FORM NRC-7 (7-78) 10 CFR 110

U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY GAO B-180225(R0362)

APPLICATION FOR LICENSE TO EXPORT NUCLEAR MATERIAL AND EQUIPMENT *(See Instructions on Reverse)*

1. APPLICANT'S USE →	a. DATE OF APPLICATION: 6/5/79	b. APPLICANT'S REFERENCE: TNP-285 79-169/01
2. NRC USE →	a. LICENSE NO.: XSNM01521	b. DOCKET NO.: 11000669

3. APPLICANT'S NAME AND ADDRESS (RIS)

a. NAME: Transnuclear, Inc.

b. STREET ADDRESS: One Skyline Place, 5205 Leesburg Pike

c. CITY: Falls Church — STATE: VA — ZIP CODE: 22041

d. TELEPHONE NUMBER *(Area Code – Number – Extension)*: 70? - 820 - 2450

4. SUPPLIER'S NAME AND ADDRESS *(Complete if applicant is not supplier of material)* (RIS)

U.S.D.O.E.

a. NAME: c/o Goodyear Atomic Corp.

b. STREET ADDRESS: Route One

c. CITY: Piketon — STATE: OH — ZIP CODE: 45661

5. FIRST SHIPMENT SCHEDULED	6. FINAL SHIPMENT SCHEDULED	7. APPLICANT'S CONTRACTUAL DELIVERY DATE	8. PROPOSED LICENSE EXPIRATION DATE	9. U.S. DEPARTMENT OF ENERGY CONTRACT NO. *(If Known)*
		To be determined	One year from date of issuance	To be assigned

10. ULTIMATE CONSIGNEE (RIS)

a. NAME: Institut Max Von Laue -

b. STREET ADDRESS: Paul Langevin

c. CITY – STATE – COUNTRY: Grenoble, France

11. ULTIMATE END USE *(Include plant or facility name)*

Will be used in the High Flux Reactor at Grenoble, France (See attached End Use Statement)

11a. EST. DATE OF FIRST USE

12. INTERMEDIATE CONSIGNEE (RIS)

a. NAME: Nukem GmbH, D-6450 Hanau, Federal

b. STREET ADDRESS: Republic of Germany and

c. CITY – STATE – COUNTRY: CERCA Romans, France

13. INTERMEDIATE END USE

Conversion and fabrication of fuel elements (See attached End Use Statement)

13a. EST. DATE OF FIRST USE

14. INTERMEDIATE CONSIGNEE (RIS)

a. NAME: Transnuklear GmbH

b. STREET ADDRESS: 645 Hanau, Postfach 110030

c. CITY – STATE – COUNTRY: Wolfgang-bei-Hanau Industriegelande, Hessen, W. Germany

15. INTERMEDIATE END USE

Intermediate for transport purposes only.

15a. EST. DATE OF FIRST USE

16. NRC USE	17. DESCRIPTION *(Include chemical and physical form of nuclear material; give dollar value of nuclear equipment and components)*	18. MAX. ELEMENT WEIGHT	19. MAX. WT. %	20. MAX ISOTOPE WT.	21. UNIT
	Uranium in the form of uranium hexafluoride enriched to 93.30 percent U235.	33.0 Kg U	93.3%	30.8 Kg U235	Kg

22. COUNTRY OF ORIGIN - SOURCE MATERIAL	23. COUNTRY OF ORIGIN - SNM WHERE ENRICHED OR PRODUCED	24. COUNTRIES WHICH ATTACH SAFEGUARDS *(If Known)*
U.S.	U.S.	

25. ADDITIONAL INFORMATION *(Use separate sheet if necessary)*

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26. The applicant certifies that this application is prepared in conformity with Title 10, Code of Federal Regulations, and that all information in this application is correct to the best of his/her knowledge.

