PDR

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

MAR 23 1988

Mr. Carlton E. Thorne, Director
Office of Nuclear Export and Import Control
Bureau of Oceans and International
Environmental and Scientific Affairs
U.S. Department of State
Washington, D.C. 20520

Dear Mr. Thorne:

Enclosed please find a request from the Department of Energy to export plutonium and neptunium to EURATOM for the purpose of U.S.-EURATOM collaborative research.

Before taking action on this request, we would appreciate your views, in accordance with established procedures and from the overall perspective of the Executive Branch, as to whether the proposed export meets the applicable criteria in the Atomic Energy Act of 1954 as amended by the Nuclear Nonproliferation Act of 1978.

Sincerely,

Marvin R. Peterson, Assistant Director
for International Security
Office of Governmental and Public
Affairs

Enclosure:
Appl. dtd 3/14/88
(XSNM02377 - EURATOM)

cc w/enclosure:
T. Hart, DOE
G. Bray, ADCA
G. Oplinger, DOD
N. Martin, DOE
R. DeLaBarre, DOS

NRC FORM 7
(12-81)
10 CFR 110

U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB
3150-0027
EXPIRES 12-31-87

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

1. APPLICANT'S USE →	a. DATE OF APPLICATION	b. APPLICANT'S REFERENCE	2. NRC USE →	a. DOCKET NO.	b. LICENSE NO.
	March 14, 1988			11004043	XSNM02377

3. APPLICANT'S NAME AND ADDRESS	RIS	4. SUPPLIER'S NAME AND ADDRESS *(Complete if applicant is not supplier of material)*	RIS
a. NAME: Theodore A. Hart		a. NAME	
b. STREET ADDRESS: U.S. Department of Energy		b. STREET ADDRESS	
c. CITY: Washington; STATE: DC; ZIP CODE: 20585		c. CITY; STATE; ZIP CODE	
d. TELEPHONE NUMBER *(Area Code – Number – Extension)*: 202/586-6185			

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)*
May 1988	May 1990	N/A	May 1990	

10. ULTIMATE CONSIGNEE	RIS	11. ULTIMATE END USE *(Include plant or facility name)*	
a. NAME: Various laboratories within the		See Attachment	
b. STREET ADDRESS: Euratom Community			
c. CITY – STATE – COUNTRY		11a. EST. DATE OF FIRST USE	
12. INTERMEDIATE CONSIGNEE	RIS	13. INTERMEDIATE END USE	
a. NAME: European Institute for Transuranium		See Attachment	
b. STREET ADDRESS: Elements			
c. CITY – STATE – COUNTRY: Karlsruhe, Federal Republic of Germany		13a. EST. DATE OF FIRST USE	
14. INTERMEDIATE CONSIGNEE	RIS	15. INTERMEDIATE END USE	
a. NAME			
b. STREET ADDRESS			
c. CITY – STATE – COUNTRY		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
	Plutonium-239	200			grams
	Neptunium-237	200			grams

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

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

See attachment-material to be returned to U.S. after completion of experiments

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	b. TITLE
	P. F. Barker, Director	Office of Nuclear Nonproliferation Policy

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USG DOE

MEMORANDUM

Date: March 4, 1988

Reply: DP-332.2

Subject: Plutonium & Neptunium Loan

To: Distribution

Two weeks ago we discussed a proposal for DOE to loan about 200 grams each of Pu and Np to scientists in Germany so that we could conduct collaborative research with them. The DOE laboratories are LLNL and LANL, with the former being most heavily involved.

Attached is an updated version of the draft proposal. If other people need to see it in order for the loan to take place, please provide them with a copy. I will be out of the country for the next two months, approximately, and unable to do any further coordination on this. The principal investigator for LLNL is Dr. Carlos Colmenares. He is a member of the Chemistry and Materials Science Department and may be reached at FTS: 532-6352. 415-537-7102 local

R G Hickman

R. G. Hickman
LLNL/ISA/DOE

Distribution:

Don Emon	DP-342
Al Evans	DP-225
Ted Hart	IE-13
Nataly Martin	DP-332
C. Colmenares	LLNL L-357
V.A. Mode	LLNL L-353

DRAFT 1142V 3/02/88

I. Proposed Protocol for the Rapid Exchange of Radioactive Samples Between U.S. National Laboratories and The Joint Research Centers of the Commission of the European Communities

II. Specific Proposal to Ship $\alpha^{239}Pu$ and ^{237}Np from the Lawrence Livermore National Laboratory (LLNL) to the European Institute for Transuranium Elements (EITE).

