

April 21, 1999

Docket Nos. 030-00952  
030-07059  
030-10645  
070-00113  
50-05  
37-13831-01  
37-13831-04

License Nos. 37-00185-04  
37-00185-05  
37-00185-06  
SNM-095  
R-2  
030-03203  
030-10851

Control No. 126017

Rodney A. Erickson, Ph.D.  
Vice President for Research  
The Pennsylvania State University  
304 Old Main  
University Park, PA 16802-1504

Dear Dr. Erickson:

We have reviewed the letters dated November 18 and December 21, 1998 and April 6, 1999, that were submitted to meet the financial assurance requirements for the licenses referenced above. We have no further questions concerning your financial assurance at this time.

In addition, the letter of credit that was previously used to meet financial assurance requirements is no longer needed.

Thank you for your cooperation.

Sincerely,

***Original signed by Pamela J. Henderson***

Pamela J. Henderson  
Nuclear Materials Safety Branch 2  
Division of Nuclear Materials Safety

cc:

Kenneth S. Babe, Corporate Controller  
Eric J. Boeldt, C.H.P., Radiation Safety Officer

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NAME	PHenderson						
DATE	04/21/99	04/ /99	04/ /99	04/ /99	04/ /99		

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**From:** Marvin Mendonca  
**To:** Pamela Henderson  
**Date:** Tue, Apr 20, 1999 4:21 PM  
**Subject:** Re: Penn State - Financial Assurance

Should we say that their proposed alternative meets the requirements? I would suggest

After reviewing the criterion in Appendix E to 10 CFR Part 30, we find that the Penn State University meets the requirements to provide self-guarantee for decommissioning its NRC licensed facilities.

Regardless, consider that you have my concurrence.

Thanks.

**From:** Pamela Henderson  
**To:** Marvin Mendonca  
**Date:** Tue, Apr 20, 1999 4:07 PM  
**Subject:** Penn State - Financial Assurance

Marvin,

Attached is the letter we are planning on sending to Penn State accepting their self-guarantee as financial assurance for decommissioning. As I mentioned in our telephone conversation today, DWM has had a contractor review the self-guarantee and OGC has also reviewed the self-guarantee. DWM and OGC have no objections to it.

Please let me know if you concur and we will issue it. I will send copies of all applicable financial assurance documents and the decommissioning funding plan to you.

Thank you for your assistance.

Pam

**CC:** Elizabeth Ullrich

**From:** Pamela Henderson  
**To:** Louis Bykoski, Stephen Lewis  
**Date:** Tue, Apr 13, 1999 10:11 AM  
**Subject:** Penn State - Self Guarantee

Lou and Steve,

I just faxed to you Penn State's 2-page letter, dated April 6, 1999, sent in response to our last set of questions regarding the basis for their bond rating. Their response looks acceptable to us. We plan on accepting Penn State's self-guarantee next Wednesday (April 21, 1999) unless we hear otherwise from DWM or OGC.

Thank you for your assistance.

Pam

**CC:** Catherine Marco, Elizabeth Ullrich, John Kinnema...



MS 6  
K-7

April 6, 1999

U.S. Nuclear Regulatory Commission  
Region I  
475 Allendale Road  
King of Prussia, PA 19406-1415  
Attn: Pamela Henderson

Dear Ms. Henderson:

In reply to your email to Eric Boeldt of March 19, 1999, I am providing further information in regard to your questions.

1. What did Moody's consider in the bond rating?

The rating is an institutional rating based upon an examination of our financial condition by a team of Moody's examiners. The examination included a wide variety of institutional attributes. Among the factors noted by Moody's in support of the bond rating were strong student demand, stable enrollment, growth among almost all revenue sources and successful fundraising campaigns. The following financial ratios were also used to benchmark Penn State against other large educational institutions:

**BALANCE SHEET RATIOS**

1. Total debt to total assets
2. Total debt to total endowment
3. Total resources (net assets) to debt
4. Unrestricted resources (net assets) to debt
5. Actual debt service coverage
6. Total resources per FTE student
7. Total debt to capitalization
8. Unrestricted operating resources to operations
9. Unrestricted resources to operations
10. Expendable resources to operations

Ms. Henderson  
April 6, 1999  
page 2

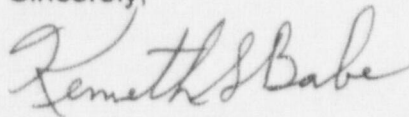
11. Expendable resources to total net assets
12. Return on unrestricted revenues
13. Return on net assets

#### CAPITAL RATIOS

1. Unrestricted operating resources to debt
  2. Unrestricted resources to debt
  3. Expendable resources to debt
  4. Total resources to debt
2. Does the rating continue to future bond issues or would a new rating be needed?
- The rating is an institutional rating and applied to all of Penn State's general obligation revenue bonds outstanding as of the June 1997 Moody's report. Moody's also applied the rating to Penn State's only subsequent bond issuance in December 1997.

Thank you for your attention to this request to allow self-guarantee as a funding mechanism for decommissioning.

Sincerely,



Kenneth S. Babe  
Corporate Controller

KSB/sk

cc: Eric Boeldt, Radiation Safety Officer, University Park  
Kenneth Miller, Radiation Safety Officer, Hershey Medical Center

MS 15

K-7

**From:** Pamela Henderson  
**To:** Eric Boeldt  
**Date:** Mon, Mar 29, 1999 10:07 AM  
**Subject:** Self-Guarantee

Eric,

We still need a bit more information with regard to the Moody's rating of the bonds presented in support of self-guarantee. I realize that you will have to pass this information along to the financial specialists.

We need to know specifically what Moody's considered in rating the bonds that the Pennsylvania State University (PSU) has presented in support of self-guarantee. The rating must have considered the institution (PSU) and not just the revenue stream.

We will require a response in writing to this inquiry. Please let me know if you have any additional questions.

Pam



**From:** Pamela Henderson  
**To:** "ejb6@psu.edu"@GATED.nrcsmtp  
**Date:** Tue, Mar 30, 1999 9:13 AM  
**Subject:** Even more on Self-Guarantee

Eric,

In addition to the information that I needed yesterday, my management has added another request for today.

In your December 21, 1998 letter, in item #3, you responded to our request that you provide a copy of the bond. You stated that since it is **not connected to a specific bond issue**, there can be no copy provided. When we look at the Moody's rating update that was attached to your November 18, 1998 letter it does mention several specific bond issuances in the first paragraph. Our question is, if a new bond were issued would Moody's have to issue a new rating? If the Moody's rating is truly institutional, a new rating would not have to be issued since the rating is based on the institution and not the bond issuance.

I hope this additional question makes sense.

Let me know if you have questions.

Thanks for your assistance.

Pam



Kenneth S. Babe  
Corporate Controller  
Office of the Corporate Controller

The Pennsylvania State University  
408 Old Main  
University Park, PA 16802  
(814) 865-1355

MS16  
K7

December 21, 1998

U.S. Nuclear Regulatory Commission  
Region I  
475 Allendale Road  
King of Prussia, PA 19406-1415  
Attn: Pamela Henderson

Dear Ms. Henderson:

In reply to your letter of December 9, 1998, I am providing further information in regard to your three additional questions.

1. What was the bond rating based on?  
The rating is an institutional rating based upon an examination of our financial condition by a team of Moody's examiners.
2. Does the rating have any limitation on it and is the payment stream restricted in any way?  
The rating is an institutional rating and is not connected to a specific bond issue. Presumably, this would be the rating of a new bond should we decide to issue such.
3. Please provide a copy of the bond with your reply to this letter.  
Since it is not connected to a specific bond issue, there can be no copy provided.

Thank you for your attention to this request to allow self-guarantee as a funding mechanism for decommissioning.

Sincerely,

Kenneth S. Babe  
Corporate Controller

Cc: Eric Boeldt, Radiation Safety Officer, University Park  
Kenneth Miller, Radiation Safety Officer, Hershey Medical Center

December 9, 1998

Docket No. 030-00952  
Control No. 126017

License No. 37-00185-04

Kenneth S. Babe  
Corporate Controller  
The Pennsylvania State University  
Office of the Corporate Controller  
408 Old Main  
University Park, PA 16802

Dear Mr. Babe:

This is in reference to your letter dated November 18, 1998 providing information in support of a request for self-guarantee for financial assurance for decommissioning for Nuclear Regulatory Commission License Nos. 37-00185-04, 37-00185-05, 37-00185-06, SNM-095, R-2, 37-13831-01 and 37-13831-04. In order to continue our review we need the following additional information with regard to Moody's bond rating:

1. What was the bond rating based on?
2. Does the rating have any limitation on it and is the payment stream restricted in any way?
3. Please provide a copy of the bond with your reply to this letter.

