SAXTON NUCLEAR EXPERIMENTAL CORPORATION

DOCKET NO. 50-146
LICENSE DPR-4

Change Request #18

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1. Applicant hereby submits Change Request No. 18 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 7th day of May, 1965.

(S E A L)

/s/ Martin A. Kohr
Notary Public
Muhlenberg Township, Berks County
My Commission Expires Feb. 4, 1966

1) Description of Change

In Supplement No. 1 to Technical Specifications, page 2, change Item F.2. to read:

> Uranium oxide (UO_2) enriched to 5.7% of U-235 shall be used in the fuel assemblies, except that the test fuel assemblies listed below having enrichments and other characteristics as described may be inserted in the reactor. In test fuel assemblies the fuel rods as described may be replaced with regular fuel rods, that is, enriched to nominal 5.7% U-235 and constructed as described in Technical Specification F.3.

Test Assembly No. 1

One 61 rod assembly containing rods of the numbers and types listed in the following table:

No. of Rods	Cladding	Clad Thickness(1)	Pellet Diameter	Enrichment	Peak Power
4(4)	304 SS	80.5 mils(11)	0.294 in.	0.71 w/o	3.1 kw/ft
4(5)	304 SS	80.5	0.294	0.29 w/o	2.2
3	304 SS	15	0.357	(2)	16
3	304 SS	15	0.357	(2)	16
3	304 SS	15	0.357	(2)	16
3	304 SS	15	0.357	(2)	16
3	16-20 SS	15	0.357	(2)	16
3	348 SS	15	0.357	(2)	16
3	304 SS(9)	15	0.357	5.69 w/o	13.5
3	304 SS	15	0.357	5.69 w/o(3)	13.5
3	Zr-4(6)	23.7	0.337	5.69 w/o	12.0
5	Zr-4(6)	23.7	0.337	6.1 w/o	13.5
3	Zr-2(6)	23.7	0.337	(2)	14
3	Zr-2(6) (Ni Free)	23.7	0.337	(2)	14
3	Zr-4(6)	23.7	0.337	(2)	14
3	Zr-4(10)	23.7	0.337	(2)	14
3	Zr-4(8)	23.7	0.337	(2)	14
3	Zr-4(7)	23.7	0.337	(2)	14
3	Zr-4(6)	23.7	0.337	7.3 w/o	16

Notes for Table

(1) All rods are free standing 0.391 in. O.D. nominal.
(2) First 14 pellets 5.69 w/o
Next 5 pellets 6.81 w/o
Next 12 pellets 6.45 w/o
Next 5 pellets 6.81 w/o
Next 13 pellets 5.69 w/o
(3) Contains approximately 100 ppm boron as zirconium diboride
(4) RCC element with perforated guide tube
(5) RCC element with solid guide tube
(6) Autoclave pre-oxide on O.D.
(7) Autoclave pre-oxide on O.D. and I.D.
(8) Furnace pre-oxide on O.D.
(9) Compartmented rod, 3 sections
(10) As pickled, no pre-oxide treatment
(11) RCC rod O.D. is 0.461 in. nominal.

Test Assemblies ii and iii

	Test Fuel Assembly No. ii	Test Fuel Assembly No. iii
	9-Rod Subassembly	9-Rod Subassembly
First 14 pellets	5.69%	5.69%
Next 2 pellets	9.19%	7.30%
Next 3 pellets	8.57%	6.81%
Next 12 pellets	8.13%	6.46%
Next 3 pellets	8.57%	6.81%
Next 2 pellets	9.19%	7.30%
Next 14 pellets	5.69%	5.69%

NOTE: The 9-rod subassembly in the first column shall not be used at reactor power levels greater than 20 MWt.

Test Fuel Assembly No. iv

One 9-rod subassembly shall have four corner rods clad with Zircaloy-4 having a nominal thickness of 23.7 mils and shall contain uranium oxide (UO_2) enriched to 6.1% U-235. The other five rods shall be clad with Type 304 stainless steel having a nominal thickness of 9.5 mils and shall contain uranium oxide (UO_2) enriched to 5.7% U-235.

