

July 12, 2022

Dr. Joseph Chimento, D.Sc.  
Assistant Vice President - System Plant Operations  
CarePoint Health  
Christ Hospital  
176 Palisade Avenue  
Jersey City, NJ 07306

Dear Dr. Chimento,

This report specifies the radiation protection requirements of the new Cardiac Catheterization Lab at CarePoint Health - Christ Hospital. The attached report is based on the drawings and information provided by Joseph Chimento and Anthony Piza of CarePoint Health to William Moloney of Bio-Med Associates via e-mail on June 28 and July 11-12, 2022.

The calculations applied in this report were made in accordance with the recommendations of the National Council on Radiation Protection (NCRP) Report Number 147.

Specifications for each barrier are enclosed (Attachment A). Also enclosed are recommendations concerning structural details and notes (Attachment B). Any changes to the drawing including the location of equipment, position of wall barriers, changes in occupancy or the designated use of adjacent areas, etc., will necessitate a recalculation of the shielding specifications.

Following installation of the x-ray equipment, a radiation safety survey of the environs must be performed. Please contact our office as soon as a tentative completion date is established in order to schedule the survey. If you require any further information, please do not hesitate to contact me.

Sincerely,

BIO-MED ASSOCIATES, INC.

  
William E. Moloney, M.S., DABR  
Medical Physicist

## ATTACHMENT A

Date: July 12, 2022

### FACILITY INFO

Facility: Christ Hospital  
Address: 176 Palisade Avenue  
City, State: Jersey City, NJ  
Contact: Dr. Joseph Chimento, D.Sc.  
Phone: (201) 868-5283  
Zip: 07306

### EQUIPMENT GENERAL

Room: Cath Lab (124)  
Manufacturer: TBD  
Model: TBD  
Model No.: TBD  
Workload: Busy

### BARRIER SHIELDING SUMMARY - See diagram page 2

Barrier ID	Description	Barrier Type	Shielding Material	Existing Shielding (inches)	Additional Shielding (inches)	Comments
A	Control Room 125	Secondary	Lead	--	1/16"	
B	Exterior (Roof)	Secondary	Concrete	12	none	
C	Equipment Room	Secondary	Lead	--	1/32"	
D	Control Room 119	Secondary	Lead	--	1/16"	
E	Scrub Area (118)	Secondary	Lead	--	1/16"	
F	Above	Secondary	Concrete	8.5	none	
G	Below	Secondary	Concrete	8.5	none	

