RADIATION ONCOLOGY RESIDENCY PROGRAM

Competency Evaluation of Resident

Resident's Name:	
Rotation:	Clinical Rotation 3
Inclusive dates of rotation:	
Director or Associate Director:	

Competency Assessment Scheme:

1. Unsatisfactory
   - Performance/Knowledge is below standard
2. Needs Improvement
   - Performance/Knowledge is below standards in certain areas and improvement is needed
3. Meets Expectations
   - Performance/knowledge that consistently meets high standards of competency
4. Above Expectations
   - Performance/Knowledge exceeds expectations
   - Performance/Knowledge is consistently high quality
5. Outstanding
   - Performance/Knowledge is exceptional and consistently superior

Evaluation criteria* (subscript = depth of knowledge, 3=most in-depth)	Score (1 – 5)	Mentor Signature
Quality Assurance Activities		
a. Understands the pertinent recommendations for quality assurance of linacs used in radiation therapy		
b. Understands in-house quality assurance documentation and procedures		
c. Competently performs routine (daily/weekly/monthly/annual) quality assurance tests of external beam treatment units		
d. Competently analyzes routine quality assurance tests of external beam treatment units		

e. Understands the basis of accepted tolerances for routine quality assurance tests performed on treatment units and of required actions should any of the checks fall out of tolerance		
f. Understands external beam treatment unit malfunction management		
g. Competently performs end-to-end checks of patient treatment plans using phan-tom images and data		
h. Understands the connectivity requirements of external beam treatment units to treatment simulators, on-board imaging systems, record and verify systems, and electronic medical records systems		
Detectors and dosimeters associated with external beam modalities		
a. Understands absorbed-dose calculation and measurement		
b. Understands Bragg–Gray, Spencer–Attix, and Burlin cavity theories		
c. Understands dosimeter design considerations (e.g., detection mechanism, sensitivity, size, shape, thickness of sensitive volume and wall, materials, energy dependence, detector/phantom media matching, dose and dose rate range, stability of reading)		
1. Ionization chambers		
a) Understands design considerations pertaining to cylindrical ionization chambers, including size, shape, materials, and electrical characteristics		
b) Understands design considerations pertaining to parallel-plate ionization chambers, including size, shape, materials, electrical characteristics, and use for measuring dose in the buildup region		
c) Understands the advantages and disadvantages of each ionization chamber design, including detector limitations		
d) Understands ionization chamber measurement techniques involving instruments such as electrometers, operational amplifiers, and triaxial cables and connections		
e) Performs acceptance testing for ionization chamber and electrometer involving measurements of leakage and evaluation of relevance, polarity effects, and stem effects		
f) Performs ionization chamber measurements using Farmer, parallel-plate, and scanning chambers, as well as large-volume survey ionization chambers		

g) Understands ion chamber correction factors, including P_{TP}, P_{pol}, P_{elec}, P_{ion}, P_{wall}, P_{grad}, P_{fl}, and P_{cel}		
h) Calculates corrected charge readings for ion chamber measurement using TG-51 formalism		
i) Understands the ion chamber calibration process on the basis of NIST/ADCL		
j) Understands design and characteristics of monitor chambers		
2. TLD/OSLD		
a) Understands the physical mechanisms involved in the process of radiation detection and readout using TLDs or OSLDs		
b) If possible, performs TLD or OSLD measurements and readout (including calibration) using standard irradiation		
c) Understands the method and rationale for TLD annealing		
d) Discusses the advantages and disadvantages of TLDs or OSLDs		
3. Diodes		
a) Understands the physical mechanisms involved in radiation detection and readout using semiconductor dosimeters		
b) If possible, performs diode measurements that include investigation of factors such as angular and dose rate dependence and temperature sensitivity		
c) Discusses the advantages and disadvantages of diodes, including their inherent limitations		
4. Film (silver bromide, radiochromic)		
a) Understands the physical mechanisms involved in radiation detection and measurement using film, including measurement of the optical density and its characteristics as a function of absorbed dose, and film's dependence on radiation energy, handling, and processor conditions		
b) If possible, performs film dosimetry including creation of calibration curve		
C) Discusses the advantages and disadvantages of using film, including its inherent limitations		
5. MOSFET detectors		
a) Understands the physical mechanisms involved in radiation detection and readout using MOSFET dosimeters		

