DOW CORNING

April 23, 2008

Materials Licensing Branch
United States Nuclear Regulatory Commission, Region III
2443 Warrenville Road, Suite 210
Lisle, IL 60532-4352

RE: Amendment Request to License No. 21-08362-08

Dear Sir/Madam:

Enclosed you will find an amendment request for Dow Corning Corporation, 2200 W. Salzburg Road, Auburn, MI 48611, **license # 21-08362-08.**

Currently (for fiscal year 2008), our license authorizes more than one activity as follows:

1) Fee Category 3A: Licenses of broadscope for possession and use of byproduct material issued under parts 30 and 33 of this chapter for processing or manufacturing of items containing byproduct material for commercial distribution.

2) Fee Category 3L: Licenses of broadscope for possession and use of byproduct material issued under parts 30 and 33 of this chapter for research and development that do not authorize commercial distribution.

Dow Corning would like to eliminate the Category 3A activity and maintain the Category 3L activity by continuing possession and use of byproduct material for research and development, but not for commercial distribution. Our activities in this regard are described below.

Dow Corning, on occasion, uses byproduct material in toxicological and environmental fate studies. Some of the studies, although conducted and monitored by Dow Corning, are sponsored by silicone manufacturers' industry associations (e.g. Silicone Environmental, Health and Safety Council (SEHSC)). The associations are non-profit trade associations comprised of silicone chemical producers and importers. The studies are conducted either internally at Dow Corning licensed facilities or Dow Corning transfers the byproduct material to a licensed contract research organization (CRO). The byproduct material is not

Dow Corning Corporation
Midland, Michigan 48686-0994
Phone: (989) 496-4000
www.dowcorning.com

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sold to the CRO, nor is it sold to the members of the association(s), although the cost of the byproduct material is accounted for in the overall cost of the study. The industry associations are invoiced for the total cost of the studies, and as a member of these associations, Dow Corning shares in the cost of these studies.

Dow Corning believes that the transfer of byproduct material to a CRO is consistent with activities of research and development set forth in 10 CFR 30.4, but is not commercial distribution. Authorization to transfer byproduct material used for research and development is in accordance with "Rules of General Applicability to Domestic Licensing of Byproduct Material" at 10 CFR Part 30.41. Authorization to transport byproduct material used for research and development is in accordance with "Packaging and Transportation of Radioactive Material" at 10 CFR Part 71.

As stated above, we wish to amend the purpose for which licensed material will be used for Carbon-14, and also Sulfur-35, as documented in Item 6 in the enclosed amendment request. Specifically, we wish to remove the activity of processing and manufacturing of carbon-14 byproduct material for commercial distribution, and for sulfur-35, we wish to include animals in its description of use. In Item 7, two personnel changes are being requested in this amendment. Jeremy Durham will assume the role of the Radiation Safety Officer (RSO) and Paul S. Larson will assume the role of the Assistant RSO. In Item 8 and Item 10 references to NUREG-1556 Volume 12 have been removed. All other terms and conditions of the license will remain the same.

If you have any questions or concerns regarding this request please feel free to contact our current radiation safety officer, Paul S. Larson, at (989) 496-1331 or e-mail to p.s.larson@dowcorning.com, or our current assistant radiation safety officer, Jeremy Durham, at (989) 496-3182 or e-mail to jeremy.durham@dowcorning.com.

Roy A. Campbell

Roy A. Campbell
Health and Environmental Sciences
Manager, Chemistry and Environmental
Dow Coming Corporation
2200 West Salzburg Road

NRC FORM 313 (10-2005) 10 CFR 30, 32, 33, 34, 35, 36, 39, and 40

U.S. NUCLEAR REGULATORY COMMISSION

APPLICATION FOR MATERIALS 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, 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, MISSISSIPPI, 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
- [x] B. AMENDMENT TO LICENSE NUMBER **21-08362-08**
- [ ] C. RENEWAL OF LICENSE NUMBER

2. NAME AND MAILING ADDRESS OF APPLICANT *(Include ZIP code)*

DOW CORNING COPRORATION
2200 WEST SALZBURG ROAD
AUBURN MI 48611

3. ADDRESS WHERE LICENSED MATERIAL WILL BE USED OR POSSESSED

DOW CORNING CORPORATION
2200 WEST SALZBURG ROAD
AUBURN MI 48611

4. NAME OF PERSON TO BE CONTACTED ABOUT THIS APPLICATION

Paul S. Larson, RSO

TELEPHONE NUMBER

(989) 496-1331

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. maiximum 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 | AMOUNT ENCLOSED $

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 CONTANED 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: Roy A. Campbell, Manager Chemistry & Environmental

SIGNATURE: Roy A Campbell

DATE: 4/23/08

FOR NRC USE ONLY

TYPE OF FEE	FEE LOG	FEE CATEGORY	AMOUNT RECEIVED	CHECK NUMBER	COMMENTS
			$		

APPROVED BY | DATE

Item. 5 Radioactive Material

a.	Element and Mass Number	b.	Chemical and/or Physical Form	c.	Maximum amount possessed at any one time
i.	Carbon-14		Any		3 curies
ii.	Hydrogen-3		Any		200 millicuries
iii.	Chromium-51		Any		200 millicuries
iv.	Phosphorus-32		Any		50 millicuries
v.	Iodine-125		Prepackaged Kits		10 millicuries
vi.	Sulfur-35		Any		50 millicuries
vii.	Any byproduct material listed in i. and ii. above		Solid or liquid waste		Possession incident to waste disposal

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

i-iv. To be used in biological tracer studies in plants, animals and microorganisms and for research and development as defined in 10 CFR Part 30, Section 30.4.

v. To be used in biological tracer studies in plants and microorganisms and for research and development as defined in 10 CFR Part 30, Section 30.4.

vi. To be used in biological tracer studies in plants, animals and microorganisms and for research and development as defined in 10 CFR Part 30, Section 30.4

vii. Possession incident to waste disposal.

