CENTRAL MICHIGAN UNIVERSITY
DEPARTMENT OF BIOLOGY

September 19, 1991

United States Nuclear Regulatory Commission
Region III
799 Roosevelt Rd.
Glen Ellyn, IL 60137
ATTN: Robert G. Gattone, Jr.
NRC License Reviewer

Dear Mr. Gattone:

This document has been prepared to address the additional information requested for the renewal of NRC License 21-01432-02, Control Number 91685 referring to the possession of radioactive materials at Central Michigan University. The items addressed in this document will refer directly to the questions posed in the letter requesting additional information, dated August 23, 1991.

1. and 2. Please note that the inclusion of John I. Scheide on the license application in Item 2 was in error. This Item (2 of the application) should be amended to delete the named individual. Dr. Scheide is the current Radiation Safety Officer of Central Michigan University and has the authority to sign this application.

3. Radioactive material

a. Item 5 #1. ^{241}Am sources We currently have a total of 5 sources. One is in a Tracer Lab R-35 unit and has an activity of 1 MBq. There are 3 sealed sources; a disc with an activity of 3 MBq and two cylinders, one of 0.4 MBq and 1 MBq. The sealed sources are used in teaching. We are also storing a 300 uCi Am-241 plated foil source until Science II is open. This source will be used for teaching purposes by being housed in a scatter chamber.

Item 5 #21. ^{63}Ni sources All of the Ni-63 sources are a part of Electron capture devices for gas chromatographs and were 15 mCi at the time the GC was initially active. All are currently being stored until Science II is opened and Brooks Hall is renovated. Two GC units are Tracor 560 units (4535 and 70280) and we have two Hewlett Packard units, a 5710A (1817A07621) and a 5730A (1844A01338).

b. Item 5 #7 ^{137}Cs source, 1 curie, Texas Nuclear Dwg. No 570-57157C. This source is currently in storage until Science II is completed. It will be used to polymerize other molecules.

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MOUNT PLEASANT, MICHIGAN 48859

Item 5 #8 ^{137}Cs source, 5.25 mCi, ICN 375. This source may be used as a calibration standard. Please note that this item was improperly referred to on page 13. It should be noted as 5.25, not 4.57, mCi.

Item 5 #9 ^{137}Cs source, 5 mCi, ICN 76002. This source may be used as a calibration standard.

c. Item 5 #24 This line has a typographical error. Plutonium-239 is the source that should be listed on this line.

d. Item 5 #26 The sodium-22 listing is correct for this institution. This item was corrected by letter (May 21, 1986).

Note. The planchets listed in item 5 #23 should be identified as Plutonium-239/Plutonium-238 planchets.

4. Facilities

In biological research, unsealed radionuclide sources are used. The table below notes the typical radionuclide use per day and the maximum stock solution bottle (the most common quantity is 250 uCi for all isotopes except the iodine nuclides). The daily use only refers to the maximum activity used in a day, not each day. In most cases, the values here represent week to month (year) uses. In many cases, the stock bottle is not used daily.

Table 1. A listing of typical maximal daily radionuclide usage and maximal stock activity.

RADIONUCLIDE	TYPICAL MAXIMUM USE PER DAY uCi	MAXIMUM STOCK ACTIVITY mCi
^{3}H	200	5
^{14}C	50	0.5
^{22}Na	10	0.2
^{32}P	50	0.5
^{35}S	50	0.5
^{36}Cl	10	0.2
^{125}I		0.01*
^{131}I		0.01*

* Currently any unsealed use of radioactive iodine will be associated with a kit for RIA or receptor binding, some kits may exceed this value, but this is a close approximation. If higher unsealed, nonbound levels are to be used, for example for protein iodination, an amendment to this license will be added.

The typical research laboratory in Brooks and Science II has at least 100 cubic meters of volume. Bench tops are variously arranged and covered with plastic-backed absorbent paper. When radionuclide activities exceed 5 uCi (except for tritium), an area monitor must be activated. Shielding will be available to reduce exposure. All pippetting will be performed by remote means with the properly trained participants wearing gloves, lab coats and film badges. Radiation exposure of the lab individuals will be reduced by restricting the amount of radionuclide in each laboratory to that needed. The doors will be locked to properly secure the radionuclide from the public and signs will designate the room as a radiation area or the presence of radioactive materials. Laboratories using 250 uCi and less will (this activity is cost effective and most commonly purchased) be monitored monthly. Laboratories using a higher activity of radionuclides greater than 250 uCi will be monitored weekly. The Radiation Safety Officer will verify compliance quarterly. Given the amounts of radionuclides used in "typical" experiments and the various procedures employed, a safe typical research laboratory will be maintained.

Aside from one acute <u>in vivo</u> experiment, for teaching purposes, all teaching and research applications of unsealed radionuclides involve <u>in vitro</u> techniques. The one exception is an experiment to demonstrate isotope distribution in a mouse using ^{32}P. The mouse would be injected intraperitoneal and the isotope permitted to be absorbed and distributed throughout the animal for 60 minutes. The animal would be sacrificed, tissues carefully dissected, and the various tissues assayed for the radioisotope. The instructor will handle the mouse, isotope injection and dissection of the animal. The current animal room facility and staff will not be used for this experiment. There is currently no need for a chronic animal experimentation. A amendment will be added if this option is necessary.

