

**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.

<p style="text-align: center;"><b>Licensee</b></p> <p>1. Cardinal Health 414, LLC</p> <p>2. 7000 Cardinal Place Dublin, OH 43017</p>		<p>In accordance with letter dated November 12, 2018,</p> <p>3. License No.: 34-32840-01 is amended in its entirety to read as follows:</p>	<p>4. Expiration Date: October 31, 2022</p>
<p>6. Byproduct, source, and/or special nuclear material</p> <p>A. Carbon-11</p> <p>B. Any byproduct material with Atomic Nos. 1 through 83</p> <p>C. Manganese-56</p> <p>D. Cobalt-56</p> <p>E. Cobalt-57</p> <p>F. Cobalt-58</p>		<p>7. Chemical and/or physical form</p> <p>A. Any</p> <p>B. Incidentally activated products</p> <p>C. Incidentally activated products</p> <p>D. Incidentally activated products</p> <p>E. Incidentally activated products</p> <p>F. Incidentally activated products</p>	<p>8. Maximum amount that licensee may possess at any one time under this license</p> <p>A. 20 curies total</p> <p>B. 200 millicuries per source and 5 curies total</p> <p>C. 10 millicuries total</p> <p>D. 200 millicuries total</p> <p>E. 100 millicuries total</p> <p>F. 50 millicuries total</p>
			<p>9. Authorized use</p> <p>A. Production, packaging and distribution of manufactured radiochemicals to persons authorized to receive the licensed material pursuant to the terms and conditions of specific licenses issued by the U.S. Nuclear Regulatory Commission or any Agreement State.</p> <p>B. Possession and storage of byproduct materials incidental to radionuclide production.</p> <p>C. Same as Item 9.B.</p> <p>D. Same as Item 9.B.</p> <p>E. Same as Item 9.B.</p> <p>F. Same as Item 9.B.</p>

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 License No.  
34-32840-01

Amendment No. 13

 Docket or Reference No.  
030-38511

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
G. Cobalt-60	G. Incidentally activated products	G. 15 millicuries total	G. Same as Item 9.B.
H. Cobalt-64	H. Incidentally activated products	H. 10 millicuries total	H. Same as Item 9.B.
I. Copper-60	I. Incidentally activated products	I. 50 millicuries total	I. Same as Item 9.B.
J. Copper-64	J. Incidentally activated products	J. 25 millicuries total	J. Same as Item 9.B.
K. Zinc-63	K. Incidentally activated products	K. 30 millicuries total	K. Same as Item 9.B.
L. Zinc-65	L. Incidentally activated products	L. 50 millicuries total	L. Same as Item 9.B.
M. Niobium-93m	M. Incidentally activated products	M. 15 millicuries total	M. Same as Item 9.B.
N. Niobium-94m	N. Incidentally activated products	N. 100 millicuries total	N. Same as Item 9.B.
O. Molybdenum-93m	O. Incidentally activated products	O. 100 millicuries total	O. Same as Item 9.B.
P. Technetium-95m	P. Incidentally activated products	P. 10 millicuries total	P. Same as Item 9.B.
Q. Technetium-96	Q. Incidentally activated products	Q. 10 millicuries total	Q. Same as Item 9.B.
R. Rhenium-183	R. Incidentally activated products	R. 20 millicuries total	R. Same as Item 9.B.
S. Rhenium-184	S. Incidentally activated products	S. 20 millicuries total	S. Same as Item 9.B.
T. Sodium-22	T. Sealed sources (Eckert & Ziegler, Model RV-022)	T. 200 microcuries per source and 400 microcuries total	T. Calibration of the licensee's instruments.
U. Sodium-22	U. Sealed sources (Eckert & Ziegler, Model Type R)	U. 1 microcurie per source and 2 microcuries total	U. Same as Item 9.T.

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V. Cobalt-57	V. Sealed sources (Eckert & Ziegler, Model RV-057)	V. 10 millicuries per source and 30 millicuries total	V. Same as Item 9.T.
W. Cesium-137	W. Sealed sources (Eckert & Ziegler, Model RV-137)	W. 300 millicuries per source and 400 microcuries total	W. Same as Item 9.T.
X. Barium-133	X. Sealed sources (Eckert & Ziegler, Model RV-133)	X. 300 microcuries per source and 400 microcuries total	X. Same as Item 9.T.
Y. Technetium-99m	Y. Any	Y. 5 curies total	Y. Same as Item 9.T.
Z. Hydrogen-3	Z. Incidentally activated products	Z. 20 millicuries total	Z. Same as Item 9.B.
AA. Nitrogen-13	AA. Any	AA. 20 curies total	AA. Same as Item 9.A.
AB. Oxygen-15	AB. Any	AB. 20 curies total	AB. Same as Item 9.A.
AC. Fluorine-18	AC. Any	AC. 60 curies total	AC. Same as Item 9.A.
AD. Manganese-54	AD. Incidentally activated products	AD. 10 millicuries total	AD. Same as Item 9.B.
AE. Sodium-24	AE. Incidentally activated products	AE. 10 millicuries total	AE. Same as Item 9.B.
AF. Aluminum-28	AF. Incidentally activated products	AF. 10 millicuries total	AF. Same as Item 9.B.
AG. Scandium-48	AG. Incidentally activated products	AG. 15 millicuries total	AG. Same as Item 9.B.
AH. Vanadium-47	AH. Incidentally activated products	AH. 15 millicuries total	AH. Same as Item 9.B.
AI. Vanadium-48	AI. Incidentally activated products	AI. 15 millicuries total	AI. Same as Item 9.B.
AJ. Chromium-51	AJ. Incidentally activated products	AJ. 50 millicuries total	AJ. Same as Item 9.B.
AK. Manganese-52	AK. Incidentally activated products	AK. 200 millicuries total	AK. Same as Item 9.B.

