NRC FORM 313 **U.S. NUCLEAR REGULATORY COMMISSION**
(10-2005)
10 CFR 30, 32, 33,
34, 35, 36, 39, and 40

APPLICATION FOR MATERIAL LICENSE

APPROVED BY OMB: NO. 3150-0120 **EXPIRES: 10/31/2008**
Estimated burden per response to comply with this mandatory collection request: 4.4 hours. Submittal of the application is necessary to determine that the applicant is qualified and that adequate procedures exist to protect the public health and safety. Send comments regarding burden estimate to the Records and FOIA/Privacy Services Branch (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0120), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

INSTRUCTIONS: SEE THE APPROPRIATE LICENSE APPLICATION GUIDE FOR DETAILED INSTRUCTIONS FOR COMPLETING APPLICATION. SEND TWO COPIES OF THE ENTIRE COMPLETED APPLICATION TO THE NRC OFFICE SPECIFIED BELOW.

APPLICATION FOR DISTRIBUTION OF EXEMPT PRODUCTS FILE APPLICATIONS WITH:

DIVISION OF INDUSTRIAL AND MEDICAL NUCLEAR SAFETY
OFFICE OF NUCLEAR MATERIALS SAFETY AND SAFEGUARDS
U.S. NUCLEAR REGULATORY COMMISSION
WASHINGTON, DC 20555-0001

ALL OTHER PERSONS FILE APPLICATIONS AS FOLLOWS:

IF YOU ARE LOCATED IN:

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

LICENSING ASSISTANCE TEAM
DIVISION OF NUCLEAR MATERIALS SAFETY
U.S. NUCLEAR REGULATORY COMMISSION, REGION I
475 ALLENDALE ROAD
KING OF PRUSSIA, PA 19406-1415

IF YOU ARE LOCATED IN:

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

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

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

NUCLEAR MATERIALS LICENSING BRANCH
U.S. NUCLEAR REGULATORY COMMISSION, REGION IV
611 RYAN PLAZA DRIVE, SUITE 400
ARLINGTON, TX 76011-4005

PERSONS LOCATED IN AGREEMENT STATES SEND APPLICATIONS TO THE U.S. NUCLEAR REGULATORY COMMISSION ONLY IF THEY WISH TO POSSESS AND USE LICENSED MATERIAL IN STATES SUBJECT TO U.S.NUCLEAR REGULATORY COMMISSION JURISDICTIONS.

1. THIS IS AN APPLICATION FOR *(Check appropriate item)*
   - ☐ A. NEW LICENSE
   - ☐ B. AMENDMENT TO LICENSE NUMBER
   - ☑ C. RENEWAL OF LICENSE NUMBER 21-09119-02

2. NAME AND MAILING ADDRESS OF APPLICANT *(Include ZIP code)*
   Northern Michigan University
   1401 Presque Isle Avenue
   Marquette, MI 49855

3. ADDRESS WHERE LICENSED MATERIAL WILL BE USED OR POSSESSED
   Northern Michigan University
   1401 Presque Isle Avenue
   Marquette, MI 49855

4. NAME OF PERSON TO BE CONTACTED ABOUT THIS APPLICATION
   John E. Rebers, Ph.D. (R.S.O.)

   TELEPHONE NUMBER
   (906) 227-1585

SUBMIT ITEMS 5 THROUGH 11 ON 8-1/2 X 11" PAPER. THE TYPE AND SCOPE OF INFORMATION TO BE PROVIDED IS DESCRIBED IN THE LICENSE APPLICATION GUIDE

5. RADIOACTIVE MATERIAL
   a. Element and mass number; b. chemical and/or physical form; and c. maximum amount which will be possessed at any one time.

6. PURPOSE(S) FOR WHICH LICENSED MATERIAL WILL BE USED.

7. INDIVIDUAL(S) RESPONSIBLE FOR RADIATION SAFETY PROGRAM AND THEIR TRAINING EXPERIENCE.

8. TRAINING FOR INDIVIDUALS WORKING IN OR FREQUENTING RESTRICTED AREAS.

9. FACILITIES AND EQUIPMENT.

10. RADIATION SAFETY PROGRAM.

11. WASTE MANAGEMENT.

12. LICENSE FEES *(See 10 CFR 170 and Section 170.31)*
   FEE CATEGORY Exempt | AMOUNT ENCLOSED $ 0.00

13. CERTIFICATION. *(Must be completed by applicant)* THE APPLICANT UNDERSTANDS THAT ALL STATEMENTS AND REPRESENTATIONS MADE IN THIS APPLICATION ARE BINDING UPON THE APPLICANT.

