TELESCOPE ARRAY ELECTRON ACCELERATOR (TA LINAC)

PURPOSE

This procedure specifies radiation safety requirements for the 40 MeV Telescope Array Electron Accelerator Project (TA LINAC) including registration, physical safety features, training and operating requirements for users, and regular safety inspections.

POLICY

All operable research accelerators used in University of Utah (University) facilities shall be authorized by the University Radiation Safety Committee (RSC) and shall be registered with the Utah Division of Radiation Control (UDRC). All authorizations and registrations (including fees) shall be submitted to the University Radiation Safety Officer (RSO) for review and processing. The University RSO shall also be notified before any kind of modification, moving, transferring, disposing, or dismantling of any particle accelerator.

The Responsible User for any accelerator shall ensure that detailed operating procedures are available and that each operator has received appropriate training and understands and follows the correct procedures.

DEFINITIONS

"Accelerator" refers to the machines built with the aim of accelerating charged particles, in this case electrons, to kinetic energies sufficiently high enough that can be used to simulate a cosmic ray induced air shower in this context.

"Acting Onsite RSO" refers to any individual the University RSO may specifically designate to act on behalf of, and under the supervision of the University RSO and the Responsible User of the facility, based on the *University of Utah Radiation Safety Policy Manual*. In this context, the term Acting Onsite RSO is applied for the 40 MeV TA LINAC facility installed at Black Rock Mesa near Delta, Utah. The Acting Onsite RSO must have the required qualifications and duties as stated in the registration of the facility with the UDRC.

"Normally Exposed Radiation User" is an individual who could receive more than one tenth (10%) of the occupational dose limit in any calendar quarter. This category includes individuals who rarely receive radiation exposures, but who work with sources that could produce a significant dose accidentally.

"Minimally Exposed Radiation User" is an individual who is unlikely to receive one tenth (10%) of the occupational radiation dose limit in any calendar quarter.

REQUIREMENTS

The requirements specified in the UDRC regulation R313-35-130 apply to the University's 40 MeV TA LINAC project. The important requirements are itemized in this RPR (RPR 33). The inspection check list is a generic list for x-ray generating machines greater than 1 MeV that is adapted to this specific accelerator. This record or an equivalent that meets or exceeds this list is to be completed by the Responsible User at the time the machine is first registered and submitted to the University RSO. The inspection form is also to be used as a safety check list after any maintenance or modification that requires disassembly.

OPERATING REQUIREMENTS

Written operating procedures covering both normal and abnormal (emergency) conditions shall be available to, and followed by, all users of the particle accelerator. The Acting Onsite RSO shall follow all related tasks stated in R313-35-140 entitled: Duties and Authorities of a Radiation Safety Officer. Each operator of the particle accelerator shall be given a copy and demonstrate an understanding of "Requirements Used for Non-Medical and for Non-Destructive Testing in Accelerators" (UDRC- R313-35-130).

Each person who will operate or maintain an accelerator shall first be given the same training as all other radioisotope users, but shall also be given appropriate instruction by the Responsible User and shall demonstrate competence in normal operation of the accelerator and on emergency procedures.

No person shall bypass a safety device without the written authorization of the University RSO and an approved procedure. Individuals who expect to perform maintenance that requires the presence of the primary beam when beam-blocking devices are removed shall be authorized in advance by the RSC and shall notify the University RSO that such work is expected.

RADIATION SURVEYS

The University RSO shall survey the radiation exposure rates in accessible areas near an accelerator at least once a year that the device is operable. The Responsible User shall request, or perform and record, a radiation survey:

1. following any change in the arrangement, number, or type of components;

2. following any maintenance requiring disassembly or removal of a component;

3. during any maintenance or alignment procedure that requires the presence of a primary beam when a component is disassembled or removed; or

4. any time a visual inspection reveals an abnormal condition.

OVERSIGHT MANAGEMENT

Some of the important responsibilities and duties of the Acting Onsite RSO who must be present during TA LINAC operation for the adequacy of the facility and radiological protection of the workers, public, and environment are ensuring:

1. radiation safety activities are being performed in accordance with approved procedures and regulatory requirements during operation of the registrant's program;

2. required radiation surveys are performed and documented in accordance with R313-35-130(4);

3. personnel are properly using their dosimetry;

4. operations are conducted safely and to assume control for instituting corrective actions including stopping of operations when necessary;

5. two man-rules at all times of TA-LINAC operation;

6. all radiation users and visitors will have radiation monitoring badges when the accelerator is turned on and in addition, environmental dosimeters installation should be performed;

7. general fence area will be locked during operation;

8. required safety equipment, radiation area monitor, and radiation survey meter will be available during operation time;

9. updated RPR 33 will be followed during the operation stage;

10. written Emergency Preparedness Procedures including notification and contact for assistance are followed; and

11. radiation survey is performed at least once a month during operation period.