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|---|-------------------------------------|--|-----------------------|
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| AL. Manganese- 52m                                    | AL. Incidentally activated products | AL. 200 millicuries total  | AL. Same as Item 9.B. |

**CONDITIONS**

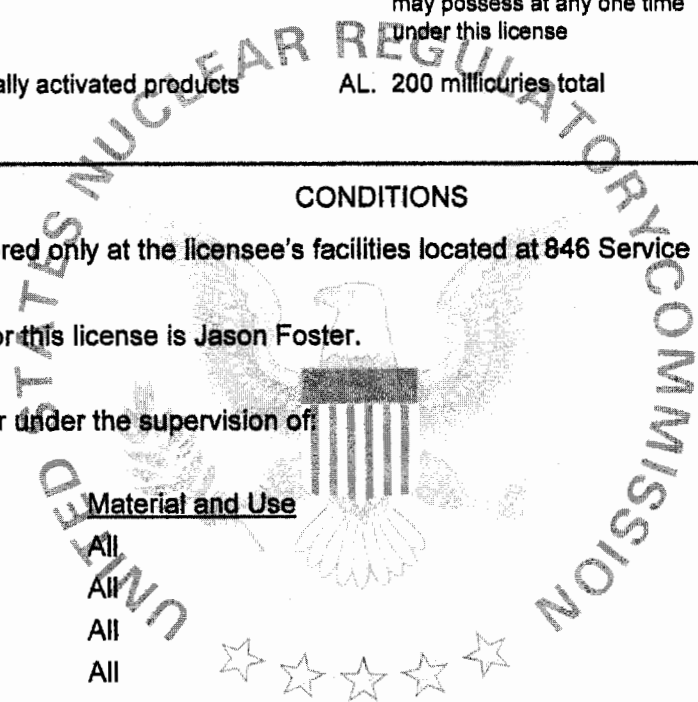
10. Licensed material may be used or stored only at the licensee's facilities located at 846 Service Road, East Lansing, Michigan, 48824.
11. The Radiation Safety Officer (RSO) for this license is Jason Foster.
12. Licensed material shall be used by, or under the supervision of:

Authorized Users

Hoppe Achuonjei  
 Matthew Anderson  
 Chris Berg  
 Robert Chicoine  
 Michael Gannon Connolly-Ng  
 Colten Conrad  
 Adam Fleshner  
 Jason Foster  
 Robert Grudkowski  
 William Harris  
 Frank Iverson  
 Rachel Jasman

Material and Use

All  
 All  
 All  
 All  
 All  
 All  
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 All  
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 All  
 All



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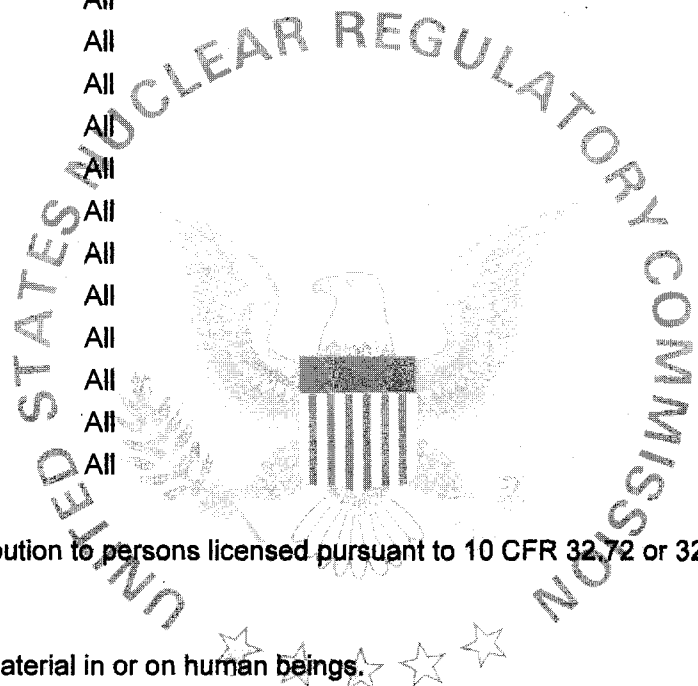
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Authorized Users

