UNIVERSITY of WISCONSIN
UWMILWAUKEE

October 13, 2017

Materials Licensing Section
U.S. Nuclear Regulatory Commission, Region III
2443 Warrenville Road, Suite 210
Lisle, IL 60532-4352

Regarding Voided Control #: 599723
Subject: License Termination Request (License Number 48-09944-01)

The University of Wisconsin – Milwaukee (UWM) requests termination of radioactive materials license number 48-09944-01. The license was utilized to conduct research activities at temporary jobsites in Yellowstone National Park and aboard one UWM research vessel.

In order to conduct research under the NRC license, radioactive materials were transferred to the NRC license from the UWM Wisconsin radioactive materials license number 079-1324-01. Upon completion of research activities, UWM packaged all stock solution, samples, and radioactive waste to meet US Department of Transportation (DOT) requirements for transport back to the campus; and then conducted closeout surveys to verify impacted surfaces met the release criteria for unrestricted use. Upon return to the campus, all radioactive materials were transferred back to the UWM Wisconsin license. Radioactive wastes were dispositioned according to the waste management program procedures of Wisconsin license.

Licensed activities were only performed aboard one research vessel, the Neeskay; and on one three week study at Yellowstone. The Neeskay has been transferred to the Wisconsin license; therefore no license termination surveys are required. The NRC requested that UWM provide a MARSSIM final status survey for activities conducted within a rented vehicle at Yellowstone; therefore UWM evaluated the closeout procedures conducted at the conclusion of research and has demonstrated that closeout procedures meet the intent of MARSSIM. The enclosed Final Status Report provides conclusive evidence that the temporary facilities meet the criteria for unrestricted use specified in 10 CFR 20 Subpart E. Dose modeling indicates that the TEDE to an average member of the critical group is a small fraction of the NRC release criterion of 25 mrem/yr.

All radioactive materials have been transferred to the UWM Wisconsin license. A completed NRC Form 314 is attached.

RECEIVED NOV 07 2017

I appreciate your time and efforts with this matter and look forward to hearing back from you. If during your review of this material you should require further information or clarification, please do not hesitate to contact Kim Axtman at (414) 430-7507.

Sincerely yours,

Robin Van Harpen
Vice Chancellor, Finance and Administrative Affairs

cc: M. Spadanuda, Assoc. Director-Compliance, University Safety and Assurances
K. Axtman, Radiation Safety Officer, University Safety and Assurances

Enclosures: NRC Form 314, Final Status Report

NRC FORM 314
(02-2017)
10 CFR 30.36(j)(1); 40.42(j)(1); 70.38(j)(1); and 72.54(k)(6)(i)(1)

U.S. NUCLEAR REGULATORY COMMISSION

CERTIFICATE OF DISPOSITION OF MATERIALS

APPROVED BY OMB: NO. 3150-0020 EXPIRES: 02/28/2020

LICENSEE NAME AND ADDRESS	LICENSE NUMBER	DOCKET NUMBER
University of Wisconsin-Milwaukee Radiation Safety Program, Attn: Kim Axtman P.O. Box 413 Milwaukee, WI 53201	48-09944-01	030-01160
	LICENSE EXPIRATION DATE June 30, 2017	

A. LICENSE STATUS (Check the appropriate box)

☑ This license has expired. ☐ This license has not yet expired; please terminate it.

B. DISPOSAL OF RADIOACTIVE MATERIAL

(Check the appropriate boxes and complete as necessary. If additional space is needed, provide attachments)

The licensee, or any individual executing this certificate on behalf of the licensee, certifies that:

☐ 1. No radioactive materials have ever been procured or possessed by the licensee under this license.

☑ 2. All activities authorized by this license have ceased, and all radioactive materials procured and/or possessed by the licensee under this license number cited above have been disposed of in the following manner:

☑ a. Transfer of radioactive materials to the licensee listed below:

State of Wisconsin Department of Health Services License Number 079-1324-01 issued to University of Wisconsin-Milwaukee as described in the attached Final Status Report

☐ b. Disposal of radioactive materials:

☐ 1. Directly by the licensee:

☐ 2. By licensed disposal site:

☐ 3. By waste contractor:

☑ c. All radioactive materials have been removed such that any remaining residual radioactivity is within the limits of 10 CFR Part 20, Subpart E, and is ALARA.

C. SURVEYS PERFORMED AND REPORTED

☑ 1. A radiation survey was conducted by the licensee. The survey confirms:

☐ a. the absence of licensed radioactive materials

☑ b. that any remaining residual radioactivity is within the limits of 10 CFR 20, Subpart E, and is ALARA.

☑ 2. A copy of the radiation survey results:

☑ a. is attached; or ☐ b. is not attached (Provide explanation); or ☐ c. was forwarded to NRC on: _____ Date

☐ 3. A radiation survey is not required as only sealed sources were ever possessed under this license, and

☐ a. The results of the latest leak test are attached; and/or ☐ b. No leaking sources have ever been identified.

The person to be contacted regarding the information provided on this form:

NAME	TITLE	TELEPHONE (Include Area Code)	E-MAIL ADDRESS
Kim Axtman	Radiation Safety Officer	414-430-7507	axtman@uwm.edu

Mail all future correspondence regarding this license to:

University of Wisconsin-Milwaukee, Radiation Safety Program, Attn: Kim Axtman, P.O. Box 413, Milwaukee, WI 53201

C. CERTIFYING OFFICIAL

I CERTIFY UNDER PENALTY OF PERJURY THAT THE FOREGOING IS TRUE AND CORRECT

PRINTED NAME AND TITLE	SIGNATURE	DATE
Robin Van Harpen, Vice Chancellor, Finance and Administrative Affairs	[signature]	10-16-17

WARNING: FALSE STATEMENTS IN THIS CERTIFICATE MAY BE SUBJECT TO CIVIL AND/OR CRIMINAL PENALTIES. NRC REGULATIONS REQUIRE THAT SUBMISSIONS TO THE NRC BE COMPLETE AND ACCURATE IN ALL MATERIAL RESPECT. 18 U.S.C. SECTION 1001 MAKES IT A CRIMINAL OFFENSE TO MAKE A WILLFULLY FALSE STATEMENT OR REPRESENTATION TO ANY DEPARTMENT OR AGENCY OF THE UNITED STATES AS TO ANY MATTER WITHIN ITS JURISDICTION.

CERTIFICATE OF DISPOSITION OF MATERIALS

PLEASE READ THESE INSTRUCTIONS BEFORE COMPLETING NRC FORM 314

Subpart E of 10 CFR Part 20 establishes the radiological criteria for license terminations/decommissioning of facilities licensed under 10 CFR Parts 30, 40, 50, 60, 61, 70, and 72, as well as other facilities subject to the Commission's jurisdiction under the Atomic Energy Act of 1954, as amended, and the Energy Reorganization Act of 1974, as amended.

INSTRUCTIONS

Section B, Item 2.
Licensees should describe the specific radioactive material transfer actions. If radioactive wastes were generated in terminating this license, the licensee should describe the disposal actions taken, including the disposition of low-level radioactive waste, mixed waste, greater-than-Class-C waste, and sealed sources.

Section B, Item 2.a.
The information provided concerning the transfer of radioactive material to another licensee should specify the date of the transfer, the name of the licensee recipient, an individual contact name and telephone number for the licensee recipient, and the recipient's NRC or Agreement State license number.

Section B, Item 2.b.
For disposal of radioactive materials, licensees should describe the specific disposal method or procedure (e.g., decay-in-storage). For those cases when radioactive materials are disposed of by a licensed disposal site or by a waste contractor, the licensee should specify the name, address, and telephone number of the licensed disposal site operator or waste contractor.

