NRC FORM 313
(7-86)
10 CFR 30, 32, 33, 34, 35 and 40

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED BY OMB
3150-0120
Expires 5-31-87

APPLICATION FOR MATERIAL LICENSE

INSTRUCTIONS: SEE THE APPROPRIATE LICENSE APPLICATION GUIDE FOR DETAILED INSTRUCTIONS FOR COMPLETING APPLICATION. SEND TWO COPIES OF THE ENTIRE COMPLETED APPLICATION TO THE NRC OFFICE SPECIFIED BELOW.

APPLICATIONS FOR DISTRIBUTION OF EXEMPT PRODUCTS FILE APPLICATIONS WITH:

U.S. NUCLEAR REGULATORY COMMISSION
DIVISION OF FUEL CYCLE AND MATERIAL SAFETY, NMSS
WASHINGTON, DC 20555

ALL OTHER PERSONS FILE APPLICATIONS AS FOLLOWS. IF YOU ARE LOCATED IN:

CONNECTICUT, DELAWARE, DISTRICT OF COLUMBIA, MAINE, MARYLAND, MASSACHUSETTS, NEW HAMPSHIRE, NEW JERSEY, NEW YORK, PENNSYLVANIA, RHODE ISLAND, OR VERMONT, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION I
NUCLEAR MATERIALS SAFETY SECTION B
631 PARK AVENUE
KING OF PRUSSIA, PA 19406

ALABAMA, FLORIDA, GEORGIA, KENTUCKY, MISSISSIPPI, NORTH CAROLINA, PUERTO RICO, SOUTH CAROLINA, TENNESSEE, VIRGINIA, VIRGIN ISLANDS, OR WEST VIRGINIA, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION II
NUCLEAR MATERIALS SAFETY SECTION
101 MARIETTA STREET, SUITE 2900
ATLANTA, GA 30323

IF YOU ARE LOCATED IN:

ILLINOIS, INDIANA, IOWA, MICHIGAN, MINNESOTA, MISSOURI, OHIO, OR WISCONSIN, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION III
MATERIALS LICENSING SECTION
799 ROOSEVELT ROAD
GLEN ELLYN, IL 60137

ARKANSAS, COLORADO, IDAHO, KANSAS, LOUISIANA, MONTANA, NEBRASKA, NEW MEXICO, NORTH DAKOTA, OKLAHOMA, SOUTH DAKOTA, TEXAS, UTAH, OR WYOMING, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION IV
MATERIAL RADIATION PROTECTION SECTION
611 RYAN PLAZA DRIVE, SUITE 1000
ARLINGTON, TX 76011

ALASKA, ARIZONA, CALIFORNIA, HAWAII, NEVADA, OREGON, WASHINGTON, AND U.S. TERRITORIES AND POSSESSIONS IN THE PACIFIC, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION V
NUCLEAR MATERIALS SAFETY SECTION
1450 MARIA LANE, SUITE 210
WALNUT CREEK, CA 94596

PERSONS LOCATED IN AGREEMENT STATES SEND APPLICATIONS TO THE U.S. NUCLEAR REGULATORY COMMISSION ONLY IF THEY WISH TO POSSESS AND USE LICENSED MATERIAL IN STATES SUBJECT TO U.S. NUCLEAR REGULATORY COMMISSION JURISDICTION.

1. THIS IS AN APPLICATION FOR (Check appropriate item)

- [ ] A. NEW LICENSE
- [ ] B. AMENDMENT TO LICENSE NUMBER _____
- [X] C. RENEWAL OF LICENSE NUMBER 35-00237-03

RENEWAL # 02501

2. NAME AND MAILING ADDRESS OF APPLICANT (Include Zip Code)

Oklahoma State University
c/o Assistant Vice President for Research
Oklahoma State University
Stillwater, OK 74078

3. ADDRESS(ES) WHERE LICENSED MATERIAL WILL BE USED OR POSSESSED:

Oklahoma State University Campus
Stillwater, OK 74078

8810210155 880613
REG4 LIC30
35-00237-03 PNU

4. NAME OF PERSON TO BE CONTACTED ABOUT THIS APPLICATION

Dr. H. M. Johnson

TELEPHONE NUMBER: 405/624-5716

SUBMIT ITEMS 5 THROUGH 11 ON 8½ x 11" PAPER. THE TYPE AND SCOPE OF INFORMATION TO BE PROVIDED IS DESCRIBED IN THE LICENSE APPLICATION GUIDE.

5. RADIOACTIVE MATERIAL
a. Element and mass number, b. chemical and/or physical form, and c. maximum amount which will be possessed at any one time: see attachment

6. PURPOSE(S) FOR WHICH LICENSED MATERIAL WILL BE USED: see attachment

7. INDIVIDUAL(S) RESPONSIBLE FOR RADIATION SAFETY PROGRAM AND THEIR TRAINING AND EXPERIENCE: see attachment

8. TRAINING FOR INDIVIDUALS WORKING IN OR FREQUENTING RESTRICTED AREAS: see attachment

9. FACILITIES AND EQUIPMENT: N/A

10. RADIATION SAFETY PROGRAM: see attachment

11. WASTE MANAGEMENT: see attachment

12. LICENSEE FEES (See 10 CFR 170 and Section 170.31)
FEE CATEGORY: N/A
AMOUNT ENCLOSED: $ N/A

13. CERTIFICATION. (Must be completed by applicant) THE APPLICANT UNDERSTANDS THAT ALL STATEMENTS AND REPRESENTATIONS MADE IN THIS APPLICATION ARE BINDING UPON THE APPLICANT.

THE APPLICANT AND ANY OFFICIAL EXECUTING THIS CERTIFICATION ON BEHALF OF THE APPLICANT NAMED IN ITEM 2 CERTIFY THAT THIS APPLICATION IS PREPARED IN CONFORMITY WITH TITLE 10, CODE OF FEDERAL REGULATIONS, PARTS 30, 32, 33, 34, 35, AND 40 AND THAT ALL INFORMATION CONTAINED HEREIN, IS TRUE AND CORRECT TO THE BEST OF THEIR KNOWLEDGE AND BELIEF.

