



Canadian Association of Nephrology Nurses and Technologists

Standards of Nephrology Technical Practice October 2022

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Introduction

Nephrology technologists play an integral role in the care of patients with End Stage Renal Disease (ESRD) who undergo renal replacement therapies. They ensure that the equipment and methods used in dialysis treatment delivery are safe, effective and in accordance with accepted protocol. The technologist shares a common goal with other nephrology professionals - to provide quality care by working as part of a multi-disciplinary team. In order to provide quality care, the nephrology technologist has a responsibility to maintain competencies in conjunction and accordance with the *CANNT Standards for Nephrology Technical Practice* through recognized training and continued education.

The Canadian Association of Nephrology Nurses and Technologists, (CANNT), as a professional association, has a mandate to establish, maintain, evaluate and revise standards of practice. The nephrology technologist requires a broad knowledge base including understanding of dialysis principles, membrane technology, electronics, hydraulics, mechanics, plumbing, water purification systems, computer applications, chemistry, and knowledge of renal anatomy and disease processes. The *CANNT Standards for Nephrology Technical Practice* provide guidelines for evaluating this knowledge by identifying the minimum professional and practice expectations. The goals and objectives of the nephrology technologist are also identified and serve as the foundation for quality technological practice.

The CANNT Technical Standards Committee, in consultation with the Board of Directors and the CANNT technical membership, develops standards that address the needs of the nephrology technical community, while recognizing that diversity exists in the field.

The *Standards for Nephrology Technical Practice* that follows are intended to:

- Identify goals for nephrology technical practice in Canada.
- Promote and define quality in nephrology technical practice by outlining qualification requirements and by providing a scope of practice statement

Nephrology Technology - Description

Nephrology technology is a specialized area of technical practice with personnel trained to provide expert support to nephrology programs in the following areas:

Haemodialysis:

Support for adult and pediatric haemodialysis programs is the largest component of the role, as haemodialysis utilizes the most sophisticated technology. The technologist requires knowledge in the preparation and operation of the entire clinical setup with expertise in the following areas:

- Principles of dialysis
- Water treatment (Theory and application of water purification equipment)
- Plumbing/Electrical installations
- Dialysis procedures and complications of dialysis
- Membrane technology and Dialyser reprocessing
- Haemodialysis systems components: including extra corporeal, hydraulic and electrical/electronic systems
- Computer applications and networking technologies
- Safety standards and directives
- Applied Sciences: chemistry, human biology, microbiology
- Access flow assessment and measures of dialysis adequacy
- Anticoagulation and coagulometric technologies
- Documentation technologies

The role of the technologist within the haemodialysis program encompasses; preventive maintenance, troubleshooting and repair of haemodialysis equipment and water treatment systems, quality assurance in accordance with Canadian Standards Association (CSA), product evaluation, clinical support, education of staff and individuals with CKD, and research in the above areas.

Peritoneal Dialysis:

Support for peritoneal programs is less intensive as the role is generally restricted to equipment support in addition to that provided to the haemodialysis program.

Goals for a Nephrology Technologist

1. To support the daily operation of the dialysis facility by providing the most efficient and timely services to the patient and the multidisciplinary team.
2. To provide quality service by establishing reasonable and measurable standards of practice for all components of technical services support.

Objectives of a Nephrology Technologist

1. To provide expertise related to the management of dialysis equipment and related technology and to assist clinical staff in making informed decisions on the acquisition, use and replacement of dialysis equipment. To work with clinical staff, and self care patients to ensure coordination of technical service for the entire Renal Program in keeping with the hospital's long-term objectives.

2. To provide ongoing performance testing of dialysis equipment in an effective and consistent manner, thereby assuring compliance with manufacturer's specifications and pertinent standards.
3. To perform the activities of machine and accessory preparation, operation and disassembly to assist clinical staff with unit patient care activities.
4. To perform preventive maintenance on dialysis equipment where it can be demonstrated that such activities minimize the cost, improve the quality of operation and/or reduce the down time and disruption associated with equipment failure.
5. To periodically measure and evaluate the quality of technical services provided to nephrology programs and adjust these services as necessary to maintain established standards.
6. To assist in evaluation of new technology pertaining to dialysis and make suggestions and/or recommendation after evaluation
7. To provide training for the patient, family and nurses in the technical aspects of dialysis in preparation for self-care at home or in a community or hospital-based self-care unit.
8. To ensure that each technologist has the opportunity for professional development and to provide means for periodically appraising this development.
9. To participate in nephrology program administrative activities and ensure cost effective utilization of human and material resources within budgetary control of Technical Services.
10. To initiate or participate in research activities within the scope of nephrology technology and in cooperation with the multi-disciplinary team.

