Report from a UK incident

Recovery of gamma NDT sources: 3 examples

INCIDENT 1 - Description

Night-time site radiography was being undertaken at a heavy engineering facility using a 0.8 TBq iridium-192 gamma source in a remote exposure container. During an exposure the source became stuck in the guide tube and several unsuccessful attempts to free it via the wind-out mechanism were made. A lead tube was then positioned around the source and the Radiation Protection Adviser contacted. The source was successfully recovered by the following actions:

- By slowly pulling the guide tube from the lead shield it was possible to determine the exact location of the source with a radiation monitor.
- The guide tube was subsequently cut with bolt cutters and the source tipped on to the floor and then covered with a bag of lead shot.
- A new cable was fitted to the projection container, connected to the source and the source wound back into the container.

An inspection of the cut tubes revealed that a small metal pellet from the end of the container transit plug had caused the jam. Leakage tests of the source indicated that the source had not been significantly damaged.

Radiological consequences

Three persons were involved in the recovery, all of whom were wearing personal dosemeters. The results were:

- Worker A: Whole body: 2.5 mSv
  Hands*: 6.5 mSv (left) 8.9 mSv (right)
- Worker B: Whole body 0.5 mSv
- Worker C: Whole body 0.1 mSv

*Assessed by spare personal dosemeters taped to the back of the hands during recovery attempts.

INCIDENT 2 - Description

Night-time radiography was being carried out in a heavy engineering radiography facility using a 0.2 TBq iridium-192 source in a remote exposure container. Checks with a dose rate meter following an exposure immediately identified that the source had become detached from the drive cable and remained in the guide tubes.

The contingency plan for the recovery of the source was initiated by the radiographers, but first attempts were aborted when it was found that the emergency shielding container could not be unlocked. This was rectified the following day and the contingency plan to recover the source was successfully implemented the next day.

An inspection revealed that the connector had broken just behind the source capsule. This is thought to have been due to the repeated stress from the radiographers pulling hard on the winding handle at the end of each exposure to ensure that the source had fully retracted.

Radiological consequences

No significant doses were received (all recorded doses below 0.1 mSv).

INCIDENT 3 - Description

Gamma radiography was being carried out in a radiography facility using a pneumatic remote exposure unit containing 7 TBq of iridium-192. At the end of an exposure it was found that the source had failed to return to its container. The Radiation Protection Supervisor was contacted immediately.

There were a number of interlocks designed to prevent access during normal operations and it took some time to override them. Further investigation with a radiation monitor revealed the source to be located near or in the end cap of the guide tube.

An appropriate contingency plan to deal with such incidents was not available. However, the supervisor and assistant removed the end cap using long-handled tongs, knocked the source on to the floor and placed it inside the original exposure container.

A radiograph of the end cap revealed internal damage and the presence of broken fragments which had caused the source to become jammed. The damage had not been previously detected due to the lack of routine maintenance checks.

Radiological consequences

Personal dosemeters indicated the following doses were received from the source recovery:

- Supervisor: 29 mSv
- Assistant: 40 mSv

Lessons learned from all three incidents

- All three incidents highlight the importance of ensuring that gamma radiography exposure systems are regularly inspected and properly maintained. This should include:
  - Thorough checks on the condition of all connecting parts
  - An examination of the integrity of the container transit plug and an inspection of the guide tubes for damage and foreign bodies.
  - Servicing in accordance with the supplier's recommendations
- The incidents highlight the importance of using a dose rate monitor after each radiography exposure. Without such checks, the doses received could have been very much higher.
- With manual exposure systems it is normal to firmly retract the source – and exposure systems should be designed to withstand reasonable force. However, repeatedly exerting too much pressure, especially when the source is fully retracted, can lead to faults occurring.
- Industrial radiographers are expected to have contingency plans and appropriate equipment for dealing with gamma sources that have not properly returned to the shielded container. With the correct emergency equipment **and** procedures gamma radiography sources can be recovered successfully while keeping doses low. Radiographers should periodically rehearse contingency plans for gamma source recovery.

- The higher the activity of the source, the more difficult it will be to restrict doses during a source recovery. This needs to be recognised at the planning stage to ensure that the facility, equipment and procedures are all appropriate for the activity of the sources used.
- Incident 2 occurred in a radiography facility. Consequently, despite being unable to immediately recover the source, the radiographers were able to make the situation safe, make the appropriate arrangements, and then successfully completing the source recovery with no significant radiation doses being received.