Item 7. Individual(s) Responsible for Radiation Safety Program and Their Training and Experience

Radiation Safety Officer – Jeremy Durham

Assistant RSO — Paul S. Larson

Dow Corning has a radiation safety committee (RSC), which will consist of the RSC chair, the RSO and/or the assistant RSO, and individuals representing Management and the Science Research and Development Staff. The Chair of the RSC, and representative of management is Roy A. Campbell. The following list of members defines a quorum for this committee: RSC chairperson, the RSO and/or assistant RSO, trained radiation workers from each area of use from which specific issues will be discussed and/or representative(s) whose field of expertise is/are necessary for the discussion to be considered acceptable.

The RSC will be responsible for approving new authorized users, new laboratories, new uses and protocols and reviewing the RSO and the program. The assistant RSO will only act in the physical absence of the RSO.

Attachments are provided with this license amendment request, for training and experience of the RSO.

Item 8. Training for Individuals Working in or Frequenting Restricted Areas

Authorized Users
All authorized users will be approved by the RSC listed above. The training for these individuals will include a comprehensive radiation safety course or previous experience with the applicable topics. In addition, these individuals must demonstrate their ability by directly using radioactive materials and the applicable monitoring equipment in the physical presence of an RSC member during their first use at the facility. The training course will cover at least those items listed within Appendix J of NUREG-1556, Vol. 7, dated December of 1999. The Radiation Safety Officer, or someone of equivalent training and experience will provide training.

Laboratory Technicians
These individuals will be trained by RSC approved Authorized Users in the procedures of that specific laboratory and in basic radiation safety topics. The Radiation Safety Officer will review these training records periodically.

Ancillary Staff
Ancillary staff will be instructed in the areas of use, how to identify these areas, how to protect themselves from radiation, what their rights are and who to contact with questions or problems.

Training for all individuals will occur prior to first use at the facility. Additional training will be performed whenever changes within the regulations or within the program warrant it. Barring any significant changes to the regulations or program, annual refresher training will be provided.

Item 9. Facilities and Equipment

All laboratories where radioactive materials are to be used must be approved by the RSC prior to initial use. All areas of use shall have access to appropriate equipment, i.e. a Geiger-Mueller (GM) counter and a Liquid Scintillation Analyzer (LSA), or something equivalent capable of detecting the radiation being used. Currently, Ludlum Model-3 GM counters and PerkinElmer Tri-Carb LSA's are in use.

If a laboratory uses potentially volatile materials, an applicable fume hood will be provided. A representative laboratory diagram is provided with this license amendment request.

Item 10. Radiation Safety Program

Audit Program
The RSO or assistant RSO will accompany a member of the Radiation Safety Committee in conducting an audit of the radiation safety program on a quarterly basis. This audit is a review of licensed activities and may not be totally inclusive of all items on the license but typically involves review of laboratory inventories, survey records and general facility conditions. These audit findings are reported to the RSC.

At least annually, an audit of the entire radiation safety program will be conducted. These results are to be reported to management responsible for the radiation safety program.

Survey 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 Licenses of Limited Scope,' dated December of 1999.

We reserve the right to upgrade our survey instruments as necessary. The instruments currently being used are PerkinElmer Tri-Carb Analytical Model 2500 or 3100 LSA's and Ludlum Model-3 Geiger Counters. All devices will be calibrated by a facility licensed by the NRC or an Agreement State.

Material Receipt and Accountability
Physical inventories will be conducted at intervals not to exceed 6 months or at other intervals approved by the NRC, to account for all sealed sources and devices received and possessed under the license.

Occupational Dosimetry
We will monitor individuals in accordance with the criteria in the section entitled "Radiation Safety Program-Occupational Dose' in NUREG-1556, Vol. 7, `Consolidated Guidance About Materials Licenses: Program-Specific Guidance About Academic, Research and Development, and Other Licenses of Limited Scope,' dated December of 1999.

Safe Use of Radionuclides and Emergency Procedures
Procedures for the safe use of radionuclides and emergency procedures have been developed and are maintained.

Survey
We will survey our facility and maintain contamination levels in accordance with the survey frequencies and contamination levels published in Appendix Q to NUREG-1556, Vol. 7, `Program-Specific Guidance About Academic, Research and Development, and Other Licenses of Limited Scope,' dated December of 1999. Leak tests will be performed at the intervals approved by NRC or an Agreement State and specified in the SSD Registration Certificate. Leak tests will be performed by an organization authorized by NRC or an Agreement State to provide leak testing services to other licenses or using a leak test kit supplied by an organization authorized by NRC or an Agreement State to provide leak test kits to other licenses and according to the sealed source or plated foil manufacturer's (distributor's) and kit supplier's instructions.

Item 11. Waste Management

We will use decay in storage model waste procedures that are 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 of 1999. For material that cannot be decayed in storage, it will be transferred to a facility that has been licensed by the NRC or an Agreement State to accept those waste materials.

