

DEPARTMENT OF
VETERANS AFFAIRS

MEMORANDUM

Date: 11 June 2018

From: DVAMC Radiation Safety Officer (114)

Subj: Radiation Shielding for Interventional Radiology Procedures Room

To: Engineering (138) – Steve Gilland

1. The purpose of this memorandum is to document shielding recommendations for a new procedure room to be constructed in 1B-136 of Building 330 at the Dayton VAMC. A mobile c-arm fluoroscopic unit will be utilized to perform various fluoroscopically-guided interventional procedures. Typically, these rooms are required to be shielded with the equivalent of at least 1/32-inch lead, including doors and windows. Floors and ceilings, if there is occupancy below or above, are normally required to also be equivalent to 1/32-inch lead or 2.5 inches of standard-density concrete (147 pounds per cubic foot). Calculation of barrier requirements is based on the methodology and data of NCRP Report No. 147 and estimated workload.

2. The estimated number of procedures per week is 50 for the new room. It is further assumed that the average fluoroscopy time per procedure is 3 minutes at 2 mA at 100 kVp. This translates into a weekly workload of 300 mA-min/week. According to Simpkin and Dixon (Health Physics, 68(5), 350-365, 1998) the unshielded secondary air kerma per mA-min at 1 meter from a beam of 1000 cm² at 100 kVp is equal to: 3.17E-2 mGy/mA-min for forward and back scatter and 9.9E-4 mGy/mA-min for leakage. Adjusting for field size (12-inch image intensifier) and source to image distance (36 inches), the scatter kerma is 2.77E-2 mGy/mA-min. The total secondary kerma is therefore equal to 2.87E-2 mGy/mA-min. Assuming the minimum distance from the fluoroscopy unit to a point any barrier is 1.5 meters, the unshielded air kerma is given by the product 300 mA-min/week and 2.87E-2 mGy/mA-min. This equals 3.83 mGy/week. The design goal is 0.02 mGy/week for uncontrolled areas if the occupancy is equal to 100%.

3. The required barrier transmission is equal to the ratio of the design goal to the unshielded air kerma and the occupancy factor (e.g., 0.02/3.83) which equals 0.0052 for 100% occupancy. This equates to a lead thickness of approximately 1.3 mm. None of the areas adjoining the procedure room have an occupancy of 100%. Using NCRP Report No. 147 recommendations regarding occupancy factors, the required barrier thickness is much less.

a. It is conservatively assumed that the occupancy in outdoor areas adjoining the procedure room is 2.5%. The required barrier transmission is equal to the ratio of the design goal to the unshielded air kerma and the occupancy factor (e.g., 0.02/3.83/0.025) which equals 0.2089. The required thickness of concrete is 16.41 mm.

b. It is conservatively assumed that the occupancy in patient holding and storage areas adjoining the procedure room is 5%. The required barrier transmission is

equal to the ratio of the design goal to the unshielded air kerma and the occupancy factor (e.g., $0.02/3.83/0.05$) which equals 0.1044. The required thickness of lead is 0.3 mm.

c. It is conservatively assumed that the occupancy in the corridor at the doors adjoining the procedure room is 12.5%. The required barrier transmission is equal to the ratio of the design goal to the unshielded air kerma and the occupancy factor (e.g., $0.02/3.83/0.125$) which equals 0.0418. The required thickness of lead is 0.54 mm.

d. It is conservatively assumed that the occupancy in the corridor adjoining the procedure room is 20%. The required barrier transmission is equal to the ratio of the design goal to the unshielded air kerma and the occupancy factor (e.g., $0.02/3.83/0.20$) which equals 0.0261. The required thickness of lead is 0.68 mm.

4. Based on these calculations, the recommended shielding is 1/32-inch (0.79 mm) leaded dry wall to a height of seven feet above the finished floor for all interior walls. The exterior wall does not require additional shielding. The door should contain 1/32-inch of lead. Please do not hesitate to contact me at william.ruckii@va.gov or X1511 if you have any questions.

