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UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT
WASHINGTON, D.C. 20555

March 2, 1981

IE Circular No. 81-03: INOPERABLE SEISMIC MONITORING INSTRUMENTATION

Description of Circumstances:

On November 8, 1980, an earthquake occurred off the coast near Eureka, California. The earthquake was reported to have a magnitude of 7.0 on the Richter Scale at the epicenter, approximately 25 to 75 miles from the Humboldt Bay Power Plant facility. There were 12 separate seismic events above a magnitude of 3.5 that occurred within 24 hours of the earthquake, the largest event measuring 5.2. Reported damage to structures included several houses that were moved off supporting posts, various chimneys that were knocked down, one highway overpass that collapsed, and unspecified damage that occurred at two pulp mills. There were three potentially different sources of plant response data: three sets of magnetic tape triaxial accelograph recorders; three sets of triaxial film recorders (passive device); and one set of triaxial response spectrum recorders (passive device). A review of the records from these instruments indicated the following: the magnetic tape triaxial recorders did not produce useful records due to a degraded low-voltage power supply in the recording system (previously scheduled for routine servicing one week after the earthquake); a buildup of dirt and dust appeared to make inoperable six of the nine film recorders (the readings from the other three are considered highly unreliable and were not obtained from the same set of triaxial recorders); the triaxial response spectrum recorder was the only instrument believed to produce reliable data.

On January 24, 1980, an earthquake measuring 5.5 on the Richter Scale occurred about 10 miles north of Lawrence Livermore Laboratory (near San Francisco, California). Numerous aftershocks also occurred with one measuring 5.2 on January 26. The damage to civil structures was considered minor. Rancho Seco Nuclear Plant, located approximately 45 miles northeast of the earthquake area, reported no physical damage, although plant personnel felt slight building motion.

Rancho Seco was shutdown for refueling during these earthquakes. During this period, the electrical seismic instrumentation system was inoperable because portions of the system were out for calibration. For the other instruments, power was not being supplied due to electrical cable problems. Whether the seismic instrumentation would have activated or not is unclear because the U.S. Geological Survey equipment close to the site did not trigger. Records from a passive recorder showed peak accelerations from 1 to 1.5 g and 0.1 g

for the January 24 and 26 events respectively, which are in excess of values which might be attributed to the seismic event. These indications are not believed to be accurate values since the recorder was in an area in which it could be easily jarred by personnel.

An earthquake measuring 3.6 to 4.1 on the Richter Scale occurred about 15 miles from the Maine Yankee site on April 17, 1979. Personnel in the control room felt the earthquake motion, but it was not felt by others inside the containment. An inspection of the strong-motion accelographs (Kinematics SMA-1) on April 19, 1979 revealed that one instrument was inoperable apparently because leakage of corrosive fumes from the rechargeable batteries destroyed the battery connection. Inspection of the seismic instruments on August 1, 1979 again revealed the corrosion problem as found before but occurring on both instruments. Based on this, a shorter inspection interval was initiated. Recent discussions with the manufacturer's representative indicate that the battery corrosion problem appears to be limited to the SMA-1 units because the SMA-2 and SMA-3 units have not exhibited a corrosion problem. Those facilities that may have SMA-1 units include Turkey Point Unit 3, Pilgrim, Maine Yankee, Vermont Yankee, Point Beach Unit 1, Fort St. Vrain, and Browns Ferry Unit 1.

The experiences at the Humboldt Bay, Rancho Seco, and Maine Yankee facilities are of concern because, if a significant earthquake had occurred, important data relating to the plant response would not have been obtained. The experiences point out that (1) calibration or testing of the seismic instrumentation should not disable a major portion of the seismic instrumentation system for long periods of time; (2) the necessity for periodic surveillance and calibration of the entire seismic monitoring system; (3) the necessity to assess the adequacy of the surveillance/calibration interval; and (4) the necessity to detect those areas where accidental impact or high background vibrations may mask the actual seismic response. In addition, Licensee Event Reports (LERs) submitted to the NRC have revealed various problems relating to seismic instrumentation. The problems involve not only the electrical time-history instrumentation, but also the passive peak acceleration recorders. A description of the problems is enclosed. Note that the first problems identified in Attachment 1 could have prevented the recording of the plant seismic response if a significant earthquake had occurred. The remainder are instances of less significant malfunctions.

The requirements for seismic instrumentation are described in Appendix A to 10 CFR Part 100 and Regulatory Guide 1.12. The instrumentation serves to enable a prompt review of the actual seismic response of plant features important to safety in comparison with that used as the design basis. This information can be used to determine whether a plant should be shutdown, or can continue to be safely operated, and to permit appropriate, timely action. If an earthquake were to occur near a nuclear facility, the most useful information of the plant's response would be from the onsite seismic instrumentation. Evaluation of the plant response due to a seismic event

and evaluation of continued operation of the facility would be difficult without accurate and reliable data. Based on the above discussion, the following action is recommended.

