

Radiation Act 2005

Annual report for the financial year
ending 30 June 2023





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Radiation regulation in Victoria in 2022–23 – a snapshot

The purpose of the *Radiation Act 2005* (the Act), which took effect in September 2007, is to protect the health and safety of Victorians and the environment from the harmful effects of radiation. The Act is administered by the Radiation Team of the department, which has a total of 15 specialist staff.

The Act requires that the Secretary of the Department of Health publishes an annual report that describes the activities of the Secretary under the Act and summarises all authorities issued, renewed, suspended, cancelled, varied, transferred or surrendered during that year. The report must also detail all radiation incidents investigated and summarise all prosecutions for offences in that year.

At the end of the 2022–23 year, there were just under 20,000 current licences or approvals issued to organisations or individuals to conduct some type of radiation practice or to use a radiation source.

During the 2022–23 financial year, a total of 99 individuals notified the department that they were intending to work in Victoria under new laws for automatic mutual recognition of their interstate licence.

The department's new radiation licensing portal and database was launched in October 2019. The first stage of implementing the new licensing database focused on the licences and approvals issued to individuals – use licences and approvals for testers and assessors. At the end of 2022–23 financial year, all of the 17,226 use licence holders had registered to use the portal.

The portal led to a significant reduction in the average processing times from an average of 18 days to an average of eight days (with 95 per cent of licences processed within five days) and the numbers of emails that are sent to the department about licensing matters.

Work continues on the next stage of the portal development, which will see management licences included.

The department recovered approximately \$4.153 million in licensing revenue in the 2022–23 financial year.

The department conducted 481 inspections in the 2022–23 financial year as part of its licensing compliance monitoring program. The number of inspections was above the Victorian State Budget target of 480 inspections.

During the year, the department conducted a variety of enforcement actions. Two search warrants were obtained and executed in relation to suspected commercial tanning operations. These searches resulted in the seizure of five tanning units. One prosecution related to the commercial tanning ban was initiated during the year.

A Prohibition Notice was issued to a management licence holder authorised to possess unsealed radioactive material for the purpose of therapeutic nuclear medicine. The notice prohibited the practice of therapeutic nuclear medicine under certain specific circumstances.

During 2022–23, 268 incidents were reported to the department compared with 248 in the previous year. Of the 268 incidents in 2022–23, 267 were in the medical sector. Most medical incidents involved unplanned exposure or additional exposure to patients as a result of errors in patient management or as a result of equipment error. None of the incidents involved any compromise in security of high-consequence sealed sources.



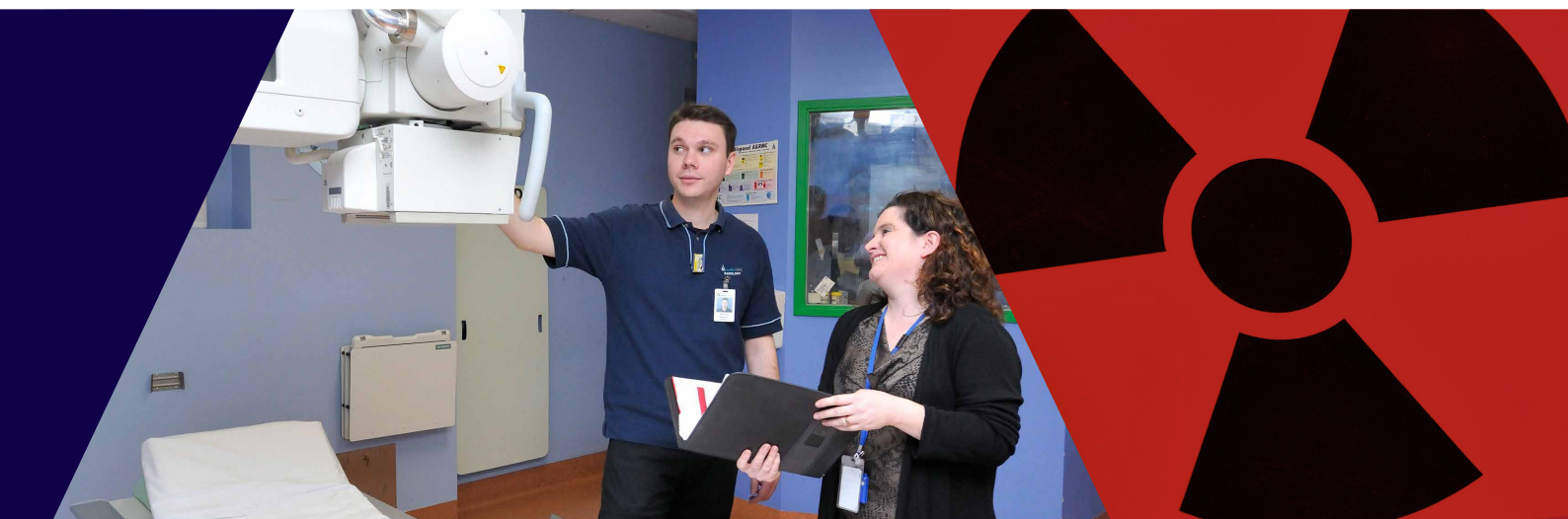
Introduction

Diagnostic, therapeutic, industrial and other uses of radiation have contributed to the safety and quality of life for all Victorians. However, radiation involves hazards if it is used inappropriately or unnecessarily. For this reason, the department regulates the use of radiation to protect people and the environment from its harmful effects by licensing users of radiation sources and managers of radiation practices under the Act.

Section 134 of the Act requires that the Secretary of the Department of Health, in respect of each financial year, publish a report that:

- a. describes the activities of the Secretary under the Act
- b. includes a summary of all authorities issued, renewed, suspended, cancelled, varied, transferred or surrendered during that year
- c. includes all radiation incidents investigated in that year
- d. includes a summary of all prosecutions for offences against the Act or the Regulations commenced in that year
- e. includes any other prescribed matter.

This 2022–23 annual report describes the activities of the Secretary for the financial year from 1 July 2022 to 30 June 2023.



Legislation

Radiation Act

The Radiation Act 2005 (the Act) commenced operation on 1 September 2007. The Act repealed previous laws.

The Act gives effect to Victoria's commitment to the National Directory for Radiation Protection (NDRP) published by the Australian Radiation Protection and Nuclear Safety Agency. The NDRP outlines a common approach for Commonwealth, state and territory governments in regulating radiation practices.

The purpose of the Act is 'to protect the health and safety of persons and the environment from the harmful effects of radiation'. It incorporates:

- the radiation protection principle
- a requirement for the Secretary of the department to have regard to both the radiation protection principle and the NDRP
- the concept of licensed activities. In particular, the licensing framework created by the Act features:
 - management licences that authorise the conduct of radiation practices (such as possessing a radiation source)
 - use licences that authorise a natural person to use a radiation source
 - radiation facility construction licences
- the concept of approved testers and the testing of prescribed radiation sources against declared radiation safety standards
- the concept of approved assessors of security and transport security plans.

The Act creates significant offences including:

- conducting a radiation practice without a management licence (the maximum penalty in the 2022–23 period for a body corporate for this offence was \$1,635,660)
- using a radiation source without a use licence (the maximum penalty in the 2022–23 period for an individual for this offence was \$218,088)
- noncompliance with the conditions of a management licence (the maximum penalty in the 2022–23 period for a body corporate for this offence was \$1,090 440).

Radiation Regulations

The Radiation Regulations 2017 (the Regulations) prescribe:

- licensing fees
- definitions of radioactive material
- radiation dose limits
- those radiation sources that must be tested and issued with a certificate of compliance before use and at specified intervals afterwards.

The Regulations also:

- strengthen the security of high-consequence radioactive material
- implement changes to the occupational dose limit to the lens of the eye to reflect recent international and national developments.

How is the Act administered?

The Radiation Team

Most of the significant powers and functions of the Act rest with the Secretary to the Department of Health. In practice, most of the powers needed to administer the laws are delegated to departmental staff.

The Act is administered by a specialist team known as the Radiation Team (the team). The team has a total of 15 specialist staff members.

The team is located within the Environmental Health Regulation and Compliance Unit (the unit), which also administers two other statewide regulatory systems. The unit has two support teams that provide support to the team:

- an operational support team that provides services such as telephone and email response, website management, investigations, and management of the unit's risk management system
- an information systems team that, among other things, administers the software systems the team uses to administer the licensing system.

The unit is located within the department's Public Health Division.

The team is led by a Team Leader and structured into three specialist teams. These teams are led by Team Supervisors who report directly to the Team Leader. The three specialist teams are the:

- Medical and Veterinary Radiation Practices Team, which has five full-time staff
- Dental and Non-ionising Radiation Practices Team, which has 2.5 full-time equivalent staff
- Industrial Radiation Practices Team, which has three full time staff.

There are also three other staff members who report to the Team Leader:

- Expert Adviser, Radiation Safety
- Senior Radiation Safety Officer
- Senior Project Officer.

The Radiation Team has two core responsibilities, which are:

- the regulation of radiation practices and individuals authorised to use radiation sources in order to protect worker health, public health, and the environment from the harmful effects of radiation; and
- preparing for and responding to radiation incidents.

The licensing system

The Act contains a licensing framework combined with significant offences provisions. The licensing framework involves:

- ‘facility construction’ licences that authorise construction of a ‘radiation facility’. Currently, these are only for premises that will house, possess, store or use high-consequence radioactive material. High consequence radioactive material is radioactive material with mandated security requirements, in addition to radiation safety requirements.
- ‘management licences’ that authorise the conduct of a radiation practice. Radiation practices include:
 - possession of radiation sources (such as X-ray units, CT scanners, radiopharmaceuticals used in nuclear medicine, radioactive sources used in industrial practices such as radiography of pipes or welds)
 - transport of radioactive material
 - sale of radiation sources
 - research involving the exposure of persons to ionising radiation
 - disposal of radiation sources
 - mining or processing of radioactive material (mineral sands, in Victoria’s case).
- ‘use licences’ that authorise individuals to use a radiation source
- ‘approved tester authorities’ that authorise individuals to issue certificates indicating compliance with mandatory radiation safety standards for certain types of medical diagnostic X-ray units
- ‘approved assessor authorities’ that authorise individuals to issue certificates indicating compliance with mandatory security standards for high consequence radioactive material.

The Act provides wide powers to make conditions. The Act and the Regulations do not include technical information, which is likely to need frequent change to reflect international and national agreements. The omission of technical detail means wide-ranging power is needed to make and apply enforceable licence conditions.

All licences issued by the department are subject to conditions. These conditions focus on compliance with nationally agreed codes specific to the type of practice involved.

Radiation safety incidents are also required to be reported to the department. The overwhelming majority of these incidents occur in medical practices, but they also occur in industrial practices. Some types of incidents, such as transport accidents involving radioactive material or the loss or theft of radioactive material, require an urgent response. These incidents are discussed in more detail later in this report.

Automatic mutual recognition

In late 2020, National Cabinet agreed to implement automatic mutual recognition (AMR). AMR allows a person who is licensed or registered for an occupation in one jurisdiction to be considered licensed or registered to perform the same activities in another jurisdiction, without the need to go through further application processes or pay additional fees. This recognition of a licence or a registration from a jurisdiction makes it easier for workers who would otherwise need to be licensed or registered for their job to work in another state and territory.

AMR for occupational licences became available from 1 July 2021 in certain states and territories. Victoria entered the scheme on this date with the scheme applying to the following types of authorities:

- use licences
- approved testers
- approved assessors.

Any worker wishing to work in Victoria under these arrangements must notify the department using a smart form available on the department's website before starting work. The department maintains an internal register of the workers who notify the department.

During the 2022–23 financial year, the department continued to liaise with other jurisdictions on the implementation of the system.

In 2022–23, 99 individuals notified the department they intended to work in Victoria under these arrangements. These numbers are expected to increase gradually over the next financial year as more workers in other jurisdictions become eligible to work in Victoria and more workers become aware of the system.

AMR is now in place in all states and territories except Queensland, but some jurisdictions have allowed more time to prepare for specific licensing schemes including radiation safety. The differences between jurisdictions' implementation timing and approaches make implementation of AMR complex.

The challenges for the department will include:

- building the notification system directly into the licensing portal discussed later in this report
- responding to enquiries from other jurisdictions about workers being allowed to work in Victoria under these arrangements in a way that both meets the needs of the workers and is efficient in a resource-constrained environment. For this reason, the department will explore the potential for expanding the details included on the public register to reduce the need for these enquiries, and to be more transparent about this aspect of the licensing system.

Summary of authorities issued by the department

Section 12 of the Act creates an offence for a person to conduct a radiation practice unless the person holds a management licence or is exempt under s.16 of the Act from the requirement to hold a management licence.

The most common radiation practice requiring a management licence is possessing a radiation source. Other radiation practices include:

- transporting radioactive material
- selling radiation sources
- procuring or arranging research that involves exposing people to radiation
- mining or processing radioactive material.

Section 13 of the Act creates an offence for a person to use a radiation source unless the person holds a use licence or is exempted under s. 16 of the Act from the requirement to hold a use licence.

Table 1 sets out the numbers of authorities issued, renewed, suspended, cancelled, varied, transferred and surrendered under the Act during 2022–23.

Table 1: Number of authorities issued, renewed, suspended, cancelled, varied, transferred and surrendered under the Radiation Act, 1 July 2022 to 30 June 2023

Authority	Management licence	Use licence	Tester	Assessor
Issued	128	1,840	7	0
Renewed	757	5,572	10	6
Suspended	0	0	0	0
Cancelled	0	0	0	0
Varied	661	458	3	0
Transferred	38	n/a	n/a	n/a
Surrendered	42	6	0	0

Table 2 sets out the numbers of current authorities under the Act as of 30 June 2023.

Table 2: Number of authorities issued as of 30 June 2023

Authority	Number
Use licences	17,226
Management licences	2,854
Approved testers	51
Approved assessors	7

Table 3 sets out the estimate of the sectors in which these licences are held.

Table 3: Estimate of the sectors in which licences are held under the Radiation Act, 1 July 2022 to 30 June 2023

Sector	Management licence	Use licence
Dental	1,544 (48.66%)	5,590 (32.16%)
Veterinary	392 (12.35%)	2,716 (15.63%)
Medical	233 (7.34%)	6,603 (37.99%)
Industrial	235 (7.41%)	1,549 (8.91%)
Sales	154 (4.85%)	n/a
Chiropractic	64 (2.02%)	182 (1.05%)
Transport	46 (1.45%)	n/a
Education	36 (1.13%)	82 (0.47%)
Mining	3 (0.09%)	n/a
Other	466 (14.69%)	658 (3.79%)

Licensing portal and database

The department launched a new radiation licensing portal and database in October 2019.

The first stage of the project focused on licences and approvals issued to individuals – use licences and approvals for testers and assessors. At the end of 2022–23 financial year, there were 17,226 use licence holders who had registered to use the portal. All use licence holders have now registered on the portal.

Users register their contact details on the web portal and can then apply for licences or approvals. Based on the type of licence, the system advises users what documents they must supply with their application. The new system removes the need for data entry by the department, which allows the application to be assessed more quickly than in the past.

Similarly, where a fee must be paid for an individual licence, this fee payment occurs when the application is lodged. This means the new system eliminates one of the processing delays that occurred in the previous system.

After a licence has been issued, users can:

- download a copy of their licence
- apply for variations to an existing licence or approval
- renew their licence at the appropriate time
- make credit card payments
- update their contact details.

Another feature of the new system is that it accommodates workers who wish to apply for a licence under the mutual recognition laws that operate across Australia. This recognition of a licence issued in another jurisdiction for the purpose of issuing a licence in Victoria is different to a person working in Victoria under AMR. The licensing system allows the person easily to apply under these arrangements. A process to notify the department of a worker's intention to work in Victoria under AMR will eventually be built into the portal.

The system also features an improved [public register of licences](https://licensing.health.vic.gov.au/public/use-licence) <<https://licensing.health.vic.gov.au/public/use-licence>>.

During 2022–23, we progressed work to include the more complex management licences, usually held by companies and other organisations. These are the licences that authorise possession of radiation sources, as well as many other practices. There are more than 2,700 management licences.

The management licence module, like that for individual licences, is based on a set of business rules the system applies to advise users what documents they need to upload with their application. Initially, the department will not require fees to be paid at the time of application. Instead, it will invoice the applicant through the portal before the application is decided. The department will monitor the use and performance of the system. We expect to transition to upfront fee payment at a later date.

Another new feature of the management licence module is aimed at the applicants and licence holders who seek to possess radiation sources. The system will ask the user to identify the makes and models of the radiation sources they wish to acquire. Business rules are then used to complete the application, saving time for the applicant and improving data quality.

The new system is expected to be implemented in the last half of 2023. This will enable us to retire the legacy database that has been used for more than 17 years.

The entire system has also migrated to a new cloud environment. The URL for the [licensing portal](https://licensing.health.vic.gov.au) is <<https://licensing.health.vic.gov.au>>.



Revenue

The department recovered approximately \$4.153 million in licensing revenue in the 2022–23 financial year.

Fee policy

The Victorian Guide to Regulation and general government policy is that regulatory fees and user charges should be set on the basis of full cost recovery. This meets both efficiency and equity objectives.

The department's approach is therefore to recover the full cost of the administration of the Act. This is done by setting fees based on the following principles:

- Applications for use licences attract a fee consisting of a non-refundable application fee plus a licence fee based on the time period of the licence. This means that the longer the licence, the higher the fee. However, there is a small discount for longer licence periods to reflect the slight reduction of administrative burden associated with longer licences.
- The fee for a use licence does not depend on the type of radiation source proposed to be used.
- Applications for a management licence attract a fee based on a non-refundable application fee plus a licence fee based on a combination of factors, including:
 - the types and numbers of radiation sources to be possessed. Sources deemed to represent a higher risk to workers, patients or the environment attract a higher fee compared with sources considered to lower risk
 - the time period of the licence – the longer the period, the higher the fee.
- There is currently no fee for a facility construction licence because the legacy licensing database cannot process a fee for this type of licence. When the database can process these fees, the department will seek to amend the Regulations to require payment of a fee for this licence type.
- Applications for an approved assessors' authorisation do not currently attract a fee. This absence of a fee reflects the department's policy of removing disincentives to work in this area.

The cost of the radiation safety regulatory programme was reviewed in mid-2022 and compared to the fees recovered in the 2021–22 year. This review found that the fees are still set at levels that achieve full cost recovery.

Fees for 2022–23

Licensing fees are defined by the Regulations in terms of the numbers of fee units that relate to the application or licence. The value of a fee unit is set by the Victorian Treasurer by a direction made under s. 6 of the *Monetary Units Act 2004*. The direction is published in the Victorian Government Gazette.

For the 2022–23 financial year, the value of a fee unit was \$15.29.

The licensing fees for each year are published on the [department's website](https://www.health.vic.gov.au/radiation/a-list-of-the-prescribed-fees-for-radiation-licences) <<https://www.health.vic.gov.au/radiation/a-list-of-the-prescribed-fees-for-radiation-licences>>.

Enforcement action

Providing advice and education to duty holders will always be the first step in seeking compliance with the Act and the Regulations. However, there may be some instances in which enforcement action is required.

The Act provides the department with several enforcement tools in addition to the power to prosecute.

Available enforcement actions

Improvement notices

The Secretary, or a delegate of the Secretary, may issue this type of notice if they believe that a person has contravened a provision of the Act or the Regulations in circumstances that make it likely that the contravention is continuing or will reoccur, or is likely to contravene a provision of the Act or the Regulations. If issued, the notice will require the person to remedy the contravention or likely contravention or the matters or activities causing the contravention or likely contravention.

Prohibition notices

Like improvement notices, these notices may be issued by the Secretary or a delegate under the same circumstances. The notice prohibits the person from carrying on the activity, or the carrying on of the activity in a specified way, until the Secretary or the delegate has certified in writing that the contravention has ceased or that the likelihood of the contravention occurring has passed.

Show cause notice

The Secretary or a delegate may issue a show cause notice notifying a licence holder of an action the Secretary or a delegate proposes taking in relation to a contravention of a requirement of the Act, with an invitation to the holder to show cause why the proposed action should not be taken.

Executing a search warrant

While the Act provides power for authorised officers to enter certain places to monitor compliance with the Act or the Regulations, under some circumstances, it is necessary first to obtain a search warrant to authorise that access. An authorised officer of the department may apply to a magistrate to issue a search warrant if the authorised officer believes on reasonable grounds that there is, or may be within the next 72 hours, a particular thing (including a document) at the place that may afford evidence of an offence against the Act or the Regulations.

Forensic data analysis

During the 2022–23 financial year, the department engaged a forensic IT consultant to provide forensic analysis of devices such as mobile telephones and computers as part of the investigation process that occurs during the execution of a search warrant.

Seizure of articles

The Act gives certain powers to authorised officers, including the power to seize anything (including a radiation source or a document) if the authorised officer reasonably believes:

- the seized thing is connected with an alleged contravention of the Act or the Regulations, or
- there is a serious risk to the health or safety of any person or the safety of the environment if the thing is not seized.

Making a radiation source inoperative

The Act gives an authorised officer power to make a radiation source inoperative.

Sealing a radiation source

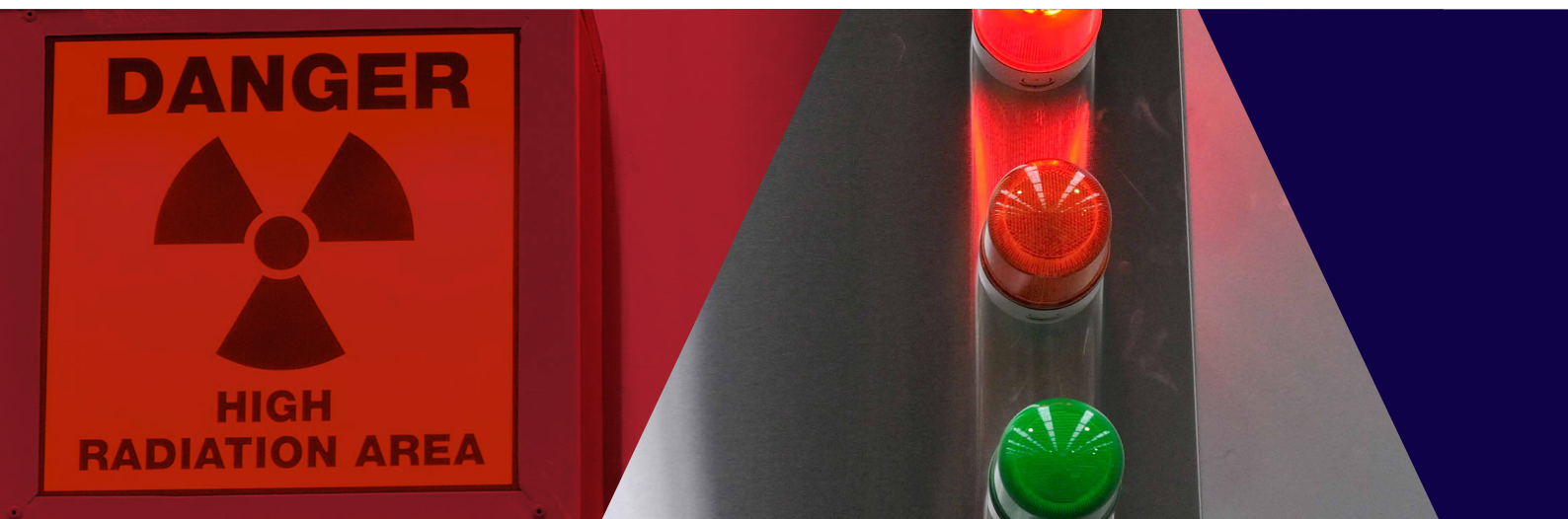
The Act gives an authorised officer the power to seal a radiation source. In practice, sealing a radiation source may be required where it is impractical to seize the source, but it is necessary to prevent its further use.

Suspending or cancelling an authority

The Act provides that the Secretary, or a delegate, may suspend or cancel an authority.

Prosecution

There are several significant offences contained within the Act and, under certain circumstances, the department may feel it is necessary to begin prosecutions for these offences.



Enforcement actions taken in 2022–23

Table 4 summarises the formal enforcement actions the department took during the year.

One search warrant was obtained and executed in relation to a suspected commercial tanning operation. This search resulted in the seizure of five tanning units.

Two prosecutions related to commercial tanning ban were completed during the year which related to investigations commenced in previous years. These are discussed later in the report.

A use licence issued to a veterinarian was cancelled (see focus on veterinary radiation practices section below).

A Prohibition Notice was issued to a management licence holder authorised to possess unsealed radioactive material for the purpose of therapeutic nuclear medicine. The notice prohibited the practice of therapeutic nuclear medicine under certain specific circumstances.

Table 4: Enforcement action

Enforcement action	Number
Improvement notice	0
Prohibition notices	1
Show cause notice	0
Execution of a search warrant	2
Sealing a radiation source	0
Seizure of commercial tanning units	5
Prosecutions initiated	1
Licences suspended	0

Stakeholder engagement and communication activities

Informed stakeholders are more likely to work in partnership with the department. They are more aware of the laws that govern them, the potential risks associated with their practices, and the ways to mitigate those risks. Informing and engaging with stakeholders is central to the overall regulatory objective and allows for collaboration and education to achieve regulatory objectives.

The department has been increasing email communication with regulated entities. The department is now distributing all written communications by email. Implementing the new licensing system (discussed earlier) has greatly assisted in this effort, as has the [redeveloped website](https://www.health.vic.gov.au/public-health/radiation) <<https://www.health.vic.gov.au/public-health/radiation>>.

Newsletters

The Radiation Team produced one edition of the radiation newsletter The Source, distributed to approximately 18,235 stakeholders in July 2022.

This issue communicated the upcoming launch of the new licensing portal for radiation management licences, upcoming variations to licences in line with new national codes, and the updated requirements for the discharge of radioactive material to sewer. It also reported on compliance inspection activities for radiation management licence holders in the medical, dental, research, transport and mining sector.

External presentations

The department carried out two presentations on radiation incident response to Fire Rescue Victoria and one on radiation safety and the Act and the Regulations to dentists and dental therapists at the Melbourne Dental School.

Representation on national committees

Radiation Health Committee

The Radiation Health Committee (RHC) advises the CEO and the Radiation Health and Safety Advisory Council of the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) on matters relating to radiation protection. This includes formulating draft national policies, codes and standards for consideration by the Commonwealth, states and territories.

The Senior Project Officer in the Radiation Team represented the department on the RHC during the year. The RHC has met three times in the 2022–23 financial year.

Victoria contributed directly to the following work of the RHC:

- project lead on the development of a new standards document for dosimetry service providers
- working group participation for the development of the Australian radiation apparatus testing requirements, which include the development of nationally consistent radiation safety standards for the purposes of compliance testing of prescribed radiation sources used for medical diagnostic purposes
- working group participation for revision of the Code of practice for radiation protection in dentistry (RPS10, 2005)
- working group participation for revision of the Code of practice and safety guide for safe use of fixed radiation gauges (2007) (RPS13) and the Code of practice and safety guide for portable density/moisture gauges containing radioactive sources (2004) (RPS5).
- working group participation for revision of the Code of practice for protection against ionizing radiation emitted from X-ray analysis equipment (1984) (RHS9), the Revised statement on cabinet X-ray equipment for examination of letters, packages, baggage, freight and other articles for security, quality control and other purposes (1987) (RHS21), and the Statement on enclosed X-ray equipment for special applications (1987) (RHS22).

ARPANSA publishes the [agendas and minutes of these committee meetings](https://www.arpansa.gov.au/about-us/advisory-council-and-committees/radiation-health-committee/agendas-and-minutes)

<<https://www.arpansa.gov.au/about-us/advisory-council-and-committees/radiation-health-committee/agendas-and-minutes>>.

enHealth

The Environmental Health Standing Committee (enHealth) provides the Australian Health Protection Principal Committee with advice on environmental factors affecting health. The Radiation Health Expert Reference Panel (RHERP) advises enHealth on radiation health matters. Victoria was represented on RHERP by the Manager of the Environmental Health and Regulation Compliance Unit.

Victoria contributed to various national radiation policy discussions and issues at RHERP, including formulation of the Draft National Radiation Safety Strategy and the development of strategies and responses to the findings of the International Atomic Energy Agency's Integrated Regulatory Review Service mission (2018).

Focus on compliance monitoring

Monitoring the compliance of radiation practices with the requirements of the Act is primarily carried out through inspecting the practices. Where possible, the department promotes compliance by providing advice and constructive guidance. It also uses technology and systems to help licence holders interpret and comply with the laws and standards applicable to them.

The department conducted 481 inspections in the 2022–23 financial year as part of its licensing compliance monitoring program. This was above the Victorian State Budget target of 480 inspections.

The compliance monitoring program included inspections of specific types of radiation practices to monitor compliance with safety or security standards, as well as inspections in relation to non-renewal of management licences.



Focus on medical radiation

Compliance monitoring

The compliance monitoring in the medical sector included inspections of computed tomography (CT) practices, dual-energy X-ray absorptiometry (DXA) practices and radiopharmacy / nuclear medicine practices. A total of 193 inspections were conducted in the medical sector. Table 5 shows the breakdown of inspections.

