July 24, 1978 SECY-78-403

SECRET

Document No. SECY/78-7
This document consists of 52 pages. No. 35 of 39 copies
Series A.

COMMISSIONER ACTION

For: The Commissioners

From: James R. Shea, Director
Office of International Programs

Thru: Executive Director for Operations

Subject: PROPOSED LICENSES TO EXPORT HIGH ENRICHED URANIUM TO THE REPUBLIC OF KOREA (APPLICATION XSNM-1173 AND XSNM-1207)

Discussion: Background

In July 1977, General Atomic filed application XSNM-1173 for a license to export 2.3 kilograms of uranium enriched to 70%, and 5.3 grams of U-235 contained in 5.7 grams enriched to 90%, to the Republic of Korea (ROK). A second application, XSNM-1207, for the export to the ROK of 15.6 kilograms of uranium enriched to 70% U-235, was received in October, 1977. All of the material covered by these two licenses would be used in the KORR-2 research reactor at the Korea Atomic Energy Research Institute (KAERI), a 2 MWt TRIGA reactor which was supplied by the U.S. to Korea under license XR-73 (5/11/70).

The two applications are being submitted for the Commission's consideration because together they constitute a single reload of the reactor, and because the same issues and considerations are involved for each.

This reactor was initially fueled with standard 20% enriched material. General Atomic subsequently

Contact:
G.G. Oplinger (492-7866)
J.G. Dunn (492-7984)

SECRET

Classified by G. G. Oplinger, IP (Name / Title)

U.S. NRC Declassification Review

1ST REVIEW – DATE: 20230620	DETERMINATION (CIRCLE NUMBER(S))
REVIEWER: 3470	1. CLASSIFICATION RETAINED
AUTHORITY: DC DD	2. CLASSIFICATION CHANGED TO:
2ND REVIEW – DATE: 20241216	3. CONTAINS RD/FRD CLASSIFIED INFO
REVIEWER: 3591	4. COORDINATE WITH: DOE, DOD
AUTHORITY: DD	5. DECLASSIFIED 20060106
	6. CLASSIFIED INFO BRACKETED
	7. OTHER (SPECIFY):

developed 70% enriched TRIGA fuel elements (known as FLIP elements), which permit operation of the reactor at a higher power level and a higher duty cycle, with much less frequent refueling and consequent significant savings in fuel cycle and spent fuel storage costs. Korea undertook an upgrading program to replac the 20% core of the KORR-2 reactor gradually with 70% FLIP elements, in order to take advantage of these savings. The U.S. provided about 6 kilograms of 70% material in the period from 1975 to 1977 for this upgrading program. The fuel elements requested in application XSNM-1173 were originally ordered to carry out the next stage of the upgrade.

Beginning in March 1977, the KORR-2 began to experienc severe fuel failures, and by February 1978 the number of damaged fuel elements had risen to 33, including 19 FLIP elements installed in the reactor and 14 standard 20% elements. In November 1977 General Atomic shipped 15 additional FLIP elements. These were later install and the reactor was operated for a short time at very low power, until further failures of the older elements forced a complete shutdown. These 15 irradiated elements are believed to be undamaged.

Following the shutdown of the reactor, General Atomic recommended immediate conversion of the entire core to 70% fuel, and application XSNM-1207 was submitted to supplement application XSNM-1173 and to complete the core.

The cause of the fuel failures is believed to be a faulty cooling water purification system, which has now been corrected.

Issues

The central issue raised by these applications is wheth the provision of the relatively large amounts of high (70%) enriched material involved meets the general test of non-inimicality, given the particular circumstances which surround this case. Of paramount relevance to th issue are the following considerations:

-- Korea is requesting further U.S. assistance in upgrading the reactor to 70% enriched fuel at a time when recent U.S. policy has attempted to reduce enrichment levels whenever technically and economically feasible.

-- Refusal to extend such assistance would probably mean that the reactor, which has been shut down since January 1978, could not resume operation for another year because of the unavailability of 20% fuel.

-- More broadly, and of central importance, there have been significant proliferation concerns regarding the Republic of Korea in the recent past. Consideration should be given to the probable effect of approving or denying these licenses on future Korean attitudes and activities in this area.

Executive Branch Views

In its memoranda of March 23 and May 9 (Appendix B), the Executive Branch notes that:

1. KORR-2 is Korea's principal nuclear research facility and provides radioisotopes for medical applications throughout Korea.

2. In accordance with current U.S. policy to encourage the use of lower-enriched uranium whenever technically and economically feasible, this reactor desigr and its proposed use were examined in detail by Argonne National Laboratory, which concluded that, while it would be technically feasible to operate the reactor on 20% enriched fuel, operation on 70% fuel is expected to be on the order of three times less costly than operation on standard, low-density, 20% fuel. Argonne therefore concurs in General Atomic's recommendation that the core be repaced with 70% fuel.

3. If the reactor were required to use a full or partia 20% core loading, it would be forced to remain inoperable for at least a year, since General Atomic does not have any standard 20% enriched fuel availab

and its current schedule of fuel deliveries to other customers would not permit it to start fabrication of such fuel for at least nine months.

4. The Executive Branch has also noted that the quantity of HEU involved in this license, together with that under XSNM-1207 and the current total of in-country unirradiated HEU, would be below 15 effective kilograms of U-235, "below the threshold of proliferation concern."

5. Few, if any, of the fuel assemblies now in the reactor could be used for operation at any but the lowest power levels. In any event, because of the gross failure of the core, it is practically impossible to isolate individual assemblies to determine the extent of their damage.

6. In the view of the Executive Branch, the export criteria of Section 127 of the Atomic Energy Act are met, and the proposed export will not be inimical to the common defense and security. The Executive Branch recommends prompt approval of these applications.

Staff Observations

Although the Executive Branch submission does not include any general information concerning the reactor and its end-use, the staff has determined that the KORR-2 is one of two research reactors operated by the Korean Atomic Energy Institute (KAERI). The reactors are used for research in neutron physics and nuclear structure, irradiation experiments, isotope production and training of reactor operators. Although the KORR-2 reactor is designed for a 2 MW thermal output, it has a pulsing capability up to 2,000 MW and is modified by the Institute members to meet the various research requirements and the requirements for the production of relatively high-level isotopes.

General Atomic has also informed us that the other research reactor, a TRIGA Mark II, is not suitable for producing the type and quantity of isotopes needed in Korea and has been relegated to primarily training applications. When operating, the KORR-2 is expected to be utilized at least two work shifts a day in the production of

isotopes. Many short-lived isotopes, such as Silver 198 colloid, Iodine 131 and Technetium 99m are produce for speedy supply to domestic end-users. These isotop contribute to research and development in the diagnosi and treatment of cancer patients and in agriculture, engineering and basic sciences and because of their sh half-life, cannot be practically imported from abroad. Also produced are other industrial radiation sources, such as Iridium 192 and Cobalt 60 which had previously been entirely imported.

The staff further notes that the Executive Branch submission does not include any technical or programma justification for moving to the higher power levels or higher duty cycle available with the use of 70% FLIP fuel. In response to our inquiries on this point, Executive Branch personnel stated that the only appare motivation for the KORR-2 upgrading program is to achieve the substantial fuel cycle economies of 70% operation. While the staff does not consider that exceptions to current U.S. HEU policy would necessaril be warranted solely on fuel cycle cost considerations, it gives important weight to the fact that the upgradi program, and the contracts for purchasing 70% fuel, we undertaken before the current U.S. policy was adopted, and at a time when the use of HEU to achieve such economies was widely accepted. By the time the U.S. adopted its current more restrictive policy, these contracts had been signed and the FLIP fuel fabricated and paid for.

An improved high-density 20% fuel (involving a higher ratio of uranium to zirconium in the fuel meat) is being developed by General Atomic in response to recen U.S. policies to reduce the use of highly enriched uranium. The staff has investigated the possibility of fueling the KORR-2 reactor with this new fuel. While General Atomic anticipates that the improved 20% fuel may be commercially available within 6 months to one year, Argonne National Laboratory personnel believ that further testing and analysis would be required before a reduction to 20% can be assured. Additional time could well be required to obtain regulatory approval for operation with the new fuel. In sum, it does not appear that the use of high-density LEU would avoid a substantial delay in restarting the reactor.

The possibility of substituting some of this new fuel for the 70% material requested in XSNM-1173 and XSNM-1207 has been the subject of recent diplomatic exchanges between the US and the ROK (see cables at Appendix F). General Atomic has indicated that it would agree to substitute 6 high density LEU elements for 6 of the HEU elements on order, if Korea agrees, and provided that the U.S. Government will compensate General Atomic for any additional costs and any additional uranium. The ROK appears willing to cooperate in a joint program to test and demonstrate a limited number of the new rods, which it would purchase, in some of the blank fuel channels available in KORR-2. It does not, however, wish to see refueling of the reactor delayed, and does not wish to substitute the unproven new fuel for the 70% elements covered by these applications. Preliminary reactions of Executiv Branch personnel to the GA substitution proposal are negative because of the financial compensation condition, although they are actively negotiating specific arrangements for the demonstration program with new fuel rods noted above. On balance, the staff does not favor pursuing the GA substitution proposal, since it does not substantially reduce the amount of HEU desired, and could jeopardize Korea's willingness to cooperate in a voluntary joint program to demonstrate the new fuel.

Based upon its independent analysis (Attachment A), the staff has concluded that the ROK currently meets the specific criteria of Section 127 of the NNPA.

The Inimicality Issue

The Commission will recall the circumstances surroundir the successful efforts of the United States to prevent the sale of a French-supplied pilot reprocessing plant to Korea in 1976. The staff has investigated currently available information concerning current South Korean nuclear activities and intentions. A recent CIA study, "South Korea: Nuclear Developments and Strategic Decision Making" (RP 78-10250) examines this question i depth. Copies of this study have been made available t the Commissioners.

While the staff does not believe it likely that the material covered by this application could be easily diverted to non-peaceful uses, nevertheless it considers that a finding of non-inimicality would not be justified if there were evidence giving rise to significant doubts about Korea's current intentions. On the basis of the recent CIA study and other inform tion available to it, the staff does not find such evidence, and therefore concludes that the export of the material covered by these applications meets the test of non-inimicality. It recalls, moreover, that following Korea's agreement to cancel the reprocessin project, the U.S. agreed to participate in a Joint Standing Committee on Nuclear and Other Energy Technology, under which U.S. assistance to Korea in these areas was expanded, in part as a compensatory gesture for the cancellation. The staff considers that continued support for legitimate ROK nuclear activities is an important element in avoiding renewed Korean interest in activities of proliferation concern

In view of the importance of this questions, the staff has made arrangements for a classified briefing on July 27 on the current South Korean nuclear program, s that Commissioners may ask any additional questions on the subject.

Physical Security

The Executive Branch has concluded that the US has assurance that the ROK is committed to providing adequate physical security for its nuclear program, including a level of protection compatible with that envisioned by the recommendations in IAEA INFCIRC/225 (State letter at Attachment E).

While the staff considers that the physical security program in the ROK is adequate to protect the material covered under the proposed license, the written assurance [required by 10 CFR 110.43(a)], relating to physical protection has not been obtained from the Government of the ROK. (The Commission will recall that a proposed exemption from this requirement was discussed in SECY 78-291 for license applications received prior to May 19, 1978. As Commissioner Bradford requested, we will forward separately a detail statement of how the physical security elements outline in NRC's regulations are fulfilled in this case.)

