



UNITED STATES  
NUCLEAR REGULATORY COMMISSION

WASHINGTON, D.C. 20555-0001

June 15, 2000

The Honorable Jesse Helms, Chairman  
Committee on Foreign Relations  
United States Senate  
Washington, D.C. 20510

Dear Mr. Chairman:

In a March 24, 2000 letter to you from Chairman Richard Meserve, he informed you of a revised application (XSNM2611) for the export of highly enriched uranium (HEU) fuel to the High Flux Materials Testing Reactor at the European Commission's Joint Research Centre in Petten, The Netherlands. At that time, the NRC had requested the Department of State to complete the Executive Branch review and make a recommendation to the Commission on this application. A copy of their review and recommendation is enclosed for your information.

If I can be of further assistance, please contact me.

Sincerely,

Dennis K. Rathbun, Director  
Office of Congressional Affairs

Enclosure:  
As stated

cc: The Honorable Joseph R. Biden, Jr.



DOCKET NUMBER  
EXPORT-IMPORT 11004440

United States Department of State

DOCKETED  
Washington, D.C. 20520

June 2, 2000  
'00 JUN -7 A9:40

Ms. Janice Dunn Lee  
Director, International Programs  
United States Nuclear Regulatory Commission  
Rockville, Maryland

OFFICE OF  
ADJUTANT GENERAL

**SERVED JUN - 7 2000**

Dear Ms. Lee:

I refer to the letter from your office dated March 1, 2000, requesting the views of the Executive Branch as to whether issuance of an export license in accordance with the application hereinafter described meets the applicable criteria of the Atomic Energy Act of 1954, as amended. I also refer to the Petition of the Nuclear Control Institute ("Petitioner") for Leave to Intervene and Request for Hearing regarding the application described below.

NRD No. XSNM02611 -- Application by Transnuclear, Inc for authorization to export to The Netherlands 140.5 kilograms of U-235 contained in 150.348 kilograms of uranium enriched to a maximum of 93.45 percent in four annual tranches of 37.587 kilograms of highly enriched uranium (HEU). The HEU in the form of metal will be fabricated into fuel elements by CERCA in France for the High Flux Reactor (HFR) in Petten, Netherlands operated by the European Commission's Joint Research Center (JRC).

The proposed export to The Netherlands would take place pursuant to the U.S.-EURATOM Agreement for Nuclear Cooperation as confirmed in a letter dated March 31, 2000 from EURATOM. EURATOM has complied with the conditions of its Agreement for Cooperation with the United States.

The Executive Branch has reviewed the application and concluded that the requirements of the Atomic Energy Act, as amended, have been met and that the proposed export would not be inimical to the common defense and security of the United States.

The Executive Branch has reviewed the physical security measures that are applicable to the proposed export and concluded that physical security will be adequate. The consultations required under Section 133 of the Atomic Energy Act, as amended, have been completed.

It is the view of the Executive Branch that the requirements of Section 134 of the Atomic Energy Act, as amended, (also referred to as the Schumer amendment to the Energy Policy Act of 1992) for approval of HEU exports have been met for the proposed export. Section 134 adds the following conditions to approval of HEU exports:

*"a. The Commission may issue a license for the export of highly enriched uranium to be used as a fuel or target in a nuclear research or test reactor only if, in addition to any other requirement of this Act, the Commission determines that-*

*"(1) there is no alternative nuclear reactor fuel or target enriched in the isotope U-235 to a lesser percent than the proposed export, that can be used in that reactor;*

*"(2) the proposed recipient of that uranium has provided assurances that, whenever an alternative nuclear reactor fuel or target can be used in that reactor, it will use that alternative in lieu of highly enriched uranium; and*

*"(3) the United States Government is actively developing an alternative nuclear reactor fuel or target that can be used in that reactor.*

*"b. As used in this section--*

*"(1) the term 'alternative nuclear reactor fuel or target' means a nuclear reactor fuel or target which is enriched to less than 20 percent in the isotope U-235;*

*"(2) the term 'highly enriched uranium' means uranium enriched to 20 percent or more in the isotope U-235; and*

*"(3) a fuel or target 'can be used' in a nuclear research or test reactor if--*

*"(A) the fuel or target has been qualified by the Reduced Enrichment Research and Test Reactor Program of the Department of Energy; and*

*"(B) use of the fuel or target will permit the large majority of ongoing and planned experiments and isotope production to be conducted in the reactor without a large percentage increase in the total cost of operating the reactor."*

The Executive Branch believes that the three conditions of Section 134 are met based on the following:

(1). The European Commission has acknowledged that the HFR Petten can be converted from HEU to LEU fuel using existing qualified LEU fuels and has provided assurances that the reactor will be converted from HEU to LEU fuel as soon as a license has been granted by the Netherlands regulatory authorities and LEU fuel procured for the reactor. As detailed below, JRC has explained the steps required for conversion including obtaining the necessary license from the Netherlands regulatory authorities and procuring and testing the new LEU fuel. The European Commission has committed to pursue these steps in a timely manner and that in any case the reactor will not operate on HEU fuel after May 12, 2006.

(2) Enclosed are copies of diplomatic notes exchanged between the U.S. Mission to the European Union in Brussels and the European Commission confirming the foregoing with regard to conversion of the HFR Petten.

(3) Argonne National Laboratory has an active DOE-funded program underway which has developed a low-enriched uranium fuel which can be used in the HFR Petten.

With regard to Petitioner's comments and request for a public hearing on the application, the Executive Branch notes the following:

Petitioner describes itself as a nonprofit, educational corporation involved in advocating and publishing positions related to nuclear non-proliferation. However, it is the view of the Executive Branch that Petitioner has not demonstrated that it has standing in the consideration of the referenced license application or that its interests will be materially affected by the outcome of these proceedings. Moreover, the Executive Branch does not believe that Petitioner brings to these proceedings any essential or relevant expertise or other resources not currently available to the Commission.