Scope of Practice

The nephrology technologist provides several levels of support depending on the size, location and complexity of the nephrology program.

1. The Nephrology Technologist assumes primary technical responsibility for all medical devices used in the delivery of renal replacement therapies, including but not limited to dialysis machines, reprocessing equipment, water treatment equipment, artificial kidneys, blood lines and related equipment.
2. The Nephrology Technologist may assume responsibilities for medical devices, not strictly related to the Nephrology program, encompassing special therapies such as: Continuous Renal Replacement Therapy (CRRT), Sustained low efficiency dialysis (SLED) and Apheresis, PD heaters, dialysis meters, etc.
3. The Nephrology Technologist participates as required in the clinical set up of dialysis equipment and supplies. Double Needle Dialysis (DND), Single Needle Dialysis (SND), Hemoperfusion (HP) Hemodiafiltration (HDF).
4. The Nephrology Technologist participates in the teaching of staff and individuals with renal failure.
5. The Nephrology Technologist develops and maintains Quality Assurance programs.

6. The Nephrology Technologist implements Continuous Quality Improvement techniques.
7. The Nephrology Technologist participates in administrative and research activities appropriate to their specialty.
8. The nephrology technologist offers direction and guidance where applicable for dialysis therapies.

Standards of Practice

Standard 1 – Qualification Requirement

The Nephrology Technologist shall possess the knowledge and skills necessary to provide comprehensive support to dialysis programs by:

1. Graduating from one of the following: an approved post-secondary program in Electronics, Biomedical Engineering, Nephrology Technology or Applied Sciences.
2. Completing an approved orientation and training program which includes such topics as:
 - a) Anatomy and physiology of the renal system
 - b) Principles of dialysis
 - c) Water treatment
 - d) Dialysis procedures and complications of dialysis
 - e) Membrane technology and dialyser reprocessing
 - f) Haemodialysis systems components: including extra corporeal, hydraulic and electrical/electronic systems
 - g) Computer applications and computer networking technologies
 - h) Safety standards and directives
 - i) Home assessments and requirement, such as well management, etc.
 - j) Applied Sciences: chemistry, human biology, microbiology
 - k) Access flow assessment and measures of dialysis adequacy
 - l) Anticoagulation and coagulometric technologies
 - m) Communication and interpersonal skills
 - n) Introduction to ethical issues impacting on nephrology technical practice
 - o) Introduction to trends and issues related to research
 - p) Continuous Quality Improvement (CQI)

Standard 2 - Regulations

The Nephrology Technologist respects the standards, procedures and policies relevant to the profession and the practice setting and demonstrates accountability in practice by:

1. Practicing within the recognized scope of the technology.
2. Functioning within the specifications of the relevant technical standards- Canadian Standards Association (CSA), Worker Safety Insurance Board (WSIB), Accreditation, Workplace Hazardous Material Information Systems (WHMIS), etc.
3. Following established policies in reference to maintenance of records, use of medications, reporting of unusual incidents.
4. Exercising professional judgement in carrying out technical support activities.
5. Checking those standards, policies and procedures with the Continuous Quality Improvement Program.

Standard 3 – Law and Ethics

The Nephrology Technologist demonstrates ethical practice by:

1. Respecting the rights of the patient and family in reference to confidentiality, privacy, beliefs and values.
2. Promoting a safe work environment for patient and health care provider alike.
3. Reporting unsafe practices to direct supervisor or others as indicated
4. Acting as an advocate on behalf of the patient and family to ensure beliefs, values and wishes are communicated and considered.
5. Promoting informed consent by collaborating with health team members to provide unbiased information through education and support for the patient and their family.
6. Maintaining standards of technical practice and professional behaviour as determined the practice setting, CANNT, and by national and/or provincial professional associations, such as OACETT, CTTAM, TechNova, etc.
7. Advocating on behalf of the nephrology patient population to ensure delivery of safe, adequate and appropriate services, regardless of individual status.

