University of Illinois at Urbana-Champaign

Division of Environmental Health and Safety

317 McKinley Hospital
1109 South Lincoln Avenue
Urbana, Illinois 61801
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070-00258
SNM-236

Region III

25 May, 1982

License Management Branch
Division of Fuel Cycle and Material Safety
Office of Nuclear Material Safety and Safeguards
United States Nuclear Regulatory Commission
Washington, D.C. 20555

RE: Special Nuclear Materials License # SNM-236

Gentlemen:

The University of Illinois at Urbana/Champaign wishes to renew Special Nuclear Materials License SNM-236. License SNM-236 as issued on 25 November, 1977 and amended on 29 August, 1980 and on 1 February, 1982 authorizes possession and use of :

a. Plutonium : 240 grams encapsulated in Pu-Be Neutron Sources.
b. Plutonium-239 : 3 grams incorporated in the form of foils, counters or plated sources.
c. Uranium-233 : 1 gram incorporated in the form of foils, counters or plated sources.
d. Uranium-235 : 12 grams incorporated in the form of foils, counters, or plated sources.
e. Uranium-235 : 300 grams in the form of UF_6.
f. Plutonium-238 : 5 microcuries encapsulated in a sealed source.

Supplementary material to assist you in consideration of this application for renewal is attached. Please direct all correspondence regarding this matter to me.

Sincerely,

Hector Mandel, Head
Health Physics Section

HM/ws
Attachments

20783

JUN 14 1982

APPLICATION FOR SPECIAL NUCLEAR MATERIAL LICENSE

Supplemental Sheet 1 of 10

1. Applicant

University of Illinois at Urbana/Champaign
Urbana, Illinois
(Send all correspondence care of:
Hector Mandel, Head
Health Physics Section
Division of Environmental Health and Safety
University of Illinois at Urbana/Champaign
343 McKinley Hospital
1109 South Lincoln Av.
Urbana, Il. 61801)

2. Specification of Activities to be Performed

Item A, Pu-Be sources will be used for performing various types of teaching and research experiments such as activation analysis, neutron counting and detection, and driving different types of subcritical assemblies.

Items B,C, and D will be used in foils, counters and plated sources for various experiments in Nuclear Engineering, Physics and the other natural sciences. For ^{233}U and Plutonium, no single unit will contain more than 50 mg and the coating deposits would average about 200 to 300 mg/cm^2. ^{233}U and Plutonium units will not be fabricated at the University, but will be purchased or borrowed. ^{235}U units may be purchased, borrowed, or fabricated from Uranyl Nitrate of high enrichment.

Counter designs would be of three types:

a. Parallel-plate fission counters requiring foils 5.0 to 7.5 cm in diameter.

b. Cylindrical fission counters having a coated area around 7.4 cm long and an inside diameter of about 2 cm.

c. Spiral fission counters in the shape of a cylinder 2.5 cm high and 2.5 cm O.D. The spiral of Platinum is coated on both sides and has an area of about 100 to 200 cm^2.

Item E, 300 gm of ^{235}U in the form of UF_6 powder will be used in experiments at the University of Illinois Advanced TRIGA Reactor (facility license R-115). Use of the material will be as described, in detail, in a letter from Hector Mandel to James G. Keppler dated 3 June, 1980 a copy of which is in your files.

Item F, 5 uCi of ^{238}Pu be used at the Nuclear Physics Laboratory to calibrate high-energy NaI detectors. The Plutonium is embedded in Carbon-13 to produce a 6.13 MeV gamma-ray which results from the decay of ^{16}N. This high-energy gamma-ray is used to calibrate the detectors.

3. Specification of Special Nuclear Materials

a. Plutonium: 240 gm (15 curies) as encapsulated Pu-Be neutron sources, Monsanto Research Corporation, Model MRC-N-SS-W-Pube. Source sizes to range from 16 gm to 160 gm contained ^{239}Pu (1 to 10 Ci).

b. Plutonium-239: 3 gm (190 mCi) as foils, counters or plated sources.

c. Uranium-233: 1 gm (9.15 mCi) as foils, counters or plated sources.

d. Uranium-235: 12 gm (25 uCi) as foils, counters, or plated sources.

e. Uranium-235: 300 gm of UF_6 powder.

f. Plutonium-238: 5 uCi encapsulated in a sealed source.