Memorandum

To: Paul Larson, RSO

From: Jeremy Durham, Assistant RSO

Date: 4/17/2008

Re: Qualifications

Job Title: Senior Chemist, Assistant RSO
I have been working with radioisotopes since starting at Dow Corning as a contractor in 1997. I became assistant RSO in 1999 shortly after becoming an employee. While at Dow Corning I have worked on approximately 30 Toxicology/Chemistry studies using ^{14}C labeled materials. During these studies I performed one or more of the following: distributions of radiolabeled materials to authorized personnel, specific activity determinations, purity checks, dosing preparations, dosing, sample handling and disposal.

I am currently responsible for insuring monthly and weekly wipe test are performed and I distribute radiolabeled materials to authorized users. I assist with quarterly audits and radioisotope inventory of the facility. I am a member of the radiation safety committee and attend quarterly radiation safety committee meetings. I coordinate the shipment of radiolabeled waste materials for disposal.

I have attended several in-house training for radiolabeled materials. I have also attended two 3 day Radiation Safety Seminars, one in September 1999 and the other in January 2001. In May 2007 I attended a 5 day radiation safety officer seminar. Engelhardt & Associates, Inc presented these seminars. In 2007 I prepared and presented a Dow Corning Corporate presentation on radiation awareness to the radiation workers and non-radiation workers.

Jeremy Durham 4-23-2008

Certificate of Completion

awarded to

Jeremy Durham

for participation in

Radiation Safety Officer Course
May 14-18, 2007 – Madison, WI

ENGELHARDT & ASSOCIATES, INC.
RADIATION CONSULTANTS
6400 Gisholt Dr., Suite, 111 Madison, WI 53713
Phone: 800.525.3078 Fax: 608.224.0821
E-mail: engel@chorus.net
www.radexperts.com

Susan J. Engelhardt, M.S.

Ralph Grunewald, Ph.D.

Joshua Walkowicz, M.S., CHP

Judith Grunewald, R.N., M.S.

24/25

RADIATION SAFETY EXAMINATION

passed Dr Eb

1. Match the following:

a. Geiger counter	b Personnel dosimeter
b. Film badge	c Contamination survey on a source
c. Leak test	a Exposure rate meter
d. Curie	g Energy, photon, same as x-ray
e. Liquid scintillation counter	e Used to count low energy betas
f. Betas	h Time needed for 1/2 of the atoms to undergo decay
g. Gammas	d Unit of activity (3.7×10^{10} dps)
h. Half-life	f Same as an electron
i. Alpha	i Equivalent to the nucleus of a helium atom

2. True/False

a. T (F) Long-term (chronic) exposure to radiation is more hazardous to health than exposure to the same amount of radiation in a short period of time.

b. (T) F Time, distance and shielding are appropriate methods of minimizing exposure to radiation.

c. (T) F Sealed source leak tests are usually required every six months.

d. (T) F The dose unit rem is an acronomyn for Roentgen equivalent man or radiation equivalent man.

e. T (F) A cell that is damaged by radiation cannot repair itself under any circumstances.

f. (T) F If there is a potential for a person to receive 10% of the annual allowed dose, the individual must wear a radiation dosimeter.

g. (T) (F) Dosimeters can be routinely used to determine internal deposition of radionuclides.

h. (T) F According to the inverse square law, if you increase the distance from a point source by a factor of two, the exposure rate is decreased by a factor of four.

SELECT THE <u>ONE</u> CORRECT ANSWER FOR EACH OF THE FOLLOWING QUESTIONS.

3. The maximum allowed whole body or deep dose per year for a radiation worker is:
   a. 0.5 rem (c) 5 rem
   b. 10 rem d. 50 rem

4. The time required to receive an exposure of 100 mR from a source when the exposure rate is 500 mR/hr is:
   a. 0.2 sec c. 1.2 min
   b. 20 sec (d) 12 min

5. Which one of the following is not part of the acute radiation syndrome?
   a. Hematopoetic syndromes
   b. Central nervous system syndrome
   c. Delayed syndrome
   d. Gastrointestinal syndrome

6. If the distance from a point source is tripled, the radiation intensity will be:
   a. tripled
   b. doubled
   c. halved
   d. one ninth
   e. one twelfth

7. If a person remains in a radiation area where the exposure rate is 120 mR/hr for 10 minutes, the exposure will be:
   a. 0.2 mR
   b. 2 mR
   c. 20 mR
   d. 200 mR

8. Half-value layer (HVL) is related to which of the following principles of radiation protection?
   a. time
   b. distance
   c. shielding
   d. monitoring
   e. geometric principle

9. Which one of the following is not true about radioactive waste?
   a. You may sewer small quantities if it's soluble in water.
   b. You may decay in storage materials with a half-life of 90 days or less.
   c. You may give it to a chemical waste broker for disposal.
   d. You may give it to a licensed radioactive waste broker for disposal.

10. Which one of the following would be the most appropriate shielding to use for gamma emitters?
   a. glass
   b. plastic
   c. lead
   d. cardboard

11. Which one of the following would be the most appropriate shielding to use for beta emitters (beta radiation only)?
   a. glass
   b. plastic
   c. lead
   d. tungsten

12. Which one of the following is NOT a method of gamma ray interaction with matter?
   a. Bremsstrahlung
   b. Compton effect
   c. Photoelectric effect
   d. Pair production

SELECT ONE OR MORE CORRECT ANSWERS FOR EACH OF THE FOLLOWING QUESTIONS.

