GENERAL ELECTRIC
SPACE DIVISION
PHILADELPHIA

PROGRAM INFORMATION REQUEST / RELEASE

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*USE "C" FOR CLASSIFIED AND "U" FOR UNCLASSIFIED

FM	TO
C. B. Mayforth	F. P. Rudek

DATE SENT	DATE INFO. REQUIRED	PROJECT AND REQ. NO.	REFERENCE DIR. NO.
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SUBJECT

SEISMIC TESTING OF PRIMARY CONTAINMENT O_2/H_2 ANALYZER SYSTEMS

INFORMATION REQUESTED/RELEASED

References: A. IEEE Std. 344-1971, "IEE Guide for Seismic Qualification of Class 1 Electric Equipment for Nuclear Power Generating Stations", Sept. 1971.

B. PIR 1R56-261A, "Seismic Analysis of O_2/H_2 Containment Sensors", from C. V. Stahle to F. Rudek, March 1973.

C. GE-NED Purchase Specification 21A030, Rev. 0, Primary Containment Oxygen Monitoring,

1.0 SUMMARY

Test requirements, facility requirements and capabilities, and a test program outline are presented for the seismic testing of the Primary Containment O_2/H_2 Analyzer System.

These tests shall demonstate capability of the system to withstand the specified Design Basis Earthquake and will verify the design through the Operation Basis Earthquake.

2.0 TEST REQUIREMENTS

As specified in Ref. C, the analyzer system is designed to the following criteria:

a. Design Basis Earthquake (DBE

Horizontal Coefficient	3.0 g
Vertical Coefficient	0.29 g
Capability	No functional failure

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RETENTION REQUIREMENTS

COPIES FOR	MASTERS FOR
1 MO.	3 MOS.
3 MOS.	5 MOS.
6 MOS.	12 MOS.
MOS.	MOS.
	DO NOT DESTROY

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2.0 TEST REQUIREMENTS (continued)

b. Operation Basis Earthquake (OBE)

Horizontal Coefficient	1.5 g
Vertical Coefficient	0.29 g
Capability	Uninterrupted operation

Ref. A indicates a frequency range of 0.1 to 33 Hz for the Design Basis Earthquake. Also, to qualify the primary containment analyzer system for the DBE, the equipment should be subjected to vibration motion that conservatively simulates that to be seen at the equipment mounting during a DBE. The levels shown above for the DBE are interpreted to provide the required conservatism and to represent the motions at the analyzer system mountings.

As specified in Ref. A, devices should be tested using either a "continuous" sinusoidal test or a "sine beat" test at selected frequencies. The frequencies of interest shall be conservatively chosen as the natural frequencies of the device, as determined by a low-level sine sweep, since the natural frequency of the structure in which the analyzer system is to be mounted is not known at this time. For such a conservative test, the sine-beat procedure, as described in Ref. A, shall be used.

Tests will be performed in each of 3 orthogonal axes, independently.

3.0 TEST EQUIPMENT

Space Division's Ling Electronics 370 shaker system and the MB C-150 shaker system will be used to perform the seismic tests required to comply with the specifications and appropriate IEEE Guidelines. The useable ranges for this test equipment are as follows:

Horizontal Coefficient

Ling 370	0.1 to 2.7 cps	0.0015 to 1.35 g*
	2.7 to 5 cps	1.35 g**
MB C-150	5 to 8.5 cps	1.35 to 3.0 g*
	8.5 to 33 cps	3.0 g

*shaker stroke limited
**shaker force limited

Vertical Coefficient

Ling 370	0.1 to 1.2 cps	0.0015 to 0.29 g
	1.2 to 33 cps	0.29 g

Because of test equipment limitations two separate shaker tables are required in order to closely approximate the seismic requirements of the procurement specification.

The containment analyzer panel and sensors shall be wired in accordance with the wiring and connection diagram, 47E226401, Rev. B. Exceptions to this diagram are that a simulated pressure signal equivalent to 14.7 psia shall be provided, and the electronics output to the recorder shall be monitored externally with a voltmeter.

4.0 TEST PROGRAM

The following outlines a tentative sequence of events to be used to qualify the analyzer system for the earthquake environment.

a. Design and construct a vibration test fixture to which the analyzer panel assembly and sensors will be mounted, utilizing normal interface attachments. The fixture shall be suitable for vertical excitation and for horizontal excitation in each of two orthogonal axes.

b. Provide suitable instrumentation of the test articles for the identification of significant resonances and measurement of responses in all test axes.

c. Attach the fixture to the shaker and perform a low-level sine sweep to identify natural frequencies below 33 Hz in the first axis.

d. If resonant frequencies below 33 Hz exist, perform sine-beat tests at these frequencies and at the specified amplitudes.

e. If no resonant frequencies exist below 33 Hz, perform a slow sine sweep (two octaves/minute, maximum) at the specified amplitude for the given orientation.

f. Repeat steps c through e, above, for the remaining two axes.

5.0 ACCEPTANCE CRITERIA

5.1 Operation Basis Earthquake (OBE

During the OBE vibration tests a constant, known concentration of oxygen shall be applied to the sensors. The electronics output as measured with the facility voltmeter shall not vary by more than ±2% of the full scale of the Containment Analyzer panel during and following the OBE tests. Spurious alarms, meter deviations, recorder deviations, etc., during vibration shall not be cause for rejection provided that adjustments made after vibration will bring the panel back to normal.

5.2 Design Basis Earthquake (DBE)

Acceptance of the Analyzer design following DBE vibration shall be verified if no functional failure occurs, which will cause the unit to be considered non-operational after DBE is completed.

5.3 Verification by Similarity

In accordance with the guidelines of IEEE Standard 344; 1971 qualification of the oxygen containment panel and sensors per this procedure shall constitute qualification of the Hydrogen Containment system which is identical as far as electronics design, and sensor configurations.