We will continue our review upon receipt of this information. Please reply in duplicate to my attention at the Region I Office and refer to Mail Control No. 126017. If you have any technical questions regarding this deficiency letter, please call me at (610) 337-6952.

Sincerely,

**Original signed by Pamela J. Henderson**

Pamela J. Henderson  
Senior Health Physicist  
Nuclear Materials Safety Branch 2  
Division of Nuclear Materials Safety

Enclosure:  
10 CFR Part 30

ML10

K. Babe  
The Pennsylvania State University

2

cc:  
Eric Boeldt, C.H.P., Radiation Safety Officer  
Rodney A. Erickson, Ph.D., Vice President for Research

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37-00185-04

PENNSTATE



Kenneth S. Babe  
Corporate Controller  
Office of the Corporate Controller

030-00952  
The Pennsylvania State University  
408 Old Main  
University Park, PA 16802  
(814) 865-1355

1 k7

November 18, 1998

U.S. Nuclear Regulatory Commission  
Region I  
475 Allendale Road  
King of Prussia, PA 19406-1415  
Attn: Pamela Henderson

Dear Ms. Henderson:

I am writing to provide assurance that The Pennsylvania State University has sufficient resources to self-guarantee the costs of removing all radioactive material associated with the radioactive materials licenses issued to the University. This guarantee applies to all of the radioactive materials licenses listed under Penn State. It applies to the use of radioactive material at the University Park campus, the Hershey Medical Center, the Commonwealth campuses, and at other locations as specified in these licenses.

We acknowledge that the radioactive materials on hand represent a future expenditure, which must be considered in planning. Financially, The Pennsylvania State University issues bonds, and the current rating of its most recent uninsured, uncollateralized, and unencumbered bond issuance as issued by Moody's is Aa3. Based on this analysis and in accordance with Appendix E of 10 CFR 30, Penn State meets the financial test required for self-guarantee.

If, at any time, Penn State's most recent bond issuance ceases to be rated in any category of "A" or above by either Standard and Poors or Moody's, Penn State will provide notice in writing of such fact to the NRC within 20 days after publication of the change of the rating service. According to the University's Decommissioning Funding Plan, the amount of financial liability was estimated at \$1,319,700.00 on September 3, 1997.

The Pennsylvania State University will review this test within 90 days after the close of each fiscal year. Penn State's fiscal year runs from July 1 to June 30. If Penn State no longer meets the requirement of (Moody's) listed above, Penn State will send a notice to the NRC of our intent to establish alternative financial assurance as specified in NRC regulations. The notice will be sent within 90 days after the end of the fiscal year for which the year end financial data show that Penn State no longer meets these financial test requirements. Penn State will provide alternate financial assurance within 120 days after the end of such fiscal year.

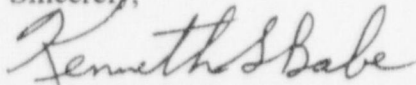
This guarantee will remain in force until the NRC terminates the University's license(s) or until the University notifies the NRC that we no longer meet the requirement. A cancellation will not occur unless an alternative assurance mechanism is in place. Penn State will provide alternative financial assurance as specified in the Commission's regulations within 90 days following cancellation of this guarantee. Penn State guarantees that upon issuance of an order by the Nuclear Regulatory Commission we will set up and fund a trust in the amount of the current cost estimates for decommissioning.

This letter applies to the following licenses:

Broadscope license:	37-00185-04	Docket # 030-00952	\$477,000
Cobalt Pool license:	37-00185-05	030-07059	71,400
Irradiator license:	37-00185-06	030-10645	61,000
Special nuclear material license:	SNM-95	70-113	12,000
Reactor operations license:	R-2	50-05	224,800
Broadscope license:	37-13831-01	030-03203	418,800
Irradiator license:	37-13831-04	030-10851	54,700
Total			\$1,319,700

Thank you for your attention to this request to allow self-guarantee as a funding mechanism for decommissioning.

Sincerely,



Kenneth S. Babe  
Corporate Controller

Cc: Eric Boeldt, Radiation Safety Officer, University Park  
Kenneth Miller, Radiation Safety Officer, Hershey Medical Center



June 19, 1997

P

## **Pennsylvania State University**

### **Contacts**

Thomas E. Calibeo	212-553-4982
John C. Nelson	212-553-4096
Dennis Farrell	212-553-7780

### **Moody's Upgrades Penn State University's Bond Rating to Aa3—\$403.2 Million of Debt Affected**

Moody's has upgraded the Pennsylvania State University's bond rating to Aa3 from A1 and assigned a stable outlook. The rating upgrade affects Penn State's \$403.2 million of outstanding general obligation revenue bonds, Refunding Series 1992, Second Refunding Series 1992 and Series 1992B and Refunding Series 1993A. The rating update and outlook reflects Moody's expectation that future student demand is likely to remain strong, perhaps even strengthen; that fundraising and non-resident student tuition will counterbalance possible erosion in state aid; and that future debt issuance will be modest.

#### **FLAGSHIP CAMPUS DRIVES STRONG MARKET POSITION; SATELLITE CAMPUS RESTRUCTURING EXPECTED TO BOLSTER UNIVERSITY-WIDE STUDENT DEMAND:**

The large size and scope of the University's enrollment (62,806 full-time equivalent students, 23 campuses) highlights strong student demand. The University generates state-wide and even national demand for its instruction, research and public service programs. Overall enrollment has grown over the past two years, despite self-imposed caps on enrollment of just under 40,000 students at the flagship University Park campus in State College. Substantial name recognition and long-established academic reputation allowed the University to maintain stable enrollment during the protracted 36% decline in Pennsylvania high school graduates which occurred between 1976 and 1995.

Strong demand for admission to University Park is reflected in the 49% selectivity, 38% yield, high student quality (1,167 SAT and 3.55 grade point average means) and large 30% out-of-state draw. Solid demand for the two-year programs generally offered at the satellite Commonwealth Campuses results from both full-time and part-time commuter students, with 86% selectivity and 44% yield indicating a large draw. Plans to restructure 15 campuses from two year to four year institutions is expected to bolster University-wide demand and allow for modest enrollment growth. This should result from fewer Commonwealth Campus student transferring to the main campus for the third and fourth year of education, allowing additional capacity at University Park for out-of-state students who pay much higher tuition than resident students.

126 017

Pennsylvania State University

Higher Education



October 29, 1998

Docket No. 030-00952  
Control No. 126017

License No. 37-00185-04

Rodney A. Erickson, Ph.D.  
Vice President for Research  
The Pennsylvania State University  
304 Old Main  
University Park, PA 16802-1504

Dear Dr. Erickson:

This is in reference to your financial assurance for decommissioning for Nuclear Regulatory Commission License Nos. 37-00185-04, 37-00185-05, 37-00185-06, SNM-095, 37-13831-01, 37-13831-04 and R-2. Our letter dated August 21, 1998 notified you that we had no further questions regarding your decommissioning funding plan (DFP) dated October 31, 1996 and additional information provided in your letter dated September 3, 1997. We also stated in our August 21, 1998 letter that you need to submit financial assurance for the revised funding amount. According to your DFP, the funds necessary to support decommissioning have increased from the current \$862,000.00 to \$1,319,700.00.

10 CFR 30.35(c) states, in part, that each holder of a specific license issued on or after July 27, 1990, shall provide financial assurance for decommissioning in accordance with the criteria set forth in the section. The current "Irrevocable Standby Letter of Credit" for \$862,000.00 does not contain adequate financial assurance for decommissioning and thus is not in accordance with the requirements of 10 CFR 30.35(c). It is important that you provide the revised financial assurance for decommissioning as soon as possible.

In addition, your DFP includes license Nos. 37-13831-01, 37-13831-04 which are for Hershey Medical Center. We understand that Hershey Medical Center plans to, or may have already undergone a change in ownership. Your financial assurance for decommissioning must take into consideration a change in ownership for Hershey Medical Center. Please note that a Statement of Intent may be used only by Federal, State or local government licensees. If you choose not to include the Hershey licenses (37-13831-01, 37-13831-04) in your funding plan, you must submit a written request to exclude these licenses from your DFP and provide the necessary funding for the revised estimate.

