

NORTHWESTERN UNIVERSITY
EVANSTON - CHICAGO

OFFICE OF RESEARCH SAFETY

April 23, 1985

B - 106 WARD BUILDING
303 EAST CHICAGO AVENUE
CHICAGO ILLINOIS 60611

RECEIVED BY LFMB	
DATE	May 3, 1985
BY	[Signature]
ORIG	[Signature]
ACTION	[Signature]

U.S. Nuclear Regulatory Commission
Material Licensing Branch
Division of Fuel Cycle and Material Safety
799 Roosevelt Road
Glen Ellyn, IL 60137

Re: Renewal 12-00382-03

Dear Sir/Madam:

Northwestern University would like to renew its Broad License for the use of radioactive materials, 12-00382-03. Northwestern University is a non-profit, educational institution and the material requested and used under this license is to be used for teaching or training, or research related to the teaching and training of students. As specified in 10CFR170.11.4, no fee is required.

Some changes have been made in the program since the application was submitted on May 29, 1979. On July 22, 1983, a request was made to renew former license SNM-330. This license was combined with 12-00382-03 in Amendment #51. On January 23, 1984, a request was made to include license SUD-556 with the broad license as well. This was done in Amendment #52. At this point, all materials formerly authorized in SNM-330 and SUD-556 have been included in license 12-00382-03. For clarification, these materials have been listed in Attachment 1.

At Northwestern University, the Radiation Safety Committee is responsible for the radiation safety program. Although names of the existing committee members have been submitted previously, I am submitting them again to eliminate reference to a number of previous amendment requests and amendments to the current license. These members are named in Attachment 2.

A number of letters and amendment requests, listed specifically in Amendment #53, Item 18, are no longer applicable. Those pertinent to the current license are listed in Attachment 3. Request is also made to delete a number of letters and amendment requests which no longer apply to this license.

Lists of radiation detection instruments and calibration procedures for instruments on both the Chicago and Evanston campuses are shown in Attachment 4.

In Appendix E (license application dated May 29, 1979) there were laboratories where radioactive materials were used or stored. This should now read 255.

In the license application dated May 29, 1979, Appendix F, a number of corrections should be made. These are described.

RECEIVED
APR 29 1985
REGION III

B610030431 B60722
REG3 LIC30
12-00382-03 PDR

FEE EXEMPT

APR 29 1985
CONTROL NO. 78805

U.S. Nuclear Regulatory Commission
License 12-00382-03 Renewal

1. A new Charter for the Radiation Safety Committee is submitted. This is Attachment 5.
2. In the Section labeled Receipt of Radioactive Materials, deliveries are made to the Research Safety Office. Packages are handled in a manner described in 10CFR20.205, not 10CFR20.201.
3. The training program is described in Attachment 6.
4. A copy of our Radiation Safety Handbook was submitted to you in January 1984 (see letter dated January 23, 1984).
5. Some correction is made in the handling of experimental animals. See Attachment 7.

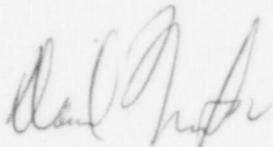
In license application, dated May 29, 1979, please disregard Appendices A, B, C, and G. Appendix A referred to committee membership and experience, updated here in Attachment 2. Appendices B and C refer to equipment and calibration procedures. This is updated in Attachment 4. Appendix G named the waste disposal firm as Atomic Disposal, Inc. The name of this company has been changed to ADCO Services, Inc. They still have the same Tinley Park, Illinois, address.

If additional information is needed, please contact David R. Miller, Radiation Safety Officer and Director, Office of Research Safety. The phone number is 312-908-8300.

Sincerely yours,



David R. Miller, Ph.D.
Radiation Safety Officer and Director,
Office of Research Safety



David Mintzer
Vice President for Research

65 MAY 3 10 10

Applicant	May 3 1984
Check No.	
Amount/Fee Category	
Type of Fee	
Date Check Rec'd	
Received By	

ATTACHMENT 1

<u>Element and Mass Number</u>	<u>Chemical/Physical Form</u>	<u>Maximum Activity Possessed</u>
A) Any byproduct material ✓ between atomic numbers 3 and 83, inclusively	A) Any	A) 2 Curies, each Maximum possession, 50 Curies total
B) Hydrogen-3 ✓	B) Any	B) 50Curies
C) Phosphorus-32 ✓	C) Any	C) 3 Curies
D) Curium-242 ✓	D) Any	D) 10 microcuries
E) Curium-244 ✓	E) Any	E) 150 microcuries
F) Americium-241 ✓	F) Any	F) 150 microcuries
G) Americium-243 ✓	G) Any	G) 10 microcuries
H) Californium-252 ✓	H) Any	H) 2 millicuries
I) Californium-252 ✓	I) Sealed source	I) 350 millicuries
J) Plutonium-241 ✓	J) Pu-Be sealed sources	J) 112 grams
K) Uranium-235 ✓	K) Any	K) 1 gram
L) Uranium ✓	L) Natural in cylindrical slugs	L) 2500 kilograms
M) Uranium ✓	M) Natural salts	M) 5 kilograms
N) Thorium-232 ✓	N) Thorium-nickle alloys	N) 20 grams
O) Thorium-232 ✓	O) Salts	O) 5 kilograms
P) Byproduct material as ✓ defined in Section 40.4, 10CFR Part 40	P) Uranium mill tailings	P) 400 kilograms

Notes:

- C) Phosphorus-32 increase from 2 to 3 Curies due to additional usage at University.
- I) Californium-252 sealed source-ORNL NSS-14, 350 millicuries original activity.
Source stored in concrete fort in Technological Institute, Room B959, Evanston.
- L) Subcritical reactor has been disassembled. Aluminum-clad slugs are stored in
Technological Institute, Room B959, Evanston.

ATTACHMENT 2

Individuals responsible for the radiation safety program and their training and experience

The Radiation Safety program at Northwestern University is under the direction of the Radiation Safety Committee. The committee roster is as follows:

Dr. Paul Hollenberg, Chairman
Dr. Arthur Campfield, Physiology and Engineering Sciences
Dr. Barbara-Ann Lewis, Civil Engineering
Dr. Daniel Linzer, Biochemistry, Cell and Molecular Biology
Dr. Thomas Lund, DDS, Dental Radiology
Dr. Allen Samarel, MD, Cardiology
Dr. Kenneth Spears, Chemistry
Dr. Chung Lee, Urology
Dr. David Miller, Radiation Safety Officer, ex-officio
Dr. Martin Rachmeler, Director, Research Services Administration, ex-officio
Dr. David Mintzer, Vice President for Research, ex-officio
Mr. Ernest Juillerat, Public Safety, ex-officio
Mr. Todd Leasia, Assistant Radiation Safety Officer, ex-officio

A brief description of the qualifications of the various members follows:

Dr. Paul Hollenberg received a Ph.D. in Biochemistry in 1969 and is an associate professor of pathology and pharmacology at Northwestern. His teaching experience has been in the field of biochemistry, molecular pharmacology, enzymology, and principles of systemic pathology. He has been a license investigator for the use of radioactive materials at Northwestern since 1974. This is his third year on the committee.

