Form NRC-374T (7-75)

U.S. NUCLEAR REGULATORY COMMISSION
MATERIALS LICENSE

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Amendment No. 11

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 1, Parts 30, 31, 32, 33, 34, 35, 36, 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); and to import such byproduct and source material. 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.

Licensee	
1. Curators of the University of Missouri c/o Radiation Safety Office 2. 413 Clark Hall Columbia, Missouri 65211	In accordance with letter dated April 28, 1980 3. License number 24-00513-35 is amended in its entirety to read as follows:
	4. Expiration date September 30, 1985
	5. Docket or Reference No. 03 000303

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
A. Cobalt 60	A. Teletherapy sealed sources (AECL Model C-146 or C-151 or Neutron Products, Inc. Model NPI-20-6000W or NPI-20-6600W)	A. 14400 curies (2 sources of not more than 7200 curies each)

9. Authorized use

A. One source to be used in an AECL Theratron 80 teletherapy unit for the treatment of humans. One source in its shipping container to be in possession of the licensee as necessary to the replacement of the source in the teletherapy unit only.

CONDITIONS

10. Licensed material shall be used only at the [redacted] University of Missouri Medical Center, Radiation Therapy Department, Columbia, Missouri.

11. The licensee shall comply with the provisions of Title 10, Chapter 1, Code of Federal Regulations, Part 19, "Notices, Instructions and Reports to Workers; Inspections" and Part 20, "Standards for Protection Against Radiation."

12. Licensed material shall be used by, or under the supervision of, physicians (as defined in 10 CFR Part 35.3(b)) who are certified by the American Board of Radiology in Radiology or Therapeutic Radiology and who have been designated by the University's Central Radiation Safety Committee and by its Human Use Subcommittee.

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Supplementary Sheet

License Number 24-00513-35
Amendment No. 11

13. The teletherapy facility shall be provided with a system permitting continuous observation of the patient from outside the treatment room, during patient irradiation.

14. A. Teletherapy sources shall be tested for leakage at intervals not to exceed six months. Records of test results shall be kept in units of microcuries and maintained for inspection by the Commission. In the absence of a certificate from a transferor indicating that a test has been made within six months prior to the transfer, the source shall not be used until tested for leakage.

B. The test shall be sufficiently sensitive to detect 0.05 microcurie of contamination on the test sample.

C. The test sample shall be taken from selected accessible surfaces of the teletherapy head. The selected accessible surfaces should be those surfaces on which one might expect contamination (if there were to be leakage) to accumulate and shall include the inner surface of the most frequently used treatment cones or beam collimating device. The test sample shall be taken with the source in the "off" position.

D. If the test reveals the presence of 0.05 microcurie or more of removable contamination, the licensee shall promptl take action to prevent spread of contamination and shall file a report within five days of the test with the Materials Branch, Division of Materials and Fuel Cycle Facility Licensing, U. S. Nuclear Regulatory Commission, Washington, D. C. 20555, describing the test results and the corrective action taken. A copy of such report shall also be sent to the Director of the appropriate Nuclear Regulatory Commission Regional Office of Inspection and Enforcement listed in Appendix D of 10 CFR 20.

15. Prior to initiation of a treatment program, each teletherapy unit shall be equipped with electrical or mechanical stops limiting use of the primary beam of radiation so as to assure compliance with § 20.105(b) of 10 CFR 20, "Standards for Protection Against Radiation," as evidenced by a radiation survey. Necessary use restrictions shall be fully described in radiation survey reports submitted in accordance with Condition No. 18.

16. A set of written emergency instructions shall be posted at the teletherapy machine control. These instructions shall inform the machine operator of the procedure to be followed should he be unable to turn the machine's primary beam of radiation "off" with the controls outside the treatment room.

17. A. Access to the teletherapy room shall be controlled by a door at each entrance. Such doors shall be normally closed.

