



OFFICE OF ENVIRONMENTAL HEALTH AND SAFETY • Hughes Hall Suite 2061 • Norfolk, Virginia 23529 • Phone: (757) 683-4495 • Fax: (757) 683-6025

Occupational Safety & Health

December 13, 2005

Environmental Health

Thomas Thompson
Materials Licensing Section
US Nuclear Regulatory Commission, Region I
475 Allendale Rd.
King of Prussia, PA 19406-1415

MS16

P-7

Laboratory Safety

Industrial Hygiene

Radiation Safety

Dear Mr. Thompson:

Hazardous Waste

Pollution Prevention

This letter is in response to your email requesting additional information and clarification to support the application to renew license number 45-09599-03, Docket No 03016045, Control No: 137851. The enclosed documentation addresses those questions as well as the ones discussed in our telephone conversation on December 1, 2005. I trust that the enclosed documentation will provide you with sufficient information concerning Old Dominion University's Radiation Safety Program. If you need any additional information, or require further clarification, please contact me.

Sincerely,

Derek Krepp
Radiation Safety Officer

Enclosures

137851

OLD DOMINION MATERIALS-002

Response:

1. After a comprehensive review of our sealed source inventory, I have included a revised sealed source possession table. Furthermore, as requested, I have included the required manufacturer and model number for the sources we possess, however, there is one exception. We are in possession of a sealed Eu-155 source that dates back to November 1, 1982. It was custom made by the University of Missouri, back when they had a reactor. The source consists of SmPd₃ powder encapsulated in aluminum. It was then exposed to a neutron field to create Sm-155, which rapidly decays, leaving Eu-155. No model number was generated or provided with the source. Based on the nature of the source and its age, I would like to request an exception be made to the sealed source identification requirement for this source. To assist you with this request, I have included a copy of the paperwork for this source. As discussed per our telephone conversation, I have only listed the type of sealed sources that we currently have in our possession. In the event a different source is needed in the future, I will submit an amendment at that time with the necessary information.

2. In regard to the alpha emitters listed in our license request, I have updated the radioactive material possession table to include any alpha emitters that were left off. In addition, I updated the table that lists the alpha emitters that will be used in unsealed form. I did not include Po-208 & Po-209, since they are only regulated by the state. As discussed in our telephone conversation, the alpha emitters are used in trace concentrations, as standards for soil sample analysis. With regards to safety, all the procedures and controls listed in the license apply.

In response to your question regarding the means of detection, two methods will be used to monitor for fixed and removable contamination, a Packard Tri-Carb liquid scintillation counter and a portable survey meter equipped with an alpha detector (a revised instrument table has been included). Finally, area surveys will ensure that all dose limits are met with respect to any gamma and x-ray emissions.

3. These revisions do not affect the amount of financial assurance required, however, they do require an updated "Certification of Financial Assurance", which I have included.

Old Dominion University
License No. 45-09589-03

1. Revised "Item 5", Radioactive Material

- unsealed sources

A. Any byproduct material with atomic number 1 through 83, with half lives less than 120 days	Any	Not to exceed 150 mCi per radionuclide and 5 curies total
B. Calcium 45	Any	4 mCi
C. Carbon 14	Any	500 mCi
D. Chlorine 36	Any	5 mCi
E. Hydrogen 3	Any	500 mCi
F. Manganese 54	Any	5 mCi
G. Plutonium 238	Any	2 μ Ci
H. Polonium 210	Any	5 μ Ci
I. Thorium 229	Any	5 μ Ci
J. Natural Thorium (Th-232)	Any	100 μ Ci
K. Uranium 232	Any	5 μ Ci
L. Uranium 234	Any	5 μ Ci
M. Uranium 235	Any	5 μ Ci
N. Uranium 236	Any	15 μ Ci
O. Uranium 238	Any	5 μ Ci
P. Natural Uranium	Any	100 μ Ci