Dr. Arthur Campfield received a Bachelor of Science degree and Master of Science degree in Engineering and a Ph.D. in Physiology from the University of California-Los Angeles. He is currently an associate professor of physiology and engineering sciences at the Medical School and Tech. Institute, respectively. His background of study included control systems theory, mathematical modeling of physiological systems, endocrinology and metabolism, and systems physiology. Dr. Campfield has been a licensed user of radioactive materials at Northwestern since 1981. This is his first year on the committee.

Dr. Barbara-Ann Lewis has a Ph.D. in Soil Science which she received in 1971. She is an associate professor of Civil Engineering. Her teaching experience has been in the fields of environmental engineering and soil science. Her research experience has been in the areas of plant physiology and nutrition, chemical defoliation and soil chemistry. She did research in the environmental effects of nuclear and fossil fueled power on terrestrial and aquatic environments and on the environmental effects of uranium mining and milling. She has been a member of the committee three years.

ATTACHMENT 2 continued

Dr. Daniel Linzer is an assistant professor in the Department of Biochemistry, Cell and Molecular Biology on the Evanston campus. He received a Ph.D. in Biochemical Studies from Princeton. Since that time he has conducted post-doctoral research at Johns Hopkins and the Howard Hughes Medical Institute. Dr. Linzer has had over four years of experience in the use of radioactive materials as well as formal course work in the principles and practices of radiation protection and the biological effects of radiation. Dr. Linzer, a relatively new faculty member, received authorization to use radioactive materials in September, 1984. This is his first year on the committee.

Dr. Thomas Lund, Professor of Dental Radiology, has been on the committee a number of years. He has been appointed as the representative of the Dental School and has himself served as Chairman of the Radiation Safety Committee. He is actively involved in teaching and research, as well as the faculty member in charge of the Dental Radiology Clinic.

Dr. Allen Samarel is serving his second year on the committee. He is a cardiologist who is actively involved in research. He is a licensed investigator to use radioactive materials and has been at Northwestern since 1979. Dr. Samarel is also the Associate Medical Director of Cardiac Rehabilitation at Northwestern Memorial Hospital.

Dr. Kenneth Spears, Associate Professor of Chemistry, has been appointed to the Radiation Safety Committee because of his expertise in the field of laser research. Dr. Spears has a Ph.D. in Physical Chemistry and has been a faculty member at Northwestern since 1972.

Dr. Chung Lee, Associate Professor of Urology, and Director of the Urology Research Laboratory, has been recently appointed to serve out the term of Dr. Edward Rozhon, who left the University. Dr. Lee has been a licensed investigator authorized to use radioactive materials in research for a number of years. He also is a former member of the committee(1978-1982). He received a Ph.D. in Physiology and Nutrition in 1969.

The status of this committee will not change before August 31, 1985, when some members are scheduled to be rotated off the committee. Committee appointments are generally for three years.

ATTACHMENT 3

Application or letter requests listed in Item 18, Amendment 53, License 12-00382-03 are shown below. Request to delete those not applicable is made.

<u>DATE</u>	<u>REFERENCE</u>
✓ June 30, 1978 ✓	SNM-330 license application
✓ May 29, 1979 ✓	12-00382-03 license application
✗ January 13, 1981 ✓	Request for Uranium and thorium salts(SUD-556)
- June 25, 1973	Reference to subcritical reactor, license SUD-556.. No longer applicable. Reactor has been disassembled, although material is still on hand. Request to delete this reference.
✓ February 1, 1978 ✓	Request for possession for U-235.. SNM-330 license
✓ May 2, 1978 ✓	Further information for possession of U-235..SNM-330
✗ May 1, 1978 ✓	Request for increase in thorium limits, solid form and thorium-nickle alloys
✗ September 7, 1979 ✓	Information on storage of Cf-252 source..12-00382-03
- October 10, 1979	Reference to committee membership..should be deleted
- June 25, 1980	Reference to committee membership..should be deleted
- November 6, 1981	Reference to committee membership..should be deleted
- January 6, 1981	No record of letter in our files or in amendments to any of three licenses
- January 26, 1981	Should read January 26, 1982..reference to committee membership and submission of charter. A new charter is included in this renewal application.
- April 1, 1982	Reference to committee membership..should be deleted
- December 6, 1982	Reference to committee membership..should be deleted
✓ May 31, 1983 ✓	Request for uranium mill tailings..SUD-556
✓ June 15, 1983 ✓	Request for uranium mill tailings..SUD-556
✓ July 22, 1983 ✓	License application for license renewal..SNM-330. Renewal in Amendment 51, License 12-00382-03. License SNM-330 terminated.
✓ January 23, 1984 ✓	License application for license renewal..SUD-556. Renewal in Amendment 52, License 12-00382-03. License SUD-556 terminated.
- November 29, 1984	Reference to committee membership...should be deleted
- December 20, 1979	Correction in instrument calibration procedure. Proper schedule for instrument calibration is semi-annual, as stated in this letter and in other licenses.