B. Each entrance to the teletherapy room shall be equipped with an electrical interlock system that will turn the teletherapy machine's primary beam of radiation off immediately upon opening of any entrance door. The interlock system shall be connected in such a manner that the teletherapy machine's primary beam of radiation cannot be turned on until all treatment room entrance doors are closed and the beam "on-off" control is reset at the control panel.

C. Electrical interlocks on entrance doors to the teletherapy room shall be tested for proper operation at least once every six months. Records of test results shall be maintained for inspection by the Commission.

D. In the event of malfunction of any door interlock, the teletherapy machine control shall be locked in the "off" condition and not used, except as may be necessary to the repair or replacement of the interlock system, until the interlock system is shown to be functioning properly.

18. Prior to initiation of a treatment program, and subsequent to each installation of a teletherapy source, radiation surveys and tests shall be performed in accordance with the following:

A. A radiation survey shall be made of:

(i) The teletherapy source housing with the teletherapy source in the "off" position. The maximum and average radiation levels at one meter from the teletherapy source in the "off" position shall not exceed 10 milliroentgens per hour and 2 milliroentgens per hour, respectively.

(ii) All areas adjacent to the treatment room, with the teletherapy source in the "on" position. The survey, except Item (c), shall be performed with a phantom in the primary beam of radiation and shall clearly establish:

(a) The radiation levels in restricted areas are not likely to cause personnel exposure in excess of the limits specified in Section 20.101, Title 10, Part 20, Code of Federal Regulations, Chapter 1, "Standards for Protection Against Radiation" (10 CFR 20).

(b) That quantities of radiation in unrestricted areas do not exceed the limits specified in § 20.105(b), 10 CFR 20.

(c) The intensity of the primary beam of radiation at a specified distance from the teletherapy source.

Form NRC-374TA (7-75)

U. S. NUCLEAR REGULATORY COMMISSION
MATERIALS LICENSE

Supplementary Sheet

License Number 24-00513-35
Amendment No. 11

18. B. Tests shall be made to determine proper operation of:

(i) Electrical interlocks on entrance doors to the teletherapy treatment room.

(ii) The teletherapy source "on-off" indicators, both at the source housing and on the teletherapy machine control panel.

(iii) Electrical or mechanical stops installed for the purpose of limiting use of the primary beam of radiation (restriction of source housing angulation or elevation, carriage or stand travel and operation of the beam "on-off" mechanism).

(iv) The teletherapy treatment timing device.

C. A report of the results of the above surveys and tests shall be sent to the Materials Branch, Division of Materials and Fuel Cycle Facility Licensing, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, not later than thirty (30) days following each installation of a teletherapy source. A copy of such report shall be sent to the Director of the appropriate Nuclear Regulatory Commission Regional Office of Inspection and Enforcement listed in Appendix D of 10 CFR 20.

19. A. Any changes made in the treatment room shielding, location of the unit within the treatment room, or use of the teletherapy unit that could result in increased radiation levels in areas outside the teletherapy treatment room shall be evaluated by a radiation survey made in accordance with Condition 18., and reported to the Commission within thirty (30) days following completion of the change(s).

B. Relocation of the teletherapy unit to a new facility is not permitted without prior approval of the plans and details by the Commission. Following such approval and relocation, a radiation survey shall be made in accordance with Condition 18., and reported to the Commission within thirty (30) days after completion of the move.

20. Each teletherapy machine shall be fully inspected and serviced during source replacement or at intervals not to exceed five (5) years, whichever comes first, to assure proper functioning of the source exposure mechanism. This inspection and servicing must be performed by persons specifically authorized to do so by the U.S. Nuclear Regulatory Commission or an Agreement State and a report of the inspection and servicing must be kept on file for review by the Commission's Office of Inspection and Enforcement.

21. Pursuant to Title 10, Chapter 1, Code of Federal Regulations, Part 40, "Domestic Licensing of Source Material," the licensee is authorized to possess, use, transfer, and import the uranium contained as shielding material in the teletherapy units authorized by this license.

