Leaflet 27

Veterinary Diagnostic X-ray Equipment

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Scope

1 This Leaflet describes the requirements for keeping and using veterinary diagnostic X-ray sets (including fluoroscopes). A summary of the associated radiation risks and regulatory requirements for such equipments are included in Annex A.

Statutory Requirements

2 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:

- Ionising Radiations Regulations 1999 (IRR99)

Duties

Commanding Officer and Head of Establishment (CO/HoE)

3 The CO/HoE 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/HoE 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/HoE'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)

4 The Radiation Safety Officer (RSO) is to ensure that they are familiar with the specific radiation hazards at the establishment and that adequate radiation protection arrangements are made to minimise the radiation hazard including the drawing up of local orders for radiation safety and the issue of instructions and procedures.

Radiation Protection Supervisor (RPS)

5 The RPS is to ensure that X-ray equipment is correctly used in accordance with local orders for radiation safety including instructions and procedures. The RPS is also to ensure that reporting procedures for any incidents are followed (see Leaflet 14). The RPS is normally the veterinary technician or veterinary surgeon within the department, and should be appropriately trained for the role. This is normally through successful completion of the RPS (X-ray) course at HMS Sultan, details of which can be obtained from the RPA. This training should be refreshed at least every five years.

Employees

6 It is the responsibility of all employees to ensure that X-ray equipment and personal protective equipment is used correctly and not deliberately misused or interfered with and that work is carried out in accordance with local orders, instructions and procedures. Any incidents are to be immediately reported to the RPS.

Hazard

Table 1 Hazard

Radiation type		Emitted	Comments
Alpha		✗	
Beta	Direct	✗	
	Bremsstrahlung	✗	
Gamma		✗	
X-rays		✓	X-ray sets generate a significant in beam exposure hazard. In addition, radiation from X-ray head leakage and scatter from the beam may affect areas around the X-ray head and beam.
Neutrons		✗	

Legal and MoD Mandatory Requirements

Table 2 Legal and MOD mandatory requirements

Requirement	Applicable	Comments	Related leaflet*
HSE authorisation	✘		
HSE notification	✓		3
EA notification**	✘		
Risk assessment	✓		2
Restriction of exposure	✓	Restriction of exposure is addressed in Leaflet 4 and local orders in Leaflet 16. A radiation safety assessment of new and refurbished X-ray rooms and facilities by the RPA is required.	4, 16
PPE	✓	PPE is covered in general in Leaflet 4. See also Annex A of this leaflet for specific guidance for use of veterinary radiography PPE.	4
Maintenance of radiation engineering controls	✓	Tests for correct operation of: mains on and exposure indication, automatic exposure termination at end of set time and on release of exposure button; room warning lights.	4
Contingency plans	✓	See Leaflet 40.	40
Designated areas	✓	Designated areas are required and are covered in general in Leaflet 4. See Annex A of this leaflet for detailed guidance including requirements for radiography outside of an X-ray room.	4
Monitoring	✘		
Training for users	✓	See Annex A of this leaflet and Leaflet 15 for RPS and user training requirements.	15
Local orders	✓	See Leaflet 16 for guidance on the requirements of local orders and the requirements of IRR 99 for local rules.	16
Appointed person	✓	RPS required.	3
Storage	✘		
Accounting	✓	Recorded on Dstl Annual Holdings Return (copy retained for 1 year).	9
Leak testing	✘		
Personal dosimetry	✓	Whole body dosimeters are to be worn by staff routinely involved with radiology procedures. It may also be necessary to monitor doses to the extremities/thyroid/eye depending on the type and amount of X-ray work being carried out.	6
Reporting procedures	✓	See Leaflet 14 for further guidance on the reporting of incidents.	14
Transport	✘		
Sale/transfer	✓		
Disposal	✓	Return to stores.	

*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).