ATTACHMENT 4

NORTHWESTERN UNIVERSITY
OFFICE OF RESEARCH SAFETY

Calibration Procedures
Chicago Campus

- A. Pulse Counting Instruments with end window, side window, and pancake GM detectors (E-120/HP190, E-120/HP260, Ludlum Model 3/HP260):
1. Measure HV and battery potential with Triplett 630A VOM. Adjust HV and replace batteries if necessary.
 2. Check and adjust zero point.
 3. Determine input threshold potential with Eberline Mini-Pulser, MP-1.
 4. Instruments are calibrated to true pulse repetition frequency. The MP-1 has a range of from 1.0 c/min to 1.6E6 c/min at an accuracy of +/- 0.1%. The output pulse has a 0.2 usec rise time, a 0.2 usec width and a 3.0 usec fall time. The pulse generator is capacitively coupled to the instrument probe connector. Calibration controls are adjusted so meter reading corresponds to the pulse generator frequency at two points per scale (typically 20% and 80% of scale).
 5. Measure selected beta-gamma standard sources (e.g., NES200S source set).
 6. Measure standard check source.
- B. Portable Gas Flow Proportional Counters (PAC4G3/AC21B):
1. Measure HV and battery potential.
 2. Check and adjust zero point.
 3. Perform plateau check (optional based on daily check source records and calibration results).
 4. Determine input threshold potential.
 5. Check the gas flow in both the "operate" and "flush" modes.
 6. Measure the ⁹⁹Tc plated sources. These sources are accurate to +/- 3% and the activities correspond to count rates which lie approximately in the midpoint of each "Lin-Log" range.
 7. Measure standard check source.
- C. Pulse Counting Instruments with Scintillation Detectors (Ludlum Model 3/44-3, Eberline PRM5-3/SPA3):
1. Measure HV and battery potential.
 2. Check and adjust zero point.
 3. Determine input threshold potential.
 4. Instruments are calibrated to true pulse repetition frequency with the MP-1 pulse generator at two points per scale. Window widths for optimum counting of nuclides of differing energies may be set using the pulse generator and HV controls as described in the PRM5-3 technical manual.
 5. Measure selected gamma sources (e.g., #NES 9033, ¹²⁹I, 1.2uCi, and DCA 3001, ¹³⁷Cs, 5uCi).
 6. Measure standard check source.

D. Ion Chamber Instruments (Victoreen 440, Kiethley 36100, Eberline RO-1):

1. Measure HV and battery potential.
2. Check and adjust zero point.
3. Place instrument in the field of the ^{137}Cs calibration source, Tech-Ops #115, 165mCi (6/2/83). The entire sensitive volume of the chamber should be in the field. Calibration distance is to be not less than 14 inches. Measure the beam at two points per scale, separated by at least 50% of the scale. If scale nonlinearity is found, the two points are adjusted such that the average fractional deviation is equal for both high and low ends of the scale. If the measured exposure rate differs at any point by greater than or equal to 10% but less than 20%, a calibration graph, chart, or correction factor is attached to the instrument. Instruments are removed from service for repair and recalibration when measured exposure rates deviate by greater than or equal to 20% from the true exposure rate.
4. Measure standard check source.

E. Ludlum 177 Alarm Rate Meter (side window GM):

1. Measure HV, battery potential.
2. Check and adjust zero point.
3. Measure input threshold potential.
4. Instrument is calibrated to true pulse repetition frequency with the MP-1 pulse generator.
5. Expose the detector to the field of the ^{137}Cs calibration source, Tech-Ops #115. Measure count rate as a function of exposure rate. Set the alarm to sound at 2.0 mR/hr in this field.
6. Measure standard check source.

F. Eberline MS2/PG1 Thyroid Counting System:

1. Perform timer operational check using "test" circuit for various times.
2. Calibrate meter to true pulse repetition frequency with the MP-1 pulse generator.
3. Optionally, optimize the HV by determining count rate as a function of HV setting for a standard source.
4. Optionally, optimize the window width for ^{125}I by determining count rate as a function of threshold for various window widths (see technical manual).
5. Determine system efficiency by measuring count rate as a function of thyroid phantom depth at standard points and geometries and calculate the efficiency function.
6. Measure standard check source.

G. Gas Flow Proportional Planchet Counter:

1. Perform HV plateau determination by measuring count rate as a function of HV setting using a standard source.

2. Perform reliability factor determination.
3. Determine efficiencies for standard beta sources (e.g. NES 200s source set).
4. Check and adjust gas flow and operation of regulator valve.
5. Measure standard check source.

H. Packard 3375-B Liquid Scintillation Counter:

1. (Optional) Should the AES ratio show deviation from acceptable values, check the normalization of photomultiplier tubes.
2. Measure quenched background standards for 3H, 14C, 32P, and other nuclides of interest.
3. Calculate background and efficiency curves for quenched samples in all channels. Calculate 14C efficiency in 3H channel for dual labelled samples.
4. Measure standard check sources.

Record#	INSTRUMENT	DETECTOR	SERIAL_NO
1	E120	HP190/HP260	4258
2	KIETHLEY36100	ION CHAMBER	9685
3	EBERLINE RO-1	ION CHAMBER	961
4	LUDLUM 177	S.W.GM	7529
5	EBERLINE MS2	PG1 THIN XT	382
6	EBERLINE PAC4G-3	AC21B GFPC	026/014
7	EBERLINE PAC4G-3	AC21B GFPC	027/067
8	EBERLINE PRM5-3	SPA3 2X2 XT	018/028
9	VICTOREEN 440	ION CHAMBER	795
10	LUDLUM MODEL 3	44-3/HP260	35836
11	N.CHI.SPECTROSHIELD	GFPC	
12	PACKARD 3375-B	LIQ SCINT.	07605
13	137CS CALIB. SOURCE		222
14	137CS CALIB. SOURCE		115
15	137CS IRRADIATOR	GAMMACELL40	127/128
16	V.CONDENSER R-METER	.25, 10, 25R	8482

Record#	MFR	RANGE_MR	SERIAL_NO	MODEL	KEV_RANGE
1	DCA	200	3090053	002 LOW E	18-200
2	DCA	200	9010002	002 LOW E	18-200
3	DCA	500	9010001	005 LOW E	18-200
4	DCA	5R	707122	050 LOW E	
5	DCA	500	8060614	883	
6	VICTOREEN	200	17578	541F	18-1100
7	VICTOREEN	200	11569	541R	30-2000

