

RapiscanTM **s y s t e m s**

An OSI Systems Company

RADIATION SAFETY MANUAL PITTSBURG, CA SITE

Rev	Description of Changes	Release Date
1	Initial Release	
2		

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1.0 PURPOSE AND SCOPE

The purpose of this document is to outline the methods used to control exposure to radiation produced at Rapiscan's Pittsburg, CA facility by linac and special nuclear materials.

This document applies to the facility and employees who will be authorized to perform work at the site.

This program includes the radiation protection methods for the use of a linear accelerator on loan from Los Alamos National Lab, and special nuclear materials including Pu-239 and HEU. Since the NRC does not have jurisdiction over radiation machines (see definition below), OSHA and Cal RHB will have jurisdiction. The regulations governing the operation of a radiation machine are 29 CFR 1910.1096 for Federal OSHA, and Title 17, Division 1, Chapter 5, Subchapter 4 for Cal RHB.

The use, possession, licensing, transport and security of the special nuclear materials is governed by NRC and California RHB regulations. The citations for these regulations regarding each segment of this program will be referenced within the applicable section.

All employees and visitors must follow the procedures outlined in this manual and the associated protocols and procedures. There is no exception to any rule without prior written permission from the site or corporate RSO.

2.0 CONTACT INFO

2.1.1 The phone number info for the RHB Headquarters is: (916) 327-5106

2.1.2 The phone number for the Richmond Regional Office of the RHB (Region 4) is:
(510) 620-3416

3.0 DEFINITIONS

3.1 Activated products – Activated products are radioactive materials produced by the interaction of radiation produced by the linac and target materials; these are normally short lived, but care must be taken when approaching potentially active areas/materials

3.2 ALARA – as low as reasonably achievable; refers to a practice to reduce occupational doses to a level that is "as low as reasonably achievable"; Appendix A discusses in detail, the ALARA principles to be used at the site

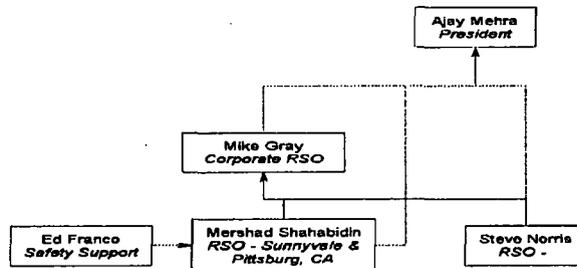
3.3 Authorized User – an individual who is authorized by license or registration condition to use a source of radiation and/or handle radioactive materials

- 3.4 Cal OSHA – California Division of Occupational Safety and Health
- 3.5 Device – means any machine capable of producing radiation or containing radioactive material
- 3.6 Dose – the amount of radiation received per unit of time, usually stated in mrem/hr (US) or $\mu\text{Sv/hr}$ (metric); this normally applies to persons
- 3.7 Exposure – the total dose received during an event or length of time or the ionization of air produced by a radiation machine
- 3.8 High radiation area – an area in which the dose rate is greater than 100 mrem/hr at 30 cm from the source of the radiation
- 3.9 LDE – Lens Dose Equivalent; the dose equivalent to the eye
- 3.10 Linac – linear accelerator
- 3.11 LINAC Use Log – a written log in which each and every use of the linac must be registered; the details will be discussed in a later section
- 3.12 Member of (the) Public – refers to anyone that does not receive occupational dose or who is not a radiation worker or authorized user
- 3.13 NCRP – National Council on Radiation Protection and Measurements
- 3.14 NRC – Nuclear Regulatory Commission
- 3.15 OSHA – Occupational Safety and Health Administration
- 3.16 Radiation area – an area in which the dose rate is greater than 5 mrem/hr at 30 cm from the source of the radiation
- 3.17 Radiation machine – any machine designed to generate ionizing radiation as its primary function; these do not contain radioactive material other than calibration sources
- 3.18 Radiation worker – a person who receives or may receive an occupational dose
- 3.19 RHB – Radiologic Health Branch of the Department of Public Health in the State of California

