## Job Class Profile: Medical Physicist

## Pay Level: LX-40 Point Band: 1177-1221

| Factor | Knowledge | Interpersonal Skills | Physical Effort | Concentration | Complexity | Accountability & Decision Making | Impact | Development and Leadership | Environmental Working Conditions | Total Points |
|---|---|---|---|---|---|---|---|---|---|---|
| Rating | 8 | 7 | 4 | 8 | 8 | 7 | 7 | 3 | 6 | |
| Points | 373 | 117 | 25 | 38 | 240 | 152 | 144 | 64 | 64 | 1217 |

## JOB SUMMARY

The Medical Physicist is primarily responsible for assuring that prescribed radiation therapy treatments are delivered accurately.

### Key and Periodic Activities

**Support of Radiation Treatment**

- Reviews and approves radiation treatment plans, ensuring calculations of dose and treatment times are correct and that the delivery matches the request from the radiation oncologist.
- Develops and approves policies and procedures for dose calculations, and specialized treatment techniques.
- Provides consultation support for the radiation oncologist when treating complex cases.
- Reviews and performs measurements for specialized techniques to ensure accurate delivery of the treatment.
- Responsible for understanding the theory behind computer algorithms used to simulate radiation interactions with the patient and ensuring these algorithms are used appropriately (i.e. knowing the limits of the modeling and being able to predict situations where inaccuracies may occur).
- Ensures that mould room services are carried out in accordance with treatment plans and established standards.

**Quality Assurance**

- Develops, administers and evaluates technical aspects of the radiation oncology quality assurance program.
- Interacts with service personnel to arrange for corrective action and ensure the safe working condition of treatment machines after service.
- Ensures that all calibration procedures are performed accurately and according to national and international standards by establishing the daily, weekly, monthly and yearly measurements and tolerances for acceptability for each treatment machine.
- Verifies the accuracy of the treatment planning software.
- Periodically evaluates the performance of all equipment used in support of radiotherapy.
- Performs and evaluates the quality assurance measurements on all radiotherapy equipment to ensure the accurate delivery of prescribed radiation doses to the patient.

## Key and Periodic Activities

— Calibrates radiation output of all radiotherapy treatment equipment.
— Measures and verifies radiation beam characteristics on all radiotherapy treatment equipment.
— Measures and verifies that all mechanical, laser and light field alignments are within acceptable limits.
— Verifies the accuracy of all elements in the transfer of treatment and image information from the imaging system to the planning system to the delivery system.

**Radiation Safety**

— Monitors radiation levels by performing surveys and wipe tests.
— Assists in the shielding design of radiation therapy facilities (i.e. bunker design, shielded patient rooms and specialized shields for patients and staff).
— Provides didactic training to all staff on controlling radiation exposure to themselves and patients, what to do in case of an emergency or uncontrolled radiation exposure and the potential effects of exposure to different levels of radiation.
— Maintains a radioactive source inventory.
— Assists in evaluating any radiation exposure incidents and informing the appropriate authorities.
— Ensures all aspects of license compliance are met and participates in compliance inspections.

**Development and Implementation of New Clinical Devices and Treatment Techniques**

— Carries out research and is primarily responsible for the development and implementation of new treatment techniques and equipment (i.e. Intensity Modulated Radiotherapy, stereotactic radiosurgery, online imaging and verification and all required additions to the quality assurance program).
— Trains staff in the use of new techniques and technologies.

**Equipment Evaluation, Selection and Commissioning**

— Assists the division manager in the preparation of performance specification and comparative assessments of equipment at the time of acquisition or upgrade.
— Participates in decommissioning of old equipment.
— Participates in supervising the installation and/or upgrade of equipment.
— Commissions new equipment for clinical use.

**Research**

— Performs applied and basic research. Presents research results at scientific meetings and participates in research seminar series and workshops.

**Administration**

— Participates in the planning, purchasing and installation of new equipment.
— Participates in the development and implementation of quality improvement, utilization review, risk management and radiation safety activities.
— Participates in the development of departmental objectives, technical standards, standards of performance, policies and procedures.
— Performs other related duties.

## SKILL

### Knowledge

**General and Specific Knowledge:**

— A broad understanding of radiological physics and the biological effects (both therapeutic and non-therapeutic) of radiation.

— A broad understanding of general medical imaging and what constitutes appropriate or inappropriate use in radiation therapy (i.e. MRI, CT, Ultrasound and PET).