13. Which of the following are considered to be delayed effects of radiation?
    a. Carcinogeneses
    b. Life span shortening
    c. Stunted growth
    d. Cataracts
    e. All of the above

14. Free radicals are:
    a. Electrically neutral
    b. Have an odd number of electrons
    c. Are usually responsible for the indirect effect of radiation
    d. All of the above

15. Which of the following are examples of Radiation Safety Officer (RSO) duties?
    a. Licensing
    b. Audits/inspections
    c. Control of radioactive material
    d. Waste disposal
    e. Keep management informed on status of the radiation safety program.

16. When responding to a radiation accident the RSO should:
    a. assure the victim has been stabilized prior to treating for contamination
    b. notify administration and wait for further instructions
    c. read the radiation safety plan
    d. decontaminate the victim and then provide care

17. When responding to a suspected radiation accident victim:
    a. record "who, what, where, when" about the radiation accident
    b. complete a radiation survey prior to treatment if not seriously injured to determine type of radiation and severity of the radiation exposure
    c. with no external or visual radiation injury send the person home with medical or RSO approval
    d. wear protective clothing

18. Which of the following radiation accidents will not require radiation protection precautions for emergency responders?
    a. contamination
    b. chemical or fire incident in the radiation area
    c. irradiation
    d. contaminated wounds

19. Which of the following are gas-filled detectors?
    a. Geiger-Mueller counter
    b. proportional counter
    c. thermoluminescent dosimetery
    d. ionization chambers
    e. film badge

20. Which of the following are operating or functional characteristics of the Geiger-Mueller type of survey instrument?
   a. it is good for measuring background levels of radiation
   b. it has a short response time to changes in radiation levels
   c. there are various sizes and shapes of detectors for different radiations and radiation levels
   d. it provides an excellent measure of particle energy

PROVIDE WRITTEN ANSWERS TO THE FOLLOWING.

21. One mCi (millicurie) equals:
   One millicurie, mCi, equals 3.7×10^7 dps
   One millicurie, mCi, equals 2.22×10^9 dpm
   One kilobecquerel, kBq, equals 1×10^3 dps
   One kilobecquerel, kBq, equals 6×10^4 dpm

22. List three methods used for protection from external radiation exposure, and one method used to detect (and prevent the spread of) contamination?
   1 Shielding
   2 Time
   3 Distance
   (1) proper PPE (gloves, Labcoat)

23. Explain the ALARA concept:
   As low as resonably achievable ie Time, Distance, shielding, PPE

24. What is the difference between contamination and irradiation?
   Contamination is where you don't want radioactive material by way of a spill or breakage. Irradiation is the alpha, beta, gamma's emitting from a source

25. Describe the process for doing a leak test:
   (1) obtain kit
   (2) open kit and wipe area around source with Dry or moist Q-Tip while wearing proper PPE
   (3) Seal kit, Survey with GM counter prior to sending it in.

Radiation Safety Officer Course

May 14-18, 2007

Madison, Wisconsin

Day One	Description	Objectives	Trainer(s)
07:30 – 08:00 AM	Continental Breakfast		
08:00 – 08:15	Seminar Objectives/Overview	Explain seminar objectives and meet trainers.	Sue Engelhardt
08:15 – 08:40	Radiation and Its Uses (Chapter 1) • Ionizing radiation and radioactive decay • Contemporary applications	Identify common applications of ionizing radiation in industry, research and medicine.	Sue
08:40 – 09:00	Regulatory Agencies and Licensing (Chapter 2) • Where regulatory standards come from • NRC vs. Agreement States • Other agencies (e.g., OSHA, FDA, EPA, DOT)	Relate how the NRC regulations are developed. Define difference between Agreement vs. Non-Agreement states. Recognize how other agencies regulate radiation.	Sue
09:00 – 09:10	Break		
09:10 – 10:00	Math Review (Chapter 4) • Basic mathematical functions (algebra, exponents, logarithms, unit conversions) • Counting statistics • Common health physics applications	Describe basic functions involving exponents, logarithms, conversion factors, etc. Apply math functions used in common health physics applications (e.g., efficiencies, inverse square law, decay, attenuation, specific activity)	Josh Walkowicz
10:00 – 10:10	Break		
10:10 – 11:30	Radiation Physics (Chapter 5) • Atomic composition, structure, and terms • Radioactive decay and half-life • Properties of common decay products	Relate the basic atomic structure and components (protons, neutrons, and electrons), and common terms. Define half-life and radioactive decay. Describe basic properties of particulate (alpha, beta) and electromagnetic (x-ray, gamma) decay products.	Ralph Grunewald
11:30 – 12:45 PM	Lunch		
12:45 – 02:50 (10 min break)	Radiation Physics (Chapter 5), continued • Radioactive decay modes and schemes • Interactions with matter	Recognize the basic decay modes and characteristics for alpha, beta, x- and gamma emissions. Compare interaction mechanisms (directly vs. indirectly ionizing).	Ralph
02:50 – 03:00	Break		
03:00 – 04:00	Group Sessions	See group objectives	All