- 3.20 RSO – Radiation safety officer; the person directly responsible for maintaining the safety of employees and visitors in regards to the dangers of ionizing radiation present at the site; (See RSO section for a list of the additional responsibilities for the RSO)
 - 3.21 SDE – Shallow Dose Equivalent; dose equivalent to the skin or extremities
 - 3.22 SNM Use Log – a written log in which each and every use of the SNM's used on site must be registered; the details will be discussed in a later section
 - 3.23 TEDE – Total Effective Dose Equivalent; total dose equivalent to the body
 - 3.24 Very high radiation area - an area in which the dose rate is greater than 500 rad/hr at 1 m from the source of the radiation
- 4.0 DOCUMENTATION/ REFERENCE MATERIALS
- 4.1 California Code or Regulations Title 17 Division 1 Chapter 5 Subchapter 4
 - 4.2 Radiation Machine Registration/Permit
 - 4.3 US NRC Regulatory Guide 6.9
 - 4.4 US NRC Regulations 10 CFR Parts 1-50
 - 4.5 US NRC Regulatory document NUREG-1556 V17
 - 4.6 OSHA Regulation 29 CFR 1910.1096
 - 4.7 NCRP 144 Radiation Protection for Particle Accelerator Facilities
 - 4.8 Linac Operating Procedures
 - 4.9 Shielding Plan for Pittsburg, CA site
 - 4.10 California Radiologic Health Branch, Notice to Employees, Form RHB 2364
 - 4.11 Rapiscan's Cargo Screening Protocols
- 5.0 RADIATION SAFETY ORGANIZATION
- 5.1 The Corporate RSO for Rapiscan Systems is Mike Gray. He is a dotted line report to Ajay Mehra, President of Rapiscan Systems. Mike is responsible for the radiation safety of all Rapiscan sites and oversees the RSO's for each site.
 - 5.2 The following chart is an organizational chart for the RSO's for Rapiscan Systems"

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6.0 RADIATION SAFETY OFFICER & AUTHORIZED USERS

6.1 Radiation safety officer:

6.1.1 The Radiation Safety Officer for Rapiscan's Pittsburg, CA site is Mr. Mershad A. Shahabidin.

6.1.2 To contact the RSO: work (310) 349-2494; after hours (424) 236-0314

6.2 Authorized operators/servicers:

6.2.1 Timothy Shaw

6.2.2 Cathie Condron

6.2.3 Craig Brown

6.2.4 Mashal Elsalim

6.2.5 Michael King

6.2.6 Ed Franco

6.2.7 John Stevenson

7.0 RESPONSIBILITIES

7.1 Responsibilities of the RSO

7.1.1.1 It is the responsibility of the site RSO to ensure that work is carried out in accordance with the requirements of state and Federal regulations and for taking all reasonable steps to ensure that these rules are followed at all times.

7.1.1.2 To prohibit any non-compliant activity associated with Rapiscan, its employees, and contractors

7.1.1.3 To ensure that survey meters are properly calibrated and maintained

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- 7.1.1.4 To ensure that personnel follow proper procedures when servicing or operating the linac
- 7.1.1.5 To ensure that engineering controls, such as interlocks, alarms, lights, etc. are kept in good working order
- 7.1.1.6 To ensure that radioactive materials are well accounted for, and that possession limits stated on Rapiscan's radioactive materials license are not exceeded
- 7.1.1.7 To make amendments to licenses, registrations and permits with the State of California and NRC, as necessary
- 7.1.1.8 To ensure that exposure levels are kept as low as reasonably achievable
- 7.1.1.9 To assure that all authorized employees are properly trained in the operation and service of linac devices
- 7.1.1.10 To ensure that unauthorized removal of the linac and special nuclear materials is prohibited
- 7.1.1.11 To ensure that personnel are provided with personal monitoring devices, as necessary; and that the doses received by individuals are reported to them, quarterly, annually, and upon receiving a dose in excess of the limits specified in the ALARA program attached to this document as Appendix A
- 7.1.1.12 To ensure that at least monthly audits for compliance are conducted, and to maintain the results of these audits
- 7.1.1.13 To act as a liaison between Rapiscan and consultants and/or regulatory authorities
- 7.1.2 Responsibilities of Management
 - 7.1.2.1 To assure that resources are made available to the RSO and employees which provide or ensure protection against the effects of radiation
 - 7.1.2.2 To enforce the procedures and policies that outline appropriate behavior and which are established by this program and others
- 7.1.3 Responsibilities of authorized users

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7.1.3.1 It is the responsibility of authorized users to become familiar with and abide by the rules set forth in this document and the regulations of the California RHB.

