

Case study of an accidental exposure to X-rays in industrial radiography

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The incident

An industrial radiographer replaced a film on a welding test pipe while the X-ray tube he was using became or was still active. The device was malfunctioning at the time (temporary loss of voltage that resulted in longer exposure times).



Dosimetry

3 types of dosimetry were performed:

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| 1. Passive OSL dosimetry provided by AV Controlatom: | 1,4 mSv |
| 2. Personal electronic dosimeter Tracerco 404: | 974 mSv |
| 3. Biological dosimetry performed by Ugent (Prof. Thierens):
(uncertainty interval 150-500 mSv) | 360 mSv |

Based on (1) the fact that we are uncertain about how and where the OSL badge and the PED were worn during the incident, and (2) the unreliability of the PED when exposed to a high dose rate (up to 100 Sv/h at 30 cm of the X-ray tube) it was decided to only use the result of the biological dosimetry.



Test of PED and OSL (225 kV – 4 mA during 15s)

Scenario 1: dose in the beam

30 cm :	OSL: 339 mSv	Tracerco: 2350 mSv
100 cm :	OSL: 41 mSv	Tracerco: 2350 mSv

Scenario 2: dose by scattered radiation (50 cm between detector and pipe)

OSL: 0,94 mSv	Tracerco: 2000 mSv
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Lessons learned and actions taken

- The incident was reported to the management two weeks after the incident. So no actions were taken during the two weeks after the incident. This was due to the radiographer's insufficient knowledge of the possible effects of radiation.
- At first the certified physician did not fully comprehend the severity of the incident. This was due to a limited communication concerning the details of the incident.
- The radiographer has a work prohibition issued by the certified physician for the use of sources of ionizing radiation for 18 years (360 mSv divided by the dose limit of 20 mSv per 12 months).
- INES scaling (IAEA INES User's manual 2008 edition):
Based on the dose of 360 mSv an INES 3 scaling is possible in Belgium. But based on the examples in the INES manual and other incidents with industrial radiography the event was scaled as **INES 2**
- The radiographer shows no acute effects and has a different job within his company