

**NorthStar Medical Radioisotopes, LLC  
RadioGenix™ Molybdenum-99/Technetium-99m Generator System**

**Licensing Guidance for Medical Use Licensees, Medical Use Permittees, and Commercial  
Nuclear Pharmacies**

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**U.S. Nuclear Regulatory Commission Contact**  
Donna-Beth Howe (301) 415-5441  
[MedicalQuestions.Resource@nrc.gov](mailto:MedicalQuestions.Resource@nrc.gov)

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## Introduction

Technetium-99m is the radionuclide used for millions of diagnostic nuclear medicine patient scans performed each year in the United States. This guidance is specific to NorthStar RadioGenix™ Molybdenum-99/Technetium-99m Generator System (hereafter the RadioGenix™ System) (Mo-99/Tc-99m). It only applies to medical licensees or commercial nuclear pharmacy licensees that possess and use the RadioGenix™ System to produce Tc-99m. The Tc-99m produced by the RadioGenix™ System is interchangeable with Tc-99m produced by existing fission generated Tc-99m when used for the preparation and use of radiopharmaceuticals under the provisions of Title 10 *Code of Federal Regulations* (10 CFR) 35.200, "Use of unsealed byproduct material for imaging and localization studies for which a written directive is not required." This guidance does not apply to medical use or commercial nuclear pharmacy licensees or applicants that only elute fission-based Mo-99/Tc-99m generators or only receive unit or bulk doses of Technetium-99m radiopharmaceuticals, rather than use the NorthStar RadioGenix™ System.

The NorthStar RadioGenix™ System is a device designed as a closed system to contain, move, and shield all Mo-99 (as a mixture of radioactive Mo-99/Tc-99m and nonradioactive Mo-98 or Mo-100) during a computer driven process of isolating Tc-99m from Mo before delivering Tc-99m into an elution vial. The Mo in this system is not derived from the fission of uranium and requires a different system to isolate and concentrate the Tc-99m than the existing fission Tc-99m generators.