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R. Erickson  
The Pennsylvania State University

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We request that you submit the required financial assurance within 30 calendar days from the date of this letter. Please reply in duplicate to my attention at the Region I Office and refer to Mail Control No. 126017. If you have any technical questions regarding this deficiency letter, please call me at (610) 337-6952.

Sincerely,

***Original signed by Pamela J. Henderson***

Pamela J. Henderson  
Senior Health Physicist  
Nuclear Materials Safety Branch 2  
Division of Nuclear Materials Safety

Enclosures:

1. Regulatory Guide 3.66
2. 10 CFR Part 30

cc:

Eric J. Boeldt, C.H.P., Radiation Safety Officer

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NAME	PHenderson							
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August 21, 1998

Docket No. 030-00952  
Control No. 126017

License No. 37-00185-04

Rodney A. Erickson, Ph.D.  
Vice President for Research  
The Pennsylvania State University  
304 Old Main  
University Park, PA 16802-1504

Dear Dr. Erickson:

This is in reference to your letter dated September 3, 1997 providing additional information on your decommissioning funding plan. We have no further questions at this time.

Please submit a revised letter of credit or a new statement of intent for the financial assurance of decommissioning funds.

If you have any questions regarding this letter, please call me at (610) 337-6952.

Sincerely,

*Original signed by Pamela J. Henderson*

Pamela J. Henderson  
Senior Health Physicist  
Nuclear Materials Safety Branch 2  
Division of Nuclear Materials Safety

Enclosure:  
Regulatory Guide 3.66

cc:  
Eric J. Boeldt, Radiation Safety Officer

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NAME	PHenderson							
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MS16  
P-6

3 Sep 97

U. S. Nuclear Regulatory Commission  
Region I  
Division of Nuclear Materials Safety  
475 Allendale Road  
King of Prussia, PA 19406-1415

Attn: Penny Lanzisera re: License No. 37-00185-04  
Docket No. 37-00952  
Control No. 1882

Dear Ms. Lanzisera:

This letter is in reply to your request of 21 Nov 96 for additional information in support of our revised decommissioning plan that was submitted on 31 Oct 96. The items are listed in the same numerical sequence as the items in your letter.

1. Over the past 37 years that I have been University Health Physicist radioisotope laboratories at this campus have routinely been decommissioned and very few instances of permanent contamination have been found. Specific records for decommissioning were not kept until recently. Laboratory "closeout" surveys were kept with routine surveys and were only retained for a limited time. However, I can only recall a few instances in which contamination was found in hood ductwork. One hood in the 1960's that was used with Tc-99 had low levels of removable contamination from a volatile form unexpected produced in a furnace and one within the last 10 years that had low levels of C-14 and Cs-137 contamination. The C-14 was from experiments in the late 1950's and early 1960's using large amounts of C-14 as carbon dioxide. The source of the Cs-137 was assumed to be from weapons fallout in the 1960's, because no Cs-137 had been used in the lab.

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SEPARATED OUT OF ~~121882~~  
8/21/98 SEP - 8 1997

We have recently started to keep specific records for decommissioning to comply with the new regulatory requirements. Since March of 1996 we have decommissioned 32 laboratories. These included 22 hoods and at least one sink per laboratory. The only contamination found was one sink trap with H-3 contamination (3000 dpm/ml). Four refrigerators had contamination on the internal surfaces (H-3 and C-14).

The surveys usually include a GSM survey and smear samples for fixed and removable contamination on benchtops and other work surfaces, floors, drawers and cabinets, walls, hood surface and accessible ductwork, sinks and sink traps. Radiation surveys are also conducted, but radiation is not a problem with the low levels of activity used in our laboratories. We do not attempt to sample ductwork or plumbing that is inaccessible. However, we do check ductwork, fans and plumbing when they are opened by maintenance personnel for repairs. We have not detected any significant contamination in these surveys.

The amount of time required for decommissioning the labs mentioned above (surveys, decontamination and waste removal) is estimated to be about 5 person-hours per lab. The laboratory with the H-3 contamination in the sink took about 21 hours because the investigator had left a large number of small samples and other material that required monitoring and some cleaning of work surfaces and storage areas was required. My recollection is that ductwork removal (ground floor to 4th floor penthouse), cleaning and preparation for disposal of the hood mentioned above with C-14 contamination took about 40-50 person-hours. Thus, I believe that my estimate of time for decontamination of hoods and sinks is conservative.

The total amount of waste generated by the University that requires offsite disposal (except for liquid scintillation vials) averages about 20 55-gallon drum every 2 years. This includes the usual decommissioning waste. Thus, I feel that my estimates of waste volume from sinks and hoods are also conservative.

2. As indicated in Item 1, our experience indicates that the estimates presented in our submission for decommissioning a typical university radioisotope laboratory are conservative. The laboratory used as a model in NUREG/CR-1754 is not at all like a typical university laboratory and is a completely unrealistic model for that purpose. The model does not consider that the normal conditions in university radioisotope laboratories are well below the limits for unrestricted release. These laboratories must be kept at levels that are appropriate for public access at all times. Decommissioning usually only requires removal of the radioactive material stocks and the waste containers. Little or no decontamination is required. We do not allow sewer disposal in our labs and very few experiments generate any airborne radioactive material to contaminate hoods and ductwork. Also, most of the activity used is short half-life radioactive material and there is no permanent contamination.
3. For the 32 laboratories mentioned in Item 1, the average area was about 55 square meters. We do not keep statistics on the wall area, but floor to floor spacing is usually about 4.3 meters. The average number of hoods per lab is about 0.7 and the number of sinks is probably about 1.5-2 per lab. However, the floor and wall areas are not relevant, if the surfaces are kept below release limits and do not require decontamination.
4. As evidenced by the information presented above, our estimates are conservative and a contingency factor is not needed. As stated above NUREG-1754 does not use a realistic model for university laboratories and is inappropriate to use for guidance.
5. No special equipment is necessary for the decommissioning, beyond what is already on hand. If special items are needed for concrete removal, etc. they will be rented and estimates that have been provided should cover such costs.
6. We have provided a cost estimate for packaging and shipping of transuranic sources. We have listed these sources for transfer to DOE, if their

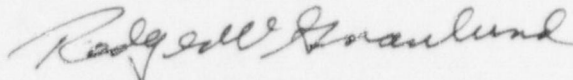


proposed source disposal program is funded. We have made no disposal estimate, because there is no data on which to make such an estimate.

7. The water in our Co-60 pool is at or below the release limit for effluents to unrestricted areas (it has about the same beta activity concentration as tap water). The pool liner is not contaminated and will not require disposal as radioactive waste.
8. Material possessed under the SNM-95 license is in the same category as in Item 6.

I will be retiring shortly and my responsibilities will be transferred to Eric Boeldt, Radiation Protection Manager. Questions on the above material should be directed to him. He can be reached at the same address and phone as are listed in the letterhead. Thank you for your consideration in this matter.

Sincerely,



Rodger W. Granlund  
University Health Physicist

NOV 21 1996

License No. 37-00185-04  
Docket No. 030-00952  
Control No. 121882

Rodger W. Granlund, RSO  
The Pennsylvania State University  
207 Old Main  
University Park, PA 16802-1503

Dear Mr. Granlund:

This is in reference to your letter dated November 5, 1996 with attached decommissioning funding plan dated October 31, 1996. The revised decommissioning funding plan provided revised cost estimates for License Nos. 37-00185-04, 37-00185-05, 37-00185-06, SNM-95, 37-13831-01, 37-13831-04, and R-2. As stated in your letter, a copy of the revised plan was sent to the Document Control Desk in Washington, DC to cover the research reactor license. This letter is in response to all additional licenses referenced. In order to continue our review, we need the following additional information:

1. In your plan, you state that "less than 5 laboratories have required the removal and disposal of sinks or fume hood components because of radioactive contamination", and therefore assume that "one laboratory in 50 will require the removal and disposal of a sink basin and trap and the interior of a hood plus the ductwork and fan." Please provide the basis for your assumption, including a description of: a) the total number of laboratories previously decommissioned; b) the types and depth of surveys conducted; c) the number of staff hours expended in decommissioning the laboratories; and d) the amount of waste generated.
2. Your estimated total person hours and radioactive waste generated appear low. For example, in Table A-2, you calculate that 56 person-hours is needed to decontaminate a sink and drain, and a fume hood with associated ventilation ductwork. However, as stated in NUREG/CR-1754, these same tasks would require approximately 98 person hours to decontaminate the same facility components. Also, in Table A-3, you estimate the waste generated from these tasks would be 3 barrels. NUREG/CR-1754 estimates that decommissioning the same components will generate 10 barrels after volume reduction.
3. Please provide information on the number of fume hoods and other laboratory components and the surface area of walls and floors. Regulatory Guide 3.66, Appendix F, Table 2, Item 2 may be used as guidance.