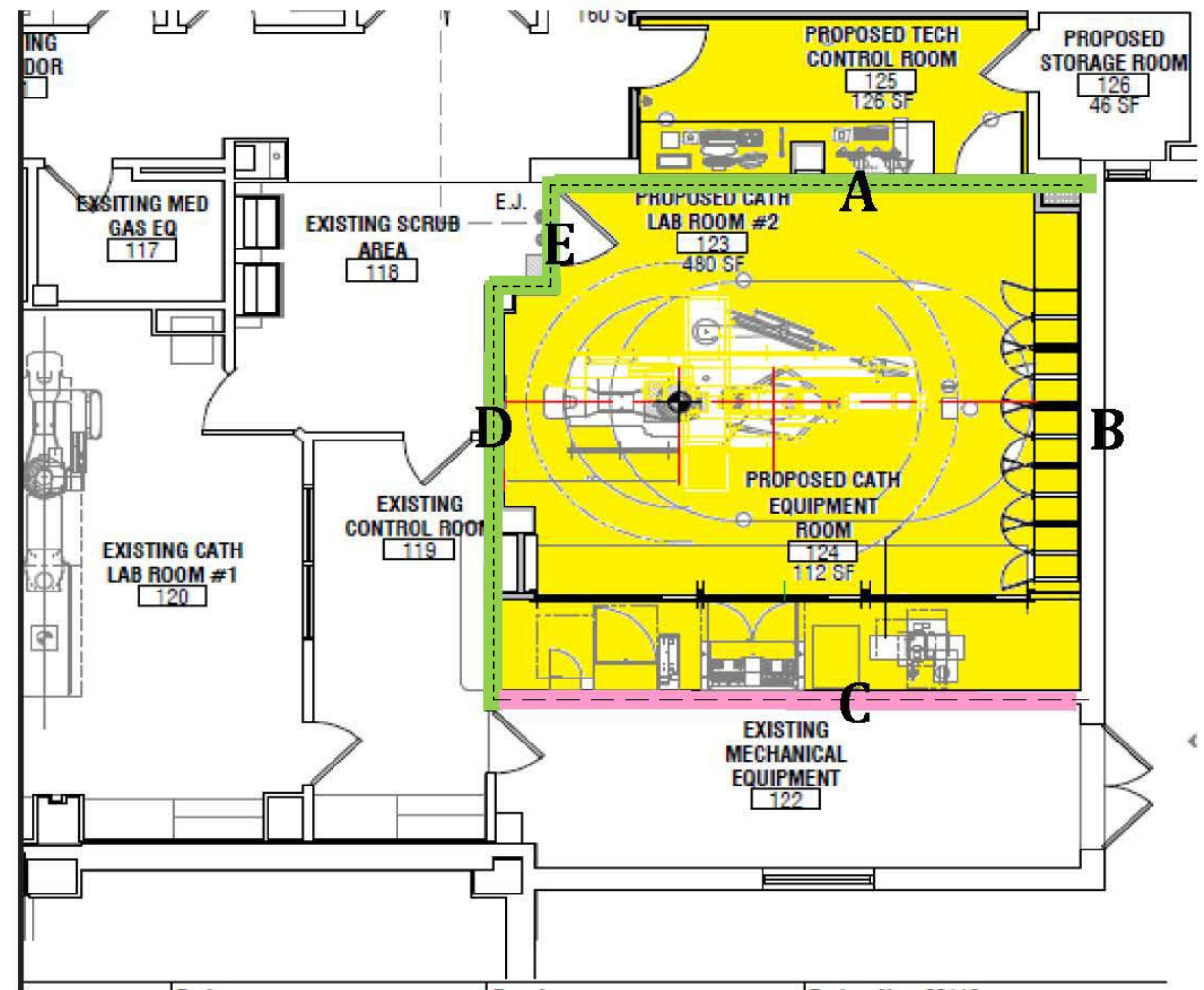
### ASSUMPTIONS / COMMENTS

- 1/16" Lead equivalence recommended for the Control barrier walls, window and doors.
- The exterior (East) wall is adjacent to a roof and requires no additional shielding due to the existing gypsum and concrete thickness.
- No additional shielding is required above or below the exam room due to the existing concrete thickness.

Christ Hospital - Cath Lab Room 124 - Shielding Design - 7-12-2022

TEMPLATE Shielding Fitting Param Rev 1/15/16

## Attachment A: Facility Drawing



- 1/64" of Lead
- 3/64" of Lead
- 1/32" of Lead
- 1/16" of Lead
- 2 x 5/8" Gypsum

## Attachment A: Secondary Barrier Calculations

Barrier: G - Below  
Barrier Type: Cardiac Angiography  
Leakage/Scatter Cat. Leakage and Forward/Backscatter  
 $K'_{100}$  (Table 4.7) = 3.80E+00

Barrier Construction (e.g. lead)	Lead	Concrete	Gypsum	Wood
a(mm-1):	2.35E+00	3.71E-02	1.39E-02	7.27E-03
B(mm-1):	1.48E+01	1.07E-01	4.64E-02	6.74E-04
Y:	7.48E-01	5.73E-01	9.19E-01	1.24E+00
Required Barrier thickness (mm):	1.00	78.758	249.051	681.560
Inherent Shielding (mm):				
Required Shielding (mm):	1.08	78.76	249.05	681.58
Required Shielding (in):	3/64	3 7/64	9 13/16	26 27/32

\* Existing lightweight concrete of 8.5 in = 6.54 in (116.1 mm) standard weight concrete

$$x_{\text{barrier}} = \frac{1}{\alpha \gamma} \ln \left[ \frac{NT K_{\text{sec}}^1}{Pd_{\text{sc}}^2} \right] + \frac{\beta}{\alpha}$$

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## Attachment B: Shielding Specifications