NORTHWESTERN UNIVERSITY
RESEARCH SAFETY EVANSTON CAMPUS
INSTRUMENT AND EQUIPMENT INVENTORY

ID NO	INSTRUMENT DESCRIPTION	MODEL NO	NO AVAIL	TYPE OF RADIATION DETECTED	RANGE	USE OF EQPMENT	LOCATION
	ALNOR VELOMETER JR.	B100	1	NA	0 - 800 LFPM	HOOD FACE VELOCITY MEASUREMENT	E
	EBERLINE 9" SPHERE	NRD	1	neutron	BF3 TUBE W/Cd LOADED P-ETHYLEN	neutron SURVEYS	E
	EBERLINE END-WINDOW GM	HP-190A	1	a,b,g,X	7 E4 CPM 1.7 mg/cm2 WINDOW	SURVEY	E
SN 1856	EBERLINE GAS PROP COUNTER	PAC-4G-3	1	a,b,H-3	0 - 500 E3 c/min	CONTAMIN. CHECK, SMEARS	E
RS 100	EBERLINE GM COUNTER	E-120	1	a,b,g,X	0 - 7 E4 c/m	SURVEY, X-RAY LEAKAGE	E
	EBERLINE GM COUNTER	E-120	1	gamma	0 - 50 mR/hr	MONITORING Cs-137 IRRADIATOR	E
	EBERLINE H-3 DETECTOR	TP-1	1	H-3	WINDOWLESS	SMEARS	E
	EBERLINE HANDPROBE	HP-260	1	a,b,g,X	7E4 CPM WINDOW 1.7 mg/cm	CONTAM. SURVEY, X-RAYS	E
	EBERLINE MINISCALER	MS-2	1	gamma	0 - E6 COUNTS	I-125	E
	EBERLINE PROPORTIONAL CHAMBER	AC-21,21B	2	a,b	WINDOW: 0.85 mg/cm2	CONTAM. SURVEY	E
RS 019	EBERLINE PULSE RATE METER	PRM-5-3	1	g,X	0 - 5 E5 c/m	I-125, Na-22, Cr-51	E
	EBERLINE RASCAL REM COUNTER	PRS-2P	1	neutron	0.2 mrem/hr - 20 rem/hr	Cf-252, Pu-Be Ra-Be	E
	EBERLINE SCINTILLATION PROBE	SPA-3	2	gamma	0 - 5 E5, 2x2 inch NAI(Tl)	I-125, Na-22, Cr-51	E
	EBERLINE SCINTILLATION PROBE	PG-1	1	gamma	0 - 100 keV	I-125	E

NORTHWESTERN UNIVERSITY
RESEARCH SAFETY EVANSTON CAMPUS
INSTRUMENT AND EQUIPMENT INVENTORY

ID NO	INSTRUMENT DESCRIPTION	MODEL NO	NO AVAIL	TYPE OF RADIATION DETECTED	RANGE	USE OF EQPMNT	LOCATION
	FLUKE DIGITAL MULTIMETER	8022B	1	NA	+/- 200mV to +/- 1000 V	ELECTRONIC CALIB & REPAIR	E
	FLUKE HIGH VOLTAGE PROBE	80K-40	1	NA	INPUT RESISTANCE 1000 M-ohms	ELECTRONIC CALIB & REPAIR	E
	LUDLUM PULSER	500	1	NA	0.1 - 10K CPM AMPL: 5mV - 5V	ELECTRONIC CALIB & REPAIR	E
	NEN I-129 CHECK SOURCE	NES-9033	1	gamma	30 keV	INSTRUMENT CHECK	E
	NEN b-REF.DISC SOURCE SET	NES-200S	1	beta	0.146 MeV - 1.162 MeV	INSTRUMENT CHECK AND CALIB.	E
	NEN g-REF.DISC SOURCE SET	NES-101S	1	gamma	0.08 MeV - 1.3 MeV	INSTRUMENT CHECK AND CALIB.	E
	VICTOREEN DOSIMETER	541R	3	g,X	0 - 200 mR		E
	VICTOREEN DOSIMETER	541F	1	g,X	0 - 200 mR		E
	VICTOREEN DOSIMETER	883	1	g,X	0 - 500 mR		E
	VICTOREEN DOSIMETER	050	1	g,X	0 - 5 R		E
	VICTOREEN DOSIMETER CHARGER	906	1	g,X			E
SN 843	VICTOREEN ION CHAMBER	440	1	b,g,X	0-300 mR/hr WINDOW: 2 mg/cm2	SURVEY RAD AREA, X-RAY	E
SN 2050	VICTOREEN ION CHAMBER	740F	1	b,g,X	0-25K mR/hr 0.00025 mg/cm2	SURVEY RAD AREAS	E

NORTHWESTERN UNIVERSITY
RESEARCH SAFETY EVANSTON CAMPUS

INSTRUMENTS READILY AVAILABLE BUT NOT PROPERTY OF ORS

ID NO	INSTRUMENT DESCRIPTION	MODEL NO	NO AVAIL	TYPE OF RADIATION DETECTED	RANGE	USE OF EQPMENT	LOCATION
	HARSHAW NaI(Tl) CRYSTAL	808/2A	1	gamma		SMEAR/LEAK TEST, g-SPECTROSCOPY	E
	NMC GAS PROPORTIONAL COUNTER	PC-3B	1	a, b	WINDOWLESS, 1 E6 COUNT CAPACITY	LEAK TEST, SMEARS	E
	NUCLEAR ASSOC. CALIB. SOURCE	726	1	gamma	99.2 mCi (3-30-78)	INSTRUMENT CALIB.	E
	NUCLEAR DATA MULTI.CHAN. ANALZR	ND60	1	gamma	1.05 E6 COUNT CAPACITY	SPECTROSCOPY	E
	ORTEC AMPLIFIER	435A	1	gamma	HIGH x64	gamma DETECTION	E
	ORTEC HIGH VOLTAGE	446	1	gamma	0 - 2900 VOLTS	gamma DETECTION	E
	ORTEC SCALER	484	1	gamma	0 - 1 E10 COUNT CAPACITY	gamma DETECTION	E
	ORTEC TIMER	482	1	NA	0 - 60 min.	gamma DETECTION	E
NU10499	PACKARD LIQUID SCINT. COUNTR	2405	1	b, H-3	1 E6 COUNT CAPACITY	LIQUID WASTE ASSESS., H-3 SMEARS	F

NORTHWESTERN UNIVERSITY
RESEARCH SAFETY EVANSTON
CALIBRATION PROCEDURE

GENERAL CONSIDERATIONS

1. Describe instrument by make, model and serial number. Note calibration interval and record today's date.
2. Examine instrument for mechanical damage. Correct where possible.
3. Adjust meter, check batteries and allow instrument to warm up for time specified by manufacturer.
4. Inspect and make electronic adjustments, including high voltage, sensitivity and internal sampling time base as in the case of digital readout instruments.
5. Calibration should be performed in radiation field similar to that in which instrument will be used.
6. Instrument readings must be $\pm 10\%$ of calibration value. Otherwise, a calibration factor or graph must be provided with the instrument. Values varying greater than $\pm 20\%$ are not acceptable and the instrument is consigned to repair.
7. All pertinent information is summarized on a calibration form or a log book is maintained for non-portable instrumentation. (Calibration form is attached.)