Recommendation: That (1) the Commission approve the issuance of an exemption from that portion of 10 CFR 110.43(a) which requires written assurances from the recipient country with respect to physical security, (2) the proposed licenses be issued to General Atomic Company, (3) the Commission, in approving the licenses, express its expectation that future reloads for the KORR-2 (not anticipated for at least 4 years) will be confined to an enrichment level of 20%, whether of standard or high-density type.

Coordination: ELD believes that no staff recommendations should be made since information disclosed at the July 27, 1978 briefing may affect the recommendation and decision. NMSS wishes to inform the Commission that it has not received country-specific information which permits it to make an independent conclusion as to the effectiveness of IAEA material control and accounting safeguards to deter and detect diversion in the ROK. With respect to physical security, NMSS has reviewed the program in the ROK and found it adequate for the purposes of the export.

James R. Shea, Director
Office of International Programs

Attachments:
1. Attachment A - Staff review and conclusions dtd 6/22/78 and 6/23/78
2. Attachment B - Executive Branch views dtd 3/23/78 and 5/9/78
3. Attachment C - Application of 7/19/77 (XSNM-1173) and application dtd 9/30/77 (XSNM-1207)
4. Attachment D - Copies of proposed licenses
5. Attachment E - State ltr dtd 3/23/78
6. Attachment F - Cable exchange between US and ROK (LOU)

Commissioners' comments should be provided directly to the Office of the Secretary by c.o.b. Friday, August 4, 1978.

Commission Staff Office comments, if any should be submitted to the Commissioners NLT July 31, 1978, with an information copy to the Office of the Secretary. If the paper is of such a nature that it requires addi time for analytical review and comment, the Commissioners and the Secretariat should be apprised of when comments may be expected.

DISTRIBUTION:
Commissioners
Commission Staff Offices
Exec. Dir. for Opers.
Secretariat

ATTACHMENT A

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

JUN 22 1978

Memorandum to the File

PROPOSED LICENSE TO EXPORT HIGH-ENRICHED URANIUM TO THE REPUBLIC OF KOREA (APPLICATION XSNM-1173)

In July 1977, General Atomic filed an application for a license to export 2.3 kilograms U-235 contained in 3.28 kilograms uranium enriched to 70%, and 5.3 grams U-235 contained in 5.7 grams uranium enriched to 93% to the Republic of Korea (ROK).

The 70% enriched material (in the form of 13 flip-type fuel elements, 2 instrumented flip fuel elements, and 2 flip fueled follower control rods and the 93% enriched material in the form of 3 TRIGA fission chambers) will be used in the KORR-2 research reactor at the Korea Atomic Energy Research Institute (KAERI).

The KORR-2 is a 2 MWt TRIGA Mark III pool-type reactor which provides radioisotopes for hospitals throughout the ROK. As noted in the Executive Branch analysis of the proposed export, this reactor (1) has operated at a greatly reduced power level since March 1977 due to damage to the cladding of numerous fuel elements in the core, and (2) has been shut down since January 197 . The fuel elements being requested in this export license application are required to run the reactor.

In response to our August 1, 1977 request for views, the Executive Branch has (1) concluded that issuance of the proposed license would not be inimical to the interests of the US, including the common defense and security; and (2) confirmed that the material will be subject to all the terms and conditions of the Agreement for Cooperation between the US and the ROK.

These views and license application analyses by the Executive Branch were forwarded by the State Department analyses of March 23 and May 9, 1978.

Confirmation of the applicability of the US-ROK Agreement for Cooperation was also set forth in the letter of September 2, 1977 from the Atomic Energy Bureau-Ministry of Science and Technology of the ROK.

Memorandum to the File

In its May 9 memorandum, the Executive Branch noted that, in accordance with current US policy to encourage use of lower-enriched uranium whenever technically and economically feasible, the KORR-II reactor design and its proposed use were examined in detail by Argonne National Laboratory. Their conclusion was that, while it would technically feasible for the reactor to be operated on LEU (20% U-235), it would be three times more costly than operating on 70% enriched fuel.

Moreover, if the KORR-II was required to use a full or partial 20% U-235 core loading, it would remain inoperable for at least a year due to the unavailability of such fuel. While 20% fuel is being developed by General Atomic, they expect that an additional year of development work will be required before it becomes commercially available.

Due to the extensive damage of most of the fuel assemblies in the reactor and the gross failure of the core, General Atomic has recommended replacement of most of the core and Argonne concurs in this view.

The staff has reviewed the subject application in light of the considerations below:

- o Safeguards. The ROK is a party to the NPT and IAEA safeguards pursuant to that treaty are in force. Also, as a party to the NPT, the ROK has undertaken an obligation to accept IAEA safeguards on all source or special fissionable material in all peaceful nuclear activities within the territory of the ROK, under its jurisdiction, or carried out under its control anywhere.

- o No Nuclear Explosive Use. As a non-nuclear weapon state party to the NPT, Korea has undertaken the obligations not to receive the transfer from any transferor whatsoever of nuclear weapons or other nuclear explosive devices or of control over such weapons or explosive devices directly or indirectly; not to manufacture or otherwise acquire nuclear weapons or other nuclear explosive devices; and not to seek or receive any assistance in the manufacture of nuclear weapons or other nuclear explosive devices.

- o Physical Security. During July 1975 and March 1978, a team of US Government experts, visited the ROK for an exchange of views on physical security including visits to those facilities at which this high-enriched uranium will be stored and utilized. Based on these reviews and pursuant to 10 CFR 110.42(a) and 110.43, the ROK's physical protection program is considered adequate for the purposes of this export. As noted in the State Department analysis, the US has assurance that the ROK is committed to maintaining adequate physical security for its nuclear program, including a level of protection comparable to that set forth in IAFA INFCIRC/225, Rev. 1., "The Physical Protection of Nuclea Materials."

- o Retransfer. The US-ROK Agreement prohibits the retransfer of any material supplied by the US beyond the jurisdiction of the ROK without US approval to such retransfer, and then only if it is within the scope of an agreement for cooperation between the US and the other nation or group of nations. Similarly, it prohibits the transfer of special nuclear material produced through the use of US-supplied material without US approval.

- o Reprocessing. The US-ROK Agreement stipulates that the reprocessing of US-supplied material may be performed only in facilities acceptable to both parties. The State Department analysis notes that:

  1. The ROK has explicitly confirmed that this provision calls for two separate and distinct steps on the part of the parties. First, there must be a mutual accord that adequate safeguards can apply. Second, the facilities must be agreed by both parties to be acceptable

  2. The right to determine whether reprocessing facilities are acceptable gives the US the authority to determine, in any specific case, the location where the reprocessing may occur and flexibility to agree with the ROK on other terms designed to assure that the reprocessing and handling of the separated plutonium occurs under prudent conditions.

  3. These conditions reinforce and supplement the rights pertaining to storage that already appear in paragraph B(3) of Article XI of the Agreement for Cooperation.

- o Sensitive Technology. The proposed export does not involve sensitive technology.

As more fully developed in its memorandum dated May 9, 1978, the Executive Branch has determined that the ROK currently meets all the criteria of P.L. 95-242, including the requirements of Section 126(a)(1) and the specific criteria of Sections 127 and 128 and that the ROK has adhered to all the provisions of its Agreement for Cooperation with the US.

The staff has concluded that issuance of the proposed license would be consistent with the recently enacted Nuclear Nonproliferation Act, including the specific criteria of Section 127.

Memorandum to File

In view of all the considerations above, and as required by Section 57 of the Atomic Energy Act and 10 CFR 110.44, the staff has concluded that the export to be made pursuant to the proposed license (1) would be subject to the terms and conditions of the Agreement for Cooperation between the US and the ROK, and (2) would not be inimical to the common defense and security of the United States or constitute an unreasonable risk to the public health and safety.

R. Neal Moore
Senior Licensing Reviewer
Office of International Programs

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

JUN 2 3 1978

MEMORANDUM TO THE FILE

PROPOSED LICENSE TO EXPORT HIGH-ENRICHED URANIUM TO THE REPUBLIC OF KOREA (APPLICATION XSNM-1207)

In September 1977, General Atomic filed an application for a license to export 10.9 kilograms U-235 contained in 15.6 kilograms uranium enriched to 70%, to the Republic of Korea (ROK).

The 70% enriched material (in the form of 70 flip-type fuel elements, 5 instrumented flip fuel elements, and 5 flip fueled follower control rods) will be used in the KORR-2 research reactor at the Korea Atomic Energy Research Institute (KAERI).

The KORR-2 is a 2 MWt TRIGA Mark III pool-type reactor which provides radioisotopes for hospitals throughout the ROK. As noted in the Executive Branch analysis of the proposed export, this reactor (1) has operated at a greatly reduced power level since March 1977 due to damage to the cladding of numerous fuel elements in the core, and (2) has been shut down since January 1978. The fuel elements being requested in this export license application are required to run the reactor.

In response to our October 14, 1977 request for views, the Executive Branch has (1) concluded that issuance of the proposed license would not be inimical to the interests of the US, including the common defense and security; and (2) confirmed that the material will be subject to all the terms and conditions of the Agreement for Cooperation between the US and the ROK.

These views and license application analyses by the Executive Branch were forwarded by the State Department analysis of May 9, 1978.

Confirmation of the applicability of the US-ROK Agreement for Cooperation was also set forth in the letter of December 5, 1977 from the Atomic Energy Bureau-Ministry of Science and Technology of the ROK.

Memorandum to File

In its May 9 memorandum, the Executive Branch noted that, in accordance with current US policy to encourage use of lower-enriched uranium whenever technically and economically feasible, the KORR-II reactor design and its proposed use were examined in detail by Argonne National Laboratory. Their conclusion was that, while it would technically be feasible for the reactor to be operated on LEU (20% U-235), it would be three times more costly than operating on 70% enriched fuel. Further financial liabilities would accrue to Korea if already fabricated 70% fuel were to be replaced with 20% fuel at US insistence.

Moreover, if the KORR-II was required to use a full or partial 20% U-235 core loading, it would remain inoperable for at least a year due to the unavailability of such fuel. While 20% fuel is being developed by General Atomic, they expect that an additional year of development work will be required before it becomes commercially available.

Due to the extensive damage of most of the fuel assemblies in the reactor and the gross failure of the core, General Atomic has recommended replacement of most of the core. Argonne concurs in this view.

The staff has reviewed the subject application in light of the considerations below:

- o Safeguards. The ROK is a party to the NPT and IAEA safeguards pursuant to that treaty are in force. Also, as a party to the NPT, the ROK has undertaken an obligation to accept IAEA safeguards on all source or special fissionable material in all peaceful nuclear activities within the territory of the ROK, under its jurisdiction, or carried out under its control anywhere.

- o No Nuclear Explosive Use. As a non-nuclear weapon state party to the NPT, Korea has undertaken the obligations not to receive the transfer from any transferor whatsoever of nuclear weapons or other nuclear explosive devices or of control over such weapons or explosive devices directly or indirectly; not to manufacture or otherwise acquire nuclear weapons or other nuclear explosive devices; and not to seek or receive any assistance in the manufacture of nuclear weapons or other nuclear explosive devices.

- o Physical Security. During July 1975 and March 1978, a team of US Government experts, visited the ROK for an exchange of views on physical security including visits to those facilities at which this high-enriched uranium will be stored and utilized. Based on these reviews and pursuant to 10 CFR 110.42(a) and 110.43, the ROK's physical protection program is considered adequate for the purposes of this export. As noted in the State Department analysis, the US has assurance that the ROK is committed to maintaining adequate physical security for its nuclear program, including a level of protection comparable to that set forth in IAEA INFCIRC/225, Rev.1., "The Physical Protection of Nuclear Materials."

