

**LEAFLET 24****POSTAL AND BAGGAGE FLUOROSCOPES****CONTENTS**

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**SCOPE**

1 Non-medical X-ray fluoroscopes are widely used for the examination of postal packages, luggage and other baggage. The fluoroscopes may be installed or portable. They may be of a compartment type allowing continuous viewing of the X-ray image of a package or 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. Operation of such equipment is subject to the Ionising Radiations Regulations 1999 (IRR99). This leaflet describes the radiation safety arrangements that employers must put in place to ensure compliance with the regulations.

2 This leaflet does not cover the radiation safety requirements for maintenance and testing of such fluoroscopes. Nor does the scope of this leaflet extend to the operation of X-ray generators for purposes other than postal and baggage security scanning by fluoroscopy. Separate leaflets cover industrial radiography, pulse and flash X-ray equipment (Leaflet 28), medical diagnostic X-ray (Leaflet 26), Dental X-ray (Leaflet 25) and Veterinary X-ray (Leaflet 27).

## STATUTORY REQUIREMENTS AND PARALLEL ARRANGEMENTS

3 In addition to the general requirements of the Health and Safety at Work etc Act 1974 and the Management of Health and Safety at Work Regulations 1999, the following specific legislation applies directly or is applied indirectly through parallel arrangements designed to achieve equivalent standards:

- Ionising Radiations Regulations 1999 (IRR99) (apply directly).

## DUTIES

### Commanding Officer (CO) and Head of Establishment

4 The Commanding Officer (CO) has a duty to the Secretary of State, and a personal responsibility, to protect the environment and secure the health, safety and welfare of their staff at work. The CO is also required to protect persons not in MOD employment (e.g. members of the public) against risks to their health and safety arising from the MOD work activities. This includes radiation safety. The CO's authority (but not responsibility) for radiation safety management arrangements may be delegated to appropriate personnel, such as a Radiation Safety Officer (RSO).

### Radiation Safety Officer (RSO)

5 The Radiation Safety Officer (RSO) is to ensure that:

- They are familiar with the specific radiation hazards at their unit or establishment and that an appropriate risk assessment has been carried out.
- Local orders include the requirements for security scanning X-ray equipment detailed in this leaflet.
- Staff are appointed, instructed and trained in their duties relating to this leaflet.
- The requirements stemming from this leaflet are subject to audit.

### Radiation Protection Supervisor (RPS)

6 An RPS must be appointed in respect of any area designated as controlled or supervised. However, area designation is **not** normally necessary where the only work with ionising radiation in the area is the operation of postal and baggage fluoroscopes. Where an RPS is appointed, they are to ensure that work is carried out in accordance with the local orders for radiation safety which are to include the requirements of this leaflet. Further information on the requirements for designated areas is given in Leaflet 4.

### Workplace Supervisor (WPS) (X-ray)

7 In units operating postal or baggage fluoroscopes but 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 leaflet.

## Employees

8 It is the responsibility of all employees to ensure that they are familiar with the relevant parts of local orders to ensure that their exposure to X-rays is restricted as far as is reasonably practicable. Any incident is also to be reported to the appropriate supervisor or line manager.

**HAZARDS**

Table 1 Ionising radiation hazards associated with postal and baggage fluoroscopes

Radiation type		Emitted	Comments
Alpha		✗	
Beta	Direct	✗	
	Bremsstrahlung	✗	
Gamma		✗	
X-rays		✓	X-ray generators used in postal and baggage fluoroscopes generate high in-beam dose rates capable of delivering up to a few mSv per minute. However, design of such equipment is to ensure that dose rates to operators are normally restricted to no more than 1 $\mu\text{Sv h}^{-1}$ . 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).  During maintenance work, involving access (by a suitably qualified engineer) to internal components, higher dose rates may be encountered.
Neutrons		✗	

**RISK ASSESSMENTS FOR POSTAL AND BAGGAGE FLUOROSCOPES****Risk assessment at procurement**

9 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. All aspects of maintenance and operation (including military service) are to be taken into account. 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 (see also Leaflet 1 and Leaflet 2). Where it is possible those managing the procurement are to produce a generic risk assessment, this is to be carried out and made available to users.