Tuan Le  
Brandon McLean  
Ken Moore  
Steve Morcos  
Thomas Morovsky  
Robert Nilsson  
Leonard Popa  
Joseph Seckman  
Robert Symons  
John Taylor Vernon  
Brandon Xiong  
John Zhang

Material and Use

All  
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All

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13. This license does not authorize distribution to persons licensed pursuant to 10 CFR 32.72 or 32.74; to persons exempt from licensing; or to general licensees.
14. The licensee shall not use licensed material in or on human beings.
15. A. Sealed sources shall be tested for leakage and/or contamination at intervals not to exceed six months or at the intervals specified in the certificate of registration issued by the U.S. Nuclear Regulatory Commission under 10 CFR 32.210 or under equivalent regulations of an Agreement State.
- B. Notwithstanding Paragraph A of this Condition, sealed sources designed to primarily emit alpha particles shall be tested for leakage and/or contamination at intervals not to exceed three months.

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- C. 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 under equivalent regulations of 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.
- D. Sealed sources need not be tested if they contain only hydrogen-3; or they contain only a radioactive gas; or the half-life of the isotope is 30 days or less; or they contain not more than 100 microcuries of beta- and/or gamma-emitting material or not more than 10 microcuries of alpha-emitting material.
- E. 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.
- F. The leak test shall be capable of detecting the presence of 0.005 microcurie (185 becquerels) of radioactive material on the test sample. If the test reveals the presence of 0.005 microcurie (185 becquerels) 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.
- G. Tests for leakage and/or contamination, including leak test sample collection and analysis, shall be performed by the licensee or by other persons specifically licensed by the U.S. Nuclear Regulatory Commission or an Agreement State to perform such services.
- H. Records of leak test results shall be kept in units of becquerels (microcuries) and shall be maintained for three years.
16. The licensee shall conduct a physical inventory every six 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 three 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.

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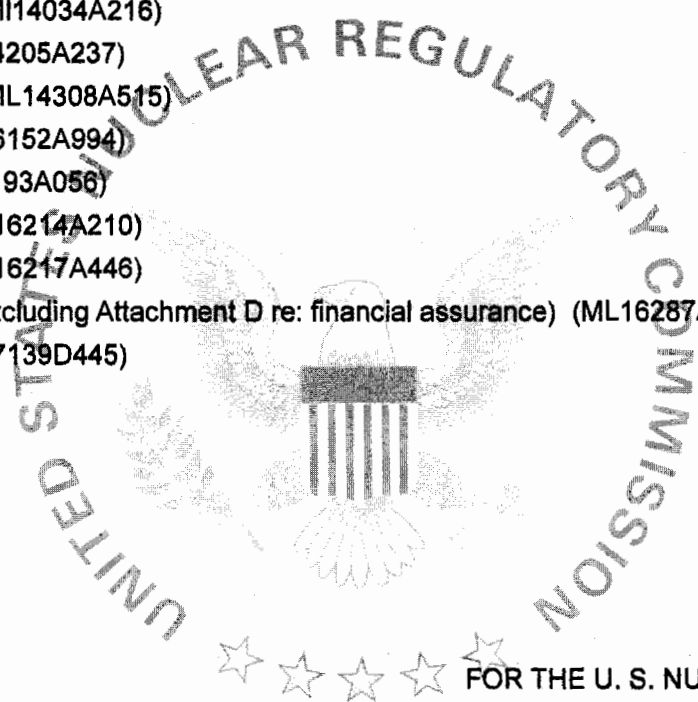
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17. Sealed sources or detector cells containing licensed material shall not be opened or sources removed from source holders by the licensee.
18. The licensee is authorized to hold byproduct material with a physical half-life of less than or equal to 120 days for decay-in-storage before disposal without regard to its radioactivity if the licensee:
- 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 disposal permitted under this License Condition shall be retained for three 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.
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 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 are more restrictive than the regulations.
- A. Application dated October 3, 2011 (ML113420035)
  - B. Letter dated December 5, 2011 (ML13133A384)
  - C. Letter dated July 23, 2013 (ML13234A394)
  - D. Letter dated October 22, 2013 (ML13296A520)
  - E. Letter dated December 19, 2013 (ML13365A136)
  - F. Letter dated January 10, 2014 (ML14034A270)

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- G. Letter dated January 21, 2014 (ML14034A277)  
H. Letter dated January 24, 2014 (ML14034A216)  
I. Letter dated June 30, 2014 (ML14205A237)  
J. Letter dated October 28, 2014 (ML14308A515)  
K. Letter dated May 24, 2016 (ML16152A994)  
L. Letter dated July 6, 2016 (ML16193A056)  
M. Letter dated August 1, 2016 (ML16214A210)  
N. Letter dated August 4, 2016 (ML16217A446)  
O. Letter dated October 11, 2016 (excluding Attachment D re: financial assurance) (ML16287A771)  
P. Letter dated May 15, 2017 (ML17139D445)



FOR THE U. S. NUCLEAR REGULATORY COMMISSION

Date: FEB 11 2019By: Bryan A. Parker  
Region III