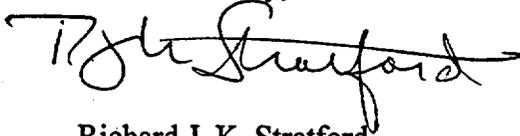
Petitioner cites the need for a hearing to ensure that all the provisions of the Schumer amendment are met by the proposed export. Petitioner has questioned the need for a four year supply of HEU to fuel the HFR until conversion to LEU can be completed. The Joint Research Centre at Petten (JRC) in its letter of May 3, 2000 responded to Petitioner's concerns. The JRC recalled that the European Commission in its diplomatic note on the conversion of the HFR, had provided assurances that the HFR will be converted from HEU to LEU fuel as soon as the Dutch regulatory authorities approve the conversion and LEU fuel is procured. The JRC stated that it will make every effort to complete the conversion as early as possible but recalled that it took more than 5 years for the University of Delft research reactor to obtain Dutch regulatory authority approval to start its LEU conversion.

Petitioner has also expressed concern that approval of the current export request might allow existing supplies of excess HEU at the JRC to be retransferred to another European Union reactor, such as the FMR-II in Germany. JRC addressed that concern in its letter of May 3, 2000 by pointing out that the HFR's existing HEU inventory is nearly exhausted and that the current export request is tailored to meet the reactor's ongoing needs on an annual basis. Regarding Petitioner's point that exact information on Petten's HEU inventory is needed, JRC had already provided detailed inventory information in support of its application.

In addition, JRC scientists delivered a paper (copy enclosed) on the status of the conversion working plan for the HFR at the research reactor meeting in France earlier this year. The report described recent completion of the Phase 1 Parametric Study in coordination with Argonne National Laboratory to determine how to accomplish conversion with minimal increase in fuel cycle costs and thermal flux penalties. The final report on the Phase 1 Study will be submitted to Dutch regulatory authorities for review. Following completion of that review and regulatory authority approval, the JRC will begin Phase 2 which involves a study of 9 different technical aspects of LEU fuel performance. Phase 2 is expected to be completed by mid-2001. Phase 3, which is expected to be concluded by early 2003, involves necessary updating of license reference documentation, including the safety analysis and environmental impact study. Actual conversion is scheduled to start in 2003.

In view of the foregoing, the Executive Branch recommends that the required determinations be made and that the requested license be issued.

Sincerely,



Richard J. K. Stratford  
Director  
Nuclear Energy Affairs

Enclosures: (1) Assurance letter  
(2) Diplomatic notes  
(3) JRC letter of May 3, 2000  
(4) JRC paper on the Status of the Conversion Working Plan



EUROPEAN COMMISSION

EURATOM SAFEGUARDS OFFICE  
Accounting and AuditingEURA-RESTRICTED

ESO-3 JB/jb-E/35/0521/2000

31. 3. 00

Annex I-b

**AGREEMENT FOR CO-OPERATION IN THE PEACEFUL USES OF NUCLEAR  
ENERGY BETWEEN EURATOM AND THE UNITED STATES OF AMERICA**

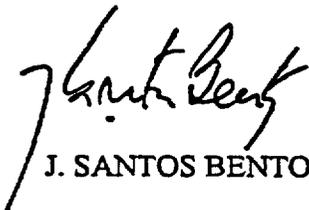
<b>To:</b> US Department of Energy NN-43, Room GA045 Washington, DC 20585-0440 Attention: Mr Rich Goorevich	<b>Fax n°:</b>  DOE: (1) 202 5861348
<b>From:</b> J. Santos Bento, Head of Unit Euratom, Luxembourg, ESO-3 <b>E-mail:</b> Jean.Binck@cec.eu.int (J. BINCK)	<b>Fax n°:</b>  +352 4301 33545

*ACKNOWLEDGMENT OF RECEIPT OF PRIOR NOTIFICATION*

Ref. : US DOE / NRC License XSNM02611 (revised)

In response to DOE prior notification dated March 21, 2000, related to NRC license No. XSNM02611 (Revised), the Commission confirms that *CERCA, Romans-sur-Isère, France and HFR, Petten, The Netherlands*, are legal persons duly authorized to receive nuclear material transferred pursuant to the Agreement.

The Commission confirms that the nuclear material related to this license will become subject to the Agreement upon receipt and further confirms that the exact quantity of nuclear material to be included in the inventory of nuclear material subject to the Agreement will be that established through exchange of information contained in Annex II and Annex III of the Administrative Arrangement relating to the above referred transfer.

  
 J. SANTOS BENTO

Copy: - ESA, Brussels, attn.: Ms Flingou (contract ref.: AGT/01/151)  
- US NRC, attn.: Mrs Betty WRIGHT (fax: + 1 301 415 23 95)

200 MAR 31 AM 6:24

RECEIVED OIP

No. 100.

The United States Mission to the European Union presents its compliments to the European Commission and has the honor to propose on behalf of the Government of the United States of America the following understandings with respect to the supply of fresh highly enriched uranium (HEU) fuel for the HFR research reactor at the Joint Research Centre at Petten, The Netherlands and the shipment of spent research reactor fuel from that reactor.

With respect to the supply of fresh HEU fuel, the Government of the United States of America understands that the HFR research reactor in Petten can be converted from HEU to low enriched uranium (LEU) fuel using existing qualified LEU fuels, and that the reactor will be converted from HEU fuel to LEU fuel as soon as the conversion has been licensed by regulatory authorities in The Netherlands and LEU fuel procured. The Government of the United States also understands that the conversion will involve an active collaboration between experts at the Joint Research Centre and the U.S. Department of Energy's National Laboratories, as well as other experts as appropriate, and that the European Commission will keep the Government of the United States informed of progress toward licensing and conversion.

