



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
REGION III  
801 WARRENVILLE ROAD  
LISLE, ILLINOIS 60532-4351

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JUL 20 2000

Susan M. Langhorst, Ph.D.  
Radiation Safety Officer  
Curators of the University  
of Missouri  
311 Jesse Hall  
Columbia, MO 65211

**SUBJECT:                   RESPONSE TO YOUR REQUEST FOR APPROVAL REGARDING  
DISPOSAL OF INCINERATOR ASH AT UNIVERSITY OF MISSOURI-  
COLUMBIA, COLUMBIA, MISSOURI (LICENSE NO. 24-00513-32)**

Dear Dr. Langhorst:

As requested in your letter, dated August 26, 1999, NRC staff of the Office of Nuclear Material Safety and Safeguards (NMSS) conducted a review of additional information on a proposed license amendment application by the University of Missouri to allow disposal of Incinerator ash at an increased concentration of Carbon-14 (<sup>14</sup>C) in a municipal landfill. In a letter, dated July 29, 1999, NRC staff did not approve the licensee's request for an increased concentration for disposal of <sup>14</sup>C because you had failed to adequately justify that the proposed increased limit was appropriate. In that letter, NRC staff stated that the licensee could conduct a specific study and submit the results to justify the increased disposal limit. In a letter to NRC, dated August 26, 1999, the licensee provided additional information to justify the proposed amendment.

NRC staff reviewed the additional information provided by the licensee and concludes that it does not provide adequate justification to increase the disposal concentration of <sup>14</sup>C in the ash. The licensee has failed to provide an acceptable assessment of potential doses to members of the public from the proposed disposal limit. Pursuant to 10 CFR 20.2002 (d), the licensee must provide "analyses and procedures to ensure that doses are maintained ALARA and within the dose limits in this part." Therefore, the licensee must demonstrate, through specific "analyses and procedures" (e.g., dose modeling), that disposal of the subject incinerator ash at the proposed concentration and quantities are maintained ALARA and within the dose limits of 10 CFR Part 20.

Please note that it is not clear whether the State of Missouri regulations for the disposal of ash in public landfills would preclude the disposal of the radioactively-contaminated ash. The licensee should be prepared to demonstrate that NRC approval of this request would not result in a violation of Missouri solid waste disposal regulations and that all appropriate regulatory authorities have approved the disposal and that the landfill authority is aware of, and has agreed in writing to receive the material. In the absence of such demonstrations, any license amendment should be appropriately conditioned to address these matters.

Information in this record was deleted  
in accordance with the Freedom of Information  
Act, exemptions 2  
FOIA- 2005-0293

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NOV 28 2000

Susan M. Langhorst, Ph.D., CHP  
Radiation Safety Officer  
The Curators of the University of Missouri  
311 Jesse Hall  
Columbia, MO 65211

Dear Dr. Langhorst:

Enclosed is Amendment No. 93 to your NRC Material License No. 24-00513-32 in accordance with your request. Please note that the changes made to your license are printed in bold font.

Please review the enclosed document carefully and be sure that you understand all conditions. If there are any errors or questions, please notify the U.S. Nuclear Regulatory Commission, Region III office at (630) 829-9887 so that we can provide appropriate corrections and answers.

Sincerely,

A handwritten signature in cursive script, appearing to read "Cassandra F. Frazier".

Cassandra F. Frazier, Senior Health Physicist  
Materials Licensing Branch

License No. 24-00513-32  
Docket No. 030-02278

Enclosure: Amendment No. 93

**MATERIALS LICENSE**

Pursuant to the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974 (Public Law 93-438), and Title 10, Code of Federal Regulations, Chapter I, Parts 30, 31, 32, 33, 34, 35, 39, 40 and 70, and in reliance on statements and representations heretofore made by the licensee, a license is hereby issued authorizing the licensee to receive, acquire, possess, and transfer byproduct, source, and special nuclear material designated below; to use such material for the purpose(s) and at the place(s) designated below; to deliver or transfer such material to persons authorized to receive it in accordance with the regulations of the applicable Part(s). This license shall be deemed to contain the conditions specified in Section 183 of the Atomic Energy Act of 1954, as amended, and is subject to all applicable rules, regulations and orders of the Nuclear Regulatory Commission now or hereafter in effect and to any conditions specified below.