Recommended Action for Holders of Operating Licenses and Construction Permits:

It is recommended that holders of operating licenses and construction permits review for applicability the specific items presented in the "Description of Circumstances" and the enclosure to the Circular. It is further recommended that the surveillance testing and calibration programs for the seismic instrumentation system be reviewed and revised as necessary to detect and prevent the malfunctions described herein and to limit the potential for having or making the entire seismic monitoring system (active and passive components) inoperable during all plant modes of operation.

No written response to this Circular is required. If you require additional information regarding these matters, please contact the Director of the appropriate NRC Regional Office.

Attachments:

1. Seismic Instrumentation Malfunctions
2. Recently Issued IE Circulars

IEC 81-03
March 2, 1981

- 2 -

PLANT	LER NUMBER/ DOCUMENTATION	EVENT DESCRIPTION
Hatch Nuclear Plant, Unit 1	Letter from Georgia Power to NRC dated 6/25/80	One channel of the Triaxial Time-History Accelerometer (Kinometrics) had shifted its sensi- tivity by 47% and natural frequency by 12%
Humboldt Bay Power Plant	NRC Reconnaissance Report dated 1/19/81	Magnetic tape time- history accelerometers (TERA Technology) were found inoperable due to a degraded low voltage power supply; 6 of 9 film recorders (TERA Technology) were inoperable because of dirt and dust buildup
Maine Yankee Atomic Power Plant	Inspection Report 50-309/79-11	Corrosion of connec- tions to the batteries on Kinometrics SMA-1 units made the units inoperable; increased testing frequency initiated
Rancho Seco Nuclear Generating Station	Inspection Report 50-312/80-03	Seismic monitoring instrumentation was inoperable due to calibration and power supply problems with electrical cable; passive accelerometers placed in area susceptible to impacts by passing traffic

Attachment 1
IEC 81-03
March 2, 1981

SEISMIC INSTRUMENTATION MALFUNCTIONS

PLANT	LER NUMBER/ DOCUMENTATION	EVENT DESCRIPTION
Beaver Valley Power Station, Unit 1	78-028	Magnetic tape recorder (Teledyne Geotech Model MTS-100) was found inoperable during surveillance test; replaced with new instrument
D.C. Cook Nuclear Plant, Unit 1	75-56	One channel was found during surveillance testing to have a severe amplifier balance shift; the amplifier board was replaced
	76-19	Movable masses on the peak recording accelerometers were against the stops; the units were replaced; initiated shortened surveillance interval
	76-50	Cassette tape (Kine- metrics) on monitoring system was found stick- ing during surveillance testing; the sticking tape was replaced
Davis-Besse Nuclear Power Station	77-13	Spurious activation of seismic trigger; unit was replaced
	79-111	Excessive noise in recorded tape prevented reading of accelerometer traces during surveillance test (Teledyne-Geotech Model 37200); part of problem was due to one lead of AC input line on playback monitor was not connected

- 3 -

PLANT	LER NUMBER/ DOCUMENTATION	EVENT DESCRIPTION
Less Significant Occurrences -		
Beaver Valley Power Station	76-53 78-040	Control room seismic alarm indicated spuriously due to misaligned reed switches; the recording scribes on the Engdahl response spectrum recorders remained operable; the reed switches were adjusted
Calvert Cliffs Nuclear Plant, Unit 1	77-79	The motor on the seismic tape playback unit (Kinometrics Model No. SMP-1) was found sticking; the motor was replaced
North Anna Power Station, Unit 1	78-060 78-118	Alarms from the (Engdahl) response spectrum recorders indicated spuriously on four separate occasions
Three Mile Island Nuclear Station, Unit 2	78-002	A defective recording plate was found in the spectrum recorder; the plates were replaced

RECENTLY ISSUED
IE CIRCULARS

Circular No.	Subject	Date of Issue	Issued to
81-02	Performance of NRC-Licensed Individuals While on Duty	2/9/81	All power reactor facilities (research & test) with an OL or CP
81-01	Design Problems Involving Indicating Pushbutton Switches Manufactured by Honeywell Incorporated	1/23/81	All power reactor facilities with an OL or CP
80-25	Case Histories of Radiography Events	12/5/80	All radiography licensees
80-24	AECL Teletherapy Unit Malfunction	12/2/80	All teletherapy licensees
80-23	Potential Defects in Beloit Power Systems Emergency Generators	10/31/80	All power reactor facilities with OL or a CP
80-22	Confirmation of Employee Qualifications	10/2/80	All holders of a power reactor OL or CP architect-engineering companies and nuclear steam system suppliers
80-21	Regulation of Refueling Crews	9/10/80	All holders of a power reactor OL or CP
80-20	Changes in Safe-Slab Tank Dimensions	8/21/80	All Part 50 and Part 70 fuel facility licensees
80-19	Noncompliance with License Requirements for Medical Licensees	8/26/80	All medical licensees
80-18	10 CFR 50.59 Safety Evaluations for Changes to Radioactive Waste Treatment Systems	8/22/80	All power reactor facilities with an OL or CP

OL = Operating Licenses
CP = Construction Permit