Standard 4 – Professional Development

The Nephrology Technologist assumes primary responsibility for acquiring and maintaining competency in Nephrology Technical Practice and demonstrates a commitment to on-going professional development by:

1. Attending national and regional symposiums such as those sponsored by CANNT and NANT.
2. Attending networking luncheons and healthcare facility lunch & learns.
3. Attending continuing education programs related to trends and issues in nephrology technology.
4. Becoming a member of a national/provincial professional association
5. Acquiring recognized dialysis certification through the Canadian Board of Examiners for Biomedical Engineering and Dialysis Technologists and Technicians (CBET/cdt).
6. Becoming a contributor for a peer-reviewed journal, such as the CANNT Journal.
7. Articulating an awareness of current technological and professional issues impacting on technical practice.
8. Identifying and acting on learning/education needs in order to maintain competence in technical practice.
9. Participating in change by adapting and contributing new knowledge and skills to nephrology technical practice.

Standard 5 – Contribution to the Multi-disciplinary Team

The Nephrology Technologist shares unique knowledge and skills with others by:

1. Participation in and/or initiation of education programs designed for technical and other health care personnel.
2. Participation in clinical rounds, conferences and seminars.
3. Collaborating and consulting with other members of the multi-disciplinary health care team.
4. Contributing to concurrent sessions at conferences and seminars and sharing information through poster presentations, publications etc.

Standard 6 – Quality Assurance

The Nephrology Technologist provides expertise in the development of quality assurance programs for dialysis equipment and technical procedures by:

1. Developing and/or implementing methods to test and verify that equipment performs within the parameters set by facility policies, Canadian Standards Association (CSA), International Organization for Standardization (ISO) and the manufacturer's specifications.
2. Performing preventive maintenance and electrical inspections on all equipment following recommendations and frequency set by manufacturer, CSA and the facility.
3. Performing repairs according to established procedures and verifying operational safety prior to release.
4. Maintaining accurate documentation.
5. Participating in clinical/ technical evaluations of equipment.
6. Researching and evaluating new procedures and products and reporting internally and externally if appropriate.
7. Reviewing unit policies and procedures to ensure they are relevant and up to date in accordance to manufacturers notification

APPENDIX I

Quality Assurance Testing

The Quality Assurance Program for nephrology equipment and procedures is recommended to include but shall not be limited to, the following tests:

HAEMODIALYSIS:

1. Approved residual testing for specific chemicals used
2. Analysis of dialysate electrolytes after all calibrations
3. Microbiological testing of dialysate as per CSA-ISO Standards
4. Routine testing and calibration of haemodialysis machines as required by the manufacturer and CSA
5. Routine testing and calibration of diagnostic equipment as per manufacturer and CSA

WATER TREATMENT FOR HAEMODIALYSIS:

1. Analysis of feed and treated water for organic, inorganic and micro-biological (bacteria and endotoxin) contaminants on a regular basis
2. Quality testing of the water purification system to ensure inclusion of all appropriate components and inert materials required for the final product water to be within CSA-ISO Standards
3. Disinfection and residual testing of water treatment systems and supply lines
4. Routine inspection for corrosion/degradation of materials
5. Consultation with manufacturers, CSA-ISO Standards, and other expert sources prior to modifying or redesigning existing water treatment systems in order to ensure compatibility of components and materials and to ensure that the system is appropriate for the feed water parameters
6. Chemical analysis of water treatment system components in order to verify safe on-going function. (For example: monitoring for carbon exhaustion as per CSA-ISO Standards).
7. Water verifications for pyrogens and other water contaminants

PEDIATRIC HAEMODIALYSIS:

1. Verification of combined extracorporeal blood volume (all extracorporeal devices including blood lines) to ensure appropriate volume for body weight
2. Appropriate selection and regular inspection of chair and bed scales to ensure accurate monitoring of individuals with low body weight, paying attention to the stability of extraneous items during interdialytic weight monitoring
3. Appropriate selection and regular inspection of fluid removal systems to ensure accuracy for individuals with low body weight
4. Appropriate selection and regular inspection of blood pumps to ensure occlusion, calibration and accuracy for various types of blood lines used in pediatric dialysis

5. It is recommended that the Nephrology Technologist providing technical support in conjunction with pediatric clients should be aware of the special needs of infants, children and adolescents.