Old Dominion University
License No. 45-09599-03

● sealed sources

Isotope	Form	Manufacturer	Model/ID	Activity
A. Nickel 63	Electroplated foils (ECD)	Barringer Instruments	400	Not to exceed 20 mCi per source and 500 mCi total
		Hewlett Packard	G1223A	
		Hewlett Packard	18803-60520	
		Hewlett Packard	19233	
		Perkin Elmer	N610-0133	
		Shimadzu	GL-86	
		Shimadzu	ECD-Mini 2	
		Shimadzu	ECD-6	
		Tracer Inc.	115500-001	
		Varian	02-001972-00	
B. Cadmium 109	Electroplated foil	Niton Corporation	309	20 mCi
C. Eu-155	Encapsulated	University of Missouri	Not available	60mCi
D. Cesium 137	Encapsulated	Beckman Coulter	C-137 Source	100µCi

Revised section 9., Facilities and equipment, Special Use Facilities, b.

List of alpha emitters (in un-encapsulated form) used, and the maximum activity used in an individual experiment:

Isotope	Maximum Activity
Th-229	<1000 dpm (4.50×10^{-4} µCi)
Th-232	<1000 dpm (4.50×10^{-4} µCi)
U-232	<1000 dpm (4.50×10^{-4} µCi)
U-234	<1000 dpm (4.50×10^{-4} µCi)
U-235	<1000 dpm (4.50×10^{-4} µCi)
U-236	<1000 dpm (4.50×10^{-4} µCi)
U-238	<1000 dpm (4.50×10^{-4} µCi)
Po-210	<1000 dpm (4.50×10^{-4} µCi)
Pu-238	<1000 dpm (4.50×10^{-4} µCi)

Old Dominion University
License No. 45-09599-03

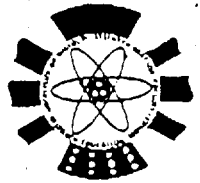
Revised section 10.2 Instruments

Portable and laboratory instruments used to perform radiation surveys and assay radioactivity include:

- a. Liquid scintillation counter, Packard Tri-Carb 2300TR
- b. Gamma scintillation counter, Beckman Gamma 5500
- c. 2" x 2" NaI multi-channel analyzer
- d. Ludlum Model 3 survey meter with model 44-9 pancake GM detector (2)
- e. Ludlum Model 3 survey meter with model 44-3 NaI detector – (3)
- f. Ludlum Model 19 with NaI detector (micro-R meter)
- g. Ludlum Model 3 with 44-7 Thin End Window GM detector
- h. Eberline Model E-520 with model HP-270 energy compensated GM detector
- i. Ludlum X-ray/Gamma Radiation Survey Meter, model 36100
- j. Eberline Model ESP-2 with model HP-210AL pancake GM detector
- k. Eberline Model ESP-2 with model AC-3 Alpha scintillation detector



UNIVERSITY OF MISSOURI - RESEARCH REACTOR
MATERIAL TRANSFER FORM



SHIP TO RSO - Eric Raudenbush
Old Dominion University
Norfolk, VA 23508
Attn: Dr. Desmond C. Cook

MURR ID 43306
CONSIGNEE BYPRODUCT LICENSE
NUMBER 45-09599-03
EXPIRATION DATE 10-31-84

P. O. No. ODU Research Foundation Grant #82-056

TARGET MATERIAL	WEIGHT	PHYSICAL FORM	RADIONUCLIDE	ACTIVITY (IN CURIES)	TRANSPORT GROUP
<u>SmPd</u>	<u>0.0041 gm</u>	<u>Solid</u>	<u>Pu-155</u>	<u>0.0513</u>	<u>IV</u>

PROPER SHIPPING NAME Radioactive Material, n.o.s., NA9181

IRRADIATION POSITION	<u>26.46 hr</u> <u>10.92 hr</u>
	<u>H1 12-14</u> <u>F1 17-19</u>
THERMAL FLUX	<u>9 x 10¹³</u> <u>5.5 x 10¹⁴</u> n/cm ² s
FAST FLUX	n/cm ² s
GAMMA DOSE RATE	R/hr