22. The following shall be performed only by persons specifically authorized by the Commission or an Agreement State to perform such services:

    A. Installation, relocation, or removal of teletherapy units containing sources.

    B. Source exchange.

    C. Any maintenance or repair operations on a teletherapy unit involving work on the source drawer, the shutter, or other mechanism that could expose the source, reduce the shielding around the source, or compromise the safety of the unit and result in increased radiation levels.

23. For a period not to exceed sixty (60) days in any calendar year, a visiting physician is authorized to use licensed material for human use under the terms of this license, provided the visiting physician:

    (a) Has the prior written permission of the hospital's Administrator and its Medical Isotopes Committee, and

    (b) Is specifically named as a user on a Nuclear Regulatory Commission license authorizing human use, and

    (c) Performs only those procedures for which he is specifically authorized by a Nuclear Regulatory Commission license.

    The licensee shall maintain for inspection by the Commission, copies of the written permission specified in subitem (a) above and of the license(s) specified in subitems (b) and (c) above. These records shall be maintained for five (5) years from the time the licensee grants its permission under subitem (a) above.

MATERIALS LICENSE

Supplementary Sheet

License Number 24-00513-35

Docket or Reference No.

Amendment No. 11

(continued)

24. Except as specifically provided otherwise by this license, the licensee shall possess and use licensed material described in Items 6, 7, and 8 of this license in accordance with statements, representations, and procedures contained in letter with enclosures dated October 8, 1979 signed by John H. Tolan; letter dated January 14, 1980 signed by John H. Tolan; letter with enclosures dated April 28, 1980 signed by L. Thomas Hussey, Assistant Vice President; and letter dated July 31, 1980 signed by John H. Tolan. The Nuclear Regulatory Commission's regulations shall govern the licensee's statements in applications or letters, unless the statements are more restrictive than the regulations.

Date SEP 2 2 1980

For the U. S. Nuclear Regulatory Commission

by Patricia L. Vacca
Material Licensing Branch

Division of Fuel Cycle and Material Safety
Washington, D.C. 20555

NRC Form 374
(12-81)

U.S. NUCLEAR REGULATORY COMMISSION

MATERIALS LICENSE

Amendment Number 59

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 1, Parts 30, 31, 32, 33, 34, 35, 36, 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); and to import such byproduct and source material. 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.

Licensee	
1. The Curators of the University of Missouri	In accordance with application dated January 29, 1981,
2. Columbia, Missouri 65202	3. License number 24-00513-32 is amended in its entirety to read as follows:
	4. Expiration date May 31, 1988
	5. Docket or 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
A. Any byproduct material between Atomic Nos. 3 to 83, inclusive	A. Any	A. 2 curies of each byproduct material with a total possession limit not to exceed 30 curies, except as noted below:
B. Hydrogen-3	B. Any	B. 30 curies
C. Cobalt-60	C. Sealed sources	C. 1 curie
D. Hydrogen-3	D. Accelerator Targets	D. 100 curies (No single target to exceed 15 curies)
E. Gold-198	E. Any	E. 1 curie
F. Polonium-210	F. Any	F. 5 millicuries
G. Neptunium-237	G. Any	G. 5 millicuries
H. Cesium-137	H. Sealed sources	H. 1 source of 4 curies, 1 source of 1 curie, 1 source of 0.15 curie, other assorted sources. Total possession not to exceed 6 curies

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MATERIALS LICENSE
SUPPLEMENTARY SHEET