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**ML 10**

R. Granlund  
PennState

-2-

4. Your plan does not appear to incorporate a contingency factor into the total decommissioning cost estimate. Please provide. NUREG/CR-1754 uses a contingency factor of 25 percent and may be used as guidance.
5. This plan does not appear to include cost estimates for any special equipment that may be necessary in decommissioning nor a cost estimate for decommissioning the waste treatment and storage facility. Please provide. Appendix F to Regulatory Guide 3.66 may be used as guidance.
6. Please provide a cost estimate for disposing of sealed transuranic sources.
7. The cost estimate for decommissioning the cobalt-60 pool irradiator does not appear to include the cost of decontaminating or disposing of the pool liner or plumbing. NRC experience in this area has identified that liners and plumbing are often contaminated. Please review your cost estimate and revise the estimate to include the above items.
8. Please provide a cost estimate for disposing of material possessed under License No. SNM-95.

We will continue our review upon receipt of this information. Please reply in duplicate to my attention at the Region I Office and refer to Mail Control No. 121882. If you have any technical questions regarding this deficiency letter, please call me at (610) 337-5169.

Sincerely,  
**ORIGINAL SIGNED BY:**  
**PENNY A. LANZISERA**

Penny Lanzisera  
Division of Nuclear Materials Safety

License No. 37-00185-04  
Docket No. 030-00952  
Control No. 121882

Enclosures:

1. NUREG/CR-1754
2. Regulatory Guide 3.66

DOCUMENT NAME: R:\WPS\DLTR\D3700185.04

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NAME	Lanzisera <i>PL</i>						
DATE	11/21/96		11/ /96		11/ /96		11/ /96

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MS-16  
P6

5 Nov 96

U.S. Nuclear Regulatory Commission  
Region I  
Nuclear Materials Section B  
475 Allendale Road  
King of Prussia, PA 19406

Dear Sir or Madam:

Enclosed is a revision of the Decommissioning Funding Plan for all of the licenses issued to the Pennsylvania State University by the Nuclear Regulatory Commission. The NRC license numbers and docket numbers are listed below.

<u>LICENSE#</u>	<u>DOCKET #</u>
37-185-04	030-00952
37-185-05	030-07059
37-185-06	030-10645
SNM-95	70-113
37-13831-01	030-03203
37-13831-04	030-10851
R-2	50-05

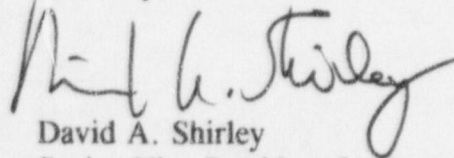
The basic plan has not changed substantially from that submitted to the NRC on 26 Jul 90. The estimates have been revised to reflect current disposal and labor costs. This has raised the total cost of decommissioning from \$862,000 to \$1,319,700. Most of the change is due to the increased cost of radioactive waste disposal.

A separate copy of the revised plan is being sent to the Document Control Desk in Washington, DC to cover the research reactor license number R-2.

The University maintains a letter of credit with Mellon Bank for financial assurance that decommissioning funds will be available, if needed. As soon as we have been notified that the revised cost estimates are acceptable, the letter of credit for the financial assurance of decommissioning funds will be replaced or amended for the new amount.

If you have any questions about the revised plan, please contact the University Health Physicist, Rodger W. Granlund at 814 865-3459, FAX 814 865-7225 or e-mail [rwg3@psu.edu](mailto:rwg3@psu.edu).

Sincerely,



David A. Shirley  
Senior Vice President for Research  
and Graduate Education

enc: Penn State University  
Decommissioning Funding Plan for  
Radiation Research Facilities

cc: NRC Document Control Desk  
K. Babe  
R. Granlund  
M. Klein  
K. Miller  
W. Witzig  
C. Yekel

**PENN STATE UNIVERSITY  
DECOMMISSIONING FUNDING PLAN  
for  
RADIATION RESEARCH FACILITIES**

REVISED 31 October 1996

Prepared by  
Rodger W. Granlund  
University Health Physicist

**PENN STATE UNIVERSITY  
DECOMMISSIONING FUNDING PLAN  
for  
RADIATION RESEARCH FACILITIES**

**INTRODUCTION**

In 1988 the Nuclear Regulatory Commission (NRC) adopted regulations requiring that licensees provide assurance that funds will be available to decommission facilities when the licenses are terminated. For facilities with existing licenses the effective date for compliance was 27 July 1990. The amount of the funds that must be set aside is determined by the amount and type of radioactive material allowed by the license. There are 4 basic categories, as determined by formulas published in the regulations. The amount to be set aside in these categories is \$0, \$75,000, \$150,000, or \$750,000. If the license exceeds the \$750,000 category, the licensee is required to submit a Decommissioning Funding Plan (DFP) to estimate the actual decommissioning costs and set aside that amount. The option to submit a DFP is also available for licenses in any of the other categories. The amounts to be set aside are separate and additive for each license. However, if a DFP is prepared it can include all the licenses in one plan.

Penn State University has five NRC licenses at University Park plus two licenses at the Hershey Medical Center. At least two of these licenses require a DFP. Thus, it is more cost effective to include all the licenses under one plan, and the estimate should be more accurate than using the formula quantities from the regulations.

There are a variety of ways to provide assurance that funds for decommissioning will be available. These include the following.

Prepaid deposits such as a trust fund, escrow account, certificate of deposit, government bond, or deposit of government securities.

A surety method such as a surety bond (open ended or with automatic renewal), letter of credit, or line of credit. A parent company guarantee-in the case of Penn State University, the State of Pennsylvania could provide the guarantee.

An external sinking fund coupled with a surety method, with the surety decreasing as the sinking fund increases.

The University has prepared estimates of the decommissioning costs associated with the NRC licenses issued for University Park and the Hershey Medical Center and has provided the assurance of the funds with a standby trust agreement and a letter of credit. Documentation for this was submitted to the NRC on 27 Mar 91. The estimated cost of decommissioning has increased with this revision of the plan, and the amount of the trust agreement and letter of credit will be revised on acceptance of the revised plan by the NRC.

Since the original plan was prepared in 1990, there have been a number of changes related to radioactive waste disposal facilities. Disposal sites in Nevada and Washington are closed or are no longer available to Pennsylvania licensees. The facility at Barnwell, SC was closed for a period of time, but it is currently available on a year-to-year basis to licensees outside the Southeast Compact. Some additional options for commercial incineration and super compaction are now available. The change with the most effect on the decommissioning cost estimate is the greatly increased unit cost for disposal. Increased labor costs and new requirements for stabilization or the use of high integrity containers (HICs) for waste with a high concentration of radioactive material have also increased the disposal cost. These changes have been incorporated into this revision of the plan to give an estimate for the cost of decommissioning as of October 1996.

## **DETERMINATION OF DECOMMISSIONING COSTS**

Several assumptions are made to determine the cost of decommissioning the facilities under each license. One is that all activities are terminated at the same time. This is very unlikely, but results in the maximum cost estimate. It is much more probable that activities would be gradually terminated over a period of at least several years. Decommissioning would occur while the staff is also performing normal activities, and the costs would be largely supported by the normal operating budget. The second assumption is that the health physics staff at University Park and the Hershey Medical Center would continue at present strength and would be responsible for the decommissioning of the facilities under the material licenses. The staff of the reactor facility would be responsible for decommissioning the reactor and associated equipment with support from the health physics staff for surveys, assays, monitoring and waste disposal. Work requiring heavy equipment or tradesmen would be done by the University Physical Plant. This is the way that such work is currently done. Cost estimates can then be made by estimating the time required for a given task by the staff involved and using the annual operating budget as the basis for the cost. It is, therefore, not necessary to list separately each individual involved and the fraction of time spent on each task.

