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March 24, 2016

U.S. Nuclear Regulatory Commission

Attn.: Dennis Lawyer
Health Physicist
Division of Nuclear Material Safety
Region 1
Licensing Assistance Team

2100 Renaissance Boulevard
Suite 100
King of Prussia, PA 19406-2713

Reference: License No. 52-25361-02
Docket Number 03038114
Mail Control Number 588543
Updated Facility Decontamination and Decommissioning Cost Estimate

Dear Mr. Lawyer:

Attached is an updated decontamination and decommissioning cost estimate for the Lantheus Medical Imaging Radiopharmacy facility located at 150 Frederica Costa Street (Suite 1) San Juan, Puerto Rico.

As the Radiation Safety Officer and Director of Environment, Health and Safety at Lantheus Medical Imaging's home office, my staff and I collaborated with Philotechnics, Ltd. to develop an updated facility decontamination and decommissioning cost estimate (DDCE) to supersede the DDCE provided to your office dated December 2015.

The attached, updated DDCE compiled by Philotechnics addresses the inconsistencies identified within the December 2015 document, which impacted the accuracy and magnitude of the overall cost estimate. As discussed, Lantheus Medical Imaging will retain the current financial assurance surety value at \$553,472, pending approval of the attached DDCE dated March 23, 2016.

Please contact me by telephone or email if you have any questions or require additional documentation concerning this matter.

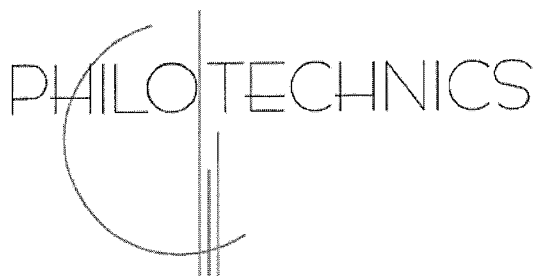
A handwritten signature in cursive script, reading "Roy Greaves", written over a horizontal line.

Roy Greaves, Radiation Safety Officer
Director, Environment Health and Safety

**Decontamination and Decommissioning
Cost Estimate
for
Nuclear Pharmacy**

Lantheus Medical Imaging
150 Frederica Costa Street, Suite #1
San Juan, Puerto Rico

Prepared by:



Philotechnics, Ltd.
201 Renovare Boulevard
Oak Ridge, TN 37830

March 23, 2016

I. Executive Summary

Lantheus Medical Imaging, Inc. (Lantheus) operates a Radiopharmacy facility in San Juan, Puerto Rico under the authority of U.S. Nuclear Regulatory License Number 52-25361-02. To estimate future decommissioning costs, Lantheus contracted Philotechnics, Ltd. to develop facility decommissioning cost estimates in accordance with the guidance provided in NUREG 1757, Consolidated NMSS Decommissioning Guidance". The facility consists of a nuclear pharmacy, a Siemens RDS Eclipse 11MeV self-shielded cyclotron producing F-18 under NRC License Number 52-25361-02, and radiopharmaceutical preparation, dispensing, Quality Control, and final packaging-for-transport rooms governed under NRC License Number 52-25361-01MD. Radionuclides handled (F-18) are short-lived. No long-lived radioactive contamination is expected to be detected within the facility during decommissioning activities, with the exception of some internal cyclotron components and the external cyclotron shielding component.

Philotechnics had developed a detailed cost estimate in 2009 which incorrectly included decommissioning of the entire facility including the operations governed under NRC License Number 52-25361-01MD and updated it in 2012. Because the facility configuration and authorized uses of radioactive materials are essentially unchanged since that time, this report describes only the process of updating the cost estimate to reflect only the portion of the facility and activities covered by NRC License Number 52-25361-02. As such, this report should be used as an addendum to the detailed report developed in March 2009.

Major cost changes result from reductions in waste volumes and waste characteristics along with changes in labor rates and waste disposal costs.

