

DOSIMETRIC EVALUATION OF AN ANGIOGRAPHY SYSTEM

Annalisa Trianni

(Medical Physics Department – Udine University Hospital, Italy)

ENSURING THAT X-RAY EQUIPMENT IS
AS SAFE AS IT IS EFFECTIVE

Goal

Safe → Minimum acceptability criteria

Effective → Optimized

EC – Radiation Protection N° 162

EUROPEAN COMMISSION

RADIATION PROTECTION N° 162

Criteria for Acceptability of Medical Radiological Equipment used in Diagnostic Radiology, Nuclear Medicine and Radiotherapy

Minimum dosimetric criteria

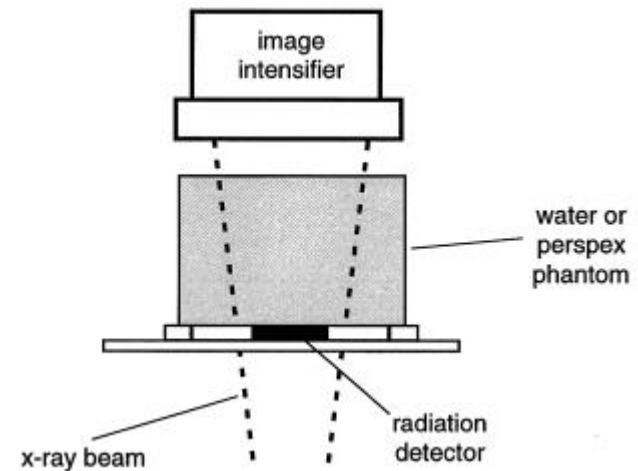
Maximum patient Entrance Dose Rates (Fluoroscopy/normal mode) ¹⁸	> 100 mGy/min at appropriate position	EC (1997b) Martin (1998)	A/C*	Values include back scatter with grid in place. In most cases 30 cm (maximum) water phantom is adequate
Patient Entrance Dose per frame (Normal digital fluorographic acquisition mode) ¹⁸	> 2mGy/frame For cardiac mode: > 0.2mGy/frame	IPEM (2005a) Dowling et al (2008)	B/C*	See also Martin (1998) for method.

The British Journal of Radiology, 71 (1998), 1283–1287 © 1998 The British Institute of Radiology

Protocol for measurement of patient entrance surface dose rates for fluoroscopic X-ray equipment

C J MARTIN, D G SUTTON, A WORKMAN, A J SHAW and D TEMPERTON

- Water phantom 30 cm x 30 cm x 20 cm (up to 30 cm)
- SDD = 100 cm
- Dose detector (IC preferred) on the table
- Phantom positioned on a rig allowing it to be supported while in contact with the detector
- 10 cm between exit surface of the phantom and the base of image detector (30 cm phantom → image detector in contact)



Expected ranges

- Ranges expected for standard applications operating with low, normal and high dose rate
- IPEM 77 (1997) → remedial action level of 50 mGy/min for all FOV

Table 2. Ranges of entrance surface dose rates for a 20 cm thick water phantom for different image intensifier field sizes and dose rate options

Intensifier field size (cm)	Patient entrance surface dose rate (mGy min ⁻¹)		
	Low	Normal	High
11–14	<25	25–50	51–75
15–18	<23	23–46	47–69
22–27	<15	15–30	31–45
28–33	<12	12–24	25–36
36–40	<9	9–18	19–27

- Minimum criteria
- Equipment characterization

What are we measuring?

The British Journal of Radiology, 71 (1998), 1283–1287 © 1998 The British Institute of Radiology

Protocol for measurement of patient entrance surface dose rates for fluoroscopic X-ray equipment

C J MARTIN, D G SUTTON, A WORKMAN, A J SHAW and D TEMPERTON

Entrance Surface Air Kerma (Rate)



Entrance Surface Air Kerma (Rate)

