



Report from a UK incident

Dental x-ray set operated continuously

Description of incident

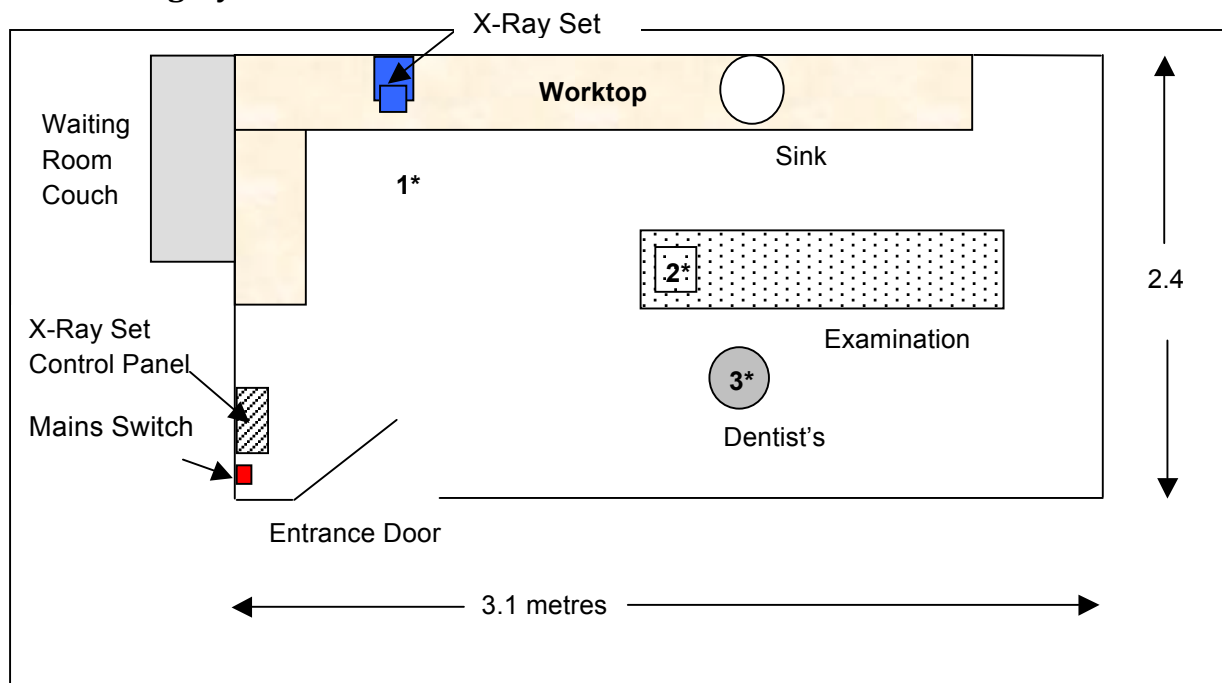
Staff at a dental practice noticed that an intra-oral x-ray set installed in one of their surgeries was leaking oil and appeared to be overheating. The equipment was isolated from the mains and the service engineer was called; in the meantime, it was also noticed that it was not possible for the equipment to generate x-rays.

On examination of the x-ray set, the engineer found that a fault had caused x-rays to be continuously generated, causing the x-ray tube to overheat and burn out. The nature of the fault was such that x-rays were being generated **at any time that the power supply was switched on**; it was not necessary for the exposure button to be pressed.

The engineer reported the incident to the national regulator, who instructed the practice to carry out an investigation into the causes of the incident.

It was subsequently found that a damaged wire had caused the x-ray set to continuously generate x-rays. The wire was damaged when the equipment was reattached to the wall after it had been removed by one of the dentists so that the surgery could be decorated during the weekend prior to the discovery of the fault. It is estimated that x-rays were being generated for about 15 minutes before the x-ray tube failed.

Plan of surgery



Radiological consequences

In the time that the x-ray set was producing x-rays, the tube was in the position it normally occupied when not being used, i.e. close to the wall opposite the entrance to the surgery, with the collimator directed either vertically downwards, or horizontally towards the wall separating the surgery from the waiting room. As all the walls in the surgery are of solid construction, no-one outside the surgery will have been exposed to the main beam. It is also likely that persons present inside the surgery would only have been exposed to scattered radiation.

As part of the investigation, doses to the five members of staff and two patients present at the practice during the time that x-rays were being generated were estimated using the levels of scattered radiation near to the x-ray set during operation and likely maximum occupancy times. These are given below:

Person	Maximum dose received (μSv)
<i>Present in same surgery as faulty x-ray set</i>	
Dental nurse (position 1 in diagram)	19
Dentist (position 3 in diagram)	3
Patient (position 2 in diagram)	6
<i>Other persons elsewhere in practice building</i>	6
Practice Manager, working in adjacent office	6
Dentist working in adjacent surgery	2
Dental nurse working in adjacent surgery	<1
Patient sitting in adjacent waiting room	

As there was considerable uncertainty in these results, and in order to provide reassurance, the national regulator instructed the practice to arrange for chromosome aberration analysis to be undertaken to rule out the possibility that anyone had received very high radiation exposures as a result of the incident.

This was carried out for the dentist and the dental nurse working in the same surgery as the faulty x-ray set; both personnel were found not to have received radiation doses above the limit of detection (approximately 100 mSv).

Lessons to be learned

Anyone installing equipment, or making significant changes is required to carry out checks during the installation to ensure that all safety features and warning devices (such as equipment status indicators, on/off switches, exposure timers and hand switches) operate correctly and that there is sufficient protection from radiation. This would include following reinstallation of equipment, as it is necessary to check that all connections and wiring has been correctly reinstated.

It is also necessary to ensure that anyone carrying out any work on x-ray equipment is competent in the task that they are carrying out, so that they understand the potential risks of working with radiation and the regulatory requirements.

During the investigation it was found that the practice had not sought advice on radiation protection from a qualified expert, as is required by national regulations, and were not meeting the administrative requirements of these regulations. The regulator instructed the practice to comply with its obligations under these regulations, but did not pursue a prosecution.

Similar incident involving dental x-ray equipment

In a similar incident a dentist taking a patient radiograph noticed straight away that the equipment had failed to terminate; immediate action to isolate the equipment from the mains was taken, thus removing the hazard.

The dentist then tried to recreate the fault without a patient in place but wasn't able to do this. The equipment was taken out of use and the engineer was called. The engineer found that a wire in the arm was being trapped when in a certain position and this was causing the timer to fail to terminate the exposure. This second incident highlights the importance of regular maintenance and also the need for all faulty equipment, including intermittent faults, to be checked by an engineer before the equipment is used again on patients.

Both incidents also highlight the importance of only switching x-ray equipment on when it is about to be used and switching it off at the mains immediately afterwards. This would prevent it from generating x-rays for extended periods without anyone noticing that this is happening. During exposures operators must observe the warning lights to ensure that the exposure terminates correctly, at the end of the set time.