— A comprehensive understanding of mathematics and computer algorithms and their application to computer modeling of the various interactions of radiation on the molecular level.

**Formal Education and/or Certification(s):**

— Minimum: Masters Degree in Medical Physics supplemented by certification by the Canadian College of Physicists in Medicine (or equivalent)

**Years of Experience:**

— Minimum: 2-3 years of related work experience.

**Competencies:**

— Policy writing.

— Treatment techniques and quality assurance procedures.

— Use computers, CT scanners, etc.

— Analysis of data using software.

— Calibration of equipment.

### Interpersonal Skills

— Communications occur with employees within the immediate work area, employees or peers within the Department and supervisors/managers, employees in other Departments but within the organization and clients/patients/general public.

— Interpersonal/communication skills are used to consult with Radiation Oncologists, Dosimetrists, and Radiation Therapists to plan and accurately deliver radiation treatments to patients. Information such as patient setup specifics must be gathered and accounted for in planning treatments. Should complicated setups be necessary, the information must be relayed in an easily understandable manner to therapists. Also any specific issues with treatment delivery and factors that might affect the accuracy of the delivery must be explained to the physician in order that they have a clear understanding of the reliability of the treatment.

— The most significant contacts include: the Radiation Oncologists & Manager to discuss clinical and planning issues, share ideas, administrative issues and proposed new equipment/techniques; other Medical Physicists to share information, discuss issues and problems and work together performing measurements; and Dosimetrists to communicate information related to treatment plans.

## EFFORT

### Physical Effort

— Performs fine finger or precision work when writing documents, analyzing data and checking therapy plans using the computer.

- Regularly uses hand tools that require accurate control and steadiness while dismantling and adjusting equipment related to quality assurance.
- Occasionally is required to lift heavy items weighing 25 to 50lbs. such as measurement jigs and devices used for quality assurance.
- Adjusting localizing lasers requires great precision and adjusting gas pressures on accelerators involve climbing a ladder.
- The Quality Assurance of other measurement devices involves crawling around and under things and some climbing onto counters.

**Concentration**

- **Visual** concentration includes: verifying all information regarding treatment plans (i.e. every parameter has to be visually checked, a large quantity of data has to be visually inspected for overall coherence, and adherence to a specific set of requirements); adjusting lasers to align with lines on Quality Assurance (QA) device; inspecting light field to see if its edges align with lines on QA device; and inspecting films for radiation field and Computerized Tomography (CT) images to test image. Data acquisition involves visual inspections of setups and constant monitoring of instruments.
- Other sensory demands are required such as **touch** to determine if a fit is correct or **smell** to indicate if a machine is overheating.
- **Eye/hand coordination** is required for activities such as: precise adjustment of lasers, to within a mm; fine adjustment of controls affecting linac output; adjustment and calibration of mechanical devices within a mm. and outlining or measuring anatomical structures using a computer mouse.
- **Repetition requiring alertness** is required such as: commissioning requires a week's worth of repetitive data collection with a single parameter being altered between sets of measurements; treatment parameters are never the same for two different patients, but it must be determined if they make sense and satisfy the requirements set out by the oncologist; routine QA requires repetition of the same acquisition techniques, but parameters have to be altered between each measurement; and inputting data into software.
- Requires **higher than normal levels of attentiveness or alertness for the health and safety of others** when working with radioactive sources for medical purposes there must be assurance that all precautions are properly implemented, and know exactly what to do if an emergency occurs and dose calibration of radiation-emitting treatment units require precise analysis of data so that patients will not be treated incorrectly.
- **Time pressures/deadlines** include: patients' treatment plans have to be ready for the patient's scheduled treatment appointment and there is limited time to check the plan; commissioning equipment is usually against a deadline to put the item in clinical use; and the replacement, repair or unscheduled recalibration of equipment means that patient treatments are being delayed. The equipment needs to be back in clinical use as soon as possible.
- There may be a **lack of control over the pace of work**. Treatment plans depend on the Oncologist's specification and Oncologists are frequently delayed in providing treatment targets to the Dosimetrists, which means the whole process is delayed. Other issues which occasionally impact the pace of work include the malfunction of equipment, network or other software problems and the shortage of staff.
- There is a requirement for **exact results and precision** in the work performed and include

items such as: treatment machines are mechanically calibrated within 1-2mm; measurements are required to be within 2% of standard; mathematical calculations of dose requiring several data, and components such as kilo voltage imagers, mega voltage imagers require accurate adjustments in order to perform correctly.