**Risk assessment for users**

10 A risk assessment is to be carried out by the unit or establishment in consultation with the Radiation Protection Adviser (RPA) prior to any new activity involving X-ray fluoroscopes. This risk assessment is to take into account information from the manufacturer, the generic 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 Leaflet 2. Risk assessments are to be reviewed as detailed in Leaflet 2.

11 The following are key inputs into the risk assessment:

11.1 Advice from the manufacturer or supplier and information from the IPT if applicable.

11.2 RPA information and advice – the Dstl ESD RPA may be able to provide detailed hazard and risk assessment information on the equipment.

- 11.3 Radiation survey information – estimated dose rates when operating and during maintenance (if carried out).
- 11.4 Planned systems of work and routine operation profile e.g. hours per day, per shift etc.
- 11.5 Personnel access and occupancy of areas subject to levels of ionising radiation.
- 11.6 Assessment of reasonably foreseeable fault conditions and resultant dose rates.
- 11.7 Assessment of the impact of reasonably foreseeable accidents/incidents.

### **DESIGN OF POSTAL AND BAGGAGE FLUOROSCOPES**

12 Non-medical fluoroscopes are normally to be designed such that the dose-rate on the external surface of the equipment or at any routinely accessible openings does not exceed  $2.5 \mu\text{Sv h}^{-1}$  so that the 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  $1 \mu\text{Sv h}^{-1}$ .

13 Automatic equipment, such as a conveyor belt security 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.

14 The fluoroscope is to, by design, or by the provision of safety devices, prevent anyone reaching inside it to an area where the dose-rate exceeds  $7.5 \mu\text{Sv h}^{-1}$ .

### **WARNING SIGNALS**

15 A warning light is to be provided on the equipment to indicate when X-rays are being generated. For non-medical fluoroscopes in which the control panel is not within sight of the fluoroscope, an additional warning light is to be provided on the control panel. Notices are to be displayed to indicate the purpose of the warning lights.

16 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**

17 The installer of the equipment has a number of duties imposed by IRR99, in particular:

17.1 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.

17.2 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

17.3 They must provide the radiation employer (the radiation employer being the operator of the fluoroscope e.g. the CO, Head of Establishment) with adequate information about proper use, testing and maintenance of the equipment.

18 The radiation 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.

19 The radiation 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.

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

### **MAINTENANCE**

21 The radiation 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 radiation employer is to arrange maintenance and testing in accordance with the manufacturer's information, Leaflet 8 (Radiation Monitoring Instruments) and the advice of the RPA.

22 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.

23 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 radiation 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 operate to their own local orders. If this arrangement is inappropriate, then the radiation employer retains all safety responsibilities and must ensure that local orders are 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**

24 A set of operating instructions is to be drawn up by the unit or establishment for each fluoroscope. Each operator is to comply with the operating instructions.

### **LOCAL ORDERS FOR RADIATION SAFETY**

25 The requirements for radiation safety are to be drawn up in accordance with Leaflet 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**

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

### **GENERAL SAFETY REQUIREMENTS**

27 Where reasonably practicable, fluoroscopes are to be fitted with interlocks to prevent access to the examination compartment during X-ray emission.

28 The condition of lead impregnated rubber curtains is to be checked regularly. Any damaged curtains are to be repaired or replaced immediately.

29 Non-medical fluoroscopes are to have viewing facilities which do not permit direct viewing of the fluoroscopy screen.

30 Fluorescent screens onto which the primary X-ray beam is directed are only to be viewed indirectly by the use of mirrors or other means to prevent exposure of the observer to the useful beam.

31 No alterations or additions are to be made to fluoroscopes after installation except by qualified authorised staff.

**LEGAL AND MOD MANDATORY REQUIREMENTS**

32 Table 2 summarises the legal and MOD mandatory ionising radiation requirements for postal and baggage fluoroscopes. In cases of doubt, the RPA is to be consulted for advice.