By its acceptance of this note, the European Commission conveys to the Government of the United States its assurances that the HFR research reactor in Petten will be

converted from HEU to LEU fuel as soon as a license has been granted by the Dutch regulatory authorities and LEU fuel procured for the reactor, and that the HFR reactor in Petten will seek such license and fuel in a timely manner. The Government of the United States confirms that such assurances satisfy the provisions of the Atomic Energy Act, as amended, for the interim supply of fresh HEU for use as fuel for the HFR research reactor in Petten. On that basis, and in accordance with applicable laws and regulations of the United States of America, the Government of the United States is prepared to make its best efforts to make sufficient fresh HEU available to the European Commission in order to permit full operation of the HFR reactor in Petten until its conversion to LEU is completed. The Government of the United States recognizes that if it is unable to supply fresh HEU for the HFR reactor in Petten, the European Commission will have the option to use other HEU available to it to operate that reactor.

With respect to the acceptance of spent fuel from the HFR reactor in Petten, the Government of the United States understands that, barring unforeseen licensing difficulties beyond the control of the European Commission, the conversion of the HFR reactor in Petten will be completed by May 12, 2006 and that in any case the reactor will not operate on HEU after May 12, 2006. On the basis of this understanding, and in accordance with the laws and regulations of the United States, the Government of the United States of America is prepared in principle to accept, for storage and disposition in the United States, spent nuclear fuel assemblies from the HFR research reactor in Petten produced from uranium enriched in the United States. All HEU and LEU spent nuclear fuel generated at the HFR

reactor in Petten, and containing uranium enriched in the United States and meeting program eligibility requirements, will be accepted by the Government of the United States, subject to the proviso in the following paragraph, as long as the spent nuclear fuel is discharged from the reactor no later than May 12, 2006 and shipments to the United States are completed no later than May 12, 2009. LEU spent nuclear fuel will not be accepted until all HEU spent nuclear fuel has been accepted, unless the Government of the United States and the European Commission agree that extenuating circumstances related to foreign research reactor spent nuclear fuel acceptance program requirements have arisen to require otherwise.

The Government of the United States will make every reasonable effort to accept all eligible spent fuel from the HFR reactor in Petten by the program deadline of May 12, 2009. However, because of limited shipping capabilities, the Government of the United States may be unable to accept fuel eligible for shipment to the United States if too many facilities try to schedule their shipments too close to the program deadline. If at the end of the U.S. acceptance program, U.S. origin HEU remains in The Netherlands, the Government of the United States and the European Commission authorities will consult, concerning its disposition, options other than shipment to the United States.

The above assurances by the European Commission to convert the HFR research reactor in Petten to LEU fuel will cease to be effective if the Government of the United States is not in a position to supply HEU required to fuel the reactor until its full conversion to LEU, or to accept the physical delivery of spent nuclear fuel from the HFR reactor.

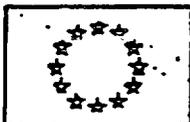
in Petten which satisfies program requirements specified in this note and contained in the Department of Energy record of decision for the environmental impact statement on a proposed nuclear weapons non-proliferation policy concerning foreign research reactor spent nuclear fuel issued on May 13, 1996.

The United States Mission to the European Union requests on behalf of the Government of the United States of America that the European Commission confirm that it shares these understandings.

The United States Mission to the European Union avails itself of this opportunity to renew to the European Commission the assurances of its highest consideration.



United States Mission to the European Union  
Brussels, January 3, 2000



## EUROPEAN COMMISSION

D(0) n° 41

The European Commission presents its compliments to The United States Mission to the European Union and has the honour to acknowledge receipt of its note of today's date which reads as follows:

"The United States Mission to the European Union presents its compliments to the European Commission and has the honor to propose on behalf of the Government of the United States of America the following understandings with respect to the supply of fresh highly enriched uranium (HEU) fuel for the HFR research reactor at the Joint Research Centre at Petten, The Netherlands and the shipment of spent research reactor fuel from that reactor.

With respect to the supply of fresh HEU fuel, the Government of the United States of America understands that the HFR research reactor in Petten can be converted from HEU to low enriched uranium (LEU) fuel using existing qualified LEU fuels, and that the reactor will be converted from HEU fuel to LEU fuel as soon as the conversion has been licensed by regulatory authorities in The Netherlands and LEU fuel procured. The Government of the United States also understands that the conversion will involve an active collaboration between experts at the Joint Research Centre and the U.S. Department of Energy's National Laboratories, as well as other experts as appropriate, and that the European Commission will keep the Government of the United States informed of progress toward licensing and conversion.

By its acceptance of this note, the European Commission conveys to the Government of the United States its assurances that the HFR research reactor in Petten will be converted from HEU to LEU fuel as soon as a license has been granted by the Dutch regulatory authorities and LEU fuel procured for the reactor, and that the HFR reactor in Petten will seek such license and fuel in a timely manner. The Government of the United States confirms that such assurances satisfy the provisions of the Atomic Energy Act, as amended, for the interim supply of fresh HEU for use as fuel for the HFR research reactor in Petten. On that basis, and in accordance with applicable laws and regulations of the United States of America, the Government of the United States is prepared to make its best efforts to make sufficient fresh HEU available to the European Commission in order to permit full operation of the HFR reactor in Petten until its conversion to LEU is completed. The Government of the United States recognises that if it is unable to supply fresh HEU for the HFR reactor in Petten, the European Commission will have the option to use other HEU available to it to operate that reactor.