License number: 24-00513-32
Docket or Reference number:
Amendment Number 59

Continued from Page 1

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
I. Americium-241	I. Any	I. 40 millicuries
J. Molybdenum-99	J. Molybdenum-99/Technetium-99m Generators	J. 6 curies
K. Americium-241	K. Sealed sources (Monsanto Research Corp. Model No. NS-22-T)	K. 6 sources of 100 millicuries each
L. Mixed activation products	L. Any	L. 10 curies
M. Californium-252	M. Electroplated on platinum foil by ORNL	M. Ten sources, each source not to exceed 0.1 microgram (52 microcuries)
N. Californium-252	N. Sealed source	N. 1 microgram (520 microcuries)
O. Californium-249	O. Electroplated on foil	O. Ten sources of 0.1 microgram each (4 microcuries total)
P. Americium-241	P. Sealed sources	P. 100 millicuries total, no single source to exceed 10 millicuries
Q. Americium-241/ Cesium-137	Q. Sealed sources (Troxler Elec. Dwg. A100281)	Q. 50 millicuries Americium-241 and 10 millicuries Cesium-137
R. Americium-241	R. Sealed source (Amersham/Searle in a type X-92 capsule)	R. 300 millicuries
S. Activation products of natural uranium	S. Any	S. 10 millicuries
T. Americium-241	T. Sealed source (Monsanto Research Model MRC-N-SS-W-AmBe)	T. 3 curies

CONTROL NO. 7927

MATERIALS LICENSE
SUPPLEMENTARY SHEET

License number: 24-00513-32
Docket or Reference number:
Amendment Number 59

Continued from Page 2

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
U. Polonium-210	U. Sealed sources (Monsanto Research Corporation Model MRC-A-SS-P-Po)	U. 5 curies
V. Americium-241	V. Sealed source	V. 100 millicuries
W. Curium-244	W. Electroplated source	W. 1 microcurie
X. Americium-241	X. Sealed Sources (Campbell Pacific Model No. CPN 131-1 or 131-2)	X. No single source to exceed 50 millicuries
Y. Cesium-137	Y. Sealed Sources (Campbell Pacific Model No. CPN 131-1 or 131-2)	Y. No single source to exceed 10 millicuries
Z. Cesium-137	Z. Sealed source (contained in J. L. Shepherd Model No. 28-6A small instrument calibrator)	Z. 1.2 curies
A.A. Americium-241	A.A. Sealed source (contained in New England Nuclear Model No. NER-492B x-ray fluorescence exciter system)	A.A. 1 curie
B.B. Americium-241	B.B. Sealed sources (Campbell Pacific CPN 131)	B.B. No single source to exceed 50 millicuries
C.C. Molybdenum-99/ Technetium-99m	C.C. Solid	C.C. 4500 curies each
D.D. Sodium-24	D.D. Irradiation Cans Used in C.C.	D.D. 50 curies
E.E. Americium-241	E.E. Sealed sources (Troxler Dwg. No. A-102700)	E.E. No single source to exceed 10 millicuries

MATERIALS LICENSE
SUPPLEMENTARY SHEET

License number 24-00513-3[illegible]
Docket or Reference number

Continued from Page 3

Amendment Number 59

9. Authorized use

A. through C. and E. through I. Medical research, diagnosis and therapy. Research and Development as defined in Section 30.4(q) of 10 CFR 30, "Rules of General Applicability to Licensing of Byproduct Material". Laboratory instruction. Instrument calibration.

D. To be used in neutron generators.

J. Production of Technetium-99m Partechmotate.

K. To be used in Troxler Electronic Labs., Inc., Model No. 1257 Soil Moisture Gauge.

L. Storage.

M. through P. Research and Development as defined in Section 30.4(q) of 10 CFR 30 "Rules of General Applicability to Licensing of Byproduct Material".

Q. To be used in Troxler Elec. Model 1403 moisture/density gauge.

R. Laboratory moisture/density measurements of soil samples.

S. Research and Development as defined in Section 30.4(q) of 10 CFR 30, "Rules of General Applicability to Licensing of Byproduct Material".

T. Student instruction and research using Atomic Laboratories Neutron Beam Facility.

U. Studies in alpha stimulation of x-ray emissions in trace elements in water.

V. To be used in a Troxler Model 1257 soil moisture gauge.

W. To be used in an EG & G Model LET-SW1/1 counter.

X. and Y. To be used in Campbell Pacific Nuclear Corporation Model 500 series moisture density gauges.

Z. To be used for instrument calibration.

A.A. To be used for laboratory research and student instruction.

B.B. For use in Campbell Pacific Nuclear Model MC-M moisture gauge.

C.C. De-canning and repackaging for shipment.

