TEC
TECHNOLOGY for ENERGY CORPORATION

October 23, 1980

Mr. Pete Capo
Nuclear Regulatory Commission
Office of Nuclear Reactor Regulations
Systems Integration Division
Instrumentation & Controls Branch
Washington, D.C. 20555

Dear Mr. Capo:

I have the following comments on pages 8 and 10:

p. 8 a) LCSR test for degradation--TEC supplies service, equipment, and training.

b) SHI test--TEC provides service/training for degradation.

c) N.A. Degradation--TEC supplies equipment and training.

d) N.A. Plunge Tau--In only one test run by Upadhyaya were errors of this magnitude recorded.

p. 10 Item (1)--A test of one channel per cycle would be better if the additional requirement that upon any evidence of degradation another channel would be tested.

Item (2)--Westinghouse has no problems with 0.8 sec nor does B & W with 12 secs. These plants will opt for continuing with no in situ surveillance program. I'm not sure what Combustion plants will do. A better criteria would require 1.2 times the longest measured time constant.

Jim Robinson suggested the enclosed modifications to pages 6, 7, 8, and 25.

I think you have done an excellent job and that this whole process is now coming together. Please let me know if I can help you.

Sincerely yours,

Ted

J. E. Mott
Vice President and Technical Director

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In the NA (or statistical) method the small fluctuations in RTD output under operating conditions are analyzed on line (or recorded for off line analysis) using spectral density and/or auto regressive techniques. The NA method has been applied to obtain consistent results under optimum reactor conditions for certain type sensors; however, currently it has not been established in a statistically dependable manner that the NA method yields results comparable with deterministic methods. The NA method can be used for detecting RTD degradation.

Table 1.1 Characterisitcs of Methods for Measuring RTD Time Response

Test	Where Performed	Necessary to take RTD out of service	Complexity of Measurement	Quality of Measurement
Plunge Test	In Lab	Yes	Need to remove RTD and ship to lab.	Plunge test measures Plunge τ directly, but measurement has poor quality for two reasons: (1) Manipulating RTD may change its time response and (2) Service conditions are usually not reproduced in the lab. Lab results must be extrapolated to service conditions. The combined effect of these two factors can result in errors up to a factor of 3.
LCSR Test	In-Situ	Yes	Test simple. Special test equipment needed.	LCSR provides an indirect measure of τ. Results are generally accurate to within 10%.
SHI Test	In-Situ	Yes	Test simple. Uses simple standard electronic test equipment.	SHI can be measured quite accurately. From changes in the SHI, RTD degradation can be detected. No good correlation between Plunge τ and SHI exists.
NA Test	In-Situ	No	Test simple. Special test equipment needed.	A good deal of sophisticated work has gone into NA. However, statistical dependable NA measurements of Plunge τ have not been carried out. NA is a useful tool for detecting RTD degradation.

Table 1.2 Practical Aspects and Availability of RTD Time Response Testing Methods

Test		Utility of Test Procedure	Rosemont & Sostman Provide	AMS Provides	TEC Provides
Plunge Test	Test for RTD Degradation	None		Yes	Yes
	Measure Plunge τ	Poor -- Errors to a factor of 3	Service only (Lab Tests)	Yes	Yes
LCSR Test	Test for RTD Degradation	OK -- However if the utility buys equipment for degradation test they might as well buy equipment for measuring Plunge τ.		Equipment and Training	Equipment and Training
	Measure Plunge τ	Good 10% Accuracy		Service or Equipment and Training	Service or Equipment and Training
SHI Test	Test for RTD Degradation	Good -- No special test equipment needed.		Training	Training
	Measure Plunge τ	Poor -- No good correlation with τ exists.			
NA Test	Test for RTD Degradation	Good. Need Special Test Equipment RTD need not be taken out of service.		Equipment and Training	Equipment and Training
	Measure Plunge	Have made limited measurements over a period of 2 years $\pm$ 10% variation. No systematic comparisons with deterministic results.			Equipment and Training

3.3 RTD DEGRADATION TESTS USING NOISE ANALYSIS (NA)

NA tests are performed by carrying out statistical (spectral, correlation, and/or auto-regressive) analysis of the normal fluctuations of the RTD output signal during normal steady state operation. These fluctuations are the RTD's response to the fluctuations in the reactor coolant temperature.

In the application of the NA method, assumptions must be made regarding the statistical properties of the coolant temperature fluctuations. If some minimum set of assumptions such as stationarity and repeatability are met, the NA method is a valid degradation method since any change in the output fluctuations can be directly attributed to the RTD itself. If, in addition to stationarity and repeatability, the coolant temperature fluctuations are "white" (equal magnitude probability of coolant temperature fluctuations over sufficient frequence band), NA can be used to determine a Plunge τ.

It has been established that the inlet coolant temperature fluctuations do not meet the requirements for a Plunge τ determination under all reactor conditions for all sensors (there are reasons to believe a Plunge τ can be determined using NA methods for certain sensors under certain verifiable reactor conditions).

The conditions for the coolant temperature fluctuations for a RTD degradation test are less restrictive than the Plunge τ. It has been established that a repeatable statistical parameter related to τ can be extracted from NA of RTDs under verifiable reactor conditions. Therefore NA methods can be used for RTD degradation measurements subject to the statistical accuracy of the measurements.