



## Incident during gamma radiography – failure to retract the source between shots

### Description of the incident

The incident occurred during night time gamma radiography using a projection container with a 721 GBq (19.5 Ci) iridium-192 source. Following an exposure, a radiographer forgot to return the radioactive source to its container before placing new films and moving the end of the projection tube for a new exposure. He also forgot to observe the safety controls and procedures provided for the container.

The sequence of events was as follows:

- The incident took place during the 12<sup>th</sup> shot, the repetitiveness of the work may have had an influence on the omission to properly return the radioactive source to the safe position.
- Operator A did not verify the actual return of the source to the container. This can be verified by checking that the remote control timer has returned to zero, that there is a yellow “source returned” indicator on the container, and finally by mechanically locking the source in the container.
- The incident occurred at 2:00 a.m. It is common for the radiography to take place at night – so as to avoid any clashes with normal daytime work on site (and thus sped up the process).
- An electronic dosimeter was worn, but it was underneath work clothing. In fact, the risk of contamination in the work area required the wearing of a paper coverall. The dosimeter did not have an audible alarm to advise the person involved of the increase in dose rate: it only emitted flashes (which would not have been visible) when a dose of 1 mSv was reached. The operator did not verify the reading on the dosimeter.
- There is a safety system on the container, whereby it has to be re-set before the next exposure in order to release the source. It is then that the operator realized that the source did not re-enter the container. The other safety device is an optical signaling of different colors located on the container that informs of the position of the source following the conventions listed below:

Green:	Source re-entered, device locked, key removed (storage position).
Yellow:	Source re-entered, device locked, key in place, shutter closed.
Red:	Shutter open, ejected source in position or ready to be ejected.
Red with white dot:	Incomplete re-entry of source holder.

However, the operator did not check these indicators during the incident.

### Radiological consequences

The radiographer received a whole body dose of 15 mSv. It is not uncommon for radiography to be undertaken using a source with up to six times the activity in this incident – thus a dose of up to 90 mSv could have been received.

In order to determine the dose received by the hands, the person was subjected to medical examinations (including a thermography of the extremities) which did not reveal any effects.

### Lessons to be learned from the incident

- For each and every radiography exposure it is essential that the return of the source to the safe position is verified. This container was fitted with special safety indicators, but these are not sufficient, by themselves, to prevent incidents. The source should **always** be locked in the container **and** a measurement must be made with a suitable dose rate monitor after **every** exposure.
- If workers have to wear additional clothing such as coveralls, it must be ensured that personal electronic dosimeters can still be read. In any case, such dosimeters should have an audible alarm function to indicate the presence of high dose rates and whenever doses above a pre-determined level are exceeded.
- There are lessons in terms of repetitive night working, i.e. in which the risk of operator error can be greatly increased. Employers should be encouraged to take such factors into account.
- Even experienced and trained radiographers need reminding of the potential radiation risks associated with poor working procedures. Refresher training should be arranged at regular intervals.