D.D. Containers for C.C.

E.E. To be used in Troxler Electronics 3220 series moisture gauges.

MATERIALS LICENSE
SUPPLEMENTARY SHEET

License number
24-00513-32

Docket or Reference number

Continued from Page 4

Amendment Number 59

CONDITIONS

10. A. Licensed material shall be used only at the licensee's facilities located at St. Louis, Rolla, Kansas City and Columbia Missouri.

B. Carbon-14 may be used at abandoned strip mine sites and at Ashland Wildlife Preserve in accordance with letters dated August 5, 1976, May 25, 1977 and June 25, 1980.

C. Material listed in Subitems 6.K., 6.Q., 6.V., 6.B.B. and 6.E.E. may be used at temporary job sites of the licensee throughout the state of Missouri.

11. The licensee shall comply with the provisions of Title 10, Chapter 1, Code of Federal Regulations, Part 19, "Notices, Instructions and Reports to Workers; Inspections" and Part 20, "Standards for Protection Against Radiation."

12. A. Licensed material shall be used by, or under the supervision of, individuals designated by the University of Missouri Central Radiation Safety Committee.

B. The use of licensed material in or on humans shall be by a physician.

C. The Radiation Protection Officer for the activities authorized by this license is John H. Tolan.

13. A. (1) Each sealed source acquired from another person and containing licensed material, other than Hydrogen 3, with a half-life greater than thirty days and in any form other than gas shall be tested for contamination and/or leakage prior to use. In the absence of a certificate from a transferor indicating that a test has been made within six months prior to the transfer, a sealed source received from another person shall not be put into use until tested.

(2) Notwithstanding the periodic leak test required by this condition, any licensed sealed source is exempt from such leak tests when the source contains 100 microcuries or less of beta and/or gamma emitting material or 10 microcuries or less of alpha emitting material.

(3) Except for alpha sources, the periodic leak test required by this condition does not apply to sealed sources that are stored and not being used. The sources excepted from this test shall be tested for leakage prior to any use or transfer to another person unless they have been leak tested within six months prior to the date of use or transfer.

CONTROL NO. 7 9273

MATERIALS LICENSE
SUPPLEMENTARY SHEET

License number: 24-00513-32

Docket or Reference number:

Amendment Number 59

Continued from Page 5

CONDITIONS:

13. B. Each sealed source fabricated by the licensee shall be inspected and tested for construction defects, leakage, and contamination prior to use or transfer as a sealed source. If the inspection or test reveals any construction defects or 0.005 microcurie or greater of contamination, the source shall not be used or transferred as a sealed source until it has been repaired, decontaminated and retested.

C. Each sealed source containing licensed material, other than Hydrogen 3, with a half-life greater than thirty days and in any form other than gas shall be tested for leakage and/or contamination at intervals not to exceed six months except that each source designed for the purpose of emitting alpha particles shall be tested at intervals not to exceed three months.

D. The test shall be capable of detecting the presence of 0.005 microcurie of radioactive material on the test sample. The test sample shall be taken from the sealed source or from the surfaces of the device in which the sealed source is permanently or semipermanently mounted or stored on which one might expect contamination to accumulate. Records of leak test results shall be kept in units of microcuries and maintained for inspection by the Commission.

E. If the test required by Subsection A. or C. of this condition reveals the presence of 0.005 microcurie or more of removable contamination, the licensee shall immediately withdraw the sealed source from use and shall cause it to be decontaminated and repaired or to be disposed of in accordance with Commission regulations. A report shall be filed within 5 days of the test with the U. S. Nuclear Regulatory Commission, Region III, Office of Inspection and Enforcement, 799 Roosevelt Road, Glen Ellyn, Illinois 60137, describing the equipment involved, the test results, and the corrective action taken.

14. Experimental animals administered licensed materials or their products shall not be used for human consumption.

15. Sealed sources containing licensed material listed in Subitems 6.K., 6.Q., 6.V., 6.X., 6.B.B. and 6.E.E. shall not be opened or removed from their respective source holders by the licensee.