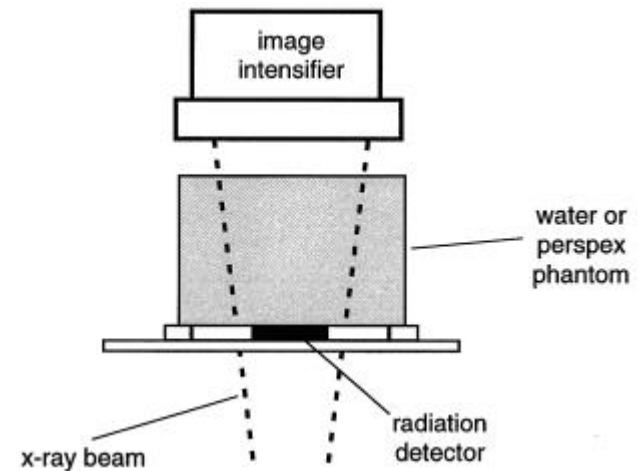
- Why to measure phantom fluoroscopy entrance surface air kerma rate (EASKR)?
 - Verify appropriate dose rates are available when acceptance testing new equipment
 - Compare to other equipment
 - Compare to benchmark values
 - Quality control monitoring of equipment performance

The British Journal of Radiology, 71 (1998), 1283–1287 © 1998 The British Institute of Radiology

Protocol for measurement of patient entrance surface dose rates for fluoroscopic X-ray equipment

C J MARTIN, D G SUTTON, A WORKMAN, A J SHAW and D TEMPERTON

- **Water phantom** 30 cm x 30 cm x 20 cm (up to 30 cm)
- SDD = 100 cm
- Dose detector (IC preferred) on the table
- Phantom positioned on a rig allowing it to be supported while in contact with the detector
- 10 cm between exit surface of the phantom and the base of image detector (30 cm phantom → image detector in contact)

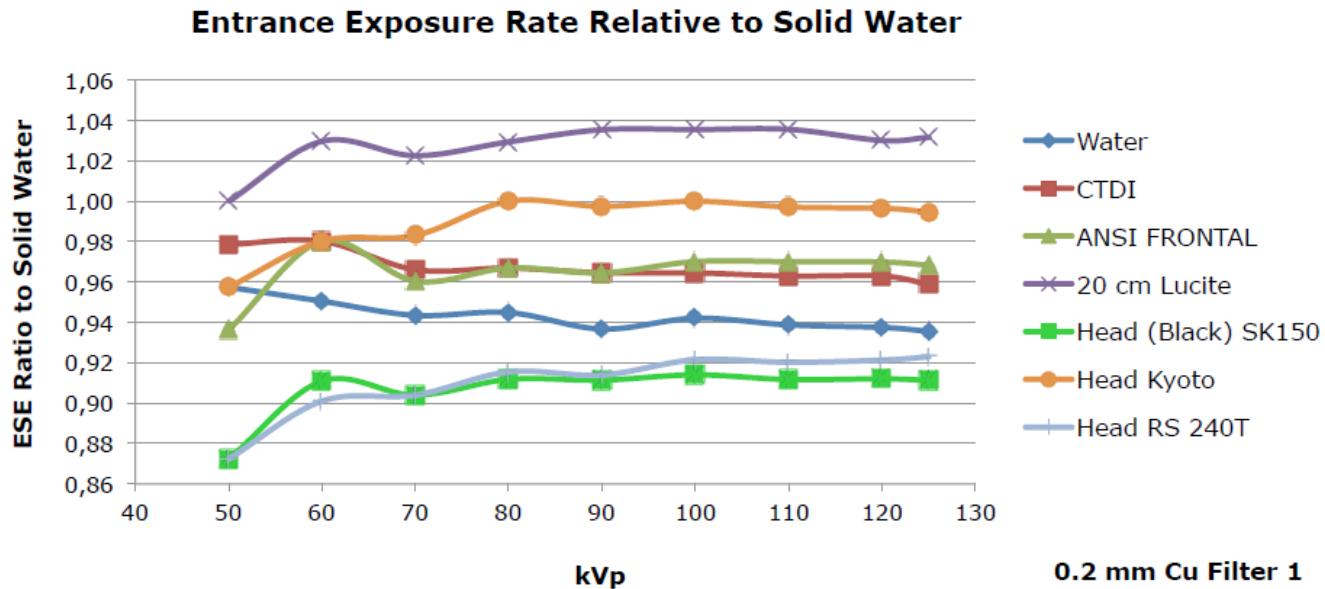


...PMMA



PMMA vs WATER

- Absorption → AEC → different exposure parameters
- Scatter:



- “Water vs. PMMA → dose rate to be multiplied by 1.22”