4. Technical Qualifications

The radiation safety program is carried out by the Health Physics staff under the watchful eyes of the Radiation Hazards Committee. Training and experience of the Committee members is as follows:

Janice M. Bahr, Associate Professsor of Animal Science and Physiology

1964 - Viterbo College, Lacrosse, Wi., B.A., Biology
1968 - University of Illinois, Urbana, Il., M.S., Zoology
1974 - University of Illinois, Urbana, Il., Ph.D., Physiology
1964 - 1966: Science Instructor, Sacred Heart High School, Durand, Wi.
1967 - 1968: Teaching Assistant, University of Illinois, Urbana, Il.
1969 (summer): Recipient of NSF Research Grant, University of Massachusetts, Amherst.
1970 - 1972: Endocrinology Trainee, Department of Physiology, University of Illinois, Urbana,, Il.
1972 - 1974: Research Assistant, Department of Animal Science, University of Illinois, Urbana, Il.
1974: Research Associate, Department of Animal Science, University of Illinois, Urbana, Il.
1974 - 1979: Assistant Professor in Animal Science, University of Illinois, Urbana, Il.
1979 - present: Associate Professor in Animal Science and Physiologyy, University of Illinois, Urbana, Ill.

Howard S. Ducoff, Professor of Physiology and Biophysics

1942 - City College of New York, B.S.
1953 - University of Chicago, Ph.D., Physiology
1946 - 1957: Full-time and part-time investigator at Argonne National Laboratory, including two year's research with Arsenic-76.
1957 - present: Physiology research and teaching radiophysiology, University of Illinois, Urbana

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John W. Gomperts, Director of Puruchases, University of Illinois, Urbana, Ill.

Richard I. Guumport, Associate Professor of Biochemistry

1960 - University of Illinois, B.S.
1968 - University of Chicago, Ph.D., Biochemistry
1968 - 1971: Postdoctoral fellow, Department of Biochemistry, Stanford University School of Medicine
1971 - present: Assistant/Associate Professor of Biochemistry, University of Illinois, Urbana, Ill.

Alfred D. Hanson, Professor of Physics

Professor Hanson has not worked directly with radioisotopes recently but has been associated with the University of Illinois High Energy Physics Group (for more than twenty-five years) working primarily with high energy x-rays from our Betatrons. Presently, he is the project leader in developing a new high-intensity, intermediate energy (a few hundred MeV) accelerator.

Previously, he worked for his thesis at Wisconsin with the 4 MeV electrostatic generator and continued this work at Los Alamos, New Mexico. In this work, he was mostly concerned with mono-energetic neutrons having energies from a few kilovolts to five MeV but also worked considerably with isotopic neutron sources.

In this work he has developed and used a number of neutron detectors (best known being the Hanson-McKibben long counter) which are useful in survey work for determining health hazards around machines and he has assisted in such surveys.

Jack T. Harroun, Superintendent of Building Services

John P. Hummel, Professor of Physical Chemistry and of Physics
Present Chairman of the UIUC Radiation Hazards Committee

1953 - Handled low levels of radioactive Tin at University of Rochester
1956 - University of California, Berkely, Ph.D., Chemistry
1953 - 1956: Did radiochemical work at University of California Radiation Laboratory. In this work, Professor Hummel handled several alpha emitters (Bismuth through Fermium). The activity levels varied from 100 dpm to 10^{10} dpm. Also, he has had some experience in handling very radioactive cyclotron targets
1956 - present: Has taught advanced Radiochemistry courses and has pursued research in High Energy Physics and Radiochemistry.

Stephen K. Kneller, Associate Professor of Veterinary Clinical Medicine - Chief of Radiology Section, College of Veterinary Medicine

1968 - Purdue University, D.V.M.
1971 - University of Georgia, M.S., Veterinary Medicine
1972 - Certified by the American College of Veterinary Radiology
1968 - 1969: Practicing Veterinarian, Parker, Indiana
1969 - 1973: Instructor, Veterinary Radiology, University of Georgia
1973 - 1975: Assistant Professor, Anatomy and Radiology, University of Georgia
1975 - Present: Associate Professor, Chief of Radiology Section, University of Illinois, College of Veterinary Medicine.