PRIMARY CALIBRATION

A. ION CHAMBERS, (may include GM's)

1. Instrument is placed in a Cs-137 radiation field. The source is NBS traceable.
 - a. If one calibration potentiometer is provided then calibrate near the midpoint of the middle scale, or at a point specified by the manufacturer, or near the midpoint of scale particularly important to surveyor.
 - b. If calibration potentiometer provided for each scale then calibrate at the midpoint of each scale or as specified by manufacturer.
2. An additional check of the calibration is performed at one-third and two-thirds of full scale at each scale.
3. Temperature, pressure and humidity are normally not a factor but their potential influence should not be ignored.

B. PORTABLE GAS PROPORTIONAL COUNTER

1. The gas proportional counter, PAC46/3, is calibrated with Tc-99 plated source set. The source set is certified by Eberline Instrument Corp. and NBS traceable.
2. Logarithmic reading instruments are calibrated near the midpoint of each decade.
3. An additional mechanical check as to the integrity of the gas flow assembly as well as the gas flow rate is performed.

C. PULSE COUNTING INSTRUMENTS (GM's, scintillation detection)

1. An input signal generated by a Ludlum 500 pulser is used to calibrate the electronic response of the instrument to be calibrated. The pulser typically generates a pulse width of 7.0 microseconds with a leading edge of 0.5 microseconds, pulse flat top for 1.5 microseconds, and pulse tail of 5.0 microseconds.
2. Additional calibration is performed in a radiation field to make the instrument particularly responsive of a desired energy or energy range. This special condition is identified on the calibration label attached to the instrument.

D. GAS FLOW PROPORTIONAL COUNTER (NMC/PC-3B)

1. A Ra(D&E) source at 177 dps \pm 5.0% is used to determine the operating voltage plateau for alpha and beta corpuscular radiations. The source is NBS traceable.
2. Acceptable performance is determined and maintained by the routine test of background, standard sources and the application of statistical criteria of reproducibility such as the Chi-Square test.

OFFICE OF RESEARCH SAFETY
SURVEY INSTRUMENT CALIBRATION

Instrument _____ Calibration Date _____
 _____ Next Calibration _____
 model no. serial no. Investigator _____
 meter _____ Department/Lab _____
 probe _____ Calibrated by _____

A. Function _____ Check Source _____
 Batteries _____ Zero _____
 Drift _____ Misc. _____
 Input Voltage _____ Test Instrument _____

B. Pulse Generator: Eberline Mini-Pulser, MP-1

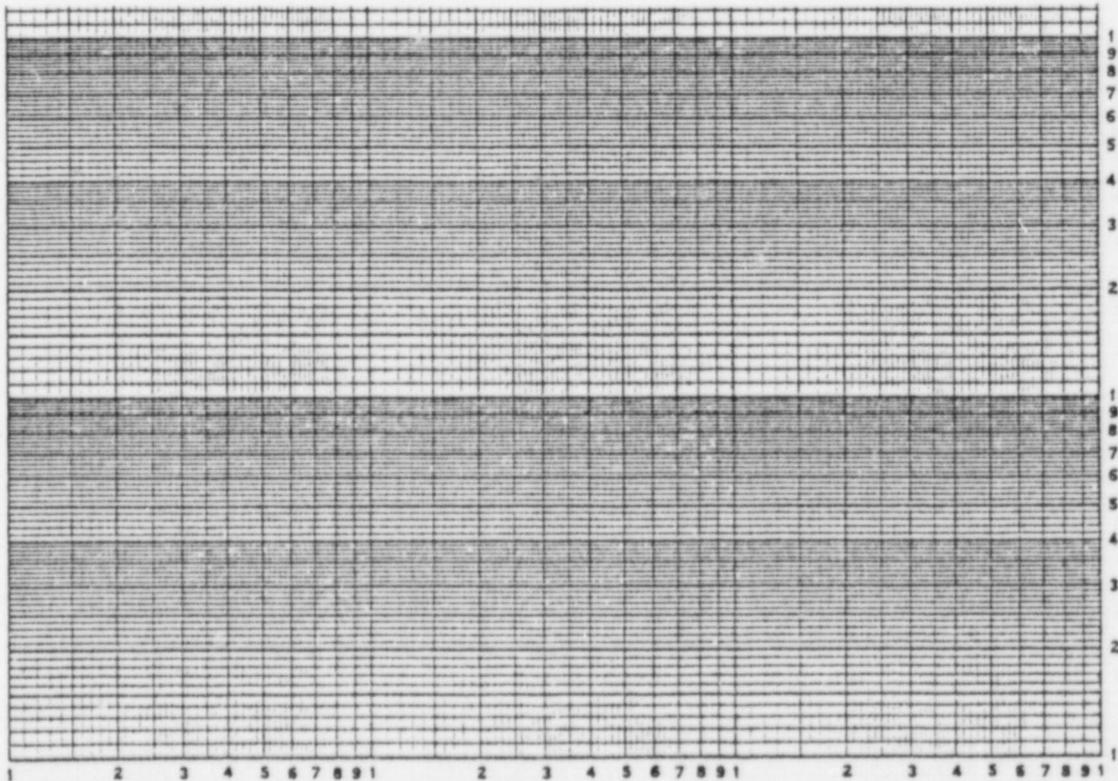
scale	pulse·min ⁻¹	c·min ⁻¹	pulse·min ⁻¹	c·min ⁻¹

INPUT SENSITIVITY:

C. Calibration Source: _____

scale	m*	field mR·hr ⁻¹	read mR·hr ⁻¹	field mR·hr ⁻¹	read mR·hr ⁻¹				

*source to detector midline distance



ATTACHMENT 5

CONTROL NO. 78805

CHARTER FOR THE RADIATION SAFETY COMMITTEE

Need: Pursuant to the provisions of Section 33-13 of Title 10, Code of Federal Regulations, Part 33 governing the issuance of specific licenses of broad scope for byproduct material, a Radiation Safety Committee is established at Northwestern University.

Convening Authority and Composition: The President of Northwestern University, upon recommendation of the Vice President for Research, will appoint a University Radiation Safety Committee. This committee will consist of at least eight members, plus ex-officio representatives. The membership shall include the Radiation Safety Officer (ex-officio), representatives of the University administration (ex-officio), and University faculty members trained or experienced in the same use of radioactive materials and radiation sources. In addition, those affiliated institutions who are receiving, acquiring, using, possessing or transferring radioisotopes or radiation producing instruments under the terms and requirements of any University held licenses or who are using the services of the Radiation Safety Office may request that a representative of their institution be appointed to serve on the Radiation Safety Committee. The Chairman of the Radiation Safety Committee shall be appointed by the President of the University.