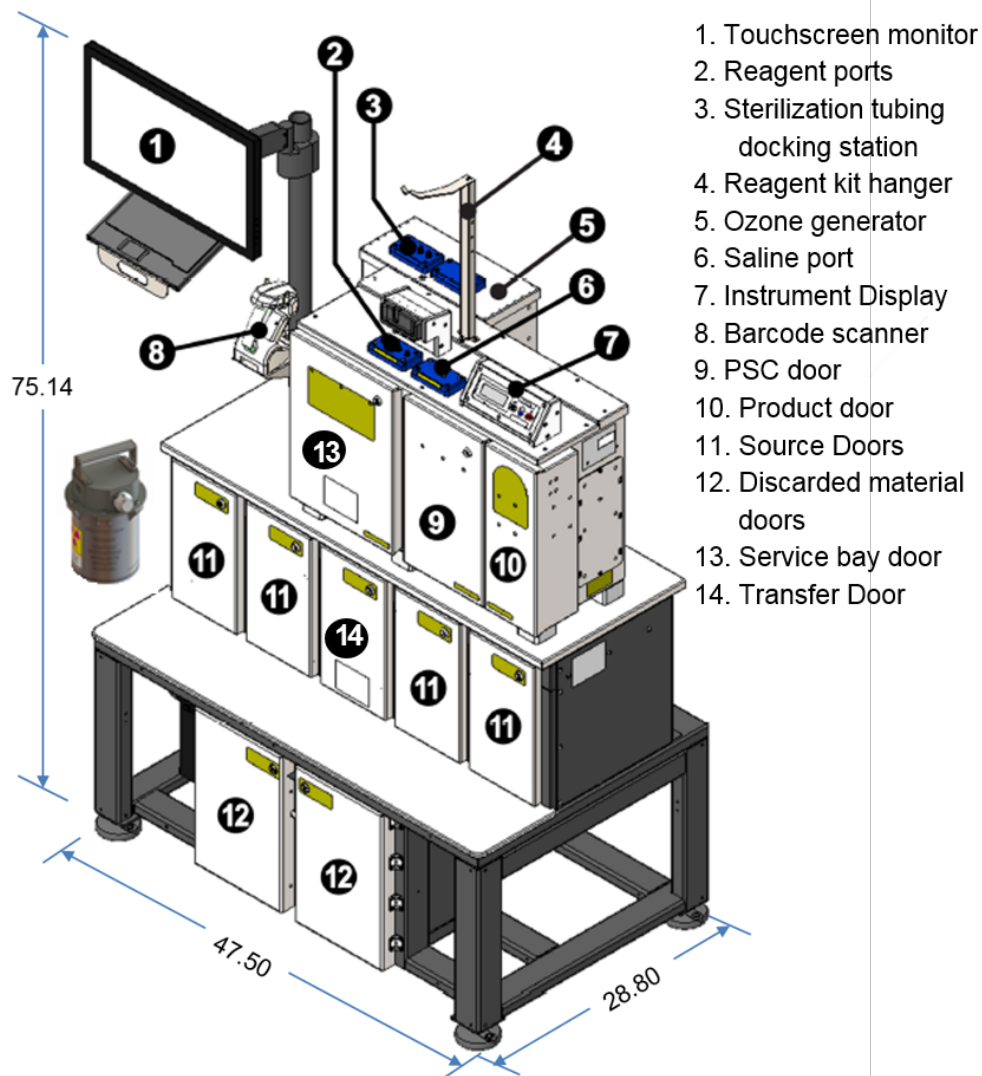


Figure. The NorthStar RadioGenix™ Mo-99/Tc-99m Generator System with the major components labeled. The radiation transport vessel on the left, next to cabinet 11, is approximately the same size as a conventional generator containing fission-produced Mo-99. The generator system weighs 3,011 pounds and is approximately 48 inches wide, 29 inches deep, and 75 inches tall.

### Mo/Tc flow through the NorthStar RadioGenix™ Mo-99/Tc-99m Generator System

- The Mo/Tc liquid is received inside its shielded radiation transport vessel (source vessel) which is placed in one of the four “Source” bay cabinets (the two outer cabinets on the middle row of cabinets).

- The vessel is connected to tubes to move the Mo/Tc liquid by computer driven valves and a syringe pump located behind the “Service Bay” door.
- The Mo/Tc is moved to the “PSC” cabinet where various chemical solutions (located on top of the “PSC” cabinet) react with the Mo/Tc solution and column to make the Mo pass through the first chromatographic column in “PSC” cabinet.
  - The Mo goes to the “Transfer” cabinet.
  - The Tc-99m adheres to the column
- Additional chemical solutions are used to wash the Tc-99m from the first column and then through a second column in the “Product” cabinet into the Tc-99m collection vial.
- The various chemical washes are pumped through valves to one of the two “Discard Material” cabinets on the bottom row.
- At the end of the process the Mo is returned to the source transport vessel for reuse.
- Once the Mo-99 is no longer usable or reaches its expiration date, it is returned in the source transport vessel to the manufacturer.

## **Protocol**

The term “protocol” used by NorthStar and in this guidance refers to discrete portions of the software program that focus on performing a specific function. In order to perform these protocols, the operator must perform specific operational tasks in conjunction with the software running the RadioGenix™ series of pumps and operational steps. The protocols for initialize system, add/change reagent kit, add source vessel, produce Tc-99m, remove source vessel, sterilization, and exchange used reagent container all involve opening the shielded doors, or handling and disposal of radioactive materials and potentially contaminated components.

## 1. 10 CFR 35.1000 Use

The engineering specifications for the materials and components of the NorthStar RadioGenix™ System are designed to maintain the entire device's integrity as a closed system, withstand high radiation fields for extended periods, and maintain adequate shielding of the radioactive material when all ten cabinet doors are closed, latched, and secured, as well as when the supplemental shielding is in place. Built-in safety features are designed to ensure that if the device fails, the radioactive material will remain shielded. The System is designed and constructed such that its components and operation differ significantly from conventional Mo-99/Tc-99m generators using fission-produced Mo-99 regulated in 10 CFR Part 35, Subpart D, "Unsealed Byproduct Material-Written Directive Not Required."

Examples of the unique features that differentiate the RadioGenix™ System from fission-produced Mo-99/Tc-99m generators regulated in 10 CFR Part 35, Subpart D, include the following:

- Licensee receives the source vessel with the liquid Mo containing Tc-99m daughter products that are both specifically produced for NorthStar;
- Licensee adds new and removes old source vessels from the system;
- Licensee, not the manufacturer, performs the automated steps to process the low specific activity Mo liquid solution to isolate and concentrate the Tc-99m for medical use;
- Materials move by the computer driven syringe pump through a multichannel distribution valve;
- Routine licensee replacement of the first chromatography column, which is the column that captures the Tc-99m;
- Routine licensee replacement of the second chromatography column, which is the column that captures the residual Mo;
- Routine ozone sterilization procedures; and
- Both liquid radioactive and non-radioactive waste solutions used in the isolation of the Tc-99m are collected and held for decay in the device before disposal.