Henry H. Koertge, Director, Division of Environmental Health and Safety

Albert J. Machiels, Assistant Professor of Nuclear Engineering

1966 - University of Liege, Belgium, Chemical Engineering and Metallurgy
1969 - University of Liege, Belgium, Nuclear Engineering
1971 - University of California, Berkely, M.S., Nuclear Engineering
1976 - University of California, Berkely, Ph.D., Nuculear kEngineering
1966 - 1968: Assistant, Chaire de Chimie Physique, University of Liege, Belgium
1970: Assistant (on leave), EURO CHEMIC, Reprocessing Plant, Mol, Belgium
1969 - 1971: Assistant, Chaire de Matmeriaux Nucleaires, University of Liege, Belgium
1971 - 1975: Research Assistant, Materials and Molecular Research Division, Lawlrence-Berkely Laboratory
1976: Junior Specialist 1, Department of Nuclear Engineering, University of California, Berkely
1979 - 1980: Visiting Assistant Professor and Research Engineer, Department of Nuclear Engineering, University of California, Berkely
1976 to present: Assistant Professor of Nuclear Engineering, University of Illinois, Urbana, Ill.

Hector Mandel, Radiation Safety Officer

1972 - University of Illinois at Urbana/Champaign, B.S. Astronomy/Physics
1974 - University of Illinois at Urbana/Champaign, M.S. Nuclear Engineering/Health Physics
1974 - 1975: Nuclear Engineer at Dresden Nuclear Power Station, Commonwealth Edison Company
1975 - 1976: Assistant Health Physicist at Quad Cities Nuclear Power Station, Commonwealth Edison Company
1976 - 1977: Lead Health Physicist at LaSalle Nuclear Power Station, Commonwealth Edison Company
1977 - 1978: Reactor Health Physicist at University of Illinois Advanced TRIGA reactor facility, University of Illinois at Urbana/Champaign
1978 - present: Head, Health Physics Section/Radiation Safety Officer, Division of Environmental Health and Safety, University of Illinois at Urbana/Champaign

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Steven H. Soboroff, Director, McKinley Health Center

For the most part, the Radiation Hazards Committee delegates the responsibility of determining user's qualifications to the Radiation Safety Officer.

During the process of considering any given user's Application for Radioisotope Procurement, the Radiation Safety Officer uses professional judgment in determining the qualifications of the user. Usually, the review process will involve discussions between the user and the RSO, or the user may be requested to answer selected questions in detail. If the RSO feels that the potential hazards warrant exhaustive review, the Application for Radioisotope Procurement is turned over to the Radiation Hazards Committee.

Once approval has been obtained, the user is carefully monitored through routine surveys and spot inspections by the Health Physics Staff. If, at any time, the RSO should feel that the qualifications of the user to work with radioactive material are questionable, the matter is brought before the Radiation Hazards Committee for review.

The type of training required for personnel involved with radiation sources is generally left to the discretion of the laboratory supervisor. To describe the training would be impractical since it will vary so greatly from one situation to another so as to require a separate description for each individual worker. The best (although inadequate and inaccurate) description is "on the job training." It can range from the simple instruction to a janitor: "Don't empty radioactive trash cans into the Dempster Dumpster," to the most elaborate list of prerequisite formal courses chosen from the multitude listed in the undergraduate and graduate course catalogues that might be required for a Ph.D. candidate in Physiology preparing to use a multicurie gamma irradiator to expose swine infected with flu viruses infused with tritium-labelled DNA.

Certainly there are available many formal courses as indicated in the attached list gleaned from the UIUC catalogues. As you can see these are scattered throughout the various curriculi running the alphabet from Animal Science through Veterinary Medicine.