THE APPLICANT AND ANY OFFICIAL EXECUTING THIS CERTIFICATION ON BEHALF OF THE APPLICANT, NAMED IN ITEM 2, CERTIFY THAT THIS APPLICATION IS PREPARED IN CONFORMITY WITH TITLE 10, CODE OF FEDERAL REGULATIONS, PARTS 30, 32, 33, 34, 35, 36, 39, AND 40, AND THAT ALL INFORMATION CONTAINED HEREIN IS TRUE AND CORRECT TO THE BEST OF THEIR KNOWLEDGE AND BELIEF.

WARNING: 18 U.S.C. SECTION 1001 ACT OF JUNE 25, 1948 62 STAT. 749 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.

CERTIFYING OFFICER -- TYPED/PRINTED NAME AND TITLE	SIGNATURE	DATE
John E. Rebers, Professor of Biology	John E Rebers	7/12/07

FOR NRC USE ONLY

TYPE OF FEE	FEE LOG	FEE CATEGORY	AMOUNT RECEIVED	CHECK NUMBER	COMMENTS
			$		
APPROVED BY				DATE	

Supplement

5) Radioactive Materials

	a. Element and mass number	b. Chemical form	c. Physical form	d. Maximum amount which will be possessed at any one time
(1)	Carbon-14	Any chemical	Solid or liquid; non-gaseous; unsealed	20 mCi
(2)	Hydrogen-3	Any chemical	" "	10 mCi
(3)	Phosphorous-32	Any chemical	" "	10 mCi
(4)	Phosphorous-33	Any chemical	" "	10 mCi
(5)	Sulfur-35	Any chemical	" "	40 mCi

Notes:
a) Our previous license also listed Copper-64 and Copper 67. We wish to remove these isotopes from our license.
b) All isotopes will be used in bound (non-volatile) forms.

6) Purpose(s) for which licensed material will be used

The purchased isotope containing compounds will be used for *in vitro* studies of genetic regulation, gene structure, plant and animal metabolism (using small animals), biological transport, enzyme assays, and for chemical synthesis of labeled compounds not commercially available for studies of molecular biology and metabolism.

7) Individual(s) responsible for radiation safety program and their training experience

Radiation Protection Officer:
John E. Rebers, Ph.D.

Assistant Radiation Protection Officer:
William Tireman, Ph.D.

Authorized Users:
Lesley Putman, Ph.D.
Suzanne Williams, Ph.D.

John E. Rebers, Ph.D., Biology, Harvard University
Radiation Protection Officer

Formal training in radioisotopes (John E. Rebers):

Lecture presentation at Harvard University, 1981, 2 hrs

4 session course, "Principles of Radiation Protection"
University of Washington
Seattle, WA 98195
4 x 3 hr sessions, 12 hours total
May, 1985

Videotape presentations at Northern Michigan University
March, 1994
"Fundamentals of Radiation Safety"
"Radiation Protection Standards"
"Risks Associated With Occupational Radiation Exposure"
These videotapes were rented from Radiological Training Services, Burke, VA. Each videotape is approximately 50 minutes long.

Experience working with radioisotopes

- At Harvard University, Dr. Rebers spent approximately 5 years working with P-32 labeled nucleotides in various molecular biological applications. H-3 and S-35 labeled amino acids were used for protein work, and some work was done with H-3 labeled cyclic AMP.

- At the University of Washington, he worked with P-32 and S-35 labeled nucleotides, as well as with H-3 and S-35 labeled amino acids. This research was over a four year period. At the University of Washington he sometimes instructed and supervised graduate students who were using radioisotopes.