Decommissioning is treated in the same manner as routine operations under the various licenses. It is quite common to cease radioisotope operations in campus laboratories and return the lab to service, without restrictions, for some other use. Because radioisotope laboratories are kept at contamination levels that allow unrestricted access, there is usually very little decontamination required. In the past 30 years there have only been a few instances when material such as bench tops, floor tile, or hood ducting has had to be removed. It is expected that some portions of the reactor pool and the waste processing areas will require removal of concrete or piping, and the estimates include such work.

Facilities that have been decommissioned are to be released for unrestricted use. Residual contamination, if any is present, is not to exceed the limits specified in Table I of Regulatory Guide 1.86. Costs for remodeling and renovation are not included. Costs are based on the current inventory of material and the number of facilities under each license. Except for disposal



of the reactor core, no license amendments are required for decommissioning, as the activities are the same as for normal operation. It is assumed that a licensed disposal site will be available for disposal of all material except reactor fuel and transuranics. The decommissioning costs are estimated for each license in separate appendices to this plan.

The cost to continue the services of the health physics and reactor staffs is calculated by estimating the time required to perform each task in terms of total person-hours. No distinction is made as to the job titles or salaries involved. The number of person-hours is multiplied by the average cost per person-hour for the operation of the Health Physics Office. The average cost per person-hour is arrived at by taking the annual budget for salaries (including a 25% overhead for fringe benefits) plus the annual budget for supplies and materials (not including waste disposal) and dividing by the number of person-hours worked per year. The same value is used for tradespersons contracted from the University Physical Plant and for the reactor staff.

The waste disposal cost estimates are based on price lists and quotations from brokers through October 1996. The charge for solid waste disposal is based on the average weight per drum of waste in past shipments and assumes that 1% is biological material, 25% will be processed by supercompaction and 74% will be incinerated by the broker.

The unit costs used for standard items are listed below.

**TABLE 1**  
**UNIT COSTS FOR DECOMMISSIONING AND DISPOSAL**

Solid waste	\$375/ft <sup>3</sup>
Waste disposed in high integrity containers	\$950/ft <sup>3</sup>
Liquid Scintillation Vials, deregulated	\$51/ft <sup>3</sup>
Liquid Scintillation Vials, regulated	\$73/ft <sup>3</sup>
Organic liquids	\$73/ft <sup>3</sup>
Hourly charge for health physics personnel and tradespersons	\$24/hr

In order to account for significant changes in decommissioning costs because of inflation, changes in the amount or type of radioactive material, or contamination of facilities, the appendix dealing with a specific license is to be reviewed when the license is amended or renewed. The complete plan is to be reviewed at least once every 3 years. The financial assurance is to be increased if the review indicates an increase in the estimated cost of greater than 20%. An application to reduce the financial assurance can also be made, if a review indicates that the estimated cost has decreased.

## SUMMARY

The estimated costs of decommissioning for each license are given in the appendices to this plan. The summary of all costs is given in Table 2.

**TABLE 2**  
**TOTAL DECOMMISSIONING COSTS**

<u>LICENSE</u>		<u>ESTIMATED COST</u>
37-185-04	Appendix A	\$477,000
37-185-05	Appendix B	\$71,400
37-185-06	Appendix C	\$61,000
SNM-95	Appendix D	\$12,000
R-2	Appendix E	\$224,800
37-13831-01	Appendix F	\$418,800
37-13831-04	Appendix G	\$54,700
<b>TOTAL</b>		<b>\$1,319,700</b>

The total decommissioning cost in this revision represents an increase of 53% over the \$862,000 value from the plan prepared in July 1990. Most the increase is because of increased costs for waste disposal.

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**APPENDIX A  
LICENSE 37-185-04****LICENSE DESCRIPTION**

This license is the broad byproduct material license for the University Park campus. The number of individual rooms covered by this license is about 250, including the radioisotope laboratories at the nuclear reactor facility and 1 laboratory at a Commonwealth Campus. A number of sealed sources are also covered by this license, and it allows the use of up to 200 Ci of irradiated components in the hot cells. Each item is covered separately below

**RADIOISOTOPE LABORATORIES**

In order to simplify the estimate for decommissioning the radioisotope laboratories, a Reference Radioisotope Laboratory (RRL) is described. This laboratory is a single room, and the decommissioning estimate is based on past experience with such laboratories. The estimate may be slightly low for a few laboratories that are very heavily used, but this is more than offset by the large number of rooms that contain only a liquid scintillation counter, a gas chromatography source, or microcurie quantities of radioisotopes. It is a routine matter for new radioisotope laboratories to be opened and former radioisotope laboratories to be decommissioned and returned to unrestricted use. When a laboratory is decommissioned, all radioactive material is removed, the room is surveyed for fixed and removable contamination, and all radiation and radioactive material labels and signs are removed. Any contaminated items are removed, with the exception of minor fixed contamination of floors and benchtops with short half-life isotopes, such as  $^{32}\text{P}$ . Hood ductwork and sink drains are not usually disassembled for checking, but are left labeled until the next time maintenance is required that involves access to these items.

For this plan it is assumed that the inside of the hood ductwork will be checked at the hood and exhaust ends. Likewise, sink drains will be checked with a sample from the sink trap. Contaminated plumbing or ductwork will be removed. The Health Physics Office routinely checks sink drains and exhaust hoods in radioisotope laboratories, when maintenance personnel are required to work on them. It is very rare that any contamination is found. In the past 30 years probably less than 5 laboratories have required the removal and disposal of sinks or fume hood components because of radioactive contamination. For the RRL it is assumed that one laboratory in 50 will require the removal and disposal of a sink basin and trap and the interior of a hood plus the ductwork and fan.

Small sealed sources, such as gas chromatography sources and calibration sources, from all labs will be packaged in one high integrity container for disposal. This container will also be used for small volumes of waste containing  $^3\text{H}$ ,  $^{14}\text{C}$ , and other radioisotopes at a concentration that exceeds the limits for unstable waste forms. The average waste volume requiring a high integrity container for disposal is 7.5 ft<sup>3</sup>/250 labs or 0.03 ft<sup>3</sup>/RRL. The time for packaging the high integrity container is included in the time estimate for the RRL in Table A-1.

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**TABLE A-1  
REFERENCE RADIOISOTOPE LABORATORY  
HEALTH PHYSICS STAFF TIME ESTIMATE  
FOR DECONTAMINATION AND SURVEYS**

<u>ITEM</u>	<u>PERSON-HOURS</u>
Retrieve laboratory records	1
Physical radioisotope inventory	2
Prepare and package inventory for disposal	4
Initial survey and decontamination	4
Final survey	4
Records and filing	2
Travel time (2 persons, 2 trips)	2
Removal of plumbing and ductwork (Table A-2)	1.1
Supervision	<u>2</u>
TOTAL	22

**TABLE A-2  
REFERENCE RADIOISOTOPE LABORATORY  
TIME ESTIMATE FOR  
PLUMBING AND DUCTWORK REMOVAL  
(Required for 1 lab in 50)**

<u>ITEM</u>	<u>PERSON-HOURS</u>
Remove sink and drain (tradesperson)	4
Remove hood interior (tradesperson)	4
Remove hood ductwork and fan (tradesperson)	32
Final survey	4
Travel time (2 persons, 4 trips)	8
Records and filing	2
Supervision	<u>2</u>
TOTAL FOR 50 LABS	56
AVERAGE PER RRL (56 PERSON-HOURS/50 LABS)	1.1

The amount of radioactive waste that will require disposal includes the waste already in the laboratory, that generated during decontamination, and the plumbing and ductwork for the sink and hood removed from 1 in 50 labs. It is assumed that the amount of solid waste collected during the decommissioning is equal to that normally collected from the laboratories during a one year period. This value is about 1000 ft<sup>3</sup>/250 labs or 4 ft<sup>3</sup>/RRL. It is assumed that 50% of the solid waste contains <sup>32</sup>P and that this waste is allowed to decay for 10 half-lives before disposal as nonradioactive material. The remainder is compacted and shipped offsite for disposal. This is an overestimate of the volume that would have to be shipped offsite, because decommissioning will probably occur over a time period long enough to allow for decay in storage of <sup>125</sup>I, <sup>35</sup>S, <sup>51</sup>Cr

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and other radioactive isotopes. An additional 0.4 ft<sup>3</sup> of solid waste is from hood ductwork and plumbing removal (20 ft<sup>3</sup> for 1 lab in 50).