- Retransfer. The US-ROK Agreement prohibits the retransfer of any material supplied by the US beyond the jurisdiction of the ROK without US approval to such retransfer, and then only if it is within the scope of an agreement for cooperation between the US and the other nation or group of nations. Similarly, it prohibits the transfer of special nuclear material produced through the use of US-supplied material without US approval.

- Reprocessing. The US-ROK Agreement stipulates that the reprocessing of US-supplied material may be performed only in facilities acceptable to both parties. The State Department analysis notes that:

  1. The ROK has explicitly confirmed that this provision calls for two separate and distinct steps on the part of the parties. First, there must be a mutual accord that adequate safeguards can apply. Second, the facilities must be agreed by both parties to be acceptable.

  2. The right to determine whether reprocessing facilities are acceptable gives the US the authority to determine, in any specific case, the location where the reprocessing may occur and flexibility to agree with the ROK on other terms designed to assure that the reprocessing and handling of the separated plutonium occurs under prudent conditions.

  3. These conditions reinforce and supplement the rights pertaining to storage that already appear in paragraph B(3) of Article XI of the Agreement for Cooperation.

- Sensitive Technology. The proposed export does not involve sensitive technology.

As more fully developed in its memorandum dated May 9, 1978, the Executive Branch has determined that the ROK currently meets all the criteria of P.L. 95-242, including the requirements of Section 126(a)(1) and the specific criteria of Sections 127 and 128 and that the ROK has adhered to all the provisions of its Agreement for Cooperation with the US.

The staff has concluded that issuance of the proposed license would be consistent with the recently enacted Nuclear Nonproliferation Act, including the specific criteria of Section 127.

Memorandum to File

In view of all the considerations above, and as required by Section 57 of the Atomic Energy Act and 10 CFR 110.44, the staff has concluded that the export to be made pursuant to the proposed license (1) would be subject to the terms and conditions of the Agreement for Cooperation between the US and the ROK, and (2) would not be inimical to the common defense and security of the United States or constitute an unreasonable risk to the public health and safety.

R. Neal Moore
Senior Licensing Reviewer
Office of International Programs

ATTACHMENT B

DEPARTMENT OF STATE

Washington, D.C. 20520

7806114

March 23, 1978

XSNM-1173
70-2664
5-768

MEMORANDUM FOR LEE V. GOSSICK
NUCLEAR REGULATORY COMMISSION

This export license application was being processed at the time of enactment of the Nuclear Non-Proliferation Act of 1978, P.L. 95-242. While our analysis deals, in substance, with the extent to which the criteria in new section 127 (and section 128, if applicable) of the Atomic Energy Act are met, the analysis is in the old format and is not specifically keyed to these criteria. The Executive Branch, in consultation with NRC staff, is currently developing new procedures pursuant to P.L. 95-242 which, after they come into effect, will be applied to license applications.

In view of the enactment of P.L. 95-242, the Department has reviewed this license application to ensure that the requirements of section 126 a. (1) of the Atomic Energy Act are met. In this regard, as indicated in the analysis, the export criteria in section 127, or their equivalent, are met. Further, Korea has adhered to the provisions of its agreement for cooperation with the United States.

Peter Tarnoff
Executive Secretary

DEPARTMENT OF STATE

Washington, D.C. 20520

7720201

March 23, 1978

MEMORANDUM FOR LEE V. GOSSICK
NUCLEAR REGULATORY COMMISSION

Subject: Comments to NRC on Nuclear Export License Application

Your letter of August 1, 1977 requested the views of the Executive Branch on the issuance of a proposed license for the export to the Republic of Korea of 2.30 kilograms of U-235 contained in 3.280 kilograms of uranium enriched to 70 percent U-235 in the form of fabricated fuel elements.

On the basis of the factors covered by the attached analysis, the Executive Branch has concluded that issuance of the proposed license would not be inimical to the interests of the United States including the common defense and security and that the United States Government has the assurance that the recipient country is committed to providing adequate physical security for its nuclear program, including a level of protection compatible with that envisaged by IAEA INFCIRC/225. The supply of this highly enriched uranium will be subject to all of the terms and conditions of the Agreement for Cooperation between the United States and the Republic of Korea.

Peter Tarnoff
Executive Secretary

Attachments:

1. License Application Analysis
2. Letter from the Atomic Energy Bureau of the Republic of Korea dated September 2, 1977

LICENSE APPLICATION ANALYSIS

Transaction: The export to the Republic of Korea of 2.30 kilograms of uranium enriched to 70% U-235 in the form of fabricated fuel elements.
Applicant: General Atomic Company
Applicant's Reference: IEL-834
Date of Application: July 19, 1977.

1. What is the purpose of the export?

These thirteen Flip-type fuel elements, two Instrumented Flip fuel elements and two Flip Fueled Follower Control Rods containing uranium enriched to 70 percent U-235 and three TRIGA fission chambers containing uranium enriched to 93 percent U-235 will be shipped to Seoul, Korea and will be used in the KORR-2 TRIGA Mark III Research Reactor at the Korea Atomic Energy Research Institute.

This reactor provides radioisotopes for hospitals throughout the Republic of Korea.

Since March 1977 this reactor has operated at a greatly reduced power level as a result of damage to the cladding of numerous fuel elements within the 104 fuel element core. According to a report from the General Atomic Company, it is believed that damage to the fuel elements is a result of a combination of stress chloride corrosion cracking due to poor moderating water quality and further cracking because of severe vibrations in the operation of the reactor.

Since January 1977 the reactor has been shut down. The fuel elements being requested in this export license application are required to run the reactor in order to test the fuel presently in the core at progressively higher power levels.

2. Does the recipient country have an Agreement for Co-operation with the United States under Section 123 of the Atomic Energy Act, as amended, and, if so is the export in question covered by the Agreement?

The supply of this highly enriched uranium is subject to all of the terms and conditions of the Agreement for Cooperation between the United States and Korea, which entered into force on March 19, 1973. This was confirmed in

a letter from the Embassy of the Republic of Korea dated September 7, 1977. This agreement, inter alia, prohibits the retransfer of any material supplied by the United States to another nation except as the United States agrees to such retransfer and then only if it is within the scope of an agreement for cooperation between the United States and the other nation or an international organization. Similarly, it prohibits the transfer of special nuclear material produced through the use of U.S.- supplied material without U.S. approval.

Article VIII, F of the Agreement provides that (a) when any special nuclear material received from the United States requires reprocessing or (b) when irradiated fuel elements containing fuel supplied by the United States requires alteration, such reprocessing or alteration shall be performed in facilities acceptable to both parties upon a joint determination of the parties that the safeguards called for by the Agreement may be effectively applied. The Republic of Korea has explicitly confirmed that this provision calls for two separate and distinct steps on the part of the parties. First, there must be a mutual accord that adequate safeguards can apply. Second, the facilities must be agreed by both parties to be acceptable.

The right to determine whether reprocessing facilities are acceptable to the United States gives us the authority to determine, in any specific case, the location where the reprocessing may occur. The clause also gives us flexibility to agree with Korea on other terms designed to assure that the reprocessing and handling of the separated plutonium occurs under prudent conditions. For example, in determining the acceptability of a facility the United States would be able to stipulate reasonable conditions of a security nature regarding storage of the separated plutonium. These conditions reinforce and supplement the rights pertaining to storage that already appear in paragraph B(3) of Article XI of the Agreement for Cooperation.

3. Has the recipient country accepted and implemented IAEA safeguards and/or other appropriate supplementary bilateral conditions (including, where applicable, understandings regarding reexport) imposed by the U.S.?

A safeguards Agreement with the IAEA pursuant to the NPT entered into force November 14, 1975.

4. Does the recipient country have adequate physical security arrangements to deal with threats of sub-national diversion of significant quantities of nuclear weapon materials (plutonium or highly enriched uranium)?

During April 1976 and July 1977, a team of U.S. Government experts visited the Republic of Korea for an exchange of views on physical security including visits to those facilities at which this highly enriched uranium will be stored and utilized The fixed site reviews included: (1) security forces, (2) physical barriers, (3) detection and alarm apparatus, (4) communication and response capabilities, (5) access and exit controls, (6) accountability and reporting procedures, and (7) physical security organization. In the area of transportation, procedures and equipment for protecting nuclear materials while in transit were also examined.

The team judged the Republic of Korea's physical protection system, equipment and procedures and equipment for transportation security adequate to physically protect the material requested in this license application.

5. What is the position of the recipient country with regard to non-proliferation?

Korea is a Party to the Treaty on the Non-Proliferation of Nuclear Weapons and deposited its instrument of ratification on April 23, 1975. The Korean Government has also signed a comprehensive safeguards agreement with the IAEA under Article III of the Treaty.

6. What understandings does the United States have with the recipient country with respect to the use of U.S.-supplied material or equipment to acquire or develop nuclear explosive devices for any purpose, and as to the recipient country's policies and actions as to such development using equipment and material from any source?

As a non-nuclear weapon state Party to the NPT, Korea is precluded from acquiring, developing or manufacturing nuclear explosive devices for any purpose.

7. In cases in which the recipient country is not required by the NPT to accept IAEA safeguards, does the recipient

country or organization have accounting and inspection procedures such as to assure compliance with the requirements of the relevant U.S. Agreements?

A safeguards Agreement with the IAEA pursuant to the NPT entered into force November 14, 1975. Korea has ratified the NPT.

8. What other factors are there which bear on the issuance of the export license, such as further U.S. understandings with the recipient country, other supplier countries or interested regional countries?

As already noted, our Agreement for Cooperation includes a provision which requires U.S. approval of any arrangements for reprocessing.

Another application for 10 kilograms of uranium enriched to 70% in the form of fabricated FLIP type fuel elements for this reactor is currently under review in the Executive Branch.

70-2715

DEPARTMENT OF STATE

Washington, D.C. 20520

RECEIVED
U.S. NRC

BUREAU OF OCEANS AND INTERNATIONAL
ENVIRONMENTAL AND SCIENTIFIC AFFAIRS

May 9, 1978

MEMORANDUM FOR JAMES R. SHEA
NUCLEAR REGULATORY COMMISSION

Enclosed is an Executive Branch analysis covering three license applications for the export of highly-enriched and low-enriched uranium to Korea. In accordance with P.L. 95-242, the analysis explicitly addresses how the requirements of Section 126 a.(1) of the Atomic Energy Act are met, including the specific criteria of Sections 127 and 128, as well as certain additional factors, envisaged by Section 126 a. (1).

The Executive Branch, on the basis of its review of this application, has concluded that the requirements of the Atomic Energy Act and P.L. 95-242 have been met and that the proposed export would not be inimical to the common defense and security of the United States. Moreover, Korea has adhered to the provisions of its Agreement for Cooperation with the United States. Therefore the Executive Branch recommends issuance of the requested export licenses.

As covered in detail in the analyses, the KORR-2 research reactor, to which fuel export license applications XSNM-1173 and XSNM-1207 apply, has been shut down since January 1978 as the result of a major fuel failure. It is our understanding that it will be necessary to keep this reactor shut down until the material covered by these two license applications can be exported. Since KORR-2 is Korea's principal nuclear research facility and provides radioisotopes for medical applications throughout Korea, we would urge prompt consideration and issuance of these licenses.

Louis V. Nosenzo
Deputy Assistant Secretary

Enclosure:
As stated.

