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## **ESTABLISHMENT OF A CORRECTION FACTOR FOR MONITORING THE EXTREMITIES OF INTERVENTIONAL FLUOROSCOPISTS**

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# REGULATIONS

The NRC and DEP have established occupational dose limits for the extremities, specifically a shallow-dose equivalent of 50 rem (500 mSv) to the skin of any extremity.

Furthermore it is required to monitor occupational exposure to radiation from radiation sources and to supply and require the use of individual monitoring devices by adults likely to receive, in 1 year from sources external to the body, a dose in excess of 10 percent of the limits, (50 mSv in the case of the extremities).

# INFECTION CONTROL

Wearing dosimetry devices can be a source of infection.

The Association of Operating Room Nurses, (AORN), recommends that personnel remove jewelry if working in the operating room setting.

The World Health Organization consensus recommendation is to strongly discourage the wearing of rings during health care.

Pennsylvania's Institute for Health Care Improvement mandates the removal of rings, bracelets, and watches before beginning surgical hand scrubbing.

yearly mortality in excess of  
100,000 due to hospital-acquired infections

# NCRP

NCRP 168 makes clear recommendations for the use of personnel dosimetry and urges monitoring the dose to the eye, the only language pertaining to extremity monitoring is that it is “recommended if high hand exposure is expected.”

This document makes 31 recommendations regarding interventional fluoroscopy, 4 pertaining to dosimetry, but none focusing on wearing extremity monitors.

# CONVERSION FACTOR

Use of a conversion factor for estimating dose is not uncommon in interventional Fluoroscopy.

The Webster calculation is widely accepted for use in determining dose to the body, and lens dose values are often calculated from other readings.

Several papers have been published regarding the development of a conversion factor for fluoroscopy.

In 2010, Miller et al used historical data to establish a conversion value of 2.8.

In 2011, Martin et al found a range of values from 0.8 to 3.4, with a mean of 2.1.

Also in 2011, Schueler et al, using phantom scatter measurements found a range of 1.3 to 2.7, with a mean of 1.7.

# OUR DATA

TABLE 1: Extremity/collar Conversion Factors based on review of historic dosimetry data

| Facility  | Range     | mean |
|-----------|-----------|------|
| GEISINGER | 1.4 – 2.9 | 1.8  |
| UPMC      | 2.5       | 2.5  |
| HERSHEY   | 1.9-2.0   | 2.0  |
| LEHIGH    | 1.9-2.1   | 2.0  |

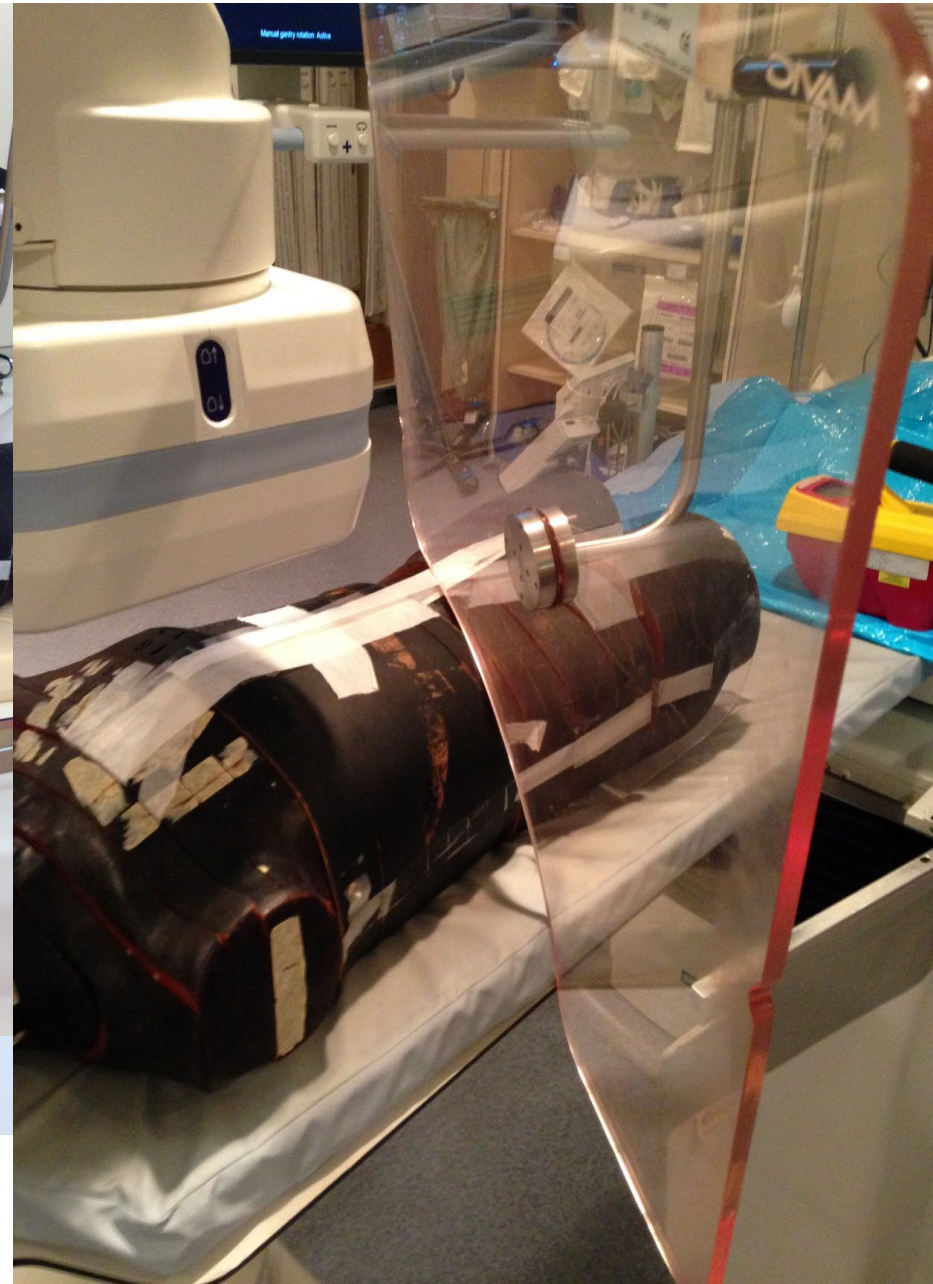
These were supplemented with direct measurements.

# Methods

- A number of interventional fluoroscopy procedures were observed in order to familiarize ourselves with the processes involved
- Observations included fluoroscopist positions, c-arm positions, fluoroscopy settings, shield placement, etc

# Observations

- PA-DEP inspectors visited catheterization lab for observations
- Detailed notes taken:
  - Physician location in relation to patient and table
  - Physician's hands in relation to the patient and table
  - Fluoroscopy machine details (technique, FOV, SID, time, crane angles, etc)
  - Shielding use and location



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# RESULTS

TABLE 2: Extremity/collar Conversion Factors  
based on phantom measurement

| Facility | Range     | mean |
|----------|-----------|------|
| GHS      | 1.0 – 3.5 | 2.3  |
|          |           |      |
|          |           |      |

# CONCLUSION

Based on the above findings,  
a conversion factor of 2.5 is indicated.

We request that the PA DEP accept a conversion factor of 2.5 for estimating the dose to the hands when ring badges cannot or will not be used for individuals performing interventional fluoroscopic procedures