Airborne gaseous radioactive material is not used in research or teaching in Chemistry, Physics or Biology. An amendment of this license will be added if such a program is necessary.

5. <u>Authorized users</u>

The radiation training and experience of both Dr. Charles Novitski and Dr. Phillip J. Squatritto is included below. Dr. Novitski has had extensive research training and experience in radioisotope usage. Dr. Novitski maintains an extremely clean lab and has excellent laboratory technique (by my rating system). He requires his students to be fully aware and trained in radioisotope methods. Dr. Squattrito has the training, but not much experience with radioactive materials. He has extensive experience with x-ray generating devices. Dr. Squattrito should be included on this license since he is the Chemistry Department representative on the Radiation Safety Committee.

Charles Novitski Ph.D. California Institute of Technology, 1979. Associate Professor. While at Caltech followed procedures for training including reading the Caltech Radiation Safety Manual, attending seminars in radiation safety and had individual instruction in order to use radioisotope at Caltech. The training satisfies the 1 to 4 criteria.

Radiation Experience:

Graduate from Fall 1969 to Spring 1977. #1 Postdoctoral experiences. City of Hope National Medical Center. $^{32}PO_4$, ^{3}H-Thymidine (.25 to 1.0 mCi). Postdoctoral and Lecturer, Monash University, Australia Fall, 1980 to Spring, 1984, ^{32}P-ATP, ^{32}P-dNTP (up to 1 mCi), DNA sequencing and DNA labeling. Research Scientist and Program leader, Agrigenetics Advanced Science Company, ^{32}P-dNTP (up to 1 mCi). Radiation labelling of DNA molecules. Central Michigan University 1990 to present, Associate Professor in the Department of Biology, ^{32}P-dNTP, ^{35}S-dNTP. DNA sequencing and labelling DNA molecules radioactivity. Current Use ^{32}P-dNTP, ^{35}S-dNTP **up to 1 mCi**. DNA sequencing and labelling DNA molecules radioactivity.

Phillip J. Squattrito Ph.D. Northwestern University, 1986. Assistant Professor. Attended radiation safety seminars required to work with radioactive materials or devices that emit radiation while at Northwestern University, the Argonne National Laboratory and Texas A&M University. The radiation safety seminars included reading manuals, short films and discussion.

Radiation Experience:

Graduate worked with X-ray diffraction and electron microscopy at Northwestern University from Fall , 1983 to Spring,1986.

Worked with Neutron diffraction at the Argonne National Lab from 1985 to 1986. Post doctoral experience at Texas A&M, Department of Chemistry working with X-ray diffraction and electron microprobe. Assistant Professor in the Department of Chemistry, CMU 1989 to present and visiting researcher Dow Chemical, Midland. Current Use; setting up an X-ray diffraction system at CMU.

6. Release of Restricted Areas

A new form has been generated to serve as a written record for the release of a room that had radionuclide use (Wipe Test Survey Form, see Enclosure 1).

7. Ventilation

This institution does not currently anticipate the use of gaseous radionuclides. If gaseous forms are necessary, an amendment to this license will be properly filed. The quantity of unsealed isotopes currently used is listed in Table 1 (page 2). All forms are covalently bound to other chemical moieties (molecules). Assume that 1% of ^{3}H was volatilized in a minimal space room (100 cubic meters). Based on the largest amount of tritium used this would represent an airborne sample of 2 uCi distributed throughout this research room for a resulting concentration of 2 X 10^{-4} uCi/ml, below 10 % of Table 1 Column 1 of Appendix B to 10 CFR Part 20. These calculations hold for all the unsealed sources. Thus, a regular air ventilation and air monitoring program is not necessary at this time.

An air monitoring program could be set up at Central Michigan University. Currently, asbestos monitoring is available through the Department of Public Safety. Facilities Management ha the ability to monitor effluent rates using a Balometer Jr. Fume hood are checked semiannually for the 100 fpm sash location using an anemometer, Kurz model # 441. The above mentioned techniques are in compliance with MIOSHA standards.

8. Surveys

a. Areas where millicurie amounts of radionuclides are used will be weekly surveyed using GM and wipe test techniques. Areas where radionuclides of 250 uCi or less are being used will be surveyed monthly. Since 250 uCi is the most commonly purchased, unsealed isotope activity and the activity of this amount is most commonly much less than 250 uCi, due to halflife and use, we are requesting that monthly surveys be used for these nuclide use areas. Use of any radionuclide activity greatly than 250 uCi will require weekly surveys. A new form has been genreated to keep track of room surveys (enclosure 1).

b. Action levels for decontamination of removable radioactive material found in a particular area are noted in Table 2 (reference source, NRC Regulatory Guide 8.23).

Table 2. Action levels for removable surface contamination at Central Michigan University. All values are in dpm/100 cm².

