24 X-ray Equipment used for Security and Postal and Baggage Screening

Scope

1. This chapter applies to X-ray generators that are used for security purposes in particular the investigation of suspect or potentially explosive devices (security X-ray equipment) and those X-ray generators that are used for screening of post and baggage. This chapter describes the radiation safety arrangements that employers must put in place to ensure compliance with the regulations.

General Requirements

Registration

2. The use of pulsed and continuous X-ray equipment for investigation of suspect or potentially explosive devices, postal X-ray and baggage X-ray scanners, requires registration with the HSE as it is considered work with a radiation generator. The practice does not require consent from HSE as it is not industrial radiography.

Radiation Protection Adviser (RPA)

3. A suitable RPA must be appointed in writing and consulted prior to the acquisition of X-ray equipment and prior to commencing work with the equipment. For all units and establishments, other than those with a resident RPA, the RPA will normally be the DRPS RPA Body.

Risk assessment at procurement

4. In the acquisition of equipment which may emit ionising radiation, safety and environmental management is to begin at the requirements definition stage of procurement and is to be carried forward through service to disposal in accordance with the requirements in Chapter 1 and Chapter 2. Those managing the procurement process and specification development of the equipment which may emit ionising radiation are to assess the risk areas and recommend solutions to reduce the risks to as low as reasonably practicable. Where possible, those managing the procurement are to produce a generic radiation risk assessment, which is to be made available to users.

Risk assessment for users

5. A risk assessment is to be carried out by the unit or establishment in consultation with the RPA prior to any new activity involving X-rays. This risk assessment is to take into account information from the manufacturer, the generic radiation risk assessment carried out at the procurement stage (if available) and take into account the recommended solutions to reduce risk provided by the acquisition process and the local conditions of use. Details of the form of the risk assessment and the actions to be taken arising from it are described in Chapter 2. Risk assessments are to be reviewed as detailed in Chapter 2.

6. The following are key inputs into the risk assessment:

a. advice from the manufacturer or supplier and information from the Project Team if applicable;

b. RPA information and advice – the DRPS RPA Body may be able to provide detailed hazard and risk assessment information on the equipment;

c. radiation survey information – estimated dose rates when operating and during maintenance (if carried out);

d. planned systems of work and routine operation profile e.g. hours per day, per shift etc.;

e. personnel access and occupancy of areas subject to levels of ionising radiation;

f. assessment of reasonably foreseeable fault conditions and resultant dose rates; and

g. assessment of the impact of reasonably foreseeable accidents / incidents.

Radiation Safety Arrangements - Security X-ray Equipment

Introduction

7. In addition to the requirements at paragraphs 1 to 5 above, Guidance is specific to the radiation safety arrangements for X-ray equipment (continuous and pulsed), used for investigation of suspect or potentially explosive devices.

8. Pulsed X-ray equipment involves a number of short pulses of X-rays being passed through the object to be investigated. The total exposure depends on the number of pulses required and the X-ray energy. Typical dose from a single pulse at a distance of 1m are a few µSv but at a distance of a few cm this rises to mSv levels per pulse.

9. Continuous X-ray for security purposes involves the use of X-ray generator and X-rays being passed through the object to be investigated. The total exposure depends on the time the X-rays are generated for and the X-ray energy.

Radiation Protection Supervisor (RPS)

10. A suitable Radiation Protection Supervisor (RPS) is to be appointed in writing for all work with security X-ray equipment. The RPS is to ensure that work is carried out in accordance with the local radiation safety orders. These orders must include the requirements of local rules (as required by IRR17) and the requirements of this chapter.

Training

11. Suitable operator training will be provided by a recognised training school, where that training school has consulted the appointed RPA and the content of the training syllabus agreed upon. Personnel to be designated as RPS are to attend a suitable training course, such as the RPS (security X-ray) course.

Monitoring Surveys

12. It is not possible to conduct surveys with standard radiation monitoring equipment for pulsed X-ray as the exposure time is shorter than the response time of the equipment.

Specialised equipment can be used to determine doses per pulse – the RPA is to be consulted for advice in this matter.

13. For continuous X-ray surveys can be conducted – the RPA is to be consulted for advice in this matter and, where applicable, the survey requirements should be specified in local orders.

