SAXTON NUCLEAR EXPERIMENTAL CORPORATION

4/2/65

Docket No. 50-146
License DPR-4

Change Request No. 19 to Technical Specifications
and
Amendment No. 17 to Operating License

1. Applicant hereby submits Change Request No. 19 to the Saxton Technical Specifications as provided for in 10 CFR 50.59.

2. To support the requested change Applicant submits the SAFEGUARDS REPORT FOR SAXTON REACTOR PARTIAL PLUTONIUM CORE II, dated March 1965.

3. Applicant submits Amendment No. 17 to Operating License to allow Saxton to receive, possess, and use plutonium as fuel in a partial loading of the Saxton Reactor.

SAXTON NUCLEAR EXPERIMENTAL CORPORATION

(S E A L)

By /s/ R. F. BOVIER
Vice President

Attest:

/s/ R. E. Sypher
Secretary

Sworn and subscribed to before me this 2nd day of April , 1965

(S E A L)

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

6/111

1. Description of Change

Make the following addition to the Saxton Technical Specifications:

Supplement No. 3 to Technical Specifications incorporating changes applicable to Partial Plutonium Core

During the operation of the Saxton Reactor with part of the core containing plutonium enriched fuel, the Technical Specifications shall be changed as indicated below. Except to the extent as changed, all of the remaining provisions of the Technical Specifications shall remain in effect.

Change Section F.2

2. Mixed natural uranium-plutonium dioxide enriched initially to a nominal 6.6 w/o PuO_2 shall be used in the central nine fuel assemblies and uranium dioxide (UO_2) enriched initially to a nominal 5.7 w/o U-235 shall be used in the remaining assemblies, except that the test fuel assemblies listed in Change No. 14 to the Technical Specifications or other changes that have been approved by the Atomic Energy Commission 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 a nominal 5.7 w/o U-235 and constructed as described in Technical Specification F.3.

Change Section F.3

3. The fuel assemblies shall be supplied as follows:

4.1. General Description: Plutonium fuel assemblies

Each main plutonium fueled assembly shall have a total overall length of 50.23 inches with a nominal fuel length of 36.6 inches and shall approximate a 5.386 inch square in cross section.

The fuel rods shall be composed of a combination of two cladding types and two fuel types. The fuel shall be either cylindrical ceramic pellets or vibration compacted loose oxide powder. The cladding shall be either Type 304 stainless steel or Zircaloy-4. The rods shall be arranged in a square lattice with an initial 0.580 inch center-to-center distance.

The ceramic pellets shall have the following initial dimensions in the respective cladding:

Zircaloy-4	Diameter	- 0.3374 in. (nominal)
	Length	- 0.3660 in. (nominal)
Stainless steel	Diameter	- 0.3558 in. (nominal)
	Length	- 0.3660 in. (nominal)

One end of each pellet shall be initially dished. The total pellet column tolerance shall be 0.183 inches initially. The maximum initial moisture content of the pellet column shall not exceed 30 ppm on a weight basis. The maximum initial nitrogen content of the pellet column shall not exceed 100 ppm on a weight basis.

The vibration compacted loose oxide fuel shall have a total column tolerance of 0.188 inches initially. The maximum initial moisture content of the loose oxide fuel column shall be 100 ppm on a weight basis. The maximum initial nitrogen content of the loose oxide fuel column shall be 100 ppm on a weight basis.

The initial clad inside diameter shall have the following dimensions:

Zircaloy-4	0.3445 in. (nominal)
Stainless steel	0.3610 in. (nominal)

The initial diametral clearance for the pelletized fuel shall be:

Zircaloy-4	0.0071 in. (nominal)
Stainless steel	0.0052 in. (nominal)

The cladding shall have the following wall thickness initially:

Zircaloy-4	0.0233 in. (nominal)
Stainless steel	0.0150 in. (nominal)

The gap between the pellet column and the internal plug end shall contain sintered aluminum oxide (Al_2O_3) discs to provide the following minimum end gaps initially:

Pelletized	0.609
Vibration compacted	0.784

The fuel rods shall be initially hermetically sealed with end plugs welded to the tubing. The end plugs shall be Zircaloy or stainless steel depending on the tubing to which they are welded.

a.2. General Description: Uranium fuel assemblies

Each main uranium fueled assembly shall have a total overall length of 50.25 inches with a nominal fuel length of 36.6 inches and shall approximate a 5.386 inch square in cross section.