DATE IN 10-15-82
DATE OUT 10-18-82
TIME OUT 0400
TOTAL HOURS 46.38

TYPE SHIPMENT A
SHIPPING CONTAINER DOT 7A, MURR Model #1000
SERIAL NUMBER _____
TRANSPORT ROUTING Federal Xpress
BILL NUMBER 287751590
TRANSPORT INDEX 5

DOCUMENTATION REQUIRED
TYPE B.....
SPECIAL FORM.....
AIR CERTIFICATION..
OTHER _____
LABELS Yellow III, Danger-Peligro

DOSE RATE		SURFACE CONTAMINATION	
AT SURFACE	<u>93</u> mR/hr	BETA/GAMMA	<u>< 2200</u> dpm/100 cm ²
AT 3 FEET	<u>5</u> mR/hr	ALPHA	<u>< 220</u> dpm/100 cm ²

HEALTH PHYSICS APPROVAL David F. ... DATE 11-1-82

"This is to certify that the above named articles are properly classified, described, packaged, marked and labeled, and are in proper condition for transportation, according to the applicable regulations of the Department of Transportation."

CERTIFIED BY _____ DATE 11-1-82
ACCEPTED BY CARRIER _____ DATE _____

11-23-82 08:57 693602E
MAILGRAM SERVICE CENTER
MIDDLETOWN, VA. 22645

ENV. HEALTH

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1-23 3685J 30 6 11/22/82 TWX MURR COMA NFKD
1415 COLUMBIA MO NOVEMBER 22 1982

DR. DESMOND C. COOK
OLD DOMINION UNIVERSITY
NORFOLK, VIRGINIA 23502

NOTIFICATION OF RADIOACTIVE MATERIAL SHIPMENT

REQUESTOR: DR. COOK
MATERIAL: EU-155
TYPE SHIPMENT: TYPE A
SHIPPING CONTAINER: DOT 7A, MURR MODEL #1220
SHIPPING DATE: 11-21-82
ROUTING: FEDERAL EXPRESS 287751590
MURR ID: 43308
CUSTOMER PO: ODU RESEARCH FOUNDATION GRANT #82-956

IF SHIPMENT NOT RECEIVED BY 11-26-82, NOTIFY REACTOR SERVICES
AT 314 882 4011, TWX 910 760 1441, OR TLX 434199

DAVID FAHRENBRINK
REACTOR SERVICES
UNIVERSITY OF MISSOURI
RESEARCH REACTOR

YC
1112 EST

NR MOOMP YG M

**OLD DOMINION UNIVERSITY**

Office of the President

Koch Hall
 Norfolk, Virginia 23529-0001
 Telephone: (757) 683-3159
 FAX: (757) 683-5679

CERTIFICATION OF FINANCIAL ASSURANCE

Principal: Old Dominion University
 Hampton Boulevard
 Norfolk, VA 23529

NRC license number 45-09599-03

Issued to: U.S. Nuclear Regulatory Commission

I certify that Old Dominion University is licensed to possess the following types of sealed sources or plated foils with a half-life greater than 120 days licensed under 10 CFR Part 30, unsealed byproduct material with a half-life greater than 120 days licensed under 10 CFR Part 30, source material in a readily dispersible form licensed under 10 CFR Part 40, and unsealed special nuclear material licensed under 10 CFR Part 70 in the following amounts:

Type of Material	Amount of Material
Unsealed byproduct material	
Hydrogen 3	500mCi
Carbon 14	500mCi
Chlorine 36	5mCi
Calcium 45	4mCi
Manganese 54	5mCi
Polonium 210	5 μ Ci
Unsealed source material	
Thorium 229	5 μ Ci
Thorium (Natural)	100 μ Ci
Uranium 232	5 μ Ci
Uranium 234	5 μ Ci
Uranium 236	15 μ Ci
Uranium 238	5 μ Ci
Uranium (natural)	100 μ Ci


Unsealed special nuclear material

Uranium 235	5 μ Ci
Plutonium 238	5 μ Ci

Sealed source material

Nickel 63	500mCi
Cadmium 109	20mCi
Cesium 137	100 μ Ci
Eu 155	60mCi

I also certify that financial assurance in the amount of \$225,000.00 will be obtained for the purpose of decommissioning as prescribed by 10 CFR Part 30.35.



