

ANNEX A

Incident Case Histories

A7

Other Radiation Uses

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IRID Case Number: 0003/94

Category: A.1.1

Equipment: Other

Nature: Dropped dosimeter/not worn

An electronics technician (a classified person) was working, under a written permit to work, on top of a target station blockhouse containing a research neutron source (linear accelerator). The LINAC was not in use. Later the same day he noticed that he had lost his personal dosimeter. He immediately reported the loss and was given a replacement. The lost dosimeter was found by an unknown person a few weeks later and sent to the Approved Dosimetry Service. The ADS, which was unaware that the dosimeter had been lost, measured a whole body gamma dose of 25.01 mSv, a thermal neutron dose of 9.14 mSv and a skin dose of 26.77 mSv and these doses were transferred to the individual's dose record. The replacement dosimeter had recorded no dose, in line with the typical monthly dose of zero recorded for this operator.

The health physicist and Radiation Protection Adviser carried out an investigation and concluded that the dose received by the dosimeter was consistent with it being exposed for several weeks while on top of the blockhouse.

Doses

No doses to persons were deemed to have occurred but the technician's dosimeter recorded a whole body gamma dose of 25.01 mSv, a thermal neutron dose of 9.14 mSv and a skin dose of 26.77 mSv.

Lessons

- 1 When the loss of a dosimeter is reported the ADS should be informed in case the dosimeter is subsequently found and returned for assessment. Also, the employer needs to make an estimate of the dose received for the relevant period, in conjunction with the RPA, and ask the ADS to record this in the individual's dose record.
- 2 Employees should check that their dosimeters are worn in such a position that they cannot be accidentally knocked off during work activities.

IRID Case Number: 0005/94

Category: C.1.1

Equipment: Analytical equipment

**Nature: Contaminated premises/
equipment**

A package, which was thought to contain an instrument incorporating a small americium-241 foil source, was opened by an employee in the goods reception area. The package actually contained three americium-241 sources in a shielded lead tube and one of the sources was leaking. As a result, radioactive contamination was spread on to his clothes and on to surrounding surfaces.

The area was later decontaminated successfully.

Doses

Fortunately, swabs taken from the employee's nose and mouth did not indicate the presence of americium-241.

Lessons

- 1 Packages containing radioactive materials should be opened and monitored under controlled conditions.
- 2 It is not possible to rely upon the descriptions of the contents of such packages given on invoices etc.

IRID Case Number: 0009/94

Category: C.1.X

Equipment: Laboratory/calibration sealed sources

Nature: Lost source

A 400 MBq iron-55 source was used for instrument calibration by mounting the source container in a calibration jig. The push-fit lid of the container was removed to expose the source, which was held in the container by a piece of foam sponge. The source was lost when the container was dropped during removal from the jig. The user, who was not aware that the source was not fixed within the container, saw only the lid of the container come off and a piece of foam fall out. He replaced these and returned the container to its storage cupboard. It was only realised that the source was missing when it was required for use four days later. In the meantime, the area had been swept and vacuumed. Despite extensive searching of the area, dustbins and vacuum cleaner contents, the source was not recovered.

Doses

Due to the low energy and activity of the source it is unlikely that any significant doses were received.

Lessons

- 1 Sources used in routine operations should be securely mounted in purpose-made holders and jigs etc designed to ensure the source holder is adequately supported.
- 2 Training of users should include familiarisation with the appearance of sealed sources.
- 3 Where a source container has been manipulated or may have been affected by some event, eg dropping, the presence of the source should be confirmed by measurement prior to returning it to storage.

IRID Case Number: 0010/94

Category: X.1.2

Equipment: Analytical equipment

Nature: Lost source

An analytical laboratory decided to dispose of a number of items of laboratory equipment which included a gas chromatograph containing a 370 MBq nickel-63 source. Procedures in place ensured that no financial irregularities took place regarding the disposal of the equipment but the presence of the radioactive source was overlooked when the equipment was disposed of to a local landfill site. The equipment was not clearly labelled as containing radioactive materials and the system for keeping regular records of the source failed. The laboratory did not require registration for the keeping and use of this source on the premises or authorisation to dispose of it by virtue of the Radioactive Substances (Testing Instruments) Exemption Order 1986 but the Order does, however, require that such sources are disposed of to a person who is authorised to dispose of them or to manufacturers of such sources.