27. AUTHORIZED OFFICIAL — a. SIGNATURE: [signature] — b. TITLE: Assistant Manager Washington Operations

INSTITUT
MAX VON LAUE
PAUL LANGEVIN

Grenoble, 3 May 1979 CO/fa

END USE STATEMENT

We certify that the following quantities based on contractual figures, and including D.O.E. allowable tolerances on uranium weight and enrichment :

kg U	kg U235	maximum enrichment
33,0	30,8	93.30

which application for export licence will be applied by Transnuclear Inc. will be used in High Flux Reactor at Grenoble.

M. JACQUEMAIN

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·INSTITUT
MAX VON LAUE
PAUL LANGEVIN

DEPARTEMENT REACTEUR

JE/od-79-143

Grenoble, le 27 avril 1979

CHECKLIST OF INFORMATION REQUIRED IN CONNECTION WITH REQUEST FOR LICENSE TO EXPORT HIGHLY ENRICHED URANIUM

1. QUANTITY REQUIRED :

about 33 kg U at 93 % U-235

The quantity of U-235 is included in 6 spent fuel elements from the HFR (High Flux Reactor) of the I.L.L. (Institute Max von Laue - Paul Langevin) in Grenoble/France.

These fuel elements are currently located at Savannah River Plant/ U.S.A. for reprocessing.

The I.L.L. entrusts two manufacturers with the production of HFR fuel elements :

NUKEM at Hanau/Western Germany
CERCA at Romans/France

Each manufacturer needs about 30 kg U at 93 % U-235 for the working stock and a further 10 kg U at 93 % U-235 for each fuel element.

2.A. a) in process

- at NUKEM : about 31,6 Kg U at 93 % U-235

- at CERCA : about 43,8 Kg U at 93 % U-235

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- at COGEMA : about 55,4 kg U at 93 % U-235

b) on hand

Three fuel elements with 27,6 kg U at 93 % U-235.

c) in core

One fuel element with 9.2 kg U at 93 % U-235.

d) in storage

Presently 7 fuel elements with about
7 x 6,3 = 44,1 Kg U at about 81 % U-235.

e) at the reprocessing plant

Presently 16 fuel elements with about
16 x 6,3 = 100,8 Kg U at about 81 % U-235
in Savannah River Plant/U.S.A. The transfer of these spent fuel elements was effected between August 1977 and April 1979.

2.B. a) in process

Each manufacturer needs a working stock of 30 kg U at 93 % U-235 and about 10 kg U at 93 % U-235 for each fuel element. The I.L.L. has signed two contracts with NUKEM and CERCA for 5 fuel elements each. The necessary working stock is therefore :
2 x (30 + 5 x 10) = 160 kg U at 93 % U-235.

b) on hand
2-3 fuel elements with 18.4 - 27.6 kg U at 93 % U-235.

c) in core

One fuel element with 9.2 kg U at 93 % U-235. 619069

3.A. Since the reactor became operational in 1972, the reactor use program consists of 6 cycles (equal to 6 fuel elements) per year. See also the I.L.L. Annual Report 1978.

3.B. The neutron flux (in $n/cm^2/s$) at several points in the reactor is :

- Thermal neutrons :
  maximum undisturbed flux in the reflector .... 1.5×10^{15}

- Neutrons with energy less than 0.625 eV :
  minimum disturbed flux at the point of the tangential beam tube .... 1×10^{15}

  Average flux in the fuel element .... 2.2×10^{14}

  Average flux in the reflector .... 1.8×10^{14}

- Fast neutrons :
  maximum flux in the centre tube .... 3.5×10^{14}

- Neutrons with energy greater than 0,821 MeV :
  maximum flux on the control rod .... 2.7×10^{14}

See also the I.L.L. Annual Report 1977, especially page 16 (beam tube arrangement), page 19 (in-pile beam tube arrangement) and drawing "Fig. 23.20".

3.C. The reactor is an international facility used purely for fundamental research. There is no reactor with the same flux level or energy spectrum in Europe.

4.A-E. The I.L.L. High Flux Reactor fuel element is a cylindrical (type HFIR) element made in one piece, incorporating 280 plates each containing 30.6 g U at 93 % U-235.