1. Applicable Agreement for Cooperation

The proposed export is subject to all of the terms and conditions of the Agreement for Cooperation between the Government of the United States of America and the Government of Korea concerning Civil Uses of Atomic Energy, which entered into force on March 19, 1973. This was confirmed in letters from the Republic of Korea's Atomic Energy Bureau to the Energy Research and Development Administration copies of which are attached.

Korea has adhered to all provisions of its agreement with the United States.

2. Extent to Which Export Criteria Are Met

A. Section 127 Criteria

As provided in Section 127 of the Atomic Energy Act, the following criteria govern exports for peaceful nuclear uses from the United States of source material, special nuclear material, production or utilization facilities, and any sensitive nuclear technology:

Criterion (1)

"IAEA safeguards as required by Article III(2) of the Treaty will be applied with respect to any such material or facilities proposed to be exported, to any such material or facilities previously exported and subject to the applicable Agreement for Cooperation, and to any special nuclear material used in or produced through the use thereof."

Korea is a Party to the Treaty on the Non-Proliferation of Nuclear Weapons and deposited its instrument of ratification on April 23, 1975. The Korean Government has also signed a comprehensive safeguards agreement with the IAEA under Article III of the Treaty, which entered into force November 14, 1975.

Therefore, it is the Executive Branch view that criterion (1) is met.

Criterion (2)

"No such material, facilities, or sensitive nuclear technology proposed to be exported or previously exported and subject to the applicable Agreement for Cooperation, and no special nuclear material produced through the use of such materials, facilities, or sensitive nuclear technology, will be used for any nuclear explosive device or for research on or development of any nuclear explosive device."

As a non-nuclear weapon state Party to the NPT, Korea is precluded from acquiring, developing or manufacturing nuclear explosive devices for any purpose. Therefore, it is the Executive Branch view that criterion (2) is met.

Criterion (3)

"Adequate physical security measures will be maintained with respect to such material or facilites proposed to be exported and to any special nuclear material used in or produced through the use thereof. Following the effective date of any regulations promulgated by the Commission pursuant to Section 304(d) of the Nuclear Non-Proliferation Act of 1978, physical security measures shall be deemed adequate if such measures provide a level of protection equivalent to that required by the applicable regulations."

The Commission has not, as yet, promulgated new regulations pursuant to Section 304(d) of P.L. 95-242.

During ~~April 1976 and~~ July 1975, a team of U.S. Government experts visited the Republic of Korea for an exchange of views on physical security including visits to those facilities at which this highly-enriched uranium will be stored and utilized. The fixed site reviews included: (1) security forces, (2) physical barriers, (3) detection and alarm apparatus, (4) communication and response capabilities, (5) access and exit controls, (6) accountability and reporting procedures, and (7) physical security organization. In the area of transportation, procedures and equipment for protecting nuclear materials while in transit were also examined.

The team judged the Republic of Korea's physical protection system, equipment and procedures and equipment for transportation security adequate to physically protect the material requested in this license application. Therefore, it is the Executive Branch view that criterion (3) is met.

Criterion (4)

"No such materials, facilities, or sensitive nuclear technology proposed to be exported, and no special nuclear material produced through the use of such material, will be retransferred to the jurisdiction of any other nation or group of nations unless the prior approval of the United States is obtained for such retransfer. In addition to other requirements of law, the United States may approve such retransfer only if the nation or group of nations designated to receive such retransfer agrees that it shall be subject to the conditions required by this section."

Article X (3) of the 1973 U.S.-Korea Agreement for Cooperation stipulates that: "No material, including equipment and devices, transferred to the Government of Korea or to authorized persons under its jurisdiction pursuant to this Agreement or the superseded Agreement will be transferred to unauthorized persons or beyond the jurisdiction of the Government of Korea, except as the Commission may agree to such a transfer to the jurisdiction of another nation or group of nations, and then only if, in the opinion of the Commission, the transfer is within the scope of an Agreement for Cooperation between the Government of the United States...and the other nation or group of nations."

Article XI B. provides inter alia that: "...the Government of the United States of America, notwithstanding any other provisions of this Agreement, shall have the following rights: ...

"(2) With respect to any source material or special nuclear material made available to the Government of the Republic of Korea or to any person under its jurisdiction under this Agreement or the superseded Agreement by the Government of the United States of America or any person under its jurisdiction and any source material or special nuclear material utilized in, recovered from, or produced as a result of the use of any of the following materials, equipment or devices so made available:

"(a) source material, special nuclear material, moderator material, or other material designated by the Commission, ...

"(ii) to require that any such material in the custody of the Government of the Republic of Korea or any person

under its jurisdiction be subject to all of the safeguards provided for in this Article and the guarantees set forth in Article X;"

These articles give the U.S. an unqualified approval right over the retransfer of material from Korea supplied by the U.S. or produced through the use of such material and allow retransfers only if it is determined to be within the scope of an agreement for cooperation with the recipient country. This right would apply to irradiated fuel because it contains U.S.-supplied material and material produced through the use of U.S. material.

Therefore, it is the Executive Branch view that criterion (4) is met.

Criterion (5)

"No such material proposed to be exported and no special nuclear material produced through the use of such material will be reprocessed, and no irradiated fuel elements containing such material removed from a reactor shall be altered in form or content, unless the prior approval of the United States is obtained for such reprocessing or alteration."

Article VIII C. of the U.S. - Korea Agreement for Cooperation provides that: "When any special nuclear material received from the United States of America pursuant to this Agreement or to the superseded Agreement requires reprocessing, or any irradiated fuel elements containing fuel material received from the United States of America pursuant to this Agreement or to the superseded Agreement are to be removed from a reactor and are to be altered in form or content, such reprocessing or alteration may be performed in facilities acceptable to both parties upon a joint determination of the Parties that the provisions of Article XI may be effectively applied."

As no joint determination under Article VIII C. can be made without the agreement of the United States, and since the facilities to be used must be acceptable to the U.S. as one of the Parties, it is the view of the Executive Branch that criterion (5) is met.

Criterion (6)

"No such sensitive nuclear technology shall be exported unless the foregoing conditions shall be applied to any nuclear material or equipment which is produced or constructed under the jurisdiction of the recipient nation or group of nations by or through the use of any such exported sensitive nuclear technology."

The proposed export does not involve sensitive nuclear technology. criterion (6) is, therefore, not applicable.

B. Section 128 Criterion

Section 128 a.(1) of the Atomic Energy Act establishes the following additional criterion: "As a condition of continued United States export of source material, special nuclear material, production or utilization facilities, and any sensitive nuclear technology to non-nuclear-weapon states, no such export shall be made unless IAEA safeguards are maintained with respect to all peaceful nuclear activities in, under the jurisdiction of, or carried out under the control of such state at the time of the export."

It should be noted that this criterion only applies to exports to take place after March 10, 1980 or pursuant to an application submitted after September 10, 1979. We anticipate that this recommended export will occur before March 10, 1980. In any case, as a Party to the NPT, Korea has accepted IAEA safeguards on all its nuclear activities thereby satisfying this criterion.

B. Special Non-Proliferation and Other Foreign Policy Considerations Related to XSNM-1173 and XSNM-1207

The KORR-II research reactor is the principle research tool of the Korean Atomic Energy Research Institute and is used for production of medical radioisotopes as well as nuclear training in reactor operation and research. In accordance with current US policy to encourage use of lower-enriched uranium whenever technically and economically feasible, this reactor design and its proposed use has been examined in detail by Argonne National Laboratory, which concluded that, while it would be technically feasible to operate the reactor on low-enriched uranium (20 percent U-235), the operation on more highly-enriched fuel (e.g., 70 percent U-235), is expected to be on the order of three times less costly than operation on current technology 20 percent enriched fuel.

More importantly, if the KORR-II were required to use a full or partial 20 percent U-235 core loading it would be forced to remain inoperable for at least a year since General Atomic does not have any 20 percent enriched fuel available and its current schedule of fuel deliveries to other customers would not permit it to start fabrication of twenty percent fuel for KORR-II for at least nine months. (This is aside from any financial liabilities which would be incurred if already fabricated 70 percent fuel under the existing General Atomic-Korean contract were to be replaced with 20 percent fuel at our insistence.) While an improved 20 percent fuel is being developed by General Atomic, it is expected to require at least an additional year of development work before it becomes commercially available.

It is believed that few, if any, of the 20 percent fuel assemblies now in KORR-II could be used for reactor operation at any but the lowest power levels. In any event, because of the gross failure of this core, it is practically impossible to isolate individual assemblies to determine the extent of their damage. Therefore, General Atomic has recommended replacement of most of the core and Argonne concurs in this view.

Issuance of both of these licenses would permit the export of 97 fuel assemblies for KORR-II, containing a total of 13.2 kilograms of U-235. It should be noted that the quantity of highly-enriched uranium involved under the two licenses as well as the total in-country unirradiated highly-

enriched uranium is below the 15 Kg. of U-235, and the effective Kg. at the 70 percent enrichment is well below the threshold of possible proliferation concern.

In light of the foregoing factors, we believe that approval of XSNM-1175 and XSNM-1207 is justified and is consistent with US policy to meet existing commitments to supply highly-enriched uranium while encouraging use of lower U-235 enrichments whenever technically and economically feasible. Further, since the KORR-II is Korea's principal nuclear research tool and also provides radioisotopes for use in medical applications throughout Korea, we would urge prompt consideration and issuance of the license to permit earliest possible startup of this reactor.

3. Additional Factors

A. Safeguards Implementation -- Significant information the Executive Branch possesses bearing on the effectiveness of implementation of IAEA safeguards in the recipient country, including any such information on steps being taken to correct any identified deficiencies in the application of IAEA safeguards in that country:

The IAEA Secretariat has concluded in its Special Safeguards Implementation Report that with regard to nuclear material subject to IAEA safeguards, while some deficiencies exist in the system, "in none of the 41 states in which inspections were carried out was there any diversion of a significant quantity of nuclear material". Although recognizing the need to correct existing deficiencies in safeguards implementation, the Executive Branch has no reason to believe that the IAEA Secretariat's conclusion is not a valid one. In the light of this and other factors associated with he proposed export, the Executive Branch believes the framework of commitments, assurances and safeguards is adequate for the purposes of these exports.

4. Inimicality Judgment

Based on review of the proposed export, it is the judgment of the Executive Branch that the proposed export will not be inimical to the common defense and security, and that the license should be issued.

XSNM-1207
70-2715
5-818

ATOMIC ENERGY BUREAU
MINISTRY OF SCIENCE AND TECHNOLOGY
REPUBLIC OF KOREA
SEOUL 110, KOREA

Cable Address: MOSTROK
Telex: MIOST K 2430
Tel.: 70-2009, 70-4234

December 5, 1977

. Joseph M. Hendrie
airman
clear Regulatory Commission
shington, D.C. 20555
S.A.

Letter of Confirmation

ar Dr. Hendrie

This is to certify that the Korea Atomic Energy
search Institute is authorized, by the Korean Government,
receive and possess 70 ea of Cat. No. 110 TRIGA FLIP
el elements, 5 ea of Cat. No. 210 TRIGA FLIP Instrumented
el elements, 5 ea of Cat. No. 310 TRIGA FLIP fueled
llower control rods (L/C No. M1901711NS00993) pursuant to
e Agreement for Cooperation between the Government of the
public of Korea, and the Government of the United States
America concerning civil uses of atomic energy.

For the Government of the Republic of Korea.