Cost estimates were developed using conservative assumptions regarding the likely extent and duration of remediation activities. Remediation was assumed to proceed to unrestricted release. Cost estimates were prepared in accordance with and in the format of NUREG 1757 "Consolidated NMSS Decommissioning Guidance"¹ Volume 3. Per NUREG 1757 a contingency of 25% is required to be added to decommissioning estimates to address unidentified and unanticipated conditions. The overall estimate for the San Juan facility is:

Estimate	25% Contingency	TOTAL
\$436,610	\$109,152	\$545,762

II. Cost Update Process

Cost estimates for decommissioning activities were based on the methodology contained in the US Nuclear Regulatory Commission's (NRC) NUREG 1757 and 10 CFR 30.35. This methodology was modified and supplemented as necessary to account for realities associated with project field implementation at the San Juan site.

Radioactive Waste Management

Philotechnics provides waste brokerage and decontamination and decommissioning (D&D) services throughout the nation. The estimated costs for packaging, transportation and disposal, as well as labor needs, are realistic estimates based on experience and contractual arrangements with waste processors and disposal facilities.

Realistic assumptions were made concerning the likely extent and duration of necessary remedial activities. Remediation to unrestricted levels (i.e., the facility could be released for any future use without restrictions) was assumed, meaning there are no long term costs associated with site surveillance and monitoring following decommissioning.

The radioactive materials of concern at this site are primarily short-lived radiopharmaceutical products and potentially a small volume of long-lived activation products within the cyclotron internal target system and within some localized areas of the cyclotron shielding. Decommissioning activities are assumed to begin within a few months after cyclotron operation ceases; short-lived radiopharmaceutical products and the majority of cyclotron activation products will have decayed to negligible levels.

All waste resulting from the activated cyclotron internal components and external shielding will likely be shipped to Energy Solutions in Oak Ridge Tennessee for processing and final disposal at Clive, Utah. Estimated price is \$0.60 per pound for Bulk Survey for Release and \$6.25 per pound for metal and dry active waste (DAW) process and disposal. These prices include disposal and contractor markup. No credit is taken for potential salvage or resale value of the cyclotron or any of its components.

All waste will fit into two (2) 20-foot sealand containers. We estimate the cost for ocean transport of waste at \$25,000 per container. Because of the weight of the waste, highway transportation from Miami to Oak Ridge will require two trucks.

Decommissioning Labor Cost

Decommissioning is assumed to be performed by an independent contractor; therefore, labor rates are indicative of CONUS average salaries for the labor categories applicable to the decommissioning project. Annual salaries reflect wages published in May 2014 by the U.S. Department of Labor, Bureau of Labor Statistics (BLS). This is the most recent data available. Specifically, the following labor categories and salaries are used:

Job Title	Value	Occupation Code, Location
Project Manager	\$94,950	11-9021, USA Average
Shipper	\$57,530	53-1031, USA Average
HP Technician	\$75,960	19-4099, USA Average
Skilled Laborer	\$42,730	47-4041, USA Average
Admin	\$34,500	43-6014, USA Average

Living expenses are taken from U.S. Department of Defense per diem rates published September 2015. The per diem rate is \$283 per day for San Juan. All project staff are paid the daily living allowance since they are assumed to be from outside the local area. The daily living expenses were multiplied by 7 days per week then divided by 5 workdays per week to correctly incorporate living expenses into the daily wage rate.

This decommissioning plan will be evaluated at least every 3 years or more frequently if the amounts or types of material at the facility change, facility conditions or operations change, changes occur in expected decommissioning procedures, or to account for inflation.