PC 02110

308083

Licensee

In accordance with the letter dated  
September 26, 2000,

- 1. The Curators of the University of Missouri
- 2. 311 Jesse Hall  
Columbia, MO 65211

3. License number 24-00513-32 is amended in its entirety to read as follows:

4. Expiration date July 31, 2003

5. Docket No. 030-02278  
Reference No.

6. Byproduct, source, and/or special nuclear material

7. Chemical and/or physical form

8. Maximum amount that licensee may possess at any one time under this license

S NUCLEAR R

A.

B.

C.

D.

E.

F.

G. Hydrogen-3

G. Any

G. 15 curies

H.

I. Technetium-99m

I. Any

I. 6 curies

J. Gold-198

J. Any

J. 1 curie

K. Polonium-210

K. Any

K. 5 millicuries

L. Neptunium-237

L. Any

L. 2 millicuries

M. Americium-241

M. Any

M. 5 millicuries

Ex 2  
Ex 2  
Ex 2

Ex 2

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6. Byproduct, source, and/or special nuclear material

7. Chemical and/or physical form

8. Maximum amount that licensee may possess at any one time under this license

N. Phosphorus-32

N. Any

N. 5 curies

P. [

Ex 2

P. Americium-241

P. Sealed source

P. 10 sources not to exceed 100 millicuries each, total not to exceed 600 millicuries

Q. Americium-241

Q. Sealed source

4 sources not to exceed 50 millicuries each, total of 200 millicuries

R. Americium-241/Cesium-137

R. Sealed source

R. 4 sources not to exceed 50 millicuries Am-241 and 10 millicuries Cs-137 each, total of 200 millicuries Am-241 and 40 millicuries Cs-137

S. Americium-241

S. Sealed source

S. 300 millicuries

T. Curium-244

T. Calibration source

T. 2 sources not to exceed 0.001 millicuries, total not to exceed 0.002 millicuries

U. Americium-241

U. Sealed source

U. 12 sources not to exceed 50 millicuries each, total not to exceed 600 millicuries

V. Americium-241

V. Sealed source

V. 5 sources not to exceed 10 millicuries each, total not to exceed 50 millicuries

W. Americium-241

W. Sealed source

W. 15 millicuries

X. Americium-241

X. Sealed source

X. 14 millicuries

Y. Americium-241

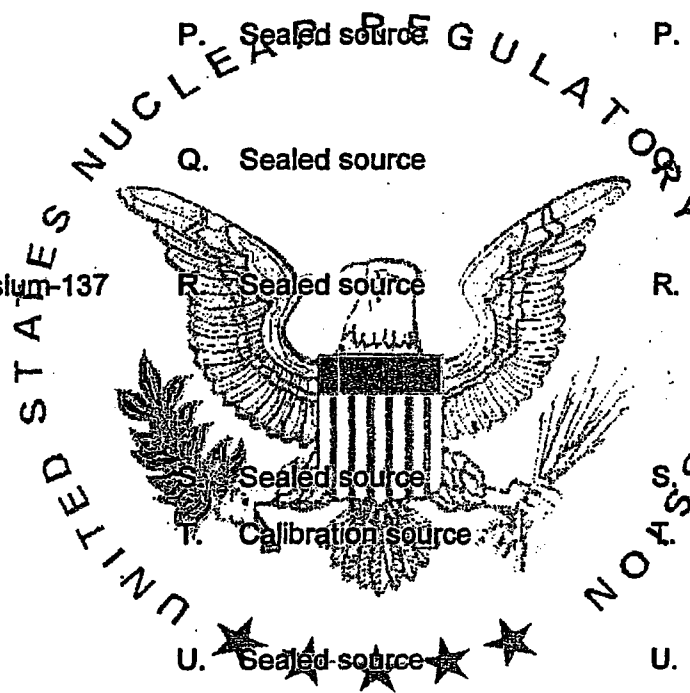
Y. Sealed source

Y. 200 millicuries

Z. Uranium (Natural)

Z. Sub-Critical Assembly Slugs in Aluminum Cans

Z. 2500 kilograms



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6. Byproduct, source, and/or special nuclear material

7. Chemical and/or physical form

8. Maximum amount that licensee may possess at any one time under this license

AA. Uranium (Natural)

AA. Any

AA. 250 kilograms

BB. Thorium (Natural)

BB. Any

BB. 250 kilograms

CC.