General Purposes: The Radiation Safety Committee has three major purposes:

- (1) Formulate and recommend to the Vice President for Research, policies governing the safe use of radioactive materials and radiation sources.
- (2) Regulate the use of radioactive material and radiation sources by reviewing and approving proposals and qualifications of individuals desiring to use such materials or sources for educational or research purposes.
- (3) Review and evaluate the performance and actions of the Radiation Safety Office.

Specific Responsibilities:

- (1) The Radiation Safety Committee shall be responsible for reviewing

and either approving or disapproving, on the basis of radiological safety or factors related to radiological health, all applications to use radioactive materials or radiation sources.

(2) The Committee shall recommend the procedures for reviewing and approving requests by individuals either to become authorized users or to change their type of authorization.

(3) The Committee shall assure that records are maintained by the Radiation Safety Office to document all actions taken by the Committee on reviewing requests by individuals either to become authorized users or to change their type of authorization.

(4) The Committee shall be responsible for recommending policies and procedures for a radiation safety program including, but not limited to, recommendations on educational programs relating to the radiation safety program, survey frequencies, size and responsibilities of the Radiation Safety Office, and requirements necessary for an individual to become an authorized user of radioactive materials or radiation sources.

(5) The Committee shall be responsible for reviewing the radiation safety program on an annual basis or more frequently if requested to do so by the Vice President for Research.

(6) The Committee shall be responsible for recommending corrective procedures or policy revisions when deficiencies in the radiation safety program are noted.

(7) The Committee shall, when deemed appropriate, review and evaluate survey reports of facilities and laboratories using radioactive materials or radiation sources.

(8) The Committee shall be responsible for establishing those subcommittees or ad-hoc committees necessary to carry out its overall responsibilities.

(9) A written record of actions taken by the Committee shall be maintained.

Administrative Procedures: The administrative procedures of the Committee may change as the requirements necessary to assure compliance with existing regulations and responsible radiation protection are altered. The following

current procedures may be modified accordingly:

(1) The policies and procedures recommended by the Committee and approved by the Vice President for Research shall be carried out by individuals and offices designated by the Vice President.

(2) All members of the Radiation Safety Committee plus two ex-officio representatives, the Radiation Safety Officer and the Research Services Administrator, shall have voting rights. When issues come to the Radiation Safety Committee concerning a voting member that member shall withdraw from voting.

(3) The Radiation Safety Officer shall answer all questions regarding the routine operation of the radiation safety program on behalf of the Committee. In addition, he shall receive and initially review all requests and proposals from individuals who desire to become authorized users and will forward these requests to the Committee as a whole with his recommendation. Requests and proposals to become an authorized user will require approval by all members voting. At least two-thirds of the voting members of the Radiation Safety Committee must vote.

(4) The Radiation Safety Officer will report the results of surveys or other information pertaining to radiation safety to the Committee upon request of the Chairman.

(5) The Radiation Safety Committee shall meet at least quarterly. A meeting must be called by the Chairman at the earliest opportunity if requested by any three (3) members of the Committee, by the Radiation Safety Officer, or by the Vice President for Research.

(6) The Radiation Safety Committee shall review the recommendations of the Radiation Safety Officer, provide final approvals or disapprovals of proposals and render final decisions on all matters raised by any other subcommittees.

(7) The Radiation Safety Officer will inform the appropriate parties of the decisions of the Radiation Safety Committee regarding requests for authorization, approval or modification of proposed uses of radioisotopes and radiation sources or any other decisions within the purview of the Committee's authority.

(8) Appeal of the decisions of the Radiation Safety Committee will be to the Vice President for Research of Northwestern University.

(9) A quorum shall consist of at least four voting members of the committee.

(1) Approval of motions shall require a majority of those present.

Amendments to the Charter:

This Charter may be amended upon three-fourths vote by the members of the Radiation Safety Committee when amendments are required to comply with Federal, State or local laws and regulations or when they will improve the operation of the radiation safety program of the University. All recommended amendments become effective upon approval by the Vice President for Research of Northwestern University.

ATTACHMENT 6

TRAINING

All individuals who plan to use radioactive materials are requested to view two 15-minute video tapes prior to receiving their dosimeter. The video tapes were purchased from the University of Indiana and are entitled "Radiation Safety:Introduction" and "Radiation Safety:Laboratory Techniques." At the same time that individuals are given a dosimeter card to complete,prior to ordering their dosimeter, they are given a packet of reference and training information.

In addition, a radiation safety seminar entitled "Safe Handling of Radioactive Materials" is offered on a quarterly basis. This training is required for all individuals who have had little or no previous training or experience in using radioactive materials. Those individuals who can show evidence of previous training or experience may be excused from this seminar.

The following subjects are covered in the training seminar.

1. A brief description of atomic structure and forms of particulate and photon radiation. There is a discussion of the types of radioactive materials commonly used in the laboratory and some of the characteristics of each.
2. An introduction to terms and concepts with some mathematics basic to measurements of radioactivity.
3. A discussion of pertinent federal, state, and university regulations which govern the use of radioactive materials or sources of radiation.
4. Emergency procedures and management of accidents.
5. Routine management and rules for handling radioactive materials, including package receipt, bioassay requirements, inventory records, etc.
6. Biological effects, including dosimetry reports, exposure limits, and the bioassay program.

The seminar is designed to cover the material in one afternoon and is alternated between campuses.

NORTHWESTERN UNIVERSITY
12-00382-03 Renewal

ATTACHMENT 7

EXPERIMENTAL ANIMALS

Special rooms are provided for housing experimental animals which have been injected or treated with radioactive materials when needed. Animals are kept in cages in which all excreta are collected. All material removed from this animal room is treated as radioactive waste and is removed by radiation safety personnel for disposal. Cages are decontaminated before returning to use. Animal care personnel who work in this area wear suitable protective clothing and personnel dosimeters if indicated. The room and equipment are surveyed after each use.

NORTHWESTERN UNIVERSITY
EVANSTON - CHICAGO

OFFICE OF RESEARCH SAFETY

November 4, 1985

B - 106 WARD BUILDING
303 EAST CHICAGO AVENUE
CHICAGO, ILLINOIS 60611

United States Nuclear Regulatory Commission
Material Licensing Section Region III
799 Roosevelt Road
Glen Ellyn, IL 60137

License #: 12-00382-03
12-00382-05
12-00094-06

Dear Sir/Madam:

Changes in the membership of the Radiation Safety Committee require that we request amendments to the above licenses.