July 24, 1987

Summary

We are proposing that the USDOE and other governmental agencies concerned develop a general protocol to allow for an easy and fast exchange of radioactive samples (accountable material) between US National Laboratories and The Joint Research Centers of the Commission of the European Communities. The role of the laboratories and the mechanism for sample exchange and accountability is defined, as well as the review of proposals for scientific content.

We are also proposing the transfer of ~200g each of α-Pu and Np, under the aegis of the new protocols, from LLNL to EITE. The scientific projects to utilize these elements are also defined.

1. Introduction

Past collaboration between DOE laboratories and the The Joint Research Centers of the Commission of the European Communities, notably with the European Institute for Transuranium Elements (EITE), Karlsruhe, FRG, has been very productive, but has been hindered by the lack of well defined protocols for communication and accountable material (Pu, Np, Am, etc.) sample exchange. We are proposing in this document the creation of these protocols in general, and presenting a specific proposal involving the EITE, the Lawrence Livermore National Laboratory (LLNL), and Los Alamos National Laboratory (LANL).

2. Background

There has been a long history of collaboration between the Department of Energy and the The Joint Research Centers of the Commission of the European Communities. Most of the activity has been with the Transuranium Institute in Karlsruhe, West Germany, and somewhat less with the Ispra Establishment (Italy); the latter mostly in terms of visits by DOE scientists on sabbaticals, etc.

A somewhat different cooperation has existed for many years between the excellent Standards Laboratory at Geel, Belgium, and the National Bureau of Standards.

Historically, cooperation began in earnest in the early 60's, when scientists from Los Alamos helped in the design and construction phases of the Karlsruhe Institute, which is modelled after the CMR building in Los Alamos. In 1968, W. M. Olson of Los Alamos spent a sabbatical year in Karlsruhe,

working on the high temperature properties of mixed oxide (U + Pu/Ox) fuels. J. W. Ward from Los Alamos determined the vapor pressures and thermodynamic properties of both americium and curium metals in 1972-73, work which led in later years to a more fundamental understanding of the electronic structure and bonding of actinide metals.

Over the years there have been many exchanges in the area of properties of nuclear fuels, information and visits going in both directions. An important contributor has been Jules Rotbort from Argonne National Laboratory, but other scientists from this laboratory have also been involved.

Research samples have been exchanged on a regular basis. Protactinium metal samples from Karlsruhe were studied at Los Alamos, resulting in good values for low-temperature heat capacity, superconductivity, and the metal vapor pressure. Ward returned to Karlsruhe in 1981-82 to characterize the unique properties of the Pa + H system, followed the next year by J. Haschke from Rockwell International, Rocky Flats Plant, who continued this work in terms of the thermodynamics of this system. In 1985 about 90g of double electro-refined Np metal was sent to Karlsruhe, resulting in a whole series of new measurements. Ward returned to perform a definitive study of the Np + H system, J. Naegele of Karlsruhe and L. Cox of Los Alamos have collaborated on XPS*(Los Alamos) and UPS*(Karlsruhe) surface studies on this metal, using the special sensitivities of the instruments at the two laboratories to best advantage. Finally, a number of high quality single crystal Np compounds and

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* XPS = X-ray photoelectron spectroscopy

UPS = Ultra violet photoelectron spectroscopy

intermetallics were made at Karlsruhe by J. C. Spirlet; it should be noted that Spirlet's preparation laboratory has gained a world-wide reputation. These samples have been shared with other laboratories and universities, for special studies.

Another long-term collaboration should also be mentioned, that of physical chemical studies on transplutonium elements and compounds. This work has been supported by the Department of Energy Basic Energy Sciences Group, and has involved R. G. Haire and J. E. Peterson of ORNL, as well as Baybarz of ORNL and J. Ward of Los Alamos, in the earlier years.

