



UNIVERSITY OF EDINBURGH GENERIC RISK ASSESSMENT - RADIATION

RP/RA10 - WORK WITH VETERINARY LINEAR ACCELERATOR

Foreword

This is a generic risk assessment for use by persons involved in or effected by the application of radiation outlined in the Scope section below. It must be read together with the relevant completed and countersigned Proposed Scheme of Work form. Together they make up the risk assessment of each application for each person working with radiation in the University. The specific control measures for each application are recorded in the relevant Local Rules.

Where risks are recognised with an application that are not included in this assessment the University Radiation Protection Adviser must be informed.

Note that this assessment refers only to the risk arising from radiation. There are other risks arising from this work and these must be properly assessed using the University's risk assessment approach. Guidance can be obtained from the Health and Safety Department.

Scope

This risk assessment applies to the routine work with the clinical linear accelerator used for veterinary radiotherapy up to a maximum 10 MV x-ray spectrum. It does not apply to servicing the linac.



Hazards

- Irradiation of part or whole of the body to external x radiation during normal use.
- Irradiation of part of the body to very high levels of external x ray or electron irradiation in case of an accident;

Persons likely to be exposed to the hazard: University staff, research staff, students, other workers and members of the public. Pregnant women and persons less than 18 years old would be at particular risk.

Risk before the implementation of control measures:

Category of Person	High	Medium	Low
University staff, research staff, students and other workers	⊙	○	○
Members of the public	⊙	○	○
Persons particularly at risk: pregnant women and young persons	⊙	○	○

The radiation levels in the main beam of a linac of this type are very high. The dose rate at 1m distance from the target is typically about 360 Gy/h. Were it a whole body irradiation, this would give rise to a LD₅₀ (60-days) in about 1 minute of exposure.

Reasonably foreseeable accidents:

Type of Incident	Possible Effects
A person being in the linac enclosure during routine operation	Exposure to the main beam; exposure to scattered radiation

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Type of Incident

Possible Effects

A person being in the linac enclosure when a failure in the linac or associated protective measures causes a beam to be generated.

Exposure to the main beam; exposure to scattered radiation

Damage is sustained to the enclosure as result of an impact

Exposure to scattered radiation.

Justification and Optimisation

It is assumed that the linac is needed to fulfil the desired work. When initially acquiring a linac a justification must be made for the desired choice of model, and the output.

Control Measures

Technical

- The linac must only be operated in a purpose-built enclosure. The enclosure should reduce the external radiation to a time-averaged dose rate of 3 $\mu\text{Sv/h}$ or an instantaneous dose rate of 7.5 $\mu\text{Sv/h}$, as advised by the University Radiation Protection Adviser.
- A person at the control area should be able to see the entrance to the enclosure.
- Access to the enclosure whilst the linac is operating should be prevented by a gate or similar that if opened stops the linac generating radiation, and if open prevents the linac generating radiation. If the gate is opened whilst the linac is generating radiation, it should not be possible to restart the linac without manual intervention.
- There must be a delay switch within the room near the exit point which has to be manually activated before the linac can begin generating radiation. This must be interconnected with the gate interlock, so that the gate has to be closed within a short period of time after the exit switch to allow the linac to generate radiation.
- There must be one or more emergency switches within the linac enclosure, at the entrance to the enclosure and at the control panel, that if operated immediately stop the linac generating radiation. The switches must be positioned so that they can be operated without anyone having to cross the main beam. Once operated, they should lock in the operated position and require manual intervention to unlock. They should be clearly labelled.
- There must be one or more warning lights located in a clear position in the enclosure and at the entrance that automatically indicate when:
 - the linac is in a preparatory state; and
 - the linac is producing radiation.

The format of the warning lights must be such as to clearly indicate their meaning, and are distinguishable.

- There must be a clear indication at the control panel of when the linac is producing radiation.
- There should be cameras installed in the enclosure so that all of the enclosure can be seen from the control area.
- The entrance to the enclosure must be fitted with a sign to indicate that it is a radiation Controlled Area when the linac is in the ready state. This could be incorporated with the warning lights.
- The linac should only be operable by using a key switch or password.

Procedural

- The procedures for safe operation of the linac must be written down in Local Rules.
- No person must be allowed in the linac enclosure while it is operating.
- A check must be made that nobody remains in the enclosure before exposure. The last person out must operate the delay switch.
- Routine operation of the linac must be in line with the prepared Local Rules and the manufacturer's instructions.

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- Operation must only be by persons trained in the correct use of the equipment.
- The exposure control key / password must be kept secure and separate from the linac when the irradiator is not being used, and only issued to those authorised to operate the linac.
- The operator must wear a whole-body radiation dosimeter.
- The linac and ancillary facilities must be inspected and maintained so far as is necessary to ensure their continuing safe use and in line with the manufacturer's recommendations. Handover arrangements in between operating and service staff should be described in the Local Rules.
- The operation of warning lights, delay switch, interlocks and emergency switches should be checked regularly and the tests recorded.
- Plans must be drawn up and included in the Local Rules for procedures in case of the accidents listed above.

Behavioural

- All users must be authorised using the University's radiation authorisation arrangements, which includes the radiation protection training arrangements.
- A Radiation Protection Supervisor must be appointed to provide suitable supervision of the use of the linac. He/she must be trained in the measures required to ensure compliance with the controls outlined in this risk assessment and with the Local Rules.
- All relevant workers must be trained in the action to be taken in order to implement the contingency plans made.

Dose Constraint

No special dose constraint is required for the work with the linac.

Dose Investigation Level

In view of the fact that the majority of the risks can be controlled by technical means, and classified workers should not be required, the investigation dose level is $\frac{6}{\text{no. of dosimeter wearing periods/y}}$ mSv per dosimeter.

Risk after the implementation of control measures:

Category of Person	High	Medium	Low
University staff, research staff, students and other workers	○	○	⊙
Members of the public	○	○	⊙
Persons particularly at risk: pregnant women and young persons	○	○	⊙

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