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a) Its geometry could not be changed without a complete reconstruction of the reactor, as it is closely integrated with the beam tubes, irradiation tubes, hot and cold sources, central control rod and tangential safety rods constituting the pile block.

b) Within its present geometrical limits, it would be completely impossible to obtain not only the performance (power, fission

Uranium were replaced by 20 % enriched Uranium. In fact the Uranium content in the UAl_3-Al alloy forming the meat is close to the technical limits of what the manufacturer can do with the powder metallurgy technology used.

To summarise, it may be said that a change to 20 % enriched uranium would involve not only the need to design a completely new fuel element, but probably at the same time a complete reconstruction of the entire reactor block surrounding the core, without the certainty of obtaining the very high flux of thermal neutrons in the reflector which makes this one of the most powerful fundamental research reactors in the world.

Such changes would of course involve a very long-term stoppage of the work of the I.L.L., as this is entirely bound up with the utilisation of the neutrons produced by the reactor.

5.A. See the following drawings :

- Fig. 23.12 Vertical section of the reactor pool
- Fig. 23.20 Irradiation tubes
- Fig. 23.1 Vertical section of the reactor vessel
- Fig. 23.18 In-core operational parameters

The D_2O cooling flux at normal power 57 MW across the fuel element is about 2 250 m^3/h, the usual temperatures at the entrance/exit of the fuel element are 30° C/50° C.

5.B. The HFR fuel element looks like the fuel element of the High Flux-Isotope Reactor of Oak Ridge/U.S.A., except that it is constructed in one piece. The 280 involute formed fuel plates contain about 9.2 kg U at 93 % U-235 (see Fig. 22.1).

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The structure material is aluminum, the plate cladding is an aluminum alloy with 1 % each of iron, nickel and magnesium (Al-Fe-Ni). The plates are rolled, the fuel assembly consisting of welding these plates onto the annular structural tubes.

The uranium meat in each plate is an uranium aluminum alloy ($UA\ell_3$-$A\ell$), manufactured by the usual powder technology.

The I.L.L. fuel elements are produced in France and in Germany (see point 1.).

5.C. The storeroom for new fuel elements is inside the reactor building. The room is monitored by radar.

The transfer of the fuel element into the fuel handling machine is manually effected outside the pool.

Before loading the reactor, the machine is checked in the pool at the test position (see Fig. 25.3 - test position = puits d'essai).

The loading and unloading of the reactor consists of locating the fuel handling machine over the top of the reactor chimney (see Fig. 23.12 - fuel handling machine = hotte) using the travelling gantry (= portique de la hotte).

The spent fuel element is unloaded under heavy water and stored still within the fuel handling machine in the pool for spent fuel elements (see Fig. 25.3). Fifty days later, the heavy water in the machine is exchanged for normal water. The fuel element is then put into the storage basket (= panier de stockage).

After a further 200 days, the spent fuel element can be evacuated in a lead container (= château de plomb) without liquid cooling.

5.D. There is no storage arrangement for new or spent fuel elements outside the reactor building, except by the fuel manufacturers.

The first 16 spent fuel elements of the reactor were reprocessed at the French Marcoule plant, the uranium was reenriched in the U.S.A. and retransfered to the I.L.L. fuel manufacturers.

Since 1977, the spent fuel elements have been sent for reprocessing to the Savannah River Plant. The reenrichment is planned to take place at Oak Ridge.

5.E. See 4.A.

Annexed papers :

- I.L.L. Annual Report 1977
- Drawing Fig. 22.1. - Fuel element
- Drawing Fig. 23.1. - Vertical reactor section
- Drawing Fig. 23.12. - Vertical reactor section
- Drawing Fig. 23.18. - Operational parameters
- Drawing Fig. 23.20. - Beam tube arrangement
- Drawing Fig. 25.3. - Pool for spent fuel elements

Drawings are in Office of
International Programs | NRC