APPENDIX II CSA-ISO Standards

It is recommended that the nephrology technologist use the following standards available from the Canadian Standards Association:

1. *CAN/CSA-C22.2 NO. 60601-2-16-09 - Medical electrical equipment - Part 2-16: Particular requirements for basic safety and essential performance of haemodialysis, haemodiafiltration and haemofiltration equipment (Adopted IEC 60601-1-2008, third edition, 2008-04)*
2. *CAN/CSA-ISO 8637- 1:21 and 2:21 – Extracorporeal systems for blood purification. Cardiovascular implants and extracorporeal systems - Haemodialysers, haemodiafilters, haemofilters and haemoconcentrators (Adopted ISO 8637:2010, third edition, 2010-07-01)*
3. *CAN/CSA-ISO 8638:12 (R-2017) - Cardiovascular implants and extracorporeal systems - Extracorporeal blood circuit for haemodialysers, haemodiafilters and haemofilters (Adopted ISO 8638:2010, third edition, 2010-07-01)*
4. *CSA Z364.5:22 Safe Installation and Operation of Hemodialysis and Peritoneal Dialysis in a Home Setting*
5. *CSA Z364.2.1-13(R-2018) - Monitoring systems for hemodialysis equipment*
6. *CSA Z32-21 - Electrical safety and essential electrical systems in health care facilities*
7. *CSA Z317.1:21 - Special requirements for plumbing installations in health care facilities*
8. *ISO/DIS 23500-1:20 - Preparation and quality management of fluids for haemodialysis and related therapies - part 1: General requirements (with Canadian deviations)*
9. *ISO/DIS 23500-2:20 – Part 2: Water treatment equipment for haemodialysis applications and related therapies*
10. *ISO/DIS 23500-3:20 – Part 3: Water treatment equipment for haemodialysis and related therapies*
11. *ISO/DIS 23500-4:20 – Part 4: Concentrates for haemodialysis and related therapies (Adopted ISO 13958::2009, second edition, 2009-04-15)*
12. *ISO/DIS 23500-5:20 – Part 5: Quality of dialysis fluid for haemodialysis and related therapies (Adopted ISO 11663:2009, first edition, 2009-04-15)*

Sources of Information:

Canadian Standards Association - Central

178 Rexdale Boulevard
Rexdale, ON M9W IR3
Telephone (416) 747-4044
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Canadian Standards Association - Eastern

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APPENDIX III

CANNT Standards of Technical Practice for Home Dialysis

Note: This document had been superseded by the newly created CSA standard- *CSA Z364.5 Safe Installation and Operation of Hemodialysis and Peritoneal Dialysis in a Home Setting*. It was thus determined that the standard be removed from the *CANNT Nephrology Technical Standards of Practice* and be appended for use as a reference document.

Introduction

Nephrology technologists play an integral role in the care of patients with End Stage Renal Disease (ESRD) who choose the home dialysis modality. In the home dialysis environment, the technologist ensures that the equipment, home installation and methods used in treatments are safe, effective and in accordance with accepted standards of practice. The technologist shares a common goal with other nephrology professionals, which is to provide quality care by working effectively as part of the multi-disciplinary team. In an effort to provide quality care, the nephrology technologist has a responsibility to remain current and competent in accordance with the CANNT Standards for Nephrology Technical Practice through recognized training and continuing self-directed education.

The CANNT Standards for Nephrology Technical Practice provide direction for dialysis treatment. To these practice standards, other critical elements are added in the context of the home environment - electrical, water supply and equipment requirements; patient training; documentation; supplies/storage and hazardous waste management. The *CANNT Standards of Technical Practice for Home Dialysis* provide guidelines for implementing and executing this knowledge, by identifying the minimum professional and practice expectations required.