Sincerely Yours,

Yeoung Hak Baek

Yeoung Hak Baek
Director General

ATTACHMENT C

Form AEC-7
(2-67)
10 CFR 30, 40

U.S. ATOMIC ENERGY COMMISSION
Washington, D.C. 20545

Form approved
Budget Bureau No.
38-R0007.

XSNM-1173
70-2664
S-768
I.C. 14610
mlc 77-209

APPLICATION FOR LICENSE TO EXPORT BYPRODUCT, SOURCE, OR SPECIAL NUCLEAR MATERIAL

Submit in Triplicate

Carefully Read Instructions on Back

1 DATE OF APPLICATION	2 APPLICANT'S REFERENCE NO. *(If any)*	3 COUNTRY OF ULTIMATE DESTINATION
July 19, 1977	IEL-834	KOREA

4 NAME OF APPLICANT STREET ADDRESS CITY, STATE, AND ZIP CODE	5 ULTIMATE CONSIGNEE IN FOREIGN COUNTRY *(Name and address)*
GENERAL ATOMIC COMPANY ATTN: W. R. Mowry P. O. Box 81608 San Diego, CA 92138	Korea Atomic Energy Research Institute P. O. Box 7, Cheong Ryang Seoul, Republic of Korea

6 INTERMEDIATE CONSIGNEE IN FOREIGN COUNTRY *(Give name and address. If same as ultimate consignee, state "Same.")*	7 IF PURCHASER IN FOREIGN COUNTRY IS OTHER THAN ULTIMATE CONSIGNEE, GIVE NAME AND ADDRESS *(If same, state "Same.")*
None	None

(a) QUANTITY TO BE SHIPPED *(See instructions on back)*	(b) COMMODITY DESCRIPTION *(Include chemical and physical form; for special nuclear material and byproduct material also specify isotopic content; if in a device, identify the device, manufacturer, and model number.)*
2.30 Kg U-235 Total See Attachment.	See Attachment.

(c) SHIPPING AND PACKING PROCEDURES *(Required for special nuclear material. See instructions on back.)*

See Attachment.

8 USE OF COMMODITIES COVERED BY THIS APPLICATION *(Describe fully, stating what will be produced or manufactured, what service will be rendered, or the nature of the research that will be performed.) (See instructions on back for special nuclear material.)*

The 3 TRIGA Fission Chambers shall be used in KORR-2 (TRIGA Mark-III) at KAERI. The 13 Flip Fuel Elements (Cat. No. 110), 2 Instrumented Flip Fuel Elements (Cat. No. 210) and 2 Flip Fueled-Follower Control Rods (Cat. No. 310) shall be used in KORR-2 (TRIGA Mark-III) at KAERI also.

The applicant, and any official executing this certificate on behalf of the applicant named in Item 4, certify that this application is prepared in conformity with Title 10, Code of Federal Regulations, Parts 30 and 36 (if for byproduct material) or Part 40 (if for source material), or Part 70 (if for special nuclear material), and Part 71 (for transport of radioactive material, if applicable) and that all information contained herein, including any supplements attached hereto, is true and correct to the best of their knowledge and belief.

GENERAL ATOMIC COMPANY

(Applicant named in Item 4)

By: William R. Mowry
Licensing Administrator

(Title of certifying official authorized to act on behalf of the applicant)

RECEIVED
U.S. NRC

1977 JUL 26 AM 7 52

-28-77 cpt
IR, Acct
I+E

Warning: 18 U.S.C. Section 1001; Act of June 25, 1948; 62 Stat. 749; makes it a criminal offense to make a willfully false statement or representation to any department

FORM NRC-7 ATTACHMENT
7/19/77
IEL-834
KOREA

8.(a) 2.30 Kg U-235 Total

(1) 1.78 Kg U-235

(2) 0.27 Kg U-235

(3) 0.23 Kg U-235

(4) 5.3 gm U-235

8.(b)

(1) 13 each, TRIGA Flip Fuel Elements, Model #110, each element contains UZrH metal alloy, the uranium (196 gm) is enriched to 70% in U-235.

(2) 2 each, Instrumented Flip Fuel Elements, Model #210, each element contains UZrH metal alloy, the uranium (196 gm) is enriched to 70% in U-235.

(3) 2 each, Flip Fueled-Follower Control Rods, Model #310, each element contains UZrH metal alloy, the uranium (166 gm) is enriched to 70% in U-235.

(4) 3 each, Fission Chambers, each chamber contains 1.9 gm uranium enriched to 93% U-235.

8.(c)

All the materials will be packaged at General Atomic Company, San Diego, California. The fuel elements/rods will be packaged in TRIGA shipping containers (NRC Certificate of Compliance #9034 and #9037).

The fission chambers will be packaged in DOT Spec 7A or equivalent packaging.

한 국 원 자 력 연 구 소

KOREA ATOMIC ENERGY RESEARCH INSTITUTE

P. O. BOX 7, CHEONG RYANG
SEOUL, KOREA

TELEX KAERI 23415
CABLE KAERI

TELEPHONE 96-0181

Mr. William Mowry
Manager, Licensing Administration
General Atomic Company
P.O. Box 81608
San Diego, California 92138

Subject: End Use Statement of Consignee

Dear Mr. Mowry:

We request that this statement be considered a part of the application filed by General Atomic Company for its license to export special nuclear material.

We desire to receive the following material in the quantity indicated below:

Material Type	Form	Quantity
Uranium 70% Enriched in U-235	U-ErZrH in 17 TRIGA fuel elements	3,280 grams of U containing 2,296 grams of U-235

We will use the special nuclear material listed above for the following purpose:

These 13 flip fuel elements (Cat. No. 110), 2 instrumeted flip fuel elements (Cat. No. 210) and 2 flip fueled follower control rod (Cat. No. 310) shall be used in KORR - 2 (TRIGA Mark-III) at KAERI.

We certify that all the facts contained in this statement are true and correct to the best of our knowledge and belief and we do not know of any additional facts that are inconsistent with the above statement.

Chang Kun Lee

By CHANG KUN LEE

Title Chief of Reactor Operation Division

Date May 12, 1977

한 국 원 자 력 연 구 소

KOREA ATOMIC ENERGY RESEARCH INSTITUTE

P.O. BOX 7, CHEONG RYANG
SEOUL, KOREA

TELEX: KAERI 23415
CABLE: KAERI

TELEPHONE: 96-0181

Mr. William Mowry
Manager, Licensing Administration
General Atomic Company
P.O. Box 81608
San Diego, California 92138

Subject: End Use Statement of Consignee

Dear Mr. Mowry:

We request that this statement be considered a part of the application filed by General Atomic Company for its license to export special nuclear material.

We desire to receive the following material in the quantity indicated below:

Material Type	Form	Quantity
Uranium - 93% Enriched in U-235	TRIGA Neutron Detectors	5.7 grams of U containing 5.3 grams of U-235

We will use the special nuclear material listed above for the following purpose:

These 3 TRIGA neutron detectors shall be used in KORR-2 (TRIGA Mark-III) at KAERI.

We certify that all the facts contained in this statement are true and correct to the best of our knowledge and belief and we do not know of any additional facts that are inconsistent with the above statement.

By CHANG KUN LEE

Title Chief of Reactor Operation Division

Date May 12, 1977

GENERAL ATOMIC COMPANY
P.O. BOX 81608
SAN DIEGO, CALIFORNIA 92138
(714) 455-3000

In Reply
Refer To: IEL-834

July 19, 1977

Dr. Michael A. Guhin, Assistant Director
Export/Import and International Safeguards
Office of International Programs
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Subject: Application for Export; Korea

Dear Dr. Guhin:

Enclosed is General Atomic Company's application for export of special nuclear material to the Atomic Energy Research Institute, Seoul, Korea. This application made under 10CFR70 requests the export of 13 TRIGA Flip Fuel Elements, two (2) Instrumented Flip Fuel Elements, two (2) Flip Fueled-Follower Control Rods, and three (3) Fission Chambers. The fuel elements and fuel-follower control rods contain a Uranium-Zirconium-Hydride Alloy in which the uranium is enriched in U-235 to 70%. The Fission Chambers contain small amounts of uranium enriched to 93% in U-235. The components listed above will be used in the Institute's research programs. Also enclosed are originally-signed letters representing the consignee's End-Use Statements concerning the above materials.

General Atomic Company, whose main office is located at 10955 John Jay Hopkins Drive, San Diego, California, is the firm exporting the material. The material packaging will be accomplished at the main office location.

The shipment of the fuel elements and the fuel-follower control rods will be in accordance with the provisions of NRC Certificate of Compliance #9034 and #9037, respectively, with their corresponding Certificates of Competent Authority, as well as applicable regulations concerning such overseas shipment. The Fission Chambers will be packaged in DOT Spec 7A or equivalent packaging suitable for an overseas shipment. We anticipate shipment of the described materials upon receipt of the required licenses and other appropriate documentation. The initial shipment is expected to be made no later than 1 December 1977.

We request issuance of the material export license at your earliest convenience and further request that the license have a validity period of one year.

Very truly yours,

William R. Mowry

William R. Mowry
Licensing Administrator
Nuclear Materials Control Division

WRM:ts
Enclosures: Form NRC-7
End-Use Statements

Form AEC-7
(2-67)
10 CFR 30, 40

U.S. ATOMIC ENERGY COMMISSION
Washington, D.C. 20545

Form approved
Budget Bureau No.
38-R0007.

XSNM-1207
70-2715
S-818
I.C. 14395
m/c 77-271

APPLICATION FOR LICENSE TO EXPORT BYPRODUCT, SOURCE, OR SPECIAL NUCLEAR MATERIAL

Submit in Triplicate

Carefully Read Instructions on Back

1 DATE OF APPLICATION	2 APPLICANT'S REFERENCE NO (if any)	3 COUNTRY OF ULTIMATE DESTINATION
9/30/77	IEL-847	Korea

4 NAME OF APPLICANT / STREET ADDRESS / CITY, STATE, AND ZIP CODE	5 ULTIMATE CONSIGNEE IN FOREIGN COUNTRY (Name and address)
GENERAL ATOMIC COMPANY ATTN: William R. Mowry P.O. Box 81608 San Diego, CA 92138	KOREA ATOMIC ENERGY RESEARCH INSTITUTE P.O. Box 7, Cheong Ryang Seoul, Republic of Korea
6 INTERMEDIATE CONSIGNEE IN FOREIGN COUNTRY (Give name and address. If same as ultimate consignee, state "Same.")	7 IF PURCHASER IN FOREIGN COUNTRY IS OTHER THAN ULTIMATE CONSIGNEE, GIVE NAME AND ADDRESS (If same, state "Same.")
Same	Same

8 (a) QUANTITY TO BE SHIPPED (See instructions on back)	(b) COMMODITY DESCRIPTION (Include chemical and physical form for special nuclear material and byproduct material also specify isotopic content; if in a device, identify the device, manufacturer, and model number.)
10.9 kg U-235 in 15.6 kg Uranium	70 Model 110 TRIGA FLIP Fuel Elements 5 " 210 " " instrumental FLIP fuel elements 5 " 310 " " fueled follower control rods Each element contains up to 196 gm Uranium enriched to 70% in Uranium 235 within U-ErZrH Metal alloy fuel.

(c) SHIPPING AND PACKING PROCEDURES (Required for special nuclear material. See instructions on back.)

The elements will be packaged by GAC at its main office location in NRC approved shipping containers COC 9034 & 9037. Multiple shipments are anticipated under the license SNM In Transit License Conditions.