7.1.3.2 To follow operation, maintenance, and repair procedures when using or servicing the device

7.1.3.3 To follow proper safety procedures during the startup, operation, and shutdown of the device

7.1.3.4 To be cognizant of the dangers of radiation and take extreme care in assuring that they nor any other person are exposed to undue radiation

7.1.4 Responsibilities of Employees

7.1.4.1 No unauthorized employees are expected to be at this site.

7.1.5 Responsibilities of Visitors

7.1.5.1 It is the responsibility of visitors to the Pittsburg site, to abide by the rules set forth in this document, the regulations of the California RHB, and the direction of authorized users and the site RSO.

8.0 EQUIPMENT

8.1 Survey Meters

8.1.1 Enough survey meters must be procured to assure that all types of radiation produced on site will be measured, including neutron

8.1.2 At least two survey meters must be available and one kept on the premises at all times. One meter is a primary meter, and the other, a backup

8.1.3 All survey meters must be calibrated annually {Note: calibrations must be staggered so that one survey meter is available at all times.}

8.1.4 Survey meters must be kept in good repair and working order. Prior to using a survey meter, check the battery condition, any cables for cracks or breaks, and check the function of the meter with a check source

8.1.5 Any damage or malfunctions to any meter must be reported to the RSO as soon as possible

8.2 Tools

- 8.2.1 All tools used for servicing the linac shall be removed from the linac area before operating the device. This is due to the possibility of activation. If tools are left in proximity to the linac during beam-on, the tools must be surveyed prior to use. Tools which become activated must not be used unless and until the radiation level returns to background.
- 8.2.2 Tools used for handling radioactive materials or their containers must be marked as such and not used for any other purposes. This is due to the fact that contamination may be present on the tools.

8.3 Shielding

- 8.3.1 Shielding has been placed in the exact locations where it is needed. DO NOT move or modify the shielding in any way without prior written consent from the site RSO.

9.0 PROCEDURE

9.1 Reviews and audits

- 9.1.1 In order to meet the intentions of radiation protection outlined in OSHA's Ionizing Radiation standard 29 CFR 1910.1096, this program must be reviewed on at least an annual basis, as applicable. {Note: the OSHA standard incorporates the NRC's regulation of radiation protection: 10 CFR 20.1101.}
- 9.1.2 An audit of the implemented program must be performed at least annually, or as needed. This must include, inspection of the facility, employee interviews, and a review of programs, procedures and policies related to the radiation safety program. It is highly recommended that monthly audits be performed as the project is only expected to last several months.
- 9.1.3 Rapiscan's facility may be inspected for compliance with applicable regulations from the California RHB or other authorities having jurisdiction at the agencies' discretion. If an inspector from the California RHB does visit the site, accommodations must be made for the inspector if at all feasible.

9.1.4 Rapiscan has certain rights in regards to these inspections, but full cooperation is expected by the RHB or other agency, unless the inspection creates an undue burden to the company.

9.2 Dose

9.2.1 Limits

9.2.1.1 ALARA: Rapiscan has embraced the concept of ALARA, in which radiation levels are kept "As Low As Reasonably Achievable". This is achieved through the implementation of this program, the ALARA program included in Appendix A, and the periodic audits and reviews outlined in the Reviews and Audits Section of this program.

9.2.1.2 "Members of the public" are limited to doses of 100 mrem/yr or 2 mrem/hr. No member of public shall receive more than this dose. If this dose is exceeded, an Exposure Investigation Form must be completed and submitted to the RSO.

9.2.1.3 Although regulations specify that occupationally exposed employees are limited to 5 rem/yr, the ALARA goal is to limit employees to 10% or 500 mrem per year. The trend of industry and recommendation of the ICRP is to adopt a policy of 500 mrem/yr and meet the spirit of the ALARA principle. Rapiscan has adopted this policy.

9.2.1.4 Female employees have the right to declare their pregnancy to their employer. This declaration is voluntary and must be in writing using the Pregnancy Declaration Form in Appendix C of this document. Once a pregnancy has ended, it must be undeclared in the same manner using the Un-declaring Pregnancy Form in the same appendix.

9.2.1.5 Regulations require that declared pregnant workers do not receive more than 500 mrem/gestation period. It is highly recommended that women who are, may become, or are planning to become pregnant, inform their supervisor or the RSO as soon as reasonable. Provisions will be made for women to perform their duties and receive less dose during their pregnancy.

9.2.1.6 Pregnant workers have the right to request to be reassigned to a different job with no occupational dose until pregnancy is over. Rapiscan may or may not honor this request if the dose rate is within the limits for pregnant workers.