### Structural Details of Protective Barriers

- Lead barriers shall be mounted in such a manner that they will not sag or cold-flow because of their own weight. They shall be protected against mechanical damage. It is recommended that lead of 1/32 inch or less thickness be bonded to panels of some rigid supporting material.
- Surfaces of lead sheets at joints in the barrier should be in contact with a lap of at least 1/2 inch or twice the thickness of the sheets, whichever is greater.
- Welded or burned lead seams are permissible, provided the lead equivalent of the seams is not less than the minimum requirement of the barrier.
- Joints between different kinds of protective materials shall be so designed that the overall protection of the barrier is not impaired.
- Joints at the floor and ceiling shall be so designed that the overall protection is not impaired.
- Windows, window frames, doors and door frames shall have the same lead equivalent as that required of the adjacent wall. Where thick concrete walls are tapered into openings, as is frequently done with observation windows, it may be necessary to add lead protective flanges around the window frame to compensate for the reduced thickness of concrete. A door baffle or threshold may be required for installations operating above 125 kVp, if the discontinuity can be struck by the useful beam. Special attention should be given to providing overlap of the shielding of the door frame and the shielding of the door.
- Holes in protective barriers shall be covered so that overall attenuation is not impaired.
- Louvers and holes in barriers for pipes, conduits, service boxes and air ducts may require baffles to insure that the overall protection afforded by the barrier is not impaired. It is advisable to locate such holes outside of the range of direction of the useful beam.
- INSTALLATION GUIDELINES FOR LEAD LINING IN FLOORS: In certain situations (eg. CT, PET), the floor and/or ceiling of your room may require radiation shielding. Whenever possible laying the Sheet Lead in the floor before the finished floor is poured is recommended. All joints should have a minimum of one inch overlap if multiple pieces are to be used. Overlap at each joint between pieces or apply 2" wide lead strip batten at each joint and glue in place. If multiple layers are to be used, stagger all joints between layers. Ensure your sheet lead selection allows for safe & easy handling at the site and be sure to verify floor-loading limits are adequate with the architect. The Sheet Lead should extend up each wall a minimum of two inches. Additional concrete can be applied over the lead finishing.

If laying Sheet Lead directly over existing concrete floor then coat fully cured concrete with a sealant like varnish to prevent chemical interaction between the concrete and lead and let the sealant or varnish fully dry. Ensure the lead is free of bumps, air pockets or obstructions and lies completely flat. It is recommended before securing lead to floor that a small sample area be done first to ensure adhesion with the varnish or sealant coating. Use a construction adhesive on hard to secure spots or areas. Press or roll the sheet lead completely flat on the floor.

Prior to laying carpeting, or tile covering we recommend applying an underlay sub floor consisting of a 1/4" or heavier approved plywood or other firm solid material over the Sheet Lead. Fastened down the material with a good quality construction adhesive. Performing this extra step will help spread the floor loading out over a wider area eliminating point loading that could deform the sheet lead below. Steel nails or screws used to secure lead barriers need not be covered with lead discs or supplementary lead since they will attenuate the radiation as effectively as lead.

The lead protection may be obtained in two ways. If possible, it is simplest to lay sheet Lead on top of the floor slab above, allowing it to extend out at least 8" in every direction beyond the lead walls below it.

Christ Hospital - Cath Lab Room 124 - Shielding Design - 7-12-2022

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## Attachment A: Secondary Barrier Calculations

Barrier: A - Control Room 125 (North)  
Barrier Type: Cardiac Angiography  
Leakage/Scatter Cat. Leakage and Forward/Backscatter  
 $K'_{100}$  (Table 4.7) = 3.80E+00

Barrier Construction (e.g. lead)	Lead	Concrete	Gypsum	Wood
a(mm-1):	2.35E+00	3.71E-02	1.39E-02	7.27E-03
B(mm-1):	1.48E+01	1.07E-01	4.64E-02	6.74E-04
Y:	7.48E-01	5.73E-01	9.19E-01	1.24E+00
Required Barrier thickness (mm):	0.935	69.585	221.243	626.270
Inherent Shielding (mm):				
Required Shielding (mm):	0.93	69.58	221.24	626.27
Required Shielding (in):	3/64	2 3/4	8 23/32	24 43/64

Barrier: B - Exterior/Roof (East)  
Barrier Type: Cardiac Angiography  
Leakage/Scatter Cat. Leakage and Forward/Backscatter  
 $K'_{100}$  (Table 4.7) = 3.80E+00