As a result of these unique features, the NorthStar RadioGenix™ System is regulated under 10 CFR Part 35, Subpart K, "Other Medical Uses of Byproduct Material or Radiation from Byproduct Material."<sup>1</sup> Therefore, this licensing guidance applies to the medical use applicants and licensees that request or possess the NorthStar RadioGenix™ System.

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<sup>1</sup> Medical Uses of Byproduct Material Licensed under 10 CFR 35.1000 are designated as Compatibility Category D. Agreement States are not required to adopt these regulations, but are not prohibited from adopting Compatibility Category D regulations if they so choose. Therefore, the Agreement States are not required to adopt guidance promulgated pursuant to this regulation, but are not prohibited from adopting the guidance.

## **2. Commercial Nuclear Pharmacy Use under 10 CFR 30.33**

The unique design, construction, materials specifications, and use features that differentiate the RadioGenix™ System from a conventional fission Mo-99/Tc-99m generator results in the need for additional information and commitments that are not required to safely use a conventional fission Mo-99/Tc-99m generator. Therefore, a commercial nuclear pharmacy that is not specifically authorized for the RadioGenix™ System will not meet the requirements in 10 CFR 30.33, “General requirements for issuance of specific licenses,” without providing additional training and experience for individuals, and making certain commitments to address specific training and safety provisions. This licensing guidance also applies to the commercial nuclear pharmacy licensees and applicants for possessing the RadioGenix™ Generator System and all sections of this guidance pertain to the commercial nuclear pharmacy applicant unless specified otherwise.

## **3. Licensing Guidance**

This guidance provides applicants with an acceptable means of satisfying the requirements for a license for the use of the RadioGenix™ System and is not intended to be the only means of satisfying requirements for a license. The applicant must submit the information required by 10 CFR 30.33 and 35.12, as described below. The applicant should submit additional information and the commitments requested below or may, unless the information is specifically required by regulation, submit alternative information and commitments for review by the U.S. Nuclear Regulatory Commission (NRC) staff to make a licensing determination. The commitments incorporated into the applicant’s license by license condition will be reviewed during routine inspections.

Applicants are reminded that licenses issued pursuant to 10 CFR 35.1000 must still meet the general requirements in Part 35, Subparts A, B, C, L, and M, except as specified in this guidance. In addition, several provisions in Subpart D are appropriate for use of the RadioGenix™ System, as discussed below. Commercial nuclear pharmacy applicants must meet the requirements in 10 CFR 32.72. Additionally, both medical use and commercial nuclear pharmacy applicants must meet applicable requirements of 10 CFR Parts 19, 20, and 30.

## **4. General**

### **4.1. Sensitive Security-Related Information:**

Certain sensitive security-related information such as information about quantities and locations of radioactive materials at licensed facilities is no longer released to the public. Submission of this type of information in an application should be marked as specified in Regulatory Issues Summary (RIS) 2005-31, available at:

<http://www.nrc.gov/reading-rm/doc-collections/gen-comm/reg-issues/2005/ri200531.pdf>.

Additional information on procedures for handling and marking security-related information and any updates are available at: <http://www.nrc.gov/reading-rm/sensitive-info.html>.



#### 4.2. Radionuclides, Form, Possession Limits, and Purpose of Use:

The applicant shall identify the radionuclides, chemical/physical form, requested maximum possession limit, and purpose of use. NRC Form 313, "Application for Materials License," may be used to submit this information. For example, the following provides the format for an acceptable request.

##### Radionuclides, Form, Possession Limits

|   |  |
|---|--|
| <b>Radionuclides:</b><br>(NRC Form 313 Item 5)            | A. Mo-99/Tc-99m<br>B. Depleted Uranium   |
| <b>Chemical/Physical Form:</b><br>(NRC Form 313 Item 5)   | A. Liquid Mo-99/Tc-99m produced by NorthStar to be used in the NorthStar RadioGenix™ System<br>B. Metal  |
| <b>Maximum Possession Limit:</b><br>(NRC Form 313 Item 5) | A. 7.5 curies of Mo-99/Tc-99m per source vessel, not to exceed 40 curies total (includes waste and decayed source vessels)<br>B. 162 kilograms total   |
| <b>Purpose:</b><br>(NRC Form 313 Item 6)                  | A. For 10 CFR 35.1000 medical use elution of Tc-99m in a NorthStar RadioGenix™ System (or for the commercial nuclear pharmacy - elution of Tc-99m in a NorthStar RadioGenix™ System).<br>B. For shielding in a NorthStar RadioGenix™ System. |

#### 4.3. Facility Address and Description [10 CFR 30.33(a)(2) and 10 CFR 35.12(b)(1)]

Provide an address of use and submit a facility diagram and description of the location where the RadioGenix™ System will be used, and any other areas where the radioactive materials associated with the RadioGenix™ System will be stored. This information should include a description of adjacent areas and rooms both above and below the unit, whether the areas and rooms are unrestricted or restricted, a description of any shielding, and include shielding calculations, if necessary.