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Leaflet 27 Annex A

Specific Requirements and Recommendations for Use of Veterinary Diagnostic X-ray Equipment

CONTENTS

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1 Radiation safety assessment for new or refurbished facilities
2 Acceptance testing of new x-ray equipment
4 Critical examination and design of new x-ray facilities
5 Controlled and supervised areas
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10 Operation of veterinary X-ray equipment
13 Training and instruction
14 Personal protective equipment
17 Ancillary equipment
21 X-ray equipment records
22 Maintenance of veterinary X-ray equipment
24 Quality assurance performance tests
25 X-ray films, cassettes and film processing requirements
27 Fluoroscopy

Reference

A Guidance Notes for the Safe Use of Ionising Radiations in Veterinary Practice, British Veterinary Association, June 2002

Radiation Safety Assessment for New or Refurbished Facilities

1 For new or refurbished X-ray facilities the RPA is to be consulted at the design stage to ensure that the design of the facility, including any shielding required, is sufficient to keep doses to personnel as low as reasonably practicable.

Acceptance Testing of New X-Ray Equipment

2 Acceptance tests are to be carried out as advised by the RPA on all newly installed veterinary X-ray equipment and when an X-ray tube is replaced to ensure that radiological functions are satisfactory and to specification.

3 Guidance on design, construction and installation of veterinary X-ray equipment is available at Reference A and from the RPA.

Critical Examination and Design of New X-Ray Facilities

4 A critical radiation safety examination including an assessment of the adequacy of room shielding is to be carried out as advised by the RPA on all new or structurally modified X-ray rooms prior to being brought into routine use.

Controlled and Supervised Areas

5 General requirements relating to controlled and supervised areas are provided in Leaflet 4.

6 A dedicated X-ray room containing installed X-ray equipment is designated as a controlled radiation area during exposures.

7 For mobile X-ray sets, the controlled radiation area extends in the direction of the X-ray beam until the beam is sufficiently attenuated by distance or shielding (e.g. solid floor or wall) and out to 3 metres from the X-ray tube head and patient in all other directions.

8 For radiography outside an X-ray room, a controlled radiation area must be demarcated using cones, tapes or cordons displaying 'X-Ray Controlled Area: Do Not Enter' signs in appropriate languages. The whole of the controlled area is to be visible to the radiographer. The X-ray set operator is to ensure that nobody is in the line of the useful beam taking into account the increasing spread of the beam with distance from the collimator. Special care is to be taken when the useful beam is horizontal. The X-ray beam is to be directed at an adequately shielded wall, e.g. solidly constructed of brick or concrete or at a suitable beam stop, such as a 2 mm thickness of lead sheet.

Radiographic Examination Considerations

9 Animal radiography is to be conducted only on the instructions of a Veterinary Officer, who will ensure that the radiographic examination is justified, be fully aware of radiation protection aspects, the radiographic procedures and techniques to be employed and that the radiation dose received by personnel present is minimised.

Operation of Veterinary X-Ray Equipment

10 Only suitably trained persons are to operate X-ray sets under the direction of a Veterinary Officer.

11 The person operating the X-ray set is responsible for ensuring the radiation safety of persons present. Non-essential personnel are to be excluded from the radiography room or demarcated controlled radiation area during such examinations. The operator is to be fully aware of the radiation protection requirements and the radiographic techniques to be employed.

12 After use, X-ray sets are to be switched off at the mains and are to be secured against unauthorised use.

Training and Instruction

13 Where veterinary assistants or other persons restrain animals, they are to be provided with appropriate protective clothing and properly instructed by the veterinary officer in the actions to be taken during radiographic examinations before the commencement of such examinations.

Personal Protective Equipment

14 X-ray personal protective equipment (PPE) for staff includes aprons, gloves and thyroid shields incorporating lead to reduce radiation exposure during X-ray examinations. This PPE is not designed to provide protection from the primary beam, but only from scattered radiation and that transmitted through the patient. Guidance on specific requirements for the use and storage of PPE is given in Reference A.

