

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

1. APPLICANT'S USE USE		2. NRC USE		3. APPLICANT'S REFERENCE RIS		4. LICENSE NO. XSNMO 1602		5. DOCKET NO. 11000860	
3. APPLICANT'S NAME AND ADDRESS a. NAME United States Department of Energy		4. SUPPLIER'S NAME AND ADDRESS a. NAME Oak Ridge National Laboratory		b. DOCKET NO. RIS		b. STREET ADDRESS P.O. Box X		c. CITY Oak Ridge	
c. STREET ADDRESS 1000 Independence Ave., S.W.		c. CITY Washington		STATE D.C.		ZIP CODE 20585		STATE TN	
c. CITY Washington		STATE D.C.		ZIP CODE 20585		c. CITY Oak Ridge		STATE TN	
d. TELEPHONE NUMBER (Area Code - Number - Extension) 202-252-6183 D. Shiller		c. CITY Oak Ridge		STATE TN		ZIP CODE 37830		c. CITY Oak Ridge	
5. FIRST SHIPMENT SCHEDULED December, 1979		6. FINAL SHIPMENT SCHEDULED December, 1980		7. APPLICANT'S CONTRACTUAL DELIVERY DATE To be negotiated		8. PROPOSED LICENSE EXPIRATION DATE December, 1980		9. U.S. DEPARTMENT OF ENERGY CONTRACT NO. (If Known) To be determined	
10. ULTIMATE CONSIGNEE a. NAME Atomic Energy of Canada, Limited		b. STREET ADDRESS		c. CITY - STATE - COUNTRY Chalk River, Ontario, Canada K0J1J0		11. ULTIMATE END USE (Include plant or facility name) Characterizing physics behaviour of proliferation-resistant thorium/uranium U-233 fuel cycles in converter reactors in the ZED-2 reactor, Chalk River Nuclear Laboratories.		11a. EST. DATE OF FIRST USE December, 1979	
12. INTERMEDIATE CONSIGNEE a. NAME None		b. STREET ADDRESS		c. CITY - STATE - COUNTRY		13. INTERMEDIATE END USE		13a. EST. DATE OF FIRST USE	
14. INTERMEDIATE CONSIGNEE a. NAME		b. STREET ADDRESS		c. CITY - STATE - COUNTRY		15. INTERMEDIATE END USE		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.	
16. NRC USE		17. DESCRIPTION Uranium 233, containing approximately 7 ppm U-232, in the form of fabricated fuel elements for critical experiments.		18. MAX. ELEMENT WEIGHT 22 kgs		19. MAX. WT. % 97.8% U-233		20. MAX. ISOTOPE WT. 21.516	
21. UNIT kgs		22. COUNTRY OF ORIGIN - SOURCE MATERIAL U.S.A.		23. COUNTRY OF ORIGIN - SNM WHERE ENRICHED OR PRODUCED U.S.A.		24. COUNTRIES WHICH ATTACH SAFEGUARDS (If Known) Not applicable		25. ADDITIONAL INFORMATION (Use separate sheet if necessary) Attachments - Memorandum - R.E. Ferguson to Director, Nuclear Affairs, approved 4/10/79 - Letter, Bengelsdorf to Critoph, AEC, 7/25/79	
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 <i>Harold Bengelsdorf</i>		b. TITLE Director for Nuclear Affairs		7911200		285	

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EXPORT/IMPORT AND INTERNATIONAL SERVICE

MEMORANDUM

DATE: *April 10, 1979*

REPLY TO:
ATTN OF: ET-78

SUBJECT: ACTION: Cooperative DOE-AECL Experiments with Uranium-233

1979 OCT 12 PM 11 03

TO: Director, Nuclear Affairs, IA-40

EXPORT/IMPORT
AND
INTERNATIONAL AGREES

ISSUE:

Action is requested to arrange temporary use of uranium-233 belonging to U. S. DOE for Atomic Energy of Canada, Limited (AECL) critical experiments at Chalk River Laboratories, Canada.

BACKGROUND:

U. S. DOE and Canadian AECL require technical data characterizing physics behavior of proliferation-resistant thorium/uranium-233 fuel cycles in converter reactors. The purpose of this action is to arrange use of DOE-owned U-233 for experiments in the AECL ZED-2 critical facility which correspond to these needs.