Table 5: Inspection breakdown in the medical sector

Inspection/practice type	Number of inspections
Computed Tomography	126
Dual energy X-ray absorptiometry (DXA)	24
Radiopharmacy / Nuclear Medicine	16
Other	27
Total	193

The inspections of CT practices were part of a compliance monitoring program commencing in 2021–2022. They focused on compliance with requirements pertaining to justification and approval of CT procedures. The inspection program aimed to assess the quality of referrals for cardiac and non-cardiac CT procedures and to ensure compliance with record-keeping requirements pertaining to approval of medical radiation procedures.

The inspections of DXA practices focused on compliance with requirements pertaining to the use of DXA for the purpose of assessment of body composition. The department introduced these requirements in 2019–20 in response to growing evidence of DXA being used for assessment of body composition without reference to clinical indications, resulting in unnecessary exposure to radiation.

The inspections of radiopharmacy / nuclear medicine practices focused on quality assurance associated with preparation of radiopharmaceuticals and minimisation of radiation doses to the hands of individuals involved in the preparation and handling of radiopharmaceuticals.

Mandatory testing of medical diagnostic X-ray units

A prescribed radiation source may only be used for human diagnostic purposes if there is a current certificate of compliance in place. The department continued to monitor licensees for compliance with the testing requirements in 2022–23. This included monitoring approved testers for compliance both with the conditions of their authorisation and with the provisions of the Act.

A high level of overall compliance (at least 80 per cent) with testing requirements was observed during the 2022–23 year.

Issue with illuminated warning lights

In August 2022, the department identified that a significant number of certificates of compliance were issued by approved testers in respect of CT scanners that did not comply with Item 1.5 of the Radiation Safety Standard for Computed Tomography Scanners. In particular, the CT scanners did not comply with the requirement to have a warning light at the entrance to the CT room that illuminates when the X-ray tube is placed in preparation mode.

Approved testers were reminded that item 1.5 of the standard requires the warning light at the entrance to the CT room to be illuminated both when the X-ray tube is placed in exposure mode and when the X-ray tube is in preparation mode.

Further investigation found that CT scanners made by two separate manufacturers were not capable of illuminating the warning sign during preparation mode as required by item 1.5 of the standard. One of the manufacturers worked closely with the department to bring their CT scanners into compliance, and from April 2023, all their CT scanners were capable of satisfying item 1.5 of the standard. The other manufacturer is in the process of implementing the necessary changes and is expected to have all their CT scanners compliant by November 2023.

Dosimetry auditing of linear accelerators

Management licence holders are required to ensure that the dose delivery performance of linear accelerators used for radiotherapy purposes is audited at a specified frequency by an independent audit service provider recognised by the department. When the requirements were introduced in 2017, Australian Clinical Dosimetry Service (ACDS) was the only service provider recognised by the department for the purpose of this requirement. In March 2023 the department recognised a second service provider, Gamma Gurus Pty Ltd. The recognition was granted following a detailed review of the company's service capabilities and quality management systems.

Treatment of skin cancer using Rhenium-188 unsealed brachytherapy compound

For the first time in Victoria, the department licensed a company to possess a rhenium-188 unsealed brachytherapy compound for the treatment of non-melanoma skin cancer. The use of rhenium-188 for the treatment of skin cancer is relatively new in Australia, with only several such practices authorised in New South Wales, Western Australia and Queensland. A condition applied in Victoria to this licence specifies numerous requirements, including the need for a referral for the treatment to be issued by a specialist dermatologist, a radiation oncologist, a plastic surgeon, or a professional designated by the department. Other jurisdictions permit referral by a general practitioner. Referral by one of the above-mentioned medical specialists is considered by the department to constitute better and more appropriate clinical management. The use of rhenium-188 for the treatment of non-melanoma skin cancer is mostly a single-session technique and the treatment can involve skin lesions in areas such as the ear and the nose that have a complex geometry.

Implementation of the Code for radiation protection in medical exposure (2019)

The implementation of this Code has been postponed until 2024.

Focus on veterinary radiation practices

Compliance monitoring

During the year, the department focused on monitoring the veterinary sector's compliance with s. 13 of the Act, which makes an offence for a person to use a radiation source without a use licence unless that person is exempt from the requirement to hold a use licence. A total of 11 inspections were conducted of veterinary radiation practices over the financial year. The focus on compliance monitoring in the veterinary sector will continue in 2023–24.



Focus on dental radiation practices

Compliance monitoring

During the year, the department undertook 126 compliance inspections of dental practices. The compliance inspections focused on three main areas:

- 3D volumetric X-ray units
- portable dental intra-oral X-ray units
- new and transferred management licences.

3D volumetric X-ray units

In 2021–22, we focused on dental practices that possessed 3D volumetric X-ray units. These inspections continued in 2022–23.

There has been a significant growth in the number of licence holders authorised to possess 3D volumetric X-ray units. This type of X-ray unit can generate detailed 3-dimensional images that are useful to support complex orthodontic procedures. However, the radiation dose to a patient and operator is greater than for other types of radiographic examinations. Due to the widespread introduction of this type of unit, there was a concern that they may be used where alternative imaging methods with a lower radiation dose would be more appropriate.

Inspections of licence holders authorised to possess 3D volumetric X-ray units has confirmed that these units are being used appropriately, with other lower-dose X-ray units being used when they provide sufficient diagnostic information.

Portable dental intra-oral X-ray units

In 2022–23, we inspected dental practices authorised to possess portable dental intra-oral X-ray units.

Portable intra-oral units most commonly support the dental care of children as part of the government's Smile Squad initiative. They also support dental care in aged care facilities and other areas.

Portable intra-oral units are often handheld and used in different locations. Due to the nature of the use of this type of X-ray unit, there is an increased reliance on administrative controls compared to installed units and the requirements specified in the *Code of practice for radiation protection in dentistry (2005)* (the Dental Code) may not be appropriate in some circumstances.

We are undertaking inspections to assess how the units are used and to determine if additional guidance is required for the safe use of these units. This work will continue in the next year and findings will be reviewed.

New and transferred management licences

We undertook compliance inspections of new management licences and recently transferred management licences in the dental sector during the year.

The inspections aimed to confirm the information provided with the application was correct, and to ensure that licence holders understood their obligations in relation to compliance with radiation legislation.

The inspections identified issues as part of these inspections, including shielding not being installed in accordance with the shielding assessment, and licence holders not being aware of their obligations to notify the department when they take possession of an X-ray unit. The department is assessing options to improve compliance in these areas.

Dental hygienists and oral health therapists

The scope of practice for dental hygienists and oral health therapists as defined by the Australian Dental Council has evolved since the Dental Code was published. They can now work independently of a dentist. The Dental Code does not currently reflect this change in the scope of practice for dental hygienists and oral health therapists.

Following discussions with the relevant professional bodies, the department will update use licence conditions to reflect the increased autonomy of dental hygienists and oral health therapists.

Recognised training courses

As part of an ongoing program of reviewing and updating of the training requirements for dental use licences, several new courses were added and some courses removed from to the list of recognised courses.

The requirements relating to dental assistants have been revised. Dental assistants were required to complete a recognised Certificate 4 course in Dental Assisting. The components of the course relating to dental radiography are contained within three units, all of which must be completed. The requirements have been updated to ensure the relevant training units are completed.

Focus on industrial radiation practices

Compliance monitoring

During the year, the department monitored compliance of industrial radiation practices in two separate sectors: the transport of radioactive material and the security of high-consequence sealed sources.

An inspection program targeted all companies authorised within Victoria to transport radioactive material. The program assessed compliance with the ARPANSA Code for the Safe Transport of Radioactive Material, which is a condition of the management licence. Inspections focused on the transport companies' development and implementation of the Radiation Management Program as required by the Code, which includes appropriate training of personnel, emergency response procedures and appropriate radiation monitoring during transport, among other things.

The department also continued to audit the approved security plans of all Victorian licence holders authorised to possess high-consequence sealed sources. The inspections ensured security plans were up to date and fully implemented with all the required physical security measures in place.

A total of 120 inspections were conducted of industrial radiation practices during the financial year. Note that these inspections may include inspections of high-consequence radioactive sources associated with other practice types including the medical sector.

The focus on both areas will be continued for the 2023–24 financial year.

Implementation of the Code of radiation protection requirements for industrial radiography (2018)

The department intends to implement this Code by means of delegate variations to relevant licences in the last quarter of 2023.

Implementation of Code for the safe transport of radioactive material 2019

The department intends to implement this Code by means of delegate variations to relevant licences in the last quarter of 2023.

Licensing of stevedores to transport radioactive material

Management licence holders authorised to transport radioactive material must do so in accordance with the requirements of the *Code of practice for the safe transport of radioactive material 2014* (the Transport Code).

In addition, the transport of high-consequence sealed sources requires that the licence holder prepare a transport security plan endorsed by an approved assessor in accordance with s. 67G of the Act. Loading and unloading by stevedores of radioactive cargo from vessels within secure terminal areas in Victorian ports falls within the definition of transport of radioactive material under the Act.

In January 2023, the department conducted a compliance inspection of a stevedore company unloading a high-consequence sealed source. The company held a management licence authorising transport of high-consequence sealed source radioactive material. The inspection noted security arrangements and handling procedures during the unloading of the high-consequence sealed source. The unloading of the sealed source occurred in the terminal occupied by the stevedoring company within a secured area of the port. No public access to this area is permitted.

Given the stringent security arrangements in place in the terminal areas of ports, radiation controls imposed by licensing under the Act do not introduce greater safety during the loading and unloading of cargo from vessels in port. This is especially the case due to the minimal handling of the radioactive material by stevedores during loading and unloading.

Consequently, the department is reviewing the benefit of the requirement for a stevedoring company to hold a management licence authorising the transport of radioactive material. Any exemption from the requirement for a stevedoring company to hold a management licence could include conditions that require compliance with parts of Section III of the Transport Code that mandate relevant training for workers and emergency response arrangements in case of a loss of control of the cargo during movement by the stevedore.

X-ray security screening of pregnant inmates at jails in Victoria

The department authorises correctional facilities to possess X-ray units for security screening purposes, including the screening of pregnant intakes or intakes who claimed to be pregnant. A condition of the licence prohibited security X-ray screening of pregnant inmates at correctional facilities. A review undertaken during the financial year concluded that the benefit of the security X-ray screening of pregnant persons outweighed the detriment of the security X-ray screening. As a result, X-ray security screening of pregnant inmates at correctional facilities in Victoria is considered justified. The review was carried out in accordance both with the requirements of the Act and with relevant human rights instruments.

Focus on mining of mineral sands and rare earths

The department regulates the processing, storage, transport and disposal of the naturally occurring radioactive material associated with mineral sand mining and processing. The mining of mineral-rich sands within Victoria generally triggers the need to regulate the radiation safety aspects of the operations due to the presence of naturally occurring radioactive material in low concentrations.

Mineral sands within Victoria are usually mined from ancient beaches, like those that existed in the Murray Basin. Mineral sands were deposited on shores where the large density of the mineral sand grains allowed them to settle close to the then existing shore and be concentrated there while lighter sands tended to be washed out to sea. There are currently two companies licensed under the Act to conduct mineral sand mining and processing in Victoria – Iluka Resources Limited and Donald Mineral Sands Pty Ltd.

Other projects have been proposed and are currently at varying stages of the required development assessment process. This typically includes a formal environmental effects assessment. The first five mineral sands projects discussed below are in the Murray Basin. The sixth is in eastern Gippsland.

Four inspections were conducted of mineral sand mining and processing sites over the financial year.

Iluka Resources Ltd – existing operations

Iluka Resources Ltd has been mining mineral sands in Victoria since 2005 in the Kanagulk and Ouyen areas. The department's regulation of Iluka's operations will continue until the rehabilitation of the mine sites at Kanagulk and Ouyen has been completed.

Iluka Resources Ltd – Wimmera Mineral Sands Project

Iluka Resources Ltd proposes to develop the Wimmera Mineral Sands project, which has an approximate area of 2,600 hectares and is about 35 kilometres southwest of Horsham. This deposit is reported to have about 200 million tonnes of heavy mineral sands ore, which is proposed to be extracted and refined on site to produce zircon, titanium oxide and rare earth products.

The proposal includes:

- developing a mineral sands mine
- processing plants
- an ore receipt and liquification system
- mine by-products transport and containment infrastructure
- offsite infrastructure such as powerlines, water pipelines, access roads and a temporary construction camp
- additional offsite infrastructure such as administration buildings, water storage dams, fuel storage and laydown areas.

The proposed mining method is likely to be progressive mining using mobile earthmoving equipment. Nine to 10 million tonnes of ore a year is proposed to be extracted, which will be refined on site to produce 192,000 tonnes of recoverable mineral product a year, over the projected 25-year life of the mine.

The Department of Environment, Land, Water and Planning (DELWP) has convened a technical reference group to advise the proponent and the department, as appropriate, on scoping and adequacy of the studies while preparing the required environment effects statement. The department's Radiation Team is part of this group.

The Wimmera mineral sands page [DELWP website](https://www.planning.vic.gov.au/environment-assessment/browse-projects/projects/wimmera-mineral-sands) <<https://www.planning.vic.gov.au/environment-assessment/browse-projects/projects/wimmera-mineral-sands>> provides more information.

Donald Mineral Sands

The site for this project is about 17 kilometres south-east of Minyip. Donald Mineral Sands is planning to mine the shallow, fine-grained sand deposit containing accumulations of titanium and zirconium minerals. The valuable minerals (ilmenite, rutile, leucosene and zircon) will be separated into a heavy mineral concentrate. The remaining non-valuable clays and sands will be returned to the soil profile.

The final rehabilitation of the mined area is intended to produce a landscape similar to that prior to the mining project, including restoration of native vegetation, drainage, and agriculturally productive land.

The project underwent an environment effects assessment process in 2008. Donald Mineral Sands Pty Ltd was issued, and still holds, a radiation management licence to undertake mining and processing of mineral sands. The company has re-engaged with regulatory bodies with a view to commencing operations.

The department has, in previous financial years, carried out a program of radon monitoring in the area of the proposed mine to establish a baseline level of radon for comparison with levels during any future mining activities.

The [Donald Mineral Sands website](https://www.astronlimited.com.au/astron-mineral-sands-projects/donald-mineral-sands-project/) <<https://www.astronlimited.com.au/astron-mineral-sands-projects/donald-mineral-sands-project/>> provides more information.



VHM Ltd – Goschen Mineral Sands and Rare Earths project

VHM Ltd proposes to develop the Goschen Mineral Sands and Rare Earths project, which has an approximate area of 8,300 hectares and is about 20 kilometres south of Swan Hill. The Goschen deposit is reported to contain about 300 million tonnes of ore and is proposed to produce a zircon and rutile concentrate, a titanium concentrate and a rare earth concentrate. The proposal includes:

- a mineral sands mine
- a mining unit plant
- a wet concentrator plant
- an interim tailings storage facility
- solar drying beds for tailings
- slurry pipelines to transfer ore from pits to the processing facilities
- additional site infrastructure such as site office, warehouse and workshop facilities, loading facilities and fuel storage.

Proposed mining methods involve open-pit mining to extract approximately five million tonnes of ore a year, increasing to 10 million tonnes of ore a year over a projected mine life of 30 years. Mine products are proposed to be transported via road or by rail for export overseas.

DELWP convened a technical reference group to advise the proponent and DELWP, as appropriate, on scoping and adequacy of the studies while preparing the environment effects statement. The department's Radiation Team is represented on the group.

The [Goschen Mineral Sands and Rare Earths website](https://www.planning.vic.gov.au/environmental-assessments/browse-projects/goschen-mineral-sands-and-rare-earths-project) <<https://www.planning.vic.gov.au/environmental-assessments/browse-projects/goschen-mineral-sands-and-rare-earths-project>> provides more information.

WIM Resources – Avonbank Heavy Mineral Sands project

WIM Resources Pty Ltd proposes to develop the Avonbank Heavy Mineral Sands project, which has an approximate area of 2,500 hectares and is about 15 kilometres northeast of Horsham. The Avonbank deposit is reported to contain around 300 million tonnes of ore, and the company proposes to produce a heavy mineral concentrate containing zircon, rare earths and titanium minerals.

The proposal includes:

- a mineral sands mine
- a wet concentrator plant
- starter ore and overburden stockpiles
- slurry pipelines
- additional site infrastructure such as a site office, warehouse, workshop, rail loading facilities and fuel storage.

The proposed mining methods involve open-pit mining to extract 9–15 million tonnes of ore a year over a projected mine life of 30 years to produce 350,000–600,000 tonnes of heavy mineral concentrate a year. Mine products are proposed to be transported via road or rail for export overseas.

DELWP convened a technical reference group to advise the proponent and DELWP, as appropriate, on scoping and adequacy of the studies while preparing the environment effects statement. The department's Radiation Team is represented on the group.

As of the end of the financial year, this project had completed its Environmental Effects Statement and panel hearings under Planning Act were underway.

The [Avonbank Mineral Sands website](https://www.planning.vic.gov.au/environmental-assessments/browse-projects/avonbank-mineral-sands) <<https://www.planning.vic.gov.au/environmental-assessments/browse-projects/avonbank-mineral-sands>> provides more information.

Focus on commercial tanning practices

Under s. 23D of the Act, it is an offence to conduct a commercial tanning practice.

During the year, the department became aware of 34 potential breaches of s. 23D of the Act.

Two search warrants were obtained and executed for matters relating to properties in Doncaster and Berwick. These searches resulted in the seizure of five tanning units.

When the tanning beds are forfeited to the department, the components in the ultraviolet light tubes, including the glass and mercury, are safely removed and recycled and the tanning beds destroyed. A courtesy letter was sent to the owners of the tanning beds notifying them of this fact.

One prosecution was initiated during the year. This prosecution related to a Doncaster property that was searched.

Regulatory policy

Implementing the Code for *radiation protection in planned exposure situations*

The department is working through a number of issues relating to implementing the ARPANSA [Code for radiation protection in planned exposure situations \(rev. 1\) \(2020\)](https://www.arpansa.gov.au/regulation-and-licensing/regulatory-publications/radiation-protection-series/codes-and-standards/rpsc-1) (the Planned Exposure Code).

Key elements of the Planned Exposure Code include the wide-ranging applicability of the code and the requirement to develop a safety assessment that is either generic or specific to the radiation source or facility (a 'graded approach'). This safety assessment must be submitted to the regulator before an authorisation will be granted. The Planned Exposure Code was endorsed by Australian health ministers in the second half of 2021.

Although the department advised stakeholders of its intention to make variations to all management licences to require compliance with this code from 1 January 2023, the work involving the code continues and its implementation is likely to be during 2024.

Ionising radiation dose limits review

Work continued during the year on a review of the changes that will be required to the regulations to implement the ionising radiation dose limits contained in the Planned Exposure Code. These dose limits are drawn from international standards, but they are often complex and difficult to implement in a legal framework.

Radiation shielding assessments

The department has previously identified deficiencies in the quality of radiation shielding assessments and the adequacy of installed radiation shielding in three key areas:

- insufficient shielding being specified at the initial shielding design stage
- insufficient shielding being installed, or shielding being installed incorrectly
- lack of regular review to ensure the shielding parameter values (for example, workload, occupancy and distances from radiation sources) on which the shielding design was based have not changed from those used in the approved shielding assessment in such a way that the shielding assessment is no longer valid.

The department developed a draft shielding standard that prescribes the requirements for a shielding assessment. The department sought initial feedback regarding the draft standard. Public comment regarding the standard will be sought in the 2023–24 financial year.

In conjunction with the standard, the department proposes to introduce an approval framework for shielding assessors. This framework would require assessments to be performed by an approved shielding assessor and approved shielding assessors to comply with the shielding design standard.

Focus on emergency preparedness and response

Under Victoria's emergency management arrangements, the department is the control agency for radiological emergencies where radiation is the principal hazard. As part of this responsibility, the department maintains a 24/7 response capability involving specialist radiation safety staff. Staff have access to vehicles with specialist radiation safety detection equipment and ancillary equipment.

Radiation monitoring equipment includes:

- radiation survey meters
- a telescopic radiation monitor survey meter (approximately 3 metre extension)
- handheld radionuclide identification instruments
- contamination monitors
- wipe-sample counting systems that can be deployed in the field
- an air-sampling instrument that can be deployed in the field
- personal electronic radiation dosimeters for all radiation regulatory staff
- a radiation portal monitor for high-volume screening of people for radioactive material contamination.

One of department's challenges is how best to maintain a response capability for what are clearly extremely low-likelihood but potentially high-consequence events.

During the past year, a number of developments occurred:

- a specialist training provider delivered a tailored week-long incident training response course to the department's radiation specialists
- the preparedness to respond to radiation incidents was reviewed. This review will continue during 2023–24.

Radiation incidents

Management licence holders must, by a condition of their licence, report incidents that are described in the department's document [Mandatory reporting of radiation incidents](https://www2.health.vic.gov.au/public-health/radiation/licensing/management-licenses-businesses/general-conditions/incident-reporting) <<https://www2.health.vic.gov.au/public-health/radiation/licensing/management-licenses-businesses/general-conditions/incident-reporting>>.

Any incident that meets one or more of the following criteria must be reported to the department:

- becoming aware of the loss or theft of a radiation source
- any breach of security relating to the possession or transport of a high-consequence sealed source
- a worker, patient or a member of the public has or may have received an unplanned or abnormal exposure to ionising radiation, other than a justified medical exposure, exceeding 1 mSv total effective dose
- the activity of the material administered to a patient during the administration of radioactive material for human diagnostic purposes exceeds the activity prescribed in the hospital/practice standard protocol for that test by 50% or more
- the activity administered to a patient during the administration of a radioactive material for human therapeutic purposes differs from that prescribed by 15% or more
- the dose delivered during administration of a human therapeutic dose of radiation to a patient from a radiation apparatus or a sealed radioactive source:
 - differs from the total prescribed treatment dose by more than 10%
 - the difference between the total prescribed dose and the delivered dose was not anticipated or accepted as part of the treatment plan
- any human therapeutic treatment delivered to either the wrong patient or the wrong tissue, or using the wrong radiopharmaceutical
- any human diagnostic procedure other than as prescribed that could lead to an effective dose exceeding 1 mSv (including the wrong patient or the wrong body part examined)
- any human diagnostic procedure resulting in an observable acute radiation effect
- any unplanned exposure to a child (under 18 years old)
- any unplanned exposure to a pregnant female
- a human diagnostic procedure that results in a skin dose that exceeds 6 Gy
- any observable radiation injury (note that effects such as erythema, which are expected to occur following therapeutic procedures, do not need to be reported)
- where a radiation source is or has been out of control (this includes situations where, for example, the source is not safely secured or shielded, or contamination is not confined)

- where an ionising radiation apparatus, sealed source or sealed source apparatus is or has been damaged or has malfunctioned in a manner that could result in a person receiving a higher radiation dose than would be received under normal circumstances
- where a surface, substance or material is or has been contaminated by radioactive material in excess of:
 - 1 kBq within any square metre in the case of alpha-emitting radioactive material, or
 - 1 MBq within any square metre in the case of beta-emitting or gamma-emitting radioactive material
- a transport accident involving radioactive material where there has been damage or possible damage to containers that contain a sealed source, sealed source apparatus or radioactive material
- a transport accident involving radioactive material where there has been a spill or release of radioactive material into the environment.



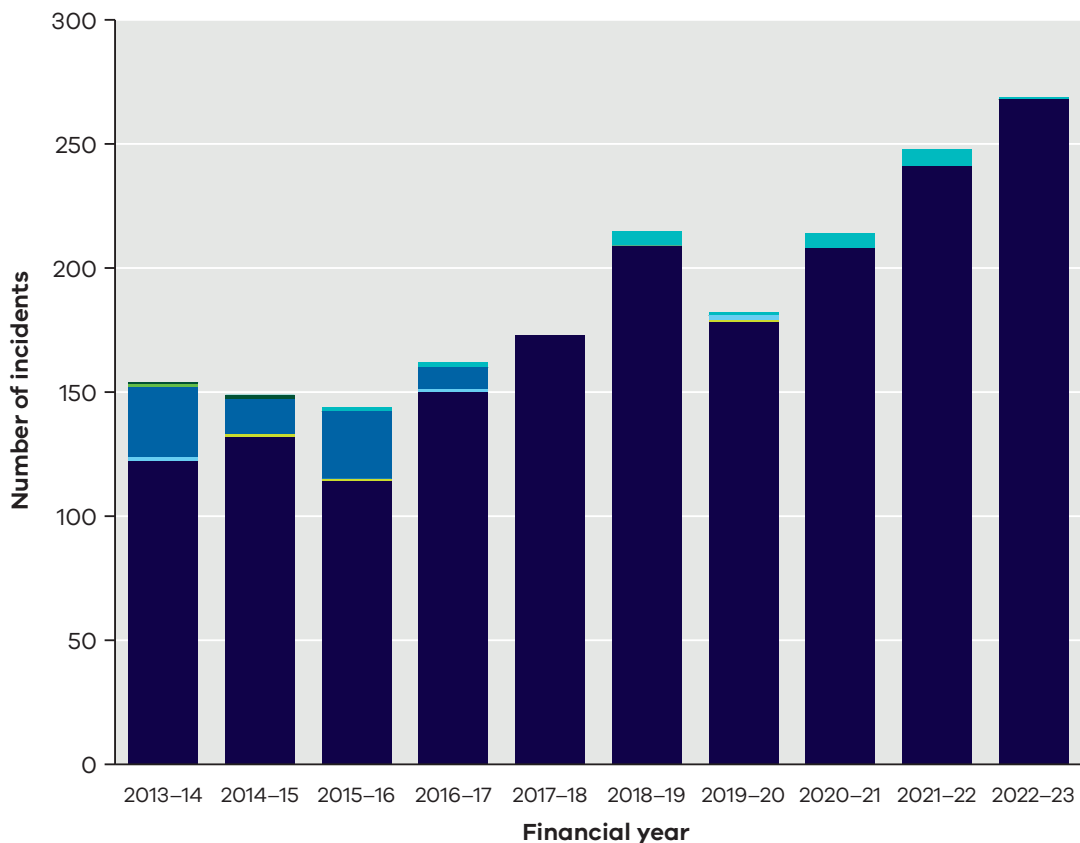
Incidents reported during 2022–23

During 2022–23, 268 incidents were reported to the department compared with 248 in the previous year.

Of the 268 incidents in 2022–23, 267 were in the medical sector. Most medical incidents involved unplanned exposure or additional exposure to patients as a result of errors in patient management or as a result of equipment error. None of the incidents involved any compromise in security of high-consequence sealed sources.

Tables 7 and 8 of Appendix 1 summarise the incidents reported in 2022–23. Figure 1 below presents an overview of reported incidents over the past 10 years.

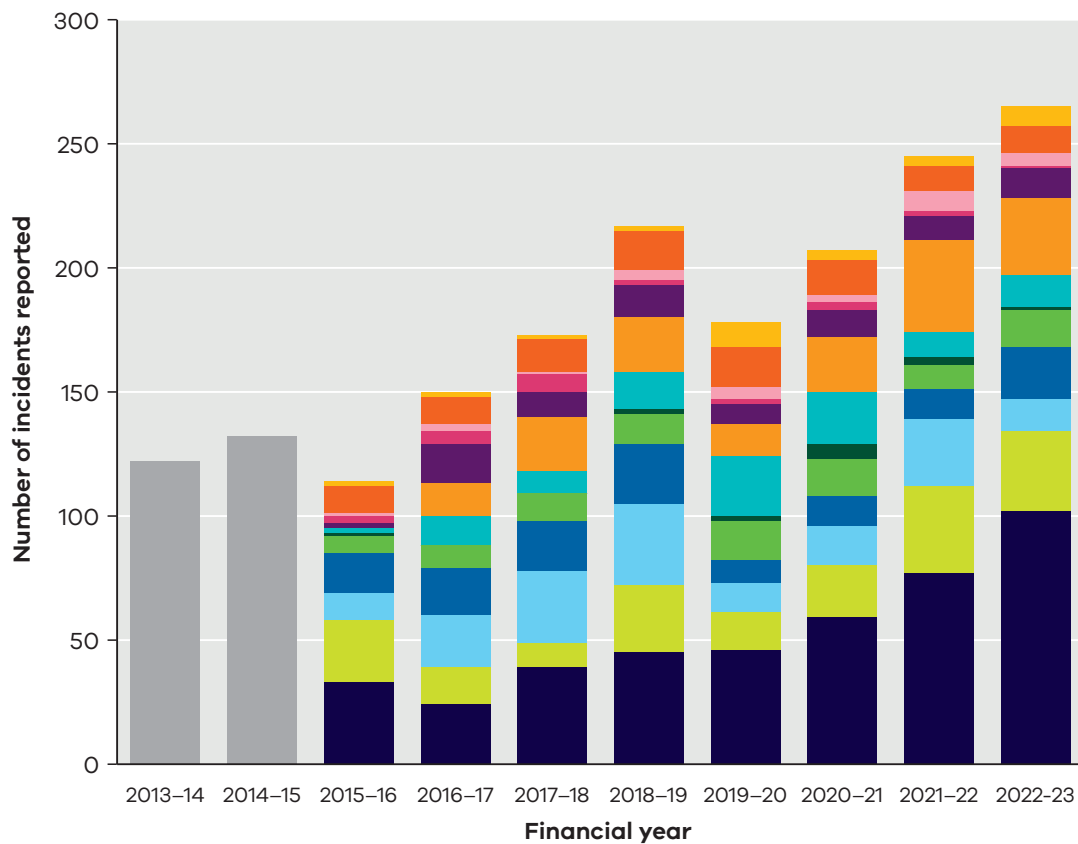
Figure 1: Overview of reported incidents over the past 10 years



- Other
- Industrial
- Inappropriate disposal
- Activation of radiation monitor alarm
- Identification of lost, abandoned, stolen or legacy radiation source
- Lost control of radiation source
- Medical

The number of incidents reported to the department has increased over the last 10 years, with the vast majority of reported incidents occurring in the medical sector. Table 6 shows the numbers of incidents in the various medical radiation incident categories by financial year from 2014 to 2023. Figure 2 shows the total number of medical incidents. Data for the 2013–14 and 2014–15 financial years has not been uncategorised.