With respect to the acceptance of spent fuel from the HFR reactor in Petten, the Government of the United States understands that, barring unforeseen licensing difficulties beyond the control of the European Commission, the conversion of the HFR reactor in Petten will be completed by May 12, 2006 and that in any case the reactor will not operate on HEU after May 12, 2006. On the basis of this understanding, and in accordance with the laws and regulations of the United

States, the Government of the United States of America is prepared in principle to accept, for storage and disposition in the United States, spent nuclear fuel assemblies from the HFR research reactor in Petten produced from uranium enriched in the United States. All HEU and LEU spent nuclear fuel generated at the HFR reactor in Petten, and containing uranium enriched in the United States and meeting program eligibility requirements, will be accepted by the Government of the United States, subject to the proviso in the following paragraph, as long as the spent nuclear fuel is discharged from the reactor no later than May 12, 2006 and shipments to the United States are completed no later than May 12, 2009. LEU spent nuclear fuel will not be accepted until all HEU spent nuclear fuel has been accepted, unless the Government of the United States and the European Commission agree that extenuating circumstances related to foreign research reactor spent nuclear fuel acceptance program requirements have arisen to require otherwise.

The Government of the United States will make every reasonable effort to accept all eligible spent fuel from the HFR reactor in Petten by the program deadline of May 12, 2009. However, because of limited shipping capabilities, the Government of the United States may be unable to accept fuel eligible for shipment to the United States if too many facilities try to schedule their shipments too close to the program deadline. If at the end of the U.S. acceptance program, U.S. origin HEU remains in The Netherlands, the Government of the United States and the European Commission authorities will consult, concerning its disposition, options other than shipment to the United States.

The above assurances by the European Commission to convert the HFR research reactor in Petten to LEU fuel will cease to be effective if the Government of the United States is not in a position to supply HEU required to fuel the reactor until its full conversion to LEU, or to accept the physical delivery of spent nuclear fuel from the HFR reactor in Petten which satisfies program requirements specified in this note and contained in the Department of Energy record of decision for the environmental impact statement on a proposed nuclear weapons non-proliferation policy concerning foreign research reactor spent nuclear fuel issued on May 13, 1996.

The United States Mission to the European Union requests on behalf of the Government of the United States of America that the European Commission confirm that it shares these understandings."

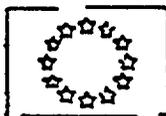
The European Commission has the honour to confirm that it shares the understandings of this note and requests you kindly to transmit this confirmation to your Government.

The European Commission avails itself of this opportunity to renew to The United States Mission to the European Union the assurances of its highest consideration.



*For the Commission of the European Communities*  
*Herbert J. Allgeier*  
*Director General of the Joint Research Centre*  
*Brussels, 10 January 2000*

*Copy to: Janice Dunn Le  
R. Hauber  
M. Peterson  
Grace Kim*



**EUROPEAN COMMISSION**  
 DIRECTORATE GENERAL JRC  
 JOINT RESEARCH CENTRE  
 Institute for Advanced Materials  
 HFR Unit

Petten, May 4, 2000  
 HFR/AG/0005.04.01

**To: The Office of General Council**  
 US Nuclear Regulatory Commission  
 Attn: Ms. Karen Cyr  
 Fax: 00 1 301 415 3200

Office of the Secretary  
 US Nuclear Regulatory Commission  
 Attn: Mr. Emile Julian  
 Fax: 00 1 301 415 1672

The Executive Secretary  
 US Department of State  
 Attn: Ms. Kristie Kenney  
 Fax: 00 1 202 647 5620

**Cc: Transnuclear, Inc.**  
 Attn: Mr. John Mangusi  
 Fax: 00 1 914 347 5170

**Subject: NCI intervention**

Please find attached a letter with annex concerning the above mentioned subject. The original letter will be sent by express mail.

J. Guidez  
 Head of HFR Unit

**Pages: Cover + 8**

Post-it® Fax Note	7671	Date	5/4/00	# of pages	9
To	Ms. Betty Wright	From	J. McLaughlin		
Co/Dept	US NRC	Co.	TNY		
Phone #		Phone #	914/347-5064		
Fax #	18	Fax #	5170		

*Betty - Enclosed for your information*

*Re:  
 XSNM02611  
 HELL for Petten*



**EUROPEAN COMMISSION**  
DIRECTORATE GENERAL JRC  
JOINT RESEARCH CENTRE  
Institute for Advanced Materials  
HFR Unit



Petten, May 3, 2000  
HFR/AG/0005.03.01

To : The Office of General Council  
US Nuclear Regulatory Commission

Office of the Secretary  
US Nuclear Regulatory Commission

The Executive Secretary  
US Department of State

Cc : Transnuclear, Inc.

Subject : NCI intervention concerning HEU export license for Petten

On April 6, 2000 the Nuclear Control Institute (NCI) submitted an amendment to a petition for leave to intervene and request for hearing in the matter of Transnuclear, Inc., License No. XSNM 02611, concerning export of highly enriched uranium (HEU) to the High Flux Reactor (HFR) of the Joint Research Centre (JRC) at Petten in the Netherlands.

In that amended petition NCI does not oppose the export of HEU to the Petten reactor, but it raises questions with regard to the following issues :

- compliance with the Schumer Amendment to the Atomic Energy Act
- the conversion period
- any HEU excess

Our response concerning these issues is as follows.

**1. Compliance with the Schumer Amendment to the Atomic Energy Act**

In January 2000 the Government of the United States and the European Commission (to whom the JRC belongs) signed and exchanged diplomatic notes concerning conversion of the HFR to low enriched uranium (LEU), supply of fresh HEU for the HFR and acceptance of spent fuel from the HFR. In these diplomatic notes (see Annex) the European Commission conveyed its assurances that the HFR will be converted from HEU to LEU fuel as soon as a license has been granted by the Dutch regulatory authorities and LEU fuel has been procured. The Government of the United States on the other hand confirmed that such assurances satisfy the provisions of the Atomic Energy Act, as amended, for the interim supply of fresh HEU for use as fuel for the HFR. On that basis the Government of the United States would be prepared to make its best effort to make sufficient fresh HEU available to the European Commission in order to permit full operation of the HFR at Petten until its conversion to LEU is completed.