Dr. Rebers has conducted work with S-35 and P-32 labeled nucleotides at Northern Michigan University in the Department of Biology since joining the department in August of 1988. He has instructed and supervised undergraduate and graduate students working with these isotopes.

Dr. Rebers has been the Radiation Protection Officer at Northern Michigan University since April, 1992, as noted in amendment # 11 of license 21-09119-02.

Lesley Putman, Ph.D., Biochemistry, Purdue University

Formal training in radioisotopes:

Videotape presentations at Northern Michigan University, March, 1994
"Fundamentals of Radiation Safety"
"Radiation Protection Standards"
"Risks Associated With Occupational Radiation Exposure"
These were rented from Radiological Training Services, Burke, VA. Each videotape was approximately 50 minutes long.

Experience working with radioisotopes:

Performed radioimmunoassays using ^{125}I at the University of Illinois Medical Center (summer, 1982) and at Purdue University (spring, 1984).

Carried out protein synthesis using ^{35}S-methionine, and supervised students using this procedure, at Northern Michigan University (1994).

William Tireman, Ph.D.

Radiation Safety Training

Undergraduate Courses

University of Wisconsin – River Falls
River Falls, WI 54022

PH 204 [1 cr.] General Physics Lab* (a.k.a. Modern Physics)	Jan. thru May 1996
PH 302 [3 cr.] Advanced Physics Lab*	Jan. thru May 1997
PH 426 [4 cr.] Nuclear Physics (no lab component)	Jan. thru May 1997

*Note: In the laboratories licensed exempt sealed and liquid sources were used along with typical undergraduate radiation detection equipment (Geiger counters and scintillation detectors).

Graduate Courses

Kent State University
Kent, Ohio 44242

1) PHY 66302 Nuclear Physics (no lab component)	Jun. thru Aug. 1999
2) PHY 76303 Advanced Nuclear Physics (no lab component)	Jan. thru May 2000

Research Training and Experience

Thomas Jefferson National Accelerator Facility
Newport News, Virginia 23606

SAF801 [8 hours Nominal] Radiation Worker I Certification June 2000
Expired: March 2004

For my dissertation work, I assembled, installed, and operated neutron detectors which were calibrated using a licensed, sealed Th-228 source. I worked with Jefferson Laboratory Radiation Control group with the decontamination and remove of the detectors after the data was collected.

Suzanne Williams, Ph.D., Biochemistry, University of Maryland

Formal training in radioisotopes:

1. Workshop: "Radiation Protection Training Course"
Office of Radiation Safety in the Dept. of Environmental Safety; University of Maryland
2 x 6 hour sessions
February, 1987
The course involved formal lecture presentation, an exam, and certification of proficiency in radioisotope usage.

2. Lecture presentation: "Radiation Safety" Radiation Safety Office of the Jerome Holland Laboratory for the Biomedical Sciences, American Red Cross, Rockville, MD
1 x 3 hour session
January 1991
The course involved a formal lecture presentation and a proficiency exam. The proficiency exam was taken yearly after attendance of the lecture presentation to ensure retained proficiency in radioisotope usage.

3. Videotape presentation: Risks Associated with Occupational Radiation Exposure", rented from Radiological Training Services, Burke, VA. 50 minutes.
March, 1994

Experience working with radioisotopes:

1. University of Maryland, College Park: 4 years experience with ^{35}S and ^{32}P in DNA sequencing studies.

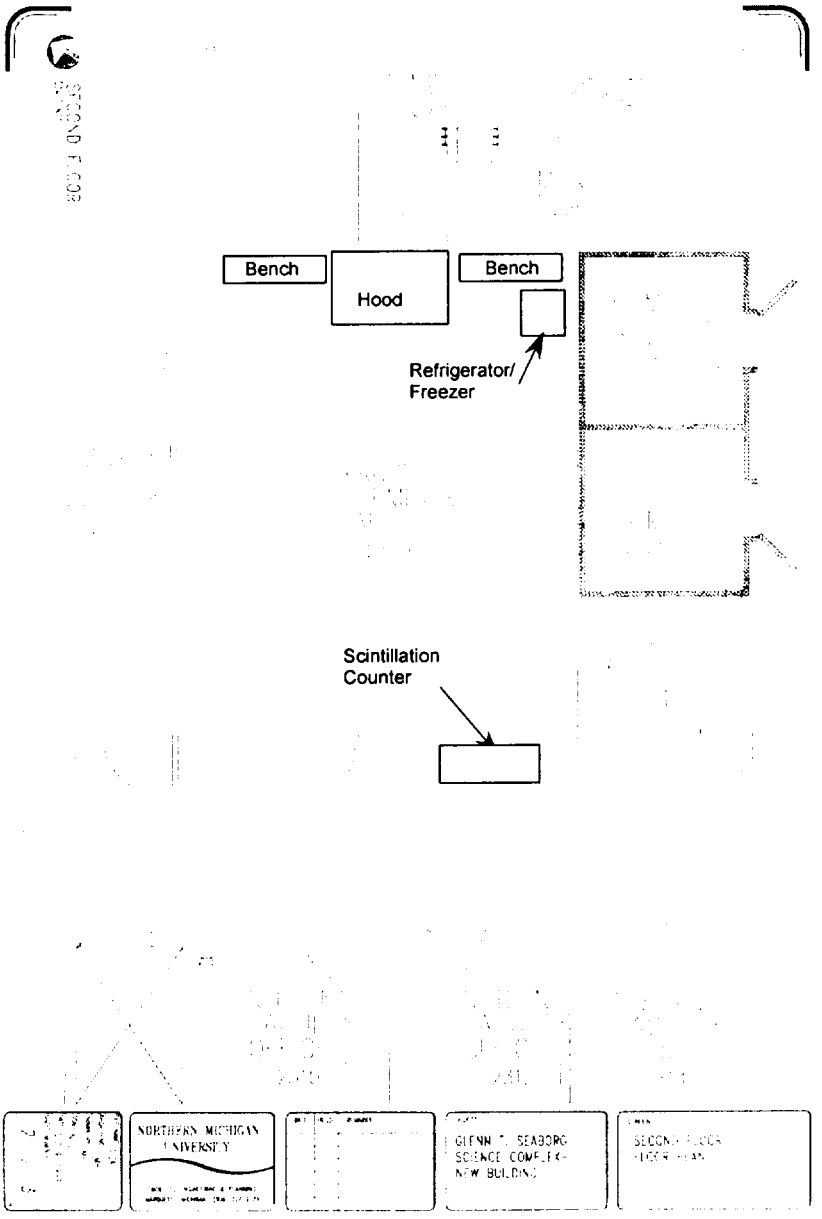
2. Jerome Holland Laboratory of the American Red Cross: 3.5 years experience with ^{3}H metabolic labeling of cells; 3.5 years experience with ^{125}I protein labeling; 1 year experience with ^{32}P labeling of DNA for Northern blotting.

8) Training for individuals working in or frequenting restricted areas.

Training will be provided for anyone using radioisotopes prior to the time those individuals begin working with isotopes, and refresher training will be provided annually. Training will be either in the form of videotapes or lectures. The training will be followed by a quiz administered by the Radiation Safety Officer to assess comprehension of the material. The training will cover core concepts of radiation safety, including radiation vs. contamination, internal vs. external exposure to radiation, biological effects of radiation, the ALARA concept, and the ways time, distance, and shielding can be used to minimize exposure to radiation. Housekeeping staff will be provided instruction on how radioactive materials are labeled, what symbols to look for in areas where radioactive materials are used, which waste containers should not be emptied and how these containers are labeled, and which areas should be avoided by housekeeping staff.

9) Facilities and Equipment

Radioisotopes will be stored and used in Room 2309 of the New Sciences Facility. A diagram of this room is provided below. The scale on this diagram is only approximate.