Figure 2: Number of medical radiation incidents by category



- Uncategorised
- Contamination of person/articles with radiopharmaceuticals
- Scan of pregnant person
- Scan failed due to patient problem
- Radiotherapy – high/low dose or healthy tissue irradiated
- Maladministration of radiopharmaceuticals
- Unnecessary exposure due to equipment failure
- High dose in interventional procedure
- Wrong imaging modality
- Wrong anatomical region
- Wrong procedure
- Wrong patient
- Unnecessary/unrequested/unapproved scan
- Unnecessarily repeated scan

The number of reported medical incidents in 2022–23 continues the trend of increasing numbers of these incidents over the past 10 years. The number of medical imaging procedures that involve ionising radiation has also increased over the same period of time. If the incident rate per procedure remains the same, we would expect more incidents to occur. It is thus important to determine whether the increase in the number of reported incidents is attributable to the increase in the number of medical procedures, or to an increase in the incident rate per procedure.

Table 6 summarises the number of medical incidents reported since the 2013–2014 financial year. It includes the number of nuclear medicine and CT medical imaging procedures performed and the incident frequency, expressed as the number of incidents per 100,000 procedures. We obtained the number of medical imaging procedures performed from Medicare Australia statistics. The Medicare Australia procedural data:

- is not a complete representation of all medical radiation procedures performed, as it excludes procedures that are not covered by Medicare. However, the data are considered to be sufficiently representative of the relative increase in total number of procedures performed
- only include CT and nuclear medicine imaging procedures because most of the reportable incidents occur with CT and nuclear medicine imaging modalities. Procedures performed with these modalities almost always result in doses to patients of 1 mSv or greater. Consequently, the dose to a patient as a result of an incident involving one of these modalities is much more likely to exceed the 1 mSv threshold for reportable incidents than for incidents involving other modalities (such as general X-ray and mammography).

Table 6: Medical radiation incidents by categories per financial year

Financial year	Number of medical incidents reported	Number of diagnostic imaging services (CT and nuclear medicine only)	Incident frequency (per 100,000 CT and nuclear medicine diagnostic imaging procedures)
2013–14	122	675,981	18.0
2014–15	132	815,525	16.2
2015–16	114	819,462	13.9
2016–17	150	887,298	16.9
2017–18	173	946,310	18.3
2018–19	217	993,218	21.8
2019–20	178	1,018,872	17.5
2020–21	207	1,126,448	18.4
2021–22	245	1,149,761	21.3
2022–23	265	1,228,582	21.6
Average			18.7

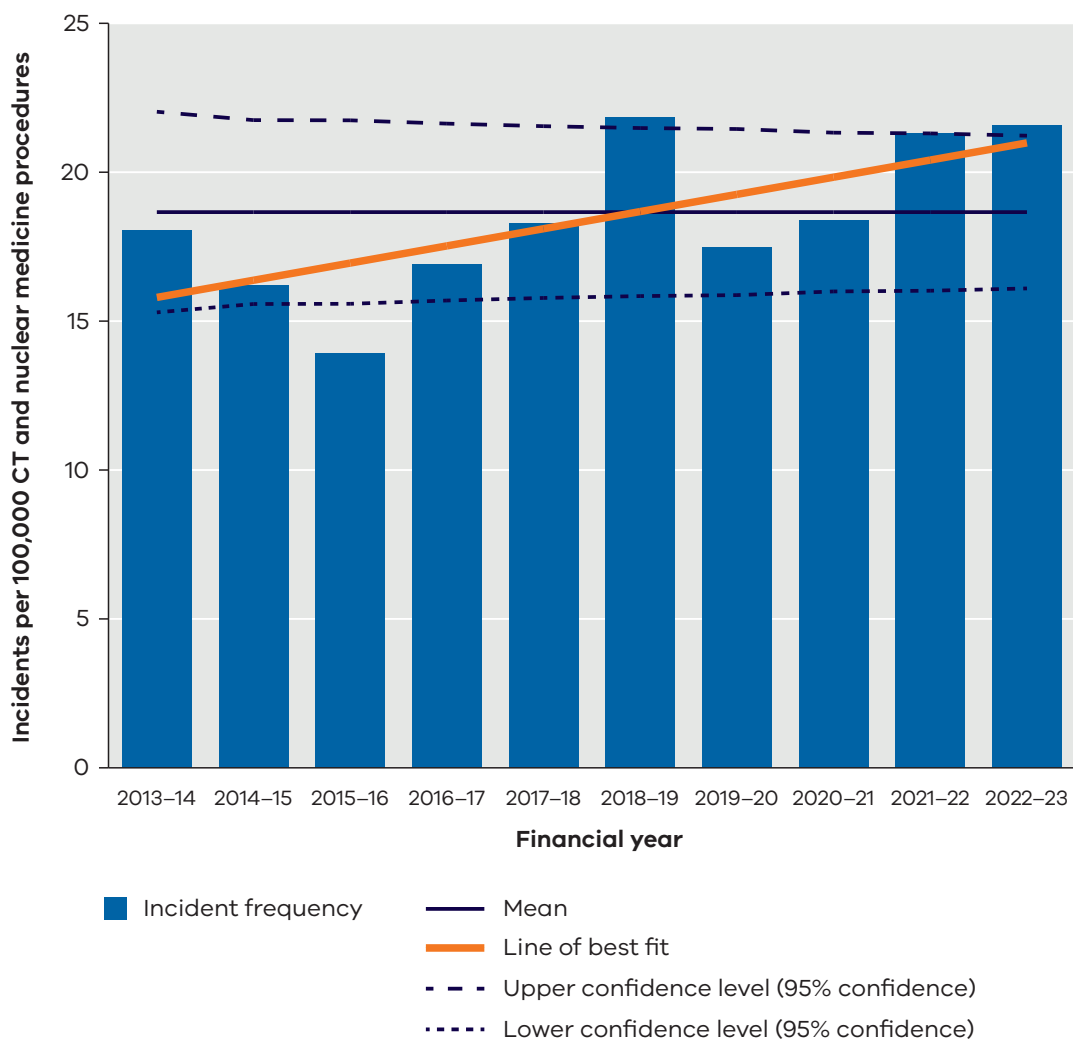
Table 6 shows that the total number of CT and nuclear medicine procedures has steadily increased since 2013–2014. The incident frequency per 100,000 CT and nuclear medicine diagnostic imaging procedures seems to show a small upward trend over time.

Further analysis can be conducted to determine if the difference between the incident frequency in a given year and the mean incident frequency over the past 10 years is statistically significant. That is, whether or not the frequency of incidents reported each year lies within the 95 per cent confidence intervals of the mean.¹

1 Assuming that the base frequency, or probability, of incidents occurring was constant, some variation about a mean would be expected each year due to the random nature of incidents occurring. It can be shown that the number of incidents occurring within a given time interval, such as a year, can be modelled using a binomial distribution. Where the probability of an incident occurring is small, such as in this case, the distribution can be approximated using a Poisson distribution. A Poisson distribution can be approximated by a standard distribution with a standard deviation of \sqrt{N} for sufficiently large N , where N is the number of occurrences of phenomena under investigation, in this case the number of incidents.

Based on the average frequency of 18.7 incidents per 100,000 CT and nuclear medicine procedures, the expected range of the frequency in any given year is approximately 15.8 to 21.5 incidents per 100,000 procedures, based on a 95 per cent confidence interval. Figure 3 shows a comparison of the frequency of incidents for each year with the confidence intervals.

Figure 3: A comparison of the frequency of incidents for each year with confidence intervals



It should be noted that the actual lower and upper confidence levels will vary slightly from year to year as they depend on the total number of procedures in a given year. As a result, the lines on the chart corresponding to these confidence levels are not completely flat.

The chart shows that the frequency of incidents occurring in most years lies within the expected range. There are four outliers: the 2015–16 incident frequency is a low-level outlier (p-value of 0.0025), while the years of 2018–19, 2021–22, and 2022–23 are high-level outliers (p-values of 0.0269, 0.0495 and 0.0263 respectively). It can also be seen that there has been a general increase in the frequency of reported incidents over the last 10 years. The rate of increase based on the line of best fit is 0.58 incidents per 100,000 procedures per year. This increase, although small, is statistically significant (p-value < 0.01).

Reasons for the increase in the frequency of reported medical radiation incidents over the past 10 years are not well known. The categories that appear to have the most significant upward trends include 'Unnecessarily repeated scan', 'Unnecessary/unrequested/unapproved scan' and 'Unnecessary exposure due to equipment failure' and these trends continued for 2022–23.

One possible factor contributing to an increase in the incidents due to equipment failure may be the increasing complexity of equipment used, primarily CT, SPECT/CT and PET/CT equipment. This equipment may have a greater likelihood of failure. Another factor may be the increased awareness among licensees of the requirement to report medical incidents. This awareness has increased significantly over the past 10 years due to the department's focus on regulating the medical use of radiation. Ultimately, it is difficult to draw any firm conclusions from the available data.

Further investigation is required to obtain suitable details for all radiation incidents and to evaluate those incidents based on factors such as underlying causes, licence holder type, equipment type/manufacture, and so on. This investigation will allow a better understanding of the range and frequency of the proximate and ultimate (root) causes of radiation incidents with the aim of identifying areas that the department can focus on in an attempt to reduce the frequency of these incidents in the future.

Appendix 1: Radiation incident details

As a guide to the radiation doses mentioned in Table 8, the public exposure limit is an effective dose of 1 millisievert (1 mSv) per year, while for occupational exposure the limit is an effective dose of 20 mSv per year.

The **becquerel (Bq)** is the standard unit of radioactivity.

1 kBq = 1,000 Bq

1 MBq = 1,000 kBq

1 GBq = 1,000 MBq

1 TBq = 1,000 GBq

The **sievert (Sv)** is the unit of effective dose of radiation and is used as a measure of risk of developing cancer and other late-onset effects.

1,000 mSv = 1 Sv

The **gray (Gy)** is the unit of absorbed dose of radiation and is used as a measure of the likelihood of development of foetal malformations and of developing acute effects such as skin burns.

1,000 mGy = 1 Gy

Pharmaceuticals

DMSA	dimercaptosuccinic acid
DOTATATE	an amino acid peptide (tyrosine-3-octreotate)
DTPA	diethylene-triamine-pentaacetate
ECD	ester dihydrochloride
FET	fluoroethyl-L-tyrosine
FDG	fluorodeoxyglucose
HDP	hydroxydiphosphonate
HIDA	hepatobiliary iminodiacetic acid
HMDP	hydroxymethylene diphosphonate
HMPAO	hexamethylpropyleneamine
IDA	iminodiacetic acid
¹⁸F DCFPyL	a prostate cancer imaging tracer
MAA	macroaggregated albumin
MAG3	mercaptoacetyltriglycine
Mebrofenin	a tracer used for imaging of the liver and the gallbladder
MIBI	methoxy-isobutyl-isonitrile
MK6240	a PET tracer used in the imaging of the brain in the diagnosis of dementia
MDP	methyl diphosphonate
Nanoscan	a colloid used for bone marrow scans and to label white blood cells for inflammation/infection imaging
PI-2620	a PET tracer with high binding affinity for aggregated tau, a key pathologic feature of Alzheimer's Disease.
PSMA	prostate-specific membrane antigen
PSR	prostatespecific radiopharmaceutical
PYP	pyrophosphate

Radioactive sources		Imaging modality acronyms	
¹⁸ F	fluorine-18	DEXA	dual energy X-ray absorptiometry
⁵¹ Cr	chromium-51	CT	computed tomography
⁶⁸ Ga	gallium-68	4D CT	CT scanning which records multiple images over time. It allows playback of the scan as a video, so that physiological processes can be observed and internal movement can be tracked
¹³¹ I	iodine-131	SPECT/CT	single-photon emission computed tomography/computed tomography
¹⁷⁷ Lu	lutetium-177	PET	positron emission tomography
^{99m} Tc	technetium-99m	PET/CT	positron emission tomography/computed tomography
		MR	magnetic resonance

Table 7: Incident summary, 2022–2023

Incident type	Number
Unnecessarily repeated medical imaging procedures	94
Unnecessary radiation exposure due to equipment failure	34
Unnecessary, unrequested or unapproved medical procedures	28
Patient underwent incorrect medical procedure	26
High patient dose during an interventional or fluoroscopic procedure	14
Maladministration of radiopharmaceutical	13
Wrong patient underwent a medical procedure	13
Patient underwent a medical procedure on the wrong anatomical region	12
A pregnant person was exposed to radiation	10
Medical procedure failed due to patient non-cooperation or other patient problem	10
Contamination of persons or articles with a radiopharmaceutical	8
Patient underwent a medical procedure using the wrong modality	4
Radiotherapy – unintended irradiation of healthy tissue or over/underdose to target tissue	1
Finding of potentially radioactive material	1
Sealed source apparatus lost or missing	0
Incident involving unsealed radioactive material	0

Table 8: Incidents, 2022–2023

Unnecessarily repeated medical imaging procedures

Incident no.	Description of incident
Incident 1	<p>A paediatric patient had an X-ray unnecessarily repeated due to radiographer error.</p> <p>A paediatric hospital patient was referred for an anteroposterior chest X-ray to determine the position of a nasogastric tube. Upon review of the image, the physician could not see the end of the tube. The X-ray was repeated to determine the tube tip position. The effective dose for the unnecessary X-ray was less than about 0.02 mSv.</p> <p>The radiographer was reminded to check for previous imaging prior to performing X-rays.</p>
Incident 2	<p>A paediatric patient had an X-ray unnecessarily repeated due to referring physician error.</p> <p>A paediatric hospital patient was referred for an anteroposterior chest X-ray to determine the position of a nasogastric tube. Upon review of the image, the physician could not see the end of the tube. The physician had not indicated what information was being sought in the referral for the X-ray. The X-ray was repeated to determine the tube tip position. The effective dose for the unnecessary X-ray was less than about 0.02 mSv.</p> <p>The physician was reminded to include accurate clinical questions in referrals.</p>
Incident 3	<p>A patient had a CT scan of the cervical spine unnecessarily repeated due to radiographer error.</p> <p>A patient was transferred from one hospital to another one. The patient had had a non-contrast CT scan of the cervical spine at the first hospital and the images were transferred to the second hospital. A physician at the second hospital referred the patient for the same scan and a radiographer carried out the scan without checking for previous scans. The effective dose due to the scan was about 3.5 mSv.</p> <p>The radiographer was reminded to check for previous imaging prior to performing scans.</p>
Incident 4	<p>A patient had a CT scan of the brain unnecessarily repeated due to radiographer error.</p> <p>A routine CT scan of the brain was performed on a hospital patient. After scanning, it was noted that the protocol required an extended anatomical range for neurosurgical planning. The patient was returned for a repeat scan with the extended anatomical range. The effective dose from the initial scan was about 1.7 mSv.</p> <p>Radiographers were reminded of the importance of performing a final check of the protocol on the electronic radiology information system before scanning.</p>
Incident 5	<p>A patient had a CT scan of the liver unnecessarily repeated due to poor contrast injection.</p> <p>A hospital patient was referred for a CT quad phase liver study. The patient's cannula was flushed by a radiographer with saline and a test bolus of saline was used to confirm that cannula pressure was within the normal range. The patient underwent the non-contrast liver scan successfully. The patient was then administered intravenous contrast to complete the following phases of the study. The arterial phase scans were completed but showed poor enhancement of structures. After the arterial phase scans had been completed, the radiographers noticed that only about half the contrast had been administered to the patient and that the injector had cut-out half way through administration. The contrast phases of the scan had to be repeated. The effective dose due to the contrast phases of the scan was about 19 mSv.</p> <p>No further action was necessary.</p>

Unnecessarily repeated medical imaging procedures (continued)

Incident no.	Description of incident
Incident 6	<p>A patient had a CT pulmonary angiogram unnecessarily repeated due to radiographer error.</p> <p>A hospital patient was referred for a CT pulmonary angiogram (CTPA). During planning, the radiographer selected an incorrect CTPA protocol. The radiographer was newly credentialled in CT scanning and was briefly working alone while other radiographers were at lunch. The radiographer selected a protocol resulting in inadequate contrast in the images. The radiographer repeated the scan and the images again showed poor contrast. A senior radiographer was then called to assist in performing the scan. The scan was then performed without error. The effective dose due to the two unsuccessful scans was about 16 mSv.</p> <p>The radiographer was counselled regarding the incident and the importance of re checking all aspects of a scan prior to attempting to repeat the scan. The radiographer was instructed to consult with other radiographers in cases where there is any difficulty in imaging. The importance of seeking justification by a radiologist prior to repeating any CT scan was stressed to the radiographer. The radiographer was retrained in CT scans involving contrast.</p>
Incident 7	<p>A patient had a nuclear medicine cardiac scan unnecessarily repeated due to extravasation of the radiopharmaceutical.</p> <p>A hospital patient presented for a nuclear medicine cardiac scan. The patient was administered with 298 MBq ^{99m}Tc-MIBI for the rest component of cardiac scan. For the stress phase of the scan, 1020 MBq ^{99m}Tc-MIBI was administered. Subsequent review of the stress phase images indicated that a lot of the radiopharmaceutical had extravasated into the arm. The patient had to be rebooked for a repeat scan. The effective dose due to the scans was about 11 mSv. No further action was necessary.</p>
Incident 8	<p>A patient had a CT scan unnecessarily repeated due to referring physician error.</p> <p>A hospital patient presented for a pre-operative CT angiogram scan of the abdomen (inferior epigastric arteries) prior to breast reconstruction. For an unknown reason, the scan was booked for a date after the reconstruction. Upon completion of the scan, the radiographer and radiologist determined from the images that the surgery had already been performed. The patient confirmed that the surgery had already taken place but thought that this scan was for a post operative review. The patient advised that pre-operative imaging had been carried out by an external imaging provider five days before the surgery. The referring plastic and reconstructive physician did not cancel the second scan. The effective dose due to the scan was about 3.3 mSv.</p> <p>The referring physician was reminded to cancel scans that were no longer required.</p>
Incident 9	<p>A patient had a CT scan unnecessarily repeated due to nuclear medicine technologist error.</p> <p>A hospital patient was having a lymphoscintigram with SPECT following the excision of a left forearm melanoma. The patient had a dog tag tucked under the armpit which the nuclear medicine technologist (NMT) misidentified as a peripherally inserted central catheter when it was noticed on the CT topogram and proceeded with the CT scan for localisation. The reporting nuclear medicine specialist instructed the NMT to repeat the CT localisation scan with the dog tag removed. The effective dose due to the scan was about 6 mSv.</p> <p>The Deputy Chief NMT counselled the NMT and reminded them of the importance of correct patient preparation and thorough investigation of potential issues identified on a tomogram prior to imaging.</p>
Incident 10	<p>A patient had a nuclear medicine parathyroid scan unnecessarily repeated due to extravasation of the radiopharmaceutical.</p> <p>A hospital patient presented for a nuclear medicine parathyroid scan. The patient was administered with 705 MBq ^{99m}Tc-MIBI. Extravasation of the radiopharmaceutical occurred upon injection. The patient was re-cannulated and administration of an additional 560 MBq ^{99m}Tc-MIBI was conducted successfully. The additional effective dose due to the extravasation was about 7 mSv.</p> <p>No further action was necessary.</p>

Unnecessarily repeated medical imaging procedures (continued)

Incident no.	Description of incident
Incident 11	<p>A patient had a CT scan of the brain unnecessarily repeated due to radiographer error.</p> <p>A hospital patient was referred for a CT scan of the brain to query bleeding after a fall. The referral was faxed to the radiography department. The night shift radiographer took the original referral from the patient notes but left the scanned referral on the fax machine. The next day, the day shift radiographer took the faxed referral off the fax machine and carried out the same scan without checking for previous imaging. The effective dose due to the scan was about 1.4 mSv.</p> <p>The radiographer was reminded to check for previous imaging prior to scanning a patient.</p>
Incident 12	<p>A patient had a CT scan of the lumbar spine unnecessarily repeated due to radiographer error.</p> <p>A hospital sent a referral for a CT scan of the lumbar spine of a patient to the radiology department indicating that imaging had to be carried out in one week's time, before surgery. The CT scan was booked in error by clerical staff for about six weeks' time. On the day of the surgery, it was noted that the CT scan had not been performed and the scan was rebooked for that day. The scan scheduled for six weeks' time was not cancelled and the patient returned for imaging at that time. The radiographer carrying out the scan did not check for previous imaging. The effective dose due to the scan was about 3.4 mSv.</p> <p>Clerical staff members at the hospital were reminded to be careful when booking scans. The radiographer was reminded to check for previous imaging prior to scanning a patient.</p>
Incident 13	<p>A paediatric patient had an X-ray unnecessarily repeated due to a digital radiography plate becoming unattached.</p> <p>A paediatric hospital patient underwent a chest X-ray as requested by the referring physician. The radiographer was using a mobile X-ray unit in the emergency department. During the image acquisition, the digital radiography plate fell off the X-ray unit and had to be reattached. The X-ray had to be repeated. The effective dose due to the X-ray was about 0.04 mSv.</p> <p>No further action was necessary.</p>
Incident 14	<p>A patient had a CT scan of the chest unnecessarily repeated due to treating team and radiographer error.</p> <p>A hospital patient had a CT scan of the chest with contrast for staging of malignancy treatment. A record of imaging from an external centre was registered by the treating team on the hospital's electronic records system with the title of the record indicating the record was for a CT scan of the abdomen and pelvis with contrast, which is why the chest scan was ordered. The body of the report, however, indicated that the CT scan carried out was of the chest, abdomen and pelvis with contrast. The following week, the treating team contacted the medical imaging department to advise that the patient had already had a CT scan of the chest with contrast at another centre. The effective dose due to the CT scan of the chest was about 3.3 mSv.</p> <p>A communication was sent to the treating team regarding the importance of correctly documenting external imaging on the hospital's electronic records system. The radiographer was counselled regarding the importance of asking the patient whether they had undergone CT imaging elsewhere recently and of thoroughly examining patient records.</p>
Incident 15	<p>A patient had a CT scan unnecessarily repeated due to radiographer error.</p> <p>A hospital patient presented for a CT angiography scan of the brain. The radiographer incorrectly set the scan delay time for the angiogram and, as a result, the injection of the contrast was mis-timed. The scan had to be repeated. The effective dose due to the scan was about 2.2 mSv.</p> <p>The Chief Radiographer of the hospital reminded the radiographer of the importance of selecting the correct scan delay times.</p>

Unnecessarily repeated medical imaging procedures (continued)

Incident no.	Description of incident
Incident 16	<p>A patient had a nuclear medicine parathyroid scan unnecessarily repeated due to extravasation of the radiopharmaceutical.</p> <p>A hospital patient presented for a nuclear medicine scan of the parathyroid. Following justification and approval of the procedure, an IV cannula was inserted. The cannula was patent and working for the first part of the study and for the flush prior to the injection of 708 MBq ^{99m}Tc-MIBI. Upon injection of the ^{99m}Tc-MIBI, it was found that extravasation had occurred; imaging was unable to be completed. The maximum effective dose from the extravasated radiopharmaceutical was about 1.3 mSv.</p> <p>No further action was necessary.</p>
Incident 17	<p>A patient had a CT scan unnecessarily repeated due to referring physician error.</p> <p>A hospital patient required a repeated CT scan of the lumbar spine because the first scan was performed using the wrong protocol and with the patient in the wrong (supine) position. The scan was required prior to a second surgical procedure. The standard CT scan protocol for the lumbar spine prior to a surgical procedure, with the particular software system used for neurosurgery procedures at the hospital, requires that the scan be performed with the patient in the prone position and that the imaging be reconstructed using thin slices. The preferred patient position after lumbar spine surgery is the supine position using thick slices. The radiographer was not aware that the patient was scheduled for a second surgical procedure and performed the scan with the patient in the supine position using thick reconstruction slices. Prior to the CT scan being repeated, however, the radiographer asked the referring physician if reconstruction of the first CT scan to include thin slices would be adequate. The physician was insistent that further imaging was required, despite the fact that the physician's only concern with the initial CT imaging (supine, limited scan range and thick reconstructed CT slices) was that the images were not reconstructed with thin slices. The referring physician did not understand that the first CT scan could have been reconstructed to meet the needs of the software. The effective dose due to the scan was about 3.9 mSv.</p> <p>The referring physician and radiography team were educated regarding the particular requirements of the software system for CT scans prior to neurosurgery using that system.</p>
Incident 18	<p>A patient had a PET brain scan unnecessarily repeated due to extravasation of the radiopharmaceutical.</p> <p>A patient was referred to a medical imaging practice for a PET brain scan using ^{18}F-FDG. The ^{18}F-FDG extravasated upon injection. The effective dose from the extravasated radiopharmaceutical was about 4.5 mSv.</p> <p>No further action was necessary.</p>
Incident 19	<p>A patient had a CT scan unnecessarily repeated due to radiographer error.</p> <p>A hospital patient was referred for a CT scan of the brain. Upon completion of the scan, the radiographer entered a "completed" code into the radiology information system (RIS). This entry populates the exam on the radiologist worklist for reporting but does not remove it from the radiographer worklist. At the completion of a scan, a "verified" code should have been entered in the RIS, which would have removed the exam from the radiographer worklist and populated the exam on the radiologist worklist for reporting. Following a change of shift, a different radiographer assumed the scan had not been performed and subsequently repeated the scan. The effective dose due to the scan was about 1.8 mSv.</p> <p>The radiographer was reminded to enter the correct code into RIS at the completion of a scan.</p>
Incident 20	<p>A patient had a CT scan unnecessarily repeated due to nuclear medicine technologist error.</p> <p>A patient attended a medical imaging practice for a PET/CT scan. The CT scan had to be repeated as the nuclear medicine technologist selected the ^{68}Ga-PSMA CT scan protocol instead of the required ^{18}F-PSR CT scan protocol. The effective dose due to the scan was about 8.9 mSv.</p> <p>The nuclear medicine technologist was reminded to concentrate on the task at hand when scanning patients.</p>

Unnecessarily repeated medical imaging procedures (continued)

Incident no.	Description of incident
Incident 21	<p>A patient had a CT scan unnecessarily repeated twice due to radiographer error.</p> <p>A hospital patient was referred for a CT carotid angiography scan. The radiographer triggered the injection of contrast agent prematurely. A repeat scan was authorised by a radiologist. The radiographer also triggered the injection of contrast agent prematurely for the second scan. The radiologist authorised a third scan. The radiographer discussed the scan with senior radiography staff members at the main campus of the hospital prior to carrying out the third scan. The third scan was successful. The effective dose due to the first two scans was about 3.7 mSv.</p> <p>The radiographer was counselled regarding the incident and required to undergo further training in CT scans using contrast.</p>
Incident 22	<p>A patient had a CT scan unnecessarily repeated due to radiographer error.</p> <p>A hospital patient was referred for a contrast-enhanced CT scan of the legs. The radiographer initiated the contrast injection and the CT scanner to trigger at the appropriate time. The radiographer didn't notice that the wrong injection protocol had been selected. The protocol selected (CT pulmonary angiogram protocol) used the correct injection rate but an incorrect volume. This error was noticed when no iodinated contrast was visible in the lower limb vessels. The scan had to be repeated using the correct contrast injection protocol. The effective dose due to the scan was about 3.6 mSv.</p> <p>The radiographer was reminded to concentrate on the task at hand when scanning patients.</p>
Incident 23	<p>A patient had a CT scan unnecessarily repeated due to radiographer error.</p> <p>A hospital patient was referred for a CT angiography aortofemoral scan. The radiographer initiated the contrast injection and the CT scanner to trigger at the appropriate time. After the CT scanner triggered, the radiographer went to zoom the live images being acquired and, rather than single clicking and dragging the mouse to zoom the image as required, accidentally double clicked the mouse which aborted the CT scan midway through the acquisition. The radiographer was unaware that a double click of the mouse would abort the scan. The scan had to be repeated at a later date. The effective dose due to the scan was about 1.8 mSv.</p> <p>No further action was necessary.</p>
Incident 24	<p>A patient had a PET scan and CT scans unnecessarily repeated due to nuclear medicine technologist error.</p> <p>A hospital patient needed to have a repeat of part of a PET scan as the patient needed to go to the bathroom mid-way through the scan. The nuclear medicine technologist (NMT) set up the protocol to rescan but forgot to select the PET to reconstruct using new CT scans. The patient had to have the required part of the PET scan repeated with new CT scans. The effective dose due to the scan was about 5.8 mSv.</p> <p>The NMT was reminded of the importance of focussing on the task at hand to ensure mistakes do not occur.</p>
Incident 25	<p>A patient had a CT scan unnecessarily repeated due to radiographer error.</p> <p>A patient attended a medical imaging practice to book in for an ultrasound scan and X-rays of the lumbar spine, pelvis, hip, and knee. The ultrasound was not able to be carried out on the day as the clinic was booked out and the patient was given an appointment in a month's time for the ultrasound scan. The X-rays were able to be carried out on the day. When the patient returned for the ultrasound, the radiographer noted that the referral included the X-ray request and carried out the X-ray as well without checking for previous imaging. The effective dose due to the unnecessarily repeated X-rays was about 1.3 mSv.</p> <p>The radiographer was reminded of the importance of checking for previous images.</p>