Recently C. Colmenares of LLNL has collaborated with J. Naegele (Karlsruhe) in a whole series of interesting surface science studies on actinide compounds, particularly in identifying chemisorptive and catalytic properties of some of these systems. Also ongoing in this area are joint studies (Cox/Naegele) on pure delta-Pu samples.

The point to be made is that these various collaborations have resulted, over the years, in extensive new data and an extension of the understanding of actinide metal, alloy and compound properties, using to best advantage the expertise of scientists and the special instrumental facilities unique to both sides of the Atlantic. However, the exchange of samples has been difficult because an adequate protocol has not been established to facilitate the process.

3. Proposed Protocol for Communication and Sample Exchange

There is a need to establish a procedure, involving DOE and other governmental agencies, to expedite the transfer of radioactive accountable materials (i.e., actinide elements and compounds) between US National

Laboratories and The Joint Research Centers of the Commission of the European Communities or vice versa. The advantages to the parties involved and DOE derives from bringing together resources and experts in various fields, either in a US or The Joint Research Centers of the Commission of the European Communities facility to carry out research in the physico-chemical sciences that may not otherwise be carried out, or, from the transfer of a unique technology among laboratories. The overall intent of the program is to encourage experimental programs that will lead to collaborative publications. Thus, we propose that DOE should establish the required protocols to implement the rapid exchange of information or of accountable samples between US National laboratories and The Joint Research Centers of the Commission of the European Communities. To facilitate this process the parties involved propose the following administrative, technical, and material accountability measures:

1) Formation of an administrative committee from the laboratories involved whose function is to authorize and control the transfer of accountable material. There will be one member and an alternate from each laboratory involved.

2) Formation of a technical steering committee composed of a senior scientist and an alternate from each laboratory involved. This committee will screen and approve technical exchanges, identify the materials required, and request their transfer. This committee will submit a short document to DOE identifying the project, its merits, availability of accountable material and its source,and request the necessary transfers.

3) In each laboratory, the members of the technical and administrative committees will be responsible to maintain accountability of any

material transferred to a laboratory on loan and to summarize in writing the disposition of the material on a yearly basis, both to the loaning institution and the USDOE. At the completion of a project, a complete accountability of material, detailing losses, will be provided. All other material remaining will be shipped back to the loaning institute.

4) Compounds and single crystals produced at a laboratory from material obtained on loan will be made available to the two parties involved and to other members on a first-come first-serve basis. The members of the technical committee will keep other members informed via a semi-annual newsletter.

5) Accountable materials will be loaned at no charge and the borrowing party will incur all transportation costs.

6) The borrowing institution will acknowledge in all publications the loaning laboratory.

7) The maximum amount of any single accountable material transferable under this protocol is 400 grams at one time.

8) Accountable material on loan to The Joint Research Centers of the Commission of the European Communities from US National Laboratories will not be transferred or loaned in any shape or form to the Soviet Union or their satellite countries, India, Pakistan, and Israel without the explicit written consent of the USDOE.

9) Loans will be for four years and renewable at the end of each term.

4. Safeguards

The main repository for the transfer of radioactive material is the European Institute for Transuranium Elements, a Joint Research Center of the Commission of the European Communities located within the Kernforschung Zentrum (German Government Laboratory) in Karlsruke, FRG. The latter is inside a completeley fenced site with restricted access and patrolled by armed personnel. The Transuranium Institute is inside the Kernforschung Zentrum and isolated by a double fence with concertina wire on top; a corridor with sensors separates the two fences. Armed guards with police dogs patrol the perimeter. Access to the Institute requires a valid permit to enter the Kernsforschung, which is exchanged by a badge valid only at the Institute. This badge and a right hand-scanner validate the access to the facility.

Accounting of all radioactive material at the Transurnaium Institue is kept by a German Government protocal based on the International Atomic Energy Agency (IAEA) document INF-CIRC-225 Rev. 1, entitled "Physical Protection of Nuclear Materials (June 1977).