Classification of Persons and Dosimetry

14. It is not normally necessary for operators to become classified persons. Radiation dosimetry, issued by the DRPS ADS, will be required in most circumstances, as advised by the RPA.

Designation of Areas

15. A controlled area is to be established and where necessary cordoned, around the X-ray equipment. The extent of controlled areas is to be determined by calculating the appropriate distance from the source to the position where the time averaged dose rate will not exceed 7.5 µSv/hr within an establishment, or 2.5 µSv/hr outside an establishment. The radiation risk assessment for the generator will indicate the extent of the controlled area.

16. In practice when investigating potentially explosive devices, it is explosives safety considerations which are most limiting, and the controlled radiation area will be contained within the explosive safety distance. Where consistent with explosives safety considerations, an appropriate number of sentries are to patrol the perimeter of the controlled area to prevent unauthorised entry.

Operating Procedures

17. Pulsed and continuous X-ray equipment is to be operated in accordance with local orders (containing the local rules and written arrangements) and the manufacturer's operating instructions. The controlled radiation area (as specified above) is to be cleared of personnel until the operation is complete. When using pulsed X-ray sets, where practicable, the X-ray set is to be directed towards solid walls.

18. Continuous X-ray sets will need to be warmed up for a defined period of time before use. The manufacturer’s instructions will determine the warm-up period, the controls that should be in place during the warm-up period will be in the local rules.

Maintenance and Testing

19. Pulsed X-ray equipment is be leak tested in accordance with the manufacturer’s instructions – this may be based on the time the X-ray equipment has been in use or based on the number of pulses undertaken. There may be a requirement to log the number of the pulses undertaken. The leak testing and maintenance should be undertaken by the manufacturer.

20. The pulsed X-ray equipment will be required to be powered and used on a regular basis, the timeframe will be determined by the manufacture and operating procedures.

21. Continuous X-ray equipment should be maintained in accordance with the manufacturer’s instructions. Continuous X-ray may be required to be powered on a regular

basis to season the tube. The frequency of the seasoning will be determined by the manufacturer.

22. During the use of X-ray equipment for testing there should be a designated test area that should be designated as a controlled area. The X-ray should be directed towards solid walls (double brick thickness) where possible and controlled area should be demarcated by barriers and signs. There should be audible and visible indicators that the X-ray equipment is energised and firing, such as the operator indicator unit (OIU) provided with some pulsed X-ray generator equipment. Operators should not be in the controlled area and should where possible be using leads to operator the X-ray at a distance defined in the local rules.

Radiation Safety Arrangements for Postal and Baggage Screening Equipment

Introduction

23. In addition to the requirements at paragraphs 1 to 5 above, specific guidance is given here on the radiation safety arrangements for postal and baggage screening equipment. Postal and baggage screening equipment may be installed or portable. They may be of a compartment type allowing continuous viewing of the X-ray image of a package (including older style fluoroscopes), or a conveyor type where images are converted to digital form and viewed on a computer monitor. Although very high radiation dose rates may exist within the equipment, design is such as to minimise exposure to operators and others.

24. This chapter does not cover the radiation safety requirements for those undertaking maintenance and testing of such equipment.

Duties

25. Duties as detailed in Chapter 39 apply. In addition, the following duties also apply.

Workplace Supervisor (WPS) (X-ray)

26. In units operating postal or baggage screening equipment where it is unnecessary to appoint an RPS, a WPS (X-ray) is to be appointed with duties to ensure that work is carried out in accordance with the local orders which are to include the requirements of this chapter.

Hazards

27. X-ray generators used in postal and baggage screening equipment generate high in-beam dose rates capable of delivering up to a few mSv per minute. However, the design of such equipment is to ensure that dose rates to operators are normally restricted to no more than 1 µSv/h. Faults or other occurrences, which may be reasonably foreseeable, could reduce the effectiveness of shielding and lead to higher dose rates – such X-ray leakage may give a general increase in exposure levels or may be confined to narrow beams (streaming pathways).

28. During maintenance work, involving access (by a suitably qualified engineer) to internal components, higher dose rates may be encountered.

Design of postal and baggage screening equipment

29. Postal and baggage screening equipment is normally to be designed such that the

dose-rate on the external surface of the equipment or at any routinely accessible opening does not exceed 2.5 µSv/hr and that the radiation dose to any person does not exceed 1 mSv in a year. Where the equipment is used in a public place, this value is not to exceed 1 µSv/hr.