Unnecessarily repeated medical imaging procedures (continued)

Incident no.	Description of incident
Incident 26	<p>A patient had an injection of radiopharmaceutical unnecessarily repeated due to extravasation of adenosine.</p> <p>A hospital patient was referred for a nuclear medicine stress/rest heart scan. During the stress portion of the scan, the syringe driver failed to administer the stress medication (adenosine) after the injection of the radioactive tracer (1200 MBq ^{99m}Tc–MIBI). Due to the absence of the adenosine, the patient was not adequately stressed and the procedure had to be rebooked for a later date. The effective dose due to the radiopharmaceutical was about 9.5 mSv.</p> <p>No further action was necessary.</p>
Incident 27	<p>A patient had a CT scan unnecessarily repeated due to extravasation of contrast.</p> <p>A patient attended a medical imaging practice for a CT scan of the abdomen and pelvis with contrast. The contrast medium extravasated and the scan had to be repeated. The effective dose due to the scan was about 6 mSv.</p> <p>No further action was necessary.</p>
Incident 28	<p>A patient had a CT scan unnecessarily repeated due to the contrast line becoming disconnected.</p> <p>A patient attended a medical imaging practice for a CT scan of the brain with contrast. The intravenous contrast line disconnected during the scan and the scan had to be repeated. The effective dose due to the scan was about 1.5 mSv.</p> <p>No further action was necessary.</p>
Incident 29	<p>A patient had a CT scan unnecessarily repeated due to the contrast line failing.</p> <p>A hospital patient was referred for a CT angiography scan of the neck and CT scan of the chest with contrast. During the contrast injection for the chest scan, the extension line failed on the cannula and the extension burst. The image was deemed non-diagnostic by the radiographer and the cannula was replaced. The chest scan was completed without error. The effective dose due to the chest scan was about 3.1 mSv.</p> <p>No further action was necessary.</p>
Incident 30	<p>A paediatric patient had X-rays unnecessarily repeated due to radiographer error.</p> <p>A paediatric hospital patient had unnecessarily repeated plain X-rays of the spine. The radiographer incorrectly interpreted the imaging request and carried out posteroanterior and lateral views instead of the requested flexion and extension views. The effective dose due to the X-rays was about 0.04 mSv.</p> <p>The radiographer was counselled on the importance of thoroughly checking imaging requests.</p>
Incident 31	<p>A patient had an X-ray unnecessarily repeated due to incorrect exposure parameter selection.</p> <p>A hospital patient was referred for a plain supine chest X-ray. The radiographer noted that the exposure did terminate quickly and stopped the exposure by releasing the hand switch. Investigation of the equipment logs by the supplier revealed that the exposure parameters were inadvertently adjusted via the touch screen controls on the X-ray tube head prior to the exposure. This could have been due to another staff member accidentally touching the screen. The effective dose from the X-ray was about 2 mSv.</p> <p>No further action was necessary.</p>
Incident 32	<p>A patient had part of a CT scan unnecessarily repeated due to radiographer error.</p> <p>A hospital patient was referred for a CT scan of the cervical and thoracic spine to assist with surgical planning. On review of the image, it was noted that the inferior aspect of the 12th thoracic vertebra was not included in the scan. A limited second acquisition was planned to cover this inferior aspect for completion. The radiographer mistakenly scanned the entire range. The effective dose due to the scan was about 7.2 mSv.</p> <p>The radiographer was reminded to concentrate on the task at hand when imaging patients.</p>

Unnecessarily repeated medical imaging procedures (continued)

Incident no.	Description of incident
Incident 33	<p>A patient had an injection of radiopharmaceutical unnecessarily repeated due to extravasation of the radiopharmaceutical.</p> <p>A patient attended a medical imaging practice for a nuclear medicine renal scan using 304 MBq of ^{99m}Tc-MAG3. The saline flush was successful and the patient did not complain of pain in the arm. The entire dose of radiopharmaceutical, however, extravasated into the patient's arm. The scan was rebooked and repeated one week later with no incident. The effective dose due to the administered radiopharmaceutical was about 1.6 mSv.</p> <p>No further action was necessary.</p>
Incident 34	<p>A patient had a CT scan unnecessarily repeated due to radiographer error.</p> <p>A patient attended a medical imaging practice with a referral for a CT scan of the kidneys, ureters and bladder from the emergency department (ED) of the hospital to which the practice was attached. The referral was faxed to the practice and then placed in the patient's folder. The patient was imaged and then transferred to another area of the ED. The referral was found in the patient's folder and refaxed to the practice. The patient had the same scan again. The radiographer failed to check for previous imaging. The effective dose due to the scan was about 3 mSv.</p> <p>Radiographers at the practice were reminded to check for previous imaging prior to scanning patients.</p>
Incident 35	<p>A patient had a CT scan unnecessarily repeated due to radiographer error.</p> <p>A hospital patient had a CT scan of the neck unnecessarily repeated due to duplicate requests. The patient was booked for the same scan one week apart by two different treatment teams. At the time of the second scan, the radiographer proceeded on the basis that the time elapsed warranted a repeat scan. After the scan, a radiologist advised that the second scan was unnecessary. The effective dose from the was about 6.5 mSv.</p> <p>The radiographer was counselled as to the importance of checking prior imaging and following up on scan justifications.</p>
Incident 36	<p>A patient had a CT scan unnecessarily repeated due to referring physician error.</p> <p>A hospital patient had a CT scan of the chest and a CT scan of the abdomen and pelvis separately that resulted in more radiation exposure (due to overlap) than would have been the case for the requested CT scan of the chest, abdomen and pelvis (CAP). The radiographer reviewed the request for the CT CAP scan and noted that the request stated that a CT scan of the abdomen had already been performed. The radiographer carried out only the CT scan of the chest. Afterwards, the requesting department advised that the written advice that the CT scan of the abdomen had already been performed had been placed on the referral in error by the referring physician. The patient was rebooked to complete the scan. The effective dose from repeated portion of the scan was about 2.8 mSv.</p> <p>The referring physician was reminded to use care when placing notes on imaging requests.</p>
Incident 37	<p>A patient had a CT scan unnecessarily repeated due to radiographer error.</p> <p>A patient attended a medical imaging practice for an epidural injection of the spine under CT guidance. An incorrect localising position was marked by the radiographer. The area was prepared and scanned, at which point it was realised that the exposed area did not cover the intended anatomy. The correct area was then localised and scanned and the procedure completed. The effective dose from the scan was about 4.4 mSv.</p> <p>The radiographer was reminded to use care when carrying out scans and to seek assistance, if required.</p>

Unnecessarily repeated medical imaging procedures (continued)

Incident no.	Description of incident
Incident 38	<p>A patient had a CT scan unnecessarily repeated due to radiographer error.</p> <p>A hospital patient was referred for a CT scan of the abdomen and pelvis. Due to the seriousness of the patient's condition, the patient was transferred to a nearby, related, hospital to undergo a surgical procedure. The first hospital did not use electronic referrals, and when the electronic order was received by the first hospital, it was converted to a paper referral and the scan carried out. The electronic referral, however, was not cancelled, and the second hospital carried out the same CT scan again based on the electronic referral. The effective dose from the scan was about 4.9 mSv.</p> <p>The radiographers at the first hospital were reminded to cancel electronic orders when they have been transferred to paper.</p>
Incident 39	<p>A patient had a CT scan unnecessarily repeated due to referring physician and radiographer error.</p> <p>A hospital patient had two separate referrals by two different physicians for a CT scan of the brain. The referrals were generated at similar times on one day. The orders were protocolled by two separate radiologists. Previous imaging was not checked by the radiographer. The effective dose from the scan was about 1.5 mSv.</p> <p>Both referring physicians and the radiographers were reminded to check for previous scans prior to carrying out medical imaging procedures.</p>
Incident 40	<p>A paediatric patient had a CT scan unnecessarily repeated due to failed contrast injection.</p> <p>A paediatric hospital patient was referred for a CT spiral angiography scan requiring intravenous contrast. The test bolus was injected successfully. The scan was then completed. Following the scan, the images showed that contrast had not been injected into the patient. Afterwards when checking the patient, it was discovered that contrast had spilled on to the table around the patient. The scan had to be repeated with the contrast bolus. The effective dose from the scan was about 10 mSv.</p> <p>No further action was necessary.</p>
Incident 41	<p>A patient had a CT scan unnecessarily repeated due to referring physician and radiographer error.</p> <p>A hospital patient had a transcatheter aortic valve implantation (TAVI) scan unnecessarily repeated. The original scan was based on a referral sent from the cardiology department to the radiology department by email about six months before the second scan. At the time of the second scan, a paper copy of the same referral was processed by radiology administration. The radiographer noticed that the scan had been performed six months previously but assumed that the current referral was a new request for a rescan; the scan was performed again. The effective dose from the scan was about 19 mSv.</p> <p>The radiographer was reminded to consult with the referring physician in cases of uncertainty.</p>
Incident 42	<p>A patient had a CT scan unnecessarily repeated due to radiographer error.</p> <p>A hospital patient had to have a CT scan of the chest repeated because the incorrect scan protocol was chosen for the first scan. A CT scan of the chest with oral and intravenous (IV) contrast was requested but patient was scanned only with IV contrast. The radiographer did not thoroughly read the referral before transferring the patient to the CT table. The effective dose from the scan was about 7.5 mSv.</p> <p>The radiographer was reminded to read referrals thoroughly before imaging patients.</p>
Incident 43	<p>A patient had a CT scan unnecessarily repeated due to radiographer error.</p> <p>A hospital patient required a CT examination of the pelvis, knees and ankles with an optimized positioning system protocol. An incorrect scan region was set by the radiographer. The entire scan had to be repeated. The effective dose from the scan was about 1.2 mSv.</p> <p>The radiographer was reminded to use care when carrying out scans.</p>

Unnecessarily repeated medical imaging procedures (continued)

Incident no.	Description of incident
Incident 44	<p>A patient had a nuclear medicine myocardial perfusion scan unnecessarily repeated due to poor binding of the radioisotope to the pharmaceutical.</p> <p>A hospital patient presented for a nuclear medicine myocardial perfusion scan. The patient was administered with 395 MBq ^{99m}Tc-MIBI for the rest component of cardiac scan. The radiopharmaceutical passed quality control (QC) tests carried out by the supplier but the radiopharmaceutical had degraded by the time it had to be injected. Biodistribution of the radiopharmaceutical indicated that there was poor binding of the radioisotope to the pharmaceutical. The patient had to be rebooked for a repeat scan. The effective dose due to the scan was about 2.4 mSv.</p> <p>The supplier was contacted and advised of the problem. The supplier advised other centres that had been supplied with ^{99m}Tc-MIBI from the same batch. The supplier took immediate action to review and update how quality control tests were performed and recorded. Other incidents of this nature occurred before the supplier advised the affected centres (see the nine incidents immediately below).</p>
Incident 45	<p>A patient had a nuclear medicine parathyroid scan unnecessarily repeated due to poor binding of the radioisotope to the pharmaceutical.</p> <p>A hospital patient presented for a nuclear medicine parathyroid scan. The patient was administered with 840 MBq ^{99m}Tc-MIBI. The radiopharmaceutical passed quality control (QC) tests carried out by the supplier but the radiopharmaceutical had degraded by the time it had to be injected. Biodistribution of the radiopharmaceutical indicated that there was poor binding of the radioisotope to the pharmaceutical. The patient had to be rebooked for a repeat scan. The effective dose due to the scan was about 5 mSv.</p> <p>The supplier was contacted and advised of the problem. The supplier advised other centres that had been supplied with ^{99m}Tc-MIBI from the same batch. The supplier took immediate action to review and update how quality control tests were performed and recorded.</p>
Incident 46	<p>A patient had a nuclear medicine parathyroid scan unnecessarily repeated due to poor binding of the radioisotope to the pharmaceutical.</p> <p>A patient presented to a medical imaging practice for a nuclear medicine parathyroid scan. The patient was administered with 900 MBq ^{99m}Tc-MIBI. The radiopharmaceutical passed quality control (QC) tests carried out by the supplier but the radiopharmaceutical had degraded by the time it had to be injected. Biodistribution of the radiopharmaceutical indicated that there was poor binding of the radioisotope to the pharmaceutical. The patient had to be rebooked for a repeat scan. The effective dose due to the scan was about 6 mSv.</p> <p>The supplier was contacted and advised of the problem. The supplier advised other centres that had been supplied with ^{99m}Tc-MIBI from the same batch. The supplier took immediate action to review and update how quality control tests were performed and recorded.</p>
Incident 47	<p>A patient had a nuclear medicine myocardial perfusion scan unnecessarily repeated due to poor binding of the radioisotope to the pharmaceutical.</p> <p>A patient presented to a medical imaging practice for a nuclear medicine myocardial perfusion scan. The patient was administered with 330 MBq ^{99m}Tc-MIBI. The radiopharmaceutical passed quality control (QC) tests carried out by the supplier but the radiopharmaceutical had degraded by the time it had to be injected. Biodistribution of the radiopharmaceutical indicated that there was poor binding of the radioisotope to the pharmaceutical. The patient had to be rebooked for a repeat scan. The effective dose due to the scan was about 2.3 mSv.</p> <p>The supplier was contacted and advised of the problem. The supplier advised other centres that had been supplied with ^{99m}Tc-MIBI from the same batch. The supplier took immediate action to review and update how quality control tests were performed and recorded.</p>

Unnecessarily repeated medical imaging procedures (continued)

Incident no.	Description of incident
Incident 48	<p>A patient had a nuclear medicine myocardial perfusion scan unnecessarily repeated due to poor binding of the radioisotope to the pharmaceutical.</p> <p>A patient presented to a medical imaging practice for a nuclear medicine myocardial perfusion scan. The patient was administered with 410 MBq ^{99m}Tc-MIBI. The radiopharmaceutical passed quality control (QC) tests carried out by the supplier but the radiopharmaceutical had degraded by the time it had to be injected. Biodistribution of the radiopharmaceutical indicated that there was poor binding of the radioisotope to the pharmaceutical. The patient had to be rebooked for a repeat scan. The effective dose due to the scan was about 2.9 mSv.</p> <p>The supplier was contacted and advised of the problem. The supplier advised other centres that had been supplied with ^{99m}Tc-MIBI from the same batch. The supplier took immediate action to review and update how quality control tests were performed and recorded.</p>
Incident 49	<p>A patient had a nuclear medicine parathyroid scan unnecessarily repeated due to poor binding of the radioisotope to the pharmaceutical.</p> <p>A hospital patient presented for a nuclear medicine parathyroid scan. The patient was administered with 980 MBq ^{99m}Tc-MIBI. The radiopharmaceutical passed quality control (QC) tests carried out by the supplier but the radiopharmaceutical had degraded by the time it had to be injected. Biodistribution of the radiopharmaceutical indicated that there was poor binding of the radioisotope to the pharmaceutical. The patient had to be rebooked for a repeat scan. The effective dose due to the scan was about 6.9 mSv.</p> <p>The supplier was contacted and advised of the problem. The supplier advised other centres that had been supplied with ^{99m}Tc-MIBI from the same batch. The supplier took immediate action to review and update how quality control tests were performed and recorded.</p>
Incident 50	<p>A patient had a nuclear medicine myocardial perfusion scan unnecessarily repeated due to poor binding of the radioisotope to the pharmaceutical.</p> <p>A patient presented to a medical imaging practice for a nuclear medicine myocardial perfusion scan. The patient was administered with 360 MBq ^{99m}Tc-MIBI. The radiopharmaceutical passed quality control (QC) tests carried out by the supplier but the radiopharmaceutical had degraded by the time it had to be injected. Biodistribution of the radiopharmaceutical indicated that there was poor binding of the radioisotope to the pharmaceutical. The patient had to be rebooked for a repeat scan. The effective dose due to the scan was about 2.5 mSv.</p> <p>The supplier was contacted and advised of the problem. The supplier advised other centres that had been supplied with ^{99m}Tc-MIBI from the same batch. The supplier took immediate action to review and update how quality control tests were performed and recorded.</p>
Incident 51	<p>A patient had a nuclear medicine myocardial perfusion scan unnecessarily repeated due to poor binding of the radioisotope to the pharmaceutical.</p> <p>A patient presented to a medical imaging practice for a nuclear medicine myocardial perfusion scan. The patient was administered with 510 MBq ^{99m}Tc-MIBI. The radiopharmaceutical passed quality control (QC) tests carried out by the supplier but the radiopharmaceutical had degraded by the time it had to be injected. Biodistribution of the radiopharmaceutical indicated that there was poor binding of the radioisotope to the pharmaceutical. The patient had to be rebooked for a repeat scan. The effective dose due to the scan was about 4.1 mSv.</p> <p>The supplier was contacted and advised of the problem. The supplier advised other centres that had been supplied with ^{99m}Tc-MIBI from the same batch. The supplier took immediate action to review and update how quality control tests were performed and recorded.</p>

Unnecessarily repeated medical imaging procedures (continued)

Incident no.	Description of incident
Incident 52	<p>A patient had a nuclear medicine myocardial perfusion scan unnecessarily repeated due to poor binding of the radioisotope to the pharmaceutical.</p> <p>A patient presented to a medical imaging practice for a nuclear medicine myocardial perfusion scan. The patient was administered with 720 MBq ^{99m}Tc-MIBI. The radiopharmaceutical passed quality control (QC) tests carried out by the supplier but the radiopharmaceutical had degraded by the time it had to be injected. Biodistribution of the radiopharmaceutical indicated that there was poor binding of the radioisotope to the pharmaceutical. The patient had to be rebooked for a repeat scan. The effective dose due to the scan was about 5.8 mSv.</p> <p>The supplier was contacted and advised of the problem. The supplier advised other centres that had been supplied with ^{99m}Tc-MIBI from the same batch. The supplier took immediate action to review and update how quality control tests were performed and recorded.</p>
Incident 53	<p>A patient had a nuclear medicine parathyroid scan unnecessarily repeated due to poor binding of the radioisotope to the pharmaceutical.</p> <p>A hospital patient presented for a nuclear medicine parathyroid scan. The patient was administered with 860 MBq ^{99m}Tc-MIBI. The radiopharmaceutical passed quality control (QC) tests carried out by the supplier but the radiopharmaceutical had degraded by the time it had to be injected. Biodistribution of the radiopharmaceutical indicated that there was poor binding of the radioisotope to the pharmaceutical. The patient had to be rebooked for a repeat scan. The effective dose due to the scan was about 6.9 mSv.</p> <p>The supplier was contacted and advised of the problem. The supplier advised other centres that had been supplied with ^{99m}Tc-MIBI from the same batch. The supplier took immediate action to review and update how quality control tests were performed and recorded.</p>
Incident 54	<p>A patient had a CT scan unnecessarily repeated due to medical staff error.</p> <p>A hospital patient had a CT scan of the thoracic spine unnecessarily repeated. The patient had already undergone imaging at another site but this imaging was initially considered incomplete by the trauma unit of the hospital. A request for repeat imaging was made by that unit. After further review, the trauma unit amended the patient's electronic medical record to indicate that the prior imaging was satisfactory and the requested scan was not required. However, this cancellation was not entered into the electronic imaging ordering system and radiographers were not informed, resulting in the scan being repeated unnecessarily. The effective dose due to the scan was about 19 mSv.</p> <p>Medical staff members involved were reminded to cancel scans that were no longer required by entering the cancellation into the electronic imaging ordering system and informing the medical imaging technologists of the cancellation.</p>
Incident 55	<p>A patient had a CT scan unnecessarily repeated due to radiographer error.</p> <p>A patient was referred to a medical imaging practice for a CT brain angiogram. A non-contrast CT scan of the brain was unnecessarily performed in addition to the CT brain angiogram. A non-contrast CT scan of the brain had been carried out six hours earlier at the practice. The scanning radiographer did not read the referral thoroughly and did not review previous imaging. The effective dose due to the scan was about 2.1 mSv.</p> <p>The radiographer was reminded to review referrals thoroughly and check all previous imaging.</p>
Incident 56	<p>A patient had a CT scan unnecessarily repeated due to radiographer error.</p> <p>A hospital patient was referred for a CT trans-catheter aortic valve implantation work up, which incorporates CT coronary angiography and a CT scan of the chest and the procedure was performed. A referral was generated for CT coronary angiography and a CT scan of the chest about 10 days later and so the scans were unnecessarily repeated. The radiographer did not check for previous scans. The effective dose due to the scans was about 50 mSv.</p> <p>The radiographer was reminded to check all previous imaging.</p>

Unnecessarily repeated medical imaging procedures (continued)

Incident no.	Description of incident
Incident 57	<p>A patient had an injection of radiopharmaceutical unnecessarily repeated due to extravasation of radiopharmaceutical.</p> <p>A hospital patient presented for a bone scan with radiopharmaceutical administered via an intravenous portal. The cannula was checked with a saline flush and no pain or skin swelling was noted. Following the injection of 539 MBq of ^{99m}Tc-HDP, the nuclear medicine technologist noted no movement of the radiopharmaceutical from the cannula site. The radiopharmaceutical had extravasated. The effective dose from the extravasation was about 2.1 mSv.</p> <p>No further action was necessary.</p>
Incident 58	<p>A patient had a CT scan unnecessarily repeated due to leakage of the contrast medium.</p> <p>A hospital patient presented for a CT pulmonary angiography scan. The radiographer positioned the three way tap for the intravenous contrast correctly for contrast administration but sealed the incorrect exit, resulting in leaked contrast. Some contrast made it through the patient's system which triggered the scan to start automatically. The scan had to be repeated. The effective dose due to the scan was about 1.7 mSv.</p> <p>The radiographer was reminded of the importance of checking the three-way tap positions.</p>
Incident 59	<p>A patient had a CT scan unnecessarily repeated due to radiographer error.</p> <p>A patient at a medical imaging practice was referred for a CT scan of the brain to query haemorrhaging after a fall. The radiographer positioned the patient incorrectly and part of the occipital lobe was not in the field of view. The scan had to be repeated. The effective dose due to the initial scan was about 1.8 mSv.</p> <p>The radiographer was reminded to be careful when positioning patients for scans.</p>
Incident 60	<p>A patient had a CT scan unnecessarily repeated due to extravasation of the radiopharmaceutical in a PET/CT scan.</p> <p>A patient attended a medical imaging practice for a PET/CT scan. The patient was injected with 232 MBq ¹⁸F. The PET scan images showed that part of the radiopharmaceutical had extravasated in the right arm. The radiopharmaceutical had to be reinjected. The effective dose due to the initial injection of radiopharmaceutical was about 4 mSv.</p> <p>No further action was necessary.</p>
Incident 61	<p>A patient had a CT scan unnecessarily repeated due to radiographer error.</p> <p>A patient attended a medical practice with a referral for a CT scan of the chest. The patient had received a CT scan of the chest a month earlier using the same referral. The radiographer did not check for previous scans. The effective dose due to the scan was about 12 mSv.</p> <p>The radiographer was reminded to check all previous imaging.</p>
Incident 62	<p>A paediatric patient had panoramic and cephalometric dental X-rays unnecessarily repeated due to radiographer error.</p> <p>A paediatric patient attended a medical imaging practice for panoramic and cephalometric dental X-rays. The radiographer saved the images in the wrong patient file. When the images could not be found, the radiographer rescanned the patient. The effective dose due to the X-rays was about 0.01 mSv.</p> <p>The radiographer was reminded to be careful when saving images.</p>
Incident 63	<p>A patient had a CT scan unnecessarily repeated due to radiographer error.</p> <p>A hospital patient underwent an unnecessary CT scan of the cervical spine due to incorrect protocol selection by the radiographer. The patient was booked for a CT brain and carotids scan with contrast, including cervical spine reformats. The radiographer initially carried out a non-contrast CT scan of the cervical spine before realising the mistake and then correctly performed the contrast enhanced carotids scan. A repeat scan was required of the cervical spine. The effective dose due to the unnecessary CT scan of the cervical spine scan was about 7 mSv.</p> <p>The importance of procedure verification was stressed to the radiographer.</p>

Unnecessarily repeated medical imaging procedures (continued)

Incident no.	Description of incident
Incident 64	<p>A patient had a CT scan unnecessarily repeated due to radiographer error.</p> <p>A hospital patient was to have a pre-operative CT scan of the brain with the scan range extended to include the sinuses, with the latter anatomy to be included as a reformat of the scan. While planning the scan, the radiographer mistakenly moved the planned scan range to the range of the sinus reformat, resulting in data being collected in this region only. As the scan was to be used for operative localisation, a contiguous scan was needed, which required that the scan be repeated with the entire range included. The effective dose from the unnecessary CT scan of the sinuses was about 1.5 mSv.</p> <p>The importance of selecting and checking the correct scan range was stressed to the radiographer.</p>
Incident 65	<p>A patient had CT scout scans unnecessarily repeated due to medical staff error.</p> <p>A hospital patient had been transferred from another institution where brain and cervical spine CT scans were carried out and were available to the hospital. A CT scan of the chest, abdomen and pelvis (CT CAP) was ordered to image the remaining areas of injury. Upon acquiring the two scout views, radio-opaque contrast was noted in the patient's bladder, which implied that a recent CT CAP may have been performed at the other institution. The institution was contacted and confirmed that a CT CAP was performed that day. The present scan was not urgent and could have been deferred until imaging results from the other institution were uploaded – this should have been arranged by the accepting team prior to the patient's arrival. The CT CAP scan was cancelled. The effective dose from the two CT scout views was about 1.4 mSv.</p> <p>Hospital staff members involved were reminded to wait for all imaging results to be made available from an institution when a patient is transferred to the hospital from that institution.</p>
Incident 66	<p>A patient had an administration of a radiopharmaceutical unnecessarily repeated.</p> <p>A patient attended a medical imaging practice for a PET scan with 360 MBq ¹⁸F FDG. During the administration, the autoinjector detected a bubble mid-administration and aborted the injection after administration of 106 MBq. The effective dose from the administration of the FDG was about 9 mSv.</p> <p>No further action was necessary.</p>
Incident 67	<p>A patient had CT scout scans unnecessarily repeated due to medical staff error.</p> <p>A hospital patient underwent unnecessary CT scans of the chest, abdomen and pelvis (CAP) and CT carotid scans. The patient had undergone imaging at another hospital prior to transfer to the trauma unit of the current hospital. CT scans of the chest, abdomen and pelvis (CAP) and CT carotid scans were then requested and carried out at the hospital to which the patient had been transferred. The pre-existing external imaging was found afterwards by the reporting radiologist. Uploading of images from the other hospital should have been arranged by the accepting team prior to the patient's arrival. The effective dose from the unnecessary scans was about 29 mSv.</p> <p>Hospital staff members involved were reminded to wait for all imaging results to be made available from an institution when a patient is transferred to the hospital from that institution.</p>
Incident 68	<p>A patient had a CT scan unnecessarily repeated due to radiographer error.</p> <p>A hospital patient was referred for a CT trauma series covering the chest, abdomen and pelvis. The CT scanner was incorrectly set to scan only the abdomen and pelvis. The scan had to be repeated to cover the chest, abdomen and pelvis. The effective dose from the unnecessarily repeated scan of the abdomen and pelvis was about 4 mSv.</p> <p>The importance of selecting and checking the correct scan range was stressed to the radiographer.</p>

Unnecessarily repeated medical imaging procedures (continued)