The Transurnaium Institute will serve as the distribution center for small samples (a few grams) going to other Institutions. Most preparative work to produce actinide compounds will also be carried out at this site.

5. Specific Proposal Involving FITE, LLNL, and LANL

A. Proposal

To ship to EITE ~200g each of high purity α-^{239}Pu and ^{237}Np from LLNL to be used in scientific experiments involving LLNL and LANL personnel utilizing the unique facilities of EITE. These experiments will be described below. The Np and Pu available at EITE are very impure (particularly high in

oxygen content), which makes them unsuitable for certain experiments. Furthermore, their purification is not economically attractive.

Discussions have also been held between LLNL and EITE personnel on the possibility of loaning some ^{242}Pu-metal to the latter if available. This isotope is much less active than ^{239}Pu and has the great advantage that its self-heating is negligible. Pu-242 is preferred for low temperature experiments (photoemission studies or resistivity measurements) or for thermal neutron experiments, in which the large fission cross section in ^{239}Pu is a serious handicap.

B. Administrative Committee

EITE: Director of the Establishment, Dr. J. Van Geel

Alternate: Head of Personnel and Administration Division, Mr. P. Blaes

LLNL: Associate Directors for Chemistry and Defense Systems, Drs. C. Gatrousis and G. Miller, respectively

Alternate: Leader of the Condensed Matter and Analytical Sciences Division Head, Dr. M. Fluss.

LANL: Program Manager for Nuclear Materials, Dr. P. T. Cunningham

Alternate: Program Manager for Plutonium Recovery, Dr. D. R. Harber

Technical Steering Committee

EITE: Head of Chemistry Division, Prof. J. Fuger

Alternate: G. Lander, Group Leader

LLNL: Dr. C. Colmenares, Surface and Interface Science Group

Alternate: To be named at a later date

LANL: Dr. J. Ward, Surface Properties of Actinides, MST Division

Alternate: Dr. L. Cox, " " " " " "

C. Short Term Projects

The short term projects involving EITE, LLNL, and LANL are:

(a) Studies of the reactivity of U, Pu, Np, and their intermetallics and alloys with Fe, Ni, Co, etc. with gases such as CO, CO_2, O_2, H_2, H_2O, and some hydrocarbons. A high resolution Ultraviolet and X-Ray Photoelectron Spectrometer (UPS and XPS, respectively) equipped to handle highly radioactive samples has been used in the measurements. This collaboration involves C. Colmenares (LLNL), who spent three months at EITE (Sept.-Dec. 1986), and J. Naegele and T. Gouder (EITE). LLNL does not currently have facilities in UPS and XPS to handle highly radioactive samples.

(b) Studies of the electronic structure of plutonium and its alloys using UPS. This collaboration involves Larry Cox (LANL) and J. Naegele (EITE). Experiments are now in progress using a small plutonium sample shipped from LANL to EITE.

(c) Study of grain-boundary impurities in gallium-stabilized δ-Pu using the electron microscope facilities at EITE. This project has not yet been initiated and will involve P. H. Adler (LLNL), I. Ray, H. Blank, and J. C. Spirlet from EITE.

D. Longer Term Projects

These projects would make use of the unique facilities at EITE, such as:

Single Crystal Production Capabilities

These include mineralization, Czochralski, zone refining equipment, and cutting and orientation facilities installed in glove boxes to handle radioactive materials. Examples of crystals that

have been grown are NpC, NpAs, PuS, PuAs, PuSb, and intermetallics such as $PuFe_2$, $NpCo_2$ etc. A large number of experiments with other European collaborators have been carried out with these materials, such as:

- Magnetization studies (Zürich),
- Mössbauer spectroscopy (Munich and Strassbourg),
- Neutron scattering (Grenoble and Riso, Denmark),
- High pressure x-ray diffraction (Hamburg),
- X-ray absorption spectroscopy (Berlin),
- Resistivity (Grenoble and Amsterdam), and
- Specific heat (Harwell, UK).

In all cases samples were encapsulated at EITE before shipment to the collaborating laboratory and then returned to EITE after the experiments.

LLNL is particularly interested in the transfer of single crystal production-technology for radioactive materials and in the synthesis of superconductor material containing actinide elements.