The amount of liquid waste for disposal on decommissioning is also assumed to be about the same as that normally collected from the labs in a one year period. As with the solid waste, 50% is assumed to contain <sup>32</sup>P, which is held for decay. Our experience is that almost all aqueous liquid waste can be released to the sanitary sewer in conformance with 20 CFR 20.2003. This amounts to about 1500 gallons/250 labs in one year or 0.8 ft<sup>3</sup>/RRL. The amount of organic liquid waste collected in one year is about 100 gallons/250 labs (0.05 ft<sup>3</sup>/RRL). Of this amount, 50% is assumed to contain <sup>32</sup>P, which is held for decay and then disposed as nonradioactive waste (as hazardous material, if necessary). The remaining organic liquid waste is shipped offsite for incineration.

Liquid scintillation fluid is assumed to be collected and shipped for disposal in the vials (3000 vials/55-gallon drum) as deregulated material. Table A-3 lists the summary of the amount of waste disposed per RRL.

**TABLE A-3  
REFERENCE RADIOISOTOPE LABORATORY  
RADIOACTIVE WASTE FOR DISPOSAL**

<u>ITEM</u>	<u>FT<sup>3</sup></u>
<b>FOR SHIPMENT OFFSITE</b>	
Solid, 2 ft <sup>3</sup> , compact 3:1	0.67
Solid, sink and hood	0.40
Liquid, organic	0.025
High integrity container waste	<u>0.03</u>
Total for offsite shipment	1.1
<b>FOR DECAY AND ONSITE DISPOSAL</b>	
Solid, 2 ft <sup>3</sup>	2.0
Liquid, aqueous	0.8
Liquid, organic	<u>0.025</u>
Total for onsite disposal	2.8
<b>LIQUID SCINTILLATION FLUID</b>	
500 vials	1.2

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**HOT CELL FACILITY**

To date, the 2 hot cells at the reactor facility have only been used for sealed sources or irradiated components and no decontamination would be required to return the facilities to unrestricted use. Over the next few years some testing of irradiated components is planned that will generate some waste and might produce minor contamination of the cells and the ventilation system. The estimate assumes that the roughing and absolute filters will require disposal and that the cell and ductwork will require cleaning. Some waste may require disposal in high integrity containers, but all items should be within the limits for Type A shipping containers. The estimated time and waste volume for decommissioning the hot cells is given in Table A-4.

**TABLE A-4  
HOT CELL FACILITY**

<u>ITEM</u>	<u>PERSON-HOURS</u>	<u>WASTE FT<sup>3</sup></u>
Initial survey	16	
Filter removal and packaging	8	15
Package specimens and other waste	240	30
Waste requiring HIC		7
Decontamination	100	
Sample identification and assay	30	
Records and filing	8	
Supervision	<u>40</u>	
Total	442	<u>52</u>

**SEALED SOURCES**

Small sealed sources are included in the time and waste estimates for the RRL. The sealed sources that require special attention are a <sup>244</sup>Cm source and several <sup>241</sup>Am sources. A 3 Ci <sup>241</sup>Am source is stored in a neutron howitzer that is also a 7A shipping container and would require no additional packaging. The other <sup>241</sup>Am sources are mostly in moisture gauges, and the sources would be removed and shipped for disposal in a shielded 7A container or in the 7A package for the gauge. This assumes that a disposal site will be available for transuranics, which is presently not the case. Those sources that the manufacturer will accept will be returned for disposal. Otherwise, the sources will be packaged and stored until a disposal site is available. The estimated time and waste volume are given in Table A-5. No disposal cost is available for transuranics, because there is no disposal site available, so the disposal cost for high integrity containers is used for sealed sources.

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**TABLE A-5  
SEALED SOURCES**

<u>ITEM</u>	<u>PERSON-HOURS</u>	<u>WASTE FT<sup>3</sup></u>
Am-241, 3 Ci	4	3.
Am-241, other sealed sources	160	22.
<sup>241</sup> Cm	10	
Records and filing	10	
Supervision	<u>20</u>	
	TOTAL	<u>25.</u>
	204	

### WASTE DISPOSAL

The waste that is to be processed and disposed includes the waste discussed above, which is collected at the time of decommissioning, plus the waste that is in storage at the termination of activities. Most of the waste that is in storage is short half-life material that is being held for decay and would be disposed as nonradioactive material. For this plan, only the <sup>32</sup>P waste is considered in this category, all other waste would be shipped offsite for disposal. Disposal costs are listed in Table 1 of the plan. Table A-6 shows the estimates for processing time and the volume of waste.

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**TABLE A-6**  
**RADIOACTIVE WASTE DISPOSAL**

<u>ITEM</u>	<u>PROCESSING PERSON-HOURS</u>	<u>SHIPPED WASTE FT<sup>3</sup></u>
Disposal as nonradioactive waste		
Solid, in storage, 1300 ft <sup>3</sup>	400	
Liquid, in storage, aqueous, 80 ft <sup>3</sup>	50	
Liquid, in storage, organic, 7.5 ft <sup>3</sup>	20	
Solid, 2 ft <sup>3</sup> /RRL	250	
Liquid, aqueous, 0.8 ft <sup>3</sup> /RRL	250	
Liquid, organic, 0.025 ft <sup>3</sup> /RRL	20	
Shipment for disposal		
Solid, in storage, 700 ft <sup>3</sup> , compact 3:1	200	230
Liquid, in storage, organic	20	7.5
Solid, 0.67 ft <sup>3</sup> /RRL	180	170
Solid, plumbing and duct, 0.4 ft <sup>3</sup> /RRL	80	100
Liquid, 0.025 ft <sup>3</sup> /RRL, organic	20	6.3
Solid, HIC, 0.03 ft <sup>3</sup> /RRL	20	7.5
Solid, hot cell	30	52
Solid, hot cell, HIC	5	7
Sealed sources, HIC	20	25
Liquid scintillation fluid, in storage	100	100
Liquid scintillation fluid, 1.2 ft <sup>3</sup> /RRL	300	300
Shipment preparation	400	
Records and filing	60	
Supervision	<u>240</u>	
TOTAL	2665	<u>1005</u>
Subtotals for shipped waste		
Solid		552
HIC		39
Liquid, organic		14
Liquid scintillation fluid		400



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**TOTAL COST**

The total decommissioning cost for license 37-185-04 is summarized in Table A-7. Unit costs used in the estimates are listed in Table 1 of the plan.

**TABLE A-7  
COST ESTIMATE FOR LICENSE 37-185-04**

<u>ITEM</u>	<u>PERSON-HOURS</u>	<u>COST</u> <u>\$ x1000</u>
RRL, 250 labs @22 hr/RRL, Table A-1	5500	132.0
Hot cells, Table A-4	442	10.6
Sealed sources, Table A-5	204	4.9
Waste disposal, Table A-6	<u>2665</u>	<u>64.0</u>
Subtotal person-hours	8811	\$211.5
	<u>FT<sup>3</sup></u>	
Solid waste	552	\$207.0
Solid, HIC	39	\$37.1
Liquid, organic	14	\$1.0
Liquid scintillation fluid	<u>400</u>	<u>\$20.4</u>
Subtotal waste shipped	1005	\$265.5
	<b>TOTAL</b>	<b>\$477.0</b>

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**APPENDIX B  
LICENSE 37-185-05**

**LICENSE DESCRIPTION**

This license covers the Co-60 facility. It consists of a pool-type irradiation facility with rod sources with a current total activity of 2900 Ci. Lead-shielded steel casks are available for emergency storage of the sources, if the pool must be drained. The sources would probably be shipped for disposal in one or more of these containers inside an overpack. It would probably require 2 shipments at an estimated cost of \$26,000/shipment.

Other than the removal of the sources, very little decontamination is anticipated. The pool water contamination levels (< 5 pCi/l) are well below the release levels for <sup>60</sup>Co in water in 10CFR20 Appendix B, Table 3. Disposal of the resin in the demineralizer is included, even though the activity is insignificant. No disposal is planned for the pool liner or any plumbing. Table B-1 gives the summary of the decommissioning costs.