The *Standards of Technical Practice for Home Dialysis* are intended to:

- Identify goals for the nephrology technologist supporting patients on a home dialysis modality
- Define and promote quality in home dialysis, by outlining qualification requirements and by providing a “scope of practice” statement.
- Reflect changes and advancements in technology through regular updates of standards.

Home Dialysis - Description

Home dialysis is a specialized area of technical practice which provides expert support to home dialysis programs and patients in both haemodialysis and peritoneal dialysis.

Haemodialysis:

Support for adult home haemodialysis programs is the largest component of the role, as haemodialysis utilizes the most sophisticated technology. The role of the technologist within the home dialysis program encompasses; preventive maintenance, troubleshooting and repair of all associated equipment, product evaluation, clinical support and education of staff and individuals with CKD. The emphasis is on making home treatment a safe modality for the patient.

The technologist requires knowledge in the preparation and operation of the entire home setup with expertise in the following areas:

- Home evaluation for equipment installation
- Plumbing and electrical installations
- Water treatment system installation
- Home dialysis procedures
- Haemodialysis systems components: including extra corporeal, hydraulic and electrical/electronic systems
- Computer applications and networking technologies
- Documentation of equipment function indicators
- Applied chemistry, applied microbiology, human biology
- Common complications of dialysis in the home environment
- Social component of dealing with patients in their home

Peritoneal Dialysis:

- Support for home peritoneal dialysis is less intensive, as the role generally entails: Incoming inspection of the peritoneal dialysis machine
- Electrical installations for home treatment equipment
- Patient/family training and education

Goals for Home Dialysis

1. To provide expertise related to the management of dialysis equipment and related technology in the home environment.
2. To assist in evaluation of new technology pertaining to home dialysis and make suggestions and/or recommendation after a comprehensive evaluation.
3. To work with medical and nursing staff to ensure coordination of technical service for the home dialysis program.

4. To provide on-going performance testing of home dialysis equipment in an effective and consistent manner, thereby ensuring compliance with manufacturer's specifications and other current standards.
5. To perform preventive maintenance on home dialysis equipment where it can be demonstrated that such activities minimize the cost, improve the quality of operation and/or reduce the down time and disruption associated with equipment failure.
6. To periodically evaluate the quality of technical services provided to home dialysis programs and adjust these services to improve unit standards.
7. To provide technical training for the patient and family in preparation for self-care at home.
8. To initiate or participate in research activities within the scope of nephrology technology and in cooperation with the multi-disciplinary team.

Standard 1 – Electrical requirements

The Nephrology Technologist will have a thorough understanding and knowledge of the electrical requirements of all dialysis related equipment and will ensure that the electrical installations for home dialysis equipment are safe and have been performed by a qualified electrician. To this end the Nephrology Technologist will:

1. Educate local electrical contractors on the requirements of the medical equipment:
 - a) The electrical outlets will meet local code (verified by contractor),
 - b) The electrical outlets will meet CSA standards for medical devices,
 - c) The electrical connections to/from equipment will be of a proper length and will be placed so as not to cause unsafe conditions,
2. Verify all work performed by the electrical contractor and obtain and file necessary documentation.

Standard 2 – Equipment requirements

The Nephrology Technologist ensures that medical equipment for home use has met all safety standards. The equipment must be able to deliver the treatment prescribed. To this end:

1. Both clinical and technical staff must be fully trained on any machines used for home treatment purposes.
2. Home dialysis equipment must meet CSA standards.
3. The equipment manufacturer must have a Health Canada license given by the Health Products and Food Branch (HPFB).
4. If equipment required is not yet released by the HPFB for use in Canada, a request must be made to the Special Access Program to gain access to medical devices not yet approved for sale in Canada.