The source was not in a position to be readily recovered from the landfill site.

Doses

No significant doses were thought to have been received by the contractor or landfill operators.

Lessons

- 1 Radiation warning labels must be displayed on all equipment that contains radioactive materials.
- 2 Regular and recorded source record keeping must be in place for each and every radioactive source located on a premises.
- 3 Engineering staff on all premises must be made aware of all devices on site that contain radioactive substances, have access to the relevant source records, and be aware of the procedures relating to their maintenance, removal and disposal.

IRID Case Number: 0015/94

Category: C.1.1

Equipment: Laboratory/calibration sealed sources

Nature: Leaking source

A technical service laboratory used a number of radioactive sources, one of which was a 185 MBq strontium-90 foil source. This particular source was 19 years old and, although this had recently been identified as a potential source of problems (the recommended working life for modern comparable sources is 5 years), no specific recommendations had been made due to the imminent replacement of the equipment. However, prior to replacement of the equipment it was found that the source had ruptured, resulting in the leakage of approximately 63 kBq from the source. It was fortunate that the majority of the contamination was contained within the body of the equipment. The source had a valid leakage test certificate, although this would soon have required renewal.

Doses

No significant radiation doses were received by any individuals as a result of the incident.

Lessons

- 1 As the age of a source increases so too does the likelihood of source leakage. The recommended working life should be used as a marker of when to review whether to continue use of a source. Factors such as source design and working environment should be taken into account when doing this.
- 2 The majority of leakage tests are taken from the exterior of equipment containing sources. In view of this, care should be taken whenever dismantling, or otherwise gaining access to the interior of, equipment containing radioactive sources. If the radioactive source has leaked then this contamination may be completely contained within the equipment until such time as the equipment is dismantled or maintenance carried out.

IRID Case Number: 0009/95

Category: X.X.2

Equipment: Other

Nature: Lost source

A private hospital was undergoing a process of upgrading its fire alarm system and emergency exit signs over an 18-month period. During a routine visit to the hospital by the Radiation Protection Adviser it was found that three of the emergency exit signs, each containing approximately 180 GBq of tritium in gaseous tritium light devices (GTLDs), had gone missing. The ensuing investigation revealed that the radiation warning labels on the exit signs had been covered over with insulating tape and the contractor concerned, not therefore knowing that they contained radioactive materials, had removed the signs to a local landfill site. The hospital did not require registration for the keeping of these GTLDs on the premises or authorisation to dispose of them by virtue of the Radioactive Substances (Gaseous Tritium Light Devices) Exemption Order 1985, but the Order does, however, require that they are disposed of to a person who is authorised to dispose of them or to the manufacturer.

The sources were not in a position to be readily recovered from the landfill site.

Doses

No significant doses were thought to have been received by the contractor or landfill operators.

Lessons

- 1 Radiation warning labels on any device must never be covered over whilst radiation remains a hazard.
- 2 Engineering staff on all premises must be made aware of all devices on site that contain radioactive substances, such as those incorporated in some luminous emergency signs and smoke detectors, have access to the relevant source records, and be aware of the procedures relating to their maintenance, removal and disposal.

IRID Case Number: 0003/96

Category: B.1.2

Equipment: Smoke detectors

Nature: Lost source

A waste disposal landfill company was informed by a waste collection authority that a number of recently delivered large ISO containers of domestic and garden refuse may have contained a number of smoke detectors containing radioactive materials. The smoke detectors had originally been 'fly-tipped', along with other refuse, on a piece of unused land. After contacting the Environment Agency, the landfill company contracted a radiation protection specialist to attempt to recover the smoke detectors from the refuse containers.

The prompt action of the waste collection authority in notifying the landfill company, upon discovering the potential radioactive contents of the waste containers, meant that the radioactive materials could be recovered before the containers were emptied into the landfill site such that retrieval would have been impossible.

The investigation discovered 27 smoke detectors, each containing 3.7 MBq americium-241. All radioactive sources were intact and were disposed of in an authorised manner.

Lesson

The discovery of any radioactive material must be investigated immediately and promptly reported to all relevant persons if a satisfactory conclusion is not reached.