	Type of Radioactive Material		
Type of surface	Alpha Emitters	High energy Beta or gamma	Low energy Beta or gamma
Unrestricted area, skin and clothing	22	220	2200
Restricted area and protective clothing	220	2200	22000

c. The radioactive material storage and waste area will be surveyed weekly.

d. Currently, the Radiation Safety Officer or his designee (a properly trained individual) performs or directs all survey activity. The RSO will perform quarterly confirmation surveys and audits of regular monitoring if the RSO is not a part of the normal survey procedure.

9. <u>Radioactive Package Receipt</u>

All radioactive material is to be delivered directly to the Radiation Safety Officer, Brooks 115. The Department of Public Safety has been notified to this and I am sending another memo to reaffirm this policy (enclosure #2). Currently, I track shipment dates and all radionuclide coming to CMU is delivered to me.

10. <u>Bioassays</u>

As may be observed in Table 1, typical experimental activities and stock solution activities for unsealed radioisotopes are below levels that would mandate a bioassay program. After review of the provided regulatory guides (NRC Regulatory Guides 8.20 [iodines] and 8.23 [tritium]), an action threshold (for activities greater than those noted) for instituting a bioassay program would be required for the following radionuclides: ^{3}H 100 mCi, ^{14}C and ^{35}S 10 mCi, ^{22}Na, ^{32}P, ^{36}Cl, ^{125}I, and ^{131}I 1 mCi. The values listed above assume nonvolatile forms and may assume a three month exposure time. If the radionuclide were of a gaseous form, 10 percent of the listed values would be expected to act as threshold. In most cases the action values exceed our license limits. Good technique would assume that all ^{14}C, ^{125}I and ^{131}I would at least initially be opened in a hood.

11. <u>Decay in Storage</u>

a. This institution requests the use of decay in storage for sulfur-35. The reasoning is that ^{35}S has an 87.4 day halflife and can be easily and safely stored over the 2.4 years required for this radionuclide to decay 10 halflives. This will reduce waste cost and national waste burial space demand. The current rate of ^{35}S usage will not require an increase in the license limit (10 mCi) since in factoring use rate, storage, and decay, the maximum amount at CMU would be approximately 5 mCi and will be a maximum of 2 cubic meter. Material will be sorted to liquid and solid phases. The liquid phase will be stored in plastic storage jugs and the solid phase combined into plastic biohazard bags and double bagged. These containers will be placed in plastic tubs. The ten halflife period starts with the final seal to the bag or container. After ten halflives, the containers will be surveyed to verify that no activity is detectable, all radiation labels removed and destroyed, and the container/contents properly disposed.

The storage area will be Brooks 209A. This room is temperature controlled, secure (separately keyed lock), has a leadlined floor and 5 foot high lead-lined walls. The ^{35}S containers will be situated such that easy visual inspection is possible. This room was detailed in the original application.

b. The above techniques will be used to dispose of all radionuclides with a halflife of 65 days or less.

12. Waste Management

a. Any licensed material discharged into the sewer system will be in accordance with 10 CFR 20.303. All waste disposal must be documented. Minimal water volume will be noted as well as radioactive material activity, if this method of disposing low level waste is used.

b. The waste disposal guidelines noted on page 18 should be amended to require conformance to 10 CFR 20.303 and Appendix B of 10 CFR Part 20.

13. Interim Storage of Materials

It is recognized that the NRC prefers that waste be maintained on site for no longer than 2 years. However, this institution's total waste generation is currently less than 1 cubic foot per year and this waste is much less than 1 mCi low intensity, total activity (mostly beta emitters). Given the current fee charges for waste and the volume assumed with waste disposal, disposal of this quantity is not cost effective. This institution would prefer to hold waste longer to make the waste disposal more cost effective. The intent is not to circumvent waste disposal, only to make it more cost effective. This period would not exceed 5 years. If the activity approaches the action thresholds noted for the bioassay considerations for long halflived nuclides or our stated license limits, the waste will be properly disposed.

The waste would be either solid or liquid and will not exceed one cubic meter.

14. Spill Procedures

All spills will be reported to the RSO and he will file a Radiation Spill Form (enclosure #3) . A new line in the spill procedure has been added (see line #4, enclosure #4).

I hope this information is sufficient to provide the NRC with a favorable review of our license reapplication. If any additional information or a clarification is necessary, please contact me at 517-774-3291 or leave a message at the Biology Department office 517-774-3227.

Sincerely,

John I. Scheide

John I. Scheide
Radiation Safety Officer
Assistant Professor of Biology

Enclosure 1

WIPE TEST SURVEY FORM

Page ___

Radiation room survey for the dates from __________ 19__
to __________ 19__.

Instrument used ______________________________.
Calibration date ________________________.
DIAGRAM OF THE SURVEYED AREA ROOM __________ IN ______________.
Be sure to detail the areas that are being surveyed by number.

Survey measurement units ______________.

	LOCATION										INITIALS
DATE	1	2	3	4	5	6	7	8	9	10	
INITIAL											

Room released for public use ________________________ date________
RSO

Room survey continued on page ______.