- When not in use, radioactive materials will be either locked in the refrigerator/freezer indicated on the diagram or locked in a safe adjacent to the refrigerator/freezer.
- NSF 2309 is kept locked except when in use for experiments. Some common-use equipment, including a shaking incubator, is stored in this room. Students using this equipment will be informed that radioactive materials are used and stored in this room and instructed to keep the room secured.
- The door shown at the back of the room connects to an adjacent tissue culture lab and provides an exit in case of fire or other emergencies. This door is locked so only those with a key can enter NSF 2309 from the tissue culture lab.
- A Packard Tri-Carb 1500 Scintillation counter is available in the laboratory. This instrument will be used to determine the results of wipe tests for contamination after the laboratory has been used for work with 14C or 3H. This is the same instrument noted previously on our license application.
- Two locked cabinets lined with 0.5 cm thick plexiglass are provided for storage of radioactive waste. Additional shielding will be used if needed to block emissions from 32P waste stored in these cabinets.
- The fume hood indicated in the diagram is checked annually to confirm that air flow is adequate. The last check showed an average face velocity of 105 cubic feet per minute with a sash height of 7 inches and an average face velocity of 108 cfm with a sash height of 18". According to Robert Ryan, an engineer employed by NMU, a typical hood with sash closed exhausts between 200 and 300 CFM. With the sash open the same hood would exhaust between 600 and 1,000 CFM.
- The benches shown, and additional benches not indicated in the diagram, have a stainless steel surface. Absorbent paper will be used on the benches whenever work with radioisotopes is conducted.
- The floor of the laboratory is coated with epoxy.

10) Radiation Safety Program

10a) Radiation Detection Instruments

We will use instruments that meet the radiation monitoring instrument specifications published in Appendix M to NUREG - 1556, Vol. 7, 'Program-Specific Guidance About Academic, Research and Development, and Other Laboratory Licenses of Limited Scope,' dated December 1999. We reserve the right to upgrade our survey instruments as necessary.

Descriptions of the radiation detection instruments presently used are provided below.

1) Liquid Scintillation Analyzer - Packard Tricarb 1500. Used for quantitative measurements of β and γ emissions.

2) Geiger counter, Ludlum Model 3 Portable Survey Meter with Model 44-9 Pancake G-M detector. Used for routine area surveys.

Calibration of Instruments

Liquid Scintillation Counter

Standard normalization and calibration protocol for Packard TriCarb scintillation counter is run periodically. Commercial C-14 and/or H-3 standards from Packard Instruments are used. The standards available include unquenched H-3 (127,700 dpm on Oct. 14, 1986), quenched H-3 (256,400 dpm on April 8, 1986), unquenched C-14 (127,700 dpm on Sept. 1, 1986) quenched C-14 (108,600 dpm on May 7, 1986).

Geiger Counter

The Ludlum Model 3 and detector are returned to the manufacturer (Ludlum Measurements, 501 Oak Street, Sweetwater, TX 79956; State of Texas Calibration License # LO-1963) annually for calibration.

Personnel Monitoring Devices

Personnel working with P-32 or P-33 are required to wear a film badge and finger badge to monitor exposure to radiation. Since film badges do not effectively record exposures received from low energy β emitters such as ^{3}H, ^{14}C, and ^{35}S, badges are not normally be issued to personnel handling only those isotopes. However, anyone working in an area where high energy β, γ, or X-ray emitting nucleotides are used may request a film badge to monitor exposure, even if that person is not working directly with the radioisotope in question. Film badges are changed each month. Radiation exposure reports supplied by Siemens are kept on file in the office of the radiation protection officer. All personnel are entitled to unrestricted access to the results of any monitoring of their radiation exposure, and are entitled to annual summaries of the results of such monitoring.

The quantities of C-14, H-3 or S-35 in tracer experiments are in the range of tens of microcuries for a given experiment. Under these conditions, no bioassay program is planned. Monitoring with the Ludlum Instruments Model 3 survey meter equipped with a model 44-9 pancake G-M detector is deemed adequate for C-14 and S-35. Monitoring for H-3 is conducted with wipe tests assayed by liquid scintillation counting. If individual exposure accumulates in a short time (usage in the millicurie range over a period of one month), urine bioassays will be performed at the local hospital's radiation laboratory to meet standards set forth in "Guidelines for Bioassay Requirements for Tritium" (NRC, Division of Fuel Cycle and Material Safety). Requirements for tritium bioassays are described in an appendix to the Northern Michigan University Radiation Safety Handbook.