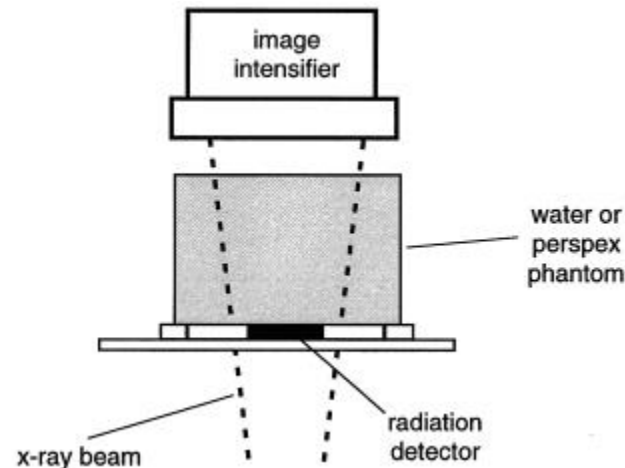
Maximum patient entrance dose rates

The British Journal of Radiology, 71 (1998), 1283–1287 © 1998 The British Institute of Radiology

Protocol for measurement of patient entrance surface dose rates for fluoroscopic X-ray equipment

C J MARTIN, D G SUTTON, A WORKMAN, A J SHAW and D TEMPERTON

- Water phantom 30 cm x 30 cm x 20 cm (up to 30 cm)
- **SDD = 100 cm**
- Dose detector (IC preferred) on the table
- Phantom positioned on a rig allowing it to be supported while in contact with the detector
- 10 cm between exit surface of the phantom and the base of image detector (30 cm phantom → image detector in contact)

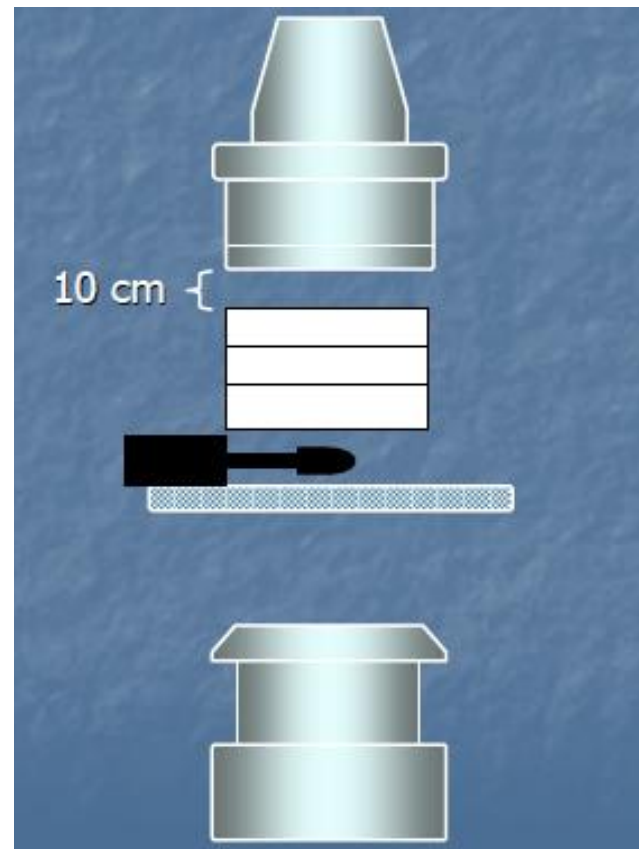
[illegible]

