INDIANA UNIVERSITY

BLOOMINGTON, INDIANA

OFFICE OF THE TREASURER

March 8, 1961

Mr. James R. Mason, Chief
Isotopes Branch
Division of Licensing and Regulation
United States Atomic Energy Commission
Washington 25, D. C.

Re: Your DLR:IB:JEB (13-108-4)

Dear Mr. Mason:

Enclosed is an application for renewal of licenses 13-108-1-4-5 to be combined under one license number.

You will recall we talked about this procedure by telephone on January 10th. We hope that the application and forms submitted are sufficient and will allow you to issue one license number, and will still allow us to make our three different areas responsible to the professors under Item 5 - RADIATION PROTECTION OFFICER.

If there is any question concerning this application, please do not hesitate to get in touch with us immediately.

Yours very truly,

INDIANA UNIVERSITY
Purchasing Department

R. M. Priest
Associate Purchasing Agent

RMP/mj

Encls.

4. INDIVIDUAL USE(S):

Henry R. Mahler, Professor

Felix Haurowitz, Professor

Lynne Merritt, Professor

Walter J. Moore, Professor

Ward B. Schaap, Associate Professor

Ralph L. Seifert, Associate Professor

John A. Thomas, Assistant Professor

A.C.G. Mitchell, Professor

L. M. Langer, Professor

R. G. Wilkinson, Professor

M. B. Sampson, Professor

D. W. Miller, Professor

ADDITION TO PREVIOUS USERS:

Applicant: Robert D. Bent

Research Experience - Institution and Rank

The Rice Institute	Research Associate	1954-1955
Columbia University	Research Associate	1955-1958
Indiana University	Assistant Professor	1958-present

Experience:

He has been doing research in the field of low energy nuclear physics, utilizing Van de Graaff and cyclotron accelerators, since 1952. This amounts to nine years of experience with sources of radiation. He is fully aware of the hazards involved, and the safety precautions that are necessary in the handling of radioactive materials.

4. INDIVIDUAL USER(S) CONT'D:

Carlos O. Miller - Associate Professor of Botany

No previous experience with isotopes other than a section of a biochemistry laboratory at Wisconsin. Will undertake studies with tritium-labelled kinetin and other adenosine derivatives.

David G. Frey - Professor of Zoology

Has worked with Carbon ^{14} during two summers. Will use Carbon ^{14}.

Thomas D. Brock - Assistant Professor of Bacteriology

Ohio State University	B.Sc.	1949
Ohio State University	M.Sc.	1950
Ohio State University	Ph.D.	1952
Upjohn Company		1952-1957
West Reserve University	Assistant Professor	1957-1960

Will use C^{14} sugar acetate, uricel and thymene, S^{35} inorganic sulfate, and P^{32} inorganic phosphate.

Howard V. Rickenberg - Associate Professor Bacteriology

Cornell University	B.Sc.	1950
Yale University	Ph.D.	1954
Pasteur Institute and London Medical Laboratory	American Cancer Society	1954-56
University of Washington	Medical School Instructor & Assistant Professor	1956-60

Will use C^{14} compounds of sugar and amino acids, S^{35} sulfate mercaptan, and P^{32} inorganic phosphates.

ADVICE TO AEC RESPONSIBLE INVESTIGATORS IN JORDAN HALL

1. Orders for active materials must originate with individuals who are listed on the AEC license as "responsible investigators."

2. All shipments received should be recorded immediately on "Product Record Forms" (a copy is attached). The upper portion of this form is sent immediately to the Radiation Safety Officer (C. W. Hagen). The lower portion should remain with the sample until decay or disposal is complete, then is sent to the Radiation Safety Officer.

3. Active samples must be stored in locked rooms or locked cupboards.

4. All containers, waste cans, and areas housing radioactive materials must be labelled with approved cards or tape.

5. Responsible investigators must take full responsibility for safe procedure by subsidiary personnel and should be familar with Federal regulations concerning safe handling practices.

6. The enclosed "Precautions," or a similar set of rules, should be posted in laboratories where work with isotopes is allowed.

7. Disposal of soluble materials is permitted through sink drains if accompanied by inert carrier and if the total amount involved is not greater than 1 mC in 24 hours.

Combustibles, including carcasses, may be incinerated in the Jordan Hall incinerator (with the permission and supervision of members of the Zoology Department) provided:

a. Ash is collected and stored for decay or disposal by burial, and
b. The effluent stack discharge does not exceed in activity the limits specified for unrestricted areas in the Federal Register. With our incinerator the following rates should not be exceeded:

carbon-14	1.0 mC each 4 days
iodin-131	0.01 mC each 10 days
tritium	12.0 mC each day.

Disposal must be proportionated, i.e., it is <u>not</u> permitted to dispose of the maximum activity of two isotopes during overlapping periods.

Non-combustibles, ash, papers, etc. may be disposed of by burial. Volume may be reduced by burning at the disposal area (in the burial pit). Such disposal will be accompanied to the site by a trained technician who will measure and record activity before and after burial.