Section B, Item 2.c.
"Residual radioactivity," as defined in 10 CFR 20.1003, means radioactivity in 'areas' (structures, materials, soils, etc.) remaining as a result of activities (licensed and unlicensed) under the licensee's control from sources used by the licensee, excluding background radiation. ALARA is defined in 10 CFR 20.1003.

FILE CERTIFICATES AS FOLLOWS:

IF YOU ARE LOCATED IN:

ALABAMA, CONNECTICUT, DELAWARE, DISTRICT OF COLUMBIA, FLORIDA, GEORGIA, KENTUCKY, MAINE, MARYLAND, MASSACHUSETTS, NEW HAMPSHIRE, NEW JERSEY, NEW YORK, NORTH CAROLINA, PENNSYLVANIA, PUERTO RICO, RHODE ISLAND, SOUTH CAROLINA, TENNESSEE, VERMONT, VIRGINIA, VIRGIN ISLANDS, OR WEST VIRGINIA, SEND CERTIFICATES TO:

LICENSING ASSISTANT SECTION
NUCLEAR MATERIALS SAFETY BRANCH
U.S. NUCLEAR REGULATORY COMMISSION, REGION I
2100 RENAISSANCE BOULEVARD, SUITE 100
KING OF PRUSSIA, PA 19406-2713

ILLINOIS, INDIANA, IOWA, MICHIGAN, MINNESOTA, MISSOURI, OHIO, OR WISCONSIN, SEND CERTIFICATES TO:

MATERIALS LICENSING SECTION
U.S. NUCLEAR REGULATORY COMMISSION, REGION III
2443 WARRENVILLE ROAD, SUITE 210
LISLE, IL 60532-4352

IF YOU ARE LOCATED IN:

ALASKA, ARIZONA, ARKANSAS, CALIFORNIA, COLORADO, HAWAII, IDAHO, KANSAS, LOUISIANA, MISSISSIPPI, MONTANA, NEBRASKA, NEVADA, NEW MEXICO, NORTH DAKOTA, OKLAHOMA, OREGON, PACIFIC TRUST TERRITORIES, SOUTH DAKOTA, TEXAS, UTAH, WASHINGTON, OR WYOMING, SEND CERTIFICATES TO:

MATERIAL RADIATION PROTECTION SECTION
U. S. NUCLEAR REGULATORY COMMISSION, REGION IV
1600 E. LAMAR BOULEVARD
ARLINGTON, TX 76011-4511

The University of Wisconsin-Milwaukee (UWM) License Termination Final Status Report

NRC License Number 48-09944-01

October 11, 2017

University of Wisconsin-Milwaukee
PO Box 413, Engelmann Suite 270
Milwaukee, WI 53201-0413

TABLE OF CONTENTS

TABLES

APPENDICES

ACRONYMS

ALARA	As Low As Reasonably Achievable
CFR	Code of Federal Regulations
DCGL	Derived Concentration Guideline Level
DOT	US Department of Transportation
LSC	Liquid Scintillation Counter
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MDC	Minimum Detectable Concentration
MDCR	Minimum Detectable Count Rate
NRC	U.S. Nuclear Regulatory Commission
PGM	Pancake Geiger-Mueller detector
TEDE	Total Effective Dose Equivalent
UWM	University of Wisconsin-Milwaukee

1.0 INTRODUCTION

The University of Wisconsin-Milwaukee (UWM) has decided to terminate their US Nuclear Regulatory Commission (NRC) radioactive materials license number 48-09944-01. The license authorizes research and development activities using C-14, H-3, P-32, Fe-59, S-35, Mn-54, Cs-137, and P-33 aboard research vessels at temporary jobsites within NRC jurisdiction; and research and development activities using C-14, H-3, and P-33 at Lake Station in Yellowstone National Park, Wyoming.

Activities aboard vessels occurred several times over a two year period on the research vessel Neeskay. Closeout surveys were performed after each usage of materials. The UWM State of Wisconsin radioactive materials license number 079-1324-01 authorizes activities on research vessels; therefore the Neeskay has been transferred to the Wisconsin license and decommissioning surveys are not required for NRC license termination. Activities at Yellowstone involving C-14 occurred one time for a three week period within a rented box truck. After usage, UWM conducted closeout surveys of the laboratory equipment and the internal surfaces of the truck. Each time the license was implemented at temporary jobsites radioactive materials were transferred from the Wisconsin license to the NRC license. Upon completion of NRC licensed activities all samples, remaining stock solution, and radioactive wastes were transferred back to the Wisconsin license.

As part of license termination, the NRC requested UWM provide final status surveys according to NUREG 1575, "*Multi-Agency Radiation Survey and Site Investigation Manual*" (MARSSIM) protocols that are designed for building structures. Because operations at Yellowstone were performed in a rented box truck and all equipment was portable (not part of or attached to a building structure), the laboratory equipment is considered equipment and materials per NUREG 1757, Volume 2, Appendix G.1.1, *Structures Versus Equipment.* At the conclusion of licensed activities, equipment and materials were released according to license procedures or disposed as radioactive waste as appropriate. The license procedures were based on the release criteria specified in NUREG 1556, Volume 7, Table Q.2, "Acceptable Surface Contamination Levels for Equipment." Specifically, the following surface activity limits were used:

- 5,000 dpm/100 cm^2 total surface activity (averaged over 1 m^2)
- 15,000 dpm/100 cm^2 total surface activity (maximum, $\leq$ 100 cm^2 area)
- 1,000 dpm/100 cm^2 removable surface activity

While the closeout surveys were not designed to MARSSIM protocols, this report demonstrates that the surveys meet the intent of MARSSIM and that the temporary facility at Yellowstone met the dose-based criteria for unrestricted use.

This report presents sufficient data to conclude that the temporary facility was suitable for unrestricted release in accordance with NRC requirements. Dose-based surface activity limits for equipment and materials such as that contained in ANSI/HPS N13.12 Table 1

indicate that potential doses from the release of equipment and materials used for research are a small fraction of the license termination criteria of 25 mrem/yr.

2.0 OPERATIONAL HISTORY

2.1 License History

The UWM NRC radioactive materials license 48-09944-01, renewed in entirety on June 26, 2007, authorizes the use of radioactive materials in any unsealed form for research and development as defined in 10 CFR 30.4 including student training. Activities are authorized at temporary jobsites at Yellowstone National Park and aboard UWM research vessels.

C-14, H-3 and P-33 are authorized for use at Lake Station in Yellowstone National Park, Wyoming and all listed nuclides are authorized for use aboard UWM research vessels at temporary job sites anywhere in the United States where the U.S. Nuclear Regulatory Commission maintains jurisdiction. The authorized nuclides and quantities listed in the table below.

Table 2-1: Licensed Materials and Quantities

Nuclide	Maximum Possession (mCi)	Authorized at Yellowstone?	Authorized on Vessel?
Carbon-14	50	Yes	Yes
Hydrogen-3	15	Yes	Yes
Phosphorus-32	15	No	Yes
Iron-59	0.5	No	Yes
Sulfur-35	5	No	Yes
Magnesium-54 [1]	1	No	Yes
Cesium-137	0.1	No	Yes
Phosphorus-33	15	Yes	Yes

The license was implemented one time for a three-week period in 2003 at Yellowstone Lake and several times from 1995-1997 aboard the research vessel Neeskay. Detailed descriptions of historical operations are provided below.