Day Two	Description	Objectives	Trainer(s)
07:30 – 08:00 AM	Continental Breakfast		
08:00 – 08:30	Radiation Units (Chapter 6) • Exposure units • Dose and dose equivalent units • Energy transfer (LET, QF)	Identify the difference between exposure and dose. Relate the traditional and SI units for exposure (R C/kg), dose (rad, Gy), and dose equivalent (rem, Sv). Examine linear energy transfer and quality factors as these pertain to biological effectiveness.	Josh Walkowicz
08:30 – 10:20 (10 min. break)	Radiation Detection and Measurement (Chapter 10) • Types of equipment • Appropriate uses • Demonstration of equipment • Self-reading dosimeters	Describe how to select and operate equipment for the different types of radiation. Identify the basic design principles of various detectors.	Ralph
10:20 – 10:30	Break		
10:30 – 11:30	Group Sessions	See group objectives	All
11:30 – 12:45 PM	Lunch		
12:45 – 01:40	Regulatory Dose Limits and Radiation Dosimetry (Chapter 7) • Dose limits (public vs. occupational) • Types of dosimeters; how they work • Personnel monitoring requirements • Dosimetry reporting requirements	Identify the regulatory dose limits for radiation workers, the embryo/fetus of a declared pregnant woman, and members of the public. Explain types and limitations of personnel dosimeters. Relate monitoring and reporting requirements.	Josh
01:40 – 01:50	Break		
01:50 – 02:30	Radiation Protection (Chapter 11) • ALARA • Methods for protection • Posting requirements	Explain what ALARA is and how to implement. Describe methods used for radiation protection (e.g., time, distance, shielding, contamination control). Apply inverse square law.	Sue
02:30 – 02:40	Break		
02:40 – 03:00	Common Sources of Radiation (Chapter 6) • Naturally occurring • Medical	Relate typical levels of radiation from common sources.	Sue
03:00 – 04:00	Group Sessions	See group objectives	All

Day Three	Description	Objectives	Trainer(s)
07:30 – 08:00 AM	Continental Breakfast		
08:00 – 09:00	Radiation Biology (Chapter 9) • Cellular, tissue, and systemic effects • Delayed effects, early somatic effects • Acute radiation syndrome • Hormesis, threshold vs. non-threshold • Risk vs. benefit	Describe the biological effects of radiation and the dose levels where these effects occur. Contrast perceived vs. real risk.	Sue
09:00 – 09:10	Break		
09:10 – 10:20	Radiation Incidents and Emergency Response (Chapter 13) • Types (gauge, medical, academic) • Procedures • Source leakage, loss • Emergency personnel as responders • Performance based training • Interactions with public, media, and employees	Define the RSO's role in planning for and preventing accidents. Examine key components of an emergency plan.	Judy Grunewald
10:20 – 10:30	Break		
10:30 – 11:30	Group Sessions	See group objectives	All
11:30 – 12:45 PM	Lunch		
12:45 – 02:00	Radiation Protection Programs (Chapter 3) • Written programs • Key elements (e.g., RSO/RSC, facility design, PPE, procedures, records, audits) • Annual reviews • Topical discussions – security and current regulatory concerns on terrorism	Examine key elements of an effective radiation protection program. Assess record keeping requirements	Sue
02:00 – 02:10	Break		
02:10 – 02:50	Responsibilities for Radiation Protection (Chap 16) • Who is responsible • Legal issues	Relate various responsibilities for radiation protection and regulatory compliance.	Sue
02:50 – 03:00	Break		
03:00 – 04:00	Group Sessions	See group objectives	All

Day Four	Description	Objectives	Trainer(s)
07:30 – 08:00 AM	Continental Breakfast		
08:00 – 08:50	NRC Regulations (Chapter 2) • Part 19, Notices, Instructions to Workers • Part 20, Radiation Protection Standards • Parts 30-35, license types and provisions • Special requirements (gauges and licenses)	Identify critical provisions of Part 19 and 20 worker information and protection standards. Identify NRC license and registration requirements (e.g., exempt, general, specific). Interpret basic provisions for specific license categories	Josh
08:50 – 09:00	Break		
09:00 – 09:50	Radiation Producing Equipment (Chapter 12) • Physics • Regulations • Programs • Dangers and biological effects	Learn differences between radiation producing equipment and radioactive material as far as regulations, licensing and programs are concerned.	Josh
09:50 – 10:00	Break		
10:00 – 10:25	Radioactive Waste (Chapter 14) • Types of waste • Disposal options • Transfer vs. storage	Relate radioactive waste disposal regulations and options (e.g., sewer, DIS). Explain waste transfer and storage requirements (e.g., facility needs).	Josh
10:25 – 11:15	Packaging, Transport, and Receipt of Radioactive Materials (Chapter 15) • Shipper's responsibilities • Transportation regulations (NRC, DOT, IATA) • Classification and packaging • Transport on public roads • Receipt of radioactive materials	Define shipper's responsibilities. Identify when radioactive materials are regulated for transportation purposes, and basic provisions for limited and Type A quantities of radioactive materials. Describe DOT provisions for employee training and transport on public roads. Procedures for safe receipt/opening of packages.	Josh
11:15 – 12:30 PM	Lunch		
12:30 – 04:00 (15 min break)	Laboratory Workstations • Lab A - Radioactive decay measurements • Lab B - Solid scintillator detector • Lab C - Geiger counter operation/measurements • Lab D – Survey and decontamination techniques • Lab E – Direct/scatter radiation measurements and leak testing	See Laboratory Agenda (handout)	All