The fuel rods shall be composed of stainless steel tubes which contain uranium dioxide fuel in the form of cylindrical ceramic

pellets. The rods shall be arranged in a square lattice with an initial 0.580 inch center-to-center distance. The pellets shall have the following initial dimensions:

Diameter (nominal)	0.357 inches
Length (nominal)	0.732 inches Core I design 0.600 inches Core II design

The ends of each pellet shall be dished initially. The total pellet column tolerance shall be 0.366 inches initially for Core I design rods and 0.300 inches initially for Core II design rods. The initial clad inside diameter shall be 0.361 ± 0.0005 inches. The diametral clearance between clad I.D. and pellet O.D. shall be initially 0.004 ± 0.001 inches.

The gap between pellet stack and internal plug end shall contain sintered aluminum oxide (Al_2O_3) circular hollow discs, to provide a minimum of .612 inch end gap on Core II design fuel and .174 inch end gap on Core I design fuel. The initial moisture content of the pellet stack shall not exceed 75 ppm on a weight basis. The fuel rod ends shall be initially hermetically sealed with end plugs welded to the tubing. Those fuel rods which require no further welding shall be clad with 0.015 inch wall of Type 304 welded stainless steel 10% cold-worked with a 400 ppm maximum cobalt content. The end plugs shall be Type 304 L or 308 stainless steel. Those fuel rods which require subsequent brazing shall be composed of 0.028 inch wall of Type 348 modified carbon, annealed stainless steel with a 500 ppm maximum cobalt content. The end plugs shall be Type 304 or 304 L stainless steel.

Change Section N.4.e and in Supplement No. 1 to Technical Specifications, pages 3 and 4, change section labeled "Change Section N.4.e" to read:

Section N.4.e

(1)	The steady state reactor power level shall not exceed the following rod control or chemical shim (boric acid solution) control	23.5 MWt
(2)	Maximum number of fuel assemblies in core	21
(3)	Maximum fuel burnup (fuel assemblies) Maximum fuel burnup (control rod followers and L assemblies)	30,000 MWD/MTU 50,000 MWD/MTU
(4)	Maximum heat flux (steady state 23.5 MWt)	553,700 Btu/hr ft^2
(5)	Average heat flux	156,700 Btu/hr ft^2

(6)	Minimum steady state DNB ratio (W-2 correlation)	2.62
(7)	Maximum fuel clad temperature (at nominal pressure)	642°F
(8)	Maximum fuel specific power	
	a) Unspiked fuel assembly	16.0 kw/ft
	b) 4-rod spiked subassembly	20.0 kw/ft
(9)	Average power density	63.5 kw/liter

(10) Under credible accident conditions as described in the Core II Safeguards Report, the minimum DNB ratio in any channel except the closed 4-rod subassembly is not expected to be less than 1.35 (by the W-2 correlation). If a loss of flow accident should occur, the 4-rod assembly will be examined or an analysis made based on actual flow coastdown characteristics to demonstrate that no deformation occurred.

(11)	The design maximum void coefficient of reactivity at operating temperature	-0.0020/% void
(12)	The design maximum temperature reactivity defect (cold clean to hot clean)	0.113
(13)	Moderator temperature coefficient of reactivity shall not be more positive than	
	a) Borated at 80°F	$+1.0 \times 10^{-4}/°F$
	b) Borated at 530°F	$-2.0 \times 10^{-4}/°F$
	c) Unborated at 530°F	$-3.5 \times 10^{-4}/°F$

In Supplement No. 1 to Technical Specifications, page 5, delete section labeled "Add Item N.3.b.(7)."

2. Purpose of Change

To allow the operation of the Saxton Reactor with part of the core loaded with plutonium enriched fuel.

3. Safety Considerations

Significant safety considerations which were not described or implicit in the Final Safeguards Report are submitted in the Safeguards Report for the Saxton Reactor Partial Plutonium Core II dated March 1965.

4. Health and Safety

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

SAXTON NUCLEAR EXPERIMENTAL CORPORATION

Application for
Reactor Construction Permit and Operating License

DOCKET NO. 50-146
Amendment No. 17

Saxton hereby requests that Section 2B of Operating License DPR-4 be amended to read as follows:

B. Pursuant to the Act and Title 10 CFR, Chapter 1, Part 70 "Special Nuclear Materials," to receive, possess, and use at any one time 130 kilograms of contained Uranium-235 and 25 kilograms of contained Plutonium-239 as fuel for the operation of the reactor.

The purpose of this change is to permit the receipt, on-site storage, and irradiation at Saxton of nine fuel assemblies using Pu-239 as the fissile material.

To support the requested change Saxton hereby submits the SAFEGUARDS REPORT FOR THE SAXTON REACTOR PARTIAL PLUTONIUM CORE II.