2.2 Yellowstone Lake

Research at Yellowstone Lake was conducted from July 14 to August 3, 2003 using 25 mCi of C-14 as bicarbonate for algal productivity research on water samples. The researcher transported 25 mCi of C-14, laboratory equipment, and supplies from UWM to Yellowstone Lake in a rented 24 ft box truck. The C-14 was packaged and transported according to US Department of Transportation (DOT) requirements.

Once at the research location in Yellowstone, the researcher set up a mobile lab within a portion of the cargo area of the box truck. Laboratory equipment and supplies were

[1] This is a typographical error on the license; should be Manganese-54. Mn-54 was never used.

unloaded from the truck and the researcher performed wipe tests on the box truck surfaces with no residual radioactivity identified. The box truck was then lined with plastic sheeting on the floor and to approximately a 6 ft height on the walls. All seams were taped and then the plastic sheeting was covered with absorbent paper to ensure that radioactive materials would not impact the box truck surfaces even in the event of a spill.

The researcher then set up a temporary lab within the front portion of the box truck and commenced research activities. Strict control of radioactive materials was a necessary feature of the research. Radioactive work was performed within well-defined and documented areas. Usage locations within the lab were constrained to small areas and proper precautions were taken to contain the radioactive materials.

The researcher performed daily surveys of areas where radioactivity was used. Surveys consisted of scan surveys with a pancake Geiger-Mueller detector (PGM). Detectable activity was identified on seven occasions at three locations (on benchtop paper covering, in an incubator and on a tray); the maximum survey result was 600 cpm on the PGM. These surfaces were immediately decontaminated and any absorbent paper was replaced.

After completion of research activities, the researcher surveyed all work areas. Any absorbent paper with detectable radioactivity was placed in a radioactive waste container. The researcher then surveyed the entire mobile lab. All lab equipment was released according to UWM procedures and waste materials were collected and packaged in appropriate containers and returned to UWM. After verifying the lab contents free of residual radioactivity, the fixtures and equipment were removed from the truck and the truck surfaces were surveyed to verify they were not impacted by research activities.

The lab contents and radioactive waste was packaged and transported according to DOT requirements to the UWM campus and transferred to the Wisconsin license.

Maps and data sheets from the surveys described above are presented in Appendix A. Page 1 contains the initial and final wipe survey of the truck surfaces with LSC results from the on-site counter; Page 2 contains daily surveys conducted during research; Page 3 contains the LSC report for the pre-use survey before plastic and paper application (recounted at UWM); and Page 4 contains the LSC report for the post-work survey of the truck surfaces (recounted at UWM).

2.3 Research Vessel Neeskay

The use of radioactive materials on the research vessel Neeskay included the use of C-14 Bicarbonate (25mCi), H-3 Leucine (2mCi), and P-32 Phosphate (2mCi). Research was conducted during several four-day trips from 1995-1997.

Licensed activities aboard the vessel were performed under approved protocols and procedures that include designation and labeling of equipment, usage areas, and storage areas. All sources of radioactivity were secured against spillage, unbreakable containers and double containment was used whenever possible, work areas were frequently

monitored to detect and control the spread of radioactivity, and no radioactivity was released to the environment.

Upon completion of each cruise all radioactive materials, including waste was collected and packaged for transfer to the UWM Wisconsin license for further analysis or disposal. A thorough radiological survey of the vessel was completed and documented to ensure no residual radioactivity remained. A PGM was used to perform area surveys, and wipe tests were counted in a Liquid Scintillation Counter to check for removable radioactivity.

The Neeskay is listed as a temporary job-site on UWM's Wisconsin Department of Health Services Radioactive Materials License number 079-1324-01. Condition 10 D states "Licensed material may be used aboard the licensee's research vessels at temporary jobsites (i.e., lakes and waterways within Wisconsin borders) anywhere in Wisconsin where DHS maintains jurisdiction for regulating the use of licensed material in accordance with statements, representations and procedures contained in the application dated July 27, 2016." A copy of the UWM Wisconsin license is presented in Appendix B. Because the Neeskay was transferred to the Wisconsin license, no license termination surveys are required.

2.4 Waste Management Practices

All liquid and solid waste generated at Yellowstone Lake was packaged and transported back to UWM per DOT regulations. There were no sinks in the mobile lab, so there was no drain disposal on site. Upon completions of each Neeskay cruise all radioactive materials, including waste, were collected and packaged for return to the University for further analysis or disposal. Drain disposal or other environmental releases are prohibited on the Neeskay. All waste materials from temporary job sites were transferred to the UWM Wisconsin license for disposition under the Wisconsin license radioactive waste management program.

Under the UWM Wisconsin license, all liquid radioactive waste is collected by Radiation Safety. The only radioactive wastes that individual labs produce that may enter drains are those small amounts associated with the washing of glassware. Individual labs are not allowed to dispose of any other liquid materials to the sewer system. Radiation Safety does drain dispose some radioactive waste if it is soluble according to the methods outlined in NRC Information Notice 94-07. Calculations are completed and documented to ensure that materials released in one month and/or annually does not exceed the limits specified in 10 CFR 20, Appendix B, Table 3 and that the sum of the fractions of multiple radioisotopes to the corresponding limit 10 CFR 20, Appendix B, Table 3 does not exceed unity. The total quantity released shall not exceed the limits of 10 CFR 20.2003(a)(4). Liquid Scintillation Cocktail containing H-3 or C-14 in activity concentrations less than 0.05 μCi per gram may be treated without regard to radioactivity, but may be controlled due to their hazardous chemical constituent. UWM contracts with a radioactive waste disposal vendor to dispose of solid waste and any liquid wastes that do not meet the requirements for drain disposal.

3.0 FACILITY RELEASE CRITERIA

The radiological release criteria for license termination are specified in NRC 10 CFR 20 Subpart E. 10 CFR 20.1402, "Radiological Criteria for Unrestricted Use." The criteria are that residual radioactivity results in a TEDE to an average member of the critical group that does not exceed 25 mrem per year, and the residual radioactivity has been reduced to levels that are as low as reasonably achievable (ALARA).

The license termination release criteria apply to facilities and/or soils impacted by licensed operations. However, there are no facilities or soils associated with licensed activities conducted at Yellowstone Lake. All equipment, supplies, and licensed materials were transported back to UWM and any radioactive materials were transferred to the UWM Wisconsin radioactive materials license.

4.0 NUCLIDES OF CONCERN

C-14 is the only nuclide of concern for license termination because C-14 was the only nuclide used at Yellowstone Lake. Because the Neeskay was transferred to the UWM Wisconsin license, there are no surveys required to demonstrate compliance with the release criteria.

5.0 DERIVED CONCENTRATION GUIDELINE LEVELS

Because operations at Yellowstone were performed in a rented box truck and all equipment was portable (not part of or attached to a building structure), the laboratory equipment is considered "equipment and materials." Per NUREG 1757, Volume 2, Appendix G.1.1, *Structures Versus Equipment,* the license termination rule applies to building structures that remain in place after decommissioning and does not apply to releases of equipment from the facility before license termination. "Equipment" includes items not attached to or not an integral part of the building structure and that are generally readily removable from the building. Examples of equipment include furniture or appliances that are not built into or attached to the structure; stocks of chemicals, reagents, metals, and other supplies; motor vehicles; and any other items that normally would not be conveyed with a building when it is sold. The License Termination Rule does not apply to equipment, so equipment should not be left on the site at license termination. Equipment should be released using criteria approved for use by the NRC as part of the facility's license conditions or radiation safety program.