Incident no.	Description of incident
Incident 69	<p>A patient had a CT scan unnecessarily repeated due to radiographer error.</p> <p>A hospital patient was referred for a CT scan of the abdomen and pelvis with rectal contrast. The protocolling task was not correctly reviewed by radiographer and the scan was performed without rectal contrast. The scan had to be repeated with rectal contrast. The effective dose from the scan was about 4 mSv.</p> <p>The importance of procedure verification and careful examination of the scan protocol was stressed to the radiographer.</p>
Incident 70	<p>A patient had a CT scan unnecessarily repeated due to radiographer error.</p> <p>A hospital patient was referred for a CT pulmonary angiogram. The radiographer inadvertently set up the contrast and saline injectors incorrectly and saline was injected into the patient when contrast was supposed to have been injected. The scan had to be repeated. The effective dose from the scan was about 5 mSv.</p> <p>The radiographer was reminded of the importance of checking that the contrast injector is set up correctly. A new process was introduced at the hospital, requiring two people to check that the contrast injector is set up correctly.</p>
Incident 71	<p>A patient had a CT scan unnecessarily repeated due to radiologist error.</p> <p>A hospital patient was referred by the emergency department (ED) for an CT scan after a fall. The patient had already had a plain X-ray carried out at another practice, which imaged down to sacral vertebra 4. The ED requested a CT scan of the lumbar spine and was querying a sacral fracture, noting on the request that the patient had landed on the buttocks. The radiologist justified a CT scan that only imaged down to sacral vertebrae 2 and 3. The CT scan was reviewed by a second radiologist who noted that some scanned regions in the plain X-ray (sacral vertebrae 3 and 4) were not adequately imaged in the CT scan. The first radiologist subsequently placed another order for a CT scan of the pelvis that included full imaging of the sacrum. The effective dose from the first scan was about 5 mSv.</p> <p>The first radiologist was reminded to review previous imaging carefully when justifying further imaging procedures.</p>
Incident 72	<p>A paediatric patient had a CT scan unnecessarily repeated due to requesting physician error.</p> <p>A paediatric hospital patient had a CT scan of the left and right femur for surgical planning of a prosthesis. The scan was requested by an orthopaedic physician. The scan range was from the pelvis to the knees. Upon review of the scan, the prosthesis team considered that further imaging was required. A second request was ordered using a scan protocol recommended by the company making the prosthesis. The second scan covered both legs from the pelvis to the ankles. The effective dose from the first scan was about 0.5 mSv.</p> <p>The ordering physician was reminded to ensure that appropriate scan protocols are used.</p>
Incident 73	<p>A patient had a CT scan unnecessarily repeated due to radiographer error.</p> <p>A patient presented to a medical imaging practice for a pre-operation CT scan of the right shoulder. The radiographer reread the scan protocol after the scan and noticed that the hand was meant to be in neutral position. The patient had to be rescanned. The effective dose from the scan was about 13 mSv.</p> <p>The radiographer was reminded to check referrals and scan protocols thoroughly before scanning patients.</p>

Unnecessarily repeated medical imaging procedures (continued)

Incident no.	Description of incident
Incident 74	<p>A paediatric patient had a CT scan unnecessarily repeated due to anaesthetist error.</p> <p>A paediatric hospital patient was referred for a CT scan of the chest. The anaesthetist was advised that the patient would be required to hold their breath and the anaesthetist indicated this would not be a problem. The breath-hold was to be commenced a few seconds after the intravenous contrast was given and the radiographer asked the anaesthetist to be in the scan room to ensure the patient held their breath at least 10 seconds prior to the CT scan. The anaesthetist, however, didn't clearly understand what was expected of them and didn't enter the room when required. The anaesthetist was in the scanning room when the breath-hold and scan were required. The radiographer aborted the scan to avoid irradiating the anaesthetist. The intravenous contrast injection and scan had to be repeated. The effective dose from the scan was about 2.2 mSv.</p> <p>The anaesthetist was reminded to seek advice if the requirements for a procedure are not clearly understood.</p>
Incident 75	<p>A patient had part of a CT scan unnecessarily repeated due to radiographer error.</p> <p>A hospital patient had a CT urography examination but the upper pole of the patient's kidney was not imaged due to the operator setting an insufficient scan range. The scan range was subsequently extended to include the upper pole of the kidney but the inferior scan range was not adjusted, resulting in a scan of the entire kidney. The effective dose from the repeated parts of the scan was about 1.2 mSv.</p> <p>The operator was spoken to by the CT supervisor and was instructed in the proper use of the scanner.</p>
Incident 76	<p>A patient had part of a CT scan unnecessarily repeated due to radiographer error.</p> <p>A patient attended a medical imaging practice for CT-guided lumbar puncture. The radiographer set the scanner up for the correct procedure and marked the anatomic area for scanning. During the procedure it was noted that the marked point did not match the scanned area because the patient had moved. The radiographer tried to fix the problem but was not successful the patient kept moving and complaining of pain. The procedure had to be abandoned and rescheduled for the next day. The incident was caused by the radiographer's lack of confidence with the procedure. The effective dose from the scan was about 2.7 mSv.</p> <p>The radiographer underwent education and was supported for a time whilst rostered in CT.</p>
Incident 77	<p>A patient had an injection of a radiopharmaceutical unnecessarily repeated due to extravasation of the radiopharmaceutical.</p> <p>A hospital patient was referred for a nuclear medicine lung ventilation/perfusion study and was injected with 140 MBq of ^{99m}Tc-macro-aggregated albumin. Upon imaging, it was found that the radiopharmaceutical had been injected extravasously. An additional 150 MBq of ^{99m}Tc-macro-aggregated albumin was administered to the patient for the study to be completed.</p> <p>The maximum skin dose to the area of the extravasation was about 3.4 Gy.</p> <p>No further action was necessary.</p>
Incident 78	<p>A patient had an injection of a radiopharmaceutical unnecessarily repeated due to extravasation of the radiopharmaceutical.</p> <p>A hospital patient was referred for a cardiac stress test. 1200 MBq of ^{99m}Tc-MIBI was drawn up and the intravenous line was tested and found to be patent. Half way through the injection, however, the intravenous line started leaking and the remainder of the radiopharmaceutical ended up on floor. It was estimated that 600 MBq had been injected into the patient. The scan was not diagnostic and had to be repeated at a later date. The floor was decontaminated.</p> <p>The effective dose from the partial injection of ^{99m}Tc-MIBI was about 4 mSv</p> <p>No further action was necessary.</p>

Unnecessarily repeated medical imaging procedures (continued)

Incident no.	Description of incident
Incident 79	<p>A paediatric patient had part of a CT scan unnecessarily repeated due to insufficient contrast injection.</p> <p>A paediatric patient had to have a fluoroscopy acquisition repeated due to a contrast injector error. The fluoroscopy unit has a 'test injection' function that is operated by quickly pressing and releasing the injector hand switch. This also works when the foot pedal is pressed on and off quickly. The test injection injects a small amount of contrast and then remains armed for a full injection as programmed. A foot pedal-controlled acquisition was completed but the injector only injected half the contrast before cutting off. The acquisition run was repeated and the injector worked correctly. The effective dose from the scan was about 0.9 mSv.</p> <p>An engineer from the supply company came and replaced a faulty component of the foot pedal.</p>
Incident 80	<p>A patient had part of a CT scan unnecessarily repeated due to failed contrast injection.</p> <p>A hospital patient required a CT scan of the neck, chest, abdomen and pelvis. The imaging sequence of the scan involved two injections of contrast medium. One injection for the chest, abdomen and pelvis (CAP) and a second injection for the neck scan. The contrast injection for the CT CAP was performed. However, the CT neck scan was performed before contrast was injected again. The radiographer felt they had triggered the injection of contrast for the CT neck but hadn't pressed the injection controls with sufficient force to initiate the injection. The CT neck scan had to be repeated with contrast. The effective dose from the scan was about 2.4 mSv.</p> <p>The Chief Radiographer reminded staff of the need to be focused whilst scanning.</p>
Incident 81	<p>A paediatric patient had a CT scan unnecessarily repeated due to failed contrast injection.</p> <p>A paediatric patient had an unnecessary fluoroscopy scan due to a poor contrast injector connection. The injector was connected as per protocol by the cardiology fellow. Due to a poor connection to the catheter or inappropriate tubing, the injector tubing disconnected from the catheter when the injection began. As a result, the scan was not diagnostic. The scan had to be repeated. The effective dose from the scan was about 0.15 mSv.</p> <p>The cardiology fellow was reminded about the correct procedure for attaching tubing.</p>
Incident 82	<p>A patient had a CT scan unnecessarily repeated due to failure of communication between health facilities.</p> <p>A patient was transferred to a hospital from a medical imaging practice associated with the hospital for a metal artefact reduction scan of their tibia following a sarcoma removal. The imaging request by the hospital requested both a tibial and chest CT scan but the imaging practice had already completed a chest CT scan earlier that day for the patient. The imaging practice staff member who conducted the CT scan verbally advised the hospital but did not document the information. The hospital radiographer who received the verbal handover also did not document the information. During staff change over, the information was not communicated to the radiographer who took over. The CT scan of the chest was unnecessarily repeated. The effective dose from the scan was about 9 mSv.</p> <p>The radiographers were reminded to document all scans rather than using a verbal handover. Alternate programs for electronic protocolling, which would enable better visibility of scans between the two sites, were being trialled.</p>
Incident 83	<p>A paediatric patient had a CT scan unnecessarily repeated.</p> <p>A paediatric hospital patient presented for an urgent CT scan of the brain following surgery. The patient was transferred to the CT table, which included sandbags in pillowcases to support the patient's neck. The radiographer assumed there were rolled towels in the pillowcases. The absorption of the X-rays by the sand resulted in an undiagnostic scan and the scan had to be repeated with rolled towels. The effective dose from the scan was about 3.2 mSv.</p> <p>The radiographer was educated to identify potential factors which may cause an issue with scanning.</p>

Unnecessarily repeated medical imaging procedures (continued)

Incident no.	Description of incident
Incident 84	<p>A patient had a CT scan unnecessarily repeated due to failed contrast injection.</p> <p>A patient attended a medical imaging practice for a CT coronary angiography. Contrast was administered but the resulting scan showed that there was extravasation of the contrast medium, possibly because the cannula was not inserted correctly. A repeat scan was required. The effective dose from the scan was about 7.4 mSv.</p> <p>Medical staff were reminded to ensure that cannulas for contrast injection are inserted correctly.</p>
Incident 85	<p>A patient had a CT scan unnecessarily repeated due to radiographer error.</p> <p>A hospital patient was referred for a CT scan of the chest, abdomen and pelvis. The patient had a low estimated glomerular filtration rate (eGFR). The study was, therefore, justified with intravenous (IV) contrast following IV hydration. On the day of the scan, the patient's eGFR had improved and a different radiologist re-justified the scan online with IV contrast, but without IV hydration. The radiographer performing the imaging heard one of the other radiographers indicating that IV hydration was not required and falsely assumed that this was because the patient was having a non-contrast study and performed the scan without contrast. The scan had to be repeated with IV contrast. The effective dose from the first scan was about 12 mSv.</p> <p>The radiographer was reminded to carry out the hospital's patient and procedure identification process thoroughly before scanning patients.</p>
Incident 86	<p>A paediatric patient had X-rays unnecessarily repeated due to radiographer error.</p> <p>A paediatric hospital patient underwent a series of plain X-rays for a scoliosis survey that was performed with a brace in situ when the procedure had been requested to be performed without a brace. As a result, the X-rays had to be repeated. In total, four unnecessary X-ray views were taken of the thoracic and lumbar spine. The effective dose from the four unnecessary X-rays was about 0.7 mSv.</p> <p>Radiographers were reminded to review scoliosis requests carefully as they are complex. A poster was developed for the work area explaining the format of the request forms, which will also be used for new staff orientation.</p>
Incident 87	<p>A patient had a CT scan unnecessarily repeated due to radiographer error.</p> <p>A hospital patient undergoing ongoing urology treatment had a referral for a CT scan of the kidneys, ureters and bladder, to be performed at a future date. The scan was protocolled as per the referral and performed by the radiographer, who looked at the date on the referral that the scan was ordered, not the scheduled date. The scan had to be rebooked for the correct date. The effective dose from the scan was about 3.1 mSv.</p> <p>The radiographer was reminded to read referrals carefully, in particular to check the date on which referrals was written as well as the date on which scans are scheduled.</p>
Incident 88	<p>A patient had a CT scan unnecessarily repeated due to radiographer error.</p> <p>A hospital patient was referred for a multiphase CT scan to assess the pancreas. The radiographer did not set the scan range correctly and the pancreas was incompletely imaged. The patient was recalled for a repeat scan to image all of the pancreas. The effective dose from the first scan was about 11 mSv.</p> <p>The radiographer was reminded to ensure that scan ranges are selected correctly.</p>
Incident 89	<p>A patient had a CT scan unnecessarily repeated due to radiographer error.</p> <p>A hospital patient was referred for a PET/CT PSMA scan. When the patient was asked about prior scans, they replied they had not had any recent scans. After the patient was scanned it was discovered that the patient had had a ¹⁸F-FDG PET/CT scan only two days before, which included a CT scan of the chest, abdomen and pelvis (CAP). This CAP scan was repeated as part of the PET/CT PSMA scan. The effective dose from the CAP scan was about 15 mSv.</p> <p>The radiographer was reminded to check for previous scans before scanning patients.</p>

Unnecessarily repeated medical imaging procedures (continued)

Incident no.	Description of incident
Incident 90	<p>A patient had a CT scan unnecessarily repeated due to radiographer error.</p> <p>A hospital patient was referred for a CT intravenous pyelography scan. The auto-injector was loaded by the radiographer but the saline and contrast pre-loaded syringes were inadvertently interchanged. The report issued by the radiologist indicated poor quality imaging. The effective dose from the scan was about 2.6 mSv.</p> <p>The radiographer was reminded to concentrate fully when loading auto-injectors.</p>
Incident 91	<p>A patient had a CT scan unnecessarily repeated due to radiographer error.</p> <p>A hospital patient was referred for a CT carotid angiogram. The region of interest (ROI) within the contrast monitoring slice used to initiate the scan was set to the wrong anatomical area (pulmonary trunk instead of the descending aorta). The scan was manually triggered, so visual identification of the contrast enhancement of the descending aorta could still have been the cue to initiate the scan. The radiographer, however, triggered the scan based on the rising values on the graph of the contrast enhancement for the ROI, being generated in real time. This resulted in an early initiation of the scan and resulted in a lack of enhancement in the acquired images. A repeat CT carotid angiogram was required. The effective dose from the scan was about 3 mSv.</p> <p>The importance of placing the monitoring ROI in the correct location and visually confirming correct enhancement was stressed to the radiographer.</p>
Incident 92	<p>A patient had a CT scan unnecessarily repeated due to extravasation of contrast.</p> <p>A hospital patient was referred for a CT scan of the abdomen and pelvis with contrast. The contrast medium extravasated and the scan had to be repeated. The effective dose due to the scan was about 5.7 mSv.</p> <p>No further action was necessary.</p>
Incident 93	<p>A patient had part of a CT scan unnecessarily repeated due to radiographer error.</p> <p>A hospital patient was referred for a CT scan of the abdomen and pelvis. While planning the scan, the radiographer accidentally changed the desired physical scan range to a region intended for lung reformats only, resulting in the scan finishing mid-way through the liver instead of the inferior end of the pelvis. The scan was restarted to capture the remaining anatomy, with a 5 cm overlap with the previous scan to ensure no anatomical details were missed. The effective dose from the overlapping CT range was about 1.2 mSv.</p> <p>The importance of correctly selecting and then checking the scan range was stressed to the radiographer.</p>
Incident 94	<p>A patient had a CT scan unnecessarily repeated due contrast medium retro-filling the patient's intravenous bag.</p> <p>A hospital patient was referred for a CT scan of the abdomen and pelvis with contrast. The contrast medium retro-filled the patient's intravenous bag because the taps were not set correctly. The scan was undiagnostic. The scan had to be repeated. The effective dose due to the scan was about 5.7 mSv.</p> <p>The importance of correctly setting the contrast taps was stressed to the radiographer.</p>

Unnecessary, unrequested or unapproved medical procedures

Incident no.	Description of incident
Incident 95	<p>A paediatric patient underwent an unnecessary lateral cephalogram due to receptionist and radiographer error.</p> <p>A paediatric patient attended a medical imaging practice for a panoramic dental radiograph only. The receptionist entered the procedure as a panoramic dental radiograph and lateral cephalogram. The radiographer did not read the referral carefully before imaging and carried out both procedures. The effective dose from the lateral cephalogram was about 0.005 mSv.</p> <p>The reception staff member was told to be careful when entering scan details on the electronic ordering system. The radiographer was reminded to carry out patient and procedure identification processes thoroughly and to examine all patient and scan details carefully.</p>
Incident 96	<p>A patient underwent an unnecessary CT scan of the brain due to radiographer error.</p> <p>A hospital patient presented for a CT scan of the cervical spine and chest to complete a trauma series started earlier in the day. The radiographer incorrectly included a scan of the brain with the scan of the cervical spine. The effective dose due to the brain scan was about 2.3 mSv.</p> <p>The Senior CT Radiographer counselled the radiographer and reminded them of the importance of selecting the correct protocols.</p>
Incident 97	<p>A patient underwent an unnecessary CT scan of the liver due to referring physician error.</p> <p>A hospital patient was scheduled to have a 4-phase liver CT scan. Between the scheduling of the scan and the patient presenting for scanning, the patient had a liver transplant and the CT scan was no longer required. The request was not cancelled by the referring physician and the scan proceeded. The effective dose due to the scan was about 21 mSv.</p> <p>The referring physician was reminded of the importance of cancelling scans that are no longer required.</p>
Incident 98	<p>A patient underwent an unnecessary CT scan of the brain due to radiographer error.</p> <p>A hospital patient was referred a CT scan of the chest, abdomen and pelvis, and a CT scan of the brain. However, the request for the brain scan was cancelled on the radiology information system (RIS); it did not need to be performed. The radiographer only consulted the referral slip before carrying out the procedures and so carried out the brain scan in addition to the other scan. The effective dose from the unnecessary brain scan was about 2.5 mSv.</p> <p>Radiographers were reminded of the importance of performing the final check of the protocol on the RIS.</p>
Incident 99	<p>A patient underwent an unnecessary high-resolution CT scan of the liver due to radiographer error.</p> <p>A hospital patient attended the radiology department with a request for a high-resolution CT (HRCT) scan of the chest. A CT scan of the chest with contrast was approved and justified by the radiologist. The radiographer selected the HRCT protocol in error and performed the HRCT scan. The effective dose from the unnecessary HRCT scan was about 2 mSv.</p> <p>The radiographer was reminded to be careful when selecting scans for patients.</p>
Incident 100	<p>A patient underwent an unnecessary CT scan of the cervical spine due to radiographer error.</p> <p>A patient was referred to a hospital for a CT scan of the brain and facial bones and a CT scan of the thoracic and lumbar spine to query tenderness in the T2/T3 area of the thoracic spine. The radiographer completed the CT scan of the brain and facial bones and a CT scan of the cervical spine and thoracic spine down to T5 as the clinical indications did not refer to the lumbar spine. Following the scans, the referring physician contacted the radiographer to state that the request had been for a scan of the thoracic and lumbar spine; a scan of the cervical spine had not been requested. The effective dose from the unnecessary CT scan of the cervical spine was about 2.7 mSv.</p> <p>The referring physician was instructed to provide more detailed clinical notes in the future. The radiographer was counselled relating to the error and reminded to seek clarification regarding scans when there was any uncertainty.</p>

Unnecessary, unrequested or unapproved medical procedures (continued)

Incident no.	Description of incident
Incident 101	<p>A patient underwent an unnecessary high-resolution CT scan of the liver due to radiologist error.</p> <p>A trauma patient presented to the emergency department (ED) of a hospital. A radiologist registrar was protocolling batches of ED scans and approved a whole-body multi slice CT for this patient. The radiologist later realised, on reporting the scan, that the chest, abdomen and pelvis (CAP) components of the scan were not necessary. The effective dose from the unnecessary CAP scan was about 8.3 mSv.</p> <p>The radiologist was reminded to be careful when approving scans.</p>
Incident 102	<p>A patient underwent an unnecessary CT scan of the chest due to radiographer error.</p> <p>A patient in a hospital emergency department was referred for a CT scan of the brain, abdomen and pelvis. The radiographer performed all the appropriate checks but accidentally selected the brain, chest, abdomen and pelvis protocol on the scanner. The effective dose from the unnecessary chest scan was about 6 mSv.</p> <p>The radiographer was reminded to be careful when selecting scans for patients.</p>
Incident 103	<p>A patient underwent an unnecessary CT scan of the chest due to radiographer error.</p> <p>A hospital patient was referred for a CT scan of the head and neck. The patient told the radiographer that they also needed a scan of the chest. The radiographer scanned the patient's head and neck and then scanned the chest without checking the request form. The radiographer realised the error when they went to verify the study. The effective dose from the unnecessary chest scan was about 3.4 mSv.</p> <p>A senior radiographer counselled the radiographer involved and reminded them of the importance of reviewing imaging request forms prior to scanning patients.</p>
Incident 104	<p>A patient underwent an unnecessary CT scan of the chest due to radiographer error.</p> <p>A hospital patient was protocollered for one type of multiphase CT scan but the senior radiographer suggested that a modified protocol be used and discussed this protocol with the radiologist. The modified protocol matched the clinical indications and would have resulted in a lower dose to the patient by excluding the chest from the delayed phase scan. A radiographer in training set up the scan with the assistance of another radiographer. Modification of the first protocol was not completed successfully and the patient had a delayed phase scan covering the chest as well as the abdomen and pelvis. The effective dose for the unnecessary scan range was about 5 mSv.</p> <p>The radiographer in training involved discussed this incident with their manager. The radiographer was reminded to be careful when selecting scans for patients.</p>
Incident 105	<p>A patient underwent an unnecessary CT scan of the kidneys, ureters and bladder due to radiologist and radiographer error.</p> <p>A hospital patient underwent an unnecessary CT scan of the kidneys, ureters and bladder (KUB). The patient was booked for two examinations – a CT KUB scan and a CT intravenous pyelogram (IVP). The CT IVP, a scan that uses an injection of contrast material to evaluate a patient's KUB, was carried out first and the CT KUB scan was carried out one week later despite the clinical question being satisfactorily answered by the first scan. The radiologist and the radiographer did not check for prior imaging and did not notice that the clinical question was answered by the first (CT IVP) scan. The effective dose for the unnecessary KUB scan was about 2.3 mSv.</p> <p>The radiologist and radiographer were reminded to check for prior imaging before approving or performing scans.</p>

Unnecessary, unrequested or unapproved medical procedures (continued)

Incident no.	Description of incident
Incident 106	<p>A patient underwent an unnecessary CT scan of the brain due to referring physician error.</p> <p>A hospital patient was referred for a CT scan brain without contrast, followed by CT scan of the brain with contrast. The patient was transferred from the ward to radiology and appropriate medical handover to the radiographers was carried out. When the radiology information system (RIS) was refreshed by the radiographers after the scan without contrast, the patient's CT request disappeared. The CT request had been cancelled by the referring physician but the radiology department was not verbally notified of the cancellation, as required. The effective dose due to the scan without contrast was about 1.3 mSv.</p> <p>Clerical and medical staff were reminded to contact radiographers by telephone when scans were cancelled.</p>
Incident 107	<p>A patient underwent an unnecessary CT scan of the kidneys, ureters and bladder due to radiologist and radiographer error.</p> <p>A hospital patient underwent a CT scan of the brain and a CT scan of the cervical spine when only a CT scan of the cervical spine was requested. The trauma shift was busy and the radiographer did not perform the time out procedure correctly. The effective dose due to the brain scan was about 1.5 mSv.</p> <p>The radiographer was counselled on the importance of carrying out the time out procedure properly.</p>
Incident 108	<p>A patient underwent a CT quad phase liver scan over a greater range than required due to radiographer error.</p> <p>A hospital patient was referred for a CT quad phase liver scan from the top to the bottom of the liver. The radiographer, due to a lapse in concentration, set the scan range to extend down to the pubic symphysis. The effective dose due to the unrequired parts of the scan was 4 mSv.</p> <p>The radiographer was reminded to concentrate on the task at hand when scanning patients.</p>
Incident 109	<p>A patient underwent an unnecessary CT scan of the chest due to radiographer error.</p> <p>A patient attended a medical imaging practice for a CT scan of the abdomen and pelvis. The radiographer did not read the referral adequately and performed a CT scan of the chest, abdomen and pelvis in error. The effective dose due to the chest scan was about 13 mSv.</p> <p>Radiographers and nuclear medicine technologists at the practice were reminded to read the referral thoroughly before performing any imaging procedure.</p>
Incident 110	<p>A patient underwent an unnecessary CT scan of the abdomen due to radiographer error.</p> <p>A hospital patient was referred for a CT pulmonary angiogram. The patient experienced a coughing fit as the scan was being initiated and the radiographer paused the scan by hitting the 'cancel move' button. Pressing the 'cancel move' button reconfigures the system and changes settings back to default settings, which can alter the pre-set location of the scan. The radiographer pressed the 'continue scan' button to continue with the procedure without checking the scan's location settings, which resulted in the patient receiving an unnecessary abdominal scan. The effective dose due to the scan of the abdomen was about 3.2 mSv.</p> <p>The radiographer was reminded to double check scan ranges before scanning patients.</p>
Incident 111	<p>A patient underwent a CT scan of a greater anatomic region than required due to radiographer error.</p> <p>A patient attended a medical imaging practice for a CT scan of the abdomen and pelvis. The radiographer inadvertently carried out a CT scan of the chest, abdomen and pelvis. The effective dose due to the scan of the chest was about 5.6 mSv.</p> <p>The radiographer was reminded to concentrate on the task at hand when scanning patients.</p>

Unnecessary, unrequested or unapproved medical procedures (continued)

Incident no.	Description of incident
Incident 112	<p>A patient underwent an unnecessary CT scan of the chest due to radiographer error.</p> <p>A hospital patient had a plain X-ray of the chest, which revealed a possible bone lesion in the patient's shoulder. The patient was then referred for a follow up CT scan to characterise this lesion. No lesion was observed and it was determined that the appearance of what was assumed to be a lesion was actually due to an accidental overexposure during the chest X-ray due to the radiographer incorrectly setting technique factors. The effective dose due to the CT scan of the chest was about 12 mSv.</p> <p>The radiographer was reminded of the importance of checking settings prior to exposures.</p>
Incident 113	<p>A patient underwent a CT scan of a greater anatomic region than required due to radiographer error.</p> <p>A hospital patient was referred for a CT scan of the spine from vertebra C7 to vertebra L1. The radiographer was focussed on applying a metal artefact reduction algorithm to the scout image and did not reduce the scan range for the main scan. The patient was scanned unnecessarily down to vertebra S2. The effective dose due to the unnecessarily scanned areas was about 5.7 mSv.</p> <p>The radiographer was reminded to concentrate on the task at hand when scanning patients.</p>
Incident 114	<p>A patient underwent an unnecessary CT scan of the kidneys, ureters and bladder due to radiologist and radiographer error.</p> <p>A hospital patient was referred for a CT scan of the chest, abdomen and pelvis (CAP) with contrast by the neurosurgery team due to a new right frontal brain lesion, which they thought might have been metastatic disease arising from the CAP. The radiology registrar reviewed and approved the CT scan. An MRI scan of the patient's brain had recently been carried out, with the report pending at the time of the CT scan. The radiology registrar was consulted to confirm if the CT scan should proceed or to wait for the results of the MRI scan. The registrar advised proceeding with the scan. The MRI report arrived and confirmed the abnormality as compatible with a high-grade glioma. The CT scan did not reveal any evidence of primary malignancy (CAP) or metastatic disease. The CT scan was unnecessary. The effective dose due to the CT scan was about 1.4 mSv.</p> <p>The director of training provided feedback to the radiology registrar who approved the study, outlining the correct justification process for similar patients in the future. Radiographers were instructed to seek advice from a senior neuroradiology registrar when dealing with queries related to neurosurgery referrals similar to this case and when unsure about the appropriate course of action.</p>
Incident 115	<p>A patient underwent an unnecessary CT scan of the lungs due to radiographer error.</p> <p>A hospital patient presented for a high-resolution CT scan (HRCT) of the chest. During the expiration and prone phase of the imaging sequence, the lung region was over-scanned because the radiographer had set the wrong scan range. The effective dose due to the unnecessarily scanned areas was about 3.5 mSv.</p> <p>The radiographer was counselled regarding the incident by the CT supervisor and the Chief Radiographer.</p>
Incident 116	<p>A paediatric patient underwent an unnecessary CT scan of the chest due to radiographer error.</p> <p>A paediatric hospital patient presented for a CT scan of the chest abdomen and pelvis with contrast. The radiographer accidentally started the main scan (without contrast) when intending to perform the locator scan. The radiographer halted the acquisition when the error was noticed and only the chest was scanned. The effective dose due to the scan was about 0.55 mSv.</p> <p>The radiographer was reminded to concentrate on the task at hand when scanning patients.</p>

Unnecessary, unrequested or unapproved medical procedures (continued)