Day Five	Description	Objectives	Trainer(s)
07:30 – 08:00 AM	Continental Breakfast		
08:00 – 09:00	*Regulatory Inspections (Chapter 17)* • How to prepare for NRC/state inspections • How to deal with inspectors • What to do if the inspection is going badly • What to do if called for an enforcement conference	Relate the inspection process. Explain how to prepare for and respond to enforcement activities.	Sue
09:00 – 09:10	Break		
09:10 – 09:30	Interactions with the Public and Media • Discussion of media contacts and public information on the sensitive issue of radiation	Define the NRC's media notification criteria. Define key aspects of communicating with the public and media.	Sue
09:30 – 10:10	Group Sessions - Writing a License/Do's & Don'ts • New, renewal, & amendment applications • NRC Form 313 or equivalent for Agreement states • Content • Fees	See group objectives	All
10:10 – 10:20	Break		
10:20 – 11:20	Group Sessions - Reportable Incidents • When to/not to report an incident • Interactions with the public and media	See group objectives	All
11:20 – 12:00	Examination and wrap-up	Complete exam and score 85% or better	All

Radiation Safety Officer Course
Performance Objectives for the Gauge Group

These performance objectives are tailored to the group and individual participants' needs. Each session is approximately 1 hour.

Day One: PM Session

- Demonstrate how to use your calculator.
- Complete common health physics applications and sample math problems (see Chapter 4).
- Restate physics and interactions of radiation with matter as it pertains to common radionuclides used in gauges.
- Compare slides on specific operation of many types of gauges (to understand common types of gauges and how they work).
- Recognize general characteristics of source capsule configuration and shutter designs.
- Explain basic counting statistics - distributions of a single count, standard deviation, and minimum detectable count.
- Define and convert between various radioactivity units (Ci, Bq, dpm, dps, cpm).
- Calculate radioactive decay.

Day Two: AM Session

- Recognize the various types and uses of survey meters.
- Demonstrate gauge types/uses.
- Differentiate what you can and cannot do with gauges with regards to maintenance and repair – routine vs. non-routine (installation, relocation, repair)
- Demonstrate (hands-on) opening and closing shutters (both cylinder and flat swing type).

Day Two: PM Session

- Describe ALARA strategies for mills/gauges.
- Demonstrate time, distance, and shielding principles.
- Differentiate what signs are needed in experimental settings.
- Examine badge requirements - who needs them, why, etc.
- Calculate dose from a point source.

Day Three: AM Session

- Examine emergency preparedness and response.

Day Three: PM Session

- Demonstrate proper lockout/tagout and then lockout/tagout a gauge (hands-on).
- Demonstrate survey procedures - exposure rate monitoring, leak tests, and wipe tests.
- Demonstrate and do hands-on radiation measurements with a Geiger counter and an ionization chamber around sources to observe how radiation is shielded, collimated, and scattered.
- Demonstrate radiation measurements through various shielding materials and at various distances to observe attenuation and understand inverse square law.
- Identify responsibilities of the RSO for the radiation safety program.
- Describe non-routine source/gauge installation, relocation & repair (hands-on)

Day Four: PM Session (Laboratory Workstations with all groups)

- *Lab A (Radioactive Decay Measurements)* – Measure the radioactivity of an unknown radioactive sample at two different time points. Calculate the half-life and determine the radionuclide from a list of possibilities. Complete worksheet and discuss findings.
- *Lab B (Solid Scintillator Detector)* – Count background, standard, and sample (leak test) using a single channel analyzer with solid scintillator. Calculate detector efficiency, minimum detectable activity, and sample activity. Complete worksheet and discuss findings.
- *Lab C (Geiger Counter Operation and Measurements)* – Inspect survey instruments for proper calibration and operation. Survey exposure rates from several beta and gamma emitting sources and observe inverse square law and effect of various shielding materials. Complete worksheet and discuss findings.
- *Lab D (Survey and Decontamination Techniques)* – Survey source/work area for radiation exposure rates and possible radioactive contamination. Demonstrate techniques for using a survey meter and performing a wipe test, and discuss response procedures for possible contamination. Complete worksheet and discuss findings/observations.
- *Lab E (Direct/Scatter Radiation Measurements and Leak Testing)* – Measure radiation levels around a sealed source through various scattering materials, and observe meter calibration and sealed source leak test procedures. Complete worksheet and discuss findings/observations.

Day Five: AM Session

- Writing a License
  - Explain device registrations and general vs. specific licenses for gauges.
  - Identify the do's and don'ts when writing a license.
  - Identify what references are available for assistance (e.g., NRC Regulatory Guides).
- Reportable Incidents
  - Complete/discuss reportable incident scenarios.
  - Summarize NRC requirements for reporting incidents.
  - Describe the NRC's media notification criteria.

Radiation Safety Officer Course
Performance Objectives for the Medical Group

These performance objectives are tailored to the group and individual participants' needs. Each session is approximately 1 hour.

Day One: PM Session

- Demonstrate how to use your calculator.
- Complete common health physics applications and sample math problems (see Chapter 4).
- Restate the regulatory structure for various types of radiation and radioactive materials commonly used in medicine.
- Examine alpha, beta, and gamma decay processes and interactions with matter.
- Define and convert between various radioactivity units (Ci, Bq, dpm, dps, cpm).
- Calculate radioactive decay both forward and backward in time.
- Calculate attenuation of radiation.

Day Two: AM Session

- Recognize various types of detectors for beta and gamma radiation (e.g., GM, LEG, HEG), and how to select appropriate detectors (e.g., for dose surveys vs. contamination surveys).
- Demonstrate how to perform function tests (hands-on) and understand calibration requirements for survey meters commonly used in medical settings.
- Explain basic counting statistics – distributions of a single count, standard deviation, and minimum detectable count.