DD. Uranium (Depleted)

DD. Any

DD. 250 kilograms

EE. Californium-252

EE. Sealed source

EE. Total not to exceed 19.0 micrograms

FF. Strontium-90

FF. Sealed source

FF. 500 millicuries

GG. Hydrogen-3

GG. Waste Storage/Processing

GG. 8 curies

HH.

II. Gadolinium-153

II. Sealed sources (North American Scientific, Inc. Model MED 3601)

II. 12 sources, not to exceed 250 millicuries each, 3 curies total

JJ. Cesium-137

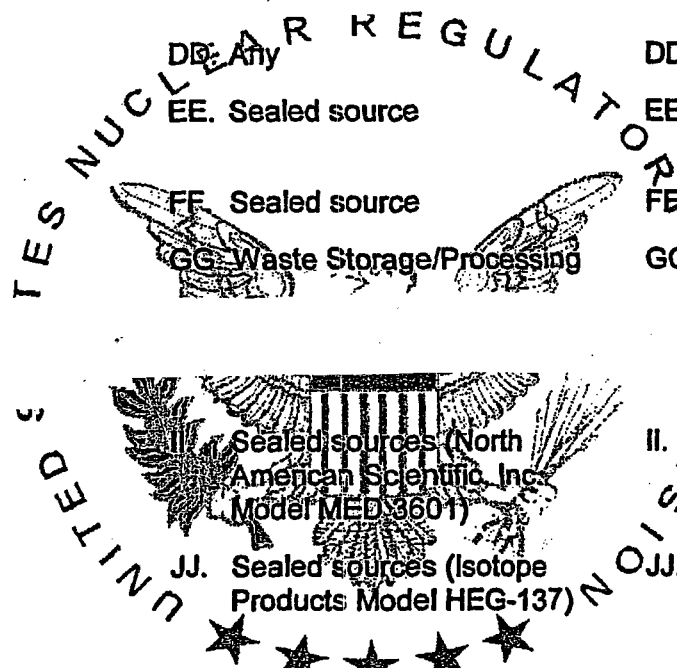
JJ. Sealed sources (Isotope Products Model HEG-137)

JJ. 8 sources, not to exceed 30 millicuries each, 240 millicuries total

KK. Uranium (depleted in uranium-235)

KK. Stainless steel covered metal

KK. 4 shields, not to exceed 12 kilograms each



9. Authorized Use:

- A. Any uptake, dilution and excretion procedure approved in 10 CFR 35.100.
- B. Any imaging and localization procedure approved in 10 CFR 35.200.
- C. Any radiopharmaceutical therapy procedure approved in 10 CFR 35.300.
- D. Any brachytherapy procedure approved in 10 CFR 35.400.