Not the only approach

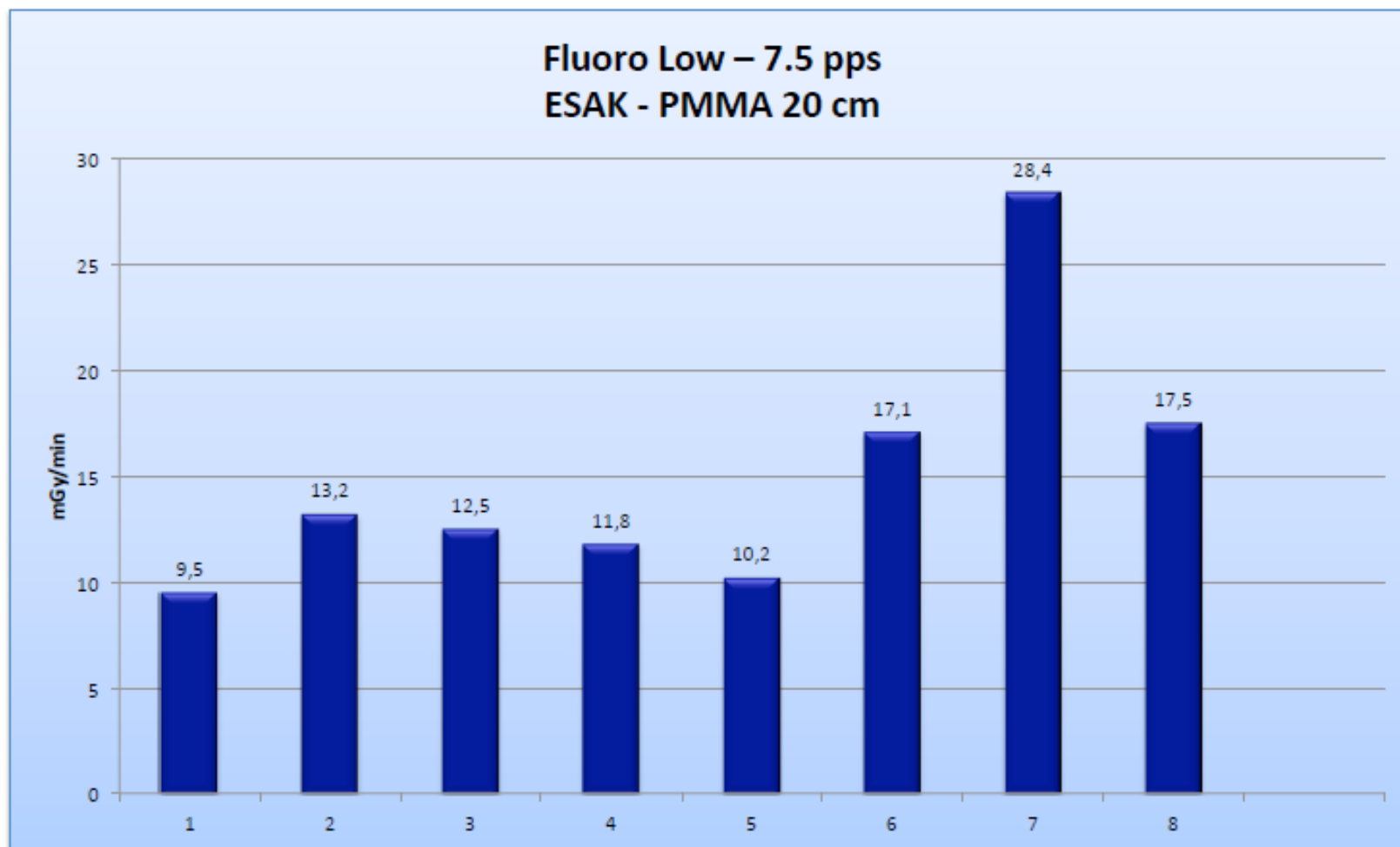
DIMOND/Sentinel



AAPM

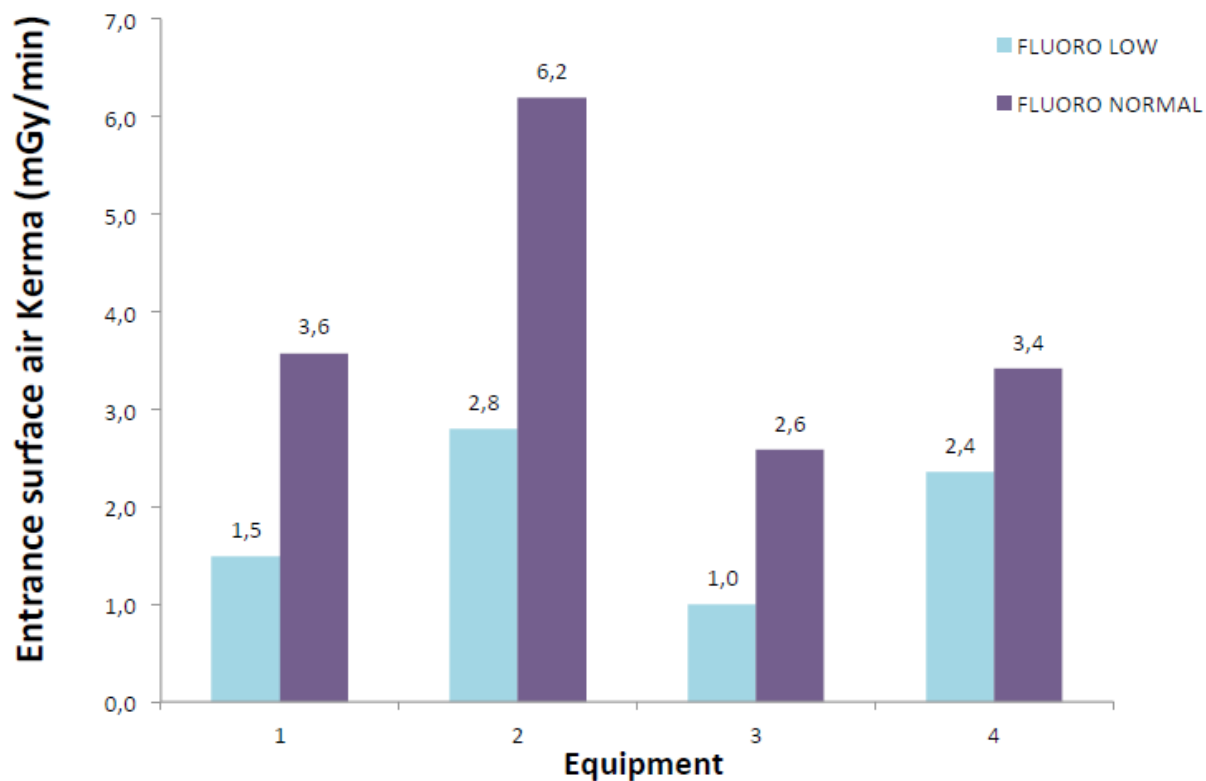


ESAK – Italian Survey (2014)

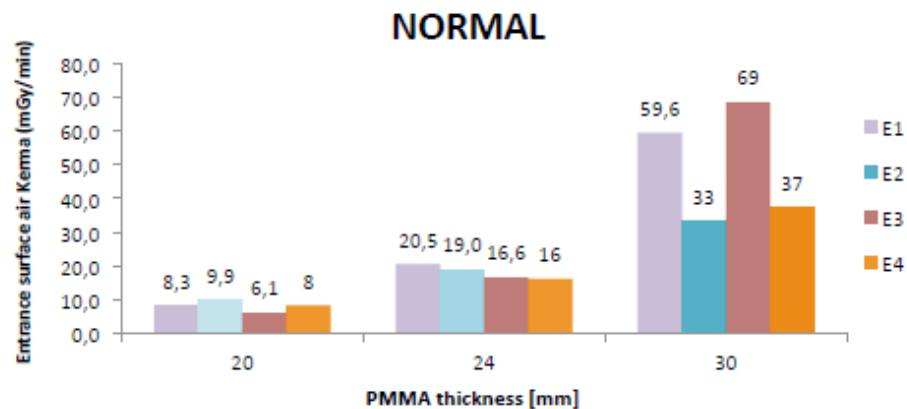
