



Report from a UK incident

## Persons exposed to x-rays emitted from crystallography equipment

### Description of the incident

A new x-ray tube had been fitted to a crystallography set by a service engineer and was undergoing initial conditioning by increasing the current and voltage slowly over a period of one hour. The operator saw that the electronic monitoring equipment associated with the set was not responding as expected, indicating a malfunction. As specified in the local rules, the operator reported this apparent malfunction to the Radiation Protection Supervisor. A radiation survey was carried out, which indicated that dose rates of up to 240  $\mu\text{Sv/h}$  were present around the tube housing. The unit was immediately disconnected from the power supply.

A subsequent investigation by the engineers found that a newly designed x-ray tube had been incorrectly fitted into the old tube housing, omitting the correct shielding adapters. This had caused the set to emit a horizontal X-ray beam from the gap in the shielding. The service engineer who had performed the installation had not performed a radiation survey of the equipment after replacing the tube.

### Radiological consequences

The (body) personal dosimeters worn by the operator and supervisor were not exposed to the x-ray beam. Doses to the extremities were estimated to be below 0.1 mSv.

### Lessons learned

Whenever maintenance is carried out that may affect the integrity of the shielding, a critical examination must be carried out before the equipment is put back into use. A Radiation Protection Expert should be consulted about the scope of the critical examination and an appropriate written procedure should be drafted. When the critical examination is carried out a written report should be provided for the user.

Employers who have such maintenance carried out by an outside contractor should ensure that they receive a copy of the critical examination report and are satisfied that the equipment is safe to operate. If considered necessary the employer should also consult a Radiation Protection Expert.

Personal dosimeters worn on the body are usually not recommended for persons working with x-ray crystallography and similar equipment. Shielding and other safety features should normally be present to ensure that persons are not exposed to x-rays at all. Where this is not the case, for example due to a malfunction, exposure to narrow x-ray beams is the most likely scenario – and a dosimeter worn on the body will may not be exposed. A survey with an appropriate radiation monitor is always a better solution. Where access to the beam cannot be completely prevented (eg in certain maintenance procedures where safety features have to be overridden) the use of extremity (finger) dosimeters may be appropriate.