**TABLE B-1  
COBALT-60 FACILITY**

<u>ITEM</u>	<u>PERSON-HOURS</u>	<u>WASTE FT<sup>3</sup></u>
Initial surveys and assays	24	
Resin packaging	40	22
Load and ship sources	120	
Drain and clean pool	24	
Final survey	30	
Records and filing	20	
Supervision	<u>40</u>	
Total	298	<u>22</u>
	<u>COST</u>	
Person-hours	\$7,152	
Waste disposal	\$8,250	
Source disposal, 2 trips	\$56,000	
Total	<b>\$71,402</b>	

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**APPENDIX C**  
**LICENSE 37-185-06**

**LICENSE DESCRIPTION**

This license covers 2 Co-60 irradiators and 1 Cs-137 instrument calibration facility, as listed below.

	PRESENT ACTIVITY
	<u>Ci</u>
AECL Gammacell Model 200, <sup>60</sup> Co	570
AECL Gammacell Model 220, <sup>60</sup> Co	5200
J. L. Shepherd Model 78, <sup>137</sup> Cs	48

The irradiators would be disposed of by return to the manufacturer or by shipment of the irradiator shield and source unit to another licensee or to a disposal site. The cost estimate is based on the transfer of a Gammacell 220 and a Gammacell 100 irradiator to another licensee a few years ago, with an increase for inflation. The <sup>137</sup>Cs irradiator is small enough to be shipped in a 55-gallon drum overpack. The time estimates include the time to arrange the shipments, prepare the shields, and package the irradiators in the overpacks. Preparation of the shields requires removing the sheet metal shrouds and electrical controls and securing the sample drawer in place. Table C-1 gives the costs for disposal of these sources. No decontamination is necessary.

**TABLE C-1**  
**GAMMA IRRADIATORS**

<u>ITEM</u>	<u>PERSON- HOURS</u>	<u>DISPOSAL COST</u>
Gammacell 200		
Packaging and disposal	80	\$25,000
Gammacell 220		
Packaging and disposal	80	\$25,000
Cs-137 irradiator		
Packaging and disposal	40	\$ 5,000
Surveys	10	
Records and filing	10	
Supervision	30	
TOTAL	250	\$55,000
	\$6,000	
<b>TOTAL COST \$61,000</b>		

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**APPENDIX D  
LICENSE SNM-95**

**LICENSE DESCRIPTION**

This license covers all the special nuclear material not included in the reactor license R-2. Among the major items are 417 unused fuel elements from the Pathfinder power reactor. These are the property of the U.S. Department of Energy and will be returned to DOE as soon as DOE can arrange for the loan of certified shipping containers for the transfer. DOE will provide the containers and pay shipping charges. This license also includes 2500 kg of natural uranium in canned slugs for a subcritical reactor. This material would also be returned to DOE with the only charges for arranging shipping and packaging the material. No decontamination is required.

This license includes six 1 Ci and one 5 Ci  $^{239}\text{Pu}$ -Be neutron sources. These would also be returned to DOE. The University has a shipping container that could be used for the transfer of the 5 Ci source and the time estimate includes time to make a second, should that be required.

The other items on the license are various fission counters plus unsealed material containing about 0.182 mCi of  $^{235}\text{U}$ , 19 mCi of  $^{233}\text{U}$ , and several  $\mu\text{Ci}$  of  $^{239}\text{Pu}$  as alpha sources. This material would be disposed at a licensed disposal site or returned to DOE, depending on ownership. Although all the material would easily fit inside one 55-gallon drum, multiple containers will probably be required to meet transportation requirements. Only minimal decontamination of storage containers for the unsealed material will be required.

The estimated cost for transfer to the DOE is given in Table D-1. No estimate is made for disposal cost, because no disposal site is available for this material.

**TABLE D-1  
SPECIAL NUCLEAR MATERIAL LICENSE**

<u>ITEM</u>	<u>PERSON- HOURS</u>
Pathfinder fuel packaging	120
Natural uranium, 2500 kg, packaging	80
Pu-239-Be neutron sources, packaging	100
Other $^{233}\text{U}$ , $^{235}\text{U}$ , $^{239}\text{Pu}$ , packaging	20
Surveys	40
Shipping	80
Records and filing	20
Supervision	<u>40</u>
<b>Total</b>	<b>500</b>

**Total cost \$12,000**

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**APPENDIX E  
LICENSE R-2****LICENSE DESCRIPTION**

This license covers the Penn State Breazeale Reactor. Included in this section of the DFP are the reactor bay, the demineralizer room and the liquid waste evaporator. The decontamination option is used for the reactor facility, as opposed to entombment. It is assumed that any license amendments required for decommissioning have been obtained before decommissioning begins. The decommissioning costs for radioisotope laboratories in the reactor facility are included in Appendix A.

**REACTOR BAY**

The first step in decommissioning will be to remove all fuel and return it to the DOE. The cask for this and the transportation will be paid for by the DOE. It is assumed that the University will be responsible for costs involved in loading the fuel, such as crane rental, surveys, and personnel costs for arranging the transfer. The water in the pool can be released to the sanitary sewer as the concentration of radionuclides is normally less than 1% of the limits in 10CFR20 Appendix B for such release, after a decay time of 1 week. With the additional decay time and continued operation of the demineralizer system until the fuel is removed, concentrations would be even lower.

During this period experimental apparatus with contamination or activation could be removed and packaged for disposal. Items without contamination or activation could be surveyed and released. After the fuel is removed from the reactor core and stored in the fuel storage racks, the south side of the pool can be drained, and cleaning of the pool and disassembly of the reactor bridge started. The lower part of the tower will have to be packaged in drums with concrete shielding. The grid plate will probably have to be cut into two or more pieces to fit the shipping containers. This will require portable shielding and remote tools to reduce personnel exposure. Additional items that will require cutting for disposal are the lead shield on the pool floor below the reactor core and the D<sub>2</sub>O tank.

Because the low concentration of contaminants in the pool water, decontamination should not be difficult. Activation of the concrete directly below the normal operating position of the reactor core and around the central beam tube may make removal of some concrete necessary. The cost estimate includes removal of 100 ft<sup>3</sup> of concrete. Only the central beam port has been used in recent years, and removal of the other ports should not be necessary. Table E-1 lists the estimates for the tasks in the reactor bay.

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**TABLE E-1  
REACTOR BAY**

<u>ITEM</u>	<u>PERSON- HOURS</u>	<u>EQUIPMENT</u>	<u>WASTE FT<sup>3</sup></u>
<b>FUEL SHIPMENTS (5)</b>			
Cask arrangements & QA	400		
Cask transfers to pool	400	\$10,000	
Cask loading	200		
Surveys and assays	200		
Records and filing	40		
Supervision	<u>200</u>		
<b>SUBTOTAL</b>	1440	<u>\$10,000</u>	
<b>CONCRETE REMOVAL</b>			
Tradespersons	<u>400</u>	\$5,000	120
Surveys and assays	100		
Cleaning	100	\$1,000	15
Records and filing	20		
Supervision	<u>100</u>		
<b>SUBTOTAL</b>	720	<u>\$6,000</u>	<u>135</u>
<b>D<sub>2</sub>O TANK</b>			
Package D <sub>2</sub> O	20		
Shipping & QA	100		
Assays	20		
Records and filing	20		
Supervision	<u>20</u>		
<b>SUBTOTAL</b>	180		
<b>COMPONENT REMOVAL</b>			
Packaging	100		22
Surveys and assays	100		
Records and filing	20		
Supervision	<u>20</u>		
<b>SUBTOTAL</b>	240		<u>22</u>
<b>OTHER BUILDING SURVEYS AND DECONTAMINATION</b>			
Surveys and assays	200		
Cleaning	<u>100</u>		
<b>SUBTOTAL</b>	300		
<b>REACTOR BAY TOTALS</b>	2880	\$16000	157

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**DEMINERALIZER ROOM**

This room contains the water handling system for the reactor, including the demineralizer, filter, heat exchanger and associated pumps. The demineralizer resin and the filter will require disposal. It may be possible to decontaminate the filter holder and demineralizer tank, but the cost estimate assumes that these items will be cut up and packaged for disposal. The heat exchanger and other plumbing should require only minimal cleaning for unrestricted release. Table E-2 lists the items in the cost estimate.