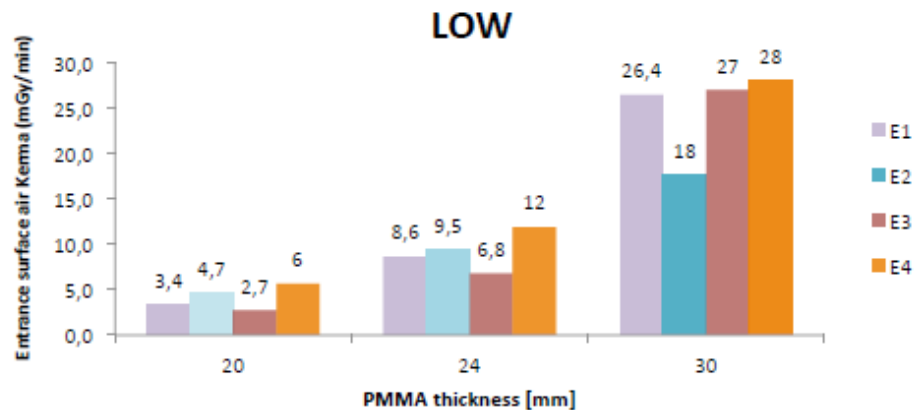


Fluoroscopy – Neuro - 2015

16 PMMA NEUROLOGY PROTOCOL



Fluoroscopy – Abdomen – 2015



ESAK – Italian Survey (2014)