Roseann Runte
President, Old Dominion University

[Corporate seal]

December 8, 2005

Financial Assurance Worksheet
for
Special Nuclear Material

11/13/2010 09:02:25

ENV HEAL 1

Radionuclide	Unsealed Special Nuclear Material license limit (uCi)	Appendix B (10CFR Part 30) in uCi	Sum of the ratio / 10 ³	Sum of the ratio / 10 ⁴	Sum of the ratio / 10 ⁵
Pu-238	2	0.01	0.2	0.02	0.0000005
U-235	5	0.01	0.5	0.05	0.0000002
SUM			0.7	0.07	0.0000007
Required Financial Assurance			If < 1, No financial assurance required. If > 1, financial assurance required is \$225,000, unless next limit is exceeded.	If > 1, Financial Assurance required is \$1,125,000.	If < 1, No Decommissioning Plan Needed
Note: Information based on 10 CFR 70.25					

11/13/2010 09:02:25

Financial Assurance Worksheet
for
Source Material

Radionuclide	Unsealed source material license limit (uCi)
Th-229	2
Th (Natural)	100
U-232	5
U-234	5
U-236	15
U-238	5
U (natural)	100
Sum	232
<p>If > 100,000uCi, must submit Decommissioning Plan and provide \$225,000 Financial Assurance. If > 10,000uCi but < 100,000uCi, licensee shall either submit Decommissioning Plan or provide \$225,000 Financial Assurance. If < 10,000uCi, no Decommissioning Plan or Financial Assurance needed.</p>	
<p>Note: Information based on 10 CFR 40.36</p>	

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Financial Assurance Worksheet
for
Sealed Sources and Plated Foils

Radionuclide	Sealed sources or plated foils (uCi)	Appendix B (10CFR Part 30) in uCi	Sum of the ratio / 10 ¹⁰	Sum of the ratio / 10 ¹²
Cadmium 109	20000	10	2.00E-07	2.00E-09
Eu-155	60000	10	6.00E-07	6.00E-09
Nickel 63	500000	10	5.00E-06	5.00E-08
Cesium 137	100	10	1.00E-09	1.00E-11
SUM			5.80E-06	5.80E-08
Financial Assurance and Decommissioning Requirements			If < 1, no financial assurance required. If > 1, financial assurance required is \$113,000.	If < 1, no Decommissioning Plan required.
Note: Information based on 10 CFR 30.35				

Financial Assurance Worksheet
for
Byproduct Material

Radionuclide	Unsealed byproduct material license limit (uCi)	Appendix B (10CFR Part 30) in uCi	Sum of the ratio / 10 ³	Sum of the ratio / 10 ⁴	Sum of the ratio / 10 ⁵
H-3	500000	1000	0.5	0.05	0.02
C-14	500000	100	5	0.5	0.0002
Cl-36	5000	10	0.5	0.05	0.0002
Ca-45	4000	10	0.4	0.04	0.00025
Mn-54	5000	10	0.5	0.05	0.0002
Po-210	5	0.1	0.05	0.005	0.00002
SUM			6.95	0.695	0.02087
Financial Assurance and Decommissioning Plan Requirements			If < 10, Financial Assurance required is \$225,000, unless next limit is exceeded.	If > 1, Financial Assurance is \$1,125,000	If < 1, No Decommissioning Plan Needed
Note: Information based on 10 CFR 30.35					