9 END USE OF COMMODITIES COVERED BY THIS APPLICATION (Describe fully, stating what will be produced or manufactured, what service will be rendered, or the nature of the research that will be performed.) (See instructions on back for special nuclear material.)

These 70 FLIP fuel elements (Cat. No. 110), 5 instrumeted FLIP fuel elements (Cat. no. 210) and 5 FLIP fueled follower control rods (Cat. No. 310) shall be used in KORR-2 (TRIGA Mark-III) at KAERI.

10 The applicant, and any official executing this certificate on behalf of the applicant named in Item 4, certify that this application is prepared in conformity with Title 10, Code of Federal Regulations, Parts 30 and 36 (if for byproduct material) or Part 40 (if for source material), or Part 70 (if for special nuclear material), and Part 71 (for transport of radioactive material, if applicable) and that all information contained herein, including any supplements attached hereto, is true and correct to the best of their knowledge and belief.

10-13-77 cys to
R, Acc + I+E

General Atomic Company
(Applicant named in Item 4)

By: [signature]
William R. Mowry
Licensing Administrator
(Title of certifying official authorized to act on behalf of the applicant)

77 OCT 3 PM 12

APPENDIX C

Warning: 18 U.S.C. Section 1001, Act of June 25, 1948, 62 Stat. 749, makes it a criminal offense to make a willfully false state

한 국 원 자 력 연 구 소

KOREA ATOMIC ENERGY RESEARCH INSTITUTE

P. O. BOX 7, CHEONG RYANG
SEOUL, KOREA

KAERI 2341 S
KAERI

TELEPHONE 96-0181

Mr. William Mowry
Manager, Licensing Administration
General Atomic Company
P.O.Box 81608
San Diego, California 92138

Subject: End Use Statement of Consignee

Dear Mr. Mowry:

We request that this statement be considered a part of the application filed by General Atomic Company for its license to export special nuclear material.

We desire to receive the following materials in the quantity indicated below:

Material Type	Form	Quantity
Uranium 70% Enriched in U-235	U-ZrHx-H in 80 TRIGA fuel elements	15.6kg of Uranium containing 10.9kg of U-235

We will use the special nuclear materials listed above for the following purpose:

Four (4) FLIP fuel elements (Cat. No. 110), 5 instrumented FLIP fuel elements (Cat. No. 210) and 5 FLIP fueled follower control rods (Cat. No. 310) shall be used in HANA-2 (TRIGA Mark-III) at KAERI.

We certify that all the facts contained in this statement are true and correct to the best of our knowledge and belief, and we do not know of any additional facts that are inconsistent with the above statement.

RECEIVED
U.S. NRC

1977 OCT 3 PM 1 24

EXPORT/IMPORT
AND
INTERNAT'L SFGRDS

By Chang Kun Lee
CHANG KUN LEE

Title Manager of
Reactor Operation Division

Date August 27, 1977

GENERAL ATOMIC COMPANY
P.O. BOX 81608
SAN DIEGO, CALIFORNIA 92138
(714) 455-3000

In Reply
Refer To: IE

September 30, 1977

Dr. Michael A. Guhin, Assistant Director
Export/Import and International Safeguards
Office of International Programs
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Subject: Application for Special Nuclear Material Export License; Korea

Ref: SNM Export License application (IEL-834), dated 7/19/77, for which XSNM-1173 is being issued.

Dear Dr. Guhin:

Enclosed is General Atomic Company's (GAC) application for export of Special Nuclear Material to the Atomic Energy Research Institute, Seoul, Korea. This application made under 10CFR70 requests the export of 80 TRIGA FLIP Fuel elements containing approximately 10.9 kg U-235, in uranium enriched to 70%. Also enclosed is an originally signed letter representing the consignees End Use Statement covering the materials in this application.

The materials in this application are in addition to the seventeen FLIP elements and three fission chambers covered under an earlier application made July 19, 1977, which is still pending with the Commission. The fuel in this application, together with that previously (Ref a.) applied for, will make possible the replacement of an entire damaged core, which is of very questionable integrity.

Core replacement is required because earlier this year, the quality of water in the KAERI TRIGA Mark III reactor tank deteriorated drastically. As a result, all existing fuel in the reactor sustained very extensive corrosion damage. The stainless steel cladding on three elements corroded completely through, allowing the elements to break into separate pieces, releasing fission products into the reactor building. The reactor was shut down and has been out of service since March.

Messrs. Louis Nosenzo of the State Department and J.D. Lafleur of NRC have been fully informed on the problem.

In considering the requirement for replacing the core with new FLIP fuel, please note the following:

1. The KAERI TRIGA Mark III, a 2000 KW steady state/2,000,000 KW pulsing reactor, was started up in April 1972. Although the initial core was composed of 20% U-235 enriched "standard" uranium fuel, all subsequent replacements for this reactor have 70% enriched FLIP fuel. GAC recommends the use of FLIP fuels for all TRIGAs of similarly high power and high duty cycle, because the short reactivity life of a "standard" fueled core would require frequent refueling, resulting in extremely high fuel cycle costs and a very much larger committment to irradiated fuel storage. Technical advantages, in addition to allowing a higher U-235 content such that core life is extended to 7 or 8 times that of a standard core, are given in Attachment 1. Further, several small routine orders (less than 20 elements) of FLIP replacement fuel have been filled for KAERI.

2. In addition to the core fuel replacement, extensive repairs to the facilities' heat exchanger are underway. GAC and Argonne National Lab (ANL) are continuing to counsel KAERI in their efforts to overcome this problem, including the improved control of water quality to insure against a recurrence.

General Atomic Company, whose main office is located at 10955 John Jay Hopkins Drive, San Diego, California, is the firm exporting the material. The material will be packaged at the main office location. The fuels being exported under the subject and Ref. (a) export licenses, are anticipated to be shipped in multiple shipments, each shipment less than 5.0 kg, and successive shipments will not be made until the arrival of its predecessor is confirmed.

The shipment of the fuel elements and fueled follower control rods will be in accordance with the provisions of NRC Certificate of Compliance 9034 and 9037 respectively, and their corresponding Certificates of Competent Authority, as well as applicable regulations for such overseas shipments.

In our previous Application, (Ref. a) we indicated our desire to make the initial shipment no later than December 1, 1977. The fabrication of the materials covered by this new application will be completed by early December, with shipments to commence med-December 1977, if possible

We request issuance of an export license which allows multiple shipment

of the subject fuels at your earliest convenience, and further request that the license have a validity period of one year.

Very truly yours,

William R. Mowry

William R. Mowry
Licensing Administrator
Nuclear Materials Control Division

WRM:sh
Attachment
Enclosures: Form NRC
End Use Statement

GENERAL ATOMIC COMPANY
P.O. BOX 81608
SAN DIEGO, CALIFORNIA 92138
(714) 455-3000

TRIGA-FLIP--A Long Lifetime Fuel Using a Low Energy Resonance Burnable Poison

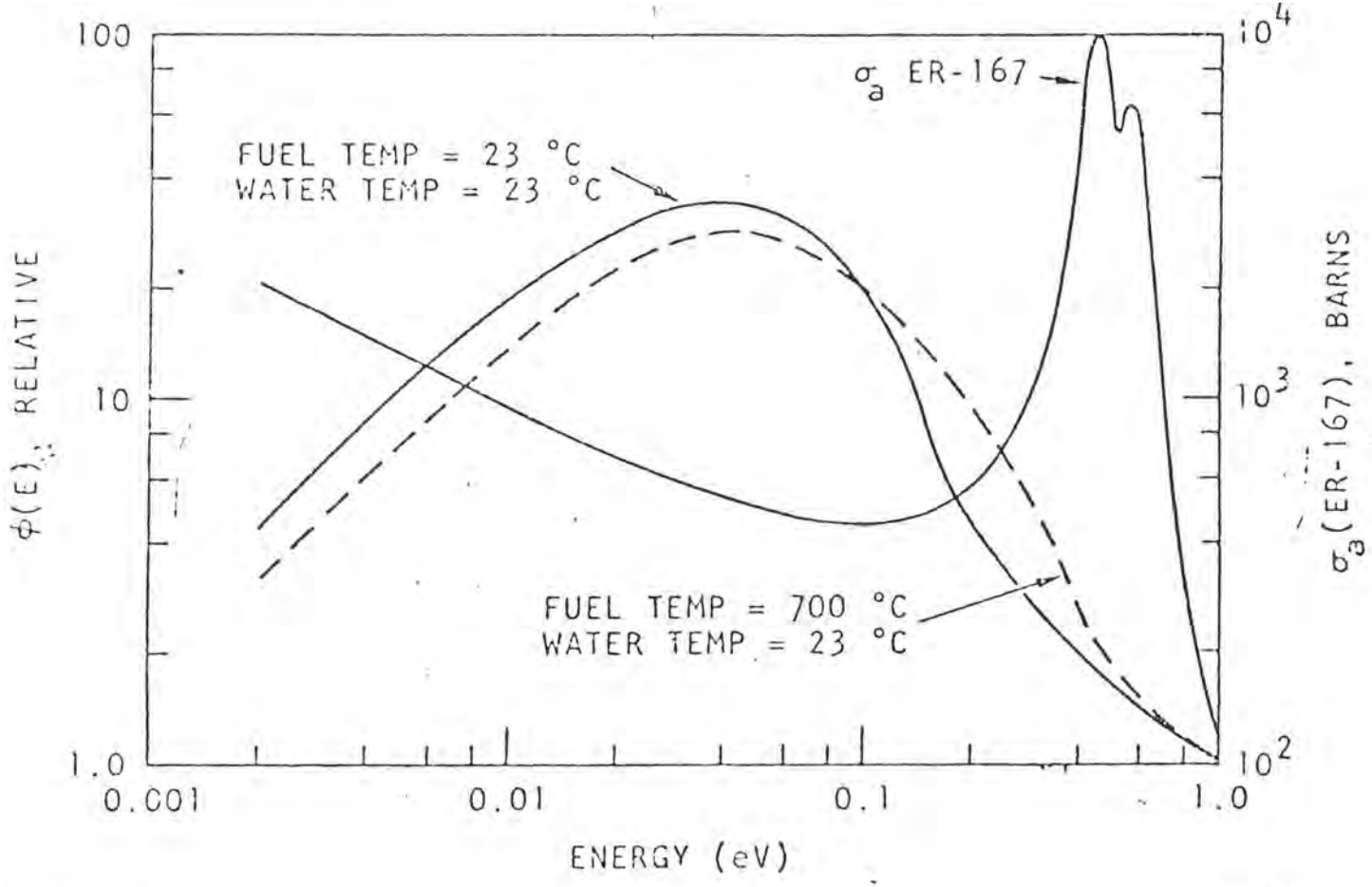
With the requirement for high fluxes combined with a high duty factor, it became important economically and from the point of view of operating efficiency to develop a fuel capable of a long operating lifetime. The FLIP* fuel is 8.5 wt-% uranium homogenously mixed with $ZrH_{1.6}$ as is the standard TRIGA fuel. However, the uranium in the FLIP fuel is enriched to 70% U-235 as compared with the 20% enrichment for standard fuel. To offset this increase in reactivity associated with the increased U-235 content, a burnable poison, erbium, is homogeneously dispersed in the fuel. The combination of the large U-235 loading and the burnable poison allows a high uranium burnup.

The prompt negative temperature coefficient for the TRIGA-FLIP fuel is based on the same core spectrum hardening characteristic that occurs in a standard TRIGA core. However, rather than possessing a temperature-dependent disadvantage factor (which is the main temperature coefficient component in a standard TRIGA core), the FLIP fuel uses the temperature hardened spectrum to decrease reactivity through its interaction with the low energy erbium resonances at 0.5 eV. (See Figure on reverse side.)