**2. The conversion period**

In the diplomatic notes mentioned above it is stated that the Government of the United States understands that, barring unforeseen licensing difficulties beyond the control of the European Commission, the conversion of the HFR at Petten will be completed by May 12, 2006.

Of course the JRC will make its best efforts to complete the conversion as early as possible. However the actual conversion can only start when a license has been granted by the Dutch regulatory authorities and LEU fuel has been procured. In this connection it is to be mentioned that it took more than 5 years before the research reactor of the University of Delft in the Netherlands obtained a license needed to start LEU conversion of that reactor.

On the basis of that experience and the amount of work to be done the European Commission applied, through Transnuclear, Inc., for a United States export license for 4 years supply of HEU anticipating that this is needed to continue operation of the HFR until its conversion to LEU is completed.

**3. Any HEU excess**

In the check list added to the export license application information is given concerning the inventory of HEU belonging to the HFR, the date when that inventory will be expended and consequently the date when the requested new fuel will be needed. From that information it is clear that the new fuel is urgently needed, and that this new fuel will not free up any HEU for possible retransfer to another reactor. The quantity for which an export license has been applied is just sufficient to cover the requirements of the HFR and there will be no room for any significant excess HEU to be acquired. Furthermore the HEU will not be ordered at one go, but yearly and progress on the conversion studies will be reported in the annual RERTR meetings (see also RERTR 1998 and 1999).

If any further information is needed, please do not hesitate to contact us.

Yours sincerely,



J. Guidez  
Head of HFR Unit

Annex : Copy of diplomatic notes

No. 100.

The United States Mission to the European Union presents its compliments to the European Commission and has the honor to propose on behalf of the Government of the United States of America the following understandings with respect to the supply of fresh highly enriched uranium (HEU) fuel for the HFR research reactor at the Joint Research Centre at Petten, The Netherlands and the shipment of spent research reactor fuel from that reactor.

With respect to the supply of fresh HEU fuel, the Government of the United States of America understands that the HFR research reactor in Petten can be converted from HEU to low enriched uranium (LEU) fuel using existing qualified LEU fuels, and that the reactor will be converted from HEU fuel to LEU fuel as soon as the conversion has been licensed by regulatory authorities in The Netherlands and LEU fuel procured. The Government of the United States also understands that the conversion will involve an active collaboration between experts at the Joint Research Centre and the U.S. Department of Energy's National Laboratories, as well as other experts as appropriate, and that the European Commission will keep the Government of the United States informed of progress toward licensing and conversion.

By its acceptance of this note, the European Commission conveys to the Government of the United States its assurances that the HFR research reactor in Petten will be

converted from HEU to LEU fuel as soon as a license has been granted by the Dutch regulatory authorities and LEU fuel procured for the reactor, and that the HFR reactor in Petten will seek such license and fuel in a timely manner. The Government of the United States confirms that such assurances satisfy the provisions of the Atomic Energy Act, as amended, for the interim supply of fresh HEU for use as fuel for the HFR research reactor in Petten. On that basis, and in accordance with applicable laws and regulations of the United States of America, the Government of the United States is prepared to make its best efforts to make sufficient fresh HEU available to the European Commission in order to permit full operation of the HFR reactor in Petten until its conversion to LEU is completed. The Government of the United States recognizes that if it is unable to supply fresh HEU for the HFR reactor in Petten, the European Commission will have the option to use other HEU available to it to operate that reactor.

With respect to the acceptance of spent fuel from the HFR reactor in Petten, the Government of the United States understands that, barring unforeseen licensing difficulties beyond the control of the European Commission, the conversion of the HFR reactor in Petten will be completed by May 12, 2006 and that in any case the reactor will not operate on HEU after May 12, 2006. On the basis of this understanding, and in accordance with the laws and regulations of the United States, the Government of the United States of America is prepared in principle to accept, for storage and disposition in the United States, spent nuclear fuel assemblies from the HFR research reactor in Petten produced from uranium enriched in the United States. All HEU and LEU spent nuclear fuel generated at the HFR

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The Government of the United States will make every reasonable effort to accept all eligible spent fuel from the HFR reactor in Petten by the program deadline of May 12, 2009. However, because of limited shipping capabilities, the Government of the United States may be unable to accept fuel eligible for shipment to the United States if too many facilities try to schedule their shipments too close to the program deadline. If at the end of the U.S. acceptance program, U.S. origin HEU remains in The Netherlands, the Government of the United States and the European Commission authorities will consult, concerning its disposition, options other than shipment to the United States.

The above assurances by the European Commission to convert the HFR research reactor in Petten to LEU fuel will cease to be effective if the Government of the United States is not in a position to supply HEU required to fuel the reactor until its full conversion to LEU, or to accept the physical delivery of spent nuclear fuel from the HFR reactor

in Petten, which satisfies program requirements specified in this note and contained in the Department of Energy record of decision for the environmental impact statement on a proposed nuclear weapons non-proliferation policy concerning foreign research reactor spent nuclear fuel issued on May 13, 1996.

The United States Mission to the European Union requests on behalf of the Government of the United States of America that the European Commission confirm that it shares these understandings.

The United States Mission to the European Union avails itself of this opportunity to renew to the European Commission the assurances of its highest consideration.



United States Mission to the European Union  
Brussels, January 3, 2000



D(0) n° 41

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"The United States Mission to the European Union presents its compliments to the European Commission and has the honor to propose on behalf of the Government of the United States of America the following understandings with respect to the supply of fresh highly enriched uranium (HEU) fuel for the HFR research reactor at the Joint Research Centre at Petten, The Netherlands and the shipment of spent research reactor fuel from that reactor.