**Complexity**

- Work typically involves a series of tasks that are different and unrelated and require the use of a broad range of skills and a diversity of knowledge.
- Typical challenges such as a treatment machine unable to deliver radiation encounters minor problems a few times a week and major problems every 1-2 months. In these instances the cause and nature of the problem (i.e. mechanical or software related) must be determined, and a solution for repair arrived at. Software issues are usually resolved, mechanical issues normally require calling technical support. Once the unit is repaired it must be tested to ensure it is working properly. Other challenges relate to discrepancies in patient dose calculations which must be addressed quickly in order that the treatment is not delayed.
- Most challenges and problems can be addresses by referring to departmental policies and procedures, manuals for software and equipment, national and international standards for Radiation Treatment and its associated equipment, phone access to manufactures' help-lines and Government Regulatory Acts (Canadian Nuclear Safety Commission).

## RESPONSIBILITY

**Accountability and Decision-Making**

- Without formal approval there is decision making authority and accountability to stop or delay treatment if there are safely concerns, recalibrate equipment if it does not meet specifications, determine if equipment is safe to use after repair, determine if a treatment plan is acceptable so that a patient can begin radiation, and the authority to make minor purchases.
- Supervisory approval would be required to put a new piece of equipment or new type of software into clinical use, to incur major purchases, or to change policy.
- There is some discretion to develop new methods for performing QA and approval of an unusual treatment plan
- There is a high degree of independent discretion and judgment in determining as to whether a borderline or questionable result, measurement or situation constitutes a safety hazard.

**Impact**

- Impacts generally affect the immediate work area, within the Department, outside the Department but within the organization and on clients/patients. Failure to complete various aspects of the job could result in delayed patient treatments. This could affect follow up for the patient and can translate through many departments.
- Work results directly impact equipment, process and systems, information, finances, facilities, material resources, human resources, health and safety and corporate image. Equipment must be checked regularly to ensure it is fit for use. Should something be found out of tolerance the equipment would have to be taken out of service until the problem is resolved. Fixing the issue may require the purchase and installation of new or replacement parts and equipment. Depending on the issue, the safety of the patients, staff and general public may be at stake. Failure to take such matters seriously could negatively affect corporate image.

- The consequence of errors are extreme and would be felt throughout the organization and by the patients. Radiation treatments for all patients in Newfoundland and Labrador could be affected by improper machine calibration, improper functioning of equipment or failure to properly assess the appropriateness of treatment techniques. Results could range from mild, such as prolonged treatment machine downtime, to severe, such as adverse radiation effects to patients.
- Quality assurance procedures are laid out according to a standardized completion schedule. Tolerances and acceptable results are typically well defined. Checking treatment plans for patients generally follow a prescribed protocol but often involve decisions not rigidly controlled. Processes followed when implementing new treatment techniques are not generally well defined or prescribed and considerable judgment is used.
- If a tumor does not receive the correct dosage, it will continue spreading. An overdose can cause severe side effects in a patient. A dose output error will most likely be detected by a co-worker, as the same employee will not check a machine twice in a row. This is a rare occurrence.

**Development and Leadership of Others**

- Does not have the fill-time responsibility for the direct supervision of staff.
- Does have development and leadership responsibilities such as leading and organizing a working group on the development of a new treatment technique, and delegating tasks amongst a multidisciplinary team; teaching radiation therapy students and radiology students; organizing the commissioning procedures of new equipment including linear accelerators and CT imagers; acting as the main advisor for the software used; developing procedures and documents regarding specific details of how to operate equipment; and
- Has team lead responsibilities to organize meetings and delegate work to a team of radiation therapists, physicians and physicists for development and implementation of new radiation therapy programs.
- Also assumes a project leader role in organizing working groups to develop new treatment techniques and treatment machines; prepare tenders for the purchase of new equipment and development of associated policies and procedures. These projects occur at least annually.

## WORKING CONDITIONS

**Environmental Working Conditions**

- Required to wear radiation monitoring devices. The radiation survey meter is used if working with radioactive sources. All areas with the possibility of higher than normal radiation levels are indicated with warning signs. Radiation safety precautions based on federal guidelines are in place.
- There is a limited likelihood of the injury or illness resulting from hazards in the work place if normal precautions are followed.
- Constantly works with radiation emitting devices and radioactive sources.
- Occasionally there is exposure to a number of other undesirable environmental conditions such as unusual/distracting noise, exposure to patients who may be infectious, low levels of lighting when performing some measurements, hazardous materials, etc.