Ex 2

Ex 2

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- E. Medical use of sealed sources included in 10 CFR 35.500 in compatible devices registered pursuant to 10 CFR 30.32(g).
- F. through N., AA., BB., DD., and EE. Research and development as defined in Section 30.4 of 10 CFR Part 30, Instrument calibration and Student Instruction.
- O. Sealed sources to be used in <sup>Ex 2</sup> for calibration and density measurements and for medical and veterinary medical brachytherapy use. <sup>Ex 3</sup>
- P. To be used in Troxler Electronics Labs, Inc., Model 1257 soil moisture/density gauge.
- Q. To be used in Troxler Electronics Labs, Inc., Model 1257 soil moisture/density gauge.
- R. To be used in Troxler Electronics Labs, Inc., Model 1403 and Model 3411B soil moisture/density gauges.
- S. To be used for laboratory moisture/density measurement of soil samples Amersham/Searly in a type X-92 capsule.
- T. Electroplated calibration sources to be used in an E.G. & G Model Let-SE 1/2 counter.
- U. To be used in Campbell Pacific Nuclear Model MC-M moisture gauges (CPN-131).
- V. To be used in Troxler Electronics 3220 series moisture gauges, Troxler Drawing No. A-102700.
- W. To be used in a Siemens Model SS10244 anatomical marker Amersham Model AMC24, also for calibration and research.
- X. To be used in a Siemens Model 035-423000 Dual Isotopic Motion Correction Point Source Holder, Amersham Model AMC24, also for calibration and research.
- Y. To be used for research, development and evaluation of a prototype device for testing utility poles at temporary job sites throughout the State of Missouri and outside of Missouri in NRC-regulated states; Amersham/Searle in a type X-92 capsule, AMC-26X108-3675LV.
- Z. To be used in a sub-critical light-water-moderated assembly for student instruction and research.
- CC. To be used for laboratory research, student instruction and instrument calibration.
- FF. To be used in Tracer Lam model 772 for veterinary medical therapy.
- GG. and HH. Short term waste inventory for including waste materials transferred from other licenses issued to the Curators of the University of Missouri.

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- II. Six sources to be used in Adac Laboratories Transmission Line Source Housing VANTAGE devices for medical radiography in humans. Six sources in shipping containers for replacement of the sources.
- JJ. Four sources to be used in ADAC Laboratories MCD-AC attenuation correction system for medical radiography in humans. Four sources in shipping containers for replacement of the sources.
- KK. Shielding in ADAC Laboratories MCD-AC attenuation correction system.

- NUCLEAR REGULATORY COMMISSION**  
**CONDITIONS**
10. Licensed material may be used at the licensee's facilities located at The University of Missouri-Columbia, Missouri Columbia campus and facilities throughout the State of Missouri and at temporary job sites of the licensee anywhere in the United States where the U.S. Nuclear Regulatory Commission maintains jurisdiction for regulating the use of licensed material.
11. The Radiation Safety Officer for this license is Susan M. Langhorst, Ph.D.
12. A. The use of licensed material in or on humans shall be by a physician, dentist, or podiatrist as defined in 10 CFR 85.2.
- B. Physicians, dentists, or podiatrists designated to use licensed material in or on humans shall meet the training criteria established in 10 CFR 35. Subpart J and shall be designated by the licensee's Radiation Safety Committee. The licensee shall maintain records of individuals designated as users for three years after the individual's last use of licensed material.
- C. Licensed material for other than human use shall be used by or under the supervision of individuals designated by the Radiation Safety Committee. The licensee shall maintain records of individuals designated as users for three years after the individual's last use of licensed material.
13. In addition to the possession limits in Item 8, the licensee shall further restrict the possession of licensed material, except for licensed material included in Attachment C of application dated February 28, 1992, to quantities below the limits specified in 10 CFR 30.72 which require consideration of the need for an emergency plan for responding to a release of licensed material.
14. A. Sealed sources and detector cells shall be tested for leakage and/or contamination at intervals not to exceed 6 months or at such other intervals as specified by the certificate of registration referred to in 10 CFR 32.210.
- B. Notwithstanding Paragraph A of this Condition, sealed sources designed to emit alpha particles shall be tested for leakage and/or contamination at intervals not to exceed 3 months.