Routine area surveys

Monthly surveys are conducted for areas where experiments with isotopes are conducted or where isotopes are stored. These surveys are only conducted during periods when isotopes covered by our license are actually held on campus. These surveys are conducted with the Ludlum Instruments Model 3 survey meter equipped with a model 44-9 pancake G-M detector. Bench tops, hoods, and any surfaces likely to have been contaminated during work with radioisotopes, and areas where radioactive waste is stored are surveyed. During periods when H-3 is in use, wipe tests assayed by liquid scintillation counting are also conducted, as noted above. Records of these surveys are maintained by the Radiation Protection Officer.

Instructions to Personnel

Copies of NRC Regulatory Guide 8.29 (Instruction concerning risks from occupational radiation exposure) and NRC Regulatory Guide 8.13 (Instruction concerning prenatal radiation exposure) are provided to all personnel using radioisotopes. In addition, periodic videotape presentations are made to instruct personnel in the safe use of radioisotopes. These presentations have included "Fundamentals of Radiation Safety", "Radiation Protection Standards", "Risks Associated With Occupational Radiation Exposure"; all three of these tapes were produced by Radiological Training Services, P.O. Box 288, Burke, VA 22015. Copies of these videotapes are available for loan from the School of Radiology at Marquette General Hospital. Other videotapes may be incorporated in future training programs when appropriate.

A copy of the Northern Michigan University Radiation Safety Handbook is distributed to all personnel working with radioisotopes. This document describes the steps that should be taken by users of radioactive materials at Northern Michigan University to keep exposure to radiation as low as reasonably achievable (ALARA). In all cases, required signs are posted in areas where radioisotopes are used or stored and on containers holding isotopic materials.

10f) Radiation Protection Program

Radioactive isotopes which require refrigeration or freezing will be stored in marked freezers in Room 2309 of the New Sciences Facility. The outside of the refrigerator or freezer is clearly marked, and individual containers inside the refrigerator or freezer are marked with the date, isotope, and amount of radiation. High energy β-emitters are stored with appropriate shielding so no radiation is detectable outside the container. Radioactive materials not requiring refrigeration are stored in locked drawers in Room 2309 of the New Sciences Facility or in the safe in this room. All storage areas are routinely monitored during the periodic laboratory surveys.

H-3 contamination will be monitored by swabbing an area of potential contamination and assaying for radioactivity liquid scintillation counting.

10g) Emergency Procedures

I. Minor spill (less than 50 microcuries)

A. Notifications

Call Radiation Protection Officer (John Rebers) at 227-1585 during work hours or at 228-3617 (home) at other times. If the Radiation Protection Officer is not available, notify the Assistant Radiation Protection Officer (Will Tireman) at 227-1056 (office) or at 2360-2717 (home).

Provide the following information:

1. Location (room number)
2. Name of caller
3. Isotope spilled and amount of isotope spilled
4. Extent of contamination

B. Control Procedures

1. Mark and isolate area of spill
2. Using absorbent paper, blot liquid from surfaces
3. Remove final traces of isotope from surfaces with absorbent paper wetted with detergent
4. Monitor radiation during decontamination and confirm that all contamination has been removed at the end of the procedure.

II. Major spill (greater than 50 microcuries)

A. Notification

1. Same as in I. A.

B. Control Procedures

1.Mark and isolate areas and prevent entry until Radiation Protection Officer arrives.

2.Cleanup and monitoring for radiation to be supervised by Radiation Protection Officer.

III. Spill with injury

A. Notification

1. Call Campus Public Safety (Emergency Number 911, from campus phones or 227-2151 if using a cellular phone) for assistance, providing information about the extent of the injury and the type of isotope involved.
2. Call Radiation Protection Officer (John Rebers) at 227 1585 during work hours or at 228-3617 (home) at other times. If the Radiation Protection Officer is not available, notify the Assistant Radiation Protection Officer (Will Tireman) at 227-1056 (office) or at 2360-2717 (home).

10h) Ordering and Securing of Radioactive Materials

Ordering Isotopes - Radioactive isotopes are ordered via normal procedures by the University Purchasing Office, which maintains a current copy of the by-product license. They check for conformance with licensing requirements. In addition, a copy of the purchasing requisition is filed with the Radiation Protection Officer, who must sign each purchase requisition and who checks to ensure that licensing requirements are met and that the possession limit for that isotope will not be exceeded by the order.