Table 2 Legal and MOD mandatory requirements for work with postal and baggage fluoroscopes

Requirement	Applicable	Comments	Related leaflet*
HSE Authorisation	✘	Not required for electrical equipment producing X-rays for the purpose of security scanning.	
HSE Notification	✓	Work involving postal and baggage fluoroscopes must be notified to HSE in accordance with Leaflet 3.	3
EA Notification**	✘	Not required for postal and baggage fluoroscopes.	
Risk assessment	✓	A risk assessment is required to identify radiation dose rates and control measures at accessible positions during operation. Reasonably foreseeable fault conditions during operation are also to be considered.  The risk assessment must also cover maintenance operations if these are to be supervised by the employer operating the equipment.	2
Restriction of exposure	✓	Observe manufacturer/equipment instruction and guidance. Ensure exposure of all personnel is as low as reasonably practicable (ALARP). Set dose investigation levels.	4
PPE	✘	Not required.	
Maintenance of engineering controls	✓	Where the equipment includes engineering controls, design features, safety features and warning devices provided to restrict exposure (e.g. shielding, safety interlocks, warning signals), these devices must be properly inspected, tested and maintained at suitable intervals – usually in accordance with the information provided by the manufacturer.	4

Table 2 Legal and MOD mandatory requirements for work with postal and baggage fluoroscopes  
(continued)

Requirement	Applicable	Comments	Related leaflet*
Contingency plans	✓	Required where the risk assessment identifies any immediate measures to be taken in the event of reasonably foreseeable faults, accidents or incidents leading to enhanced exposure levels.	40
Designated areas	✗ (but see comment)	Equipment is normally to be designed such that dose rates in the working area are ALARP and area designation is unnecessary. Designated areas may be required for some equipment during certain maintenance tasks. Normally, a controlled area will be necessary where the dose rate in the area exceeds $7.5 \mu\text{Sv h}^{-1}$ and a supervised area if any person could receive more than 1 mSv in a year - the RPA is always to be consulted regarding area designation and the associated control measures.	4
Designation of personnel	✗ (but see comment)	Not normally required as operators are most unlikely to receive annual dose levels in excess of 6 mSv whole body (or other levels specified in Annex E to Leaflet 4).	4, 6
Monitoring	✓	Local orders are to specify the radiation surveys to be conducted, at regular intervals, around the equipment. Frequency of monitoring is to be that advised by the manufacturer or RPA. Local orders are to include provision for monitoring following any accident or incident that could have caused damage to the equipment and following maintenance or repair.  RPA advice must be sought on the suitability and calibration requirements for survey instruments and regarding appropriate action levels.	4, 8, 16
Training for users	✓	Persons employed as operators are to be formally trained in its use – the training must include appropriate radiation safety aspects. Documentary evidence of the training is also to be retained. Personnel carrying out radiation monitoring duties must also be suitably trained.  Information must be provided to other persons, such as couriers, who may need to spend time in the vicinity of the equipment – so that they are aware of the measures to be taken for restriction of exposure and the content of local orders relevant to their duties.	15, 16

Table 2 Legal and MOD mandatory requirements for work with postal and baggage fluoroscopes  
(continued)

Requirement	Applicable	Comments	Related leaflet*
Local orders	✓	See Leaflet 16 for guidance.	16
Appointed person	✓	RPS not required except for areas required to be designated as controlled or supervised. Where an RPS is not required, a local workplace supervisor needs to be appointed to ensure that local orders for radiation safety are followed.	39
Storage	✗	Not applicable.	
Accounting	✗	Not applicable.	
Leak testing	✗	Not applicable.	
Personal dosimetry	✗ (but see comment)	Unless advised by the RPA, personnel do not require personal dosimetry as their doses are likely to be much less than 1 mSv per year.	6
Reporting procedures	✓	An unusual radiation event or overexposure is to be reported in accordance with the procedures in Leaflet 14.	14
Transport	✗	Radiological controls are not applicable to the transport of X-ray generators.	
Marking	✓	Postal and baggage fluoroscopes are to be marked on the outside with a radiation warning sign.	4
Sale/Transfer	✓	See Leaflet 11	11
Disposal of redundant items	✗ (but see comment)	Radiological controls are not applicable to electrical equipment. Radiation warning signs are to be removed if the X-ray tube has been removed and the equipment earmarked for disposal has been permanently disabled.	

\*JSP 392, unless otherwise stated

\*\*Environment Agency (EA) for England and Wales, Scottish Environment Protection Agency (SEPA) for Scotland and Environment and Heritage Service for Northern Ireland (EHSNI).