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- C. In the absence of a certificate from a transferor indicating that a leak test has been made within 6 months prior to the transfer, a sealed source or detector cell received from another person shall not be put into use until tested.
- D. Sealed sources need not be leak tested if:
- (i) they contain only hydrogen-3; or
  - (ii) they contain only a radioactive gas; or
  - (iii) the half-life of the isotope is 30 days or less; or
  - (iv) they contain not more than 100 microcuries of beta and/or gamma emitting material or not more than 10 microcuries of alpha emitting material; or
  - (v) they are not designed to emit alpha particles, are in storage, and are not being used. However, when they are removed from storage for use or transferred to another person, and have not been tested within the required leak test interval, they shall be tested before use or transfer. No sealed source or detector cell shall be stored for a period of more than 10 years without being tested for leakage and/or contamination.
- E. The leak test shall be capable of detecting the presence of 0.005 microcurie of radioactive material on the test sample. Records of leak test results shall be kept in units of microcuries and shall be maintained for inspection by the Commission. If the test reveals the presence of 0.005 microcurie or more of removable contamination, a report shall be filed with the U.S. Nuclear Regulatory Commission and the source shall be removed immediately from service and decontaminated, repaired, or disposed of in accordance with Commission regulations. The report shall be filed within 5 days of the date the leak test result is known with the U.S. Nuclear Regulatory Commission, Region III, 801 Warrenville Road, Lisle, Illinois 60532-4351, ATTN: Chief, Nuclear Materials Safety Branch. The report shall specify the source involved, the test results, and corrective action taken. Records of leak test results shall be kept in units of microcuries and shall be maintained for inspection by the Commission. Records may be disposed of following Commission inspection.
- F. Tests for leakage and/or contamination shall be performed by the licensee or by other persons specifically licensed by the Commission or an Agreement State to perform such services.
15. Pursuant to 10 CFR Part 40, "Domestic Licensing of Source Material," the licensee is authorized to possess, use, transfer, and import up to 999 kilograms of depleted uranium contained as shielding material.



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16. The licensee shall conduct a physical inventory every 3-months to account for all sources and/or devices received and possessed pursuant to 10 CFR 35.59, 10 CFR 35.400 and 10 CFR 35.500 and every 6 months for all other sources and/or devices. Records of inventories shall be maintained for 5 years from the date of each inventory, and shall include the information required in 10 CFR 35.59(g).
17. A. Detector cells containing a titanium tritide foil or a scandium tritide foil shall only be used in conjunction with a properly operating temperature control mechanism which prevents the foil temperature from exceeding that specified by the manufacturer and approved by U.S. Nuclear Regulatory Commission.
- B. When in use, detector cells containing a titanium tritide foil or a scandium tritide foil shall be vented to the outside.
18. In lieu of using the conventional radiation caution colors (magenta or purple on yellow background) as provided in 10 CFR 20.203(a)(1), the licensee is hereby authorized to label detector cells, containing licensed material and used in gas chromatography devices, with conspicuously etched or stamped radiation caution symbols.
19. Sealed sources or detector cells containing licensed material shall not be opened or sources removed from source holders by the licensee.
20. The licensee is authorized to hold radioactive material with a physical half-life of less than 65 days, and those isotopes listed in Table 11-A1 application dated February 28, 1992, for decay-in-storage before disposal in ordinary trash provided:
- A. Radioactive waste to be disposed of in this manner shall be held for decay a minimum of 10 half-lives.
- B. Before disposal as ordinary trash, byproduct material shall be surveyed at the container surface with the appropriate meter set on its most sensitive scale and with no interposed shielding to determine that its radioactivity cannot be distinguished from background. All radiation labels shall be removed or obliterated.
- C. Generator columns shall be segregated so that they may be monitored separately to ensure decay to background levels prior to disposal.
- D. A record of each disposal permitted under this License Condition shall be retained for 3 years. The record must include the date of disposal, the date on which the byproduct material was placed in storage, the radionuclides disposed, the survey instrument used, the background dose rate, the dose rate measured at the surface of each waste container, and the name of the individual who performed the disposal.
- E. Radioactive waste being held for decay shall not be stored for a period greater than 4 years.