Incident no.	Description of incident
Incident 117	<p>A patient underwent an unnecessary CT scan of the chest due to radiographer error.</p> <p>A hospital patient presented for a CT arteriogram (an X-ray of the arteries and veins) from the aortic bifurcation to the lower limb vessels. The radiographer misread the protocol and started the scan from the top of the chest instead of from the aortic bifurcation. The effective dose due to the unintended chest scan was about 3 mSv.</p> <p>The radiographer was reminded to read the referral and protocol thoroughly before performing any imaging procedure.</p>
Incident 118	<p>A patient underwent an unnecessary CT scan of the chest due to radiographer error.</p> <p>A hospital patient was referred for a CT scan of the sinus without contrast and CT scan of the chest with contrast. A referral for a CT pulmonary angiogram had been generated overnight and carried out before the above two scans. A radiographer carried out the CT scans of the sinus and chest and stated on the CT checklist that they had checked previous imaging but the previous imaging procedures were not reviewed thoroughly. The effective dose due to the unintended chest scan was about 4.6 mSv.</p> <p>The radiographer was counselled regarding the incident and reminded to check previous imaging thoroughly before scanning patients.</p>
Incident 119	<p>A patient underwent an unnecessary arterial CT scan of the abdomen due to radiographer error.</p> <p>A hospital patient was referred for a portal venous phase CT scan. The radiographer was multitasking when scanning the patient. The radiographer had the radiology information system open with the details of another patient on screen. The second patient was referred for an arterial CT scan of the abdomen. The radiographer performed the latter scan on the first patient. The radiographer did not realise the error until the scan was complete. The effective dose due to the unintended scan was about 6 mSv.</p> <p>The radiographer was counselled regarding the incident and reminded to concentrate on one patient at a time.</p>
Incident 120	<p>A patient underwent an unnecessary CT scan of the cervical spine due to radiographer error.</p> <p>A hospital trauma patient had a CT scan of the cervical spine that could have been reconstructed retrospectively from the aortic arch to circle of Willis angiography scan that had already been conducted. The effective dose due to the unnecessary CT scan of the cervical spine was about 1.2 mSv.</p> <p>Senior CT radiographers were reminded to consider reconstruction options to avoid unnecessary scans.</p>
Incident 121	<p>A patient underwent an unnecessary PET scan of the whole body due to radiographer error.</p> <p>A patient attended a medical imaging practice with a referral for a ¹⁸F-FDG PET scan of the brain and advised the radiographer of a history of melanoma. Using Microsoft Teams, the radiographer attempted to check with the referring physician whether the physician wanted a brain scan or whole-body scan. A whole-body scan would be used to identify and locate any metastases. The radiographer waited a short while for a response from the physician but then decided that a whole-body scan was required. The physician replied 42 minutes later to advise that only a brain scan was required, by which time the whole-body scan had already been performed. The radiographer had changed the scan protocol to carry out the whole-body scan but forgot to change the time over brain, so that neuro-analysis was not possible. The brain scan had to be carried out at a later time. The effective dose due to the unnecessary scan was about 3.7 mSv.</p> <p>The radiographer was advised to phone the appropriate physician directly, rather than using Microsoft Teams, when it is necessary to clarify scan details. The radiographer was also reminded not to carry out scans until such time as that clarification is received.</p>

Unnecessary, unrequested or unapproved medical procedures (continued)

Incident no.	Description of incident
Incident 122	<p>A patient underwent an unnecessary CT scan of the brain due to radiographer error.</p> <p>A hospital patient was referred for CT scan of the cervical spine. The radiographer did not read the referral carefully enough and carried out a scan that included the brain as well. The effective dose due to the unnecessary CT scan of the brain was about 2.1 mSv.</p> <p>The radiographer was reminded to read the referral thoroughly before performing any imaging procedure.</p>

Wrong patient underwent a medical procedure

Incident no.	Description of incident
Incident 123	<p>A patient underwent a CT scan intended for another patient due to referring physician error.</p> <p>A hospital patient had a CT scan of the chest when plain X-ray thoracic imaging was required. The CT scan request was placed for the wrong patient by the referring physician. The effective dose due to the scan was about 3.3 mSv.</p> <p>The referring physician was reminded to be careful when placing patients' names on referrals.</p>
Incident 124	<p>A patient underwent a CT scan intended for another patient due to radiographer error.</p> <p>A patient at a medical imaging practice responded when another patient, with the same first name, was called; the referral was for a CT scan of the chest and abdomen. The patient was asked for their full name, date of birth and address. The patient provided their first name, month and decade of birth, and town of residence. These details matched those of the patient who was actually referred for the CT scan and the wrong patient was then scanned. The effective dose due to the scan was about 16 mSv.</p> <p>All radiographers at the practice were reminded to identify patients correctly using three identification points.</p>
Incident 125	<p>A paediatric patient underwent an X-ray intended for another patient due to referring physician error.</p> <p>A paediatric patient was referred to a medical imaging practice for a chest X-ray. Patient identification checks and procedure matching checks were correctly completed. The referring physician later advised that the wrong child had been sent for the chest X-ray. The effective dose due to the X-ray was about 0.006 mSv.</p> <p>The referring physician was reminded to be careful when placing patients' names on referrals.</p>
Incident 126	<p>A patient underwent a CT scan intended for another patient due to referring physician error.</p> <p>A patient at a medical imaging practice had a CT scan of the head requested for another patient because the referring physician placed the wrong patient label on the referral. The effective dose due to the scan was about 1.8 mSv.</p> <p>The referring physician was reminded to be careful when placing patients' names on referrals.</p>
Incident 127	<p>A patient underwent a CT scan intended for another patient due to referring physician error.</p> <p>A patient at a medical imaging practice had a CT scan of the abdomen and pelvis with rectal and oral contrast that was requested for another patient because the referring physician placed the wrong patient label on the referral. The effective dose due to the scan was about 7.7 mSv.</p> <p>The referring physician was reminded to be careful when placing patients' names on referrals.</p>

Wrong patient underwent a medical procedure (continued)

Incident no.	Description of incident
Incident 128	<p>A patient underwent a CT scan intended for another patient due to radiographer error.</p> <p>A patient attended a medical imaging practice for a CT of the chest but was mistaken for another patient and underwent a CT scan of the abdomen and pelvis intended for that patient. The first patient was not correctly identified by the radiographer; patient details were obtained but they were not checked with the referral or the patient's details on the scanner. The effective dose due to the scan was about 7.2 mSv.</p> <p>The radiographer was reminded to identify patients correctly and was required to complete the practice's patient identification module.</p>
Incident 129	<p>A patient underwent a CT scan intended for another patient due to radiographer error.</p> <p>A patient attended a medical imaging practice for a CT scan of the kidneys, ureters and bladder. The radiographer was busy and distracted and picked up a referral for another patient, for a CT scan of the brain. In addition, a different radiographer checked the patient's identifying information before sending them to the CT scanning room. The effective dose due to the brain scan was about 1.4 mSv.</p> <p>The radiographers were reminded to carry out patient and procedure identification processes thoroughly. The radiographers were cautioned not to rely upon a colleague to carry out these processes.</p>
Incident 130	<p>A patient underwent a nuclear medicine scan intended for another patient due to medical staff error.</p> <p>A hospital patient had a nuclear medicine scan of the thyroid intended for another patient. A clerical staff member asked the patient for their name, did a name search, and selected a patient with the same name without verifying the patient's date of birth and address. The nuclear medicine technologist did not check the patient's identity appropriately and the nuclear medicine physician did not notice a mismatch in the patient's date of birth and address during the justification and approval stage. The nuclear medicine technologist proceeded with the scan. The error was discovered when the correct patient called the hospital to inquire about their thyroid scan. The effective dose due to the scan was about 2.3 mSv.</p> <p>All staff members involved were reminded to carry out patient and procedure identification processes thoroughly.</p>
Incident 131	<p>A patient underwent a CT scan intended for another patient due to medical imaging staff error.</p> <p>A patient at a medical imaging practice was booked in for a breast biopsy. The referral for a CT scan for another patient had been uploaded into the file for the first patient. No one checked the referral in the booking for the first patient. The effective dose due to the scan was about 12 mSv.</p> <p>All staff members involved were reminded to carry out patient and procedure identification processes thoroughly.</p>
Incident 132	<p>A patient underwent a CT scan intended for another patient due to requesting physician error.</p> <p>A hospital patient had a CT scan of the chest, abdomen and pelvis (CAP) intended for another patient. After the scan, the requesting physician stated that they had requested the scan for an incorrect patient who had similar clinical indications. The effective dose due to the scan was about 29 mSv.</p> <p>The requesting physician was reminded to be careful when completing referrals.</p>

Wrong patient underwent a medical procedure (continued)

Incident no.	Description of incident
Incident 133	<p>A patient underwent a CT scan intended for another patient due to referring physician and radiographer error.</p> <p>A hospital patient was referred for CT pulmonary angiogram (CTPA) scan. The referring physician entered the wrong patient name on the referral. The radiographer did not complete the patient and procedure identification process correctly and the wrong patient had the CTPA scan. The mistake was identified after the scan was completed. The effective dose due to the scan was about 4.4 mSv.</p> <p>The requesting physician was reminded to be careful when completing referrals. The radiographer was reminded to carry out patient and procedure identification processes thoroughly.</p>
Incident 134	<p>A patient underwent a CT scan intended for another patient due to referring physician and radiographer error.</p> <p>A hospital patient presented with a referral from an emergency department (ED) for a CT scan of the abdomen and pelvis. The patient was called from the ED waiting room and transported to the CT scanner room by the radiographer. The radiographer conducted three points of identification check, and these matched what was on the referral, but the radiographer did not question the patient about the procedure. Just after the scan was completed, the referring physician came to the scanner room and asked for scan to be cancelled as it was ordered for the wrong patient. The effective dose due to the scan was about 16 mSv.</p> <p>The requesting physician was reminded to be careful when completing referrals. The radiographer was reminded to carry out patient and procedure identification processes thoroughly.</p>
Incident 135	<p>A patient underwent a CT pulmonary angiogram intended for another patient due to radiographer error.</p> <p>A hospital patient was referred for a CT pulmonary angiogram with intravenous contrast. An orderly went to get the patient from the emergency department cubicle. The patient had changed cubicles so the orderly brought back an incorrect patient for the scan. The radiographer asked closed questions to establish the patient's identity (ID) and the patient always responded in the affirmative. The radiographer did not check the patient's ID band. The effective dose due to the scan was about 2.8 mSv.</p> <p>The radiographer was retrained in the carrying out of patient and procedure identification processes.</p>

Patient underwent incorrect medical procedure

Incident no.	Description of incident
Incident 136	<p>A patient underwent a PET ⁶⁸Ga-DOTATE scan instead of the intended PET FDG scan due to lack of clarity in the referral.</p> <p>A hospital patient was referred for a PET FDG scan but had a PET ⁶⁸Ga-DOTATE scan instead: an option for a neuroendocrine DOTATATE scan had been indicated in the referral. As the patient had previously had a PET ⁶⁸Ga-DOTATE scan, a ⁶⁸G-DOTATATE scan was protocolled by a radiologist based on Medicare eligibility indications for a FDG scan and the ⁶⁸G-DOTATATE scan was carried out. The effective dose due to the scan was about 5.1 mSv.</p> <p>The referring physician was reminded to be clear about what scans are required when filling out referrals.</p>

Patient underwent incorrect medical procedure (continued)

Incident no.	Description of incident
Incident 137	<p>A patient underwent a cardiac rest ischemia exam instead of the intended cardiac amyloidosis nuclear medicine scan due to medical staff error.</p> <p>A hospital patient was referred for a cardiac amyloidosis nuclear medicine scan. A clerical staff member selected the cardiac rest/stress scan in error. The nuclear medicine specialist noted the clerical error and wrote a note stating the scan was meant to be a cardiac amyloid scan, not a cardiac rest/stress scan. However, the specialist did not check the box indicating the change in the ordered procedure, which would have placed the study on the clerical worklist to make changes to the order. The cardiac rest/stress ischemia scan remained on the worklist. On the day of the procedure, the cardiac technologist failed to note that the referral was for a cardiac amyloidosis scan, not a cardiac rest/stress scan. The nuclear medicine technologist did not cross-check the correct procedure with the original referral. The specialist picked up the error before the second part of the scan was completed and only the rest component of the scan was completed. The effective dose due to the scan was about 2.2 mSv.</p> <p>Clerical staff members were reminded to use care when entering the code for a procedure into the electronic ordering system and to consult with clinical staff when unsure. The nuclear medicine specialist was reminded of the process for changing an incorrect examination. The cardiac technologist was reminded of the importance of ensuring that the correct patient and procedure were selected during patient preparation. The nuclear medicine technologist was reminded to check all order information before injecting a patient.</p>
Incident 138	<p>A patient underwent a CT skeletal survey instead of the intended whole body nuclear medicine bone scan due to receptionist error.</p> <p>A patient at a medical imaging practice underwent a CT skeletal survey instead of the intended whole body nuclear medicine bone scan. The patient presented to the practice's reception desk with a referral for a "whole body bone scan" The receptionist did not know which modality was requested for the scan. The patient called the medical practice to determine which modality was requested. The patient was incorrectly advised by the receptionist at the medical practice that the referring practitioner had requested a CT scan. The scan was booked in and carried out as a CT skeletal survey. The effective dose due to the scan was about 13 mSv.</p> <p>The receptionist was reminded to seek clarification on procedures directly from referring practitioners, where possible.</p>
Incident 139	<p>A patient underwent an intravenous CT cholangiogram instead of the intended inferior vena cava CT venogram due to radiology fellow error.</p> <p>A hospital patient was referred for an inferior vena cava (IVC) venogram. The radiology fellow incorrectly protocolled the patient to receive an intravenous cholangiogram (IVC). The clinical details provided by the referrer clearly suggested that a venogram was required. The radiographers performing the CT scan did not pick up the incorrect protocol as they did not thoroughly review the clinical details on the referral. The effective dose due to the scan was about 2.2 mSv.</p> <p>The radiology fellow and radiographers were reminded to review referrals thoroughly.</p>
Incident 140	<p>A paediatric patient underwent a CT scan with an adult protocol instead of a paediatric protocol due to radiographer error.</p> <p>A paediatric hospital patient was referred for a CT rotational profile scan. After the scan, it was noted that the CT scanner's adult scan protocol was used rather than the dedicated paediatric scan protocol. The radiographer failed to select the correct scan protocol. The effective dose due to the scan was about 0.63 mSv.</p> <p>A notification was sent to CT radiographers to remind them to use paediatric specific scan protocols for paediatric patients.</p>

Patient underwent incorrect medical procedure (continued)

Incident no.	Description of incident
Incident 141	<p>A patient underwent a mammogram instead of the intended ultrasound scan due to radiographer error.</p> <p>A patient attended a medical imaging practice for a breast scan. A mammogram was booked in on an electronic referral but there were no referrer details. An ultrasound scan was actually required. The radiographer did not read the paper referral, which indicated that an ultrasound scan was required. The effective dose due to the mammogram was about 2.3 mSv.</p> <p>The radiographer was reminded that, when a referral has not been completed with referrer details, referrer signature and date, the procedure should not be performed.</p>
Incident 142	<p>A patient underwent a CT scan of the chest instead of the intended CT scan of the kidneys, ureters and bladder due to radiographer error.</p> <p>A patient attended a medical imaging practice for a CT scan of the kidneys, ureters and bladder. The radiographer did not read the referral and completed a CT scan of the chest as the radiographer had performed four chest CT scans in a row prior to this patient and assumed the request was for another CT scan of the chest. The effective dose due to the chest scan was about 7.1 mSv.</p> <p>The radiographer was reminded to carry out patient and procedure identification procedures thoroughly.</p>
Incident 143	<p>A paediatric patient underwent a CT leg length protocol scan instead of the intended CT rotational profile scan due to radiographer error.</p> <p>A paediatric hospital patient was referred for a CT rotational profile scan. The clinical indications for the use of a CT rotational profile examination are discrepancy in leg lengths and rotation of limbs. The radiographer misinterpreted the justification and approval documentation for the scan and proceeded to perform a CT leg length protocol scan. The paediatric radiologist on duty considered that the imaging carried out did not address the clinical indication for imaging. The patient was recalled for the CT rotational profile scan. The effective dose due to the CT leg length protocol scan was about 0.01 mSv.</p> <p>The radiographer was reminded to review all patient documentation carefully prior to carrying out scans.</p>
Incident 144	<p>A paediatric patient underwent a CT scan of the pelvis instead of the intended CT rotational profile scan due to referring practitioner error.</p> <p>A paediatric hospital patient underwent a CT scan of the pelvis. The scan was approved by a radiologist based on the clinical indication on the referral. A CT rotational profile scan was actually required based on the actual clinical indication being investigated. The incorrect scan was performed based on an incorrect clinical indication being placed on the referral by the referring practitioner. The patient was rescheduled for a CT rotational profile scan. The effective dose due to the CT scan of the pelvis was about 2.3 mSv.</p> <p>The referring practitioner was reminded to ensure that correct clinical indications are placed on referrals.</p>
Incident 145	<p>A patient underwent a dual energy CT neck scan instead of the intended CT scan of the chest, abdomen and pelvis due to radiographer error.</p> <p>A hospital patient presented with a referral for a CT scan of the chest, abdomen and pelvis. The usual process in place at the hospital required that the scan be carried out (based on the patient's referral) at the time of the scan type being loaded on the workstation schedule. The referral is then scanned into the radiology information system (RIS) after completion of the scan. In this instance, however, a radiographer took the referral for scanning into the RIS prior to the CT scan being performed. The requested scan protocol was therefore registered as completed and not loaded on the workstation schedule and an incorrect scan was selected and performed. This resulted in the patient having an unnecessary dual energy CT scan of the neck. The effective dose due to the CT scan of the neck was about 1.5 mSv.</p> <p>The radiographer was reminded of the correct procedure for processing referrals.</p>

Patient underwent incorrect medical procedure (continued)

Incident no.	Description of incident
Incident 146	<p>A patient underwent a CT scan of the knee instead of the intended CT scan of the hip due to radiographer error.</p> <p>A patient attended a medical imaging practice for a CT scan of the hip but a CT scan of the knee was carried out in error as the radiographer did not understand the difference between the hip and knee protocols with the CT system used at the practice. The effective dose due to the CT scan of the knee was about 8.3 mSv.</p> <p>The radiographer was trained in the CT system used at the practice. The radiographer was also reminded to be careful when selecting scan ranges on CT scanners and to seek assistance in cases of uncertainty.</p>
Incident 147	<p>A patient underwent a colonic/duodenal transit study instead of the intended gastric/duodenal transit due to referring practitioner and nuclear medicine technologist error.</p> <p>A hospital patient required a gastric/duodenal transit study using a ^{99m}Tc colloid. The referral generated was for a colonic/duodenal transit study (19.8 MBq ^{67}Ga-gallium citrate). The nuclear medicine technologist (NMT) carrying out the scan sought advice from the referring practitioner and was told by the practitioner to carry out the procedure at the top of the referral, not a gastric emptying study. The referring practitioner, on receiving the test results, asked a nuclear medicine consultant why a colonic transit study was performed and not a gastric emptying study. The NMT should have sought clarification from a nuclear medicine physician before carrying out the scan. The effective dose from the scan was about 2 mSv.</p> <p>NMTs at the hospital were counselled on importance of clear referrals and time-out procedures, including the need to follow up with nuclear medicine physicians when in doubt. The referring practitioner was reminded to write clear referrals.</p>
Incident 148	<p>A patient underwent a CT pulmonary angiogram instead of the intended CT abdominal angiogram due to radiographer error.</p> <p>A hospital patient was referred for a CT abdominal angiogram. The radiographer inadvertently carried out a CT pulmonary angiogram on the patient. The radiographer was inexperienced and made an error in the patient identification and procedure matching process. The effective dose from the scan was about 3.5mSv.</p> <p>The radiographer was reminded to carry out patient and procedure identification procedures thoroughly.</p>
Incident 149	<p>A patient underwent a triple phase CT scan of the abdomen and pelvis instead of the intended single-phase CT scan of the abdomen and pelvis due to radiographer error.</p> <p>A hospital patient was referred for a single-phase CT scan of the abdomen and pelvis. The scan protocolled by the radiologist was incorrectly interpreted by the radiographer as a triple phase CT scan of the abdomen and pelvis. The effective dose from the scan was about 6 mSv.</p> <p>The radiographer was reminded to carry out patient and procedure identification procedures thoroughly.</p>
Incident 150	<p>A patient underwent a plain X-ray of the lumbar spine instead of the intended CT scan of the lumbar spine due to radiographer error.</p> <p>A patient was referred by a chiropractor to a medical imaging practice with a request for a CT scan of the lumbar spine. The receptionist entered the appointment into the electronic ordering system as a plain X-ray of the lumbar spine. The radiographer read the request quickly and did not pick up that a CT scan of the lumbar spine was requested, not a plain X-ray. A standard view X-ray of the Lumbar spine was performed in error. The effective dose from the X-ray was about 1.2 mSv.</p> <p>The receptionist was reminded to be careful when entering scans into the electronic ordering system. The radiographer was reminded to carry out patient and procedure identification procedures thoroughly and to read referrals carefully.</p>

Patient underwent incorrect medical procedure (continued)

Incident no.	Description of incident
Incident 151	<p>A patient underwent a normal CT scan of the chest instead of the intended low dose CT scan due to radiographer error.</p> <p>A hospital presented with a referral for a low dose CT scan of the chest. The radiographer reviewed the justification and approval provided in the radiology information system but made an error in entering the procedure into the image ordering system, entering 'CT Chest' rather than 'CT Chest Low Dose'. The additional effective dose due to the normal CT scan was about 3.1 mSv.</p> <p>The radiographer was counselled regarding the incident and reminded to be careful when transcribing patient information.</p>
Incident 152	<p>A patient underwent a CT scan of the chest instead of the intended CT scan of the liver due to radiographer error.</p> <p>A hospital patient was referred for a quad-phase CT scan of the liver. The radiographer inadvertently selected the wrong protocol and carried out a quad-phase CT scan of the chest. The effective dose from the scan was about 5 mSv.</p> <p>The radiographer was reminded to carry out patient and procedure identification procedures thoroughly.</p>
Incident 153	<p>A patient underwent a CT scan of the abdomen and pelvis without contrast instead of the intended CT scan of the kidneys, ureters and bladder with contrast due to radiographer error.</p> <p>A hospital patient was referred for a CT scan of the kidneys, ureters and bladder with contrast. The radiographer inadvertently selected the wrong scan protocol and the patient had a CT scan of the abdomen and pelvis without contrast in error. The effective dose from the scan was about 3.4 mSv.</p> <p>The radiographer was reminded to be careful when selecting scan protocols on CT scanners.</p>
Incident 154	<p>A patient underwent a CT scan of the cervical spine instead of the intended CT scan of the lumbar spine due to radiographer error.</p> <p>A patient attended a medical imaging practice with a referral for a CT scan of the lumbar spine. The radiographer failed to perform the patient and procedure identification process properly and carried out a CT scan of the cervical spine in error. The effective dose from the scan was about 3 mSv.</p> <p>The radiographer was reminded to carry out patient and procedure identification processes thoroughly.</p>
Incident 155	<p>A patient underwent dual-energy scan with the incorrect protocol due to radiographer error.</p> <p>A hospital patient was referred for a dual-energy CT scan of the full spine and both shoulders for investigation of gout. The requested imaging was not a routine investigation. Being unfamiliar with this non-routine procedure, the radiographer scanned the patient with an incorrect dual-energy protocol and the datasets required for gout reformatting were not acquired. The effective dose from the scan was about 13 mSv.</p> <p>A communique was sent to all CT radiographers at the hospital advising them to seek the advice of senior CT radiographers prior to selecting imaging protocols for non-routine investigations.</p>
Incident 156	<p>A patient underwent an orthopaedic CT scan using the wrong protocol due to radiographer error.</p> <p>A patient presented to a medical imaging practice for a pre-operative orthopaedic CT scan. A scan with a particular protocol was ordered. The patient was incorrectly scanned using a different protocol. The radiographer did not read the referral thoroughly. Due to differences in scan parameters between the two protocols, the acquired data could not be used to reformat images for the software used by the required protocol. The patient was rescanned using the correct protocol. The effective dose from the incorrect scan was about 2 mSv.</p> <p>The radiographer was reminded to use greater vigilance in identifying the correct patient and procedure and ensuring correct protocols are used.</p>

Patient underwent incorrect medical procedure (continued)

Incident no.	Description of incident
Incident 157	<p>A patient underwent a CT scan with an unnecessarily extended scan range due to radiographer error.</p> <p>A hospital patient was referred for a thoracic angiogram and triphasic renal scan, which were protocolled together as one scan, but only to below the kidneys as per the standard arterial phase of a triphasic renal scan. The radiographer, however, chose a scan range required for a standard thoracic angiogram, which ends at the symphysis pubis. This resulted in an unnecessary radiation dose to the region from the sacroiliac joint to the symphysis pubis. The effective dose due to the unnecessarily scanned regions was about 4 mSv.</p> <p>The radiographer was reminded to carry out patient and procedure identification processes thoroughly.</p>
Incident 158	<p>A patient underwent dual-energy scan with the incorrect protocol due to clerical staff, radiologist and radiographer error.</p> <p>A patient at a medical imaging practice presented for a CT scan for left first sacral nerve root injection. The scan was booked in the system by clerical as a CT scan for a left sacro-iliac injection. Neither the radiologist nor radiographer consulted the referral. The radiographer failed to carry out the practice's patient and procedure identification process correctly. The effective dose from the incorrect scan was about 5.4 mSv.</p> <p>The staff involved were assigned to train in the practice's patient and procedure identification process.</p>
Incident 159	<p>A patient underwent a normal CT scan instead of the required dual energy CT scan due to radiographer error.</p> <p>A hospital patient had a CT scan of the brain using the incorrect protocol. The patient was referred for a non-contrast CT scan of the brain using a dual energy protocol instead of the routine single energy protocol. The correct scan was recommended and protocolled by a radiologist. The radiographer performing the scan did not thoroughly review the request for the CT scan. The effective dose from the incorrect scan was about 2.5 mSv.</p> <p>The Radiation Safety Officer and Chief Radiographer of the hospital counselled the radiographer and reminded them of the importance of thoroughly reviewing the imaging request.</p>
Incident 160	<p>A patient underwent a CT scan of the abdomen and pelvis instead of the required CT colonography due to radiographer error.</p> <p>A patient at a medical imaging practice had a CT scan of the abdomen and pelvis instead of the required CT colonography because the radiographer failed to perform the time out procedure properly, to ensure the correct scan is being performed on the correct patient. The effective dose from the incorrect scan was about 10 mSv.</p> <p>The radiographer was reminded of the importance of performing the time out procedure correctly to ensure the correct scan is being performed on the correct patient.</p>
Incident 161	<p>A patient underwent a CT coronary angiogram instead of the intended CT coronary artery bypass graft procedure due to radiographer error.</p> <p>A patient presented to a medical imaging practice for a CT coronary artery bypass graft (CT CABG) procedure. The radiographer misread the request and performed a CT coronary angiogram (CTCA). The patient had to return for the CT CABG procedure. The effective dose due to the CTCA scan was about 3.6 mSv.</p> <p>The radiographer was reminded to follow the patient and procedure identification process of the practice and to read referrals thoroughly.</p>

Patient underwent a medical procedure on the wrong anatomical region

Incident no.	Description of incident
Incident 162	<p>A paediatric patient underwent an X-ray of the wrong anatomical region due to radiographer error.</p> <p>A paediatric hospital patient was referred for an X-ray of the left humerus for follow up of a fracture. The radiographer inadvertently imaged the right humerus. The effective dose due to the X-ray was about 0.0025 mSv.</p> <p>The radiographer was counselled regarding the incident and supervisors began working with the radiographer on how to minimise mistakes in the future. The radiographer was monitored for a few months after the incident.</p>
Incident 163	<p>A paediatric patient underwent an X-ray of the wrong anatomical region due to radiographer error.</p> <p>A paediatric patient was referred for a plain X-ray series of the left side of the body. The radiographer performed the correct X-ray series on the left side up to the shoulder but accidentally imaged the right shoulder instead of the intended left shoulder. Whilst attempting to distract the child so as to perform the X-rays, the radiographer experienced a momentary lapse in concentration and carried out an unintended right shoulder X-ray. The effective dose due to the X-ray was about 0.002 mSv.</p> <p>The radiographer was reminded to concentrate on the task at hand when imaging patients.</p>
Incident 164	<p>A paediatric patient underwent an X-ray of the wrong anatomical region due to radiographer error.</p> <p>A paediatric hospital patient was referred for an X-ray of the right shoulder but the left shoulder was X-rayed in error. The radiographer did not confirm the correct side for imaging on the electronic request. The effective dose due to the X-ray was about 0.01 mSv.</p> <p>The radiographer was reminded to consult the referral when imaging patients.</p>
Incident 165	<p>A patient underwent a CT scan of the wrong anatomical region due to radiographer error.</p> <p>A patient attended a medical imaging practice with a referral for a CT scan of the left hip, knee and ankle. The right side was scanned in error. The radiographer did not read the referral prior to scanning the patient. The effective dose due to the scan was about 11 mSv.</p> <p>The radiographer was reminded to consult the referral before imaging patients.</p>
Incident 166	<p>A paediatric patient underwent an X-ray of the wrong anatomical region due to radiographer error.</p> <p>An X-ray of the left tibia and fibula was performed on a paediatric hospital patient when the right side required imaging. The radiographer checked the side to be imaged with the mother who confirmed it was the right side. The mother wished to wait outside during imaging. The mother had removed the patient's left sock and the radiographer X-rayed the left tibia and fibula. The effective dose due to the X-ray was about 0.01 mSv.</p> <p>The radiographer was reminded to consult the referral before imaging patients and to concentrate on the task at hand.</p>
Incident 167	<p>A patient underwent a CT scan of the wrong anatomical region due to radiographer error.</p> <p>A patient attended a medical imaging practice with a referral for a CT scan with contrast to query a recurrent pilonidal abscess. The area to be scanned was not indicated on the referral. The radiographer, assuming that the abscess may have been in the paranasal sinuses, carried out a CT scan of the soft tissues of the neck. The radiographer did not read the referral correctly or get clarification from the referring physician. The effective dose due to the neck scan was about 3.6 mSv.</p> <p>The radiographer was reminded to read the referral thoroughly before imaging patients and to consult the referring physician in cases of uncertainty.</p>

Patient underwent a medical procedure on the wrong anatomical region (continued)