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PRECAUTIONS TO BE OBSERVED IN 'HOT' AREAS

Tolerable Exposure

No person should receive more than 100 mr/wk to any part of the body, summing exposure from all sources. Damage from such exposure is believe undetectable.

Sources of Exposure

1. Ingestion of active material.
2. Inhalation of active material.
3. Wounding with contaminated objects or contamination of open wounds with active material.
4. External irradiation.

Detection of Exposure

1. Film badges or ionization chambers should be worn by those working with dangerously active materials or by persons working routinely under conditions permitting exposure.
2. Blood counts should be obtained routinely by continuously exposed personnel.
3. Assay activity in urine, feces, or nasal exudates whenever ingestion or inhalation of active materials is suspected.

Avoidance of Exposure

1. Survey 'hot' areas before beginning operations and calculate safe working times and distances.
2. Clean work area (wipe down and change papers) before and after operation.
3. Wear lab coats while working and check activity on coats and clothing after working.
4. Use appropriate shielding, secondary containers, and absorbers.
5. Dispose of wastes immediately and in appropriate containers.
6. Maintain greatest practical distance from sources.
7. Run all evaporations slowly and under effective hoods.
8. Do not smoke, eat, or apply lipstick in 'hot' areas. Do not bring such materials into 'hot' areas.
9. Do not pipette by mouth in 'hot' areas.
10. Obtain hand counts after using active materials. Decontaminate as necessary.
11. Protect all open wounds while in 'hot' areas.
12. Decontaminate any wound received in 'hot' areas and report the accident immediately.

PROCEDURES FOR HANDLING RADIOACTIVE MATERIALS

Department of Physics
Indiana University

1. All orders for radioisotopes must be approved by the Chairman of the Isotope Committee (A. C. G. Mitchell).

2. Shipments are received and opened only by responsible supervisory personnel (Professors Langer, Mitchell, Wilkinson, and Sampson). Aliquots for research are meted out by the above for use by themselves or by instructed personnel working under their supervision.

3. Areas in which radioisotopes are stored or used are so indicated by radiation warning signs. Isotopes are stored in lead enclosures in controlled areas.

4. Personnel working with radioactive materials wear film badges and pocket dosimeters to monitor the accumulated dose. Survey meters are used to determine the instantaneous rate of irradiation. No personnel are permitted to accept an integrated dosage in excess of 100mR in any one week. All personnel receive monthly blood counts.

5. Areas in which radioactive material is handled are surveyed periodically. All spills or surface contaminations are cleaned up at once. In the case of non-removable contamination, the contaminated surface is either removed or appropriately covered over.

6. Expended material is usually disposed of after having decayed to an insignificant level. Disposal is by means of controlled burning (to reduce the bulk) and then buried in an unfrequented area. During chemical processing small amounts (less than 1.mc) of water soluble material are flushed into the sewer, usually highly diluted with inactive carrier isotopes of the same element.

USE OF RADIOACTIVE MATERIALS IN THE DEPARTMENT OF CHEMISTRY

(For information and regulations manual) Effective January 1960

To promote safety and prevent unnecessary contamination of any area the users of radioactive materials must have adequate safety information, and regulations must be strictly observed which will assure proper use of such materials.

The Chemistry Committee on Radioisotopes (CCR) has the responsibility of (1) making information available, (2) providing regulations, and (3) assisting the departmental chairman in the enforcement of the regulations.

Authorization to use radioisotopes

Under the conditions of our license no member of the department may use any radioisotope without authorization by the CCR. Any prospective user and any new uses must be referred to the Committee for approval.

Procurement of radioisotopes

All requisitions for the procurement of isotopes must be prepared in accordance with the licensing regulations and they must receive action by the departmental chairman. He will not authorize procurement unless the specified user(s) has been approved by the CCR.

Supervision of use

Faculty members have responsibility for the proper use of radioisotopes by students, research technicians, and other workers in their research or instructional groups. This responsibility must be implemented by making certain that all persons concerned satisfy the requirements for clearance by the CCR. Chemistry C507 is especially recommended. It should precede actual participation in work requiring the use of isotopes.

Protection against radiation

Food and drink must not be consumed in areas where there is radioactivity that might be ingested.

Pipetting of radioactive material by mouth must not be allowed.

All other practices that might result in appreciable exposure to radiation must be prohibited.

Personnel monitoring

1. Pocket dosimeters are available in the Radiochemistry building. The record of exposure of each worker must be recorded in a bound notebook kept in this building. The record is kept by worker's name so that cumulative exposure records are readily determined. Records must be entered in the notebook at least once per week. The book will be inspected at least once per week by the Safety Officer or his representative.

2. Film badge service will be provided for those workers whose supervisors deem it necessary or desirable. Pocket dosimeters should also be worn by such workers. Consult with the Safety Officer concerning this service.

3. In case of any possible overexposure or accidents the Safety Officer should be notified immediately. He will also notify the Manager of the Chicago Operations Office, P.O. Box 59, Lamont, Illinois in accordance with the amendment to Title 10, Chapter 1, Part 20, Code of Federal Regulations, "Standards for Protection Against Radiation," May 13, 1957.

