



Report from a UK incident

## Unusually high-recorded doses - 3 examples from industrial radiography

### Description of the incidents

1. An industrial radiographer undertook gamma radiography (on site and in enclosures) using a 500 GBq iridium-192 source in a remote exposure container. His company was notified by the Approved Dosimetry Service that one of his personal dosimeters had recorded **a whole body dose of 3.4 Sv**.

The radiographer was immediately referred for a medical examination and a blood sample was taken for chromosome aberration analysis, all of which indicated that he had not been exposed to this level of dose. The chromosome aberration analysis estimated the dose to be less than 100 mSv (95% confidence). The radiographer was reasonably certain that he had not dropped his dosimeter since he kept it zipped in a pocket of his overalls. He had been working night shifts and during the daytime they were stored in an unlocked locker in changing rooms, well away from the radiography rooms and source store. Other companies had access to these changing rooms during the daytime, and it was concluded that the badge had been deliberately exposed with malicious intent.

2. Whilst performing x-ray radiography, a radiographer realised that he had left his personal dosimeter (which was attached to a key fob) on the exposure table. He terminated the exposure after 30 seconds and retrieved the dosimeter; however, he did not report the incident. The Approved Dosimetry Service subsequently reported **a whole body dose of 18 mSv, and skin dose of 100 mSv**.

An investigation was carried out: although it was not possible to accurately reproduce the recorded doses, it was concluded that the operator had not been exposed.

3. A radiographer worked with gamma (iridium-192 and cobalt-60) and x-ray sources in radiography enclosures. His dosimeter, which was worn for a two-month period, recorded **a whole body dose of 600 mSv, and a skin dose of 630 mSv**.

Chromosome aberration analysis of a blood sample indicated that he was unlikely to have received a whole body exposure greater than 100 mSv. An investigation was unable to find a precise cause of the high recorded dose. The radiographer stated that he had not lost his dosimeter at any time and it was always kept in a safe place when not in use. The investigation did find some localised radiation leakage from enclosure doors (which was remedied) but this could not have accounted for the high dose.

4. An industrial radiographer left his personal dosimeter in his desk drawer before going on holiday. A few days later, during an office move, the desk was

temporarily stored in an x-ray radiography enclosure for one week. On his return, he recovered his dosimeter from the drawer (now located in his new office) and wore it for the remainder of the dose assessment period. It was returned to the Approved Dosimetry Service as usual at the end of this period, who reported **a whole body dose of 57 mSv and a skin dose of 65 mSv**.

An immediate investigation was carried out, which indicated that the dosimeter was likely to have been exposed by a 400 kV x-ray set inside the enclosure over a period of four days. A full reconstruction of the incident was carried out, and the measured doses were similar to those received by the original dosimeter. It was concluded that the radiographer had not received the recorded doses.

### **Radiological consequences**

It is possible to conclude that none of the radiographers received the doses recorded on their personal dosimeters – although not all the cases could identify a convincing explanation for the results.

### **Lessons Learned**

- Where persons are issued with personal dosimeters, they should be made aware of the importance of always wearing them while working with radiation sources, and also the importance of storing them in a secure, low-background, location. Equally, staff should be made aware that the deliberate misuse of dosimeters will not be tolerated.
- Dosimeters should be attached to clothing and not to items such as car key fobs which may not always be in the possession of those involved (and could in any case shield the dosimeter).
- Accidentally exposed dosimeters, whether worn or not, should always be reported to the employer, who should alert the Approved Dosimetry Service (ie so that only valid doses are assigned to an individual's dose record).
- A dose assessment period of two months is rather long for situations such as industrial radiography where persons may be at risk of receiving high doses. If a high dose is recorded, a long assessment period makes it more difficult to investigate the possible causes. A one-month period (or less in some cases) is normally more appropriate.
- Where the recorded dose is very high (much greater than 100 mSv), chromosome analysis provides the best means of demonstrating (to the individual concerned, and to others) whether the dose is likely to have actually been received.
- Radiography enclosures should not be used as temporary storage locations.