WARNING: 18 U.S.C. SECTION 1001 ACT OF JUNE 25, 1948, 62 STAT. 749 MAKES IT A CRIMINAL OFFENSE TO MAKE A WILLFULLY FALSE STATEMENT OR REPRESENTATION TO ANY DEPARTMENT OR AGENCY OF THE UNITED STATES AS TO ANY MATTER WITHIN ITS JURISDICTION.

SIGNATURE--CERTIFYING OFFICER	TYPED/PRINTED NAME	TITLE	DATE
Howard M Johnson	Howard M. Johnson	Licensing Representative	5-27-87

14. VOLUNTARY ECONOMIC DATA

A. ANNUAL FEE TYPE

- [ ] <$250K
- [ ] $250K - $500K
- [ ] $500K - $750K
- [ ] $750K - $1M
- [ ] $1M - 2.5M
- [ ] $2.5M - 7M
- [ ] $7M - 10M
- [ ] >$10M

B. NUMBER OF EMPLOYEES (Total for entire facility, excluding outside contractors)

C. NUMBER OF BEDS

D. WOULD YOU BE WILLING TO FURNISH COST INFORMATION (Dollar and/or staff hours) ON THE ECONOMIC IMPACT OF CURRENT NRC REGULATIONS OR ANY FUTURE PROPOSED NRC REGULATIONS THAT MAY AFFECT YOU? (NRC regulations permit it to protect confidential commercial or financial proprietary information furnished to the agency in confidence)

- [ ] YES
- [ ] NO

FOR NRC USE ONLY

TYPE OF FEE	FEE LOG	FEE CATEGORY	COMMENTS	APPROVED BY
REN	June 1-15	EX 3A	FEE EXEMPT 170.11(a)(4) 46523	
AMOUNT RECEIVED	CHECK NUMBER			DATE: 6/2/87

5. Radioactive Materials

a. Byproduct Material-
(1) Any byproduct material between Atomic Numbers 3 and 83, inclusive.
(2) Hydrogen 3
(3) Cobalt 60
(4) Cesium 137
(5) Cesium 137
(6) Actinium 227
(7) Americium 241
(8) Curium 244 (application for amendment to possess this source filed on 2-24-87)

b. Chemical and/or Physical Form
(1) Any
(2) Any
(3) Sealed Source
(4) Sealed Source
(5) Any
(6) Any
(7) AmBe sealed sources
(8) Sealed source

c. (1) through (8): Information on specific sealed sources in current possession under above authorizations now in effect is provided in Item 10.

d. (1) 200 millicuries of each byproduct material between Atomic Numbers 3 and 83, except Cobalt 60 and Cesium 137.

Total possession limit: 50 curies

(2) 100 curies
(3) 1 curie
(4) 4 curies
(5) 400 millicuries
(6) 5 millicuries
(7) 1320 millicuries
(8) 0.50 millicuries

6. Use of Licensed Material

Material will be used for "research and development" as defined in the Code of Federal Regulations, Title 10, Section 30.4(q). Sealed sources will be used in instruments and gauges and for instrument calibration.

7. Individuals Responsible for Radiation Safety Program

a. The President of the Oklahoma State University has appointed a Radiological Safety Committee with the responsibility for advising appropriate administrators on the use of radiation devices and/or

radioisotopes to the end that no hazard to the health or safety or the research work of others occurs. The organization, purpose, and function of this committee are spelled out in detail in the attached "HANDBOOK of Responsibilities, Procedures, and Regulations Governing the Safe Use of Ionizing Radiations on the Campus of Oklahoma State University (March 1987) pp. 2-4." For simplicity in future reference, this document will hereafter be simply referred to as the HANDBOOK.

b. The below named individuals are now serving as member of the Radiological Safety Committee:

Dr. R. J. Bahr, D.V.M.
Dr. Eddie Basler
Dr. Donald L. Cooper, M.D.
Dr. E.M. Hodnett, Emeritus
Dr. H.M. Johnson, Radiological Safety Officer
Dr. W.A. Sibley, Chairman

A Vita of each of the above members, giving his background and training as it applies to the handling of radiations and radioisotopes, is attached.

c. Dr. H.M. Johnson was appointed Radiological Safety Officer (R.S.O.) in 1986 and the duties of Radioisotope Procurement Agent (R.P.A.). As R.S.O., he is responsible for monitoring adherence to the regulations of the committee which fall within the framework of NRC regulations and additional appropriate guidelines. As R.P.A., he is responsible for insuring that the procurement of radioisotopes complies with the University License and such other regulations as have been set up by the Committee. A more complete statement of his responsibilities, authority, and operations is provided in the attached HANDBOOK, Sections I and II, pp. 4-10.

Dr. Johnson's Vita is presented below, along with appropriate references to his responsibilities and duties.

d. Radiological Safety Committee members have already been listed above. Their Technical Vitas are included at this point.

TECHNICAL VITA OF DR. R.J. BAHR, ASSOCIATE PROFESSOR OF VETERINARY MEDICINE AND SURGERY (RADIOLOGIST)

Academic Training

D.V.M., Oklahoma State University, 1970
B.S. Oklahoma State University, 1968

Specialty

Radiology

Experience and Training

1970 - 1971	Private Practice, St. Petersburg, Florida
1971 - 1973	U. S. Air Force - Assistant Base Veterinarian, Sheppard A.F.B. (7 months) C.C.K. Air Force Base, Taiwan Republic of China, Base Veterinarian (17 months)
1973 - 1974	Radiology Internship Kansas State University
1974 - 1976	Radiology Residency Department of Radiological Sciences University of California - Davis
1975 - 1976	Clinical Radiologist, Radiobiology Laboratory, University of California Davis
1976 - 1980	Assistant Professor of Veterinary Radiology, University of Missouri - Columbia
1980 - 1982	Staff Radiologist, Grand Avenue Pet Hospital (private practice) Santa Ana, CA
1982 - 1984	Independent private practice as a Veterinary Radiologist
1984 - Present	Associate Professor of Veterinary Radiology, Oklahoma State University

TECHNICAL VITA OF DR. EDDIE BASLER, PROFESSOR OF BOTANY

Academic Training:

1952-1954 - Ph.D. from Washington University; Major - Botany
1950-1952 - M.S. from University of Oklahoma; Major - Botany
1946-1950 - B.S. from University of Oklahoma; Major - Botany

Field of Specialization:

Plant Physiology; Transport of plant hormones, growth regulators and herbicides

Professional Experience:

1954-1955 - Research Associate; Washington University, St. Louis, MO
1955-1957 - Assistant Professor; Washington University, St. Louis, MO
1957-present - Assistant Professor; Associate Professor, and Professor, Oklahoma State University, Stillwater, OK
1968 - Visiting Professor; University of Illinois, Urbana, IL

461523

Experience Using Radioisotopes:

1950-1952 - C-14 labeled plant hormone transport in plants, University of Oklahoma
1952-1957 - C-14 labeled nucleic acid bases for studies on RNA synthesis, Washington University, St. Louis, MO
1957-Present - C-14, H-3, S-35, P-32, Rb-86 used in studies of plant hormone transport and mode of action of herbicides

TECHNICAL VITA OF DR. DONALD L. COOPER, M.D., DIRECTOR, OKLAHOMA STATE UNIVERSITY HOSPITAL AND CLINIC

Academic Training:

M.D., University of Kansas, School of Medicine
A.B., Kansas State College, Pittsburg, Kansas

Field of Specialization:

General Practice

Experience and Training:

1960-Present - Director, Oklahoma State University Hospital and Clinic, Stillwater, OK
1958-1960 - Kansas State University Health Service, Manhattan, KS
1956-1958 - Private Practice
1954-1956 - U.S. Air Force--Research and Development Command, Albuquerque, NM
1953-1954 - Intern, St. Mary's and Children's Mercy Hospitals, Kansas City, MO

TECHNICAL VITA OF DR. E.M. HODNETT, EMERITUS PROFESSOR OF CHEMISTRY

Academic Training:

Ph.D., Purdue University

Specialty:

Medicinal Chemistry

Radiochemical Experience:

1954-1965 - Project leader, Oklahoma State University, direction of student in the study of mechanisms or organic reactions by means of

carbon-14 and hydrogen-3 on projects sponsored by the U.S. Atomic Energy Commission, Texaco, Dow Chemical Company, and the Oklahoma Agricultural Experiment Station, resulting in eight Ph.D. dissertations and twelve M.S. theses

1957 - U.S. Public Health Service, Mercury, Nevada, Nuclear Test Series Off-Site, Monitoring Program

1954 - Research participant, Oak Ridge National Laboratory, Use of radioactive compounds to study reaction mechanisms using C-14 mostly

1952-1953 - Associate Chemist, Argonne National Laboratory, Synthesis of radioactive or organic compounds in the study of the mechanisms of organic reactions, Used H-3 a great deal for labeling purposes

1952 - Synthesis of radioactive Systox with S-35

TECHNICAL VITA OF DR. H. M. JOHNSON, ASSOCIATE PROFESSOR, OF ENGINEERING TECHNOLOGY AND RADIOLOGICAL SAFETY OFFICER

Academic Training:

1972 - Ph.D., Biochemistry and cell Physiology, University of Texas at Austin

1968 - M.S., Radiation Health Physics, Colorado State University

1961 - B.S., Biological Science, Southeastern State University

Teaching Experience:

1982-Present - Associate Professor of Engineering Technology
1975-1982 - Associate Professor, Radiation Safety and Health
1973-1975 - Associate Professor, Radiation and Nuclear Technology, Oklahoma State University
1972-1973 - Instructor, Oklahoma State University

Professional Activities:

Consultant to various Corporations involving:
Writing and reviewing operational procedures for maintaining radiation safety
Training Radiation Safety Officers
Training technicians to handle radioisotopes
Supervising technicians in performance of radiation surveys and swipe tests
Member of the Radiation Safety Committee
Tearhes radiological safety on campus and as extension courses

Organizational Activities:

Health Physics Society, Oklahoma Technical Society
Central Oklahoma Society of Nuclear Medicine

TECHNICAL VITA OF DR. WILLIAM A. SIBLEY, PROFESSOR OF PHYSICS AND CHAIRMAN, RADIOLOGICAL SAFETY COMMITTEE

Academic Training:

1960 - Ph.D., University of Oklahoma
1958 - M.S., University of Oklahoma
1956 - B.S., University of Oklahoma

Field of Specialization:

Solid State Physics

Professional Experience:

1978-Present - Assistant Vice President for Research, Oklahoma State University
1976-1978 - Director, School of Physical and Earth Sciences (Departments of Chemistry, Geology, and Physics), Oklahoma State University
1970-1976 - Head, Department of Physics, Oklahoma State University, Director of Research and Graduate Studies, College of Arts and Sciences (1974)
1961-1970 - Head, Non-Metals Section, Solid State Division, Oak Ridge National Laboratory, Radiation Damage and Optical Properties in Insulation Crystals
1960-1961 - Radiation Damage in Metals, Kernforschunganlage, Julich and Institute for Metal Physics, Technical University of Aachen, Germany

Experience Using Radioisotopes:

1500-1979 - Co-60 gamma cell

e. The organization and purpose of the Radiological Safety Committee and its general functions with respect to personnel, procurement of isotopes, and supervision of isotope usage and disposal and described in the HANDBOOK, pp. 1-4. More specific details of its responsibility in these latter matters are provided on pages 5, 6, 9, and 10.

f. The Radiological Safety Officer, Dr. H.M. Johnson is an appointee of the University President and a member of the

Radiological Safety Committee. As such, his Technical Vita appears above with those of the other members. A general statement of his responsibility as R.S.O. (and as R.P.A.) is given in the HANDBOOK, pp. 4-5. Further specific details of his responsibilities and authority appear on pages 6, 7, 9, 15, 16, and 21.

8a. Formal Training* and 8b. Experience

Technical vitas for members of the Radiological Safety Committee and the Radiological Safety Officer have already been presented in Item 15 and need not be reproduced here.