Day Two: PM Session

- Examine NRC dose limits and personnel dosimetry requirements - who needs dosimeters, when, why, etc.
- Describe practical radiation protection measures (time, distance, shielding, contamination control) and ALARA strategies for medical settings.
- Demonstrate how to conduct wipe tests and leak tests for removable contamination.
- Differentiate NRC required radiation warning signs, labels, postings, etc. needed in experimental settings.
- Calculate dose from a point source.

Day Three: AM Session

- Explain personnel bioassays for radioactive materials commonly used in medicine.
- Compare patient release after nuclear medicine procedures vs. non-release of radioactivity from the research setting.
- Identify RSO responsibilities and the critical components of a radiation safety program in a medical facility.
- Describe Quality Management Program requirements and effective auditing techniques.
- Describe NRC requirements for training (frequency, content, etc.).
- Explain how to receive/ship a radioactive package (e.g., for Nuclear Medicine).
- Describe radioactive waste management and setting up a decay in storage procedure.

Day Three: PM Session

- Examine emergency preparedness and response.

Day Four: PM Session (Laboratory Workstations with all groups)

- *Lab A (Radioactive Decay Measurements)* – Measure the radioactivity of an unknown radioactive sample at two different time points. Calculate the half-life and determine the radionuclide from a list of possibilities. Complete worksheet and discuss findings.
- *Lab B (Solid Scintillator Detector)* – Count background, standard, and sample (leak test) using a single channel analyzer with solid scintillator. Calculate detector efficiency, minimum detectable activity, and sample activity. Complete worksheet and discuss findings.
- *Lab C (Geiger Counter Operation and Measurements)* – Inspect survey instruments for proper calibration and operation. Survey exposure rates from several beta and gamma emitting sources and observe inverse square law and effect of various shielding materials. Complete worksheet and discuss findings.
- *Lab D (Survey and Decontamination Techniques)* – Survey source/work area for radiation exposure rates and possible radioactive contamination. Demonstrate techniques for using a survey meter and performing a wipe test, and discuss response procedures for possible contamination. Complete worksheet and discuss findings/observations.
- *Lab E (Direct/Scatter Radiation Measurements and Leak Testing)* – Measure radiation levels around a sealed source through various scattering materials, and observe meter calibration and sealed source leak test procedures. Complete worksheet and discuss findings/observations.

Day Five: AM Session

- Writing a License
  - Identify regulatory requirements and NRC/state licensing process for medical uses.
  - Identify the do's and don'ts when writing a license.
  - Identify what references are available for assistance (e.g., NRC Regulatory Guides).
- Reportable Incidents
  - Complete/discuss reportable incident scenarios.
  - Summarize NRC requirements for reporting incidents and misadministrations.
  - Describe the NRC's media notification criteria.

Radiation Safety Officer Course
Performance Objectives for the Research Group

These performance objectives are tailored to the group and individual participants' needs. Each session is approximately 1 hour.

Day One: PM Session

- Demonstrate how to use your calculator.
- Complete common health physics applications and sample math problems (see Chapter 4).
- Restate the regulatory structure for various types of radiation and radioactive materials commonly used in research.
- Examine alpha, beta, and gamma decay processes and interactions with matter.
- Define and convert between various radioactivity units (Ci, Bq, dpm, dps, cpm).
- Calculate radioactive decay.
- Calculate attenuation of radiation.

Day Two: AM Session

- Recognize various types of detectors for beta and gamma radiation (e.g., LSC, GM, LEG), and how to select appropriate equipment (e.g., for exposure rate monitoring vs. radioanalyses).
- Demonstrate how to perform function tests (hands-on) and understand calibration requirements for survey meters commonly used in research facilities.
- Explain basic counting statistics - distributions of a single count, standard deviation, and minimum detectable count.

Day Two: PM Session

- Examine NRC dose limits and personnel dosimetry requirements - who needs dosimeters, when, why, etc.
- Describe practical radiation protection measures (time, distance, shielding, contamination control) and ALARA strategies for research settings.
- Demonstrate how to conduct wipe tests and leak tests for removable contamination.
- Differentiate NRC required radiation warning signs, labels, postings, etc. needed in experimental settings.
- Calculate dose from a point source.

Day Three: AM Session

- Explain personnel bioassays for radioactive materials commonly used in research.
- Contrast radiation risk vs. benefit issues.
- Identify RSO responsibilities and the critical components of a radiation safety program in a research facility.
- Describe effective auditing techniques.
- Describe NRC requirements for training (frequency, content, etc.).
- Explain how to receive/ship a radioactive package.
- Describe radioactive waste minimization, management, and disposal (including decay in storage) for radioactive materials commonly used in research.

Day Three: PM Session

- Examine emergency preparedness and response.