Barrier Construction (e.g. lead)	Lead	Concrete	Gypsum	Steel
a(mm-1):	2.35E+00	3.71E-02	1.39E-02	2.53E-01
B(mm-1):	1.48E+01	1.07E-01	4.64E-02	2.59E+00
Y:	7.48E-01	5.73E-01	9.19E-01	8.00E-01
Required Barrier thickness (mm):	0.420	35.717	112.690	3.036
Inherent Shielding (mm):		304.8		
Required Shielding (mm):	0.42	0.00	112.69	3.04
Required Shielding (in):	1/32	0	4 7/16	1/8

\* Existing exterior wall is approximately 12 in. >> approximate 1.5 in. that is required

Barrier: C - Equipment Room 122 (South)  
Barrier Type: Cardiac Angiography  
Leakage/Scatter Cat. Leakage and Forward/Backscatter  
 $K'_{100}$  (Table 4.7) = 3.80E+00

Barrier Construction (e.g. lead)	Lead	Concrete	Gypsum	Steel
a(mm-1):	2.35E+00	3.71E-02	1.39E-02	2.53E-01
B(mm-1):	1.48E+01	1.07E-01	4.64E-02	2.59E+00
Y:	7.48E-01	5.73E-01	9.19E-01	8.00E-01
Required Barrier thickness (mm):	0.496	40.887	130.206	3.653
Inherent Shielding (mm):				
Required Shielding (mm):	0.50	40.99	130.21	3.65
Required Shielding (in):	1/32	1 5/8	5 9/64	5/32

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## Attachment A: Secondary Barrier Calculations

Barrier: D - Control Room 119 (West)  
Barrier Type: Cardiac Angiography  
Leakage/Scatter Cat. Leakage and Forward/Backscatter  
 $K'_{100}$  (Table 4.7) = 3.80E+00

Barrier Construction (e.g. lead)	Lead	Concrete	Gypsum	Wood
a(mm-1):	2.35E+00	3.71E-02	1.39E-02	7.27E-03
B(mm-1):	1.48E+01	1.07E-01	4.64E-02	6.74E-04
Y:	7.48E-01	5.73E-01	9.19E-01	1.24E+00
Required Barrier thickness (mm):	1.00	78.758	249.051	681.560
Inherent Shielding (mm):				
Required Shielding (mm):	1.08	78.76	249.05	681.58
Required Shielding (in):	3/64	3 7/64	9 13/16	26 27/32

Barrier: E - Scrub Area (West)  
Barrier Type: Cardiac Angiography  
Leakage/Scatter Cat. Leakage and Forward/Backscatter  
 $K'_{100}$  (Table 4.7) = 3.80E+00

Barrier Construction (e.g. lead)	Lead	Concrete	Gypsum	Wood
a(mm-1):	2.35E+00	3.71E-02	1.39E-02	7.27E-03
B(mm-1):	1.48E+01	1.07E-01	4.64E-02	6.74E-04
Y:	7.48E-01	5.73E-01	9.19E-01	1.24E+00
Required Barrier thickness (mm):	1.432	100.705	313.531	897.672
Inherent Shielding (mm):				
Required Shielding (mm):	1.43	100.71	313.53	897.67
Required Shielding (in):	1/16	3 31/32	12 11/32	31 13/16

Barrier: F - Above  
Barrier Type: Cardiac Angiography  
Leakage/Scatter Cat. Leakage and Forward/Backscatter  
 $K'_{100}$  (Table 4.7) = 3.80E+00

Barrier Construction (e.g. lead)	Lead	Concrete	Gypsum	Wood
a(mm-1):	2.35E+00	3.71E-02	1.39E-02	7.27E-03
B(mm-1):	1.48E+01	1.07E-01	4.64E-02	6.74E-04
Y:	7.48E-01	5.73E-01	9.19E-01	1.24E+00
Required Barrier thickness (mm):		114.464		
Inherent Shielding (mm):		165.1		
Required Shielding (mm):		0.00		
Required Shielding (in):		0		

\* Existing lightweight concrete of 8.5 in = 6.54 in (116.1 mm) standard weight concrete

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No.	Date	Description

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CATH LAB #2 - SUITE EXPANSION  
176 PALISADE AVENUE  
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Seal:  


Posen Project No.: DCA Number:  
22119 NJPRP-14794  
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Drawn By: Author  
Checked By: Checker  
Date: 8/10/2022  
Scale: Dwg No. Issue No.: Drawing:  
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