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21. Radioactive waste other than that specified in Condition 20. shall not be stored for a period greater than 2 years.
22. Radioactive waste currently possessed exceeding the storage provisions of Condition 20.E., and 21. shall be disposed of within one year of the issuance of this license.
23. Notwithstanding Conditions 20. and 21., radioactive waste transferred from other University of Missouri Licenses shall be disposed of within one year of receipt.
24. Pursuant to 10 CFR 20.1302 and 10 CFR 20.2002, the licensee is authorized to dispose of licensed material by incineration provided the gaseous effluent from incineration does not exceed the limits specified for air in Appendix B, Table II, 10 CFR Part 20.
25. The licensee shall not use licensed material in or on human beings except as provided otherwise by specific condition of this license.
26. Experimental animals, or the products from experimental animals, that have been administered licensed materials shall not be used for human consumption.
27. The licensee shall not acquire licensed material in a sealed source or device that contains a sealed source unless the source or device has been registered with the U.S. Nuclear Regulatory Commission under 10 CFR 32.210 or with an Agreement State.
28. The licensee is authorized to transport licensed material only in accordance with the provisions of 10 CFR Part 71, "Packaging and Transportation of Radioactive Material."
29. The licensee shall maintain records of information related to decommissioning at 311 Jesse Hall, Columbia, Missouri as specified in 10 CFR 30.35(g) until this license is terminated by the Commission.
30. Pursuant to 10 CFR 20.2002, the licensee may dispose of incinerator ash containing radioactive materials with Atomic Nos. 1-83, other than those isotopes listed below, as ordinary waste in a landfill, provided the concentrations of the isotopes, expressed in  $\mu\text{Ci}$  per gram of ash, at the time of disposal, do not exceed the numerical values listed in Table II, Column 2, 10 CFR 20, Appendix B. Isotopes not included are hydrogen-3, carbon-14, aluminum-26, chlorine-36, silver-108m, niobium-94, iodine-129, technetium-99, and thallium-204, for which the concentrations must not exceed 10 percent of the values listed in Table II, Column 2, 10 CFR Part 20, Appendix B.
31. Pursuant to 10 CFR 20.2002, the licensee may incinerate tritium waste without the requirement for removing any ash previous to or following tritium waste incineration, provided the ash is not used for the dilution of subsequently incinerated waste containing other licensed materials.
32. The licensee is authorized to receive and analyze samples containing byproduct material only from its research and development, and student instructions activities, as described in letters dated July 17, 1997 and November 14, 1997.

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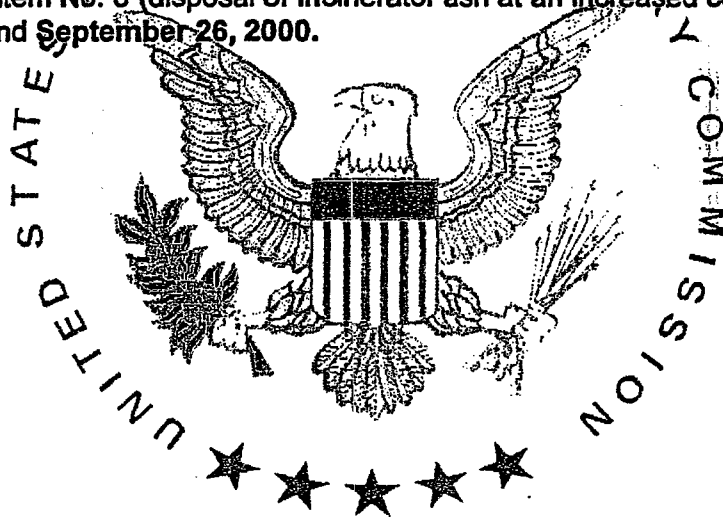
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33. Except as specifically provided otherwise in this license, the licensee shall conduct its program in accordance with the statements, representations, and procedures contained in the documents, including any enclosures, listed below, except for minor changes in the medical use radiation safety procedures as provided in 10 CFR 35.31. The U.S. Nuclear Regulatory Commission's regulations shall govern unless the statements, representations, and procedures in the licensee's application and correspondence are more restrictive than the regulations.

A. Application dated February 28, 1992; and

B. Letters dated June 5, 1992 (except reference to disposal of ash residue and Section E.3.a, Items No. ii, iii, and iv), June 30, 1992, June 27, 1995, December 6, 1995, March 7, 1996, October 23, 1996, March 12, 1997, July 17, 1997 (excluding Item No. 7 and excluding Item No. 8 (disposal of incinerator ash at an increased concentration limit of C-14)), November 14, 1997 (excluding Item No. 7 and excluding Item No. 8 (disposal of incinerator ash at an increased concentration limit of C-14)), April 29, 1998, and September 26, 2000.



FOR THE U.S. NUCLEAR REGULATORY COMMISSION

Date NOV 28 2000

By Cassandra F. Frazier  
Cassandra F. Frazier  
Materials Licensing Branch  
Region III