High purity U-233 in the amount of about 22 kilograms containing less than 10 parts per million U-232 contamination is necessary to conduct the experiments. Material that is 97.8% pure and contains about 7 ppm U-232 meets these requirements and is available in the U. S. under materials project number PAG0401030. Other near-term uses for it have not been identified.

The term of this arrangement is to be 30 months. The series of experiments will require 20 to 24 months, and 6 months are allowed for fuel fabrication and shipment.

The low level irradiation of the U-233 in the course of use by AECL is not to result in significant depletion of U-233, nor in an increase in U-232 contamination of more than 7 parts per million.

The technical results of the AECL research will be substantial and relevant to the programmatic interests of the U. S. General value references are (a) the cost of performing equivalent work in the U. S. and (b) the level of U. S. effort in areas benefitted by the research.

The work will include measurement in ZED-2 of fuel conversion ratios, detector responses, fast fission ratios, and reactivity-related factors ("buckling") for a range of fuel lattice substitutions corresponding to advanced, moderated reactors. The variables within the range of measurements include lattice spacing, fuel mix ratios corresponding to fuel burnup, temperature, amount of reactivity

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1361 050

poisoning, and composition of coolant. The estimated time for one case (measurements at one pitch, one temperature, one level of poison, and one coolant) is four weeks, and all the measurements are expected to require about 20-24 months (the remainder of the 30-month term of AECL use is allowed for fuel preparation, fabrication, shipment and return). Operating costs for an equivalent program in the U. S. would be more than \$1 million if appropriate facilities and staff could be identified. In addition, scheduling facilities, fuel conversion and fabrication, and staff reassignment and qualification would increase this figure substantially.

Worldwide studies of technical and other means for controlling the weapons proliferation potential attending useful civil applications of nuclear power have been intensified at U. S. behest. The Canadian proposal to do these collaborative experiments is a positive response to this encouragement. Much of the DOE participation in these broad nonproliferation studies is as analyses of alternate and proliferation resistant fuel cycles. The AECL experiments will support the parts of this work related to advanced converters because it will no longer be based entirely on calculations which are subject to uncertainties in point nuclear data for fuel isotopes and in approximations used in the calculational methods. Near-term domestic effort in these fuel cycle studies will total tens of millions of dollars. If these studies should lead later to actual design work, the cost of all work benefitted by the AECL experiments would become greater.

The recommended financial basis for this arrangement briefly is that AECL is to fund all costs directly connected with this use of the U-233, and that the U. S. is to waive use charges on the U-233 material in view of expected benefits to the DOE assessments of proliferation resistant fuel cycles.

The expenses to be met by AECL include:

- those of performing the experiments in ZED-2 (greater than \$1 million)
- costs of removing U-232 daughters from the U-233 if required
- costs of chemically converting the uranium to the form needed by AECL (up to about \$200,000 by Manual Chapter Appendix 1701, Part IV, B.6)
- the cost of fabricating the U-233 for the experiments (estimate \$200,000-700,000 depending on need for a new fabrication setup)
- all charges resulting from handling shipment to Canada and return shipment to the U. S.

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1361 051

An implied cost of the U. S. waiver of use charges of about \$530,000 can be estimated from appropriate manual chapter and Federal Register entries:

- . A sales price of U-233 at less than 10 parts per million U-233 is about \$82 per gram (28 F.R. 5314 and Manual Chapter Appendix 1701, Part IV, A.6.). Use charges for special nuclear material are 12% of the price basis per year (Federal Register, Vol. 42, No. 189, p 51636). Using the sales price as the price basis, the use charge is approximated as $\$82 \times 22000 \times .978 \times .12 \times 2.5$, or about \$530,000.

It is noted that this waiver

- . is consistent with Manual Chapter Appendix 1701, Part II, O., 1.,
- . has an implied cost which is much smaller than either total AECL costs or the U. S. funding of related proliferation resistant fuel cycle studies, and
- . only implies a cost figure as no actual outlay is involved. The U-233 already exists and there are no alternative uses for it during the term of this collaboration.