3.4 FACILITY DECOMMISSIONING SUMMARY

Radioactive Material license numbers and types (i.e., Byproduct, Source):
U.S. Nuclear Regulatory Licenses 52-25361-01MD and 52-25361-02
Types and quantities of materials authorized under the licenses listed above:
<ul style="list-style-type: none">A. F-18 is produced in quantities of 30 Curries maximum.B. Any byproduct material atomic numbers 1-83 as incidentally activated products; 30 mCi each, 1 Ci total.C. Mn-54 as incidentally activated products, 200 mCi maximum.D. Co-60 as incidentally activated product, 100 mCi total.E. Zn-65 as incidentally activated products, 100 mCi maximum.G. Any byproduct material permitted within 10 CFR 35.65(a) as sealed sources, 50 mCi maximum.
The facility is in operation. Therefore, activation products are present in the internal cyclotron target components, and within cyclotron shielding materials.
Description of how licensed materials are used:
Fluorine-18 is produced on the cyclotron and processed, dispensed, and packaged for off site shipment and use. Radioactive waste is held for decay and does not accumulate more than a few drums.
Description of facility, including buildings, rooms, grounds, and description of where particular types of materials are used:
The facility consists of the Cyclotron room, maintenance area (including cooling system) and the radiochemistry/pharmacy labs. Negative ventilation removes air from the cyclotron room and discharges on the roof through a high efficiency particulate air (HEPA) filter. Total area of these rooms is approximately 3500 square feet. The cyclotron room contains the RDS Eclipse cyclotron including spent target material, laboratory benches, and accumulated waste. The radiochemistry area contains laboratory benches and three hot cells. All radioactive material in radiochemistry and pharmacy areas is short-lived. None of that equipment is expected to become radioactive waste.
Quantities of materials or waste accumulated before shipping or disposal
A few drums of short lived waste to allow for decay. Waste storage space is minimal.

Use this table to summarize relevant features of the facility. Copy and complete the table as necessary for each room, laboratory, or area. Rooms laboratories, or areas with similar levels of contamination may be consolidated into one table.

Name of room, laboratory, or area:		Cyclotron and cyclotron shielding shielding		
Level of Contamination:		Low; some activated equipment and structures		
Component	Number of Components	Dimensions of Component (specify units)	Total Dimensions (specify units)	
Glove Boxes				ft3
Fume Hoods				ft3
Lab Benches				ft3
Sinks				ft3
Drains				ft3
Floors				ft2
Walls				ft2
Ceilings				ft2
Ventilation/Ductwork				ft3
Hot Cells				ft3
Equipment/Materials			82000	lb
Soil Plots				ft2
Storage Tanks				ft3
Storage Areas				ft3
Radwaste Areas				ft3
Scrap Recovery Areas				ft3
Maintenance Shop				ft3
Equipment Decon Areas				ft3
Concrete shields				lb
Concrete floor				ft3
Feature/Equipment Mass			82000	lb
Waste Fraction			1.00	
Waste Mass			82000	lb

Use this table to summarize relevant features of the facility. Copy and complete the table as necessary for each room, laboratory, or area. Rooms laboratories, or areas with similar levels of contamination may be consolidated into one table.

Name of room, laboratory, or area:	Balance of F-18 production facility, minus cyclotron and shielding			
Level of Contamination:	Low, likely none			
Component	Number of Components	Dimensions of Component (specify units)	Total Dimensions (specify units)	
				ft3
				ft3
Lab Benches/tables/casework	1		750	ft3
Sinks	2		6	ft3
Drains	1		3	ft3
Floors	0		3425	ft2
Walls	0		7250	ft2
Ceilings	0		3425	ft2
Ventilation/Ductwork	1		232	ft3
Hot Cells	3		244	ft3
Equipment/Materials			1000	ft3
Soil Plots	0		0	ft2
Storage Tanks			0	ft3
Storage Areas			0	ft3
Radwaste Areas			75	ft3
Scrap Recovery Areas			0	ft3
Maintenance Shop			0	ft3
Equipment Decon Areas			0	ft3
Concrete shields			0	lb
Concrete floor				ft3
Feature/Equipment Volume			2235	ft3
Waste Fraction			0.01	
Waste Volume			22.35	ft3
Density (lb/ft3)			10	
Waste Mass			223.5	lb

3.6 PLANNING AND PREPARATION

(Work Days)