The erbium is used as both a burnable poison and as a material to enhance the prompt negative temperature coefficient. This is the first design and large scale test of a reactor system dependent almost entirely on a thermal spectrum shift into a low-lying resonance for inherent safety and control. The resulting temperature coefficient increases strongly with temperature, and averages out to be comparable with the more constant standard TRIGA fuel value of $-1 \times 10^{-4}/^{\circ}C$. For pulsing operation, the shorter neutron lifetime resulting from the heavier fuel loading gives a higher peak power and a shortened pulse width compared with a standard TRIGA core for the same reactivity insertion. TRIGA-FLIP fuel is designed to give a core life of 7 or 8 MW years.

---

*Fuel Lifetime Improvement Program



LC73227

EL-1128

TRIGA-FLIP Core--thermal neutron spectra vs fuel temperature relative to σ_a vs energy for Er-167

ATTACHMENT D

FORM NRC 250
(7-75)

NRC LICENSE NO.

THIS LICENSE EXPIRES 1 May 1979

United States of America
Nuclear Regulatory Commission

XSNM-1173

Pursuant to the Atomic Energy Act of 1954, as amended, and the Energy Reorganization Act of 1974 and the regulations of the Nuclear Regulatory Commission issued pursuant thereto, and in reliance on statements and representations heretofore made by the licensee, a license is hereby issued to the licensee authorizing the export of the materials and/or production or utilization facilities listed below, subject to the terms and conditions herein.

LICENSEE	ULTIMATE CONSIGNEE IN FOREIGN COUNTRY
NAME General Atomic Company P.O. Box 81608 ADDRESS San Diego, CA 92138 Attn: W. R. Mowry	NAME Korea Atomic Energy Research Institute ADDRESS P.O. Box 7, Cheong Ryang Seoul, Republic of Korea
INTERMEDIATE CONSIGNEE IN FOREIGN COUNTRY NAME NONE ADDRESS	OTHER PARTIES TO EXPORT NONE
APPLICANT'S REF NO IEL-834	COUNTRY OF ULTIMATE DESTINATION Korea

QUANTITY	DESCRIPTION OF MATERIALS OR FACILITIES
2.30 kilograms Uranium-235	Contained in 3.280 kilograms uranium, as fuel elements and control rods, enriched to 70 w/o maximum.
5.30 grams Uranium-235	Contained in 5.60 grams uranium, as fission chambers, enriched to 93 w/o maximum.

Conditions 3, 4, 5, 6, and 8 on page two of this license apply to this export.

////////////////////////////////////END////////////////////////////////

Neither this license nor any right under this license shall be assigned or otherwise transferred in violation of the provisions of the Atomic Energy Act of 1954, as amended and the Energy Reorganization Act of 1974.

This license is subject to the right of recapture or control by Section 108 of the Atomic Energy Act of 1954, as amended and to all of the other provisions of said Acts, now or hereafter in effect and to all valid rules and regulations of the Nuclear Regulatory Commission.

THIS LICENSE IS INVALID UNLESS SIGNED BELOW BY AUTHORIZED NRC REPRESENTATIVE

Michael A. Guhin, Assistant Director
Export/Import and International
Safeguards
Office of International Programs

DATE OF ISSUANCE _____

EXPORT LICENSE

U.S. NUCLEAR REGULATORY COMMISSION
EXPORT LICENSE

Conditions

License Number XSNM-1173

Condition 1 — Licensee shall file with the Customs Officer or the Postmaster two copies, in addition to those otherwise required, of the Shipper's Export Declaration covering each export and mark one of such copies for transmittal to the U.S. Nuclear Regulatory Commission, Washington, D.C. 20555. The following declaration should accompany or be placed on the Shipper's Export Declarations for such exports:

> "This shipment is being made pursuant to specific license number (**specific license number**) filed at (**location of Customs office where license is filed**), on (**date license was filed**). This license expires on (**expiration date of license**), and the unshipped balance remaining on this license is sufficient to cover the shipment described on this declaration."

Condition 2 — Exports authorized in any country or destination, except Country Groups Q, S, W, X, Y, and Z in Part 370, Supplement No. 1, of the Comprehensive Export Schedule of the U.S. Department of Commerce.

Condition 3 — This license covers only the nuclear content of the material.

Condition 4 — The material to be exported under this license shall be shipped in accordance with the physical protection requirements for special nuclear material in 10 CFR 73.

Condition 5 — Special nuclear material authorized for export under this license shall not be transported outside the United States in passenger-carrying aircraft in shipments exceeding (1) 20 grams or 20 curies, whichever is less, of plutonium or uranium 233, or (2) 350 grams of uranium 235.

Condition 6— This license authorizes export only and does not authorize the receipt, physical possession, or use of the nuclear material.

Condition 7 — The licensee shall complete and submit an NRC Form 741 for each shipment of source material exported under this license.

Condition 8 — The licensee shall advise the NRC in the event there is any change in the designation of the company who will package the nuclear material to be exported under this license, or any change in the location of the packaging operation, at least three weeks prior to the scheduled date of export.

Condition 9 - Shipments by air of 5 kgs or more of uranium-235 (contained in uranium enriched to 20% or more in the U-235 isotope) shall be scheduled with no planned intermediate stops after leaving the last terminal in the United States. In the event such a schedule is not possible, the licensee shall submit an alternative for the consideration and approval of the NRC prior to shipment to the Director, Office of International Programs, U.S. Nuclear Regulatory Commission, Washington, D.C., 20555.

EXPORT LICENSE

FORM NRC 250
(7-75)

NRC LICENSE NO.

XSNM-1207

THIS LICENSE EXPIRES 1 July 1979

United States of America
Nuclear Regulatory Commission

Pursuant to the Atomic Energy Act of 1954, as amended, and the Energy Reorganization Act of 1974 and the regulations of the Nuclear Regulatory Commission issued pursuant thereto, and in reliance on statements and representations heretofore made by the licensee, a license is hereby issued to the licensee authorizing the export of the materials and/or production or utilization facilities listed below, subject to the terms and conditions herein.

LICENSEE	ULTIMATE CONSIGNEE IN FOREIGN COUNTRY
NAME: General Atomic Company	NAME: Korea Atomic Energy Research Institute
ADDRESS: P.O. Box 81608 San Diego, CA 92138 Attn: W. R. Mowry	ADDRESS: P.O. Box 7, Cheong Ryang Seoul, Republic of Korea
INTERMEDIATE CONSIGNEE IN FOREIGN COUNTRY	**OTHER PARTIES TO EXPORT**
NAME: NONE ADDRESS:	NONE
APPLICANT'S REF NO: IEL-847	COUNTRY OF ULTIMATE DESTINATION: Korea

QUANTITY	DESCRIPTION OF MATERIALS OR FACILITIES
10.9 kilograms Uranium-235	Contained in 15.6 kilograms uranium, as fuel elements and control rods, enriched to 70 w/o maximum.

Conditions 3, 4, 5, 6, 8, and 9 on page two of this license apply to this export

//////////////////////////////////END//////////////////////////////////

Neither this license nor any right under this license shall be assigned or otherwise transferred in violation of the provisions of the Atomic Energy Act of 1954, as amended and the Energy Reorganization Act of 1974.

This license is subject to the right of recapture or control by Section 108 of the Atomic Energy Act of 1954, as amended and to all of the other provisions of said Acts, now or hereafter in effect and to all valid rules and regulations of the Nuclear Regulatory Commission.

THIS LICENSE IS INVALID UNLESS SIGNED BELOW BY AUTHORIZED NRC REPRESENTATIVE

DATE OF ISSUANCE _____

U.S. NUCLEAR REGULATORY COMMISSION

EXPORT LICENSE

Conditions

License Number XSNM-1207

Condition 1 — Licensee shall file with the Customs Officer or the Postmaster two copies, in addition to those otherwise required, of the Shipper's Export Declaration covering each export and mark one of such copies for transmittal to the U.S. Nuclear Regulatory Commission, Washington, D.C. 20555. The following declaration should accompany or be placed on the Shipper's Export Declarations for such exports:

> "This shipment is being made pursuant to specific license number (**specific license number**) filed at (**location of Customs office where license is filed**), on (**date license was filed**). This license expires on (**expiration date of license**), and the unshipped balance remaining on this license is sufficient to cover the shipment described on this declaration."

Condition 2 — Exports authorized in any country or destination, except Country Groups Q, S, W, X, Y, and Z in Part 370, Supplement No. 1, of the Comprehensive Export Schedule of the U.S. Department of Commerce.

Condition 3 — This license covers only the nuclear content of the material.

Condition 4 — The material to be exported under this license shall be shipped in accordance with the physical protection requirements for special nuclear material in 10 CFR 73.

Condition 5 — Special nuclear material authorized for export under this license shall not be transported outside the United States in passenger carrying aircraft in shipments exceeding (1) 20 grams or 20 curies, whichever is less, of plutonium or uranium-233, or (2) 350 grams of uranium 235.

Condition 6— This license authorizes export only and does not authorize the receipt, physical possession, or use of the nuclear material.

Condition 7 — The licensee shall complete and submit an NRC Form 741 for each shipment of source material exported under this license.

Condition 8 — The licensee shall advise the NRC in the event there is any change in the designation of the company who will package the nuclear material to be exported under this license, or any change in the location of the packaging operation, at least three weeks prior to the scheduled date of export.

Condition 9 - Shipments by air of 5 kgs or more of uranium-235 (contained in uranium enriched to 20% or more in the U-235 isotope) shall be scheduled with no planned intermediate stops after leaving the last terminal in the United States. In the event such a schedule is not possible, the licensee shall submit an alternative for the consideration and approval of the NRC prior to shipment to the Director, Office of International Programs, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555.

ATTACHMENT E

DEPARTMENT OF STATE

Washington, D.C. 20520

7720201

March 23, 1978

MEMORANDUM FOR LEE V. GOSSICK
NUCLEAR REGULATORY COMMISSION

Subject: Comments to NRC on Nuclear Export License Application

Your letter of August 1, 1977 requested the views of the Executive Branch on the issuance of a proposed licens for the export to the Republic of Korea of 2.30 kilograms of U-235 contained in 3.280 kilograms of uranium enriched to 70 percent U-235 in the form of fabricated fuel elemen

On the basis of the factors covered by the attached analysis, the Executive Branch has concluded that issuanc of the proposed license would not be inimical to the interests of the United States including the common defense and security and that the United States Government has th assurance that the recipient country is committed to providing adequate physical security for its nuclear program including a level of protection compatible with that envisaged by IAEA INFCIRC/225. The supply of this highly e riched uranium will be subject to all of the terms and co ditions of the Agreement for Cooperation between the Unit States and the Republic of Korea.