9.2.2 Exposure

9.2.2.1 Employees and visitors, who are not authorized users, are prohibited from entering areas in which radiation levels are above those stated above, unless they have received proper training, been provided dosimetry, and are accompanied by an authorized user.

9.2.2.2 Employees who are expected to receive some dose in excess of the limit for "members of public," must be provided and wear the appropriate dosimetry.

9.2.3 Dosimetry

9.2.3.1 Dosimetry must be provided for all employees who work with or near the linac device or who may otherwise receive an occupational dose of ionizing radiation prior to starting work in the radiation area(s). Dosimetry is to be issued and documented on the Dosimetry Issue Form in Appendix D.

9.2.3.2 Dosimetry must be appropriate for the radiation expected; in the case of the linac and special nuclear materials, the radiation generated is the emission of neutrons, betas, alphas, gamma rays, and X-rays.

9.2.3.3 Rapiscan has determined that TLD (thermo-luminescent dosimetry) are the appropriate dosimeters for all radiation of concern at the facility and provide these badges to authorized users. TLD's will be exchanged monthly.

9.2.3.4 Anyone who will enter the linac area must be issued an electronic dosimeter, and the audible alarm shall be set to 100 mrem/hr. (See Work Permit Section)

9.2.3.5 It is forbidden for employees to share or exchange dosimeters, and employees must not take dosimeters home. Dosimetry is to be preferentially stored on a peg board at the site when not in use. The control dosimeter shall also be stored on the same peg board.

- 9.2.3.6 Area dosimeters are also placed inside and outside of the facility to provide a history of the dose rates in these areas. These dosimeters are also to be exchanged monthly.
- 9.2.3.7 No visitor will be allowed access to the facility without clearance to enter the facility from the RSO. While on site, a visitor must wear the dosimetry provided to him/her.

9.3 Postings

9.3.1 Radiation Areas

- 9.3.1.1 Posting: all areas must be posted with properly colored signs (yellow on magenta) made from material appropriate for the environment in which they are being posted. These signs must also be posted in a conspicuous area and visible to persons outside the radiation area to assure employees are aware of the hazards and dangers within the area.

9.3.1.2 Radioactive materials

- 9.3.1.2.1 All areas in which radioactive materials are stored, must be posted: "CAUTION" or "DANGER, RADIOACTIVE MATERIALS."

9.3.1.3 Radiation area

- 9.3.1.3.1 All areas inside the fence (including the fence) surrounding the "Navy Building" at the Pittsburg site shall be posted as a radiation area and include the words "CAUTION, RADIATION AREA". This is to also include the water tower adjacent to the building.

9.3.1.4 High radiation area

- 9.3.1.4.1 Areas with radiation levels at or above 100 mrem/hour at 30 cm from the source of the radiation must be marked "CAUTION" or "DANGER, HIGH RADIATION AREA". Because of the nature of the radiation from the linac and special nuclear materials, it is highly recommended that "DANGER, HIGH RADIATION AREA" be used.

9.3.1.5 Very high radiation area

9.3.1.5.1.1 Areas with radiation levels at or above 500 rad/hour must be posted
"GRAVE DANGER, VERY HIGH RADIATION AREA."

9.3.2 Work and Public Areas

9.3.2.1 The most recent revisions of Form RHB 2364, "Notice to Employees," must be posted in a conspicuous location in the workplace, and is available on-line at <http://www.dhs.ca.gov/rhb>.

9.3.2.2 A copy of all registrations must be kept on site and made available to all employees. These registrations must be posted conspicuously in the workplace.

9.3.2.3 A copy of the operating and emergency procedures or information regarding how they may be obtained or reviewed must be posted in a conspicuous place, as well.

9.3.2.4 Any notice of violation received from the California Radiologic Health Branch (RHB) must be posted for employees to view within 2 days after the receipt of the notice and for 5 days or until the violation has been corrected, whichever is later.

9.3.2.5 A copy of the California RHB codes must be made available to all employees. Posting the link to the online California codes and referencing in particular Title 17, Division 1, Chapter 5, Subchapter 4, in a conspicuous location as well as how to contact the RSO in case of questions regarding these regulations, is acceptable.

9.4 Surveys

9.4.1 All survey meters shall be checked for operability prior to use by verifying battery power, cable connections, operation with a check source, and verifying the calibration date. If the meter is shown to not perform properly from any of these checks, remove the survey meter from service and inform the RSO as soon as possible.