Standard 3 – Patient Training

The purpose of training is to enable the patient and their family to be competent and confident in performing the dialysis treatment in their home, without clinical or technical personnel present. Technologists are actively involved in providing training to the home patient, which includes, but is not limited to the following areas:

General Principles

1. Basic dialysis theory and the various dialysis modalities available
2. Overview of home installation standards, which includes plumbing and electrical requirements
3. Proper placement, use, testing and consequences of not using safety equipment
4. Supply storage and inventory
5. Proper disposal of medical waste
6. Need for cooperation with professionals and support staff - visits by nurses and technical staff, contractors, delivery personnel, sometimes at inconvenient hours.
7. Reporting procedure and what products need to be returned should defective products be found during a treatment
8. Investigation and documentation of patient injuries and near misses
9. Sharing of new safety protocols with the dialysis community to help ensure the safety and wellbeing of all dialysis patients

Dialysis Machine Training

1. Overview of operation of Haemodialysis machine
2. Basic maintenance, cleaning and disinfection of Haemodialysis machine
3. Interpretation of alarms and basic troubleshooting
4. Monitoring and maintaining log of daily checks before initiating treatment
5. Verification of residual disinfection and dialysate quality
6. Use and placement of leak detectors
7. Use of testing supplies - manual or automated
8. Use of remote monitoring if available or offered

Water Treatment Training

1. Overview of basic operation of water treatment equipment.
2. Basic maintenance, cleaning and disinfection of portable reverse osmosis unit
3. Checking for residual disinfectant in reverse osmosis unit
4. Interpretation of alarms and basic troubleshooting
5. Logging of daily checks before initiating treatment
6. Use and placement of leak detectors
7. Sample taking for testing by patient or local lab

Peritoneal Equipment Training

1. Overview of basic operation of peritoneal equipment (heater, cyclor)
2. Basic maintenance, cleaning and disinfection of peritoneal equipment
3. Interpretation of alarms and basic troubleshooting

Standard 4 – Documentation

The Nephrology Technologist maintains documentation pertaining to dialysis and water treatment equipment installed in the patient's home. All documentation pertaining to the patient, the treatment or the equipment falls under the Protection of the Privacy of Personal Information, according to Canadian law.

The documentation includes, but is not limited to:

1. Record of initial visit to patient's home.
2. Tracking of initial raw water quality and results of annual testing as per CSA-ISO standards.
3. Photos taken during and after equipment installation.
4. Consent for plumbing and electrical modifications, signed by the landlord if patient is not an owner. Photographs of the home installation are required, as well as proof of insurance coverage for leaks and equipment related damages.
5. Water quality testing (monthly and annual) records as per CSA –ISO standards.
6. All service and maintenance records of the dialysis machine and water treatment equipment.
7. Review of records kept by the home patient, regarding equipment operation. These records can be paper copies, but if saved in electronic format, they must be backed-up regularly.
8. Information regarding the contractor or local utility must be kept as well for the duration of the patient's home treatment and afterwards, as per medical record keeping practices.
9. Documentation stating the patient has been trained and is competent in caring for the dialysis machine and water treatment equipment.

Standard 5 – Water Quality

The technologist will ensure that home dialysis water quality meets or exceeds current CSA standards for "water for dialysis". To this end the Nephrology Technologist will ensure that:

1. Components of the portable water treatment system operate properly
2. System monitoring and documentation are performed in a timely manner
3. Tests for chlorine breakthrough and bacterial growth are performed in a correct and timely manner

4. Cleaning and disinfection of the reverse osmosis (RO) unit are performed according to accepted protocols
5. Correct procedure for changing sediment filters is followed
6. Troubleshooting of equipment problems follows safe practices

Reverse Osmosis system (RO) or De-ionization (DI) Water Treatment Systems

- a) *RO system*: A portable RO unit with pretreatment (sediment and carbon filters) is the first choice and primary method of water treatment for home dialysis. This type of system will provide dependable, high quality water at a reasonable cost and is relatively easy to operate and maintain.
- b) *DI tanks*: DI systems are bulky and more expensive over the long term. They require a higher dependency on the water treatment vendor, as tanks have a limited life and must be exchanged or regenerated on a regular basis. It should be noted, however, that DI systems use less water. For this reason, they are a recommended option for certain situations.