Day Four: PM Session (Laboratory Workstations with all groups)

- *Lab A (Radioactive Decay Measurements)* – Measure the radioactivity of an unknown radioactive sample at two different time points. Calculate the half-life and determine the radionuclide from a list of possibilities. Complete worksheet and discuss findings.
- *Lab B (Solid Scintillator Detector)* – Count background, standard, and sample (leak test) using a single channel analyzer with solid scintillator. Calculate detector efficiency, minimum detectable activity, and sample activity. Complete worksheet and discuss findings.
- *Lab C (Geiger Counter Operation and Measurements)* – Inspect survey instruments for proper calibration and operation. Survey exposure rates from several beta and gamma emitting sources and observe inverse square law and effect of various shielding materials. Complete worksheet and discuss findings.
- *Lab D (Survey and Decontamination Techniques)* – Survey source/work area for radiation exposure rates and possible radioactive contamination. Demonstrate techniques for using a survey meter and performing a wipe test, and discuss response procedures for possible contamination. Complete worksheet and discuss findings/observations.
- *Lab E (Direct/Scatter Radiation Measurements and Leak Testing)* – Measure radiation levels around a sealed source through various scattering materials, and observe meter calibration and sealed source leak test procedures. Complete worksheet and discuss findings/observations.

Day Five: AM Session

- Writing a License
  - Identify regulatory requirements and NRC/state licensing process for research related use.
  - Identify the do's and don'ts when writing a license.
  - Identify what references are available for assistance (e.g., NRC Regulatory Guides).
- Reportable Incidents
  - Complete/discuss reportable incident scenarios.
  - Summarize NRC requirements for reporting incidents.
  - Describe the NRC's media notification criteria.

Certificate of Completion

awarded to

Jeremy Durham

for participation in

Radiation Safety Seminar

January 30 – February 1, 2001 – Las Vegas

presented by Engelhardt & Associates, Inc.

Susan J. Engelhardt, M.S.

Joshua Walkowicz, M.S.

Dee Kaiser, M.S.

Ralph Grunewald, Ph.D.

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John Walkowicz

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Chemistry and Environmental Sciences

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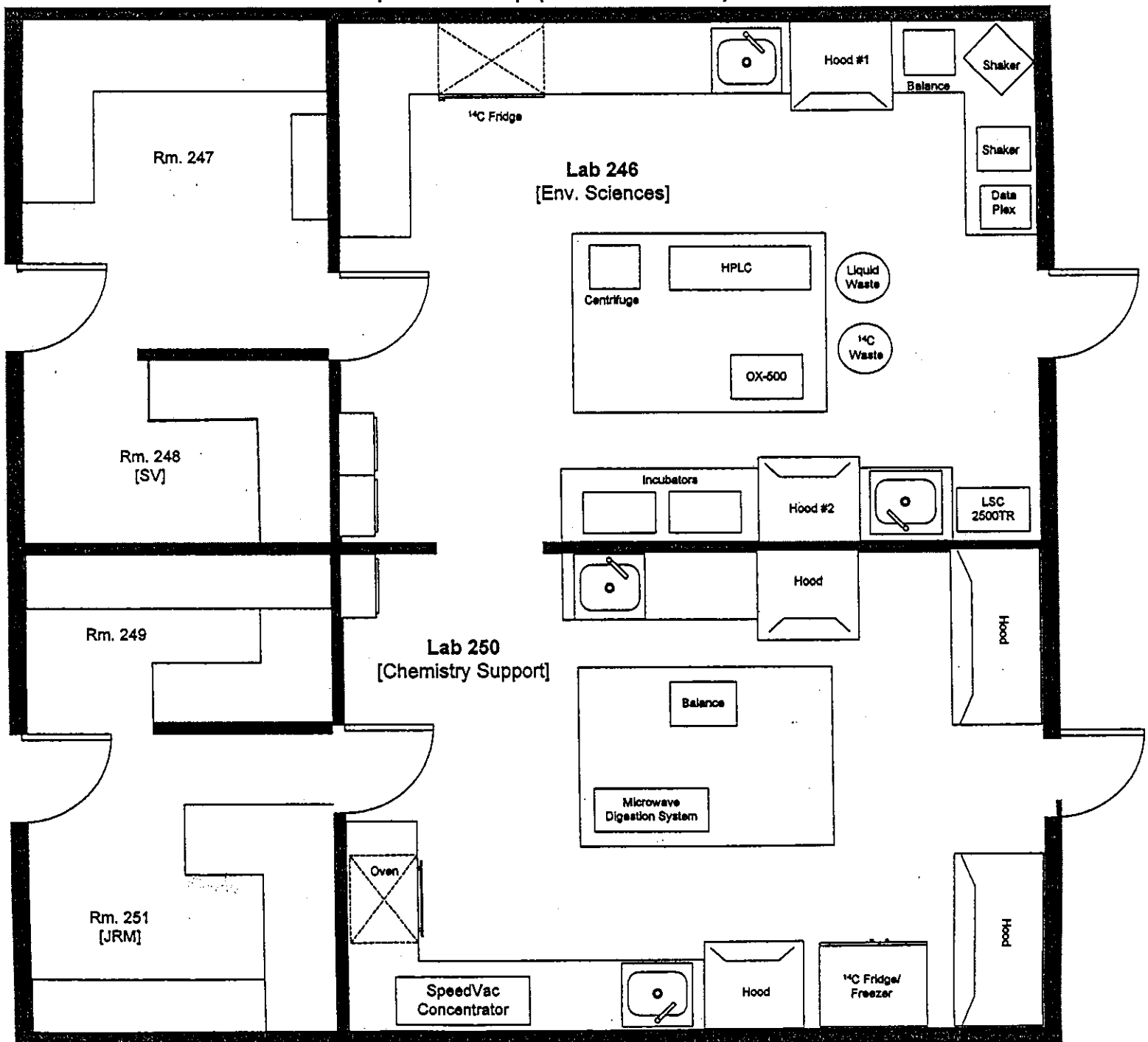

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