The Health Physics staff is essentially a service, consulting and liaison unit. The Health Physics Staff does try to supplement the efforts of the laboratory supervisors as much as possible. In certain cases a Health Physics' staff member will perform a detailed surveilance and evaluaton of a particular procedure, monitoring it in the lab from start to finish and offering on-the-spot counselling as the procedure continues. The decision to do this is made either when a particular project is approved or when a particular shipment is delivered. It is done whenever a new proposed project appears to involve above-normal potential hazards or when a new group begins using procedurues and materials with which others have had difficulties in the past.

For janitors, maintenance personnel, etc., there is a brief dissertation, "Radiation Information," on Pages 107 and 110 of the Building Operations Manual which is issued to new building service workers.

All of our radiation protection procedures as well as descriptions of the responsibilities of the Radiation Safety Officer and the laboratory supervisors remain basically unchanged from those described in the UIUC Radiation Safety Manual, a copy of which you have on file. At the present time, a revised version of the UIUC Radiation Safety Manual is being circulated among the Radiation Hazards Committee members in draft form. All of the changes being contemplated are procedural in nature and do not involve changes in any license conditions. It is our understanding that the types of changes being made will not require prior notification or review by the NRC since they involve changes dictated by NRC rule changes, changes in internal management forms or specific dates, changes in contractors for waste disposal, and mainly cosmetic changes in the format of the UIUC Radiation Safety Manual.

Courses Related to the Radiation Safety Program

Animal Science 463 - Radioisotopes in Biological Research: Principles and Practice

Biophysics 312 - Introduction to Radiobiology

Biophysics 415 - Radiation Biophysics

Biophysics 463 - Radioisotopes in Biological Research

Chemistry 397 - Radiochemistry

Chemistr 398 - Radiochemistry Laboratory

Chemistry 496 - The Use of Carbon-14 Labelling Techniques

Mechanical Eng. 302 - Nuclear Power Engineering

Nuclear Eng. 241 -Introduction to Radiation Protection

Nuclear Eng. 243 - Radiation Protection Laboratory

Nuclear Eng. 341 - Principles of Radiation Protection

Nuclear Eng. 347 - Introduction to Nuclear Engineering

Nuclear Eng. 357 - Nuclear Reactor Safeguards

Nuclear Eng. 397 - Radiochemistry

Nuclear Eng. 398 - Radiochemistry Laboratory

Nuclear Eng. 421 - Nuclear Concepts

Nuclear Eng. 441 - Nuclear Radiation Shielding
Nuclear Eng. 451 - Nuclear Reactor Laboratory

Nuclear Eng. 454 - Nuclear Engineering Laboratory Investigations

Nuclear Eng. 458 -Nuclear Design Engineering

Nuclear Eng. 490 -Special Topics in Nuclear Engineering

Physics 470 - Introdcution to Nuclear and Particle Physics

Physics 471 - Nuclear Physics I

Physiology 331 - General Radiobiology

Veterinary Biosciences 367 - Radiology and Radiobiology

5. Description of Equipment, Facilities, and Instrumentation

The Departments of Nuclear Engineering, Chemistry, and Physics (presently the only users of this material) have the necessary filtered hoods or dry-boxes to safely handle the fabrication of ^{235}U sources. No other departments will be authorized to use these sources unless they can demonstrate the adequacy of their procedures, equipment and facilities to the the Health Physics staff.

Most of these materials are presently stored in a locked cage at the Nuclear Reactor Laboratory. The Pu-Be sources are stored in their original shipping containers (55 gallon Parafin-filled drums) in Room 103 of the Nuclear Engineering Laboratory when not in use except one Pu-Be source which is stored in the radiochemistry lab Room 18, Noyes Laboratory.

5.1 Radiation Detection Instruments

The following is a list of radiation detection instruments which are available for use by the Health Physics Section:

Radiation Survey Instruments - 4 Geiger-Meuller instruments
4 Ionization Chamber instruments
1 Neutron Survey instrument

Special Detectors and probes - 1 Low-Energy gamma NaI detector

Air Sampling Equipment - 1 Low-Volume Air Sampler
1 High-Volume Air Sampler
1 Tritium Air Monitor

Laboratory Instruments - 1 Liquid Scintillation Counter
1 Gas-Flow Proportional Counter
1 Calibrated, Reference-class Exposure Meter

5.2 Calibration

Portable gamma and neutron survey instruments will be calibrated when new, at six-month intervals thereafter, and after each instrument repair.