Adverse nuclear proliferation implications will not be a result of this action. The major AECL objective is to explore the technical basis for thorium cycles in CANDU reactors which meet nonproliferation goals consistent with results of the International Fuel Cycle Evaluation. More immediately, the entire 22 kg lot of U-233 material is to be returned to the U. S. when the AECL research is complete. The return can be accurately inventoried as the material is not to be subjected to significant dilution or depletion in the course of its use by AECL, and arrangements for the material to be inspected while in use in Canada are possible. Finally, CANDU operations with natural uranium since 1968 have produced thousands of kilograms of fissile material. Thus, the presence of 22 kg of U-233 will not constitute a significant change in availability of fissile material in Canada.

Other communications concerning this arrangement are:

1. Campbell to Thorne, November 3, 1977
2. Bengelsdorf to Campbell, February 6, 1978
3. Campbell to Bengelsdorf, February 15, 1978
4. Critoph to Shiller, March 14, 1978

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1361 052

- 5. Hemmig draft, Canadian Request for Scientific Use of 22 kgs U-233, April 25, 1978
- 6. Critoph to Shiller, July 28, 1978

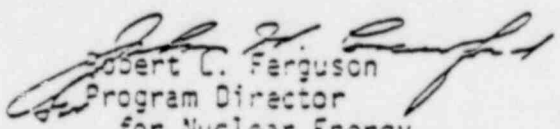
RECOMMENDATION:

see Critoph

We recommend that IA implement an arrangement with AECL for research use of U. S.-owned U-233 in the Canadian ZED-2 facility as discussed above.

NEXT STEP:

IA should establish and carry out actions for negotiating a U. S. DOE/ AECL agreement enabling this AECL use of U-233. These actions should provide coordination of contacts between U. S. laboratory and AECL staffs concerning U-233 decontamination, conversion, and U-233 fabrication for research usage, costs of these steps, and scheduling of delivery. RRT staff can give technical support to IA as required.


 Robert L. Ferguson
 Program Director
 for Nuclear Energy

APPROVED: *H. B. ...*
 DISAPPROVED: _____
 DATE: 4/10/77

This will be subject to "subsequent agreement" procedure under the Nuclear Non-Proliferation Act of 1978.

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July 25, 1979

1979 OCT 12 PM 1 03

EXPORT CONTROL 1979
AND
INTERNATIONAL SAFEGUARDS

Mr. E. Critoph, Director
Advanced Projects and Reactor
Physics Division
Chalk River Nuclear Laboratories
Atomic Energy of Canada Limited
Chalk River, Ontario
Canada, K0J 1J10

Dear Mr. Critoph:

We are pleased to advise you that DOE is agreeable in principle to use by AECL of about 22 kgs of DOE-owned U-233 for experiments in the AECL ZED-2 critical facility without any use charge. We will need a meeting to discuss in greater detail the proposed experiments and possible terms and conditions to ensure that the loan of this U-233 meets U.S. non-proliferation objectives. We understand that AECL will pay all costs connected with this use of the U-233 and furnish the results to DOE.

We are proceeding to:

- (1) Draft a loan agreement which will be furnished to you for review and comment. (This agreement will be a "subsequent arrangement" under the Nuclear Non-Proliferation Act of 1978 (NNPA) and will have to be processed under the appropriate procedures.)
- (2) Initiate a request to the Nuclear Regulatory Commission for an export license. This will trigger the necessary review steps under the NNPA. In view of the amount of U-233 involved, this matter will be submitted by the Executive Branch to President Carter for his approval.

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In the meantime, you should start discussions directly with Oak Ridge concerning conversion and fabrication. Your contact at the Oak Ridge National Laboratory (ORNL) will be Mr. R. E. Brooksbank (Area Code 615, 574-6927) with Mr. J. R. Farrott, Jr. as his alternate.

If you have any comments, suggestions, or questions concerning the above, please pass them on to Mr. Shiller. Also, I suggest that you call Mr. Shiller (Area Code 202, 252-6183) with respect to setting up a meeting in Washington as mentioned in the first paragraph above.

Sincerely,

for ^{*RWD*}
Harold D. Bengelsdorf
Director for Nuclear Affairs
International Nuclear and
Technical Programs

- bcc: H. Handyside, DAS/WTP
- H. Bengelsdorf, DIR/ONA ←
- M. McDonough, ONA
- P. Brush, OGC
- J. Lewellen, ET-884
- R. Brooksbank, ORNL
- M. Moss, ER
- D. Cooper, DOS
- F. Buckholz, ACDA

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