With respect to the supply of fresh HEU fuel, the Government of the United States of America understands that the HFR research reactor in Petten can be converted from HEU to low enriched uranium (LEU) fuel using existing qualified LEU fuels, and that the reactor will be converted from HEU fuel to LEU fuel as soon as the conversion has been licensed by regulatory authorities in The Netherlands and LEU fuel procured. The Government of the United States also understands that the conversion will involve an active collaboration between experts at the Joint Research Centre and the U.S. Department of Energy's National Laboratories, as well as other experts as appropriate, and that the European Commission will keep the Government of the United States informed of progress toward licensing and conversion.

By its acceptance of this note, the European Commission conveys to the Government of the United States its assurances that the HFR research reactor in Petten will be converted from HEU to LEU fuel as soon as a license has been granted by the Dutch regulatory authorities and LEU fuel procured for the reactor, and that the HFR reactor in Petten will seek such license and fuel in a timely manner. The Government of the United States confirms that such assurances satisfy the provisions of the Atomic Energy Act, as amended, for the interim supply of fresh HEU for use as fuel for the HFR research reactor in Petten. On that basis, and in accordance with applicable laws and regulations of the United States of America, the Government of the United States is prepared to make its best efforts to make sufficient fresh HEU available to the European Commission in order to permit full operation of the HFR reactor in Petten until its conversion to LEU is completed. The Government of the United States recognises that if it is unable to supply fresh HEU for the HFR reactor in Petten, the European Commission will have the option to use other HEU available to it to operate that reactor.

With respect to the acceptance of spent fuel from the HFR reactor in Petten, the Government of the United States understands that, barring unforeseen licensing difficulties beyond the control of the European Commission, the conversion of the HFR reactor in Petten will be completed by May 12, 2006 and that in any case the reactor will not operate on HEU after May 12, 2006. On the basis of this understanding, and in accordance with the laws and regulations of the United

States, the Government of the United States of America is prepared in principle to accept, for storage and disposition in the United States, spent nuclear fuel assemblies from the HFR research reactor in Petten produced from uranium enriched in the United States. All HEU and LEU spent nuclear fuel generated at the HFR reactor in Petten, and containing uranium enriched in the United States and meeting program eligibility requirements, will be accepted by the Government of the United States, subject to the proviso in the following paragraph, as long as the spent nuclear fuel is discharged from the reactor no later than May 12, 2006 and shipments to the United States are completed no later than May 12, 2009. LEU spent nuclear fuel will not be accepted until all HEU spent nuclear fuel has been accepted, unless the Government of the United States and the European Commission agree that extenuating circumstances related to foreign research reactor spent nuclear fuel acceptance program requirements have arisen to require otherwise.

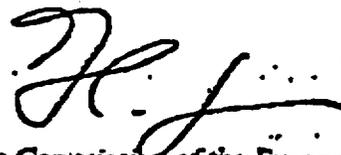
The Government of the United States will make every reasonable effort to accept all eligible spent fuel from the HFR reactor in Petten by the program deadline of May 12, 2009. However, because of limited shipping capabilities, the Government of the United States may be unable to accept fuel eligible for shipment to the United States if too many facilities try to schedule their shipments too close to the program deadline. If at the end of the U.S. acceptance program, U.S. origin HEU remains in The Netherlands, the Government of the United States and the European Commission authorities will consult, concerning its disposition, options other than shipment to the United States.

The above assurances by the European Commission to convert the HFR research reactor in Petten to LEU fuel will cease to be effective if the Government of the United States is not in a position to supply HEU required to fuel the reactor until its full conversion to LEU, or to accept the physical delivery of spent nuclear fuel from the HFR reactor in Petten which satisfies program requirements specified in this note and contained in the Department of Energy record of decision for the environmental impact statement on a proposed nuclear weapons non-proliferation policy concerning foreign research reactor spent nuclear fuel issued on May 13, 1996.

The United States Mission to the European Union requests on behalf of the Government of the United States of America that the European Commission confirm that it shares these understandings."

The European Commission has the honour to confirm that it shares the understandings of this note and requests you kindly to transmit this confirmation to your Government.

The European Commission avails itself of this opportunity to renew to The United States Mission to the European Union the assurances of its highest consideration.



*For the Commission of the European Communities*  
*Herbert J. Allgeier*  
*Director General of the Joint Research Centre*  
*Brussels, 10 January 2000*

# STATUS OF THE CONVERSION WORKING PLAN IN THE HIGH FLUX REACTOR (PETTEN, THE NETHERLANDS)

J.A. HENDRIKS, P.J.M. THIJSSSEN, F.J. WIJTSMA

*Nuclear Research and consultancy Group (NRG)  
P.O. Box 25, 1755 ZG Petten, the Netherlands*

*paper presented at  
RRFM Meeting in  
Colmar, France  
March 19-21, 2000*

and

A. GEVERS, J. GUIDEZ

*Joint Research Centre (JRC)  
P.O. Box 2, 1755 ZG Petten, the Netherlands*

## ABSTRACT

The conversion from HEU to LEU has often many disadvantages: flux penalties, increase of fuel consumption, cost and delay to obtain a new license, etc. But to fulfill the non-proliferation programme, and to simplify the future fuel supply, the HFR renewed in 1998 studies on conversion possibilities.

To minimise the conversion costs, these studies were made with a progressive conversion that avoids the need of one new core and permits to begin the conversion with a replacement of 5 elements at each cycle. Hence the conversion can be made in 7 cycles, without special elements and with a normal burn-up for each element. To avoid an increase of fuel consumption, an increase of the fuel cycle length from 24.7 to 28.3 days was also considered. This point allows to reduce the number of annual cycles from 11 to 10 and enables in one cycle to have the possibility of four successive irradiations for Molybdenum production (7 days) in one irradiation position.

