SAXTON NUCLEAR EXPERIMENTAL CORPORATION

DOCKET NO. 50-146
LICENSE DPR-4

Amendment No. 1 to Change Request No. 27

1. Applicant hereby submits Amendment No. 1 to Change Request No. 27 supplying additional information requested in Division of Reactor Licensing letter of August 23, 1967.

SAXTON NUCLEAR EXPERIMENTAL CORPORATION

By /s/ R. E. Neidig
President

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QUESTION 1

What will be the pH range within which you will operate during the test? How does this range compare with previously approved ranges used during pH tests?

ANSWER

Section N.4.b.(6) of Supplement No. 1 to the Saxton Technical Specifications was amended by Change No. 15 to permit pH tests at Saxton based on total alkali concentration in the primary coolant. Saxton now operates not on a pH range but on an alkali concentration range of 0 - 3.2×10^{-4} molal. This concentration range will not be changed for the test.

Based on primary coolant containing 500 ppm boron (as H_3BO_3) and 0 - 3.2×10^{-4} molal lithium (as LiOH), the calculated pH range during the test will be 4.95 - 6.48 at 77°F and 5.5 - 7.5 at 530°F.

QUESTION 2

Discuss procedures to be followed to assure that no thermal limits will be exceeded when performing pH tests at power levels above 23.5 MWt.

ANSWER

A series of tests have been conducted at WAPD to determine the effects of crud on DNB. The experimental data obtained from these tests are presented in Table 1.

Table 1

Nominal Test Conditions			$\left(\frac{q''_{DNB,\ measured}}{q''_{DNB,\ predicted\ by\ W\text{-}3}}\right)$	
Pressure psia	Inlet Temp., °F	Mass Rate of Flow (#/hr ft^2) x 10^6	Clean Tube	Crudded Tube
2000	480	1.5	1.055 1.055 1.135	1.174 1.287
				* 1.204 1.242
2000	480	2.5	1.179 1.277	1.391
2000	550	1.5	1.156	1.407
2000	550	2.5	1.152	1.258

* Results obtained from simultaneous crud injection and DNB testing.

Answer to Question 2 (continued)

The results indicate that the DNB heat flux is increased when a crud layer exists on the fuel rod surface.

Other studies (1) have been conducted to determine the effect of crud deposit on the heat transfer coefficient and wall temperature in the boiling regime. These tests indicate the wall temperature was lower in nucleate boiling for a given heat flux when crud deposit existed as compared with clean surfaces. Thus, there is no significant effect on the heat transfer in the boiling region.

pH tests conducted at Saxton at 15 MWt, 20 MWt and 23.5 MWt have demonstrated that the reactor power level has a negligible effect on the magnitude of the reactivity change. Therefore, no appreciable difference is expected at the 35 MWt power level.

The initial pH tests will be conducted with the test subassembly located in the periphery of the core at a power level of 23.5 MWt. The measured parameters, i.e., reactivity coefficients, fuel temperatures and power distribution will be compared with predicted values. If significant differences are found, the tests will be terminated until an evaluation of the differences can be made.

From the above statements, it is concluded that new procedures are not needed to assure that thermal limits are met when performing pH tests at power levels above 23.5 MWt.

(1) Discussion by P. Cohen and G. R. Taylor, Westinghouse Electric Corporation on paper by W. C. Elrod, J. A. Clark, E. R. Lody and H. Merte, "Boiling Heat Transfer Data at Low Heat Flux", ASME Paper No. 66 WA/HT-19.

QUESTION 3

What is the maximum rate at which pH can be changed? What is the estimated reactivity addition rate corresponding to this change?

ANSWER

The primary coolant pH can be increased 2.0 units (at 530°F) in approximately one-half hour, which is the time required for charging lithium hydroxide solution from the purification system surge tank. Based on observations made at Saxton during more than 15 tests, the reactivity change resulting from this pH change begins slowly, increases to a maximum rate, then again becomes slow - in sigmoidal fashion. The typical total reactivity change at Saxton for this pH change is 0.2% $\Delta k/k$. The maximum reactivity insertion rate is typically 0.017% $\Delta k/k$ per hour. It requires between 10 and 20 hours for the total reactivity change to occur following adjustment of coolant pH.