Gamma instruments are calibrated by varying the distance from the detector to a standardized 100 milligram ^{226}Ra (NBS) source and by adjusting the instrument calibration control for the proper indication. Calibrations are performed up to 2 R/hr and at at least two points on each scale, one at about 20% of full scale and the other at about 80% of full scale.

Neutron monitoring instruments are calibrated by varying the distance from the detector to a calibrated five curie Pu-Be neutron source.

The Health Physics staff calibrates survey instruments owned and used by other departments at their request and also cross-checks their instruments against the Health Physics instruments occasionally at the time of routine laboratory surveys.

6. Radiation Protection Program

Our radiation protection program is probably best illustrated by our Radiation Safety Manual (a copy of which is provided to all who apply for the privilege of using radioisotopes on this campus). The most recent revision of the Manual is in your files.

As indicated on page 35 of the Radiation Safety Manual, the Radiation Hazards Committee has been placed administratively under the jurisdiction of the Office of the Chancellor. Actually it reports directly to and is appointed by the Vice Chancellor for Administrative Affairs. The Health Physics Office is administratively and budgetarily a sub-unit of the Division of Environmental Health and Safety which reports to the same Vice Chancellor.

The Committee usually meets formally only once or twice a year to review the work of the Health Physics staff and to consider modifications of policies. However, the members are available individually or collectively at any time to offer advice and to aid in determining the proper course of action whenever new or unusual situations arise. Sometimes, in such cases, a special meeting of the whole committee will be called. Sometimes, a subcommittee will be formed of members with expertise bearing on a particular problem. Otherwise, the authority of the Committee is delegated to the Health Physics staff who perform the Health Physics functions, leak test sealed sources, maintain the radioisotope and radiation safety records, and submit written reports the the Committee.

6.1 Film Badges

Film badges (beta, gamma, neutron and finger badges) are obtained from one of the commercial suppliers of this service. At the present time, the contract for this service at the UIUC is held by R.S. Landauer, Jr. & Co., Division of Tech/Ops., Inc., Glenwood Science Park, Glenwood, Il. 60425.

6.2 Radiation Survey Program

On rare occasions when a ^{235}U source is being fabricated, (always in a filtered hood or a dry-box) the person responsible will survey himself and the area frequently during fabrication and will clean up the area afterwards. Otherwise there will be no routine survey program other than leak testing the sealed sources. Discovery of a leaking source would of course prompt a non-routine survey of the area. Leak tests will be done by a member of the Health Physics staff at 3-month intervals for alpha-emitting sources and at six-month intervals for others. However, sources "contained" in sealed equipment will not be removed from the equipment for leak testing unless there is evidence of leakage outside the equipment. Leaking sources will be repaired or withdrawn from use.

Leak testing will consist of wiping the source and the inside of its container with a Q-tip or filter paper or equivalent material either dry or moistened with water or other non-corrosive solvent. (Except: fragile alpha windows will not be wiped). The wipe samples will be counted in a gas-proportional flow counter.

6.3 Waste Disposal

There should be no waste from the Pu-Be sources or the ^{233}U or ^{239}Pu. Waste from the (rare) fabrication of ^{235}U sources and counters is expected to be minimal as in the past. Waste from the ^{235}U used in the Nuclear-Pumped Laser research will be returned to the vendor. Small quantities of of liquid waste can safely be washed down the sewer. (This institution has a sewage flow of more than two million gallons per day.)

6.4 Record Management and Material Control

Records of receipt, use, location and disposal of material, personnel monitoring surveys, etc., are maintained in steel filing cabinets in the Health Physics Office. Appendix I of the UIUC Radiation Safety Manual describes procedures for "Purchase, Aquisition, and Transfer of Radioactive Materials."

6.5 Routine and Emergency Procedures

Routine laboratory procedures and emergency procedures are outlined in the UIUC Radiation Safety Manual.