Test Fuel Assembly No. v

One 9-rod subassembly shall have four corner rods clad with Zircaloy having a nominal thickness of 23.7 mils and shall contain uranium oxide (UO_2) enriched to 6.1% U-235. The other five rods shall be clad with Type 304 stainless steel having a nominal thickness of 9.5 mils and shall contain uranium oxide (UO_2) having the same enrichment as Test Fuel Assembly No. iii.

Test Fuel Assembly No. vi

One four-rod subassembly shall have rods clad with Type 304 stainless steel having a nominal thickness of 23.5 mils and shall contain uranium dioxide (UO_2) fuel pellets uniformly enriched to 8.3 w/o U-235. One of these rods may contain up to 100 ppm boron initially as zirconium diboride.

Test Fuel Assembly No. vii

One 9-rod subassembly shall have four corner rods and the center rod clad with Zircaloy-4 having a nominal thickness of 23.7 mils and shall contain uranium oxide (UO_2) uniformly enriched to 7.3%. Two of the other rods shall be clad with Type 304 stainless steel having a nominal thickness of 15 mils and shall contain uranium oxide (UO_2) uniformly enriched to 5.7% U-235. One other rod shall be clad with Type 304 stainless steel having a nominal thickness of 16.1 mils, shall contain uranium oxide (UO_2) having a content of 0.29% U-235, and shall be concentrically located within a solid stainless steel guide tube. The remaining rod shall be clad with Type 304 stainless steel having a nominal thickness of 16.1 mils, shall contain uranium oxide (UO_2) having a content of 0.71% U-235 and shall be concentrically located within a perforated stainless steel guide tube.

Test Fuel Assembly No. viii

One 9-rod subassembly shall have three corner rods clad with Zircaloy-4 having a nominal thickness of 23.7 mils and shall contain vibrationally compacted uranium dioxide (UO_2) enriched to 7.2% U-235 and compacted to 86 $\pm$ 2% theoretical density. The fourth corner rod and the central rod shall be clad with Type 304 stainless have a nominal thickness of 15 mils and shall contain vibrationally compacted uranium dioxide (UO_2) enriched to 7.2% U-235 and compacted to 85 $\pm$ 2% theoretical density. Three of the remaining rods shall be clad with Zircaloy-4 and shall contain uranium dioxide (UO_2) pellets 0.337 inches in diameter which are enriched to 6.1% U-235. One of these rods shall have a previous irradiation exposure of $\sim$ 7500 megawatt days per metric ton (MWD/MT) and shall contain a 15 mil diameter hole machined through the clad. The second of these rods shall have a previous irradiation exposure of $\sim$7500 MWD.MT. The third of these rods shall have a 15 mil diameter hole machined through the clad. The final rod shall be clad with sensitized Type 304 stainless steel and shall contain uranium dioxide (UO_2) pellets enriched to 5.69% U-235 and the ten central pellets shall have 20 mil chamfers on both ends.

Following a period of irradiation, the two defected, Zircaloy-4 clad rods may be replaced by similar, defected, unirradiated Zircaloy-4 clad rods.

Test Fuel Assembly No. ix

One 9 x 9 fuel assembly shall contain 81 rods clad with Type 304 stainless steel of 15 mils thickness and shall contain uranium dioxide (UO_2) fuel pellets of 5.69% U-235 enrichment. This assembly is made by removing the central 21 rods from a normal 9 x 9 fuel assembly. The space left by removal of the central 21 rods shall be filled by a plug consisting of a stainless steel tube 0.125 inches thick and 2.75 inches in diameter welded to perforated stainless steel end plugs. The end plugs shall be designed so that flow through the plug will experience the same enthalpy rise that is experienced by flow through a normal fuel assembly. The plug shall contain three concentrically mounted stainless steel pipes 0.125 in. thick and of 2.125, 1.50 and 0.75 in. diameters, respectively. Horizontal restraint for the plug shall be provided by the grids of the fuel assembly. Vertical support for the plug shall be provided by a 1.5 in. diameter stainless steel pipe extension of the reactor head port flange. When Change Request No. 16 has been approved by the Atomic Energy Commission, this plug may be removed and replaced by a fueled super-critical loop pressure tube assembly.