b) Discusses the advantages and disadvantages of using MOSFETs, including their inherent limitations		
Introduction to Treatment Planning and Special Projects		
a. Introductory knowledge, observation and/or hands on experience in clinical treatment planning for external beam radiotherapy. Residents are expected to know basic anatomy.		
b. A special clinical project related to external beam radiotherapy		
Treatment Planning Workstations		
1. Data acquisition		
a. Explains the connection between linac commissioning and the data required for operation of a treatment planning system		
b. For a particular treatment planning system, describes the linac data needed for:		
c. Photon beams		
d. Electron beams		
e. IMRT and VMAT		
2. Acceptance testing		
Describes what tests of the treatment planning system need to be performed before patient-specific planning can commence for:		
i. Photon beams		
ii. Electron beams, and		
iii. Brachytherapy sources		
3. Quality assurance		
a. Describes the tests that need to be performed and their accuracy		
b. Describes accuracy checks for the following input devices and types of images:		
c. Digitizers		

d. Film scanners		
e. Imported images from instruments such as CT scanners, MRI scanners, and picture archiving and communication (PACS) systems		
f. Describes accuracy checks for the following output devices:		
i. Printers		
ii. Record and verify systems		
iii. DICOM output		
4. Computer algorithms (models)		
Describes how the computer algorithm calculates dose for at least one major treatment planning system with regard to:		
i. Photon beams		
ii. Electron beams		
iii. Brachytherapy calculations		
iv. Proton beams (Optional)		
a. Describes the advantages and disadvantages of the various treatment planning calculation algorithms		
b. Describes how the computer algorithm determines the number of monitor units per beam or segment (for step-and-shoot IMRT)		
5. Plan normalization		
a. Describes the numerous normalization capabilities available on a treatment planning system		
b. Describes how different normalization schemes affect final isodose curve representation		
c. Describes how the computer plan normalization relates to the calculation of monitor units for patient treatments		
6. Inhomogeneity (heterogeneity) corrections		
a. Describes the type of data that need to be taken on a CT scanner in preparation for treatment planning using inhomogeneous material		
b. Describes how these CT data are converted into inhomogeneity data usable in a treatment planning system		
c. Describes how computerized treatment planning systems take inhomogeneities into account		
d. Identifies where the computer algorithm calculates dose with acceptable accuracy and in which regions calculational accuracy is suspect		

e. Describes how the accuracy of the inhomogeneity corrections performed by a treatment planning system would be checked		
7. Beam modeling		
a. Completely models at least one photon beam energy for a treatment planning system		
b. Completely models at least one electron beam energy for a treatment planning system		
c. Completely models at least one proton beam energy for a treatment planning system (optional)		
d. Tests the accuracy of his or her modeling for the beams and is able to describe the criteria for acceptability of the modeling		
8. Imaging tests		
a. Describes the tests that would be performed to ensure that the imported image data are correct		
b. Demonstrates that images can be imported from CT, MR, and PET or PET/CT scanners		
c. Demonstrates that the above imaging sets can be accurately fused with the primary treatment planning image set		
d. Describes the different image fusion algorithms available on a treatment-planning system (e.g., CT-CT, CT-MR, CT-PET)		
9. Secondary monitor unit check computer programs		
a. Describes what input data need to be acquired		
b. Describes the checks of that input data that need to be performed to ensure that the monitor unit check program is working correctly		
c. Describes how imported data from treatment-planning systems are handled in a monitor unit check program		
d. Describes how the monitor unit check program calculates the number of monitor units for off central-axis normalization points		
e. Describes how the monitor unit check program calculates monitor units for treatments involving inhomogeneous material		
Protection		
a. Understands the federal (e.g., Nuclear Regulatory Commission [NRC], Canadian Nuclear Safety Commission [CNSC]) and state licensing requirements for by-product materials and x-ray-producing devices		
b. Explains the principles behind a radiation protection program, including the rationale for the dose limits for radiation workers and members of the public		

c. Understands federal, state/provincial, local, and institutional regulatory requirements		
d. Explains the concept of ALARA		
e. Understands site planning and how to supervise construction (i.e., key elements to monitor)		
f. Understands structural shielding designs relevant to a radiotherapy department (e.g., NCRP 151) and discusses the key parameters necessary to perform a shielding calculation		
g. Performs shielding calculations for an accelerator vault, including primary and secondary barrier transmission calculations		
h. Discusses the shielding requirements for the maze and door of a high-energy room		
i. Performs a radiation survey of a facility that includes low-energy and high-energy (greater than 10 MV) units		
j. Explains the advantages and disadvantages of various materials that may be used for shielding		
k. Explains how special procedures such as TBI and SBRT may impact shielding parameters		