Estimate the number of workdays, by specific labor category, that will be required to complete planning and preparation activities. Include all labor categories, including Supervisor, Foreman, Craftsman, Technician, Health Physicist, Laborer, Clerical, and others as needed.						
Activity	Project Mgr/Health Physicist		Shipper	HP Technician	Radiation Workers	Clerical
Preparation of Documentation for Regulatory Agencies	2		5			1
Submittal of Decommissioning Plan to NRC when required by 10 CFR 30.36(g)(1), 40.42(g)(1), or 70.38(g)(1)	2					0.5
Development of Work Plans	5			2		5
Procurement of Special Equipment	5					1
Staff Training	2		1	2	6	2
Characterization of Radiological Condition (including sampling, soil and tailings analysis, or groundwater analysis, if applicable)	2			4		
Other (specify) Mobilization	1		1	2		
TOTALS	19		7	10	6	9.5

3.7 DECONTAMINATION OR DISMANTLING OF RADIOACTIVE FACILITY COMPONENTS (Work Days)

Estimate the number of workdays, by specific labor category, that will be required to complete decontamination and/or dismantling activities for each facility component. Copy and complete this table as necessary for each room, laboratory, or area. Rooms, laboratories, or areas with similar levels of contamination may be consolidated in one table.

Name of room, laboratory, or area:							
Level of Contamination:		Low					
Component	Decon Method	Project Mgr/Health Physicist		Shipper	HP Technician	Radiation Workers	Clerical
Glove Boxes	Remove/Disp						
Fume Hoods	Remove/Disp	1		1	2	2	1
Lab Benches	Remove/Disp				2	2	0.1
Sinks	Remove/Disp	0.25			0.25	0.25	0.1
Drains	Remove/Disp				0.25	0.25	0.1
Floors	Scabble				1	2	0.1
Walls	Remove/Disp				1		0.1
Ceilings	Vac/Wipe				1		0.1
Ventilation/Ductwork	Remove/Disp	2		1	2	4	0.5
Hot Cells	Remove/Disp	3		2	4	8	1
Equipment/Materials	Sur/Rem/Disp	4		2	6	18	0.1
Soil Plots	Sample						
Storage Tanks	N/A						
Storage Areas	Remove/Disp						
Radwaste Areas	Remove/Disp	0.25		0.5	0.5	1	0.25
Scrap Recovery Areas	N/A						
Maintenance Shop	Remove/Disp						
Equipment Decontamination	Remove/Disp						
Shield blocks	Remove/Disp	2		5	4	8	2
Cyclotron	Remove/Disp	2		5	4	8	2
TOTALS		14.5		16.5	28	53.5	7.45

3.8 RESTORATION OF CONTAMINATED AREAS ON FACILITY GROUNDS (Work Days)

Estimate the number of work days, by specific labor category, that will be required to restore contaminated areas on the facility grounds.						
Activity	Project Mgr/Health Physicist		Shipper	HP Technician	Radiation Workers	Clerical
Restore Floors						
Restore Walls						
Restore Roof						
Restore Utilites						
TOTALS	0		0	0	0	0

3.9 FINAL RADIATION SURVEY

(Work Days)

Estimate the number of work days, by specific labor category, that will be required to conduct a final radiation survey.						
Activity	Project Mgr/Health Physicist		Shipper	HP Technician	Radiation Workers	Clerical
FSS Setup	2					1
Survey Packages	1					1
Class 1	5			10		1
Class 2	2.5			5		0.5
Class 3	2.5			5		0.5
TOTALS	13		0	20	0	4

3.10 SITE STABILIZATION AND LONG-TERM SURVEILLANCE (Work Days)

Estimate the number of work days, by specific labor category, that will be required to complete site stabilization and long-term surveillance activities.						
Activity	Project Mgr/Health Physicist		Shipper	HP Technician	Radiation Workers	Clerical
TOTALS	0		0	0	0	0