Only qualified faculty members are assigned operational responsibility for supervising isotope use. These individuals hold advanced degrees in their scientific disciplines. They and their projects are carefully reviewed before receiving Committee approval. The representative lists attached are provided only to illustrate the quality and diversity of training and experience exhibited by personnel in our program.

* In the Item 8a list under each of the four areas of training, J stands for on-the-job, C for formal course work, and JC for both. The type of training is listed under the following four categories.

  a = fundamentals of radioactivity

  b = instrumentation and standardization

  c = radioactivity calculation

  d = biological effects of radiation

8a. Formal Training

	Individual	Where Trained	Duration of Training	Type of Training			
				a	b	c	d
(1)	Basler, Eddie (Botany/Microbiology)	Univ of Okla Washington Univ	2 years 5 "	J J	J J	J J	
(2)	Bantle, J. A. (Zoology)	Eastern Mich Univ Ohio State Univ U of Colo Med School	1 year 3 " 3 "	 J	 J J	 J J	JC J J
(3)	Beames, C. G. (Zoology)	New Mexico Highlands Univ Rice Univ	4 months 2 year	C J	C J	C J	C J
(4)	Blankemyer, J. T. (Zoology)	Mound Lab Temple Univ	1 year 3 "	J JC	J JC	J JC	J JC
(5)	Burks, S. L. (Zoology)	Okla State Univ	6 months	C	C		
(6)	Clinkenbeard, K. (Veterinary Pathology)	Johns Hopkins University Univ of California, Davis	4 years 3 "	JC J	JC J	J J	JC J
(7)	Craven, R. (Botany/Microbiology)	University of Tennessee	4 years	JC	J	JC	C
(8)	Eberle, R. (Veterinary Parasitology)	Baylor College of Medicine Univ Tennessee City of Hope Medical Center	4 years 3 " 4 "	JC J J	JC J J	JC J J	C J
(9)	Edwards, W. C. (Physiological Sciences -OADDL)	Iowa State Univ Okla State Univ	2 years 10 "	JC J	JC J	JC J	JC J

16. Formal Training (continued)

Individual	Where Trained	Duration of Training	Type of Training			
			a	b	c	d
(10) Essenberg, M. K. (Biochemistry)	Brandeis Univ	5 years	J	J	J	
	Okla State Univ	3 "	JC	JC	JC	C
(11) Essenberg, R. C. (Biochemistry)	Cal Tech	1 year				C
	Harvard	5 years	J	J	J	
	U Leicester (U.K.)	2 "		J	J	
(12) Francko, D. A. (Botany/Microbiology)	Kent State University	3 years	JC	JC	JC	
	Michigan State Univ	4 "	J	J	J	J
	Okla State Univ	6 "	J	J	J	J
(13) Geisert, R. (Animal Science)	Univ of Nebraska	2 years	JC	JC	C	C
	Univ of Florida	3 "	JC	J	J	J
(14) Gholson, R. K. (Biochemistry)	Univ of Illinois	2 years	J	J	C	C
	Okla State Univ	16 "	J	J	J	J
(15) Grula, E. A. (Botany/Microbiology)	Purdue Univ	2 years	C	C	C	C
(16) Hodnett, E. M. (Chemistry)	Argonne Lab	1 year		JC	JC	
	Oak Ridge Lab	3 months		J	J	
	Nevada Test Site	6 weeks		JC		
	Okla State Univ	11 years		J	J	
(17) Horn, G. W. (Animal Science)	Purdue Univ	1 year	JC	JC	JC	

16. Formal Training (continued)

Individual	Where Trained	Duration of Training	Type of Training			
			a	b	c	d
(18) Hurst, J. G. (Zoology)	Okla State Univ	5 years	J	JC	JC	J
(19) Leach, F. R. (Biochemistry)	Univ of Texas	4 years	J	J	J	J
	Univ of Cal-Berkeley	2 "	J	J	J	J
	Cal Tech	1 year		J	J	J
(20) Matt, R. (Biochemistry)	Univ. of Wisconsin, Madison	6 years	J	JC	J	J
	M. I. T.	5 "	JC	J	J	JC
(21) McKeever, S. W. S. (Physics)	Univ Sussex, England, UK.	1 semester	C	C	C	C
(22) Melcher, U. K. (Biochemistry)	Mich State Univ	2 years	C	JC	JC	
	U Texas S.W. Med School	3 "	J	J	J	J
	Univ Aarhus	1 year	J	J		
(23) Mitchell, E. D. (Biochemistry)	Michigan State Univ	3 years	JC	C	C	
	Michigan State Univ	7 "	J	J	J	J
(24) Morrill, L. G.	Utah State Univ	1 year	JC	JC	JC	C
(25) Nelson, E. C. (Biochemistry)	Ohio State Univ	5 years	JC	JC	JC	JC
	Oak Ridge Lab	2 weeks	JC	JC	JC	JC
(26) Odell, G. V. (Biochemistry)	Rocky Flats, Colo	3 years	J	J	J	J
	Oak Ridge Lab	1 year	J	J	J	J
	Texas A & M	2 years	JC	C	C	JC

16. Formal Training (continued)

Individual	Where Trained	Duration of Training	Type of Training			
			a	b	c	d
(27) Owens, F. N. (Animal Science)	Univ of Minnesota	2 years	JC	JC	C	C
	Univ of Illinois	6 "		J	J	
(28) Ownby, J. D. (Botany/Microbiology)	Univ of Tenn	2 years	JC	JC	C	C
	Colorado State Univ	3 "	JC	JC	C	C
(29) Sanborn, M. R. (Botany/Microbiology)	Iowa State Univ	4 years	JC	JC	JC	
(30) Sauer, J. R. (Entomology)	Tulane Univ	3 years	JC	JC	C	C
(31) Sibley, W. A. (Physics)	Kernforschunganlage -Julich, Aachen	1 year	J	J	J	
	Oak Ridge Lab	9 years	JC	J	JC	C
(32) Staley, T. E. (Physiological Sciences)	Univ of Notre Dame	1 year	C	C	C	C
(33) Stone, J. F. (Agronomy)	Iowa State Univ	4 years	JC	JC	JC	JC
(34) Wettemann, R. P. (Animal Science)	Michigan State Univ	5 years	JC	JC	JC	JC
(35) Zuber, P. (Botany/Microbiology)	University of Virginia	4 years	JC	JC	JC	JC
	Harvard U	5 "	J	J	J	J

