

# GENERAL ELECTRIC

NUCLEAR POWER

SYSTEMS DIVISION

MFN-146-82

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October 7, 1982

U. S. Nuclear Regulatory Commission  
Office of Nuclear Reactor Regulation  
Division of Engineering  
Washington, DC 20555

Attention: Dr. William V. Johnston  
Assistant Director for Material and Qualifications  
Engineering

Gentlemen:

SUBJECT: DYNAMIC TESTING OF THE BWR HIGH PRESSURE COOLANT  
INJECTION TURBINE

On August 2, 1982 General Electric met with representatives of the NRC Staff to discuss the planned dynamic testing of a BWR 4/5 High Pressure Coolant Injection (HPCI) Turbine. This letter documents General Electric's understanding of the conclusions reached at that meeting.

Over the last six months GE has had a number of meetings with the NRC on the subject of Environmental Qualification. At various times during these meetings the NRC staff has stated that the dynamic testing of devices needs to address long duration hydrodynamic loads. GE believes that the original test plan was adequate to qualify the HPCI turbine for dynamic loads. However, in order to avoid potential delays in obtaining NRC acceptance of this test, GE, at the request of our customers, has modified the Test Plan and Procedure to specifically address loads from both SRV actuation and Post LOCA Chugging. This modification was the subject of the August 2, 1982 meeting.

As discussed in this meeting, dynamic testing which takes into consideration SRV loads is based on a calculated 300 SRV actuations per plant life time using available plant operating data. These SRV actuations will be enveloped by a 0.7g maximum acceleration at a frequency range of 5-100 Hz with a test duration of 7.5 minutes. GE proposed to run two, two axis tests, in order to address actuations in three axis. One test would run with inputs in one horizontal plus vertical direction and the second with inputs in the other horizontal plus vertical direction by rotating the turbine 90°. These accelerations at the test table would be run prior to the table actuations representative of the five upset and one faulted events.

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Also discussed at the meeting was a modification which takes into consideration the phenomena of Chugging. This modification is based on a calculated Chugging duration of six hours post LOCA with each Chug being 1-5 seconds long and having a strong motion duration of 0.2 seconds. This loading will be enveloped by a 15 minute test using a 1.65g maximum acceleration at 20-100 Hz. Again, two tests at 90° will be performed in order to simulate three axis loadings. This test would be performed following the faulted and upset condition actuations since this phenomena occurs following the LOCA condition.

As a result of the information exchange at the meeting, it is GE's understanding that the NRC finds the above discussed approach acceptable. An NRC concern dealt with assuring that an adequate number of stress cycles are contained in the time histories supplied to the seismic table. GE has subsequently contacted the testing laboratory which will conduct these tests and has received assurance that the TRS used will contain a sufficient number of strong motion cycles to accommodate the estimated four stress cycles per actuation which the turbine might be expected to see. This will be verified prior to the running of the tests.

GE wishes to point out that these modifications to the original HPCI seismic qualification test are considered to be extremely conservative. Since this proposal has been made at the specific request of our customers, whose overriding consideration is that of NRC acceptance of the test, and since neither the technical basis nor the methodology for demonstrating compliance to this NRC concern have been finalized, GE proposed a test modification which contains both more stress cycles and a longer duration of exposure to such cycles than the turbine is expected to experience during expected operation. This modification should therefore not be considered as a commitment on the part of either GE or our customers to include such considerations in future dynamic tests. We anticipate that over a period of time such vibration aging effects will be shown to be non-contributors to the overall lifetime determination of such devices. Furthermore, both experience and literature reviews, show that electric equipment is rarely found to be vibration age sensitive. This is due, in part, to the fact that such devices are not mechanically loaded, the materials of construction are relatively ductile, and those with moving parts are designed for hundreds of thousands and even millions of operational cycles. For such devices, the acceleration forces associated with the conservatively calculated Safe Shutdown Earthquake, rather than the vibration aging phenomena addressed in the above described HPCI turbine test, are the loads of interest to be addressed in any seismic qualification test.

Very truly yours,

  
J. F. Quirk, Manager  
BWR Systems Licensing  
Nuclear Safety & Licensing Operation

ADDED DYNAMIC  
TESTING  
OF  
HPCI TURBINE

AUGUST 2, 1982

## BACKGROUND

- HPCI TURBINE QUAL UNDERWAY
  - IEEE 323-74
  - IEEE 344-75
  
- INCLUDES AGING, DYNAMIC TESTS, LOCA
  
- DYNAMIC TESTING
  - 5 UPSET EVENTS
  - 1 FAULTED EVENT
  - SCHEDULED W/O 8-9-82
  
- QUALIFICATION SPONSORED BY:
  - LIMERICK
  - SHOREHAM
  - SUSQUEHANNA
  - HOPE CREEK

## ISSUE

- NRC HAS STATED THAT ALL QUAL SHOULD INCLUDE HYDRODYNAMIC EFFECTS OF LONG DURATION.
- EFFECTS ARE SRV AND CHUGGING.
- SUCH EFFECTS DO NOT APPLY TO HOPE CREEK.

PLAN

- SRV

0.7G 5 TO 100 HZ

7.5 MINUTE DURATION

ENVELOPE OF PLANT RESPONSE SPECTRA

DURATION BASED ON 900 - .5 SEC/CYCLE

ACTUATIONS

PLAN

CHUGGING

1.65 G 20 - 100 HZ

15 MINUTE DURATION

ENVELOPE OF PLANT RESPONSE SPECTRA

DURATION BASED ON 6 HRS. CHUGGING

## SUMMARY

- ADDING SRV AND CHUGGING TO HPCI QUALIFICATION
- RESPONSIVE TO NRC CONCERNS