Installation and Testing of the Water Treatment System and Dialysis Machine

1. Pre-installation Activities:
 - a) All necessary modifications should be completed prior to the equipment installation date.
 - b) Arrange to have equipment and supplies delivered to the home several days prior to the first scheduled home treatment. This will allow adequate time for installation and testing.
2. Installation Activities
 - a) Measure and cut hoses for the water treatment system and dialysis machine to ensure safe operation and movement.
 - b) Assemble and install the water treatment system, then connect the system to the water and drain supplies.
 - c) It is advantageous to install a large shallow plastic tray underneath the water treatment cart to act as a catch-basin for water leaks.
 - d) Install the dialysis machine in its final location.
3. Testing and Adjustment Activities
 - a) Test the water treatment system for proper operation and leaks and perform any necessary adjustments at this time.
 - b) Check and record the incoming water pressure. If necessary, reduce the pressure to a safe level for the equipment and to prevent channeling in the carbon tank.
 - c) Perform a chlorine test post carbon filter to ensure proper chlorine removal.
 - d) Perform electrical safety checks on the equipment including ground resistance and leakage current.
 - e) Run the dialysis machine, perform functional checks and make adjustments and repairs as needed.

4. Post Installation Activities

- a) Once the equipment has been installed and tested, do a final training session with the patient to confirm that they are comfortable with all aspects of the water treatment system.
- b) Disinfect the equipment.
- c) Take water samples for chemical analysis and microbiology testing as prescribed by CSA.
- d) Ask the patient to sign the “Statement of Receipt and Agreement” document. This acknowledges receipt of capital equipment items on loan from the dialysis centre and that the equipment will be used and cared for as instructed.

5. Water Quality Testing

Total Chlorine (Chlorine + Chloramines):

- a) Chlorine and chloramines are removed from municipal tap water with filters containing granular activated carbon. Carbon tanks regenerated with new carbon should be used.
- b) The patient should perform a test for Total Chlorine **daily** to determine the effectiveness of the carbon tank. The sample should be taken post worker carbon tank and tested using a DPD Total Chlorine test kit or appropriate test strips.
- c) The carbon tank should be replaced if the chlorine test is positive, indicating chlorine levels above 0.1 mg/L. The patient should refrain from using the equipment until the carbon tank has been replaced.
- d) Carbon tank exchange can usually be arranged for the same or following day by either the technologist or water treatment vendor.
- e) The carbon tank should be replaced every 6 months even if no chlorine breakthrough has been detected, as per protocol.
- f) The patient should record the total chlorine test results on the daily log.

Filter Pressures (5-Micron Sediment Filter):

- a) The pre and post pressures should be monitored **daily** by the patient to ensure the filter is not becoming blocked. Suspended particles in the feed water and carbon fines from the carbon tank can clog the RO membrane. The 5-micron filter will prevent most of this material from reaching the RO membrane.
- b) The 5-micron filter should be replaced every 6-weeks or immediately if the pressure drop across the filter is greater than 10 PSI. The patient is responsible for this task.
- c) The patient should record the pressure readings and delta-pressure on the daily log sheet.

RO Product Water Conductivity/ DI Product Water Resistivity:

- a) Pure water is essentially non-conductive and highly resistive. Conductivity is measured in micro-Siemens/cm and resistivity is measured in mega-Ohms/cm. Both are water quality indicators and measure water's ability to conduct electricity.
- b) RO conductivity or DI resistivity should be monitored **daily** by the patient prior to commencing dialysis to ensure that the RO unit or DI tanks are working effectively. Daily checks should be recorded on the log sheet by the patient.
- c) In the event of a conductivity/resistivity alarm, the patient should discontinue treatment and contact the home dialysis technologist. The technologist will arrange a home visit to investigate the problem. If DI tanks are being used, then the water treatment vendor may be contacted to exchange the tanks.

Microbiology Testing - Bacteria Count and Endotoxin Concentration:

- a) The water sample is to be taken from the sample port on the output of the RO or Ultra-filter (for DI systems). The patient must use proper sampling technique as instructed by the technologist.
- b) The CSA-ISO limit for microbial count in product water is 100 CFU/ml with an action level of 50 CFU/ml (colony forming units). The patient is instructed to report readings above 50 CFU/ml to the technologist for further advice and to record all readings.
- c) Product water samples are to be collected **monthly** by the technologist or patient for microbiology testing (bacteria and endotoxin) in compliance with CSA-ISO standard. The CSA-ISO limit for endotoxin (pyrogens) in product water is 0.25 EU/ml (endotoxin units) with an action level of 0.125 EU/ml.