UWM license release criteria for equipment and materials are those specified in NUREG 1556, Volume 7, Table Q.2, "Acceptable Surface Contamination Levels for Equipment." Specifically, the following surface activity limits apply:

- 5,000 dpm/100 cm^2 total surface activity (averaged over 1 m^2)
- 15,000 dpm/100 cm^2 total surface activity (maximum, area $\leq$ 100 cm^2)
- 1,000 dpm/100 cm^2 removable surface activity

A derived concentration guideline level (DCGL) is the radionuclide specific surface activity concentration that could result in a dose equal to the release criterion. Even though the UWM release criteria for equipment and materials are not dose-based, the term DGGL is applied to these limits for consistency with MARSSIM terminology. Dose-based limits would be several orders of magnitude higher.

6.0 SURVEY INSTRUMENTATION

6.1 Instrument Calibration

The PGM used for surveys was calibrated per license procedures at the time; however the calibration record is not readily available.

6.2 Functional Checks

The researcher performed daily functional checks on the PGM detector using a check source of known activity. Daily functional checks of the liquid scintillation counter consisted of performing the instrument's automatic quality assurance protocol that utilized H-3 and C-14 sources as well as a background standard.

6.3 Efficiency Determination

MARSSIM protocols for building structures use ISO-7503-1 methodology that takes into account the texture of the surface and the 2-pi detector efficiency. Because impacted surfaces were released according to approved license procedures relative to equipment and materials vs. building structures, the published 4-pi C-14 efficiency (5%) [2] is used to convert measurements to units of dpm/100 cm^2 and to determine detection sensitivities. It should be noted that the surfaces were in a laboratory environment with smooth finishes, so ISO 7503-1 methods would be conservative. Additionally, the license criteria for release of equipment and materials are not dose-based, and are therefore very conservative for C-14.

The liquid scintillation counter was not set up to report values in dpm; therefore an efficiency of 80% is assumed for C-14.

6.4 Minimum Detectable Concentrations

The minimum detectable concentration (MDC) for measurement methods are determined using MARSSIM equations.

6.4.1 Ratemeter Scanning

Scanning Minimum Detectable Concentration at a 95% confidence level is calculated using the following equation, which is a combination of MARSSIM equations 6-8, 6-9, and 6-10:

[2] www.ludlums.com Model 44-9 PGM detector specifications sheet.

$$MDC_{scan} = \frac{d'\sqrt{b_i}\left(\frac{60}{i}\right)}{\sqrt{p}\cdot E_{tot}\cdot\frac{A}{100cm^2}}$$

Where:

MDC_{scan}	= minimum detectable concentration (dpm/100 cm^2)
d'	= desired performance variable (1.38)
b_i	= background counts during the residence interval (counts)
i	= residence interval (seconds)
p	= surveyor efficiency (0.5)
E_{tot}	= total detector efficiency for radionuclide emission of interest (cpm/dpm)
A	= detector probe area (cm^2)

A typical MDC_{SCAN} calculation for C-14 using the PGM detector at a scan rate of one detector width per second is shown below:

$$i = 1\,\text{sec}$$

$$b_i = 1\,\text{sec}\cdot\frac{40\text{ counts}}{\text{minute}}\cdot\frac{\text{minute}}{60\text{ sec}} = 0.67\text{ counts}$$

$$MDC_{SCAN} = \frac{1.38\sqrt{0.67}\left(\frac{60}{1}\right)}{\left(\sqrt{0.5}\right)(0.05)\left(\frac{15.5}{100}\right)} = 12{,}337\text{ dpm/100 cm}^2$$

6.4.2 Static Counting

Timed counts were not performed; however the surveyor recorded measurements at discrete locations during baseline, daily, and release surveys. The surveyor paused at these discrete locations, listened for an audible increase in the detector count rate, and then recorded the average count rate indicated on the meter face. Because the surveyor paused and listened to the audible response, the ratemeter scanning equation is used to estimate the detection sensitivity assuming a residence interval of 10 seconds.

A typical MDC_{STATIC} calculation for C-14 using the PGM detector with a residence interval of ten seconds is shown below:

$$i = 10\,\text{sec}$$

$$b_i = 10\,\text{sec}\cdot\frac{45\text{ counts}}{\text{minute}}\cdot\frac{\text{minute}}{60\text{ sec}} = 6.7\text{ counts}$$

$$MDC_{SCAN} = \frac{1.38\sqrt{6.7}\left(\frac{60}{10}\right)}{\left(\sqrt{0.5}\right)(0.05)\left(\frac{15.5}{100}\right)} \approx 3{,}901 \text{ dpm/100 cm}^2$$

6.4.3 Smear Counting

Smear counting Minimum Detectable Concentration at a 95% confidence level is calculated using the following equation, which is NUREG 1507, "Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions", Table 3.1 (Strom & Stansbury, 1992):

$$MDC_{smear} = \frac{3 + 3.29\sqrt{B_r \cdot t_s \cdot (1 + \frac{t_s}{t_b})}}{t_s \cdot E}$$

Where:

MDC_{smear} = minimum detectable concentration level (dpm/smear)
B_r = background count rate (counts per minute)
t_b = background count time (minutes)
t_s = sample count time (minutes)
E = instrument efficiency for radionuclide emission of interest (cpm/dpm)

The liquid scintillation counter was setup to count samples in three channels as described in Section 9.4. The MDC calculation for the C-14 LSC channel using conservative parameters is shown below.

$$^{14}\text{C MDC}_{\text{SMEAR}} = \frac{3 + 3.29\sqrt{(25)(1)\left(1 + \frac{1}{1}\right)}}{(1)(0.8)} = 33 \text{ dpm}$$

Because the counting efficiency is different for each LSC measurement depending on quench characteristics, and in consideration of the errors associated with wipe counting (i.e., area wiped, wiping pressure, etc.), the *a priori* estimate of smear MDCs calculated above is applied to all removable contamination measurements.

6.5 Instrumentation Specifications

The instrumentation used for facility decommissioning surveys is summarized in the following tables.

Table 6-1: Instrumentation Specifications

Detector Model	Detector Type	Detector Area (cm²)	Window Thickness (mg/cm²)	Typical Efficiency
Johnson HP-265	Pancake G-M	15.5	1.7	5 % (C-14)
Packard 150	Liquid Scintillation	N/A	N/A	80 % (C-14)

Table 6-2: Typical Instrument Operating Parameters and Sensitivities

Measurement Type	Detector Model	Maximum Scan Rate (in/sec)	Count Time (sec)	Background (cpm)	MDC (dpm/100 cm²)
Surface Scans	Pancake G-M	1.7	N/A	40	12,337 (C-14)
Fixed Measurements	Pancake G-M	N/A	10	40	3,901 (C-14)
Removable Activity	Packard 150	N/A	60	25 (C-14)	33 (C-14)

7.0 AREA CLASSIFICATION

Based on the facility operational history, areas were classified as impacted or non-impacted. Non-impacted areas are areas without residual radioactivity from licensed activities and are not surveyed during final status surveys. Impacted areas are those areas with potential residual radioactivity from licensed activities. Impacted areas are subdivided into Class 1, Class 2 or Class 3 areas. Class 1 areas have the greatest potential for contamination and therefore receive the highest degree of survey effort for the final status survey using a graded approach, followed by Class 2, and then by Class 3.

Usage areas within the temporary lab were well defined and research activities were conducted over a short period of time (<3 weeks) by a single user; therefore the operational history is well understood. Surveys were conducted at least daily in the specific locations of usage (trays, benchtop locations, etc.).

Because the truck surfaces were covered with plastic and absorbent paper, waste materials and C-14 compounds were packaged per DOT requirements for shipment, there were no spills, and no contamination was detected on 100% survey of the plastic covering after research, the box truck is classified as non-impacted. After research was completed, all equipment and materials were surveyed and released for unrestricted use or packaged for

shipment according to DOT requirements, then the non-impacted status of the truck was confirmed by performing a wipe survey.