Incident no.	Description of incident
Incident 168	<p>A patient underwent a CT scan of the wrong anatomical region due to radiographer error.</p> <p>A patient attended a medical imaging practice for a CT scan of the left hip and knee for pre-operative planning. The radiographer imaged the incorrect knee. As the error was not picked up until one month after the original scan, the data was no longer available to reconstruct the correct knee. A repeat scan was required of the correct knee. The effective dose due to the scan was about 6.7 mSv.</p> <p>The radiographer was reminded to carry out patient and procedure identification procedures thoroughly and to concentrate on the task at hand when imaging patients.</p>
Incident 169	<p>A patient underwent a CT scan of the wrong anatomical region due to radiographer error.</p> <p>A patient presented to a medical imaging centre with a request for a CT scan of the right shoulder. The patient wrongly indicated that the left shoulder was in pain and a CT scan of the left shoulder was carried out. The error was noted by the radiographer after the scan was performed. The radiographer did not read the referral correctly. The effective dose due to the scan was about 7.2 mSv.</p> <p>The radiographer was reminded to read the referral carefully before imaging patients.</p>
Incident 170	<p>A patient underwent a CT scan of the wrong anatomical region due to radiographer error.</p> <p>A hospital patient was referred for a CT scan of the chest. The radiographer did not follow patient and procedure identification processes correctly and carried a CT scan of the abdomen and pelvis instead. The effective dose due to the scan was about 8 mSv.</p> <p>The radiographer was reminded to carry out patient and procedure identification processes thoroughly.</p>
Incident 171	<p>A paediatric patient underwent an X-ray of the wrong anatomical region due to radiographer error.</p> <p>A paediatric hospital patient was referred from the orthopaedic clinic for an X-ray of the left knee. Clinical notes indicated there was medical concern concerning the right knee and an X-ray of the left knee was requested for comparison. The radiographer X-rayed the right knee with four attempts at a lateral view. After the X-rays, the radiographer realised that the incorrect knee had been imaged. The effective dose due to the X-rays was about 0.04 mSv.</p> <p>The radiographer was counselled regarding the proper use of the patient and procedure identification processes in use at the hospital.</p>
Incident 172	<p>A paediatric patient underwent an X-ray of the wrong anatomical region due to nursing staff error.</p> <p>A hospital patient had a femoral central venous catheter (CVC) inserted. The morning nursing staff had advised the resident physician that a CVC had been inserted. A chest X-ray was ordered by the physician to check positioning of the CVC, under the impression that the CVC was inserted in the chest (femoral CVC line placements are commonly assessed using an ultrasound scan of the abdomen). The patient was off ward during the afternoon nursing handover and proceeded directly to the medical imaging department for the chest X-ray. The morning nursing staff did not advise the afternoon nursing staff of the CVC placement during handover. Upon returning to the ward, nursing staff found that the CVC was inserted as a femoral line. The effective dose due to the chest X-ray was about 0.03 mSv.</p> <p>Nursing staff members were reminded to carry out handover briefings thoroughly.</p>

Patient underwent a medical procedure on the wrong anatomical region (continued)

Incident no.	Description of incident
Incident 173	<p>A patient underwent a CT scan of the wrong anatomical region due to radiographer error.</p> <p>A patient attended a medical imaging practice with a referral for a CT scan of the thoracic and lumbar spine. The patient's scan was accidentally entered into the electronic ordering system as a CT scan of the cervical and thoracic spine. The radiographer did not read the referral carefully and used the (incorrect) entry in the electronic ordering system in selecting the scan. The radiologist picked up the error and the patient was called to return for a CT scan of the lumbar spine. The effective dose due to the unnecessary CT scan of the cervical spine was about 3 mSv.</p> <p>The radiographer was reminded to read referrals carefully and was counselled regarding the proper use of the patient and procedure identification processes in use at the practice.</p>

Patient underwent a medical procedure using the wrong modality

Incident no.	Description of incident
Incident 174	<p>A patient underwent a CT scan of the lumbar spine instead of the intended plain radiograph of the lumbar spine due to radiographer error.</p> <p>A hospital patient presented for plain X-rays of the lumbar spine. The examination was required because the patient had suffered a fall and a direct blow to the lumbar region. The patient advised staff that a CT scan was required. Neither reception staff nor the radiographer noticed that the request was for plain X-rays and not a CT scan. The effective dose due to the CT scan was about 12 mSv.</p> <p>The radiographer was cautioned to follow the patient and procedure identification process and to read referrals thoroughly.</p>
Incident 175	<p>A patient underwent a plain radiograph of the lumbar spine instead of the intended CT scan of the lumbar spine due to radiographer error.</p> <p>A patient attended a medical imaging practice with a referral for a scan of the lumbar spine. The exam was registered as a plain X-ray of the lumbar spine by a receptionist at the front desk. The radiographer only checked the referral thoroughly after the X-ray had been carried out and noticed that the referral merely stated, 'lumbar spine' and did not specify the modality. The radiographer subsequently called the referring physician and was advised that a CT scan of the lumbar spine was requested. The effective dose due to the plain X-ray was about 1.4 mSv.</p> <p>The radiographer was reminded to follow the patient and procedure identification process and to read referrals thoroughly.</p>
Incident 176	<p>A patient underwent a CT scan of the thoracic spine instead of the intended plain radiograph of the thoracic spine due to clerical and radiographer error.</p> <p>A patient presented to a medical imaging practice for a plain X-ray of the thoracic spine and a CT scan of the lumbar spine with separate referral forms. The plain X-ray of the thoracic spine was entered into the practice's electronic system as a CT scan of the thoracic spine by clerical staff. The radiographer who carried out the scan did not read the referral properly. The effective dose due to the CT scan of the thoracic spine was about 14 mSv.</p> <p>The clerical staff members were reminded to use care and read referrals thoroughly when entering scan details. The radiographer was reminded to follow the patient and procedure identification process and to read referrals thoroughly before scanning patients.</p>
Incident 177	<p>A patient underwent a CT scan of the cervical spine instead of the intended plain radiograph of the cervical spine due to radiographer error.</p> <p>A patient attended a medical imaging practice with a referral of a plain X-ray of the cervical spine. The patient had booked the appointment online as a CT scan of the cervical spine. The radiographer did not read the referral thoroughly and performed a CT scan of the cervical spine when a plain X-ray had been requested. The effective dose due to the CT scan was about 3.0 mSv.</p> <p>The radiographer was reminded to read referrals thoroughly.</p>

High patient dose during an interventional or fluoroscopic procedure

Incident no.	Description of incident
Incident 178	<p>A patient underwent a cardiac angioplasty procedure that resulted in a high radiation dose to the skin.</p> <p>A hospital patient underwent a cardiac angioplasty procedure under fluoroscopic guidance. Throughout the procedure, steps were taken to keep the dose as low as possible. The skin entrance dose for the procedure was about 6.2 Gy. The patient did not develop any erythema. No further action was necessary.</p>
Incident 179	<p>A patient underwent a thoraco-abdominal fenestrated endovascular graft repair that resulted in a high radiation dose to the skin.</p> <p>A hospital patient underwent a thoraco-abdominal fenestrated endovascular graft repair under fluoroscopic guidance. Blood flow to one of the kidneys became obstructed during the procedure and the kidney had to be re-cannulated. This resulted in a longer screening time. Throughout the procedure, steps were taken to keep the dose as low as possible. The skin entrance dose for the procedure was about 8 Gy. The patient did not develop any erythema. No further action was necessary.</p>
Incident 180	<p>A patient underwent an intracranial aneurysm coiling procedure that resulted in a high radiation dose to the skin.</p> <p>A hospital patient underwent an intracranial aneurysm coiling procedure under fluoroscopic guidance. Throughout the procedure, steps were taken to keep the dose as low as possible. The skin entrance dose for the procedure was about 8 Gy. The patient did not develop any erythema. No further action was necessary.</p>
Incident 181	<p>A patient underwent a pseudo aneurysm embolisation procedure that resulted in a high radiation dose to the skin.</p> <p>A hospital patient underwent a pseudo aneurysm embolisation procedure under fluoroscopic guidance. Throughout the procedure, steps were taken to keep the dose as low as possible. The skin entrance dose for the procedure was about 9.6 Gy. The patient did not develop any erythema. No further action was necessary.</p>
Incident 182	<p>A patient underwent an attempted inferior vena cava filter removal procedure under fluoroscopic guidance that resulted in a high radiation dose to the skin.</p> <p>A hospital patient underwent an unsuccessful inferior vena cava (IVC) filter removal procedure. Throughout the procedure, steps were taken to keep the dose as low as possible. The skin entrance dose for the procedure was about 8.3 Gy. The patient did not develop any erythema. No further action was necessary.</p>
Incident 183	<p>A patient underwent a percutaneous transluminal rotational atherectomy under fluoroscopic guidance that resulted in a high radiation dose to the skin.</p> <p>A hospital patient underwent a percutaneous transluminal rotational atherectomy under fluoroscopic guidance. Throughout the procedure, steps were taken to keep the dose as low as possible. The skin entrance dose for the procedure was about 7 Gy. The patient did not develop any erythema. No further action was necessary.</p>
Incident 184	<p>A patient underwent a fenestrated aortic aneurysm repair procedure under fluoroscopic guidance that resulted in a high radiation dose to the skin.</p> <p>A hospital patient underwent a fenestrated aortic aneurysm repair procedure under fluoroscopic guidance. Throughout the procedure, steps were taken to keep the dose as low as possible. The skin entrance dose for the procedure was about 7–15 Gy. The patient did not develop any erythema. No further action was necessary.</p>

High patient dose during an interventional or fluoroscopic procedure (continued)

Incident no.	Description of incident
Incident 185	<p>A patient underwent an emergency cerebral clot retrieval procedure under fluoroscopic guidance that resulted in a high radiation dose to the skin.</p> <p>A hospital patient underwent an emergency cerebral clot retrieval procedure under fluoroscopic guidance. Throughout the procedure, steps were taken to keep the dose as low as possible. The skin entrance dose for the procedure was about 6.5 Gy. The patient did not develop any erythema. No further action was necessary.</p>
Incident 186	<p>A patient underwent a cerebral coiling procedure using digital subtraction angiography that resulted in a high radiation dose to the skin.</p> <p>A hospital patient was referred for a cerebral coiling procedure using digital subtraction angiography. Throughout the procedure, steps were taken to keep the dose as low as possible. The skin entrance dose for the procedure was about 6.6 Gy. The patient did not develop any erythema. No further action was necessary.</p>
Incident 187	<p>A patient underwent a gastroduodenal artery embolization interventional procedure that resulted in a high radiation dose to the skin.</p> <p>A hospital patient was referred for an emergency gastroduodenal artery embolization interventional procedure. Throughout the procedure, steps were taken to keep the dose as low as possible. After a discussion between operating staff and intensive care unit teams, the decision was made to cease the procedure, given the clinical situation of the patient. The patient passed away shortly afterwards. The skin entrance dose for the procedure was about 7.8 Gy. No further action was necessary.</p>
Incident 188	<p>A patient underwent an intracranial aneurysm coiling procedure using digital subtraction angiography that resulted in a high radiation dose to the skin.</p> <p>A hospital patient was referred for an intracranial aneurysm coiling procedure using digital subtraction angiography. Throughout the procedure, steps were taken to keep the dose as low as possible. The skin entrance dose for the procedure was about 9 Gy. The patient was followed up for any tissue reactions in accordance with the hospital's standard procedures. No further action was necessary.</p>
Incident 189	<p>A patient underwent a digital subtraction angiography angioembolisation and potential vertebroplasty for a haemangioma of the fifth lumbar vertebra that resulted in a high radiation dose to the skin.</p> <p>A hospital patient was referred for a digital subtraction angiography angioembolisation and potential vertebroplasty for a haemangioma of the fifth lumbar vertebra. Throughout the procedure, steps were taken to keep the dose as low as possible. The skin entrance dose for the procedure was about 12 Gy. The patient was followed up for any tissue reactions in accordance with the hospital's standard procedures. No further action was necessary.</p>
Incident 190	<p>A patient underwent an intracranial aneurysm coiling procedure using digital subtraction angiography that resulted in a high radiation dose to the skin.</p> <p>A hospital patient was referred for an intracranial aneurysm coiling procedure using digital subtraction angiography. Throughout the procedure, steps were taken to keep the dose as low as possible. The skin entrance dose for the procedure was about 6.1 Gy. The patient did not develop any erythema. No further action was necessary.</p>
Incident 191	<p>A patient underwent a hepatic embolisation procedure under fluoroscopic guidance that resulted in a high radiation dose to the skin.</p> <p>A hospital patient was referred for a hepatic embolisation procedure under fluoroscopic guidance. Throughout the procedure, steps were taken to keep the dose as low as possible. The skin entrance dose for the procedure was about 6.9 Gy. The patient did not develop any erythema. No further action was necessary.</p>

Unnecessary radiation exposure due to equipment failure

Incident no.	Description of incident
Incident 192	<p>A patient had part of a CT scan unnecessarily repeated due to equipment malfunction.</p> <p>A hospital patient underwent a CT scan of the abdomen and pelvis. When the images were reviewed, there was an artefact through a section of the pelvis making the image undiagnostic. A section of the scan through the pelvis was repeated. The effective dose from the repeated segment of the scan was about 7 mSv.</p> <p>A service engineer from the supplier came and rectified the problem.</p>
Incident 193	<p>A paediatric patient had a CT scan unnecessarily repeated due to equipment malfunction.</p> <p>A paediatric patient at a medical imaging practice required a repeat CT scan of the brain. One-off tube arcing rendered the initial scan undiagnostic. The effective dose from the failed scan was about 3 mSv.</p> <p>Radiographers were made aware of this tube arcing incident and were instructed to report similar incidents.</p>
Incident 194	<p>A patient had a CT scan unnecessarily repeated due to equipment malfunction.</p> <p>A hospital patient was having a CT scan when a scanner power failure occurred part way through the scan. A second scan was required to image the remaining volume. In order to ensure complete coverage an overlap between the two imaged volumes was required. The effective dose from the rescanned region was about 1.7 mSv.</p> <p>The power failure was a one-off occurrence and no further action was required.</p>
Incident 195	<p>A patient had a CT scan unnecessarily repeated due to equipment malfunction.</p> <p>A hospital patient presented for a whole body PET/CT scan. The scan (vertex to mid thighs) was acquired without incident. During the PET acquisition, the scanner bed halted owing to a camera/bed fault and the acquisition stopped prematurely. The patient was transferred to a neighbouring hospital for the PET/CT imaging; the CT scan had to be repeated; no additional radiopharmaceutical was required. The effective dose from the scan was about 10 mSv.</p> <p>A service engineer from the supplier came to identify and rectify the problem.</p>
Incident 196	<p>A patient had a CT scan unnecessarily repeated due to equipment malfunction.</p> <p>A hospital patient underwent a CT scan of the brain which had to be repeated due to a scanner malfunction. The scanner had failed to reconstruct the images and the image data set was irretrievable. The patient was rescanned on another CT scanner. The effective dose from the scan was about 1.9 mSv.</p> <p>The scanner was closed for patient use pending an engineering team from the supplier attending to investigate the malfunction. The scanner was deemed operational after the investigation and the error considered a one-off malfunction.</p>
Incident 197	<p>A patient had a CT scan unnecessarily repeated due to equipment malfunction.</p> <p>A patient attended a medical practice for CT scan of the abdomen and pelvis with contrast. The scanner only provided the data set for the upper half of the planned range. The patient was rescanned multiple times to cover the full range as the emergency department was pushing for the scan to be completed. The effective dose from the scan was about 14 mSv.</p> <p>A service engineer from the supplier came to identify and rectify the problem. Investigation revealed that the CT internal memory server was corrupt and incapable of dealing with the large data set acquired.</p>
Incident 198	<p>A paediatric patient had an X-ray unnecessarily repeated due to equipment malfunction.</p> <p>A paediatric hospital patient was having an anteroposterior X-ray of the chest and pelvis as requested by a physician. After the pelvis X-ray, an error occurred, and the X-ray unit became unresponsive. The system needed to be rebooted and the X-ray of the pelvis was lost. The radiographer then repeated the X-ray of the pelvis. The effective dose from the X-ray of the pelvis was about 0.03 mSv.</p> <p>The supplier was called to investigate the problem and found that the problem was with the scanner's wireless communication system. The problem was rectified by a service engineer.</p>

Unnecessary radiation exposure due to equipment failure (continued)

Incident no.	Description of incident
Incident 199	<p>A patient had a CT scan unnecessarily repeated due to equipment malfunction.</p> <p>A hospital patient underwent a CT scan of the brain. The scanner incorrectly reconstructed the images during the scan; the image data set contained artefacts and was non-diagnostic. The patient was rescanned on another CT scanner. The effective dose from the scan was about 1.8 mSv.</p> <p>The scanner was closed for patient use until the supplier's engineering team could be contacted to investigate the scanner malfunction. After a reboot and troubleshooting, the scanner was returned to clinical use.</p>
Incident 200	<p>A patient had a CT scan unnecessarily repeated due to equipment malfunction.</p> <p>A patient attended a medical imaging practice with a referral for a CT scan of the chest without contrast. The CT scan stopped scanning halfway through the examination. The scan was repeated but no images came through. The effective dose from the scan was about 32 mSv.</p> <p>An engineer from the supply company came to service the machine and rectified the problem.</p>
Incident 201	<p>A patient had a CT scan unnecessarily repeated due to equipment malfunction.</p> <p>A patient attended a medical imaging practice for a CT scan of the brain, cervical spine and pelvis. The CT computer froze after the cervical spine. A hard shutdown was performed on the CT scanner. Once restarted, the CT brain and cervical reconstructions were no longer in the reconstruction queue in the patient's file. The brain and cervical spine had to be rescanned. The effective dose from the scan was about 3.7 mSv.</p> <p>An engineer from the supply company came and rectified the problem.</p>
Incident 202	<p>A paediatric patient had an X-ray unnecessarily repeated due to equipment malfunction.</p> <p>A paediatric patient underwent an anteroposterior chest X-ray as requested by the clinician. After the chest X-ray, an error occurred, and the X-ray unit became unresponsive. The system was required to be rebooted and the chest X-ray was lost. The error was in the wireless system of the X-ray unit. The radiographer had to repeat the chest X-ray. The effective dose from the X-ray was about 0.02 mSv.</p> <p>The supplier was contacted to assist in fixing the wireless system.</p>
Incident 203	<p>A paediatric patient had an CT scan unnecessarily repeated due to equipment malfunction.</p> <p>A paediatric hospital patient was referred for a CT scan of the brain without contrast. The diagnostic quality was impaired by a system generated ring artefact. The radiologist stated that a tumour could not be excluded based on the image and ordered a repeat CT with contrast. The effective dose from the CT scan without contrast was about 4.5 mSv.</p> <p>A CT system recalibration carried out by the supplier corrected the artefact.</p>
Incident 204	<p>A patient had an injection of a radiopharmaceutical unnecessarily repeated due to equipment malfunction.</p> <p>A patient at a medical imaging practice was injected with 850 MBq of ^{99m}Tc HDP for a bone scan prior to a gamma camera malfunction. The entire injected dose of ^{99m}Tc HDP had to be repeated at a later date. The effective dose from the administration of the ^{99m}Tc HDP was about 3.4 mSv.</p> <p>The gamma camera malfunction was reported to the equipment supplier and a technician from the supplier attended to remedy the fault.</p>
Incident 205	<p>A patient had a CT scan unnecessarily repeated due to equipment malfunction.</p> <p>A hospital patient was having a CT scan of the brain when a tube arc malfunction occurred. The patient was moved to another CT scanner where the examination was completed successfully. The effective dose from the failed scan was about 2.2 mSv. The fault with this scanner had been an intermittent one and was also responsible for the four incidents immediately below.</p> <p>Service technicians from the supplier came and replaced the X-ray tube. The scanner was subsequently replaced by a new scanner.</p>

Unnecessary radiation exposure due to equipment failure (continued)

Incident no.	Description of incident
Incident 206	<p>A patient had a CT scan unnecessarily repeated due to equipment malfunction.</p> <p>A hospital patient was having a CT scan of the abdomen and pelvis when a tube-arc malfunction occurred. The patient was moved to another CT scanner where the examination was completed successfully. The effective dose from the failed scan was about 5.7 mSv.</p> <p>Service technicians from the supplier came and replaced the X-ray tube. The scanner was subsequently replaced by a new scanner.</p>
Incident 207	<p>A patient had a CT scan unnecessarily repeated due to equipment malfunction.</p> <p>A hospital patient was having a CT scan of the brain when a tube-arc malfunction occurred. The patient was moved to another CT scanner where the examination was completed successfully. The effective dose from the failed scan was about 2.1 mSv.</p> <p>Service technicians from the supplier came and replaced the X-ray tube. The scanner was subsequently replaced by a new scanner.</p>
Incident 208	<p>A patient had a CT scan unnecessarily repeated due to equipment malfunction.</p> <p>A hospital patient was having a CT scan of the brain and face when a tube-arc malfunction occurred. The patient was moved to another CT scanner where the examination was completed successfully. The effective dose from the failed scan was about 2.7 mSv.</p> <p>Service technicians from the supplier came and replaced the X-ray tube. The scanner was subsequently replaced by a new scanner.</p>
Incident 209	<p>A patient had a CT scan unnecessarily repeated due to equipment malfunction.</p> <p>A hospital patient was having a CT scan of the abdomen and pelvis when a tube-arc malfunction occurred. The patient was moved to another CT scanner where the examination was completed successfully. The effective dose from the failed scan was about 6.5 mSv.</p> <p>Service technicians from the supplier came and replaced the X-ray tube. The scanner was subsequently replaced by a new scanner.</p>
Incident 210	<p>A patient had a fluoroscopy scan unnecessarily repeated due to equipment malfunction.</p> <p>A patient at a medical imaging practice underwent a repeated barium swallow study after a fluoroscopy X-ray unit error occurred. The error resulted in some screening runs not being saved for reporting on the picture archiving and communication system. The effective dose from the failed scan was about 37 mSv.</p> <p>The equipment malfunction was reported to the equipment supplier and a technician from the supplier attended to rectify the problem. The technician also recommended increasing the frequency of deletion of archived studies from the hard disc. An equipment scan check was performed prior to returning the equipment to clinical use.</p>
Incident 211	<p>A paediatric patient had X-rays unnecessarily repeated due to equipment malfunction.</p> <p>A paediatric hospital patient had an anteroposterior (AP) chest X-ray as requested by a medical practitioner. After the first chest X-ray, the cassette became stuck in the capturing phase and eventually turned off; the image was lost. A second chest X-ray was taken after re-booting the cassette; the same error occurred. The radiographer then changed the cassette being used and the chest X-ray was taken successfully. The effective dose due to the two AP chest X-rays was about 0.04 mSv.</p> <p>The supplier came to replace the batteries in the cassette.</p>
Incident 212	<p>A patient had a CT scan unnecessarily repeated due to equipment malfunction.</p> <p>A patient was referred to a medical imaging practice for a CT scan of the chest and abdomen. During the scan, the machine malfunctioned for an unknown reason, yielding suboptimal images. The scan was repeated on the same machine with no issues. The effective dose from the failed scan was about 11 mSv.</p> <p>The failure was a one-off occurrence. Further action was to be taken if the problem recurred.</p>

Unnecessary radiation exposure due to equipment failure (continued)

Incident no.	Description of incident
Incident 213	<p>A patient had a CT scan unnecessarily repeated due to equipment malfunction.</p> <p>A hospital patient was having a PET/CT scan when the PET/CT imaging system failed. A gantry error occurred after the low-dose CT scan was completed. The PET/CT study was repeated on a different PET/CT scanner. The low-dose CT scan had to be repeated. The effective dose due to the CT scan was about 3.8 mSv.</p> <p>A gantry fuse was replaced and the CT scanner was recalibrated.</p>
Incident 214	<p>A patient had a PET scan unnecessarily repeated due to equipment malfunction.</p> <p>A patient attended a medical imaging practice with a referral for a PET scan with ¹⁸F-FDG scan. The scanner 3D reconstruction software froze whilst the scan was being acquired. The supplier was contacted and the supplier advised that the system be restarted. The patient had to be rescanned. The error did not occur again. The effective dose due to the scan was about 7.6 mSv. No further action was necessary.</p>
Incident 215	<p>A patient had an injection of a radiopharmaceutical unnecessarily repeated due to equipment malfunction.</p> <p>The PET/CT brain scan of a hospital research participant was not performed, after the participant was administered with 193 MBq ¹⁸F-MK6240, due to scanner malfunction. The effective dose from the administration of the radiopharmaceutical was about 5.7 mSv.</p> <p>The supplier was contacted and came out to replace faulty components.</p>
Incident 216	<p>A patient had a CT scan unnecessarily repeated due to equipment malfunction.</p> <p>A hospital patient presented from the emergency department for a CT scan of the brain and cervical spine. A low dose planning localiser scan was undertaken without issue. However, during acquisition of the main scan, the scanner produced a gantry acquisition system error message early in the acquisition, aborting any further continued imaging. The patient was transferred to another CT system to complete the required imaging. The partially imaged area required re-imaging in order to complete the scan in full. The effective dose due to the repeated part of the scan was about 3.4 mSv.</p> <p>The equipment malfunction was reported to the equipment supplier and a technician from the supplier attended to rectify the problem.</p>
Incident 217	<p>A patient had a CT scan unnecessarily repeated due to equipment malfunction.</p> <p>A patient attended a medical imaging practice for a CT coronary angiogram. The scan was unsuccessful due to the CT scanner cutting out, possibly due to tube loading issues. The scan had to be repeated at another practice. The effective dose due to the scan was about 3 mSv.</p> <p>Engineers from the equipment supplier attended and rectified the problem.</p>
Incident 218	<p>A patient had an injection of a radiopharmaceutical unnecessarily repeated due to equipment malfunction.</p> <p>A patient at a medical imaging practice was injected with 219 MBq of ¹⁸F-FDG for a PET/CT scan. The patient was positioned on the PET/CT scanner and the CT scan was completed. After the CT scan was completed, the scanning table failed to move into the PET gantry and the scan could not proceed. The effective dose from the administration of the ¹⁸F-FDG was about 4 mSv. This incident and the two incidents immediately below were all related. The fault occurred after the patients had already been injected with ¹⁸F-FDG and were waiting for uptake.</p> <p>A technician from the supplier attended and replaced a faulty part.</p>

Unnecessary radiation exposure due to equipment failure (continued)

Incident no.	Description of incident
Incident 219	<p>A patient had an injection of a radiopharmaceutical unnecessarily repeated due to equipment malfunction.</p> <p>A patient at a medical imaging practice was injected with 211 MBq of ¹⁸F-FDG for a PET whole body scan followed by a 60-minute uptake phase. During the uptake phase of the procedure, the scanning table failed to move into the PET gantry and the scan could not proceed. The scan had to be rescheduled for another day. The effective dose from the administration of the ¹⁸F-FDG was about 3.9 mSv.</p> <p>A technician from the supplier attended and replaced a faulty part.</p>
Incident 220	<p>A patient had an injection of a radiopharmaceutical unnecessarily repeated due to equipment malfunction.</p> <p>A patient at a medical imaging practice was injected with 206 MBq of ¹⁸F-FDG for a PET whole body scan followed by a 60-minute uptake phase. During the uptake phase of the procedure, the scanning table failed to move into the PET gantry and the scan could not proceed. The scan had to be rescheduled for another day. The effective dose from the administration of the ¹⁸F-FDG was about 3.9 mSv.</p> <p>A technician from the supplier attended and replaced a faulty part.</p>
Incident 221	<p>A patient had a CT scan unnecessarily repeated due to equipment malfunction.</p> <p>A hospital patient was referred for a CT scan of the chest, abdomen and pelvis. The scan was aborted due to a hardware failure. Upon review of the images, it was noted that an 18 mm gap in the image data existed and a partial CT abdomen pelvis scan was performed to capture the missing data. The effective dose due to the repeated part of the scan was about 2 mSv. This incident was related to the incident immediately below.</p> <p>An engineer from the supplier attended and replaced a faulty graphics card.</p>
Incident 222	<p>A patient had a CT scan unnecessarily repeated due to equipment malfunction.</p> <p>A hospital patient was referred for a CT scan of the chest, abdomen and pelvis. The scan was aborted due to a hardware failure. Upon review of the images, it was noted that an 18 mm gap in the image data existed and a partial CT abdomen pelvis scan was performed to capture the missing data. The effective dose due to the scan was about 1.4 mSv.</p> <p>An engineer from the supplier attended and replaced a faulty graphics card.</p>
Incident 223	<p>A patient had a CT scan unnecessarily repeated due to equipment malfunction.</p> <p>A patient was referred to a medical imaging practice for a CT scan of the brain. The images had a significant artefact and were undiagnostic. The patient was rebooked at a different site for a repeat scan. The effective dose due to the scan was about 1.4 mSv.</p> <p>A technician from the supplier attended and rectified the fault.</p>
Incident 224	<p>A paediatric patient had a CT scan unnecessarily repeated due to equipment malfunction.</p> <p>A paediatric hospital patient was referred for a CT scan of the ocular orbits. During the scan, the machine malfunctioned and images could not be reconstructed. A repeat orbit scan was required. The effective dose from the failed scan was about 0.23 mSv.</p> <p>The system functioned correctly afterwards. Nevertheless, the fault was reported to the equipment supplier.</p>
Incident 225	<p>A patient had a CT scan unnecessarily repeated due to equipment malfunction.</p> <p>A patient was referred to a medical imaging practice for a CT scan of the chest, abdomen and pelvis with contrast. The CT scanner failed during the portal venous phase of the scan, after injection of the contrast medium. The scan was unable to be completed. The effective dose from the failed scan was about 7.5 mSv.</p> <p>An engineer from the supplier attended and rectified the fault.</p>