15 Unless positioned behind protective screens all persons present are to wear protective aprons and stand at least two metres from the X-ray tube. No animal is to be manually restrained for radiographic examination unless there is a clinical reason for avoidance of sedation or anaesthesia. In such circumstances the individual restraining the animal is to ensure that no part of their body is in the primary beam. Where it is necessary for a person to place their hands close to the X-ray beam for manipulation, support or restraint of an animal, protective gloves together with lead rubber hand and forearm drapes are to be worn. Dosemeters issued by the Approved Dosimetry Service (ADS) are to be attached to each hand inside the glove to assess the radiation dose received.

16 Each piece of X-ray PPE is to have its own identifying number. Gloves and aprons are to be visually examined at 3-monthly intervals and radiographically examined at least every 12 months for the determination of deterioration or reduction in shielding effectiveness. Records of examinations are to be kept for 2 years.

Ancillary Equipment

17 For fixed installations, a protective screen incorporating a lead-glass window and having a lead equivalence of not less than 1 mm is to be provided at the control console.

18 For work without a purpose built table, a 1 mm thick sheet of lead larger than the maximum beam size employed is to be placed under the cassette or film in order to reduce scatter and protect feet and legs of anyone standing close to the table.

19 Special free standing or long handled cassette holders are to be available when it is necessary to support cassettes such as during horizontal beam radiography.

20 Suitable positioning aids, such as hoof blocks and lead-shot bags are to be available to assist patient positioning.

X-Ray Equipment Records

21 All units and establishments are to maintain the following records for X-ray equipment:

21.1 An inventory of equipment including the name of manufacturer, model number, serial number or other unique identifier, year of manufacture and year of installation.

21.2 A record of all equipment defects, maintenance and QA tests.

Maintenance of Veterinary X-Ray Equipment

22 Veterinary X-ray sets are to be maintained in accordance with manufacturer's instructions, or as laid down by service maintenance departments. Servicing is to be carried out at least once a year. A record of defects and maintenance carried out on these units is to be kept by the establishment. The scattered radiation, leakage and radiation output of veterinary X-ray sets is to be examined during visits by the RPA.

23 Safety checks on the correct functioning of X-ray warning lights and automatic termination of X-ray exposures are to be carried out routinely.

Quality Assurance Performance Tests

24 The following QA tests are to be carried out:

24.1 Accuracy of alignment of the light beam delineator with the X-ray beam;

24.2 Check of radiographic image quality using step wedge test tool;

24.3 Analysis of undiagnostic radiographs.

X-Ray Films, Cassettes and Film Processing Requirements

25 The fastest film and film intensifying screen combination, or most appropriate CR cassette, compatible with a satisfactory radiograph is to be used.

26 To reduce the number of retakes of veterinary X-ray films arising from poor processing, the following darkroom requirements and processing instructions are specified:

26.1 The darkroom must be light tight to prevent the fogging of X-ray films during development;

26.2 The darkroom is to be kept in a clean condition to prevent film damage;

26.3 The darkroom is to be fitted with adequate safe lights normally consisting of a 25 Watt pearl bulb with a safe light filter, or appropriate LED safe light, which must be compatible with the films in use;

26.4 A warning light together with an explanatory notice are to be provided at the darkroom entrance, to indicate when film development is in progress;

26.5 Chemicals and films used in veterinary radiography are to be within date for use. Where manual processing is used, a programme of regular chemical changes is to be introduced in accordance with manufacturer's instructions, or at least every four weeks. A record of all changes of chemicals is to be kept. Film processing is to be carried out as a standardised procedure;

26.6 For manual processing basic darkroom equipment must include a suitable thermometer and accurate timer;

26.7 Routine checks are to be made on the processing system to detect any deterioration in the quality of radiographs. In the event of any deterioration in the film quality a review of the processing conditions is to be undertaken. If such a review does not resolve the problem then the X-ray set must be checked.

Fluoroscopy

27 Fluoroscopic examinations are only to be undertaken using specialist equipment and expertise. Fluoroscopic equipment is to include image intensification. The RPA is to be consulted prior to the use of fluoroscopic equipment in MOD veterinary facilities.