A working plan for fuel licensing has been sent to the safety authorities and is presented in the paper.

## 1. Introduction

The High Flux Reactor (HFR) Petten, the Netherlands, belonging to the Institute of Advanced Materials of the Joint Research Centre (JRC) of the European Commission is one of the most powerful multipurpose materials testing reactors in the world.

JRC as owner of the HFR and license holder is responsible for all supplementary programme work. Reactor operation, maintenance and commercial exploitation are subcontracted to the Nuclear Research and consultancy Group (NRG) being a daughter company of the Netherlands Energy Research Foundation (ECN) and KEMA, the Netherlands.

## 2. General

The HFR is a pool-in-tank type, light water cooled and moderated Research Reactor (RR), operated at a nominal power of 45 MW. In operation since 1962 and following a complete refurbishment in recent years, the HFR has a technical lifetime beyond the year 2015.

The reactor provides a variety of irradiation positions [1]: in the reactor core, in the reflector region and in the poolside. Horizontal beam tubes are available for fundamental and medical research. This research is performed in close co-operation with the Interfaculty Research Institute of the Delft (NL) University. Excellently equipped hot-cell laboratories on the NRG-site together with additional nuclear facilities such as a Low Flux Reactor and a Decontamination and waste treatment facility, have led to the unique HFR structure in which NRG and JRC are co-operating with the aim to adopt a

more market oriented approach and to offer their long standing and recognised competence to the medical, industrial and scientific world.

With at least 275 full power days per year and safe, reliable and predictable operation following the annual programme, the HFR is the major radioisotope supplier in Europe. Roughly 60% of the treatments/diagnoses within Europe make use of the variety of radioisotopes produced at the HFR leading to approximately 7 million treatments in Europe per year.

The present operation schedule consists of 11 cycles of 28 days (24.7 days of full power and 3.3 days of maintenance, core reloading and check-out procedures) and 2 maintenance stops of about 4 weeks. The yearly operational programme is followed as closely as possible to offer the customers a predictable time table for experimental and isotope production planning.

### 3. Back-ground

#### 3.1 Historical review

At the first criticality in 1961 the reactor was started with a „US-fuel cycle“ as many other RR. HEU was provided by the USA and the spent fuel returned by more or less well established shipments. Life seemed to be easy at that time.

Although the HFR staff has been actively involved in the RERTR-programme since the beginning of the research towards a LEU fuel cycle, it was decided not to convert to this LEU fuel in the eighties for a number of reasons:

- Quality of fuel: the use of LEU fuel for reactors which have been designed to operate with HEU has disadvantages with respect to neutronic performance, Pu-production and reprocessing.
- Costs of conversion; the conversion process costs a lot of time and money while the outcome was not always beneficial for the performance of the reactor in terms of thermal flux.
- Political reasons; the beginning of the period of conversion was rather strange. While all converted European reactors had to pay the penalties (loss of flux, money and time) the US authorities stopped the return of foreign spent fuel to the USA. Furthermore very few US based reactors were scheduled to convert at this time, effectively giving them a commercial advantage.
- Independence; the US policy was not discussed with parties involved but more or less imposed.

In conclusion the decision was taken to use the HEU fuel available in Europe, to continue operation without conversion of the reactor and to participate in the central organisation for radioactive waste in the Netherlands, in order to take care of the back-end of the fuel cycle.

#### 3.2 HFR fuel cycle

Compared to the eighties, the current situation with respect to the fuel cycle has changed significantly:

- fresh uranium supply: it has become more and more difficult to purchase HEU fuel. Although Russian HEU fuel has become available on the market, due to the difficult formal procedures, this does not provide a reliable option for the future of the HFR.
- spent fuel return/storage: with the renewal of the US spent fuel return policy a positive sign was given to the RR community. Although the return option is limited in time and has financial constraints it provides a solution for the urgent spent fuel problems at the HFR.
- delay in construction of HABOG facility; temporary storage of spent fuel in MTR-2 containers is necessary, which is subject to political discussions.

Taking into account the need to assure the HFR fuel cycle as well as the public and political opinion being strongly in favour of conversion the decision was made by the European Commission to reconsider the possibility to convert the HFR.

Immediately after this decision a project was started for the conversion consisting of 3 phases, i.e.:

- phase 1: parametric study to define the optimum LEU-element
- phase 2: technical qualification of the conversion
- phase 3: review and update of license reference study

This three phase approach was submitted to the Dutch competent Authorities and consent was granted.

#### 4. Phase 1: Parametric study

##### 4.1 Introduction

Already at the start of the RERTR program the first studies were performed on the possible conversion of the HFR [2]. More recently a new contract was given to AEA Technology (Winfrith, UK) to investigate possible HFR conversion based on both  $U_3Si_2$  and the newly developed UMo-fuel. Although this latter fuel is not yet qualified and is part of the recent RERTR-development, it looks promising for non-converted reactors. This AEA study confirmed results of earlier studies [3], [4]. Following political discussions and the approval by the US-DOE of the diplomatic notes on HFR conversion, HEU supply and spent fuel policy, a cooperation between Argonne National Laboratory and Petten site was established determine the optimum LEU fuel design based on  $U_3Si_2$  fuel.

Objectives of the HFR conversion studies are:

- minimal changes of fuel cycle cost (back-end/front-end);
- minimal penalties on thermal flux (in-core and PSF);
- short planning and implementation program.