16. A. Detector cells containing titanium tritide foil shall only be used in conjunction with a properly operating temperature control mechanism which prevents foil temperatures from exceeding 225 degrees Centigrade.

B. Detector cells containing scandium tritide foil shall only be used in conjunction with a properly operating temperature control mechanism which prevents foil temperatures from exceeding 325 degrees Centigrade.

MATERIALS LICENSE
SUPPLEMENTARY SHEET

License number
24-00513-32

Docket or Reference number

Continued from Page 6

Amendment Number 59

CONDITIONS:

17. In lieu of using the conventional radiation caution colors (magenta or purple on yellow background) as provided in Section 20.203(a)(1), Title 10, Code of Federal Regulations, Part 20, the licensee is hereby authorized to label detector cells and cell baths, containing licensed material and used in gas chromatography devices, with conspicuously etched or stamped radiation caution symbols without a color requirement.

18. Detector cells containing licensed material shall not be opened by the licensee.

19. Maintenance, repair, cleaning, replacement and disposal of foils contained in detector cells shall be performed only by the device manufacturer or other persons specifically authorized by the Commission or an Agreement State to perform such services.

20. Except as otherwise specified in this license, the licensee shall have available and follow the instructions contained in the manufacturer's instruction manual for the chromatography device.

21. The licensee shall not use licensed material in or on human beings or in field applications where activity is released except as provided otherwise by specific condition of this license.

22. The licensee shall conduct a physical inventory every six (6) months to account for all sealed sources listed in Subitems 6.K., 6.Q., 6.V., 6.X., 6.B.B. and 6.E.E. received and possessed under the license. The records of the inventories shall be maintained for two (2) years from the date of the inventory for inspection by the Commission, and shall include the quantities and kinds of byproduct material, location of the sealed sources and the date of the inventory.

23. Patients containing cobalt-60, cesium-137, or iridium-192 implants shall remain hospitalized until surveys made with an appropriate radiation detection instrument indicate that all implants have been removed. The results of these surveys shall be recorded and maintained for inspection by the Commission for five (5) years from the time the implants are removed.

24. Patients containing Iodine-131 for the treatment of thyroid carcinoma or patients containing therapeutic quantities of Gold-198 shall remain hospitalized until the residual activity is 30 millicuries or less.

25. The licensee may transport licensed material or deliver licensed material to a carrier for transport in accordance with the provisions of Title 10, Code of Federal Regulations, Part 71, "Packaging of Radioactive Material for Transport and Transportation of Radioactive Material Under Certain Conditions."

MATERIALS LICENSE
SUPPLEMENTARY SHEET

License number
24-00513-32
Docket or Reference number

Amendment Number 59

Continued from Page 7

CONDITIONS:

26. Pursuant to Section 20. 106(b) and 20.302, 10 CFR 20, 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 20. Ash residues may be disposed of as ordinary waste provided appropriate surveys pursuant to Section 20.201 are made to determine that concentrations of licensed material appearing in the ash residues do not exceed the concentrations (in terms of microcuries per gram) specified for water in Appendix B, Table II, 10 CFR 20.

27. The licensee is authorized to hold radioactive material with a physical half-life of less than 65 days 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 ten (10) half-lives.

    B. Prior to disposal as normal waste, radioactive waste shall be monitored to determine that its radioactivity cannot be distinguished from background with typical low-level laboratory survey instruments. All radiation labels will 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.

28. Except as specifically provided otherwise by this license, the licensee shall possess and use licensed material described in Items 6, 7, and 8 of this license in accordance with statements, representations, and procedures contained in application dated January 29, 1981; and letters dated August 6, 1982, October 11, 1982 and April 7, 1983. The Nuclear Regulatory Commission's regulations shall govern the licensee's statements in applications or letters, unless the statements are more restrictive than the regulations.

For the U. S. Nuclear Regulatory Commission

Date APR 29 1983

By William J. Olsen
Materials Licensing Section
Region III

CONTROL NO. 79273