3.11 TOTAL WORK DAYS BY LABOR CATEGORY

Enter the total work days for each specific labor category from the applicable table above (i.e., from the bottom rows of Tables 3.6 through 3.10).						
Task	Project Mgr/Health Physicist		Shipper	HP Technician	Radiation Workers	Clerical
Planning and Preparation (TOTALS from Table 3.6)	19		7	10	6	9.5
Decontamination and/or Dismantling of Radioactive Facility Components (Sum of TOTALS from all copies of Table 3.7)	14.5		16.5	28	53.5	7.45
Restoration of Contaminated Areas on Facility Grounds (TOTALS from Table 3.8)	0		0	0	0	0
Final Radiation Survey (TOTALS from Table 3.9)	13		0	20	0	4
Site Stabilization and Long-Term Surveillance (TOTALS from Table 3.10)	0		0	0	0	0

3.12 WORKER UNIT COST SCHEDULE

Estimate labor costs (including salary, fringe benefits, and corporate overhead). Include all appropriate labor categories, including Supervisor, Foreman, Craftsman, Technician, Health Physicist, Laborer, Clerical, and others as needed.						
Labor Cost Component	Project Mgr/Health Physicist		Shipper	HP Technician	Radiation Workers	Clerical
Salary (\$/year)	\$94,950		\$57,530	\$75,960	\$42,730	\$21,490
Overhead Rate (%)	100%		100%	100%	100%	100%
Total Cost Per Year	\$189,900		\$115,060	\$151,920	\$85,460	\$42,980
Living Expenses (PD*7/5) ¹	\$396		\$396	\$396	\$396	0
Total Cost Per Work Day ²	\$1,127		\$839	\$981	\$725	\$165

¹ Per Diem Rate: \$283 per day.

² Based on 260 work days per year (e.g., 260).

3.13 TOTAL LABOR COSTS BY MAJOR DECOMMISSIONING TASK

Multiply the estimated work days for each specific labor category (from Table 3.11) by the total cost per work day for the corresponding labor category (from Table 3.12), and enter the results in the table below. Then, add across all labor categories to determine the total labor costs for each major decommissioning task.

Labor Cost Component	Project Mgr/Health Physicist	0	Shipper	HP Technician	Radiation Workers	Clerical	Total Labor Cost
Planning and Preparation	\$21,405	\$0	\$5,871	\$9,805	\$4,349	\$1,570	\$43,001
Decontamination and/or Dismantling of Radioactive Facility Components	\$16,335	\$0	\$13,839	\$27,454	\$38,782	\$1,232	\$97,642
Restoration of Contaminated Areas on Facility Grounds	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Final Radiation Survey	\$14,646	\$0	\$0	\$19,610	\$0	\$661	\$34,917
Site Stabilization and Long- Term Surveillance	\$0	\$0	\$0	\$0	\$0	\$0	\$0

3.14 PACKAGING, SHIPPING, AND DISPOSAL OF RADIOACTIVE WASTES (Excluding Labor Costs)

(a) Packing Material Costs

Estimate the types and volumes of waste expected to be generated, along with the number and types of containers required for packaging the waste. Multiply the number of containers required by the unit cost per container.

Waste Type	Volume (ft3)	Number of Containers	Type of Containers	Unit Cost of Container	Total Packaging Costs
DAW	22	0.1	20' Sealand	\$2,200	\$220
Concrete	0	0	0	\$0	\$0
Activated Cyclotron Shield, 60,000 lbs composite material	1000	1.5	20' Sealand	\$2,200	\$3,300
Metal	220	0.5	20' Sealand	\$2,200	\$1,100
TOTAL					\$4,620

(b) Shipping Costs

Estimate the types and volumes of waste expected to be generated, along with the number and types of containers required for packaging the waste. Multiply the number of containers required by the unit cost per container.