- 9.4.2 A survey form is included in Appendix E of this manual. This form is to be used when performing weekly and other surveys. Completion of the form shall include the name of the person performing the survey, date, model and serial number of instrument used (including probe model and serial number), background level, radiation level and units, and location referenced on a survey map.
- 9.4.3 Survey maps, which show the date and measurements throughout the linac/SNM area, esp. in proximity to the SNM, shall be placed on the outside of the linac area to ensure that employees are aware of the radiation level in the area. A copy of each map and the corresponding survey form must be posted and also kept by the RSO.
- 9.4.4 Surveys of the facility must be performed and documented at least weekly with the linac in normal operating conditions. Do not prolong linac shots in order to obtain survey readings.
- 9.4.5 Immediately after the wait period, surveys of the radiation level within the linac room must be performed prior to approaching the linac or cargo container to assure that no activation products have been generated after beam-on. These surveys do not need to be documented.

9.4.6

9.5 Use Logs

- 9.5.1 A linac use log must be kept on site at all times. This log must be completed each time the linac is used. That is to say that if an experiment is run on a particular day and the linac is activated several times during that day, there will only need to be one entry in the log, but the total "beam on" time must be listed.
- 9.5.1.1 Entries must be made in the log each working day for the duration of the linac trials. If there is no "beam on" time in a day, it must be stated as such.
- 9.5.2 A separate log must be kept for the use of the special nuclear materials.
- 9.5.3 The linac and SNM use logs are included in Appendix F.
- 9.5.4 Use logs must contain the following:

- 9.5.4.1 Date of test
- 9.5.4.2 Start and end times of the test
- 9.5.4.3 Name of person conducting test
- 9.5.4.4 Names of those persons (employees, visitors, contractors, etc.) authorized to be on site for the experiment
- 9.5.4.5 Notes regarding the operation or malfunctions of the machine or incidents regarding the radioactive material

9.6 Reports and Notifications

9.6.1 Employee notifications

- 9.6.1.1 In the event that an employee is exposed to unexpected radiation or contaminated with radioactive material, the employee must be notified immediately or as soon as reasonably possible, using the Exposure Investigation Form included in Appendix B.
- 9.6.1.2 In the event that an employee is required to wear a personal monitoring device, the employee must be made aware of exposures reported through the monitoring device contractor. These reports are to be provided to the users upon receipt from the contractor.
- 9.6.1.3 If an employee wishes to receive a copy of his/her dose records, they may do so using the Request for Dose Records Form in Appendix G.

9.6.2 Agency Notifications

- 9.6.2.1 In the event that an employee or member of the public is exposed to radiation or radioactive material in excess of the regulatory limits specified in Cal RHB regulations outlined below, the RSO must be notified immediately. The RSO will then make the determination of reporting requirements to the California RHB based upon state regulations.
 - 9.6.2.1.1 If an individual receives a dose in excess of the following dose limits the California RHB must be notified immediately by telephone:

- TEDE: 25 rem or more
- LDE: 75 rem or more
- SDE: to the skin or extremities; 250 rad or more
- An intake during a period of 24 hours exceeding 5 times the annual limit for a radionuclide
- Names of persons involved in the incident must be filed on a separate attachment

9.6.2.1.2 If an individual receives a dose in excess of the following dose limits the California RHB must be notified within 24 hours by telephone:

- TEDE exceeding 5 rem in 24 hours
- LDE exceeding 15 rem in 24 hours
- SDE to skin or extremities exceeding 50 rem in 24 hours
- An intake during a period of 24 hours exceeding the annual limit for a radionuclide
- Names of persons involved in the incident must be filed on a separate attachment

9.6.2.2 If the linac or special nuclear material is lost, stolen, or attempted to be stolen the RSO must be notified immediately by telephone. The RSO must then notify the California RHB immediately by telephone.

