

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, 36, 37, 39, 40, 70 and 71, 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.

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| Licensee 1. The Curators of the University of Missouri 2. 26 Arnold B. Grobman Dr. University of Missouri - St. Louis, Facilities St. Louis, MO 63121-4400 | | In accordance with letter dated October 26, 2021, 3. License No.: 24-00513-38 is amended in its entirety to read as follows: | 4. Expiration Date: April 30, 2023 5. Docket No.: 030-32694 Reference No.: |
| 6. Byproduct, source, and/or special nuclear material A. Carbon-14 B. Hydrogen-3 C. Calcium-45 D. Molybdenum-99 E. Phosphorus-32 | 7. Chemical and/or physical form A. Any B. Non-volatile C. Any D. Any E. Any | 8. Maximum amount that licensee may possess at any one time under this license A. 30 millicuries total B. 30 millicuries total C. 5 millicuries total D. 10 millicuries total E. 120 millicuries total | 9. Authorized use A. For research and development as defined in 10 CFR 30.4, including metabolic labeling, use as tracers for isotope uptake studies by microorganisms (e.g., yeast cells), in vitro experiments, instrument calibration, and student instruction, as described in the application dated October 11, 2012. B. Same as Subitem No. 9.A. C. Same as Subitem No. 9.A. D. Same as Subitem No. 9.A. E. Same as Subitem No. 9.A. |

**MATERIALS LICENSE
SUPPLEMENTARY SHEET**

License No.: 24-00513-38

Docket or Reference No.:
030-32694

Amendment No. 31

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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 | 9. Authorized use |
| F. Phosphorus-33 | F. Any | F. 20 millicuries total | F. Same as Subitem No. 9.A. |
| G. Sulfur-35 | G. Any | G. 80 millicuries total | G. Same as Subitem No. 9.A. |
| H. Americium-241 | H. Sealed or plated sources (Isotope Products Laboratories, Model 449-66-3) | H. 10 microcuries total | H. For possession and storage only with intent to dispose. |



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CONDITIONS

10. Licensed material shall be used or stored at the licensee's facilities located at 8001 Natural Bridge Rd., St. Louis, Missouri, 63121.

11. The Radiation Safety Officer (RSO) for this license is Rachel L. Henken, Ph.D.

12. Licensed material shall only be used by, or under the supervision of:

Non-Medical Use

Cynthia Dupureur, Ph.D.

Wendy Olivas, Ph.D.

Patricia Parker, Ph.D.

Teresa Thiel, Ph.D.

Xuemin (Sam) Wang, Ph.D.

Material and Use

Carbon-14, hydrogen-3, phosphorus-32, sulfur-35

Hydrogen-3, phosphorus-32, sulfur-35

Phosphorus-32

Carbon-14, hydrogen-3, molybdenum-99, phosphorus-32, phosphorus-33, sulfur-35

Carbon-14, hydrogen-3, calcium-45, phosphorus-32, sulfur-35

13. A. Sealed sources shall be tested for leakage and/or contamination at intervals not to exceed the intervals specified in the certificate of registration issued by the U.S. Nuclear Regulatory Commission under 10 CFR 32.210 or by an Agreement State. In the absence of a registration certificate, sealed sources shall be tested for leakage and/or contamination at intervals not to exceed 6 months, or at such other intervals as specified.
- B. In the absence of a certificate from a transferor indicating that a leak test has been made within the intervals specified in the certificate of registration issued by the U.S. Nuclear Regulatory Commission under 10 CFR 32.210 or by an Agreement State, prior to the transfer, a sealed source received from another person shall not be put into use until tested and the test results received.
- C. Sealed sources need not be tested if they 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 shall be stored for a period of more than 10 years without being tested for leakage and/or contamination.

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- D. The leak test shall be capable of detecting the presence of 185 becquerels (0.005 microcuries) of radioactive material on the test sample. If the test reveals the presence of 185 becquerels (0.005 microcuries) or more of removable contamination, a report shall be filed with the U.S. Nuclear Regulatory Commission in accordance with 10 CFR 30.50(c)(2), and the source shall be removed immediately from service and decontaminated, repaired, or disposed of in accordance with Commission regulations.
- E. Tests for contamination shall be performed by the licensee or other persons specifically licensed by the U.S. Nuclear Regulatory Commission or an Agreement State to perform such services. In addition, the licensee is authorized to collect leak test samples but not perform the analysis: analysis of leak test samples shall be performed by persons specifically licensed by the Commission or an Agreement State to perform such services.
- F. Records of leak test results shall be kept in units of microcuries and shall be maintained for 3 years.
14. The licensee shall conduct a physical inventory every 6 months, or at other intervals approved by the U.S. Nuclear Regulatory Commission, to account for all sealed sources and/or devices received and possessed under the license. Records of inventories shall be maintained for 3 years from the date of each inventory, and shall include the radionuclides, quantities, manufacturer's name and model numbers, and the date of the inventory.
15. Sealed sources or plated sources containing licensed material shall not be opened or sources removed from source holders by the licensee, except as specifically authorized.

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16. The licensee is authorized to hold radioactive material with a physical half-life of less than or equal to 120 days for decay-in-storage before disposal in ordinary trash provided:
- A. Before disposal as ordinary trash, the waste shall be surveyed at the container surface with the appropriate survey instrument 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, except for radiation labels on materials that are within containers and that will be managed as biomedical waste after they have been released from the licensee.
 - B. A record of each such 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.
17. The licensee shall not use the licensed material in or on humans.
18. The licensee shall not use licensed material in field applications where activity is released except as provided otherwise by specific condition of this license.

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19. 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. This license condition applies only to those statements, representations, and procedures that are required to be submitted in accordance with the regulations. The U.S. Nuclear Regulatory Commission's regulations shall govern unless the statements, representations, and procedures in the licensee's application and correspondence impose on the licensee requirements that are more restrictive than or in addition to the regulations.
- A. Application dated October 11, 2012 (ML12291A666)
 - B. Letter dated February 28, 2013 (ML13105A436)
 - C. Letter dated October 30, 2014 (ML14308A351)
 - D. Letter dated January 14, 2015 (ML15036A600)
 - E. Letter dated December 3, 2021 (ML21337A261)
 - F. Letter dated November 15, 2021 (ML21328A179)



FOR THE U.S. NUCLEAR REGULATORY COMMISSION

Date: December 15, 2021By: _____
Magdalena R. Gryglak
Region 3