EXPOSURE MONITORING

Users of the particle accelerator who are approved to perform work during operation are classified as normally exposed. Each normally exposed radiation user of the accelerator shall complete the "RADIATION USER PERSONAL DATA" form (RPR 1A). The dosimeter shall be worn whenever the accelerator is operating and

shall be kept in an unexposed location at all other times.

All dosimeters shall be returned promptly at the end of the monitoring period. Dosimeters not returned by the 5th working day of the month after they are worn, but within the next 30 days, are considered to be late. Dosimeters returned more than 30 days, or damaged or misused in any way that invalidates the reading, are considered to be lost. Fines are imposed for late or lost dosimeters (see the *Radiation Safety Policy Manual*).

Users of the accelerator during times when the main beam is shut down and who are not specifically approved to perform maintenance procedures during operation are classified as minimally exposed and are not issued personal dosimeters.

Any suspected exposure to the primary beam of the accelerator shall be reported promptly to the University RSO.

REFERENCES

"Requirements for X-Ray Equipment Used for Non-Medical Applications", R313-35, Utah Radiation Control Rules, Utah Department of Environmental Quality.

"Radiation Protection Design Guidelines for 0.1 - 100 MeV Particle Accelerator Facilities", NCRP Report No. 51, 1979.

"Radiation Alarms and Access Control Systems", NCRP Report No. 88, 1986.

"Radiation Protection for Particle Accelerator Facilities", NCRP Report No.144, 2003.

RPR 33. PARTICLE ACCELERATOR SAFETY INSPECTION

Responsible user: _____ Group #: _____ Phone: _____

Location: _____ Installation date: _____ Inspection Date: _____

FACILITY REQUIREMENTS

Site and equipments are properly posted? **Yes No**

CONTROL AND INTERLOCK SYSTEMS

Controls labeled? **Yes No**

Interlocked? **Yes No**

Scram and Emergency stop button? **Yes No**

WARNING DEVICES

Audible warning 15 seconds prior to system activation? **Yes No**

OPERATING PROCEDURES

System secured from unauthorized use? **Yes No**

Warning and safety devices are tested quarterly when accelerator is in use? **Yes No**

Circuit diagrams are available? **Yes No**

RADIATION MONITORING

Continuous radiation monitoring in radiation areas, independent of the accelerator controls and interlock systems with readout at the console? **Yes No**

Radiation monitors calibrated annually and after repairs? **Yes No**

RADIATION SURVEYS

Annual survey instrument calibration? **Yes No**

Monthly radiation survey/facility evaluation was performed monthly when facility is in use? **Yes No**

Since the last radiation survey, have any of the following conditions occurred:

Removal or disassembly of any component that normally stops the primary beam? **Yes No**

EQUIPMENT REQUIREMENTS

Signs and Labels

"CAUTION - RADIATION AREA" posted? **Yes No**

OPERATING REQUIREMENTS

Are written operating procedures available to all users? **Yes No**

Has written approval been granted by the Radiation Safety Committee or the University RSO for operation of the unit in a manner other than specified in the written procedure or for bypassing safety devices? **Yes No**

PERSONNEL REQUIREMENTS

Have all operators received instruction and demonstrated adequate knowledge of:

Utah Rules (R313-44) and facility operating procedures?	**Yes**	**No**
Radiation hazards associated with use of accelerator?	**Yes**	**No**
Significance of radiation warning and safety devices?	**Yes**	**No**
Symptoms of acute localized exposure?	**Yes**	**No**
Procedure for reporting actual or suspected exposure?	**Yes**	**No**

Personnel Monitoring

Have personal monitoring devices been issued?	**Yes**	**No**
If "Yes", are they used in compliance with University requirements?	**Yes**	**No**

RADIATION SURVEY DATA

Radiation survey meter(s) available at facility:

Make/Model: _____ Serial No.: _____ Calibration Date: _____

Make/Model: _____ Serial No.: _____ Calibration Date: _____

Radiation survey meter(s) used for this survey, if different:

Make/Model: _____ Serial No.: _____ Calibration Date: _____

Make/Model: _____ Serial No.: _____ Calibration Date: _____

Survey results:

With machine operating at usual kVp and mA:

Maximum exposure rate within 30 cm from shield walls: _____ mR/hr

Is the dose rate less than 2 mrem in any one hr? **Yes** **No**

Maximum exposure rate at operator's position: _____ mR/hr

Is the dose rate less than 2 mrem in any one hr? **Yes** **No**

Surveyed By: _____