Receiving Isotopes - Isotopes with relatively long half-lives are received by the Biology Stockroom Manager during normal business hours and the package placed in the locked isotope receiving area. The licensee ordering the material is notified and checks the incoming packages for leaks using a Ludlum Measurements Model 3 survey meter equipped with a model 44-9 pancake G-M detector. Packages containing isotopes that are weak β-emitters are tested for leakage using a wipe test with detection by liquid scintillation counting, in those cases where the β-particle is not sufficiently energetic to be detected by the survey meter. Packages are then opened and inventoried, using the Model 3 survey meter continuously when appropriate. During the entire procedure, handlers wear disposable plastic gloves. Personnel exposure is monitored by film badge and by a ring badge, if appropriate. If a shipment with significant external radiation is received, the Radiation Protection Officer is notified immediately and is responsible for transferring the isotope to safe storage. Significant external radiation is determined by the type and amount of isotope at the time of requisition.

Security of radioactive isotopes - All University personnel responsible for transporting isotopes are aware of the contents and must sign for them on receipt. Radioisotopes are kept in a locked refrigerator/freezer or in a locked cabinet.

A copy of a memorandum describing purchase requirements for radioactive materials is included as part of the NMU Radiation Safety Handbook, and is distributed to all authorized users of radioisotopes, as well as to the individuals listed below.

Mr. David Erickson	Chemistry Stockroom Manager
Ms. Jingfang Niu	Biology Stockroom Manager
Dr. Neil Cumberlidge	Head, Department of Biology
Dr. Fred Joyal	Provost and Assoc. VP for Acad. Admin.
Mr. Art Gischia	Director, Purchasing
Mr. John Basolo	Warehouse Attendant, Central Receiving
Dr. Suzanne Williams	Head, Department of Chemistry

Duties of Radiation Protection Officer

The duties of the Radiation Protection Officer include periodic checking to ensure all approved isotopic uses conform to the requirements and limitations of the byproduct license. These include inventory checks, procedural requirements, and record maintenance. The Radiation Protection Officer is also responsible for reviewing notices received from the Nuclear Regulatory Commission and acting upon these notices as appropriate.

Records to be maintained in addition to isotopic inventory logs include:

1) Monthly and accumulate dose from film badge readings
2) Records of isotopes used and disposition of wastes
3) Notes on any spills and area contaminated
4) If contamination occurs, method of decontamination

The Radiation Protection Officer has the responsibility of providing current information supplied by the NRC to all users and to implement any changes that might be required under new regulations. He also has the responsibility to see that isotopes are properly prepared for disposal and to supervise the periodic transmission of waste materials to a licensed disposal site.

11) Waste Management

We will use the model waste procedures published in Appendix T to NUREG - 1556, Vol. 7, 'Program-Specific Guidance About Academic, Research and Development, and Other Licenses of Limited Scope,' dated December 1999.

Solid forms of isotopes, including waste gloves and paper, are stored in clearly marked containers. If waste contains isotopes other than weak β-emitters, the container is placed within 1 cm Plexiglas

shielding (for P-32) or in a lead-lined storage area (for strong β-emitters other than P-32).

Liquid wastes, including scintillation fluid, are stored in capped bottles in storage areas in Room 2309 of the New Sciences Facility. All scintillation fluids used should be biodegradable or aqueous cocktails, so that they may be disposed of as ordinary liquid radioactive waste, rather than as mixed radioactive/hazardous waste. Organic solvents that require disposal as mixed waste may not be used for liquid scintillation counting. Experiments requiring scintillation counting of P-32 should use Cerenkov counting of samples in water when practical, to avoid generating scintillation waste.

All waste containers, whether containing solid or liquid waste, should be clearly labeled with the isotope, the amount of radiation (in microcuries) and the date. A prominent warning label with colors and symbols approved by the NRC designating the container as containing radioactive waste should be attached.

The waste storage areas are routinely surveyed during periodic monitoring of the isotope use area.