4. The permissible weekly dose of radiation is specified in Appendix A of the above-mentioned code (Federal Register 22, No. 19, p. 553, Jan. 29, 1957) but, for Indiana University, an exposure in excess of 150 mrem per week is considered excessive and must be reported to the Safety Officer.

Radiation symbols

Standard signs are available in the stockroom.

It is necessary to use the standard insignia at all "radiation areas" where there exists radiation in excess of 5 mrem per hour or where a person could receive a dose in excess of 150 mrem in any 5 consecutive days.

Restricted areas of use

The regulations prohibit use of radioactive material in an unrestricted area if the radiation levels will result in a person receiving a dose in excess of 2 mrems per hour if continuously present in the area or a dose in excess of 100 mrems in any seven consecutive days.

Disposal

1. All burials of radioactive materials will be supervised by the Safety Officer and will be recorded by him in a book kept in the Chemistry Business Office.

2. Tables of permissible concentrations of isotopes which can be disposed in the sewage system are available in the Chemistry Business Office and from the Safety Officer. All disposals must be recorded on the forms furnished with each shipment of radioisotopes (attached to each package by the stockroom keepers).

3. All disposals of radioisotopes must be made in one sink, only, in each area and must be recorded, also, on a second record sheet kept at this sink. The special sink in the Hot Laboratory (Room 7) of the Radiochemistry Building is the proper sink for that building.

4. A record must also be made of all radioactive solids placed in the waste can in the Hot Laboratory (Room 7). The isotope, approximate quantity, date, and name of person making the disposal should be entered on the record sheet posted near the can. The volume of such disposals should be as small as possible. Non-active paper towels and glassware should not be placed in this waste can. Similar records must be kept for temporary waste cans that may be used outside the Radiochemistry building. All solid wastes, except animals, should eventually be placed in the waste can in the Hot Laboratory.

5. All radioactive biological material as well as other materials must be handled with care and foresight. For example, some materials may be essentially harmless in the fresh state but during storage putrifactive processes may result in the liberation of C^*H_4, C^*O_2, S^*H_2, and other volatile forms of radioactive material. In general decomposition can be conveniently prevented by storage in the frozen state at about -15°C.

Radioactive excreta of animals should be collected by trained workers such as graduate students and made alkaline by the addition of CaO to prevent the evolution of S^*H_2 or C^*O_2. Alkaline urine should be concentrated, after the addition of permanganate, to reduce the volume before burying the material.

Records

1. The sheet furnished with each shipment of radioactive material is to be kept with the material at all times until the material is all gone. At this time, the sheet is to be returned to the Chemistry Business Office where it will be kept on file. This office will issue monthly requests for reports on the disposal of each shipment of radioactive materials received until it has been established that all the activity received has been accounted for.

Daily Sewage Disposal Limits

material	microcuries	material	microcuries
A^{41}	1,000	Eu^{154}	10
Ag^{105}	10	F^{18}	500
Ag^{111}	100	Fe^{55}	500
Am^{241}	1,000	Fe^{59}	10
As^{76}, As^{77}	100	Ga^{72}	100
At^{211}	1,000	Ge^{71}	500
Au^{198}	100	H^3 (HTO or T_2O)	1,000
Au^{199}	100	Ho^{166}	1,000
$Ba^{140} + La^{140}$	10	I^{131}	100
Be^7	500	In^{114}	10
C^{14}	500	Ir^{190}	1,000
Ca^{45}	100	Ir^{192}	100
$Cd^{109} + Ag^{109}$	100	K^{42}	100
$Ce^{144} + Pr^{144}$	10	La^{140}	100
Cl^{36}	10	Lu^{177}	1,000
Cm^{242}	1,000	Mn^{52}	10
Co^{60}	10	Mn^{56}	500
Cr^{51}	500	Mo^{99}	100
$Cs^{137} + Ba^{137}$	10	Na^{22}	100
Cu^{64}	500	Na^{24}	100

material	microcuries
Nb^{95}	100
Ni^{59}	10
Ni^{63}	10
P^{32}	10
Pb^{203}	1,000
$Pd^{103} + Rh^{103}$	500
Pd^{109}	100
Pm^{147}	100
Po^{210}	1
Pr^{143}	100
Pu^{239}	10
Ra^{226}	1
Rb^{86}	100
Re^{183}	1,000
Re^{186}	100
Rh^{105}	1,000
$Ru^{103} + Rh^{103}$	10
S^{35}	500
Sb^{124}	10
Sc^{46}	10
Sm^{151}	1,000
Sm^{153}	100
Sn^{113}	100

material	microcuries
Sr^{89}	10
$Sr^{90} + Y^{90}$	1
Ta^{182}	100
Tc^{96}	10
Tc^{99}	10
Te^{127}	1,000
Te^{129}	1,000
Th^{234}	1,000
Th(natural)	500
Tl^{204}	500
Tm^{170}	1,000
U(natural)	500
U^{233}	10
U^{234}-U^{238}	500
V^{48}	10
W^{185}	100
Xe^{133}	1,000
Xe^{135}	1,000
Y^{90}	10
Y^{91}	10
Zn^{65}	100
Unidentified radioactive materials or any of the above in unknown mixtures	1

December 1959

H. G. Day