9.6.2.3 A follow up investigation shall be performed immediately, as well, and a written report determining the cause and future preventative action must be submitted to the California RHB within 30 days as per 10 CFR 20.2201 and must include:

9.6.2.3.1 Description of licensed material involved, including type, quantity, chemical and physical form

9.6.2.3.2 Description of circumstances under which the loss or theft occurred

9.6.2.3.3 Statement of disposition or probable disposition involved

9.6.2.3.4 Exposures of individuals to radiation, the circumstances under which they were exposed, and possible TEDE to persons in unrestricted areas

- 9.6.2.3.5 Names of persons involved in the incident must be filed on a separate attachment
- 9.6.2.3.6 Actions that will be taken to recover the licensed material
- 9.6.2.3.7 Procedures or measures that have been or will be taken to prevent the recurrence of the loss or theft
- 9.6.2.3.8 An additional follow up written report must be filed with the California RHB within 30 days of the initial written report, if further information is discovered
- 9.6.2.4 In the event that the radioactive material is involved in a fire or other incident, the RSO must be notified as soon as possible by phone. After the incident a record of the event must be filed using the Radiological Occurrence Report in Appendix H. The RSO must then notify the California RHB as stipulated in section 30295 of the regulations.
- 9.6.2.5 The RSO must be notified of any other significant events that involve radiation or radioactive material using the Radiological Occurrence Report, to determine the course of action to be taken and to determine any notification requirements. The site RSO will consult with the Corporate RSO to determine these requirements.
- 9.6.3 Amendments to Registrations and Reports
 - 9.6.3.1 The RSO must review all amendments to licenses and/or registrations.
 - 9.6.3.2 An Executive Officer of Rapiscan must sign an amendment request for any radioactive material license that may become necessary.
- 9.7 Training
 - 9.7.1 Operators
 - 9.7.1.1 Operators of the linac must be trained in the following prior to being authorized to use linac devices:

- 9.7.1.1.1 Radiation safety – operators of the linac must be trained in radiation safety including the inherent dangers of the device, and what methods are to be taken to protect themselves and others from these dangers; further details of the training materials are listed in Appendix I. Refresher training must be performed annually. Trainees must acknowledge receiving the training on the Radiation Safety Training Acknowledgement Form in Appendix I
- 9.7.1.1.2 Proper operation of the linac – this training must be performed once, and operators must be trained on any operational changes to the device.
- 9.7.1.1.3 Lockout/tagout awareness – as required by OSHA/Cal OSHA, in order to prevent the inadvertent startup of a linac being serviced, service providers must follow proper lockout/tagout procedures. *Operators* of the linac must be trained in the *awareness* of lockout/tagout annually.
- 9.7.1.1.4 Shutdown – operators must be trained in the preferred method of shutdown of the linac as well as emergency shutdown procedures.
- 9.7.1.1.5 Start-up – operators must be trained in the proper start up procedures of the linac device, especially following an emergency shutdown.

9.7.2 Servicers

- 9.7.2.1 Servicers of the linac must be trained in the following:
 - 9.7.2.1.1 Radiation safety – servicers of the linac must be trained in radiation safety including the inherent dangers of the device, and what methods are to be taken to protect themselves and others from these dangers; further details of the training materials are listed in Appendix I. Refresher training must be performed annually.
- 9.7.2.2 Proper operation of the linac. This training must be performed once, and servicers must be trained on any operational changes to the device.
- 9.7.2.3 Lockout/tagout procedures – as required by OSHA/Cal OSHA, in order to prevent the inadvertent startup of a linac being serviced, service providers must follow proper lockout/tagout procedures. *Servicers* of the linac must be trained in the *complete lockout/tagout* program annually.

9.7.3 Visitors

- 9.7.3.1 Visitors who will be working at the Pittsburg facility must receive the appropriate training or have appropriate experience prior to entering the facility. Personnel on site are responsible for refusing access to persons not properly trained or authorized. The RSO is responsible for assuring the training is provided to visitors.

9.8 Records

- 9.8.1 The RSO will keep the following records or designate someone to keep them:

- 9.8.1.1 Licensing and registration documentation
- 9.8.1.2 Dosimetry and exposure reports
- 9.8.1.3 Training records and syllabus of all radiation safety training sessions
- 9.8.1.4 Surveys of areas and devices
- 9.8.1.5 Radiation Safety Program reviews
- 9.8.1.6 Audit findings (from internal or third party audits)
- 9.8.1.7 Inspection reports (from the RHB)
- 9.8.1.8 Other applicable records pertaining to the facility, devices, employees, customers, etc.

9.9 Sealed Sources

- 9.9.1 Sealed sources must be handled properly with respect to their inherent hazards. The use of tongs is recommended when handling the sources.
- 9.9.2 Sealed sources must be accounted for and secured against unauthorized removal when not in use.
- 9.9.3 Sealed sources must be leak tested at least every 6 months, or as specified on the source's device registration (SSD).
- 9.9.4 If a leak test exceeds 0.005 μCi of removable contamination, the source must be removed from use and the CA RHB must be notified immediately.