The following individuals are now serving on the Committee:

Dr. Thomas Lund, DDS, Chairman	Professor, Dental Radiology
*Dr. Donald L. Helseth	Asst. Professor, Oral Biology
*Dr. Chung Lee	Assoc. Professor, Urology
Dr. Barbara-Ann Lewis	Assoc. Professor, Civil Engineering
*Dr. Elmer Lewis	Professor, Mech. & Nuclear Engineering
Dr. Daniel I. Linzer	Asst. Professor, Biochemistry, Molecular and Cell Biology
Dr. Allen Samarel, MD	Asst. Professor, Medicine
Dr. Kenneth Spears	Assoc. Professor, Chemistry

* Denotes a new member.

Dr. Lund, the new Chairman, has been a member of the Radiation Safety Committee since 1977 and chaired the Committee in 1983-1984.

Dr. Elmer Lewis served on the Radiation Safety Committee from 1976-1982, and chaired the committee from 1979-1982. He is a Professor in the Department of Mechanical and Nuclear Engineering. He received his Ph.D. in nuclear engineering in 1965 and has been a Professor at Northwestern University since 1968. Dr. Lewis has had teaching responsibility in the area of reactor physics and analysis, and has research experience on problems of neutron transport and reactor physics calculational models.

Dr. Chung Lee's educational background is in the area of physiology and nutrition. He has been affiliated with Northwestern University since 1971 and Director of the Urology Research Laboratory since 1974. Dr. Lee has been a licensed investigator for the use of radioactive materials since 1971. He served on the Radiation Safety Committee from 1978 to 1981 and has been reappointed for another three-year term. Dr. Lee is well-acquainted with the radiation safety program at Northwestern, has served on internal audit subcommittee, and is past chairman of the Animal Care Committee at Northwestern.

RECEIVED
NOV 5 1985
REGION III

dupe of 864224455

2pp'

CONTROL NO. 80079

Dr. Donald L. (Larry) Helseth received his Ph.D. from Northwestern University in Biochemistry in 1981. He served post-doctoral positions at Rutgers Medical School and in the Oral Biology Department at Northwestern University from 1981 to 1983. From 1983 to the present, Dr. Helseth has been on the staff in the Oral Biology Department as Instructor and Assistant Professor. He has been using radioactive materials at Northwestern since 1978 and received a license authorization in 1983. Dr. Helseth is well acquainted with the radiation safety program at Northwestern and is informed on the safe use of radioactive materials.

Please contact me if you need additional information.

Sincerely,

David R. Miller
David R. Miller, Ph.D.
Office of Research Safety

NORTHWESTERN UNIVERSITY
EVANSTON - CHICAGO

EX 3L 170-11(a)(4)
1K 20
FEE EXEMPT

OFFICE OF RESEARCH SAFETY

November 4, 1985

B - 106 WARD BUILDING
303 EAST CHICAGO AVENUE
CHICAGO, ILLINOIS 60611

RECEIVED BY LFMB

Date: 11/12/85
 Log: Nov 5 III
 By: [Signature]
 Action Comp: [Signature]
 License: 12-00382-03

RECEIVED
85 NOV 12 P12:12
U.S. FEE PROGRAM

United States Nuclear Regulatory Commission
Material Licensing Section: Region III
799 Roosevelt Road
Glen Ellyn, IL 60137

Dear Sir/Madam:

As part of our effort to minimize the volume and activity of low-level radioactive waste which is shipped for disposal, Northwestern University's Office of Research Safety has made changes in the low-level radioactive waste program in accordance with License Amendment # 51, January 25, 1984 (see Enclosure 1).

The university has designated a storage-for-decay facility in the basement of the Ward Building, 303 East Chicago Avenue, Chicago, Illinois, 60611, Rooms B-073 and B-039(see Enclosure 2). As soon as existing equipment is cleared out, the Office of Research Safety will begin storing compacted, dry low-level radioactive waste containing nuclides with half-lives of less than 65 days. Waste will be stored in 55-gallon drums(usually DOT-17H). Each drum will contain only one nuclide. Nuclides to be stored will predominantly be 32P, 51Cr, 125I, and 131I. Small quantities of other nuclides may be stored from time to time.

At current rates of generation, we will reach equilibrium in about 20 months at about 75 55-gallon drums. At average rates of nuclide usage, we will have the following approximate activity: 32P(75 mCi), 51Cr(6 mCi), 125I(45 mCi), and 131I(much less than 100 uCi average, but up to 10 mCi at any one time).

The storage facility is a below-grade room of approximately 450 ft². Room B-074 is under our control and is used for radwaste supply storage. Room B-049 houses air conditioning equipment. Rooms B-029 and B-035(actually one room) are to be used for storage by the Dental School. The wall between the radwaste storage facility and the Dental School storage area is solid four-inch block construction. Most of the stored low-level radioactive waste will be placed along the west and south walls of B-073 and B-039.

Waste will be stored for at least ten half-lives for each nuclide, after which time it will be monitored with appropriate survey instruments. The Office of Research Safety has portable gas flow proportional detectors and both thin and thick crystal scintillation detectors for this purpose. The waste will also be examined for any signs, stickers, tape, or labels bearing radiation warnings or symbols before disposal.

RECEIVED
NOV 5 1985
REGION III

8602240468-851122
REG3 LIC30
12-00382-03 PDR

CONTROL NO. 80079

NOV 5 1985

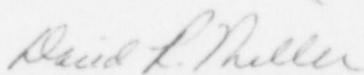
No generator columns are used or disposed of by this license.

Records will be maintained showing nuclide and activity in each drum, date placed into storage, date removed from storage and surveyed, survey results, and final disposition.

This program change will reduce the volume of all low-level radioactive waste which is shipped for landfill by about 30%, and reduced the volume of dry low-level radioactive waste for landfill by about 40%.

Please contact us for further information about this program change, if necessary.

Sincerely,


David R. Miller, Ph.D.
Director, Office of Research Safety

CC: Illinois Department of Nuclear Safety
Division of Nuclear Materials
1035 Outer Park Drive
Springfield, IL 62704

Enclosures(2)

MATERIALS LICENSE
SUPPLEMENTARY SHEET

License number

12-00382-03

Docket or Reference number

SNM-330

Amendment No. 51

22. The licensee is authorized to hold radioactive material with a physical half-life of less than 65 days for decay-in-storage before disposal in ordinary trash provided:
- A. Radioactive waste to be disposed of in this manner shall be held for decay a minimum of ten (10) half-lives.
 - B. Prior to disposal as normal waste, radioactive waste shall be monitored to determine that its radioactivity cannot be distinguished from background with typical low-level laboratory survey instruments. All radiation labels will be removed or obliterated.
 - C. Generator columns shall be segregated so that they may be monitored separately to ensure decay to background levels prior to disposal.