8b. Experience

Individual	Isotope	Max. Amt.	Where Experience Gained	Duration of Experience	Type of Use
(1) Basler, Eddie	C-14	1.0 mCi	OU, OSU, WU	32 years	Tracer
	H-3	1. "	OSU	25 "	"
	S-35	2. "	"	7 "	"
	P-32	10. "	"	7 "	"
	Rb-86	10. "	"	7 "	"
	Ca-45	1. "	"	7 "	"
	Ni-63	2. "	"	15 "	GC Detector
(2) Bantle, J. A.	H-3	5. mCi	Ohio State, OSU	9 years	Tracer
	C-14	1. mCi	Ohio State	9 "	"
	P-32	5. mCi	OSU	14 "	"
	I-131	0.25 mCi	U of Colo Med	4 "	"
(3) Beames, C. G.	Cr-51	5. mCi	N. M. Highlands	4 Months	Counting Techniques
	H-3	1. Ci	Rice Univ, OSU	2, 14 yrs	Tracer
	C-14	1. mCi	" " "	2, 17 "	"
	Na-22	0.2 mCi	OSU	11 years	"
	Na-24	1. mCi	"	11 "	"
	K-42	1. mCi	"	10 "	"
(4) Blankemeyer, J. T.	Cs-137	0.2 mCi	Temple	6 months	Tracer
	Pu-239	Classified	Mound Lab	1 year	Classified
	Rb-86	2. mCi	Temple, OSU	9 "	Tracer
	K-42	2. mCi	"	9 "	"
(5) Burris, S. L.	Ni-63	2. mCi	OSU	16 years	GC Detector
(6) Clinkenbeard, K. P.	C-14	10. mCi	John Hopkins Univ, Univ.CA.	6 years	Tracer
	H-3	10. "	" " " " "	6 "	"
	P-32	10. "	" " " " "	6 "	"

8b. Experience

Individual	Isotope	Max. Amt.	Where Experience Gained	Duration of Experience	Type of Use
(7) Cravens, Rebecca	H-3	0.25 mCi	University of TN, OSU	5 years	Tracer
	C-14	0.25 mCi	" " ", "	5 "	Tracer
	S-35	1. mCi	" " ", "	5 "	Tracer
(8) Eberle, R.	H-3	10. mCi	Baylor Med. Coll., Univ. of TN	12 years	Tracer
	C-14	1. mCi	" " " " " "	12 "	"
	S-35	10. mCi	" " " " " "	12 "	"
	I-125	5. mCi	City of Hope Medical Center	12 "	"
	Cr-51	10. mCi	" " " " "	12 "	"
	P-32	1. mCi	" " " " "	2 "	"
(9) Edwards, W. C.	Ni-63	15. mCi	OSU	10 years	GC Detector
(10) Essenberg, M. K.	H-3	1. mCi	Brandeis Univ., OSU	10 years	Tracer
	C-14	0.05 mCi	" " , "	9 "	"
	Co-60	0.05 mCi	" " , "	6 "	"
(11) Essenberg, R. C.	H-3	5. mCi	Harvard, Liecester, OSU	19 years	Tracer
	C-14	1. mCi	" " "	19 "	"
(12) Francko, D. A.	P-32	1. mCi	Kent St. Univ., OSU	7 years	Tracer
	H-3	0.25 mCi	Michigan St. Univ., OSU	9 "	"
	C-14	25. mCi	" " " "	9 "	"
(13) Geisert, R.	H-3	1. mCi	Univ. of Florida, OSU	7 years	Tracer
	I-125	1. mCi	Univ. of Nebraska, OSU	7 years	"
(14) Gholson, K. K.	H-3	1. mCi	OSU	23 years	Tracer
	C-14	2. mCi	OSU	23 "	"

8b. Experience

Individual	Isotope	Max. Amt.	Where Experience Gained	Duration of Experience	Type of Use
(15) Grula, E. A.	H-3	0.5 mCi	OSU	25 years	Tracer
	C-14	2. mCi	OSU	25 years	"
(16) Hodnett, E. M.	H-3	5. mCi	Argonne, OSU	1, 16 yrs.	Isotope Effect
	C-14	5. "	ORNL, OSU	3 mo., 16 yrs.	" "
(17) Horn, G. W.	H-3	2. mCi	Univ. of Georgia	9 years	Tracer
	C-14	2 "	OSU	6 years	"
(18) Hurst, J. G.	I-125	5. mCi	OSU	8 years	Tracer
	I-131	20. mCi	OSU	21 "	"
(19) Leach, F. R.	H-3	5. Ci	UCB, CIT, OSU	25 years	Tracer
	C-14	5. "	UT, UCB, CIT, CSU	25 "	"
	P-32	100. mCi	UT, OSU	25 "	"
	S-35	75. mCi	UT, OSU	25 "	"
(20) Mort, R.	H-3	1. mCi	Univ. of Wisconsin, MIT	11 years	Tracer
	C-14	1. mCi	" " " , "	11 "	"
	S-35	5. mCi	MIT	3 "	"
	P-32	50. mCi	"	3 "	"
	I-125	100. mCi	"	3 "	"
(21) McKeever, S. W. S.	Co-60	1000. mCi	Univ. Bermingham (England)	4 years	Irradiation
	Sr-90/Y-90	100. mCi	Univ. Sussex (England)	2 years	Irradiation