##### 4.2 Boundary conditions

The cooperation between ANL and NRG/JRC resulted in narrowing the scope of work performed by AEA Technology with the following boundary conditions:

- progressive core conversion: for economic reasons a progressive core conversion will be applied;
- geometry of fuel element: due to progressive core conversion the pressure drop of HEU and LEU element should be the same;
- type of fuel: fuel meat will be composed of  $U_3Si_2$  - Al with a max. density of  $4.8 \text{ g.cm}^{-3}$ ;
- coolant gaps: coolant gaps in fuel element and fuel section of control rod must be the same for thermal hydraulic reasons;
- limited flux penalties for scientific and commercial application;
- increase length of cycle to reduce fuel consumption.

##### 4.3 Results

Based on the boundary conditions given in §4.2 a limited number of parameters remains to achieve the most economic core conversion i.e.

- length of cycle: by increasing the cycle length from 24.7 days to 28.3 days the number of cycles per year will be reduced thus leading to improved fuel cycle economics. Furthermore an optimum planning for specific commercial isotope irradiations can be achieved;
- number of plates per element: the number of plates per element and coolant gaps are directly linked. For thermal reasons the number of plates should be as high as possible;
- meat/cladding thickness: by defining the coolant gaps and the number of plates the thickness is immediately fixed. Minor changes can be achieved by slight variations of meat and cladding thickness;
- type and amount of burnable poison: burnable poison is used to compensate for excess reactivity and to manage the control rod movement in the course of a cycle. Based on HFR experience Boron and Cadmium are suitable burnable poisons to be incorporated in the side plates.
- density of  $U_3Si_2$  is  $4.8 \text{ g.cm}^{-3}$

The combined efforts of the nuclear specialists from ANL and NRG have led to the following optimum design of the LEU fuel element resp. LEU fuel follower of the control rod:

• type of fuel/density	U <sub>3</sub> Si <sub>2</sub> - Al
• number of fuel plates (FE/CR)	20/17
• meat thickness	0.76 mm
• cladding thickness	0.38/0.57 mm
• coolant gaps	2.46 mm
• type of burnable poison	Cd-wires
• amount of burnable poison	40 x 600 x Ø 0.5 mm

## 5. Phase 2 Technical qualification

After completion of phase 1, which is scheduled for the end of March 2000, the final report on the parametric studies will be submitted to the Dutch competent licensing Authorities. Immediately after their consent is obtained phase 2 will be formally started. During this phase 9 different technical aspects will be studied to cover all technical questions related to this new fuel. These points can be classified as:

- design drawings, ordering and hydraulic measurements of 2 industrial prototype elements;
- in-pile testing of 2 industrial prototype elements to prove industrial manufacturing practice;
- bibliographic review of U<sub>3</sub>Si<sub>2</sub> fuel behaviour;
- thermal hydraulic calculations to verify DNB resp. BDC safety limits;
- continued neutronic calculations during the foreseen progressive core conversion;
- influences on HFR utilisation for both industrial and scientific applications (safety criteria and shift of spectrum);
- consequences on the fuel cycle (front and back end);
- mechanical criteria such as loading of lower grid plate, handling tools and control rod drop time;
- consequences on accident/incident calculations (change in source term, core transient behaviour).

All aspects will be covered in parallel as far as technical feasible and should finally result in the complete knowledge of all technical aspects of the conversion. The results of phase 2 will become available by mid 2001.

## 6. Phase 3: License reference study

The conversion study will lead to a large amount of paper work such as the update of the HFR's license reference documentation:

- description of the plant
- safety analysis report
- technical specification
- environmental impact study

The necessary work to complete phase 3 starting mid 2001 will be fully integrated in the HFR Safety Reevaluation. Actual conversion is scheduled to start in 2003.

## 7. Conclusions

On bases of the results achieved so far it can be concluded that:

- the design of the optimum LEU fuel element is nearing completion; only some minor technical details need to be finished;
- preliminary results indicate that conversion of the HFR is technical feasible with limited consequences with respect to thermal flux;
- as soon as the design is fixed, 2 prototype elements will be ordered at CERCA and tested in the reactor;

- cost of the LEU fuel cycle could be decreased with respect to front end and back end costs by increasing the cycle length to 28.3 days;
- with an increased cycle length the strength of the HFR as Europe's major irradiation facility will not be jeopardised;
- with the conversion of the HFR a significant reduction of the world wide annual HEU consumption will be achieved;
- the exchange of Diplomatic Notes also allows the return of spent fuel to DOE Savannah River.

## 8. Acknowledgements

The authors would like to express their appreciation to the staff of Argonne National Laboratory for their support and cooperation during phase 1 of the conversion project.

## 9. References

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October 03-08, 1999.

UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION

In the Matter of )  
 )  
TRANSNUCLEAR, INC. )  
 )  
(Export of 93.45% Enriched Uranium )  
for the HFR/Petten Reactor in )  
The Netherlands) )

Docket No. 11004440

CERTIFICATE OF SERVICE

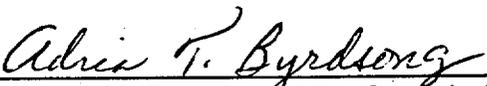
I hereby certify that copies of the foregoing LETTER FROM RICHARD J. K. STRATFORD TO JANICE DUNN LEE DATED 06/02/00 have been served upon the following persons by U.S. mail, first class, or through NRC internal distribution.

Trip B. Rothschild, Esq.  
Office of the General Counsel  
Mail Stop - O-15 D21  
U.S. Nuclear Regulatory Commission  
Washington, DC 20555

Eldon V.C. Greenberg, Esq.  
Galloway & Greenberg  
1835 K Street, NW, Suite 801  
Washington, DC 20006

Executive Secretary  
U.S. Department of State  
Washington, DC 20520

Mathew George  
Traffic Coordinator  
Transnuclear, Inc.  
Four Skyline Drive  
Hawthorne, NY 10532-2176

  
Office of the Secretary of the Commission

Dated at Rockville, Maryland,  
this 7<sup>th</sup> day of June 2000