Maladministration of radiopharmaceutical

Incident no.	Description of incident
Incident 226	<p>A patient was administered with an excess of a radiopharmaceutical due to nuclear medicine technologist error.</p> <p>A patient was prescribed with 1600 MBq ^{90}Y microspheres for the treatment of hepatoma. The nuclear medicine technologist inadvertently entered 1900 MBq into the dose calculation worksheet and this dose was drawn up and administered to the patient's liver by a radiologist. The absorbed dose to the liver due to the excess administration was about 14.7 Gy. No adverse consequences were noted due to this dose. The effective dose due to the excess administration was about 59 mSv.</p> <p>The nuclear medicine technologist was reminded to use care when drawing up radiopharmaceuticals. All doses were to be checked with another technologist in the future.</p>
Incident 227	<p>A patient had to have a PET scan repeated because of an underdose of the radiopharmaceutical.</p> <p>A patient at a medical imaging practice needed a repeat ^{18}F-FDG PET scan due to underdosing of the radioisotope. The nuclear medicine technologist selected the incorrect isotope type on the dose calibrator when calibrating the patient dose. The effective dose due to the first ^{18}F-FDG administration was about 2.1 mSv.</p> <p>All nuclear medicine technologists at the practice were reminded of the importance of correctly selecting the isotope type when using the dose calibrator.</p>
Incident 228	<p>A patient was administered with the wrong radiopharmaceutical due to nuclear medicine technologist error.</p> <p>A hospital patient with metastatic neuroendocrine cancer was referred for a nuclear medicine scan and injected with 117 MBq ^{68}Ga-DOTATATE instead of the required 153 MBq ^{18}F-FDG. The requested tracer was not indicated on the referral and the nuclear medicine technologist injected ^{68}Ga-DOTATATE based on the clinical notes on the referral. The effective dose from the administration of the wrong radiopharmaceutical was about 6 mSv.</p> <p>The nuclear medicine technologist was reminded to consult with the referring physician when the referral is incomplete. Nuclear medicine technologists at the hospital were told to ensure referrals are complete before accepting them. The referring physician was cautioned to ensure that referrals are completed properly.</p>
Incident 229	<p>A patient was administered with the wrong radiopharmaceutical due to nuclear medicine technologist error.</p> <p>A hospital patient was referred for a nuclear medicine scan of the parathyroid gland with $^{99\text{m}}\text{Tc}$-MIBI. The nuclear medicine technologist drew up 814 MBq of $^{99\text{m}}\text{Tc}$ in error. Immediately after injecting the $^{99\text{m}}\text{Tc}$, the nuclear medicine technologist realised that the wrong radiopharmaceutical had been injected. The effective dose from the administration of the wrong radiopharmaceutical was about 9.8 mSv.</p> <p>The nuclear medicine technologist was reminded to be vigilant when drawing up radiopharmaceuticals.</p>
Incident 230	<p>A patient was administered with an excess quantity of a radiopharmaceutical due to nuclear medicine technologist error.</p> <p>A hospital patient was referred for a whole body scan with ^{18}F-FDG. One nuclear medicine technologist (NMT) had to measure the height and weight of the patient. Another NMT drew up the ^{18}F-FDG dose according to the weight recorded by the first NMT on the paperwork. The patient's weight was written down as 45 kg by the first NMT but the second NMT thought this looked like 95 kg due to the poor handwriting of the first NMT. The patient should have been injected with 135 MBq ^{18}F-FDG but was injected with 274 MBq, based on 3 MBq per kg. The effective dose from the excess radiopharmaceutical was about 2.7 mSv.</p> <p>NMTs at the hospital were reminded of the importance of clear handwriting. They were also reminded to take care to ensure all the information is correct when a handover occurs.</p>

Maladministration of radiopharmaceutical (continued)

Incident no.	Description of incident
Incident 231	<p>A patient was administered with the wrong radiopharmaceutical due to nuclear medicine technologist error.</p> <p>A hospital patient was referred for a nuclear medicine renal scan using ^{99m}Tc-DTPA. The nuclear medicine technologist (NMT) removed a cold kit radiopharmaceutical vial from the storage freezer to make up the radiopharmaceutical. The freezer contained DTPA, PYP (pyrophosphate) and HMDP, all in separate snap lock bags. The NMT selected PYP instead of the required DTPA. The NMT did not check the label on the vial. The patient was injected with 290 MBq of ^{99m}Tc-PYP. The effective dose from the administration of the wrong radiopharmaceutical was about 1.3 mSv.</p> <p>The NMT was reminded to check the labels on vials of pharmaceuticals when making up radiopharmaceuticals. Pharmaceutical vials were now separated in the freezer by a divider and will be housed in separate containers.</p>
Incident 232	<p>A patient was administered with the wrong radiopharmaceutical due to nuclear medicine technologist error.</p> <p>A patient attended a medical imaging practice for a nuclear medicine biliary scan. The nuclear medicine technologist (NMT) mistakenly picked up the incorrect vial, withdrew a dose and injected it intravenously into the patient. Upon viewing the images, the technologist realised that the patient had been incorrectly injected with 150MBq of ^{99m}Tc-colloidal antimony sulphide rather than the intended ^{99m}Tc mebrofenin. The effective dose from the administration of the wrong radiopharmaceutical was about 1.4 mSv.</p> <p>The NMT was reminded to check the labels on vials before injecting radiopharmaceuticals.</p>
Incident 233	<p>A patient was administered with the two radiopharmaceuticals instead of one.</p> <p>A hospital patient was having a ^{18}F-FDG PET/CT scan. The scan image had an unusual appearance. A delayed rescan (approximately four hours post administration) of the patient indicated that the patient had been administered with approximately 240 MBq of ^{18}F-PI-2620 in addition to the prescribed 238 MBq of ^{18}F-FDG. No nuclear medicine technologist recalled having made this error, and there was no record of the incorrect radiopharmaceutical having been drawn up. Despite the unusual appearance, the scan was diagnostic. The effective dose due to the incorrectly administered ^{18}F-PI-2620 and the delayed additional CT component was about 12 mSv.</p> <p>A review of the hot lab layout and workflow systems and protocols was carried out. The review resulted in the addition of an extra drawing-up area for better segregation of different tracers and implementation of additional checks prior to administration.</p>
Incident 234	<p>A patient was administered with the wrong radiopharmaceutical due to nuclear medicine technologist error.</p> <p>A patient presented to a medical imaging practice for a myocardial perfusion scan. The radiopharmaceutical was injected for the rest phase of the procedure and the patient positioned on the scanner for imaging. Upon imaging, it was discovered that the wrong radiopharmaceutical had been injected. The patient had been injected with 698 MBq ^{99m}Tc-HDP, a bone imaging agent, rather than ^{99m}Tc-MIBI. Two syringes had been labelled with the incorrect radiopharmaceutical by the nuclear medicine technologist (NMT). The procedure was aborted and rescheduled for another day. The effective dose from the administration of the wrong radiopharmaceutical was about 3.4 mSv.</p> <p>The NMT was reminded to exercise greater caution when labelling syringes and vials.</p>

Maladministration of radiopharmaceutical (continued)

Incident no.	Description of incident
Incident 235	<p>A patient was administered with the wrong radiopharmaceutical due to nuclear medicine technologist error.</p> <p>A patient attended a medical imaging practice for a nuclear medicine bone scan with 650 MBq ^{99m}Tc-HDP. The nuclear medicine technologist (NMT) made up a vial of ^{99m}Tc-MAA vial thinking that the MAA was HDP and injected ^{99m}Tc-MAA into the patient. The NMT did not read the label on the vial but relied on the colours used for the vials. Both HDP and MAA came in a vial with a blue cap and white label. The effective dose from the administration of the wrong radiopharmaceutical was about 7.2 mSv.</p> <p>The nuclear medicine technologist was reminded to read the labels on vials rather than relying on the colours of the labels.</p>
Incident 236	<p>A patient was administered with the wrong radiopharmaceutical due to nuclear medicine technologist error.</p> <p>A patient attended a medical imaging practice for an urgent renal scan. The nuclear medicine technologist (NMT) did not read the referral correctly and injected the patient with 332 MBq ⁶⁷Ga-MAG3 instead of the intended 332 MBq ⁶⁷Ga-DTPA. The reporting physician alerted staff of the misadministration. The patient had to be rebooked for the scan. The effective dose from the administration of the wrong radiopharmaceutical was about 1.7 mSv.</p> <p>The NMT was reminded to read referrals thoroughly before injecting radiopharmaceuticals.</p>
Incident 237	<p>A patient was administered with the wrong radiopharmaceutical due to referring physician error.</p> <p>A hospital patient was referred for a gated blood pool study (GBPS). The request for the exam was incorrectly made by the referring physician as being for a myocardial perfusion scan. The patient was injected with 338 MBq of ^{99m}Tc-MIBI for a myocardial perfusion scan and the patient was imaged. A second medical opinion of the resultant images was requested and it was at this time that the error was identified. The effective dose from the administration of the wrong radiopharmaceutical was about 3.1 mSv.</p> <p>The referring physician was reminded to fill out referrals carefully.</p>
Incident 238	<p>A patient was administered with the wrong radiopharmaceutical due to nuclear medicine technologist error.</p> <p>A hospital patient was referred for prostate cancer staging imaging. The imaging was to be done using 160 MBq ⁶⁸Ga-PSMA. The nuclear medicine technologist inadvertently drew up a dose of ¹⁸F-FDG and injected the patient with it. The error was realised after the scan had taken place. The patient was rescheduled to be scanned with ⁶⁸Ga-PSMA. The effective dose from the administration of the wrong radiopharmaceutical was about 5.3 mSv.</p> <p>The NMT was reminded to read referrals thoroughly and to read labels on lead pots and vials before injecting radiopharmaceuticals.</p>

Radiotherapy – unintended irradiation of healthy tissue or over/underdose to target tissue

Incident no.	Description of incident
Incident 239	<p>A patient had healthy tissue irradiated due radiation therapist error.</p> <p>A hospital patient received radiotherapy to a skull vertex graft rather than to the intended site at left frontal scalp region. There was a complete geographic miss for the full course of treatment of 50 Gy in 20 fractions. Treatment of the graft site was requested by a radiation oncologist using a referral from a plastic surgeon. The graft site appeared to be the site where the primary lesion was, as indicated by the clinical scenario and as confirmed by the patient. The treatment led to significant moist desquamation of normal tissue. The patient was referred to the plastic surgeon for review. The surgeon was not concerned with the reaction and believed it would heal over time.</p> <p>The skin treatment protocol of the hospital was changed to require a preoperative photo to define the intended radiotherapy treatment site in patients that have had lesions surgically removed that are considered to be at risk of recurrence. An advisory to discuss the case with the referring physician was also advised to the protocol.</p>

Medical procedure failed due to patient non-cooperation or other patient problem

Incident no.	Description of incident
Incident 240	<p>A patient had an unnecessarily repeated administration of a radiopharmaceutical.</p> <p>A hospital patient presented to the radiology department for a nuclear medicine bone scan to assess bony disease associated with metastatic breast cancer. After injection of 825 MBq ^{99m}Tc, there was a delay in calling the patient. The patient indicated that they could not wait and left the department. The scan had to be rescheduled. The effective dose due to administration of the radiopharmaceutical was about 4.7 mSv.</p> <p>No further action was necessary.</p>
Incident 241	<p>A patient had an unnecessary administration of a radiopharmaceutical.</p> <p>A patient attended a medical imaging practice for a nuclear medicine myocardial perfusion scan. The patient completed the stress test and scan in the morning. The patient returned in the afternoon for the rest scan and 975 MBq ^{99m}Tc-MIBI was administered. Whilst waiting the required time for the rest scan, the patient deteriorated and an ambulance had to be called. The scan was unable to be performed. The effective dose due to administration of the radiopharmaceutical was about 7.8 mSv.</p> <p>No further action was necessary.</p>
Incident 242	<p>A patient had an unnecessary CT scan of the brain.</p> <p>A patient at a medical imaging practice sneezed midway through a CT scan of the brain and the scan had to be repeated. The effective dose due to the scan was about 1.5 mSv.</p> <p>No further action was necessary.</p>
Incident 243	<p>A paediatric patient had a CT scan of the wrong anatomical region.</p> <p>A paediatric hospital patient was scheduled to have a CT scan of the chest. Restraints were unable to be used on the patient due to the patient's small size. During the planning of the scan, the patient became agitated and moved to reach their mother. The radiographer subsequently moved the scanner table to a position to ensure the patient could easily see their mother. The radiographer moved the table back to the planned location once ready to proceed with the scan. Following image reconstruction, it was evident that a lower region was imaged than the intended chest region. This was the result of patient movement prior to image acquisition. The scan was aborted by the radiographer. Further discussion with the radiologist indicated that the patient should be rescheduled to undertake the examination under general anaesthetic. The effective dose due to the scan was about 0.41 mSv.</p> <p>No further action was necessary.</p>
Incident 244	<p>A patient had an unnecessary CT scan of the pulmonary arteries.</p> <p>A patient attended a medical imaging practice for a CT scan of the pulmonary arteries. As the CT contrast was being injected, the patient complained about a pain in the arm at the site of the injection. The contrast injection was immediately ceased. It was determined that the contrast did in fact slowly enter the bloodstream and did not extravasate, however not enough contrast material was injected to outline the pulmonary arteries fully. The study had to be repeated with a second injection of contrast and a second CT scan of the chest. The effective dose due to the scan was about 21 mSv.</p> <p>No further action was necessary.</p>
Incident 245	<p>A patient had an unnecessary administration of a radiopharmaceutical.</p> <p>A patient attended a medical imaging practice for a PET/CT scan. The patient was injected with 296 MBq of ¹⁸F-FDG. After a 60 minute uptake period, the PET/CT scan was commenced. About three minutes into the PET emission scan, the patient became very panicked and agitated. The scan was terminated. The effective dose due to the administration of the radiopharmaceutical was about 5.1 mSv.</p> <p>No further action was necessary.</p>

Medical procedure failed due to patient non-cooperation or other patient problem (continued)

Incident no.	Description of incident
Incident 246	<p>A patient had an unnecessary administration of a radiopharmaceutical.</p> <p>A patient attended a medical imaging practice for a PET scan. The patient was injected with 315 MBq of ^{18}F-FDG. The patient became anxious when about to go into the scanner and refused to be scanned. The effective dose due to the administration of the radiopharmaceutical was about 6 mSv.</p> <p>No further action was necessary.</p>
Incident 247	<p>A patient had an unnecessary administration of a radiopharmaceutical.</p> <p>A patient attended a medical imaging practice for a bone scan and was injected with 861 MBq $^{99\text{m}}\text{Tc}$. Whilst waiting for uptake, the patient was called home because of a plumbing emergency. The patient was not scanned and had to return another day for the procedure. The effective dose due to the administration of the radiopharmaceutical was about 7.3 mSv.</p> <p>No further action was necessary.</p>
Incident 248	<p>A patient had an unnecessary administration of a radiopharmaceutical.</p> <p>A patient attended a medical imaging practice for a PET scan. The patient was injected with 352 MBq of ^{18}F-FDG. The patient had a panic attack due to claustrophobia halfway through imaging and the scan had to be aborted. The effective dose due to the administration of the radiopharmaceutical was about 6.5 mSv.</p> <p>No further action was necessary.</p>
Incident 249	<p>A patient had an unnecessary administration of a radiopharmaceutical.</p> <p>A patient attended a medical imaging practice for a nuclear medicine parathyroid scan. The patient was injected with 790 MBq $^{99\text{m}}\text{Tc}$-MIBI. When on the scanner bed, the patient was unable to lie down due to back pain. The patient's registrar was called and decided, after consulting with the patient, not to continue with the scan. The effective dose due to the administration of the radiopharmaceutical was about 7 mSv.</p> <p>No further action was necessary.</p>

A pregnant person was exposed to radiation

Incident no.	Description of incident
Incident 250	<p>A patient who underwent a medical imaging procedure was subsequently found to have been pregnant at the time of the procedure.</p> <p>A patient was referred to a medical imaging practice for an abdominal X-ray. The patient indicated that she was not pregnant. The patient later advised the practice that she was, in fact, pregnant at the time of the X-ray. The dose to the foetus was about 1.2 mGy.</p> <p>No further action was necessary.</p>
Incident 251	<p>A patient who underwent a medical imaging procedure was subsequently found to have been pregnant at the time of the procedure.</p> <p>A patient attended a hospital for CT scan of the abdomen and pelvis to investigate abdominal pain. The patient indicated that she was not pregnant. Eight days after the scan, the radiology registrar was contact by the patient's obstetrician who advised that the patient was about four weeks pregnant at time of the scan. The dose to the foetus was about 13 mGy.</p> <p>No further action was necessary.</p>

A pregnant person was exposed to radiation (continued)

Incident no.	Description of incident
Incident 252	<p>A patient who underwent a medical imaging procedure was subsequently found to have been pregnant at the time of the procedure.</p> <p>A hospital patient was referred for a CT scan of the pelvis as a result an accident. As part of the CT time-out procedure, the patient was asked if she were pregnant; the patient replied that she was not pregnant. The scan proceeded. The reporting radiologist was informed by emergency department staff that the patient was pregnant at the time of the scan: requested pathology results had included a β-HCG pregnancy test. The radiographer had checked for pathology results prior to scanning but results were not available at that time. The dose to the foetus was about 4.4 mGy.</p> <p>No further action was necessary.</p>
Incident 253	<p>A patient who underwent a medical imaging procedure was subsequently found to have been pregnant at the time of the procedure.</p> <p>A hospital patient required a CT scan following a motor vehicle accident. Prior to the scan, the patient was asked if she might be pregnant; the patient replied that she was not pregnant. The patient proceeded to have a CT scan of the brain and cervical spine, a CT scan of the chest, abdomen, pelvis and plain X-rays of both tibiae. Following the scans, blood tests indicated that the patient was pregnant. An ultrasound scan indicated that the patient was about 6 weeks pregnant. The dose to the foetus was about 11 mGy.</p> <p>No further action was necessary.</p>
Incident 254	<p>A patient who underwent radiotherapy treatment was subsequently found to have been pregnant at the time of the procedure.</p> <p>A hospital patient was undergoing radiotherapy treatment for a low grade brain tumour. She indicated to the nurse part way through the treatment that she may have been pregnant due to symptoms that had become evident. A hospital urine test returned positive for pregnancy five days after the radiotherapy treatment commenced. An ultrasound the day after the urine test indicated a gestational age of 5 weeks and 5 days at treatment fraction 23. The planning CT scan was undertaken prior to the pregnancy. The dose to the foetus was about 0.8 mGy.</p> <p>No further action was necessary.</p>
Incident 255	<p>A patient who underwent a medical imaging procedure was subsequently found to have been pregnant at the time of the procedure.</p> <p>A patient at a medical imaging practice underwent a four-phase CT scan of the liver. Prior to the scan, the patient was asked if she might be pregnant; the patient replied that she was not pregnant. The patient later advised the practice that she was pregnant at the time of the scan. The dose to the foetus was about 25 mGy.</p> <p>No further action was necessary.</p>
Incident 256	<p>A patient who underwent a medical imaging procedure was subsequently found to have been pregnant at the time of the procedure.</p> <p>A patient at a medical imaging practice underwent a CT scan of the lumbar spine and a plain X-ray of the right hip. Prior to the scans, the radiographers confirmed with the patient that she was not pregnant. The patient later advised the practice that she was pregnant at the time of the scan. The dose to the foetus was about 14 mGy.</p> <p>No further action was necessary.</p>
Incident 257	<p>A patient who underwent a medical imaging procedure was subsequently found to have been pregnant at the time of the procedure.</p> <p>A patient attended a medical imaging practice with a referral for X-rays of the thoracic and lumbar spines. Prior to the scans, the radiographers asked the patient if she was pregnant and she responded that there was always a chance. The patient refused having a pregnancy test prior to the X-rays. The patient later carried out a home pregnancy test and advised the practice that she was pregnant at the time of the scan. The dose to the foetus was about 7 mGy.</p> <p>No further action was necessary.</p>

A pregnant person was exposed to radiation (continued)

Incident no.	Description of incident
Incident 258	<p>A patient who underwent a medical imaging procedure was subsequently found to have been pregnant at the time of the procedure.</p> <p>A patient attended a medical imaging practice with a referral for a CT scan of the lumbosacral spine. Prior to the scans, the radiographer asked the patient if she was pregnant and she responded that she was not pregnant. The patient later advised the practice that she was pregnant at the time of the scan. The dose to the foetus was about 1.3 mGy.</p> <p>No further action was necessary.</p>
Incident 259	<p>A patient who underwent a medical imaging procedure was subsequently found to have been pregnant at the time of the procedure.</p> <p>A hospital patient underwent a digital subtraction angiography procedure and a CT scan for a renal biopsy. Prior to the scans, the radiographer asked the patient if she was pregnant and she responded that she was not pregnant. The patient's general practitioner advised the hospital later that day that she was pregnant at the time of the scan. The dose to the foetus was about 1 mGy.</p> <p>No further action was necessary.</p>

Contamination of persons or articles with a radiopharmaceutical

Incident no.	Description of incident
Incident 260	<p>Spillage of a radiopharmaceutical resulted in the contamination of the patient and the patient's surroundings.</p> <p>During the attempted intra-ictal injection of a hospital patient with 650 MBq ^{99m}Tc-ECD, the entire administration was spilled, resulting in the contamination of the patient and the patient's surroundings. The affected surfaces and the patient were decontaminated. The effective doses from the spill to both the nurse and patient were less than about 0.1 mSv.</p> <p>The staff member involved in the injection received additional practical training to supplement current training and experience.</p>
Incident 261	<p>Spillage of a radiopharmaceutical due to a damaged vial.</p> <p>A hospital nuclear medicine technologist attempted to draw up 247 MBq of ¹⁸F-DCFPyl. A crack in the vial was noticed after no liquid could be retrieved from the vial. Upon investigation, it was found that the base of the vial had completely fractured and the entire contents of the vial had leaked. At no stage was the vial dropped or forcefully handled during the preparation and calibration procedures. The damage to the vial appears to have occurred during the radioisotope production process. The only objects contaminated were the calibration dipper and the inner surface of the transport pig. No individuals or other surfaces were contaminated.</p> <p>The supplier was contacted and notified of the incident.</p>
Incident 262	<p>A leaking radiopharmaceutical generator delivered to a hospital resulted in the contamination of staff members and surfaces.</p> <p>Following the receipt and storage at a hospital of a ^{99m}Tc generator containing 515 GBq ⁹⁹Mo, a nuclear medicine technologist (NMT) noticed that the dose calibrator indicated radiation was being detected with no radioactive source in the well. The NMT undertook a contamination survey of the NMT involved in the incident and items/surfaces in the hot lab. The survey identified radioactive contamination on the clothing of the two NMTs, the delivery slip, the lead box for transporting eluate within the nuclear medicine department and the delivery container. The contaminated clothing was removed and stored in the hospital's waste store for decay and the affected items in the hot lab were isolated behind lead bricks in the far corner of the hot lab. No person received a dose greater than 1 mSv.</p> <p>The supplier was contacted and notified of the incident.</p>

Contamination of persons or articles with a radiopharmaceutical (continued)

Incident no.	Description of incident
Incident 263	<p>Spillage of a radiopharmaceutical resulted in the contamination of a patient and the floor near the patient.</p> <p>A nuclear medicine technologist at a hospital inadvertently dropped an uncapped syringe containing approximately 800 MBq of ^{99m}Tc-MDP on the floor near the patient before injecting the patient. Contamination was detected on the floor and the patient's shoes and pants. The patient was provided with instructions for managing the contamination on their clothing. The floor was decontaminated. No contamination was detected on the two technologists involved. About 90 MBq was spilled: approximately 20 MBq on the floor and 70 MBq on the patient's shoes and pants. The effective dose to the patient was less than 0.4 mSv; the effective dose to the two technologists was less than 10 μSv.</p> <p>The technologist was reminded not to rush injection procedures.</p>
Incident 264	<p>Spillage of a radiopharmaceutical resulted in the contamination of a patient, a nuclear medicine specialist, the floor near the patient and equipment.</p> <p>During a routine cardiac stress test being carried out on a hospital patient, the nuclear medicine (NM) specialist inadvertently spilled about 280 MBq of ^{99m}Tc-MIBI. Contamination was detected on the patient's left arm, the left side of the bicycle stand, the floor next to the bicycle and on the shoes of the NM registrar. The patient's arm, the floor and the bicycle stand were decontaminated. The registrar's shoes were taken away for storage until the ^{99m}Tc had decayed sufficiently. The skin doses to the patient's arm and the registrar's feet were both less than about 0.1 mGy. The effective doses to the staff members involved were less than about 10 μSv.</p> <p>No further action was necessary.</p>
Incident 265	<p>Spillage of a radiopharmaceutical resulted in the contamination of a patient's bedding.</p> <p>A hospital patient required an injection of 90 MBq of ^{99m}Tc-bicisate dihydrochloride (used to image blood flow in the brain) at the time of an ictal episode. As the radiopharmaceutical was being injected, an unknown quantity of the radiopharmaceutical leaked onto the patient's bedding. The radioactive contamination was identified by the nuclear medicine technologist. Based on the patient imaging, the amount of the radioactive contamination was deemed to be low. The contaminated linen and mattress were placed in storage for decay and, as a precaution, the patient was instructed to shower and change pyjamas. The effective doses to the staff members involved were well below 1 mSv.</p> <p>No further action was necessary.</p>
Incident 266	<p>Spillage of a radiopharmaceutical resulted in the contamination of a nuclear medicine preparation bench.</p> <p>A nuclear medicine technologist (NMT) at a medical imaging practice was reconstituting a vial of ^{99m}Tc-MIBI. The top of the vial fractured when the NMT attempted to remove the vial from the heat block. The ^{99m}Tc-MIBI spilled out of the vial onto the benchtop. The NMT was using long forceps and was not personally contaminated. The spill was cleaned up according to the practice's protocol and the room was closed for the remainder of the day. As this was the only molybdenum generator room, the same NMT was required to go into the room to elute the generator each day. The incident occurred because the NMT grabbed the vial by the glass part of the vial neck, which came into contact with the side of the heat block, causing the vial to fracture. The effective dose to the NMT due to the spill clean-up and subsequent visits to the contaminated area was about 0.7 mSv.</p> <p>The NMT received additional training in the reconstitution process to ensure the potential for recurrence was minimised.</p>

Contamination of persons or articles with a radiopharmaceutical (continued)

Incident no.	Description of incident
Incident 267	<p>Spillage of a radiopharmaceutical resulted in the contamination of a PET preparation bench.</p> <p>A nuclear medicine technologist (NMT) at a medical imaging practice was drawing up a ^{68}Ga-dotatate dose. When inverting the syringe to remove an air bubble, the NMT dislodged the plunger and ^{68}Ga-dotatate was spilt onto bench in PET hot lab. The spill was cleaned up according to the practice's protocol. The effective dose to the NMT was about 0.3 mSv.</p> <p>The NMT was retrained in the proper preparation of radiopharmaceuticals.</p>

Finding of potentially radioactive material

Incident no.	Description of incident
Incident 268	<p>The department was notified of uranium compounds in the possession of a suburban resident.</p> <p>Two authorised officers from the Radiation Team attended a residential apartment block after a phone call was received by the department from a resident of one of the units. The resident advised that, on sorting through material left behind by his deceased father-in-law, he had found a case with "yellowcake" in it. The authorised officers entered the carpark below the apartment block, where the case was stored in a small, locked shed. The case contained two small, white lead pots labelled "U_3O_8" in addition to other items. Inside each lead pot was a plastic vial containing a small quantity of yellow powder. The surface dose rates at the surface of the vials were about 0.22 $\mu\text{Sv/h}$ and 0.15 $\mu\text{Sv/h}$, confirming that the material in the vials was radioactive, and probably U_3O_8. No other radioactive material was detected in the case and no contamination of any object or the floor of the garage was detected. The two lead pots were collected by the authorised officers and taken to the Victorian Government Interim Storage Facility for storage.</p>

Glossary

Term	Definition
Angiography/ angiogram	The use of X-rays and contrast to image the arteries in the brain, heart, or kidneys.
Extravasation	The leakage of intravenously infused medications into the extravascular tissue around the site of infusion.
Extravenous	Existing or taking place outside of, or administered outside of, a vein or veins.
Fiducial markers	Markers that provide a method of ensuring accurate target localisation for tumours or organs for radiotherapy.
Gamma camera	A device that detects the radiation from radiopharmaceuticals that have been administered to a patient in order to diagnose a medical condition.
Intravenous (IV)	Existing or taking place within, or administered into, a vein or veins.
PACS	Picture archival and communication system.
p-value	A p-value measures the probability that obtaining the observed difference in results is due to chance alone. The lower the p-value, the greater the statistical significance of the observed difference, i.e. the lower the p value, the more likely there is a true correlation between variables. A p-value of 0.05 or lower is generally considered statistically significant.