8b. Experience

Individual	Isotope	Max. Amt.	Where Experience Gained	Duration of Experience	Type of Use
(22) Melcher, U. K.	I-125	2. mCi	UTSWMS, OSU	13 years	Tracer
	I-131	1. "	" , "	11 "	"
	H-3	1. "	" , "	16 "	"
	C-14	0.1 "	MSU, OSU	16 "	"
	S-35	0.1 "	Univ. Aarhus	1 "	"
	P-32	2. "	" "	1 "	"
(23) Mitchell, E. D.	H-3	0.10 mCi	OSU	17 years	Tracer
	C-14	0.50 mCi	"	10 "	"
(24) Morrill, L. G.	Ni-63	15. mCi	OSU	7 years	GC Detector
(25) Nelson, E. C.	I-131	0.19 mCi	Ohio State	2 months	Tracer
	C-14	1. mCi	" " , OSU	1, 21 years	"
	H-3	1. "	OSU	21 years	"
(26) Odell, G. V.	C-14	2. mCi	Texas A. OSU	17 years	Tracer
	H-3	2. "	" "	7 "	"
	S-35	2. "	" "	7 "	"
	U-235	Classified	Rocky Flates	3 "	Classified
			ORNL	1 "	"
(27) Owens, F. N.	C-14	2. mCi	UI, OSU	6, 7 years	Tracer
(28) Ownby, J. D.	H-3	2. mCi	U of Tenn, Colo State	5 years	Tracer
	C-14	0.5 "	" " " "	5 "	"
	P-32	5. "	OSU	2 "	"
(29) Sanborn, M. R.	C-14	100. mCi	Iowa State	4 years	Tracer
	H-3	200. "	" " , OSU	4, 9 years	"

8b. Experience

Individual	Isotope	Max. Amt.	Where Experience Gained	Duration of Experience	Type of Use
(30) Sauer, J. R.	H-3	1. mCi	OSU	8 1/2 years	Tracer
	C-14	0.05 mCi	"	15 "	"
	Cl-36	0.05 mCi	"	12 "	"
	Na-22	0.1 "	"	9 "	"
	P-32	2. "	"	5 "	"
	Ca-45	0.1 "	"	8 1/2 "	"
	I-125	5. "	"	6 1/2 "	"
(31) Sibley, W. A.	Co-60	5000. Ci	ORNL, OSU	9, 15 years	Grammacell Irradiator
(32) Staley, T. E.	I-125	5. mCi	OSU	7 years	Tracer
	H-3	5. "	"	8 "	"
	C-14	1. "	"	8 "	"
(33) Stone, J. F.	Ra-226:Be	100. mCi	Iowa State, OSU	30 years	Moisture Gage
	Pu-239:Be	4. Ci	OSU	5 "	" "
	Pu-238:Be	0.284 Ci	"	15 "	" "
	Cs-137	0.250 Ci	"	15 "	" "
	P-32	1. mCi	"	6 "	Tracer
	Sr-85	1. "	"	1 year	"
	Sr-90	1. "	"	1 "	"
	C-14	1. "	"	25 years	Densitometry
(34) Wettemann, R. P.	H-3	0.5 mCi	OSU	12 years	Tracer
	I-125	3. "	"	12 "	"
	C-14	0.5 "	"	12 "	"
(35) Zuber, P.	S-35	5. mCi	Univ. of Virgina, Harvard	10 years	Tracer
	P-32	5. mCi	" " " , "	10 "	"
	H-3	5. mCi	" " " , "	10 "	"
	C-14	5. mCi	" " " , "	10 "	"

10. Radiation Protection Program

A complete description of the Oklahoma State University Radiation Protection and Control program is provided in the attached HANDBOOK. The HANDBOOK is distributed to Authorized Users and concerned administrators in loose-leaf form allowing for modification as required. The right to make minor changes in response to local operating situations is reserved but major modification arising from additional regulatory requirements will be reported to the Commission.

Special attention is directed to some important facets of the program. Reference to HANDBOOK pages is given where appropriate.

a. The organization and purpose of the Radiological Safety Committee and its general functions with respect to personnel, procurement of isotopes, and supervision of usage and disposal are described in the HANDBOOK, pp. 1-4. More specific details of its responsibility in these latter matters are provided on pages 5, 6, 9, and 10.

b. The Radiological Safety Officer, Dr. H.M. Johnson is an appointee of the University President and a member of the Radiological Safety Committee. As such, his technical Vita appears above with those of the other members. A general statement of his responsibility as R.S.O. (and as R.P.A.) is given in the HANDBOOK, pp. 4-5. Further specific details of his responsibilities and authority appear on pages 6, 7, 9, 15, 16, and 21.

c. Specific radiological safety standards and procedures are covered in the HANDBOOK, pp. 4-21. Of particular interest considering our type and scope of operations are the following:

1. Function of Radiological Safety Committee -
   HANDBOOK, pp. 4 and 6
2. Routine laboratory surveys by the R.S.O. -
   HANDBOOK, pp. 6-7
3. Package receipt procedures -
   HANDBOOK, pp. 14-16
4. Storage and transportation of radioactive material -
   HANDBOOK, pp. 16-17 and Item 10d of this application
5. Waste disposal -
   HANDBOOK, pp. 17-19 and Item 11 of this application
6. Inventory of radionuclides -
   HANDBOOK, p. 7
7. Personnel monitoring -
   HANDBOOK, pp. 19-20
8. Instrument calibration -
   HANDBOOK, p. 21 and Item 10g of this application
9. Leak test procedures and responsibilities -
   HANDBOOK, pp. 8-9 and Item 10f of this application
10. Responsibility for training in Health Physics -
    HANDBOOK, p. 21
11. Approval of users of radionuclides -
    HANDBOOK, pp. 5-6

12. Radiation accident procedures -
    HANDBOOK, Appendix C (copies posted in restricted areas)
13. Procurement of radionuclides -
    HANDBOOK, p. 4
14. Bioassay requirements for tritium and iodine users -
    HANDBOOK, pp. 20-21

d. Storage of Sealed Sources

Oklahoma State University at the present time possesses the following sealed sources of byproduct material subject to twice yearly leak testing. Procedures and responsibilities for obtaining and maintaining additional sealed sources subject to the total activity restrictions of the blanket authorizations in Item 5 are given in the HANDBOOK, pp. 8-9.

A.= Nature of shield B.= Manufacturer C.= Model No.