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9.9.5 Sources must be inventoried at least every 6 months.

9.9.6 Sources in storage need only to be leak tested every 10 years.

9.10 Chain of Custody

9.10.1 If sources are transferred, even temporarily, to or from another licensee or government agency, a Chain of Custody Form (included in Appendix J) must be completed prior to the transfer. These forms must be given to the RSO for keeping until the project is complete and the sources have returned to the proper licensee.

9.11 Shipping/Receiving/Transporting Radioactive Materials

9.11.1 Receipt of radioactive materials

9.11.1.1 Upon receipt of a source, the outer package must be immediately inspected for visual damage. If the package is significantly damaged, the shipment must be rejected. The package must be quarantined; the delivery driver must immediately notify the shipping company and follow the guidance given by the shipping company's compliance person. A record of this event must be made by Rapiscan.

9.11.1.2 The package must then be surveyed to assure that the radiation levels around the package are within regulatory limits. If the survey measures high radiation levels, clear the area around the package and contact the RSO immediately.

9.11.1.3 Once received, the package must be opened to verify that the source or source container has not been damaged, and that the serial number of the source can be verified against the shipping records and other pertinent documents. If the source appears damaged, a wipe must be taken to assure that no removable contamination is present on the container and other areas as necessary. Results of these wipe tests and a record of the damage to the device must be maintained.

9.11.2 Transport of radioactive materials

9.11.2.1 Transport of special nuclear materials must be performed in accordance with 10 CFR Parts 71 and 74.

9.11.3 Preparation and shipping of radioactive materials

9.11.3.1 Only persons who have received training on DOT's hazardous materials regulations and the proper packaging of radioactive (special nuclear) materials may prepare the shipment for transport. A wipe must be performed on the container to assure that no removable contamination is present prior to transporting the package. And a survey of the package must be performed to assure that radiation levels do not exceed the limits, unless the package meets the criteria of an "excepted package".

9.12 Area Controls

9.12.1 Warning lights must be mounted inside and outside of the linac operating areas, and must be activated when the linac is energized.

9.12.2 Emergency shut-off switches must be located inside the linac operating areas and shut down the primary power to the device.

9.12.3 Interlocks must be put in place on the doors to the linac room to assure that persons in or around the device are not unduly exposed.

9.12.4 Shielding sufficient to reduce the dose rates to acceptable levels shall be installed on the inside of the linac area to prohibit exposure to persons on the outside of the room. Shielding must be visually inspected and surveyed at least weekly and after any incident which has potentially damaged the shielding to ensure its integrity. Any abnormalities must be documented on a Radiological Occurrence Form and forwarded to the RSO.

9.12.5 Surveys of the areas must be posted outside the room as stated in "Surveys".

9.12.6 Signs and other postings must be posted as outlined in "Postings".

9.12.7 Administrative procedures must be put into place to assure that only authorized personnel are permitted in the radiation areas.

- 9.12.8 The linac and special nuclear materials must be secured against unauthorized removal. This is discussed further in the Security Section.
- 9.12.9 Interlocks and safety devices shall be tested weekly to assure that they are functioning correctly. Records of these functional checks must be kept on file at least for the duration of the experiment. These tests are outlined in the "Safety Protocols for Linac/SNM Use."
- 9.13 Changes to the Linac development Areas
- 9.13.1 No changes are to be made to the linac, shielding, containers, etc. without the prior written approval of the site RSO.
- 9.14 New Devices
- 9.14.1 In the event a new device is installed at the facility, the RSO or a designee will apply for the radiation machine registration in accordance with applicable California RHB regulations.
- 9.14.2 The RSO may recommend changes to the device if he/she sees that the device may be out of compliance.
- 9.15 Special Projects
- 9.15.1 New special projects involving radiation, radiation emitting devices, radioactive material, or any combination thereof, must be brought to the attention of the RSO for review. The RSO is responsible for overseeing the safety of the employees working on the project.
- 9.15.2 Any employee involved in special projects involving radiation, radiation emitting devices, radioactive sources, radioactive material, or any combination thereof, must be trained in the safety practices of the project before proceeding with the hands-on portion of the project.
- 9.16 Servicing of Devices
- 9.16.1 In the event that a device needs to be serviced, repaired, maintained, or upgraded, the following steps must be followed:

- 9.16.1.1 Work must be performed by following the proper shutdown and lockout/tagout procedures
- 9.16.1.2 Assure that the device is prepared for operation, before energizing it
- 9.16.1.3 Perform area surveys of the device at incremental power levels
- 9.16.1.4 Fix any leaks immediately
- 9.16.1.5 The device must not be put back into service until repaired

9.17 Accidents

9.17.1 Fire

- 9.17.1.1 In case of a fire, the linac area must be evacuated immediately, except for those employees who perform critical shutdown procedures.
- 9.17.1.2 Employees with critical shutdown procedures, must perform shut downs of the linacs provided that they are not putting themselves at undue risk prior to exiting the building.
- 9.17.1.3 The Pittsburg Fire Department (PFD) must be notified immediately.
- 9.17.1.4 The RSO must be notified immediately.
- 9.17.1.5 The RSO or other designee must inform the PFD of the exact location of the fire and of the potential exposure risk(s), if at all possible.
- 9.17.1.6 After the event, the event must be documented on the Radiological Occurrence Form and forwarded to the RSO. An investigation will be performed to understand the cause of the event and determine whether any unanticipated exposures occurred.

9.18 Radioactive materials

- 9.18.1 Tools and other objects which have been exposed to the radiation from the linac may contain activated products, (radioactive materials). Caution must always be used when handling materials in the linac room.
- 9.18.2 Using a survey meter to determine the amount of dose from a target will help to assure that if and when they are safe to handle.

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- 9.18.3 Any radioactive material must be stored in locations where they are secure from unauthorized removal.
- 9.18.4 Activation products may be present when entering the linac room. Review the "Safety Protocols for Linac/SNM Use" for proper wait times and handling procedures.

9.19 Radioactive Waste

- 9.19.1 There is no Low Level Radioactive Waste (LLRW) expected to be generated.
- 9.19.2 Any radionuclides generated which have a half-life of longer than 120 days, may be stored on site for decay.
- 9.19.3 If radionuclides are generated that have half-lives of longer than 120 days, they will be collected as radioactive waste.
- 9.19.4 Radioactive waste must not be discarded with normal refuse. A licensed radioactive waste contractor must be contacted to properly dispose of this waste.

10.0 SECURITY

- 10.1 The facility must have a continually monitored alarm system to assure that there are no unauthorized entries. Keys and/or keypads must be installed on the entrances to the building and the linac room.
- 10.2 Keys and codes to the facility are not to be given to anyone other than authorized users listed in this program.
- 10.3 Removal of sources from their storage containers or the building is prohibited unless previously approved by the site RSO.
 - 10.3.1 During normal operation, radioactive sources will be removed from the storage area and returned to the source area at the end of daily operations. The sources will only be removed from the storage area only by authorized users on Rapiscan Laboratories' radioactive materials license and for the purpose of the project listed in this program.

- 10.3.2 All radioactive sources must be logged out when removed from their storage containers. Logged information will include: in/out date and time, responsible user, source type, and source ID. Sources in use will be the responsibility of the authorized user until returned and logged in to the storage container.
- 10.3.3 Sealed sources must not be removed from their enclosures, and must be returned to their storage containers and logged in at the end of each day.
- 10.3.4 Sources will be scanned with the inspection system, either alone, in combination with other sources, or surrounded by standard cargo materials. After scanning any sources, a hand-held survey meter will be used to check the source for remnant activation prior to removal of the source from the inspection zone or cargo container.
- 10.3.5 Radioactive sources will be stored in a locked cabinet in the non-shielded section of the building, far enough from the operator's room that the radiation dose rate in the operator's room will not be affected by the sources. Pu and HEU sources must not be in the building at the same time.

11.0 WORK PERMITS

- 11.1 All uses of the linac MUST be performed using the radiation work permit system.
- 11.2 This system is outlined in the Radiation Work Permit Work Instruction and its included forms located in Appendix K.

12.0 LIST OF APPENDICES

Appendix	Description
A	ALARA Program
B	Exposure Investigation Form
C	Pregnancy Declaration Form
C	Pregnancy Un-declared Form
D	Dosimetry Issue Form
E	Survey Form
F	LINAC Use Log
F	SNM Use Log
G	Request for Dose Records Form
H	Radiological Occurrence Report
I	Radiation Safety Training Acknowledgement Form
I	Training Syllabus
J	Chain of Custody Form
K	Work Permit

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