**TABLE E-2  
DEMINERALIZER ROOM**

<u>ITEM</u>	<u>PERSON-HOURS</u>	<u>WASTE FT<sup>3</sup></u>
Initial surveys and assays	40	
Package resins	100	22
Package filter	20	7
Package demineralizer	100	22
Final surveys	30	
Records and filing	10	
Supervision	<u>20</u>	
DEMINERALIZER ROOM TOTALS	320	<u>51</u>

**WASTE WATER EVAPORATOR**

This facility consists of a steel shed housing an evaporator, a stainless steel lined holdup tank, and a small tank used for the final evaporation of concentrate from the evaporator. A 1000 gallon underground suspect tank is located beside the shed. These tanks have contained relatively low concentration waste water in recent years and they might meet release criteria without decontamination. However, the estimate includes disposal of the tanks and the evaporator as radioactive waste. A 6000 gallon fiberglass distillate tank is also buried near the shed. This tank is used to store the distillate from the evaporator for use as reactor makeup water. It has not been exposed to contaminated water and decontamination should not be necessary. There may be minor contamination in the underground piping for the waste tanks. The piping will be checked for contamination at the accessible ends and, where possible, with small radiation detectors inside the piping. Table E-3 gives the estimates for the waste water evaporator.

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**TABLE E-3  
WASTE WATER EVAPORATOR**

<u>ITEM</u>	<u>PERSON- HOURS</u>	<u>EQUIPMENT</u>	<u>WASTE FT<sup>3</sup></u>
Initial surveys and assay	50		
Package suspect tank	100	\$500	22
Package holdup tank	50	\$500	22
Package evaporator	100		15
Package plumbing	50		22
Package concentrate tanks	100		22
Final surveys	30		
Reports and filing	20		
Supervision	<u>100</u>		
<b>TOTAL</b>	<b>600</b>	<b>\$1000</b>	<b>103</b>

**REACTOR FACILITY TOTAL**

Table E-4 lists the total decommissioning cost estimate for the reactor.

**TABLE E-4  
REACTOR TOTAL COST**

<u>ITEM</u>	<u>PERSON HOURS</u>	<u>EQUIPMENT</u>	<u>WASTE FT<sup>3</sup></u>
Reactor bay	2880	\$16,000	157
Demineralizer room	320		51
Waste water evaporator	<u>600</u>	<u>\$ 1,000</u>	<u>103</u>
<b>TOTALS</b>	<b>3800</b>	<b>\$17,000</b>	<b>311</b>
	<b>\$91,200</b>		<b>\$116,625</b>

**TOTAL COST \$224,825**



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**APPENDIX F**  
**LICENSE 37-13831-01**

**LICENSE DESCRIPTION**

This license is the broad byproduct material license for the Hershey Medical Center at Hershey, PA. Excluding nuclear medicine, there are almost the same number of radioisotope laboratories (rooms) under this license as are under the broad byproduct material license for the University Park Campus (Appendix A). The waste disposal program and the operation of the laboratories are also very similar at both campuses. Therefore, the same estimates for decommissioning and disposal are used for the Hershey Medical Center as for the University Park Campus. The hot cell items are deleted, because there are no hot cells at the Hershey Medical Center. The data for sealed sources was also adjusted to account for the smaller number of  $^{241}\text{Am}$  sources (one 100 mCi and one 12 mCi) at the Hershey Medical Center.

**TABLE F-1**  
**RADIOACTIVE WASTE DISPOSAL**  
**HERSHEY MEDICAL CENTER**

<u>ITEM</u>	<u>PROCESSING</u> <u>PERSON-HOURS</u>	<u>SHIPPED</u> <u>WASTE</u> <u>FT<sup>3</sup></u>
Disposal as nonradioactive waste		
Solid, in storage, 1300 ft <sup>3</sup>	400	
Liquid, in storage, aqueous, 80 ft <sup>3</sup>	50	
Liquid, in storage, organic, 7.5 ft <sup>3</sup>	20	
Solid, 2 ft <sup>3</sup> /RRL	250	
Liquid, aqueous, 0.8 ft <sup>3</sup> /RRL	250	
Liquid, organic, 0.025 ft <sup>3</sup> /RRL	20	
Shipment for disposal		
Solid, in storage, 700 ft <sup>3</sup> , compact 3:1	200	230
Liquid, in storage, organic	20	7.5
Solid, 0.67 ft <sup>3</sup> /RRL	180	170
Solid, sink and hood, 0.4 ft <sup>3</sup> /RRL	80	100
Liquid, 0.025 ft <sup>3</sup> /RRL	20	6.3
Solid, HIC, 0.03 ft <sup>3</sup> /RRL	20	7.5
Sealed sources, HIC	20	7.5
Liquid scintillation fluid, in storage	100	100
Liquid scintillation fluid, 1.2 ft <sup>3</sup> /RRL	300	300
Shipment preparation	400	
Records and filing	60	
Supervision	<u>240</u>	
TOTAL	2630	<u>929</u>

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Subtotal for shipped waste	<u>FT<sup>3</sup></u>
Solid	500
HIC	15
Liquid, organic	14
Liquid scintillation fluid	400

**TOTAL COST**

The total decommissioning cost for license 37-13831-01 is summarized in Table F-2. Unit costs used in the estimates are listed in Table 1 of the plan.

**TABLE F-2**  
**COST ESTIMATE FOR LICENSE 37-13831-01**

<u>ITEM</u>	<u>PERSON-HOURS</u>	<u>COST</u> <u>\$ x1000</u>
RRL, 250 labs @22 hr/RRL, Table A-1	5500	\$132.0
Sealed sources	20	\$ 0.5
Waste disposal, Table A-6	<u>2630</u>	<u>\$63.1</u>
Subtotal person-hours	8150	\$195.6
	<u>FT<sup>3</sup></u>	
Solid waste	500	\$187.5
Solid, HIC	15	\$14.3
Liquid, organic	14	\$1.0
Liquid scintillation fluid	<u>400</u>	<u>\$20.4</u>
Subtotal waste shipped	1005	\$223.2
	<b>TOTAL</b>	<b>\$418.8</b>

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**APPENDIX G  
LICENSE 37-13831-04**

**LICENSE DESCRIPTION**

This license covers one AECL Model 220 Gammacell irradiator at the Hershey Medical Center with a present activity of about 300 Ci of <sup>60</sup>Co. This unit is scheduled to be replaced with a new Gammacell 220 irradiator. The old irradiator will be returned to the manufacturer. An additional self-shielded <sup>137</sup>Cs irradiator is expected to be added to this license within a few months and is included in the estimate. Decommissioning costs are assumed to be the same as for the Gammacell irradiators at the University Park campus, as shown in Appendix C. The estimated cost is shown below in Table G-1.

**TABLE G-1  
GAMMACELL 220 IRRADIATOR**

<u>ITEM</u>	<u>PERSON- HOURS</u>	<u>DISPOSAL COST</u>
Gammacell 220		
Packaging and disposal	80	\$25,000
<sup>137</sup> Cs irradiator		
Packaging and disposal	80	\$25,000
Surveys	8	
Records and filing	8	
Supervision	<u>20</u>	
TOTAL	196	<u>\$50,000</u>
	\$4,704	

**TOTAL COST \$54,704**

BETWEEN:

License Fee Management Branch; ARM  
and  
Regional Licensing Sections

Program Code: 01100  
Status Code: 2  
Fee Category: EX 3L 2C 1D  
Exp. Date: 19950630  
Fee Comments: 170.11(A)(4)  
Decom Fin Assur Req: Y

LICENSE FEE TRANSMITTAL

A. REGION **I**

1. APPLICATION ATTACHED

Applicant/Licensee: PENNSYLVANIA STATE UNIVERSITY (THE)  
Received Date: 980821  
Docket No: 3000952  
Control No.: 126017  
License No.: 37-00185-04  
Action Type: Fin. Assurance

2. FEE ATTACHED

Amount: \_\_\_\_\_  
Check No.: \_\_\_\_\_

3. COMMENTS

*SEPARATED OUT OF 121882.*

Signed *M. A. Perkins*  
Date *8/21/98*

B. LICENSE FEE MANAGEMENT BRANCH (Check when fee is paid)

**FEE NOT REQUIRED**  
*EX 3L 2C 1D 7A*

1. Fee Category and Amount: \_\_\_\_\_

2. Correct Fee Paid. Application may be processed for:

Amendment   
Renewal \_\_\_\_\_  
License \_\_\_\_\_

3. OTHER \_\_\_\_\_

Signed \_\_\_\_\_  
Date \_\_\_\_\_

RECEIVED BY LFDCB	
Date	<i>8/25/98</i>
Loc	<i>Aug 2 I EB</i>
By	<i>EA</i>
Date Completed	<i>8/25/98</i>