SAXTON NUCLEAR EXPERIMENTAL CORPORATION

DOCKET NO. 50-146
LICENSE DPR-4

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CHANGE REQUEST NO. 24

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1. Applicant hereby submits Change Request No. 24 in compliance with paragraph 3B of License DPR-4 for change of the Technical Specifications to be authorized by the Commission as provided in 10 CFR 50.59.

SAXTON NUCLEAR EXPERIMENTAL CORPORATION

BY /s/ R. E. NEIDIG
President

ATTEST:

/s/ R. E. SYPHER
Secretary

(S E A L)

Sworn and subscribed to before me this 28th day of July, 1966.

(S E A L)

/s/ Charles J. Ausel
Notary Public
Muhlenberg Township, Berks County
My Commission Expires Oct. 14, 1966

2214

1) DESCRIPTION OF CHANGE

In Supplement No. 1 to Technical Specifications, add the following Test Fuel Assemblies to Item F.2.

Test Fuel Assembly XV

One 9-rod subassembly shall have the four corner rods and the center rod clad with type 304 stainless steel having a nominal thickness of 15 mils and shall contain uranium dioxide (UO_2) pellets enriched to 5.7% U-235, having a previous irradiation exposure of approximately 4250 MWD/MTU. The four remaining rods shall be chosen in any combination from among the following:

a) Rods clad with Zircaloy-4 having a nominal thickness of 23.5 mils and containing a series of Zircaloy-4 capsules. Each capsule shall contain one or more zirconium alloy test specimens. The zirconium alloy test specimens consist of portions of 0.016 inch thick grid strap material loaded within the capsule. Some of the specimens are actual spring fingers of an advanced fuel rod grid design and some are materials test strips formed into an arc.

b) Rods identical to standard fuel rods except that they are internally pressurized to produce tensile stresses of approximately 41,500 psi in the clad at reactor operating conditions.

c) Rods identical to standard fuel rods except that they are internally pressurized to produce tensile stresses of approximately 27,500 psi in the clad at reactor operating conditions.

d) Rods clad with Zircaloy-4 having a nominal thickness of 23.5 mils and containing uranium dioxide (UO_2) pellets uniformly enriched to 17.4% U-235. These rods have a previous exposure of approximately 1900 MWD/MTU and are internally pressurized to produce a maximum tensile stress of approximately 22,000 psi in the clad at reactor operating conditions.

This test subassembly may be operated only in a peripheral core location while containing the 17.4% enriched fuel rods.

Fuel Assembly xvi

One 9-rod subassembly similar to Fuel Assembly xv except that the four corner rods and the center rod have a previous irradiation exposure of approximately 1000 MWD/MTU and that the end closures on these five rods are substandard for test purposes. The four remaining rods shall be chosen in any combination from among the following:

a) Rods clad with Zircaloy-4 having a nominal thickness of 23.5 mils and containing a series of Zircaloy-4 capsules. Each capsule shall contain one or more zirconium alloy test specimens. The zirconium alloy test specimens consist of portions of 0.016 inch thick grid strap material loaded within the capsule. Some of the specimens are actual spring fingers of an advanced fuel rod grid design and some are materials test strips formed into an arc.

b) Rods identical to standard fuel rods except that they are internally pressurized to produce tensile stresses of approximately 41,500 psi in the clad at reactor operating conditions.

c) Rods identical to standard fuel rods except that they are internally pressurized to produce tensile stresses of approximately 27,500 psi in the clad at reactor operating conditions.

d) Rods clad with Zircaloy-4 having a nominal thickness of 23.5 mils and containing uranium dioxide (UO_2) pellets uniformly enriched to 17.4% U-235. These rods have a previous exposure of approximately 1900 MWD/MTU and are internally pressurized to produce a maximum tensile stress of approximately 22,000 psi in the clad at reactor operating conditions.

This test subassembly may be operated only in a peripheral core location while containing the 17.4% enriched fuel rods.

2) PURPOSE OF CHANGE

The purpose of this change is to permit the insertion of test fuel assemblies xv and xvi into the reactor. The scope of this experiment involves modification of two 9-rod subassemblies previously inserted into the reactor.

The objective of the experiment involving assembly xv is to provide information on the in-pile performance of zirconium alloy test specimens subjected to combined thermal and radiation fluxes, with particular emphasis on the amount of stress relaxation experienced with the specimens loaded to simulate conditions which would be present in a fuel assembly spring clip.

The objective of the experiment involving assembly xvi is to continue the accumulation of neutron exposure on both the Zircaloy-4 and stainless steel clad, internally pressurized rods, and to determine the effects of continued in-pile operation on various kinds of sub standard weld features.

3) SAFETY CONSIDERATIONS

For assembly xv the design characteristics of the four rods containing the capsules and zirconium alloy test specimens are given in Table I. The four rods are identical in design, material, quality control, and assembly to a standard fuel rod. The atmosphere within each rod will be helium under one atmosphere pressure at room temperature.

The thirteen Zircaloy-4 capsules contained in each of the above rods, are attached end-to-end by means of a threaded joint. The string of capsules is in turn attached to the top end plug of the rod and is suspended in the rod with a 0.375 inch nominal gap at the bottom end to accommodate tolerance accumulations and slight differential thermal expansion from differences in clad and capsule temperatures. Each zirconium alloy test specimen is contained in a special machined cavity in the capsule which subjects the test specimen to a specified pre-load and deflection. Chemical analyses and descriptions of test specimens are given in Table II. Stainless steel spring pins are used to secure each specimen in its capsule and to lock the threads joining the capsules in order to secure the parts during assembly and remote disassembly operations. The pins are installed with an interference fit in the capsules.

The assembly consisting of the top end plug and capsule string is made an integral part of the rod by welding the end plug to the rod cladding. Thus the primary containment for the capsules and test specimens is provided by the rod cladding. The small diametral clearance (22 mils) between the capsules and the I.D. of the cladding will prevent the stainless steel pins and test specimens from being dislodged during the in-pile test. The temperature rise in the capsules, due to gamma heating, is calculated to be 39-78°F when the subassembly is operated in the periphery of the core and will increase to 78-156°F when the subassembly is operated in the center of the core. The cladding temperature will be approximately the same as the reactor coolant. Therefore, the stresses in the cladding during operation will be no more severe than those in a fuel rod, and the structural integrity of the rod will be maintained.

TABLE I

Rod Design Characteristics

Rod O.D.	=	0.391 inches
Rod I.D.	=	0.343 inches
Wall Thickness	=	0.024 inches
Capsule O.D.	=	0.321 inches

TABLE II

Description and Materials Stress-Relaxation Experiment

Description of Test Specimen	Material
Arc-Type	Zr-2½Nb (Annealed)
Arc-Type	Zr-2½Nb (Heat Treated)
Arc-Type	Zr-2½Nb-½Cu (Annealed)
Arc-Type	Zr-2½Nb-½Cu (Heat Treated)
Arc-Type	Zr-4
Spring Fingers	Zr-2½Nb
Spring Fingers	Zr-2½Nb-½Cu