8602240470-851122
REG3 LIC30
12-00382-03 PDR

For the U.S. Nuclear Regulatory Commission

JAN 25 1984

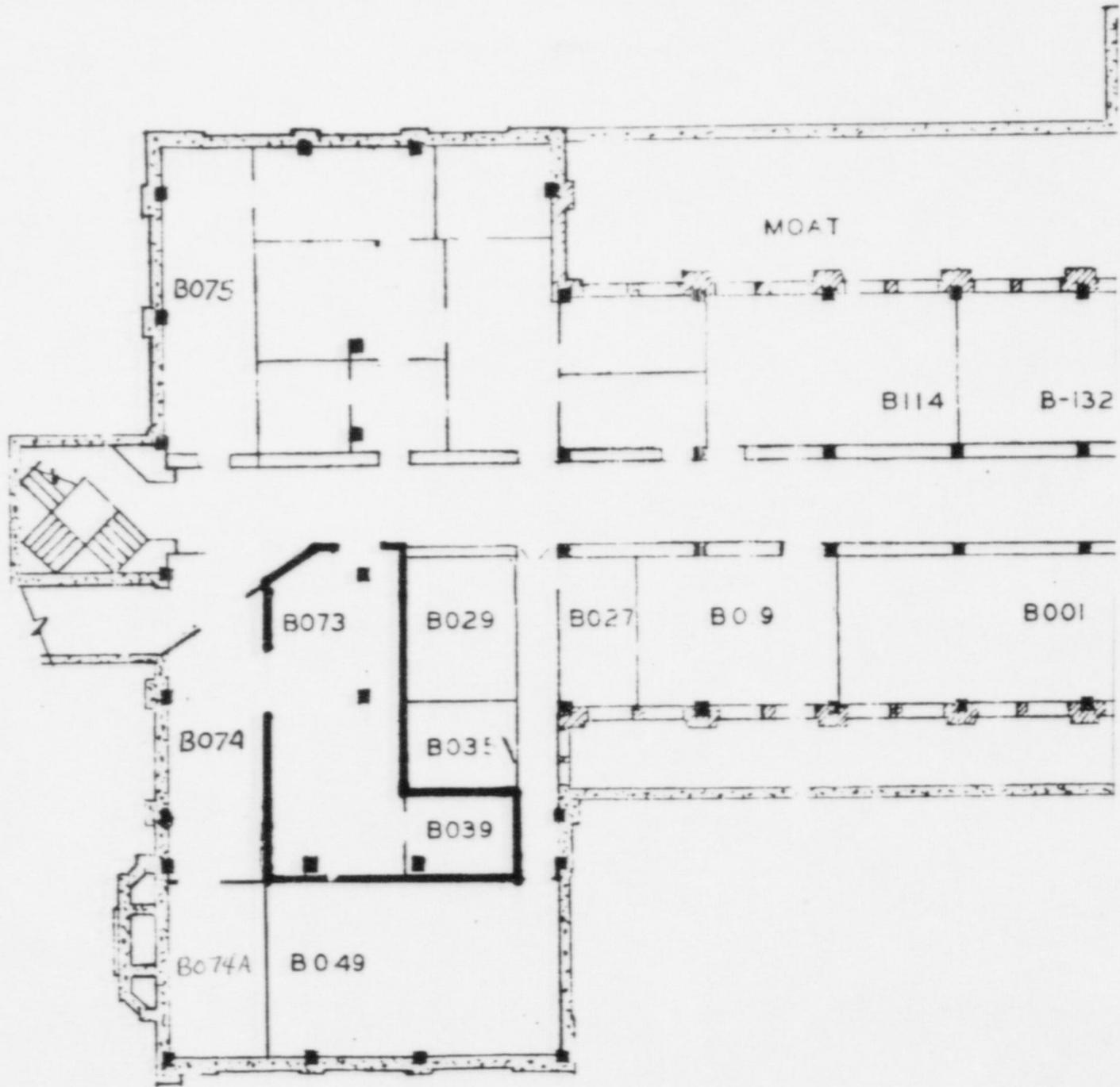
Date _____

By _____

Materials Licensing Section, Region III

CONTROL NO. 80079

CONTROL NO. 80079



ENCLOSURE 2

ATTACHMENT 6

TRAINING

All individuals who plan to use radioactive materials are requested to view two 15-minute video tapes prior to receiving their dosimeter. The video tapes were purchased from the University of Indiana and are entitled "Radiation Safety:Introduction" and "Radiation Safety:Laboratory Techniques." At the same time that individuals are given a dosimeter card to complete,prior to ordering their dosimeter, they are given a packet of reference and training information.

In addition, a radiation safety seminar entitled "Safe Handling of Radioactive Materials" is offered on a quarterly basis. This training is required for all individuals who have had little or no previous training or experience in using radioactive materials. Those individuals who can show evidence of previous training or experience may be excused from this seminar.

The following subjects are covered in the training seminar.

1. A brief description of atomic structure and forms of particulate and photon radiation. There is a discussion of the types of radioactive materials commonly used in the laboratory and some of the characteristics of each.
2. An introduction to terms and concepts with some mathematics basic to measurements of radioactivity.
3. A discussion of pertinent federal, state, and university regulations which govern the use of radioactive materials or sources of radiation.
4. Emergency procedures and management of accidents.
5. Routine management and rules for handling radioactive materials, including package receipt, bioassay requirements, inventory records, etc.
6. Biological effects, including dosimetry reports, exposure limits, and the bioassay program.

The seminar is designed to cover the material in one afternoon and is alternated between campuses.

NORTHWESTERN UNIVERSITY
12-00382-03 Renewal

ATTACHMENT 7

EXPERIMENTAL ANIMALS

Special rooms are provided for housing experimental animals which have been injected or treated with radioactive materials when needed. Animals are kept in cages in which all excreta are collected. All material removed from this animal room is treated as radioactive waste and is removed by radiation safety personnel for disposal. Cages are decontaminated before returning to use. Animal care personnel who work in this area wear suitable protective clothing and personnel dosimeters if indicated. The room and equipment are surveyed after each use.