(1) to (4) Hewlett Packard Ni-63 ECD's #2-6195 (2 mCi each)

A.
(1), (2) Gas Chromatograph
(3) Gas Chromatograph
(4) Gas Chromatograph

B.
(1), (2) Hewlett Packard
(3) Hewlett Packard
(4) Hewlett Packard

C.
(1), (2) Model 5750
(3) Model 5755B
(4) Model 7620A

(5) Tracor Ni-63 ECD #4552 (15 mCi)
A. Gas Chromotograph
B. Tracor
C. Model 560

(6) Sigma Ni-63 ECD #824 (15 mCi)
A. Gas Chromotograph
B. Sigma
C. Model 2000

(7) Traacor Ni-63 ECD #4547 (15 mCi)
A. Gas Chromotograph
B. Tracor
C. Model 560

(8) Perkin-Elmer Ni-63 ECD #N800-0113 (15 mCi)
A. Gas Chromotograph
B. Perkin-Elmer
C. Model Sigma 2000

(9) Hewlett Packard Ni-63 ECD #18803-60520 (15 mCi)
A. Gas Chromatograph
B. Hewlett Packard
C. Model 5830A

(10) Perkin-Elmer Ni-63 ECD #009-0282 (15 mCi)
A. Gas Chromatograph
B. Perkin-Elmer
C. Model 3920B

(11) Nuclear Chicago Cs-137 Probe source #5176 (2000 mCi)
A. Density gauge
B. Nuclear Chicago
C. Model 5120

(12) Nuclear Chicago Cs-137 Probe source #77 (3 mCi)
A. Density measurement probe
B. Nuclear Chicago
C. Model P-20

(13) Surplus Cs-137 Probe source #R-51 (250 mCi)
A. Mounted in fixed position in a lead collimator as integral part of a gamma ray densitometer bolted to floor in Room 205C Ag Hall
B. Local construction in use about 15 years
C. N.A.

(14) Donated (prior to 1955) Co-60 "The Big One" (Current 16.8 mCi)
A. Stored in lead container in storage well located in Physical Sciences B49
B. N.A.
C. N.A.

(15a) to (15c) Donated (prior to 1955) Co-60 #'s 213, 216, 217 (Current 1.3 mCi each)
A. Stored in lead-shielded container in storage well located in Physical Sciences B49
B. N.A.
C. N.A.

(16) Tracer Lab Co-60 #R3149A (4.9 mCi)
A. Stored in lead pig, Industrial Bldg. 122B
B. N.A.
C. N.A.

(17) New England Nuclear Co-60 #Co-177 (0.5 mCi)
A. Stored in lead pig, Industrial Bldg. 122B
B. N.A.
C. N.A.

(18) Tracer Lab Sr-90 Veterinary Therapy Source #72-11 (60 mCi)
A. Lucite + lead, stored in Vet. Med. Teach. Hosp. -144
B. N.A.
C. N.A.

(19) Unknown Orgin Sr-90 liquid (7.7 mCi)
A. Glass + metal can stored in locked safe in Industrial Bldg. 122B
B. N.A.
C. N.A.

(20) U.S. Nuclear Cs-137 #E-506 (10 mCi)
A. Stored in lead pig, Industrial Bldg. 122B
B. N.A.
C. N.A.

(21) 3-M Cs-137 #66-6 (150 mCi)
A. Stored in lead pig, Industrial Bldg. 122B
B. N.A.
C. N.A.

(22) 3-M Cs-137 #70-15B (1 Ci)
A. Stored in lead pig, Industrial Bldg. 122B
B. N.A.
C. N.A.

(23) Gulf Nuclear VL-1 (125 mCi)
A. Stored in lead pig, Dairy Bldg. 112
B. N.A.
C. N.A.

(24) Daybreak Nuclear AFR-244 (0.5 mCi)
A. Stored in irradiator shield, Physical Science 252
B. Daybreak irradiator
C. Model 750
(Application for amendment to possess this source filed 2-24-87)

(25) Troxler Am-241:Be moisture probe (14 sources-170 mCi total)
A. Stored in probe assembly (location varies with use)
B. Troxler
C. Model 3400

* Three Pu:Be neutron sources and one Co-60 Gammacell held under other current University licenses not listed here.

e. Radiation Detection Instruments

All Departments of the University using byproduct material have appropriate instrumentation readily available. The following listing--which is not all-inclusive and which is subject to change upon discontinuation of use and/or new purchases--emphasizes instruments available to individual users for monitoring, surveying, and smear contamination testing. Most of these and others not included are also used in various educational and research programs.

A.	B.	C.	D.	E.	F.
(1) Monitor	W.B. Johnson	RML-1A w/GP-200	1	β,γ	0-50K
(2) Survey Meter	W.B. Johnson	GSM-5 W/GP-200	3	β,γ	0-20mR/hr

Radiation Detection Instruments (continued)

	A.	B.	C.	D.	E.	F.
(3)	Survey Meter	W.B. Johnson	GSM-5 w/PPA-2	1	β,γ	0-20mR/hr
(4)	Cutie Pie	Nuclear Chicago	2586	1	β,γ	0-2500 mR/hr
(5)	Nuclear Spectrometer	Baird Atomic	980530	1	N.A.	0-1000K
	w/Gas Flow Counter	Baird Atomic	912080	1	α,β	Bkg 60CPM
	w/NaI well Counter	Baird Atomic	810C	1	γ	Bkg 240CPM
(6)	Scintillation Counter	Scintrex	BGS-15	1	γ	0-10K CPS
(7)	Survey	Picker	600081	1	β,γ	0-30K
(8)	LSC (Tricarb)	Packard	3320	3	β	0-1000K Bkg 20CPM
(9)	LSC (Tricarb)	Beckman	3133	2	β,γ	0-1000K Bkg 20CPM
(10)	LSC (Tricarb)	Packard	3033	1	β	0-1000K Bkg 30CPM
(11)	LSC (Tricarb)	Beckman	3150T	1	β	0-200K Bkg 15CPM
(12)	Automatic Gamma Well Counter	Searle	1190	1	γ	0-1000K Bkg 200CPM
(13)	Multichannel Analyzer	Ortex	6220	1	α,β,γ	N.A.
(14)	Gas Flow Counter	Tracer Lab	N.A.	3	β,γ	Bkg 95CPM
(15)	G-M Counter	Eberline	Ms-3	5	α,β,γ	Bkg 60CPM
(16)	Neutron Counter	Eberline	PNC-4	3	n	0-500K
(17)	Survey Meter	Eberline	E-140	2	β,γ	0-50mr/hr