Because all impacted surfaces were released using the UWM license procedures for release of equipment and materials, there are no impacted facility surfaces that are applicable to MARSSIM protocols; however, this report is designed to show that closeout surveys meet the intent of MARSSIM.

8.0 SURVEY UNITS

A survey unit is a geographical area of specified size and shape for which a separate decision is made whether or not that area meets the release criteria. A survey unit is normally a portion of a building or site that is surveyed, evaluated, and released as a single unit.

Even though there are no impacted structures associated with licensed research activities applicable to MARSSIM protocols, the surveyor performed surveys of the temporary laboratory after research and prior to releasing all equipment and materials; this consisted of scan surveys, fixed measurements, and wipe surveys at ten judgmental locations with the highest probability for residual radioactivity. For the purpose of demonstrating MARSSIM equivalence, the temporary laboratory is considered a single Class 1 survey unit and the data is assessed using MARSSIM procedures.

9.0 FINAL STATUS SURVEYS

Even though there are no impacted structures associated with licensed activities, the surveyor conducted a final survey of the temporary laboratory (the daily survey for the last day of research) before surveying all equipment and materials for release. These surveys were conducted by performing scan surveys, fixed measurements, and removable activity measurements as discussed further in this section. Survey data was documented on survey maps and/or associated data information sheets. Survey maps and data sheets are presented in Appendix A.

9.1 Background Determination

For direct measurements, an ambient background was determined for each survey, was subtracted from gross measurements, and was used to calculate the actual survey MDCs and associated count errors. The surveyor conducted background measurements outside the box truck. For wipe surveys, the surveyor collected a wipe outside the truck with each data set.

9.2 Surface Scans

Scanning was used to identify locations within the survey unit that exceed the investigation level. All impacted areas received a 100% scan of accessible surfaces.

9.3 Total Surface Activity Measurements

Total surface activity measurements were taken at each identified sample location. These measurements were performed by holding the detector at the sample location for a fixed amount of time (assumed to be 10 seconds) and listening for an audible increase in the detector count rate.

9.3.1 Number of Samples

Per MARSSIM Section 4.6: "Special considerations may be necessary for survey units with structure surface areas less than 10 m^2 or land areas less than 100 m^2. In this case, the number of data points obtained from the statistical tests is unnecessarily large and not appropriate for smaller survey unit areas. Instead, some specified level of survey effort should be determined based on the DQO process and with the concurrence of the responsible regulatory agency. The data generated from these smaller survey units should be obtained based on judgment, rather than on systematic or random design, and compared individually to the DCGLs."

Because only a small section of the temporary lab within the box truck was used for research and radioactivity was limited to small discrete areas within the lab, the number of samples and sample locations judgmentally selected by the surveyor are appropriate for the situation. The locations are spatially distributed and selected at locations of highest probability for residual radioactivity.

9.3.2 Sample Locations

Sample locations were judgmentally selected by the surveyor. A map of final status survey locations is included in Appendix A.

9.4 Removable Surface Activity Measurements

Removable surface activity measurements were collected by wiping an area of approximately 100 cm^2. The LSC was set up for three channels without background subtraction at the following energies:

Channel 1 (^3H):	0 – 18.6 keV
Channel 2 (^{14}C):	0 – 156 keV
Channel 3 (Open):	2 – 2,000 keV

Because C-14 is the only nuclide of concern, only the C-14 channel is considered.

10.0 SURVEY RESULTS AND DATA QUALITY ASSESSMENT

The statistical guidance contained in Section 8 of MARSSIM was used to determine if areas are acceptable for unrestricted release.

10.1 Building Structural Surfaces Scan Data

The surveyor did not detect any locations of elevated radioactivity while listening to the audible detector response during scans of 100% of accessible impacted surfaces.

10.2 Data Summary Tables

Final status data is presented in the following tables.

Table 10-1: Structural Surfaces Total Beta Surface Activity Summary [3]

# of Sample Locations	Mean	MDC	Standard Deviation	Min.	Max.	Investigation Level	Any Results Exceeding Investigation Level?
	(net dpm/100 cm²)						
10	3,901	3,901	0	3,901	3,901	5,000	NO

Table 10-2: Building Structural Surfaces Removable C-14 Summary [4]

# of Sample Locations	Mean	Standard Deviation	Min.	Max.	Investigation Level	Any Results Exceeding Investigation Level?
	(net dpm/100 cm²)					
12	4	7	-5	19	1,000	NO

10.3 Determining Compliance

A sufficient number of samples were taken and all total and removable surface activity results were less than the applicable DCGL; therefore, no further statistical tests are required.

Conclusion: The null hypothesis is rejected; the survey unit passes the statistical tests and is suitable for release for unrestricted use.

11.0 ALARA ANALYSIS

Due to the extremely low doses associated with residual radioactivity from licensed activities, a quantitative ALARA analysis is not required.

12.0 CONCLUSION

The survey unit passes and is suitable for unrestricted release based on the surface activity limits for equipment and materials specified in the UWM license. Dose-based surface activity limits such as those contained in ANSI/HPS N13.12-2013 Table 1 (based on 1 mrem/yr) indicate that potential doses from the release of equipment and materials used for research are a small fraction of the license termination criteria of 25 mrem/yr.

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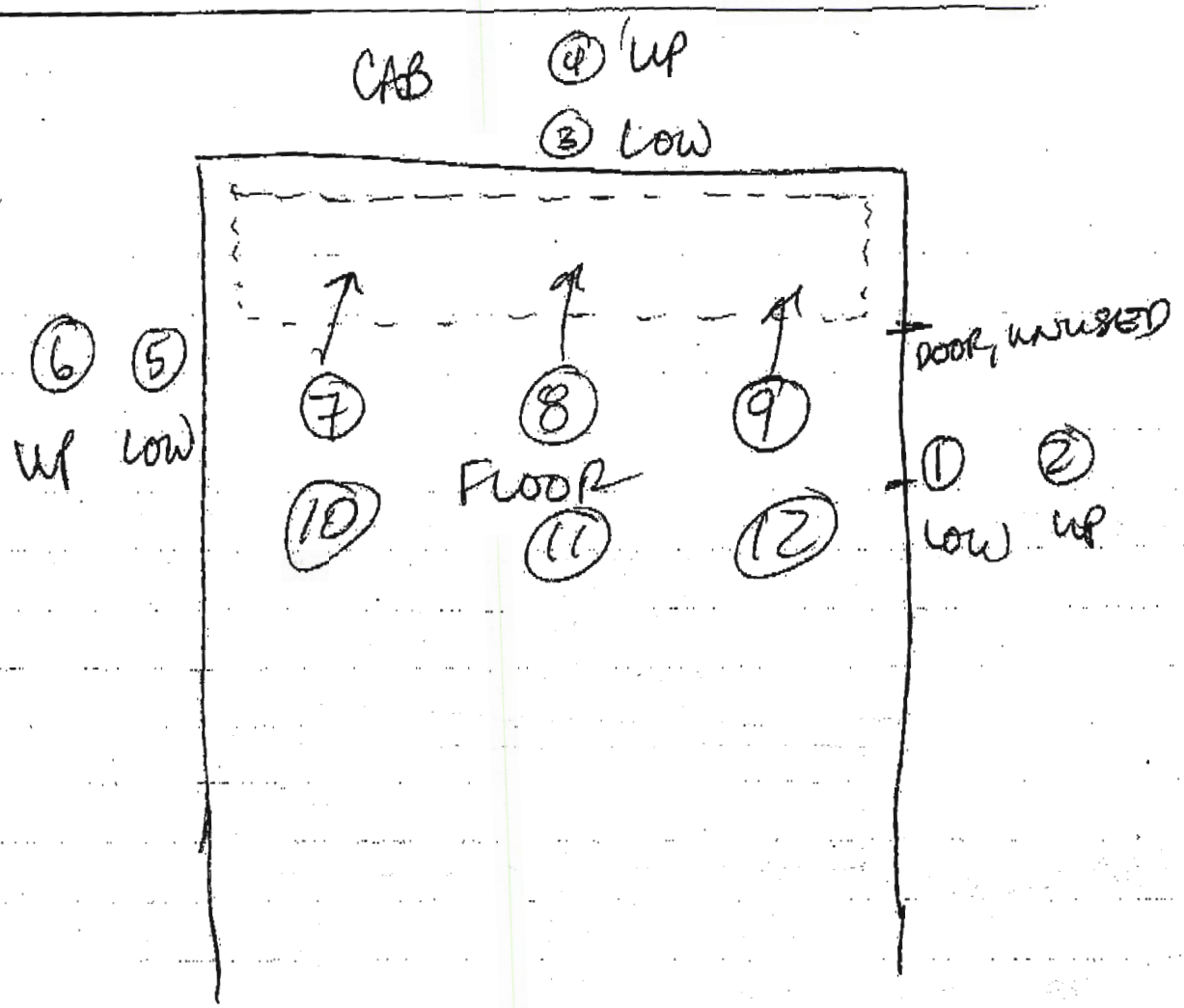
[3] The total surface activity results are from the daily surveys conducted on 7/31/03. Survey results were recorded as "background"; therefore the MDC was used for each survey result.