30. Automatic equipment, such as a conveyor belt baggage or parcel X-ray machine, where the production of X-rays is triggered by the presence of a parcel, are to be designed so that cutting the power to the conveyor belt will prevent X-ray production. An emergency stop button to isolate the power to the conveyor is also to be located at the entry and exit ports to the X-ray chamber and where appropriate, also at the control panel.

31. Postal and baggage screening equipment should include design features or safety devices that prevent anyone reaching inside it to an area where the dose-rate exceeds 7.5 µSv/hr.

Warning signals

32. A warning light is to be provided on the equipment to indicate when X-rays are being generated. Notices are to be displayed to indicate the purpose of the warning lights.

33. All warning lights are to be tested on an annual basis and following any maintenance or repair. Records are to be kept of the tests to indicate the type of test carried out and when the next test is due.

Installation

34. The installer of the equipment has a number of duties imposed by IRR17, in particular:

a. they must carry out a critical examination of the way in which the equipment has been installed ensuring that safety features and warning devices operate correctly and that there is sufficient protection for persons from exposure to ionising radiation;

b. they must consult with their RPA or with the operator's RPA with regard to the extent of the critical examination and in regard to the results of that examination; and

c. they must provide the employer (the employer being the operator of the postal and baggage screening equipment e.g. the CO, Head of Establishment) with adequate information about proper use, testing and maintenance of the equipment.

35. The employer must consult their RPA regarding the plans for installing the equipment in relation to engineering controls, design features, safety features and warning devices. They are also to consult the RPA regarding the acceptability of the test results of the critical examination and the requirements and results of any further commissioning tests or radiation surveys.

36. The employer is to ensure that they understand the information provided by the manufacturer and installer and that a radiation survey is carried out prior to first use.

37. The equipment is not to be operated until any deficiencies identified in the initial inspection have been repaired by a suitably qualified person, and the equipment has been re-inspected and monitored.

Maintenance

38. The employer must ensure that engineering controls, design features, safety features and warning devices are properly maintained, examined and tested at suitable intervals (typically annually). The employer is to arrange maintenance and testing in accordance with the manufacturer's information, Chapter 8 (Radiation Monitoring Instruments) and the advice of the RPA.

39. Records must be kept of the examinations and tests to identify if any faults were found, how they were rectified and when the next examination or test is due.

40. In many cases, it is permissible for employers to hand-over the area in which the equipment is housed to maintenance staff. In this case, the employer is to ensure that suitably competent staff will undertake the maintenance / repair and that it is clear that the maintenance employer has control of the area – the maintainer is to then appoint their own RPS and operate to their own procedures and local rules. If this arrangement is inappropriate, then the employer retains all safety responsibilities and must ensure that the maintainer's safety documentation is adequate to cover the maintenance task and that appropriate training of their own supervisory staff has been carried out. If the maintenance requires area designation, then an RPA must be consulted.

Operating instructions

41. A set of operating instructions is to be drawn up by the unit or establishment for each screening equipment type. Each operator is to comply with the operating instructions.

Local Orders for Radiation Safety

42. The requirements for radiation safety are to be drawn up in accordance with Chapter 16. The local orders are to include the requirements for periodic radiation surveys, as advised by the manufacturer or RPA, and are also to specify dose rate action levels. RPA advice is to be sought regarding the action levels and the action to be taken if they are exceeded.

Security

43. The equipment is to be kept locked and secured when not in use. If key controlled, the key is to be kept in safe custody; the names of persons authorised to draw the key are to be recorded.

General Safety Requirements

44. Where reasonably practicable, postal and baggage screening equipment are to be fitted with interlocks to prevent access to the examination compartment during X-ray emission.

45. The condition of lead impregnated rubber curtains is to be checked regularly. Any damaged curtains are to be repaired or replaced immediately. Advice should be sought from the RPA if there is operational requirement to use the machine before the damaged curtains are replaced.

46. Fluoroscopes are to have viewing facilities which do not permit direct viewing of the fluoroscopy screen.

47. No alterations or additions are to be made to postal and baggage screening equipment after installation except by qualified, authorised staff.