Peter Tarnoff
Executive Secretary

Attachments:

1. License Application Analysis
2. Letter from the Atomic Energy Bureau of the Republic of Korea dated September 2, 1977

ATTACHMENT F

~~LIMITED OFFICIAL USE~~

Department of State

INCOMING TELEGRAM

61

PAGE 01 SEOUL 05430 230949Z 6819 SEOUL 05430 230949Z

ACTION OES-07

INFO OCT-01 EA-10 ISO-00 ACDA-12 CIAE-00 INR-10 IO-13
L-03 NSAE-00 NSC-05 EB-08 NRC-05 SOE-02 DODE-00
DOE-15 SS-15 SP-02 CEQ-01 PM-05 /114 W
------------------027352 230954Z /10

P R 230811Z JUN 78
FM AMEMBASSY SEOUL
TO SECSTATE WASHDC PRIORITY 1557
DOE WASHDC PRIORITY
DOE GERMANTOWN PRIORITY
INFO AMEMBASSY TOKYO

LIMITED OFFICIAL USE SEOUL 5430

DEPT FOR OES/NET/RIC, D.H. COOPER

DOE FOR R. WILLIT

DEPT PASS NRC, J. LAFLEUR

E.O. 11652: N/A
TAGS: TECH ENRG KS
SUBJ: KAERI VIEWS ON DEMONSTRATION OF 20 PERCENT ENRICHED TRIGA FUEL

REF: STATE 151719

1. KOREA ATOMIC ENERGY RESEARCH INSTITUTE (KAERI) PRESIDENT HYUN, KYUNG-HO IS INTERESTED IN DEMONSTRATION OF PERFORMANCE AND ECONOMIC ASPECTS OF NEWLY DEVELOPED 20 PERCENT ENRICHED FUEL ELEMENTS IN FURTHERANCE OF SIMPLIFYING RESEARCH REACTOR FUELING PROBLEMS AND NON-PROLIFERATION GOALS.

2. AS A COUNTERPROPOSAL TO REFTEL (PARA. 4) GENERAL ATOMIC SUGGESTION THAT SIX TO EIGHT NEW 20 PERCENT ENRICHED ELEMENTS BE SUBSTITUTED FOR A LIKE NUMBER OF THE NINETY-SEVEN 70 PERCENT ENRICHED ELEMENTS ALREADY ON ORDER, HYUN IS PREPARED TO PLACE A NEW ORDER FOR AN ADDITIONAL SIX NEW-TYPE 20 PERCENT ENRICHED ELEMENTS IF GENERAL ATOMIC IS PREPARED TO SUPPLY INSTRUMENTATION TO COLLECT NECESSARY PERFORMANCE DATA.

3. SCHATT SUGGESTION THAT DEMONSTRATION IRRADIATION OF AS MANY AS TWELVE ADDITIONAL NEW 20 PERCENT ENRICHED ELEMENTS (TOTAL OF 18 NEW TYPE 20 PERCENT ELEMENTS IN THE CORE) WOULD GREATLY IMPROVE STATISTICAL RELIABILITY OF DEMONSTRATION WAS REGARDED AS AN UNDERTAKING OF JOINT RESEARCH PROGRAM PROPORTIONS WHICH WOULD INVOLVE TIME FOR NEGOTIATIONS CONCERNING COST-SHARING AND PROGRAM PLANNING. THEY ARE WILLING TO DISCUSS THIS KIND OF PROGRAM BUT FEEL THEIR INTERESTS ARE BEST SERVED NOW IF THE TRIGA MARK III CAN BE REFUELED FOR OPERATION AS SOON AS POSSIBLE.

4. THE KAERI MARK III TRIGA CORE PLATE HAS 121 HOLES WHICH ARE UTILIZED AS FOLLOWS: FUEL ELEMENTS, 114 HOLES; ION CHAMBERS, 3 HOLES; CENTRAL THIMBLE, 1 HOLE; IRRADIATION FACILITY, 1 HOLE; PNEUMATIC IRRADIATION FACILITY, 1 HOLE; PNEUMATIC CONTROL ROD (NOT, REPEAT NOT A FUEL FOLLOWER CONTROL ROD), 1 HOLE. IT SHOULD BE NOTED THAT THE REACTOR NORMALLY OPERATES WITH 4 FUEL-FOLLOWER CONTROL RODS IN THE CORE, ALL OF WHICH OCCUPY FUEL ELEMENT HOLES.

5. KAERI'S RECENT 70 PERCENT ENRICHED FUEL ELEMENT ORDERS INCLUDE: FIRST ORDER: 10 FUEL ELEMENTS (FE) AND 5 FUEL FOLLOWER CONTROL RODS (FFCR). SECOND ORDER: 15 FE AND 2 FFCR. THIRD ORDER: 75 FE AND 5 FFCR. BECAUSE REACTOR WILL OPERATE WITH ONLY 4 FFCR, IN CORE AND ALL 100 FE IN CORE, A TOTAL OF 104 FUEL ELEMENT HOLES ARE FILLED. THIS LEAVES 10 CORE PLATE HOLES OPEN. EIGHT FFCR'S WOULD NOT BE IN THE CORE.

6. THE NEW-TYPE 20 PERCENT ENRICHED ELEMENTS WOULD OCCUPY SIX OF THE TEN (114 MINUS 104) UNOCCUPIED FUEL ELEMENT HOLES. KAERI FEELS THERE IS A LIMITED ECONOMIC RISK (COST OF RADIOACTIVITY CLEANUP FOLLOWING FUEL CLAD RUPTURE) INVOLVED IN DEMONSTRATING PERFORMANCE OF THE NEW-TYPE 20 PERCENT ENRICHED FUEL, PARTICULARLY FOR PULSED OPERATION AND WOULD APPRECIATE RECEIVING APPROPRIATE DATA.

7. KAERI HOPES TO RECEIVE ALL ORDERED FUEL ASAP.
STERN

~~LIMITED OFFICIAL USE~~

Department of State

OUTGOING TELEGRAM

62

PAGE 01 STATE 151719 8419 STATE 151719

ORIGIN OES-07

INFO OCT-01 EA-10 ISO-00 ACDA-12 CIAE-00 INR-10 IO-13
L-03 NSAE-00 NSC-05 EB-08 NRC-05 SOE-02 DODE-00
DOE-15 SS-15 SP-02 CEQ-01 PM-05 /114 R

DRAFTED BY OES/NET/EIC: D B HOYLE:SMJ
APPROVED BY OES/NET/EIC: D B HOYLE
ACDA: R WILLIAMSON
DOE/IA: S CEJA
EA/K: F MISCH

----------065751 150730Z /21

P 150009Z JUN 78
FM SECSTATE WASHDC
TO AMEMBASSY SEOUL

LIMITED OFFICIAL USE STATE 151719

E.O. 11652: N/A

TAGS: TECH, ENRG, KS

SUBJECT: FUEL FOR KORR-2 RESEARCH REACTOR

REF: STATE 88681

1. ON MAY 9 EXECUTIVE BRANCH RECOMMENDED TO NRC THAT TWO EXPORT LICENCES BE ISSUED FOR TOTAL OF 107 TRIGA FLIP-TYPE ELEMENTS ENRICHED TO 70 U-235 FOR USE IN KORR-2 REACTOR. NO ACTION HAS BEEN TAKEN ON THIS RECOMMENDATION BY NRC TO DATE.

2. IN LATE MAY, AT VIENNA MEETING OF IAEA ADVISORY GROUP ON RESEARCH REACTOR RENEWAL AND UPGRADING PROGRAM, GENERAL ATOMIC ISSUED STATEMENT THAT IT HAD DEVELOPED AND WAS PREPARED TO MAKE IMMEDIATELY AVAILABLE URANIUM ZIRCONIUM HYDRIDE FUEL ENRICHED TO 20 U-235 AS SUBSTITUTE FOR TRIGA FUEL PRESENTLY ENRICHED TO EITHER 70 OR 93 U-235. THIS EXCHANGE IS POSSIBLE BY INCREASING THE URANIUM CONTENT OF TRIGA FUEL FROM THE PREVIOUS 12 WEIGHT PERCENT TO EITHER 30 OR 45 WEIGHT PERCENT. THE LOWER ENRICHED FUEL SHOULD HAVE ESSENTIALLY THE SAME COST AND PERFORMANCE AS PRESENT 70 ENRICHED FUEL.

3. GENERAL ATOMIC'S DEVELOPMENT OF THIS FUEL WAS IN RESPONSE TO USG PROGRAM TO REDUCE UTILIZATION OF HIGHLY ENRICHED URANIUM AS RAPIDLY AS POSSIBLE TO LOWEST FEASIBLE LEVEL. AND WORK WAS PARTIALLY FUNDED BY DOE UNDER PROGRAM DESCRIBED IN REFTEL. AS CHAIRMAN OF WORKING GROUP 8, GROUP C, OF INFCE ON RESEARCH REACTORS, WE BELIEVE THAT ROK SHOULD HAVE A SPECIAL INTEREST IN THIS DEVELOPMENT.

4. GENERAL ATOMIC WILL BE CONTINUING TESTS OF THE NEW LOW ENRICHED FUEL IN SEVERAL IRRADIATION FACILITIES, BUT WE BELIEVE THAT FURTHER EARLY DEMONSTRATION WOULD BE HIGHLY DESIRABLE. WE HAVE INFORMALLY DISCUSSED WITH GENERAL ATOMIC THE POSSIBILITY OF ITS PROVIDING SOME OF THESE NEW 20 ENRICHED ELEMENTS IN LIEU OF THE 70 ELEMENTS COVERED BY THE PRESENT EXPORT LICENSE APPLICATIONS. GENERAL ATOMIC BELIEVES THAT, WITH KAERI AGREEMENT, IT COULD SUBSTITUTE WITH LITTLE OR NO ADDITIONAL COST, SOME SIX TO EIGHT OF THE NEW 20 ENRICHED ELEMENTS FOR 70 ENRICHED ELEMENTS PROVIDED FOR IN THE CURRENT CONTRACT. IF IT WERE TO DO SO, GENERAL ATOMIC BELIEVES THAT ONE OR TWO OF THESE ELEMENTS WOULD BE INSTRUMENTED TO OBTAIN MAXIMUM DATA FROM THE TEST. IN ORDER TO IMPROVE STATISTICAL RELIABILITY, DOE BELIEVES IT WOULD BE PREFERABLE TO INCREASE THE NUMBER OF 20 ELEMENTS IN KORR-2 TO AT LEAST TWELVE (PERHAPS MORE) AND IS AGREED TO EXPLORE MEANS BY WHICH THESE ADDITIONAL ELEMENTS MIGHT BE MADE AVAILABLE AT COMPARABLE COST TO KOREA. WE WOULD, OF COURSE, WISH TO SEE ALL OF THESE 20 ELEMENTS INSERTED IN THE REACTOR AT THE EARLIEST FEASIBLE DATE.

5. BEFORE FURTHER EFFORTS ARE EXPENDED TO DEVELOP SUCH A DEMONSTRATION OF 20 ENRICHED TRIGA FUEL, WE WOULD LIKE EMBASSY TO SOUND OUT KOREANS TO DETERMINE WHETHER THEY ARE PREPARED TO COOPERATE IN PRINCIPLE, STRESSING IMPORTANT CONTRIBUTIONS WHICH COLLABORATION BETWEEN OUR TWO COUNTRIES COULD MAKE TOWARD INFCE. IF SO, WE COULD THEN PROCEED TO WORK OUT CONTRACTUAL, TECHNICAL AND ECONOMIC DETAILS. REQUEST THAT KAERI BE APPROACHED ON THIS MATTER AND ITSREACTION REPORTED SOONEST. YOU MAY ASSURE KAERI CONTACTS THAT THEIR AGREEMENT TO PARTICIPATE IN SUCH A DEMONSTRATION SHOULD IN NO WAY SLOW DOWN DELIVERY OF 70 FUEL NEEDED FOR OPERATION OF KORR-2 AND COULD, IN FACT, HAVE A FAVORABLE IMPACT ON NRC CONSIDERATION OF THE PENDING EXPORT LICENSE APPLICATIONS. CHRISTOPHER