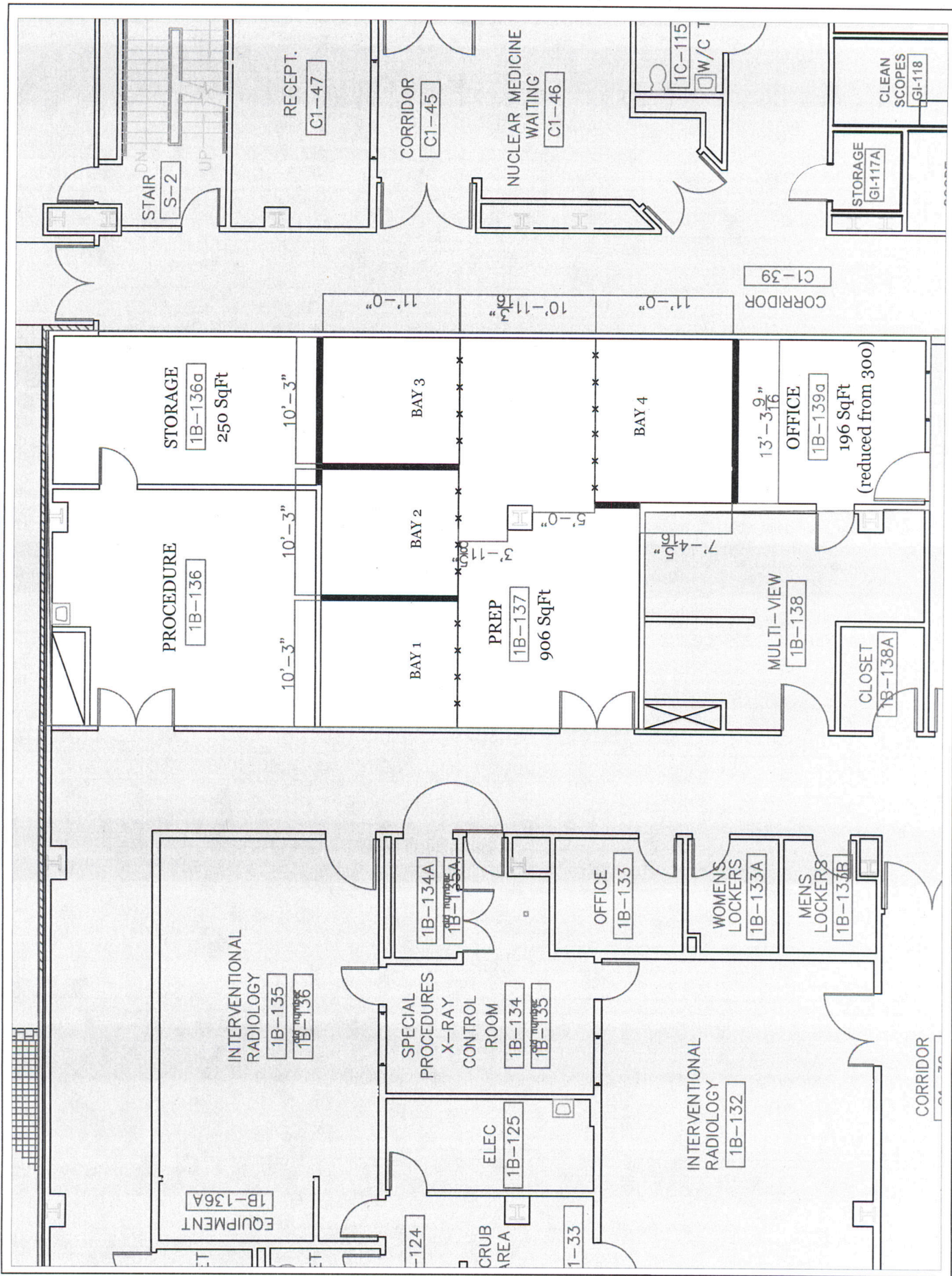


William R. Ruck II, MS, DABR, DABMP
Radiation Safety Officer

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Architectural Drawing dated 6/1/2018

cc:

Radiation Safety Committee



LOCATION DEPARTMENT OF VETERANS AFFAIRS VA MEDICAL CENTER DAYTON, OHIO	PROJECT TITLE PROPOSED RADIOLOGY BAYS	SHEET TITLE B-330 1ST FLOOR	DRAWN BY FCA	DATE 06/01/2018	SHEET 1 of 1
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