Chemical Analysis of Organics and Inorganics:

- a) Product water samples should be collected **annually** by the technologist and sent to an accredited laboratory for a complete analysis of organic and inorganic content.
- b) Results of this analysis should be reviewed for compliance with CSA-ISO standards and a copy should be kept on file.
- c) Feed water must comply with federal and provincial standards for drinking water and should be tested for compliance, as per CSA guidelines.

Standard 6 – Space requirements

The technologist will ensure that adequate space exists for the patient's chair/bed, dialysis machine and water treatment equipment. This includes "move around room" during periodic equipment maintenance. Adequate height, lighting and ventilation requirements need to be assessed and addressed. It is essential that there be safe access for Emergency staff (EMS) during a potential crisis.

Standard 7 – Supply Storage

The Nephrology Technologist provides operational expertise for proper storage of medical supplies.

1. Medical supplies:
 - a) Must be at safe height for patient reach to avoid strain and possible injuries.
 - b) Must be off the floor to avoid cold exposure and water damage.
2. Bulk supplies i.e.: concentrate, peritoneal solutions:
 - a) Must be at safe height for patient reach to avoid strain and possible injuries.
 - b) Must be stored at room temperature; cold storage room can cause degassing of liquid supplies and/or crystallization.
 - c) Must be delivered in amounts appropriate to patient use, in order to prevent over-stocking and expiration.

Standard 8 – Hazardous Waste Management

The Nephrology Technologist will ensure the patient has a working knowledge of proper storage and disposal of hazardous wastes. This will protect the patient, health care worker and other family members, as well as meeting local municipal waste disposal requirements. To this end, the nephrology technologist will provide training in:

1. Disposal of Sharps
 - a) Appropriate container for used sharps is available.
 - b) Appropriate demonstration of use of sharps container is provided.
 - c) Proper disposal of sharps container according to local municipal regulations.
2. Storage of Chemicals and Cleanup of Spills
 - a) Spill resistance container is used for all disinfectants.
 - b) WHMIS training is provided to the patient and family.
 - c) MSD (Material Safety Data) sheets are updated and stored safely for easy reference.
 - d) Cleanup of chemical spills is demonstrated to patient so that safe handling and disposal is used.

Standard 9 - Patient safety

The Nephrology Technologist will ensure the patient and family have a good knowledge of home dialysis safety policies. This would include proper placement, use, operation and testing of safety equipment and possible consequences for incorrect use. To this end, the nephrology technologist will:

1. Ensure that the patient and family have been instructed and practiced an escape route in case of fire, flooding, and other natural disasters.
2. Ensure that the treatment space is free of visible dust, mold, and is adequately lit and that there is enough ventilation and height in the patient's treatment room.
3. Ensure the correct placement of safety equipment such as:
 - a) *Enuresis alarms*: These will be used on the patient's access to warn of a blood leak due to a loose needle or incorrect connection of a central line. The patient should be informed that a dialysis machine will not necessarily alarm if a venous needle becomes dislodged.
 - b) *Audio water detector alarms*: These will be utilized to detect possible blood, water or dialysate leaks. Each patient should be issued four alarms and spare batteries. One water detector will be placed on the front base of the dialysis machine where the acid jugs sits during the treatment. This detector should be tested before use and placed on the machine base after the machine has been primed and any excess fluid spilled there is cleaned up. This detector will alarm if a leak occurs in the blood tubing on the front of the dialysis machine. A second alarm should be tested and placed under the dialyser during treatment. This alarm will indicate a leak either of blood or dialysate that might occur during treatment. The third and fourth alarms should be situated under the dialysis machine and the RO system to detect water leaks if they should occur.
 - c) *A light source such as a night light*: This will remain on during the night for patients on nocturnal treatment. It should illuminate the front of the machine and the machine should be angled so that the front is visible during the treatment. This would allow the patient to see any blood leakage or other problems with the blood tubing during the night.
 - d) *An emergency kit*: This kit should contain emergency disconnect supplies, a flashlight and emergency contact numbers, as well as any other supplies that might assist in an emergency and be within easy reach during treatments.