisition by properly functioning components of the system, such as the RSA discussed previously, when the June 10, 1987 earthquake occurred. The problem of erroneous alarms as a result of induced noise was discussed. IPC reported that they had modified the circuitry to eliminate spurious alarms."

IP Response:

As indicated in the subject inspection summary, the input signal circuitry to the Response Spectrum Analyzer has been modified to eliminate spurious alarms.

3) "The destruction of the seismic sensor in the "free field" location and the electrical shorts experienced on the seismic control panel inside the control room as a result of lightning storm were discussed. Conditions which make this conclusion plausible are (a) the free field sensor is anchored to a buried slab of concrete in close proximity to a microwave transmission tower which is provided with an extensive ground-grip to prevent damage by lightning, and (b) the sensor cable which transmits the electrical signal to the control panel within the main plant structure is shielded and grounded to the main plant ground-grid."

"Thus when lightning struck the microwave tower, the microwave tower ground-grid potential was raised with respect to the (distant) ground potential of the main plant structure. The electrical damage experienced within the control panel could very well have been the result of electrical shorts as a result of this condition. IPC reported that they are implementing a lightning arrestor type system to prevent future repetition of lightning related malfunctions of the seismic monitoring system."

IP Response:

A plant modification added surge suppressors to the seismic trigger. The surge suppressors will protect this instrumentation from damage caused by the effects of lightning.

4) "In cases where the OBE levels of ground motion have been exceeded during an earthquake, the control room operator is informed of this condition in two ways: (1) the seismic switch located on the Fuel Building basemat (plant foundation) operates an annunciator on the control room display panel, and (2) the Response Spectrum Analyzer activates an annunciator at the control room display panel indicating that information received for the on-line sensors has exceeded the OBE design spectrum at one or more frequencies. An important feature of the OBE exceedence switch is that instead of being activated at the OBE high frequency acceleration of 0.10g as reported in the Clinton Safety Evaluation Report (Sections 2.5 and 3.7), it is activated at the OBE high frequency level obtained from the actual earthquake time history used in the structural design (Clinton FSAR Section 3.7). IPC reported these accelerations to be 0.11g for horizontal motion and 0.13g for vertical motion."

(The NRC also suggested adding) "Additional information either in FSAR Section 3.7.4 or in the Technical Specifications indicating the actual Zero Period Acceleration (ZPA) value of the OBE exceedence annunciation."

IP Response:

The accelerations discussed in the NRC Request for the Additional Information (0.11g and 0.13g) are the setpoints for the seismic switch which annunciates, in the main control room on the Seismic Warning Panel, when the accelerations associated with an Operational Basis Earthquake (OBE) are exceeded. Since the OBE response spectra zero period acceleration (ZPA) at the switch location is 0.109g in North-South and East-West directions, OBE is not exceeded until the acceleration is greater than 0.109g. Thus, the setpoint for exceeding an OBE in the transverse and horizontal directions is 0.11g.

The 0.13g acceleration value for the vertical direction has been determined to be incorrect. The vertical response spectra curve ZPA at the switch location is 0.11g. This condition is being corrected.

Adding additional information (the actual ZPA for an OBE at the sensor location) to the Final Safety Analysis Report (FSAR) or Technical Specifications will not improve equipment reliability or operator response. This information is stored in the Response Spectrum Analyzer (RSA), and it is available to the operator on demand.

5) "During the plant walkdown immediately following the June 10, 1987 earthquake, it was noted that the baseplate of the (passive) Response Spectrum Recorder had not been properly grouted to the concrete floor to which it was anchored by eight 3/4" diameter studs. IPC engineering staff performed an analysis of the plate in its ungrouted configuration and determined that the resonant frequencies in the horizontal and vertical direction were at least an order of magnitude higher than those frequencies of significance to the seismic design of the plant ($\leq$35Hz). Mounting features of several other seismic monitoring sensors which appeared to have flexible mounting were also discussed with IPC. IPC indicated that in all cases the mountings were sufficiently rigid to have resonant frequencies much higher than 35Hz."

IP Response:

The baseplate for the (passive) Response Spectrum Recorder has been grouted in accordance with the applicable design drawings.