Radiation Detection Instruments (continued)

	A.	B.	C.	D.	E.	F.
(18)	Alpha Survey	W.B. Johnson	GSM-5 w/ASP-2A	1	α	0-50K
(19)	Survey Meter	Eberline	E-520	1	β,γ	0-2K mR/hr
(20)	Survey Meter	Atomic Acces.	463	1	β,γ	0-100mR/hr
(21)	Autogamma NaI Well Counter	Packard	5210	1	γ	0-2000K Bkg 200CPM
(22)	LSC PRIAS PL (Tricarb)	Packard	116	1	β	0-500K Bkg 15CPM
(23)	Automatic Gamma Well Counter	Nuclear Chicago	1185	1	γ	0-1000K Bkg-250CPM
(24)	Survey Meter	Dosimeter Corp	3007	1	β,γ	0-50mR/hr
(25)	Gas Flow Planchette Counter	Nuclear Chicago	C-110B	2	α,β	0-1000K (total)
(26)	Survey Meter	Nuclear Chicago	2612P	1	β,γ	0-2-mR/hr
(27)	Scintillation Detector	Nuclear Chicago	D55	1	α	Bkg 1CPM
	w/3054 Manual sample changes				β	Bkg 50CPM
	w/J55 Nose Piece				γ	Bkg 400CPM
(28)	Survey Meter	Nucleus	S101	1	β,γ	0-50K
(29)	Automatic Gamma Well Counter	Packard	5024	1	γ	0-1000K Bkg 150CPM
(30)	LSC (Tricarb)	Packard	C2524	1	β	0-1000K Bkg 20CPM

f. Leak Testing of Sealed Sources

For purposes of illustration only, current leak testing procedures are here described. Byproduct material sealed sources (1) through (13) listed above have swipes taken from their accessible surfaces by the individual users assigned responsibility for their use. These are counted by the R.S.O. on equipment listed as (5) on the instrument list above. Sealed sources (14) through (23) are swiped and counted by professional personnel designated by the R.S.O. using equipment listed as (5) on the instrument list. Sealed sources listed as (25) are leak tested and counted by the user using equipment listed as (27).

Although we reserve the local right to substitute comparable personnel or equipment, and to add new sources within the limits of our authorization, no important procedural modifications will be made. The test will be capable of detecting their presence of 0.005 microcuries of radioactive material on the test sample. If the tests reveal the presence of 0.005 microcuries or more of removable contamination, we will immediately withdraw the sealed source from use and inform the appropriate NRC office within five days indicating action taken.

g. Calibration of Instruments

Gieger survey instruments will be calibrated on all scales using a Cobalt-60 or Cesium-137 standard point source in air. Neutron survey instruments will be calibrated on all scales using a standard Pu:Be neutron source available locally. Calibrations will be done and batteries changed annually or more often if required when in regular use. Local regulations on instrument calibration for persons responsible for byproduct material use are given in the HANDBOOK, page 21.

Local calibration service on a professional level is furnished by personnel of the University's School of Technology. Local calibration has the advantage of assuring simple, fast-turnaround service.

Smear test instruments -- tricarbs, gas-flow or NaI gamma well counters -- may be interchangeably used by investigators for sensitive experimental research measurements and are thus calibrated at each operation using commercially obtained calibration sources.

h. Location of Use of Licensed Material

All radionuclides and sealed sources will be used on the OSU CAMPUS except the following:

(1) H-3, C-14 and P-32 may be used for *in vitro* tracer studies of ecosystems at temporary job sites throughout the State of Oklahoma.

(2) Moisture and/or soil density gauges containing Cs-137 and Am-241:Be sources may be used at Agricultural Research Stations and at temporary job sites throughout the State of Oklahoma.

11. Waste Management

Local regulations concerning waste disposal are covered in Section III-I of the HANDBOOK, pp. 17-19. Specific comment and explanation are provided below for each type of waste disposal.

a. Gaseous Wastes and Air Contamination
All releases are in conformance with 20.106 of CFR Part 20. Refer to Section III-I, Part 2 of the HANDBOOK, pp. 17-18, for University policies and procedures.

Typical amounts released are indicated by the 4th quarter 1986 data below (rounded to the nearest tenth of a mCi).

H-3	Trace
C-14	0.2 mCi
Other isotopes	0

b. Solid Wastes
i. Refer to Section III-I, Part 3 of the HANDBOOK, page 18 for University policies and procedures.

ii. All radionuclides with a half-life of less than 65 days will be held for decay for 10 half-lives. The material will be checked with an appropriate survey meter to determine its activity level. If the activity is not above background then it will be disposed of in the ordinary trash.

iii. All radionuclides with a half-life equal to or greater than 65 days will be disposed of through a commercial waste disposal service or the original supplier. The commercial waste disposal service will be one properly licensed to receive waste in accordance with paragraph 20.301 (a) of the CFR Part 20. Present contracts for radioactive waste disposal are with ADCO Services Inc., P.O. Box 35, Tinley Park, IL 60477.

iv. No radioactive material will be disposed of by incineration except for materials listed under 20.306 or as specifically approved by the Commission under 10 CFR 20.106 and 20.302.

c. Liquid Waste
i. It is our current practice to place even stricter limits on disposal of liquid wastes into the sanitary sewer system than that required by 10 CFR Part 20.303. Applicants for use of radionuclides agree on dilution factors which will reduce point of entry concentrations below the limits in Appendix B, Table I, column 2 of Part 20.

Typical amounts released are indicated by the 4th Quarter, 1986 data below (rounded to the nearest tenth of a mCi).

H-3	1.2 mCi
C-14	1.0 mCi

P-32	0.9 mCi
I-125	0.3 mCi
Ni-63	trace
S-35	trace

ii. All radioactive liquid waste not disposed of in the sanitary sewer system will be disposed of by commercial waste disposal service as described under Item 11b-ii for solid waste.

iii. Refer to Section III-I, Part 4 of the HANDBOOK, pp. 18-19 for specific University policies and procedures.