[4] The removable activity measurements are the post-research wipes conducted on 8/3/03 and are not at the same locations as the total surface activity measurements.

13.0 REFERENCES

- NRC Regulations 10 CFR 20 Subpart E
- NUREG-1575, "Multi-Agency Radiation Survey and Site Investigation Manual" (MARSSIM)
- NUREG-1757, Volume 1, Rev. 2 "Consolidated NMSS Decommissioning Guidance: Decommissioning Process for Materials Licensees," September, 2006
- NUREG 1507, "Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions"
- ISO-7503-1, "Evaluation of Surface Contamination – Part 1: Beta Emitters and Alpha Emitters." 1988
- NUREG-1757, Volume 2, Rev. 1 "Consolidated NMSS Decommissioning Guidance: Characterization, Survey, and Determination of Radiological Criteria," September, 2006
- ANSI/HPS N13.12-2013, "Surface and Volume Radioactivity Standards for Clearance," May 2013
- NUREG 1556, Volume 7, Table Q.2, "Acceptable Surface Contamination Levels for Equipment," December 1999
- Ludlum Measurements website, http://ludlums.com/component/virtuemart/radiation-detector-185-detail?activetab=specifications&Itemid=2657 accessed September 20, 2017

Appendix A
Survey Maps and Results



YNP 03 PRE USE WIPE TEST MAP
BEFORE PLASTIC 7/10/03

	BEFORE (7/10)		AFTER (8/3)	SAT ON BEFORE COUNTING
1	45		48	
2	39		72	
3	58		90	
4	70		52/56	IMMED/OVERNIT
5	38		108	
6	95	GREASY	53	
7	79		50	
8	52		72	
9	60		18!	
10	62		70	
11	58		48	
12	70		78	
CON	BACK WINDOW OF CAR 88		80/118	IMMED/OVERNIGHT

COUNTED FOR STATISTICS BACK AT WATER, ATTACHED

Radiation Survey for the Month of JULY 2003

Location: YNP FIELD SITE Authorized User: CUTHER

BEGIN/END

Instrument: PACKARD 150 LIQ SCINT CTR

DAILY PANCAKE COUNTER

Unit of Measure: CPM

FRONT

T B1 B2

I1 F2 F3 F4

I2 F1 R

R=REFER

I=INCUBATOR T=TRAY
B=BENCH F=FLOOR

	Date 2003	BKG	Check Source	Location 1 I1	2 I2	3 F1	4 F2	5 T	6 B1	7 B2	8 F3	Initials F4	R	INIT
OPEN SOURCE	7/14/03	40	10K	BKG	BKG	BKG	BKG	BKG	250[1]	BKG	BKG	BKG	BKG	RLC
	7/15	40	10K	BKG	BKG	BKG	BKG	BKG	BKG	BKG	BKG	BKG	BKG	RLC
	7/16	45	10K	BKG	BKG	BKG	BKG	BKG	BKG	BKG	BKG	BKG	BKG	RLC
	7/17	40	10K	BKG	BKG	BKG	BKG	BKG	350[1]	BKG	BKG	BKG	BKG	RLC
	7/18	45	10K	BKG	BKG	BKG	BKG	BKG	BKG	BKG	BKG	BKG	BKG	RLC
	7/19	40	10K	BKG	BKG	BKG	BKG	BKG	BKG	BKG	BKG	BKG	BKG	RLC
	7/20	40	10K	BKG	BKG	BKG	BKG	BKG	BKG	BKG	BKG	BKG	BKG	RLC
	7/21	40	10K	BKG	BKG	BKG	BKG	BKG	BKG	BKG	BKG	BKG	BKG	RLC
	7/22	45	10K	BKG	BKG	BKG	BKG	BKG	BKG	BKG	BKG	BKG	BKG	RLC
	7/23	40	10K	BKG	400[2]	BKG	BKG	BKG	BKG	BKG	BKG	BKG	BKG	RLC
	7/24	40	10K	BKG	BKG	BKG	BKG	BKG	600[1]	BKG	BKG	BKG	BKG	RLC
	7/25	40	10K	BKG	BKG	BKG	BKG	500[3]	BKG	BKG	BKG	BKG	BKG	RLC
	7/26	40	10K	BKG	BKG	BKG	BKG	BKG	BKG	BKG	BKG	BKG	BKG	RLC
	7/27	45	10K	BKG	BKG	BKG	BKG	BKG	BKG	BKG	BKG	BKG	BKG	RLC
	7/28	40	10K	BKG	BKG	BKG	BKG	250[3]	BKG	BKG	BKG	BKG	BKG	RLC
	7/29	40	10K	BKG	300[2]	BKG	BKG	BKG	BKG	BKG	BKG	BKG	BKG	RLC
	7/30	40	10K	BKG	BKG	BKG	BKG	BKG	BKG	BKG	BKG	BKG	BKG	RLC
	7/31	40	10K	BKG	BKG	BKG	BKG	BKG	BKG	BKG	BKG	BKG	BKG	RLC
		PACK UP TO LEAVE. WIPE TEST												
30 SEC ON SITE CTS	8/3	30/118	SEE	MAP. ALL LESS THAN BKG SAMPLE (CAR WINDOW)										

Comments: 1 SPOT ON PAPER. REPLACED → BKG
2 SPOT ON PLASTIC COVER. ACID WASHED → BKG
3 SPOTS IN TRAY AFTER INOCULATION. ACID WASHED → BKG

DataLink 1500 2.15 (C) Copyright Packard Instrument Co. 1987 16-Aug-13 20:35

03 4NP

Protocol No. 10 Protocol Name: WIDE OPEN WINDOW User: ANY

PRE-USE WIPE TEST

Region A: LL-UL= .0- 18.6 Bkg= .000 Div(K)=1.00
Region B: LL-UL= .0- 156 Bkg= .000 Div(K)=1.00
Region C: LL-UL= 2.0- 2000 Bkg= .000
QIP = tSIE

