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September 26, 2018

VIA EMAIL ONLY

Jason VonEhr
Senior Health Physicist
US Nuclear Regulatory Commission
1600 East Lamar Boulevard
Arlington, Texas 76011-4511
Jason.vonehr@nrc.gov

Re: NRC Special Inspection

Jason:

This letter provides responses to your email of September 24, 2018. In your first question, you asked when the mobile ceiling-mounted shield was installed and whether the consultant contemplated the timing of the installation of the shielding in his reconstruction. Providence, through Radiation Safety Officer Mark Winslow, provided the following answer;

> Regarding the mobile shield- I corresponded with one of the radiology supervisors, they stated that Cath Lab 6 has had overhead shielding on both sides of the table since the fluoroscopy unit was initial[ly] install[ed] in May of 2010. The installation of the fluoroscopy unit in Cath Lab 2 occurred in October of 2015. There was overhead shielding on the primary side, which did reach to the off (secondary) side of the table, but was occasionally awkward to use due to crossing in front of the camera. As a result, secondary overhead shielding was installed in May of 2016. The secondary or off side is used less frequently.

In answer to your second question, please find attached a letter from Northwest Radiation Services consultant John Gough confirming that the positioning and shielding usage that he observed during his August/September reconstruction was consistent with his experience in medical radiation safety and was as he expected it to be. He confirmed that the positioning was consistent with the practice of doctors [redacted].

Please also find attached the raw data file for Providence IR procedures from January through May of 2016, as requested in your email of August 30, 2018.

That should complete all of the outstanding requests for information from the NRC, please let me know if there is anything further PAMC can provide ahead of convening the enforcement panel next week.

Sincerely,

Chester D. Gilmore,
Attorney

cc: Chief Inspector Michael Hay via email:
Michael.hay@nrc.gov

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September 26, 2018

Providence Alaska Medical Center
Attn: Mark Winslow, Ph.D.
Radiation Safety Officer
3200 Providence Dr.
Anchorage AK 99508.

RE: Additional clarification to NRC questions from September 24, 2018.

Mark,

Jason vonEhr, Health Physicist with the Nuclear Regulatory Commission (NRC), forwarded the following questions on September 24 ,2018 with regards to the overhead shield and cases observations for the IR procedures at Providence Alaska Medical Center (PAMC).

1) Our understanding during the inspection was that the mobile ceiling-mounted shield was installed in the recent past - maybe 2015 or 2016. Please produce the date or region of time the install occurred, and whether the consultant report took this change-in-shielding into account in their reconstruction.

Noelle Brassard in an email forwarded on September 24, 2018 indicated that Cath Lab 2 had an overhead shield installed at the time of initial installation. The reconstruction simply added a second overhead shield to provide greater flexibility in the deployment of in room shielding. The majority of IR and Cath Labs only have one installed overhead shield and this single overhead shield can be positioned on either side of the table. A second shield provides some additional flexibility and greater coverage when available. My testing only deployed one shield so was a conservative review of in room shielding. Deployment of the second available shield would have provided some additional reduction to the magnitude of the scattered radiation exposure that was measured.

2) Both the August and September reports used three IR procedures to form the basis for scatter values from Cath Lab 6. The NRC needs to understand whether these three procedures adequately represent the diversity of cases (and thus IR doctor positions/shielding use) represented over the past several years, or alternatively represent 'bounding' cases that could be used to inform the rest of the dose analysis. In short - justify using the three cases that were the basis of the rest of the report and the foundation of the doctor's final dose estimates.

1) As noted in my report the modeling of occupation exposure to staff in relation to the air kerma usage was derived from measurements utilizing a chest phantom. The derived the correction factors from air kerma usage to scattered radiation exposure were measured at a distance of **50 cm** from the midline of the phantom. This distance was used as it was the closest distance that a physician could be positioned in a case giving the equipment in the typical IR suite. My initial modeling was not based on the case observations, but instead on the measurements utilizing the phantom.
2) I used the case observations to provide some context to the modeled radiation exposure values to demonstrate that the scatter ratios from the phantom was a conservative approach for modeling the occupational exposure.

3) In two of the three cases observed, the IR physician was typically at a distance of **100 cm** or more from the midline of the patient. The third case observed did have a measurable radiation exposure and the physician was positioned at a closer distance. This was also the shortest case with regards to fluoroscopy usage with a total air kerma usage that was less than 1% of the cumulative total air kerma usage from all three cases observed.
4) What was observed with regards to physician positioning and fluoroscopy usage for the three cases is consistent with what I observed at my facility. Physician are typically positioned at distances greater than 50 cm from the midline of a patient. As indicated in #1 above, 50 cm is the closest that a physician can be positioned relative to the midline of the patient and still employ the overhead shield. In all three cases I observed the overhead shield deployed. Additionally, it has been my experience in observing other IR and Cath Lab procedures that the overhead shield is deployed as standard practice.
5) The three cases that were observed were not used to calculate the occupation exposure, but to provide some context to the ratio of scatter radiation dose measured at the collar equivalent position vs. the air kerma usage from the chest phantom. Two of the three cases had no measurable radiation exposure for the dosimeter that was worn at the collar and the value used to provide a ratio of radiation exposure to air kerma usage was the smallest significant value that could be displayed (0.1 mrem). The other case had a measurable value due to the close proximity of the physician to the patient (0.4 mrem). For this "worst case" scenario the physician had an air kerma usage to occupational exposure ratio of 0.00067. However, this "worst case" scenario has very limited fluoroscopy usage (6 mGy). Whereas the total cumulative air kerma usage for the three cases observed was 634 mGy. Taking the three cases in aggregate and using a minimum value of 0.1 mrem for the two cases that had no measurable value, the total occupation exposure measured would be less than 0.6 mrem for a dosimeter worn at the collar. The total aggregate air kerma usage was 634 mGy so the ratio of occupation exposure to air kerma usage for these three cases in aggregate would be 0.00001. I used this information to correlate against existing dosimetry data for IR/Cath Lab physicians where I had complete dosimetry data and air kerma usage. I concluded that the scatter ratios for the phantom could be used as a conservative approximation of potential occupational exposure.
6) One observation is that as case complexity increases, and case times (and consequently fluoroscopy usage) increase, physicians tend to employ more radiation protection (i.e. they tend to position further from the table edge / patient, tend to position in line with the over head shield and tend to take a step back when employing fluoroscopy). Additionally, overall air kerma usage be weighted toward the longer, more complicated cases. In the three cases I observed, the longest case had the smallest ratio of scatter radiation to air kerma usage and the air kerma usage in that case was about 20x the next highest use case.

In conclusion, I believe that the three cases observed can be used to provide some context to how a physician is positioned in the IR suite during a procedure. As I indicated, the values measured in the three cases were not used to model the occupational dose, but were instead used to insure that the dose modeling from the chest phantom provided a sufficiently conservative estimate of occupational exposure.

My observations would indicated that if actual occupational dosimetry measurements were used in combination with physician air kerma usage, the ratio of total occupation exposure to total air kerma usage would be lower than the values derived from the chest phantom measurements that I made, indicating those values can provide a suitable conservative estimate of occupational radiation exposure.

John Gough, MS, CHP, DABMP
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Senior Associate – Medical Health Physicist
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