IRID Case Number: 0009/96

Category: X.1.2

Equipment: Nuclear medicine

**Nature: Contaminated premises/
equipment**

Under the supervision of a medical physicist from a nearby hospital, a prisoner was administered with a therapeutic quantity, 435 MBq, of radioactive iodine-131 within the prison. This was an unusual event for the prison; its radiation uses were normally limited to diagnostic X-rays and X-ray security. The prison had no authorisation under the Radioactive Substances Act 1993 either to hold or to dispose of the iodine, and failed to monitor, designate any controlled or supervised areas, or write local rules for the procedure. The medical physicist supplied the prison officers with information regarding physical isolation of the prisoner and the practical aspects of feeding, toilet facilities, bed linen etc but did not inform them of their regulatory obligations. As a result, prison staff were unaware that they were carrying out procedures at the prison that contravened both the Ionising Radiations Regulations 1985 and the Radioactive Substances Act 1993. The first time they became aware of the situation was seven months later when the prison's Radiation Protection Supervisor mentioned the incident to the Radiation Protection Adviser during a training course. The RPA visited the prison a short time later to establish what had occurred.

Doses

By the time the RPA visited the site, any iodine contamination would have decayed away. Since neither radiation nor contamination monitoring had been carried out at the time of the treatment, it was impossible to determine whether anyone other than the patient had received any significant doses of radiation.

Lessons

- 1 An organisation should always consult a radiation protection specialist when it is involved with procedures involving ionising radiation which are beyond the scope of its normal work.
- 2 Whenever an organisation supplies sources of ionising radiation to another organisation, the former must supply full information regarding the radioactive source involved as well as the radiation protection and legislative requirements.

IRID Case Number: 0003/97

Category: A.1.2

Equipment: Other

Nature: Lost source

A small 'home-made' check source made up of natural thorium oxide in a 35 mm photographic film can covered with resin was found in rubbish on a factory site. The source was used as a check source for density gauges at another company. The source had been left in a cupboard in a maintenance area, but had later been moved to a temporary building. The temporary building was later sold and moved to another location. The building was then cleared out and the source discarded as rubbish. The dose rate from the source was $200 \mu\text{Sv h}^{-1}$ at the container mouth, falling to $2.5 \mu\text{Sv h}^{-1}$ at 150 cm.

Although the source was exempt from the requirements of the Radioactive Substances Act 1993, the company erroneously thought that the Ionising Radiation Regulations 1985 also did not apply to the source in terms of safe storage and accounting. The home-made nature of the source meant that it probably did not meet the requirements of the regulations in terms of suitability of encapsulation.

Doses

It is unlikely that any significant doses were received as a result of this incident.

Lesson

Safe storage and accounting of all radioactive sources are essential and required by the regulations. Radioactive sources exempt from some of the requirements of the Radioactive Substances Act 1993 by virtue of an Exemption Order are not exempt from requirements for regular source record keeping.

IRID Case Number: 0001/98

Category: B.1.1

Equipment: Thickness gauges

Nature: Leaking source

Two laboratory instruments with integral tritium/zirconium sealed sources were discovered to be leaking radioactive materials. The discovery was made during preparation for disposal of a number of redundant sources in a source store. The two sources, each having activity of 296 GBq, were part of a laboratory electronic thickness gauge used to measure the thickness of tin coatings on steel. The equipment was replaced by a laboratory X-ray device and it is likely that the sources had been held in the store for four to five years.

On discovering the leak, the Radiation Protection Adviser removed the sources from the devices and sealed them in plastic bags to prevent further contamination of the inside of the source store. Both the devices and sources were retained in a lead lined box until removal from the site.

The radiological hazard, which occurred from this incident, was small and the RPA took sufficient actions to prevent the risk of further contamination outside of the instruments. It is likely that there had been a gradual loss of source integrity and that the sources had been leaking for some time. There was no evidence that the leaks had been caused through intent or accident.

Doses

The dose to the RPA who discovered the leaking sources is not known, but would be expected to be small.

Lessons

- 1 Companies must carefully consider the safe disposal of redundant equipment containing radioactive materials. Disposal should occur with minimal delay or further problems may arise.
- 2 Regular inspections of all equipment containing radioactive materials must be carried out. In particular, the requirement for routine tests for leakage of radioactive material continues even when the sources are awaiting disposal.