PID	S#	Time	CPMA	CPMB	CPMC
43	1	1.00	14.00	21.00	27.00
43	2	1.00	12.00	27.00	24.00
43	3	1.00	15.00	23.00	28.00
43	4	1.00	11.00	22.00	25.00
43	5	1.00	25.00	42.00	34.00
43	6	1.00	12.00	19.00	23.00
43	7	1.00	26.00	35.00	25.00
43	8	1.00	6.00	11.00	16.00
43	9	1.00	6.00	14.00	21.00
43	10	1.00	13.00	25.00	30.00
43	11	1.00	29.00	42.00	31.00
43	12	1.00	13.00	22.00	19.00

DataLink 1500 2.15 (C) Copyright Packard Instrument Co. 1987 12-Aug-:3 8:47

Protocol No. 10 Protocol Name: WIDE OPEN WINDOW User: ANY

Region A: LL-UL= .0- 18.6 Bkg= .000 Div(K)=1.00
Region B: LL-UL= .0- 156 Bkg= .000 Div(K)=1.00
Region C: LL-UL= 2.0- 2000 Bkg= .000
QIP = tSIE

034NP
POST WORK
WIPE TEST

PID	S#	Time	CPMA	CPMB	CPMC	
43	1	1.00	5.00	16.00	*19.00	CAR WINDOW
(1 missing vial)						
43	3	1.00	9.00	16.00	18.00	1
43	4	1.00	10.00	24.00	28.00	2
43	5	1.00	12.00	26.00	34.00	3
43	6	1.00	12.00	20.00	21.00	4
43	7	1.00	21.00	34.00	26.00	5
43	8	1.00	5.00	15.00	18.00	6
43	9	1.00	5.00	20.00	25.00	7
43	10	1.00	13.00	24.00	25.00	8
43	11	1.00	12.00	18.00	24.00	9
43	12	1.00	9.00	26.00	28.00	10
51	13	1.00	14.00	25.00	27.00	11
51	14	1.00	11.00	18.00	24.00	12

OK

Appendix B
Wisconsin Radioactive Materials License Number 079-1324-01

STATE OF WISCONSIN
DEPARTMENT OF HEALTH SERVICES

RADIOACTIVE MATERIALS LICENSE

Under s.254.365, Wisconsin Statutes and Chapter DHS 157, Wisconsin Administrative Code, and in reliance on statements and representations made by the licensee, a license is issued authorizing the licensee to receive, acquire, possess and transfer radioactive material designated below; to use the material for the purpose(s) and at the place(s) designated below; and to deliver or transfer the material to persons authorized to receive it in accordance with Chapter DHS 157, Wisconsin Administrative Code. This license is subject to all applicable rules and orders of the Wisconsin Department of Health Services (DHS) including Chapter DHS 157, Wisconsin Administrative Code now or hereafter in effect, and to any conditions specified below.

Licensee Name and Address	In accordance with letter dated May 9, 2017, 3. License No: 079-1324-01 is amended in its entirety to read as follows:
1. University of Wisconsin - Milwaukee University Safety and Assurances	4. Amendment No.: 10
2. Radiation Safety Program Post Office Box 413 Milwaukee, Wisconsin 53201-413	5. Expiration Date: February 28, 2021

6. Radioactive material	7. Chemical and/or physical form	8. Maximum amount of radioactive materials that the licensee may possess at any one time under this license:	9. Authorized Use:
A. Beryllium-7	A. Any	A. 10.0 mCi	**A through DD.** For use in *in vitro* studies; research & instruction as defined in DHS 157.03(315). Items L, M, and O may be used in *in vivo* studies.
B. Barium-133	B. Any	B. 1.0 mCi	
C. Bismuth-207	C. Any	C. 1.0 mCi	
D. Calcium-45	D. Any	D. 10.0 mCi	
E. Carbon-14	E. Any	E. 500.0 mCi	
F. Cesium-134	F. Any	F. 1.0 mCi	
G. Cesium-137	G. Any	G. 1.0 mCi	
H. Chromium-51	H. Any	H. 10.0 mCi	
I. Cobalt-60	I. Any	I. 10.0 mCi	
J. Europium-152	J. Any	J. 10.0 mCi	
K. Europium-154	K. Any	K. 1.0 mCi	

RADIOACTIVE MATERIALS LICENSE
SUPPLEMENTARY SHEET

License Number: 079-1324-01

Amendment No.: 10

L.	Fluorine-18	L.	Any	L.	60.0 mCi	
M.	Hydrogen-3	M.	Any	M.	100.0 mCi	
N.	Iodine-125	N.	Unbound or Volatile	N.	50.0 mCi	
O.	Iodine-125	O.	Bound or Non-Volatile	O.	10.0 mCi	
P.	Iron-59	P.	Any	P.	10.0 mCi	
Q.	Mercury-203	Q.	Any	Q.	10.0 mCi	
R.	Nickel-63	R.	Any	R.	100.0 mCi	
S.	Phosphorus-32	S.	Any	S.	100.0 mCi	
T.	Phosphorus-33	T.	Any	T.	1.0 mCi	
U.	Lead-210	U.	Any	U.	5.0 mCi	
V.	Sodium-22	V.	Any	V.	1.0 mCi	
W.	Samarium-151	W.	Any	W.	10.0 mCi	
X.	Strontium-85	X.	Any	X.	1.0 mCi	
Y.	Strontium-90	Y.	Any	Y.	100.0 mCi	
Z.	Sulfur-35	Z.	Any	Z.	10.0 mCi	
AA.	Technetium-99	AA.	Any	AA.	10.0 mCi	
BB.	Yttrium-88	BB.	Any	BB.	10.0 mCi	
CC.	Yttrium-90	CC.	Any	CC.	10.0 mCi	
DD.	Zinc-65	DD.	Foil sources registered either with NRC under 10 CFR 32.210 or with an Agreement State	DD.	No single source to exceed 15 millicuries	
EE.	Nickel-63	EE.	Sealed source registered with NRC under 10 CFR 32.210 or with an Agreement State	EE.	One source not to exceed 3 curies	EE. To be used for sample analysis in compatible gas chromatography devices.

RADIOACTIVE MATERIALS LICENSE
SUPPLEMENTARY SHEET

License Number: 079-1324-01

Amendment No.: 10

FF.	Cesium-137	FF.	Sealed source registered with NRC under 10 CFR 32.210 or with an Agreement State	FF.	One source not to exceed 0.75 mCi	FF.	To be used in J.L. Shepherd and Associates Instrument Calibrator Model 28-6B for instrument calibration.
GG.	Cesium-137	GG.	Sealed source registered with NRC under 10 CFR 32.210 or with an Agreement State	GG.	One source not to exceed 0.75 mCi	GG.	Storage only, pending disposal.
HH.	Polonium-208	HH.	Liquid or solid	HH.	0.001 mCi	HH-WW and ZZ.	For use as calibration and quality control sources in alpha spectrometry.
II.	Polonium-209	II.	Liquid or solid	II.	0.002 mCi		
JJ.	Radium-226	JJ.	Liquid or solid	JJ.	0.001 mCi		
KK.	Thorium-228	KK.	Liquid or solid	KK.	0.100 mCi	KK-NN, RR-YY.	For research and development related to the separation and concentration of metal ions.
LL.	Thorium-229	LL.	Liquid or solid	LL.	0.100 mCi		
MM.	Thorium-230	MM.	Liquid or solid	MM.	0.100 mCi		
NN.	Thorium-232	NN.	Liquid or solid	NN.	0.100 mCi		
OO.	Uranium-234	OO.	Liquid or solid	OO.	0.001 mCi		
PP.	Uranium-235	PP.	Liquid or solid	PP.	0.001 mCi		
QQ.	Uranium-238	QQ.	Liquid or solid	QQ.	0.001 mCi		
RR.	Americium-241	RR.	Liquid or solid	RR.	0.100 mCi		
SS.	Americium-243	SS.	Liquid or solid	SS.	0.100 mCi		
TT.	Curium-244	TT.	Liquid or solid	TT.	0.005 mCi		
UU.	Actinium-227	UU.	Liquid or solid	UU.	0.100 mCi		
VV.	Neptunium-237	VV.	Liquid or solid	VV.	0.100 mCi		
WW.	Protactinium-233	WW.	Liquid or solid	WW.	0.100 mCi		
XX.	Uranium-233	XX.	Liquid or solid	XX.	0.01 grams (0.095 mCi)		
YY.	Plutonium-239	YY.	Liquid or solid	YY.	0.0015 grams (0.092 mCi)		
ZZ.	Uranium-236	ZZ.	Liquid or solid	ZZ.	0.100 mCi		