P-32 and S-35 wastes are stored for ten half-lives (143 days for P-32 or 874 days for S-35) to allow decay to background. After ten half-lives have elapsed, the container is monitored to ensure that no radioactivity remains and is then disposed of as non-radioactive material. Other isotopes are transferred periodically to an approved low level radioactive waste storage site by a licensed broker. Current storage space is adequate for both short-lived and long-lived radioisotopes.

Procedures to segregate the radioactive materials.

Liquid radioactive waste is stored in bottles, and solid radioactive waste is stored in sealed plastic bags. Both bottles and bags are labeled with the isotope, the amount of activity, the date, and the authorized user.

Physical Description of Storage Area

Waste is stored in Room 2309 of the New Sciences Facility, where work with radioisotopes is conducted. Packages of P-32 waste being held for decay-in-storage (DIS) are kept in a storage cabinet shielded with Plexiglas and monitored to ensure that activity immediately in front of the hood is not detectable above background. A Ludlum Measurements Model 3 survey meter equipped with a model 44-9 pancake G-M detector is used to monitor the activity during routine radiation surveys. Packages of S-35 waste are stored in locked cabinets. No shielding beyond the cabinet doors is needed for the β particles emitted by S-35. Packages of waste held for decay-in-storage are readily accessible for visual inspection during routine monthly surveys.

The waste will be stored in Room 2309 of the New Sciences Facility on the Northern Michigan University campus, and is protected from the weather at all times in this location.

Room 2309 of the New Sciences Facility, where waste is stored for DIS, is normally kept locked. The room is open only when faculty or graduate students conducting research are present.

The normal building ventilation system is adequate to provide ventilation of the storage area.

A fire extinguisher is present in the room, on the wall beside the scintillation counter.

Extremes of temperature and humidity are prevented by the climate control system in the New Sciences Facility building.

The New Sciences Facility building is protected from other physical hazards and is monitored by campus personnel.

Packaging and Container Integrity

Plastic-coated 1 gallon glass bottles are used for storage of small volumes of liquid waste. If storage of larger volumes becomes necessary, plastic 5 gallon carboys will be used. Tightly sealed plastic bags are used for storing solid waste. The waste generated poses no hazard to either bottles or bags.

The DIS packages are inspected monthly during routine area surveys of West Science 51.

No remote handling of DIS packages is needed.

Radiation Protection

Room 2309 of the New Sciences Facility is posted in accordance with 10 CFR § 20.203, since this room is used for laboratory work with radionuclides. Other procedures for radiation protection are described in the Northern Michigan University Radiation Safety Handbook.

In the event of an accident involving injury or fire, the Northern Michigan University Public Safety Department would be notified, as outlined in the "Emergency Procedures" section of the Radiation Safety Handbook. The Public Safety Department would then coordinate any further notification of fire, police, or medical departments needed.

Waste-in-storage is noted on the radioisotope inventory sheet, which is updated every six months. Each authorized user is responsible for monitoring waste-in-storage and disposing of the waste after ten half-lives have elapsed.

Disposal Procedures

The waste is monitored in Room 2309 of the New Sciences Facility; routine area surveys of this room show no activity detectable above the background seen in other rooms in the West Science building. Solid and liquid waste are stored separately; no gaseous waste is stored. P-32 and S-35 waste are stored in segregated areas; containers are also individually marked. P-32 waste is held for a minimum of 143 days and S-35 is held for a minimum of 874 days before disposal. Prior to disposal, a Ludlum Measurements Model 3 survey meter equipped with a model 44-9 pancake G-M detector is used to monitor the activity at the surface of solid waste to ensure that no activity above background is detectable; liquid waste is monitored by scintillation counting. A disposal record which indicates the results of this survey is maintained by the Radiation Protection Officer.

Training

Training is described under the "Instructions to Personnel" section of the Radiation Safety Program (above).

Maximum possession limits do not exceed those referred to by this section.

Rebers - Biology

Northern Michigan University
1401 Presque Isle Avenue
Marquette, MI 49855-5301

FIRST CLASS
UNITED STATES POSTAGE
PITNEY BOWES
02 1A
0004382377
$ 01.14⁰
JUL 13 2007
MAILED FROM ZIP CODE 49855

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