Waste Type	Number of Truckloads	Unit Cost (\$/mile/truckload)	Ocean Transport*	Overweight Charges (\$/mile)	Distance Shipped (miles)	Total Shipping Costs
DAW	0.1	\$2.00	1	\$ -	875	\$263
Activated Cyclotron Shield, 60,000 lbs composite material	1.5	\$2.00	1	\$ -	875	\$3,939
Metal	0.4	\$2.00	1	\$ -	875	\$1,050
Ocean Transport estimate						\$50,000
TOTAL	2					\$55,252

* Add \$25,000 per Sealand Container to account for ocean transport

(c) Waste Disposal Costs

Estimate the volume of waste to be disposed. Multiply the volume of waste disposed by the unit disposal cost (including any volume based surcharges). Add any surcharges that are based on the number of containers of waste along with the number and types of containers required for packaging the waste. Multiply the number of containers required by the unit cost per container.

Waste Type	Disposal Volume (ft3)	Density (lb/ft3)	Disposal Mass (lbs)	Unit Cost	Surcharges (\$/ft3 or \$/container)	Total Disposal Costs
DAW	22	10	223.5	6.25	1	\$1,397
Activated Cyclotron Shield, 60,000 lbs composite material	1000	60	60000	0.60	1	\$36,000
Metal	220	100	22000	6.25	1	\$137,500
TOTAL	1242					\$174,897

3.15 EQUIPMENT/SUPPLY COSTS (Excluding Containers)

Estimate the quantity of equipment and supplies required for decommissioning and multiply that quantity by the appropriate unit costs.			
Equipment/Supplies	Quantity	Unit Cost	Total Equipment/Supply Cost
Protective Clothing	200	\$2	\$400
Respirators	10	\$20	\$200
Instrumentation	5	\$100	\$500
Air Fare (round trip)	5	\$700	\$3,500
Crane and Crew (days)	2	\$3,000	\$6,000
TOTAL			\$10,600

3.16 LABORATORY COSTS

If applicable, estimate the costs for analyses to be performed by an independent third party laboratory.			
Activity	Quantity	Unit Cost	Total Item Cost
Sampling & Analysis	20	\$250	\$5,000
Transport of Samples	20	\$10	\$200
Testing and Analysis			\$0
Other (specify)			
TOTAL			\$5,200

3.17 MISCELLANEOUS COSTS

Estimate any other applicable costs.	
Activity	Total Cost
License Fees (Reciprocity)	\$1,900
Insurance	\$6,835
Taxes	\$0
Other (specify): Security	\$1,746
TOTAL	\$10,481

3.18 TOTAL DECOMMISSIONING COSTS

Enter the total costs reported in Tables 3.13, 3.14(a)-(c), 3.15, 3.16, and 3.17 into the appropriate cells below, and add then to obtain a subtotal. Add to the subtotal a contingency allowance in the amount of 25 percent of the total decommissioning cost estimate. Also, calculate for each task/component the percentage it represents of the total.		
Task/Component	Cost	Percentage
Planning and Preparation (from Table 3.13)	\$43,001	9.8%
Decontamination and/or Dismantling of Radioactive Facility (From Table 3.13)	\$97,642	22.4%
Restoration of Contaminated Areas on Facility Grounds (From Table 3.13)	\$0	0.0%
Final Radiation Survey (From Table 3.13)	\$34,917	8.0%
Packing Material Costs (TOTAL from Table 3.14(a))	\$4,620	1.1%
Shipping Costs (TOTAL from Table 3.14(b))	\$55,252	12.7%
Waste Disposal Costs (TOTAL from Table 3.14(c))	\$174,897	40.1%
Equipment/Supply Costs (TOTAL from Table 3.15)	\$10,600	2.4%
Laboratory Costs (TOTAL from Table 3.16)	\$5,200	1.2%
Miscellaneous Costs (TOTAL from Table 3.17)	\$10,481	2.4%
SUBTOTAL	\$436,610	100.0%
25% Contingency	\$109,152	25.0%
TOTAL DECOMMISSIONING COST ESTIMATE	\$545,762	125.0%