RADIOACTIVE MATERIALS LICENSE SUPPLEMENTARY SHEET	License Number: 079-1324-01 Amendment No.: 10

CONDITIONS

10. A. Licensed material may be used or stored at the licensee's facilities located at Lapham Hall at 3209 N. Maryland Avenue, Milwaukee; the Chemistry Building at 3210 N. Cramer Street, Milwaukee; or the Great Lakes WATER Institute facility at 600 E. Greenfield Avenue, Milwaukee.

B. Licensed material in Subitem 6.E and Subitem 6.M may be used or stored at the licensee's facilities located at Garland/Pearse Halls at 2441 E. Hartford Avenue, Milwaukee.

C. Licensed material in Subitem 6.L may be used or stored at the licensee's facilities located at the Physics Building at 1900 E. Kenwood Boulevard, Milwaukee.

D. Licensed material may be used aboard the licensee's research vessels at temporary jobsites (i.e., lakes and waterways within Wisconsin borders) anywhere in Wisconsin where DHS maintains jurisdiction for regulating the use of licensed material in accordance with statements, representations and procedures contained in the application dated July 27, 2016.

11. The Radiation Safety Officer for this license is Kimberly Axtman.

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

Kimberly Axtman	**Cs-137(Item 6.FF and 6.GG)**
Russell L. Cuhel, Ph.D.	C-14, H-3, P-32, P-33, S-35, Ni-63(Item 6.FF)
Mark Dietz, Ph.D.	Am-241, Ba-133, Bi-207, Ca-45, C-14, Cm-244, Co-60, Cr-51, Cs-134, Cs-137, Eu-152, Eu-154, Fe-59, Na-22, Ni-63(Item 6.S), Pb-210, Sm-151, Sr-85, Sr-90, Tc-99, Th-228, Th-229, Y-90, Zn-65, Pu-239, U-233, Th-230, Th-232, Am-243, Ac-227, Np-237, U-238
Madhusudan Dey, Ph.D.	P-32, P-33, S-35
David N. Frick, Ph.D.	P-32
Laodong Guo, Ph.D.	Hg-203, Pb-210, **Po-208**, Po-209, Pa-233/Np-237, Y-88, Fe-59
Fred J. Helmstetter, Ph.D.	C-14, H-3
J. Val Klump	Be-7, Cs-134, Cs-137, Ra-226, Th-230, Th-232, U-234, U-235, U-236, U-238, Am-243, Ac-227, **Po-209**
Mark J. McBride, Ph.D.	H-3, P-32, P-33, S-35
Heather A. Owen, Ph.D.	**P-32**
Xiaohua Peng, Ph.D.	P-32
Daad Saffarini, Ph.D.	H-3, P-32
Brian S. Shepherd, Ph.D.	H-3, I-125 (bound), I-125 (unbound), P-32, P-33, S-35
Yongjin Sung, Ph.D	F-18
James Waples	**Y-88, Th-229, Po-209, Bi-207, U-236, Ra-226**
Charles Wimpee, Ph.D.	P-32, S-35
Ching-Hong Yang, Ph.D.	P-32
Erica B. Young, Ph.D.	C-14
Dazhong Zhao, Ph.D.	P-32, P-33

13. The licensee is authorized to transport licensed material in accordance with the provisions of Chapter DHS 157, 'Radiation Protection', Subchapter XIII, 'Transportation'.

RADIOACTIVE MATERIALS LICENSE
SUPPLEMENTARY SHEET

License Number: 079-1324-01

Amendment No.: 10

14. Sealed sources containing licensed material shall not be opened or removed from the J. L. Shepherd and Associates Instrument Calibrator Model 28-6B.

15. Animals, or the products from animals, that have been administered licensed material shall not be used for human consumption.

16. Written instructions contained in the manufacturer's instruction manual for the J. L. Shepherd and Associates Instrument Calibrator Model 28-6B shall be followed and a copy of these instructions shall be made available to each individual using or having responsibility for use of licensed material. Any changes in these instructions shall have the prior approval of DHS.

17. 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 DHS, the NRC or another Agreement State to perform such services.

18. Licensed material shall not be used in field applications where it is released.

19. The licensee shall conduct a physical inventory every 6 months, or at other intervals approved by DHS, to account for all sealed sources and/or devices received and possessed under the license. Records of inventories shall be maintained for 5 years from the date of each inventory and shall include the radionuclides, quantities, manufacturer's name and model numbers, location of the sealed or foil sources, and the date of the inventory.

20. Except for plutonium contained in a medical device designed for human application, no plutonium, regardless of form, shall be delivered to a carrier for shipment by air transport or transported in an aircraft by the licensee except in packages the design of which the Nuclear Regulatory Commission has specifically approved for transport of plutonium by air.

21. Detector cells containing licensed material shall not be opened or the sources removed from the detector cell by the licensee.

22. 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.

23. License material shall not be used in or on humans beings.

24. 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, radioactive 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.

    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 radioactive 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.

25. 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,

RADIOACTIVE MATERIALS LICENSE SUPPLEMENTARY SHEET	License Number: 079-1324-01
	Amendment No.: 10

listed below. Chapter DHS 157, 'Radiation Protection' shall govern unless the statements, representations, and procedures in the licensee's application and correspondence are more restrictive than the rule.

A. Application, with attachments, dated July 27, 2016 and signed by Robin Van Harpen, Vice Chancellor of Finance and Administrative Affairs, excluding Item 8, Radioactive Material.

B. Letter, with attachments, dated August 23, 2016 and signed by Sharron A. Daly.

C. Letter, with attachments, dated August 24, 2016 and signed by Sharron A. Daly.

D. Letters, with attachments, dated October 4, 2016 and signed by Melissa C. Spadanuda.

E. Letter, with attachments, dated December 12, 2016 and signed by Melissa C. Spadanuda.

F. Letter, with attachments, including facility diagrams, dated May 9, 2017 and signed by Kimberly Axtman.

E. Letter, with attachments, dated May 30, 2017 and signed by Kimberly Axtman.

FOR THE WISCONSIN DEPARTMENT OF HEALTH SERVICES

Mark Paulson

Digitally signed by Mark D. Paulson
Date: 2017.06.09 14:45:42 -05'00'

SIGNATURE

2017/06/09
DATE

Materials Program Supervisor

UNIVERSITY of WISCONSIN
UWMILWAUKEE

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FACSIMILE

DATE: 11/06/17

TO:

NAME: Sandy Frazier

ORGANIZATION: NRC

FAX NUMBER: 630-515-1259

PHONE NUMBER:

FROM: Kim Axtman

NUMBER OF PAGES (Including Cover Sheet): 33

COMMENTS: call me, if you have any questions
414-430-7507.