Test Fuel Assembly No. x

One 9-rod subassembly shall have eight rods clad with Zircaloy-4 having a nominal thickness of 23.3 mils. The fuel shall be mixed natural uranium-plutonium dioxide enriched to 6.6 w/o PuO_2. Four of the rods shall contain vibration compacted fuel and the remaining four shall contain sintered ceramic pellet fuel. The ninth rod position will be a flux thimble for use with in-core instrumentation.

Test Fuel Assembly No. xi

One 9-rod subassembly shall have the center rod and the four corner rods clad with Type 304 stainless steel having a nominal thickness of 15 mils and shall contain uranium dioxide (UO_2) uniformly enriched to 5.7% U-235. Two of the remaining rods shall be clad with Zircaloy-4 having a nominal thickness of 23 mils and shall contain uranium dioxide (UO_2) uniformly enriched to 6.45 w/o U-235. The third rod shall be clad with Zircaloy-4 having a nominal thickness of 23 mils and shall contain uranium dioxide (UO_2) uniformly enriched to 6.1 w/o U-235. This rod shall have a previous irradiation exposure in excess of 13,000 MWD/MTU. The last rod shall be clad with Zircaloy-4 having a nominal thickness of 2_ mils and containing uranium dioxide (UO_2) uniformly enriched to 7.3% w/o U-235 and shall have a previous irradiation exposure in excess of 3000 MWD/MTU.

Test Capsules

Test capsules containing non-fuel material may be inserted in any of the eleven dummy fuel locations adjacent to the reactor core region or in any of the eight irradiation sample tubes on the periphery of the core provided that:

1) Prior to irradiation, the design of the test capsule has been evaluated by the SNEC Safety Committee and found acceptable with regard to physical, thermal and hydraulic performance and effect on core reactivity, neutron flux and reactivity coefficients.

2) No foreseeable failure of a test capsule could result in damage to any core component or in any manner alter the ability of the control system to function.

2) Purpose of Change

The purpose of this change is to permit insertion of test fuel assembly xi into the reactor. The scope of this experiment involves modification of the improved grid design subassembly as outlined in Change Report No. 12. The subassembly will contain the five non-removable rods previously in the subassembly plus two new fuel rods and two previously irradiated fuel rods.

The objectives of this experiment are to provide information on irradiation effects on various clad surface treatments and to extend the irradiation exposure of the previously irradiated rods.

3) Safety Considerations

The design characteristics of the fuel in test assembly xi are given in Table 1. The operation of test fuel assemblies containing rods similar to those in test assembly xi in Saxton has been reviewed in the Addenda to the Phase I Safeguards Report so that operation of this test assembly does not present any significant hazards considerations not described in the Saxton Final Safeguards Report and its Addenda.

4) Health and Safety

It is our opinion that the health and safety of the public will not be endangered by this change.

TABLE 1
FUEL ROD DESIGN PARAMETERS FOR THE MODIFIED
IMPROVED GRID DESIGN 3x3 TEST ASSEMBLY x

Rod No.	Type	Clad Material	Clad Thickness(1)	Fuel Pellet Diameter	Fuel Enrichment(6)	23.5 MWt Estimated Maximum Power Density - kw/ft	
						Periphery	Center
753, 762 756, 755 757	Non-Removable(7)	304 SS	0.015 in.	0.357 in.	5.69 w/o	4.6	13.5
102(2)	Removable	Zr-4 (Ni Free)	0.023 in.	0.337 in.	6.1 w/o	4.6	13.5
123(3)	Removable	Zr-4	0.023 in.	0.337 in.	7.3 w/o	5.35	16.0
702	Removable	Zr-4(4)	0.023 in.	0.337 in.	6.45 w/o	4.75	14.0
703	Removable	Zr-4(5)	0.023 in.	0.337 in.	6.45 w/o	4.75	14.0

(1) All rods are "free standing" with 0.391 in. O. D.

(2) Previously irradiated to approximately 13,000 MWD/MTU.

(3) Previously irradiated to approximately 3,000 MWD/MTU.

(4) Clad surface is burnished and autoclave tested.

(5) Clad surface is burnished only.

(6) Enrichments are uniform throughout rod.

(7) Previously irradiated.