#### 4.4. Posting Requirements

The RadioGenix™ System is subject to the posting requirements in 10 CFR 20.1902. The unit produces a non-uniform radiation field while it is being operated. Therefore, the applicant needs to be aware that, at different times during set up and the Tc-99m production processes, and in different areas around the unit, there may be radiation areas and high radiation areas that need to be posted. If the RadioGenix™ System can be accessed on all sides, then appropriate radiation markings and controls will be needed for each accessible side.

#### 5. Training and Experience

Under 10 CFR §§ 30.33 and 35.12, the applicant must submit documentation of the training and experience for the authorized individuals and the Radiation Safety Officer (RSO). The applicant

must provide commitments describing the training and experience for the supervised individuals operating the RadioGenix™ System, the RadioGenix™ System Administrator, and the RadioGenix™ System Administrator Designee.

### 5.1. Authorized Individuals [10 CFR 30.33(a)(3) and 10 CFR 35.12(b)(1)]

The NRC has determined that individuals meeting the guidance provided below will be considered qualified and can be authorized for the use of the RadioGenix™ System. Applicants may also submit alternative training and experience commitments to be reviewed on a case-by-case basis by NRC staff. The alternative information should include an explanation of why the applicant believes the alternative information demonstrates that the individuals are qualified to be authorized individuals. Identify each individual for whom the applicant is seeking recognition as an authorized individual (**physician authorized users (AUs) and authorized nuclear pharmacists (ANPs)**) of the RadioGenix™ System and provide documentation of his/her training and experience. NRC Form 313A (AUD), "Authorized User Training and Experience and Preceptor Attestation for uses defined under 35.200 and 35.300," and NRC Form 313A (ANP), "Authorized Nuclear Pharmacist Training and Experience and Preceptor Attestation [10 CFR 35.55]" or other formats may be used to document this training and experience. If qualified, the authorized individual will be listed on the license as authorized for the RadioGenix™ System. The individual will be considered qualified for use of the RadioGenix™ System if the licensee demonstrates that the individual meets the following:

The individual:

A. Is identified:

- (1) As an **authorized user** on (1) a Commission or Agreement State medical use license, or (2) a medical use permit issued by a Commission or Agreement State broad scope licensee or master material licensee, or a master material license permittee of broad scope for medical uses in 10 CFR 35.200, "Use of unsealed byproduct material for imaging and localization studies for which a written directive is not required," or 10 CFR 35.300, "Use of unsealed byproduct material for which a written directive is required," provided the authorized user successfully completed the requirements in 10 CFR 35.290(c)(1)(ii)(G); or
- (2) As an **authorized nuclear pharmacist** on one of the following that authorizes medical use or the practice of nuclear pharmacy: a Commission or Agreement State license, or a permit issued by a Commission or Agreement State broad scope licensee or master material license permit, or by a master material license permittee of broad scope, or is identified as an authorized nuclear pharmacist by a commercial nuclear pharmacy authorized to identify authorized nuclear pharmacist;

**OR**

B. Meets the requirements in 10 CFR 35.59, "Recentness of training and:

- (1) 10 CFR 35.290, "Training for imaging and localization studies," or 10 CFR 35.390, "Training for use of unsealed byproduct material for which a written directive is required," and 10 CFR 35.290(c)(1)(ii)(G), or
- (2) 10 CFR 35.55, "Training for an authorized nuclear pharmacist," or

- (3) A physician who can be authorized for 10 CFR 35.200 medical uses or a nuclear pharmacist who can be authorized as an authorized nuclear pharmacist under the provisions of 10 CFR 35.57, "Training for experienced Radiation Safety Officer, teletherapy or medical physicist, authorized medical physicist, authorized user, nuclear pharmacist, and authorized nuclear pharmacist."

**AND**

- C. In A. or B. above, has successfully completed the following training and experience provided at a facility authorized to have a RadioGenix™ System using a fully functional generator connected to a Mo-99/Tc-99m source vessel and producing Tc-99m.
- (1) Training in the RadioGenix™ System operation, safety, and emergency procedures. This training shall be provided by NorthStar or an individual certified by NorthStar to provide the training, and
- (2) Perform each of the protocols (i.e., initialize system, produce Tc-99m, add/change reagent kit, exchange used reagent container, remove source vessel, and sterilization) at least three times in the physical presence of a NorthStar representative or an individual certified by NorthStar to proctor all the protocols. The four protocols ("sterilization," "add source vessel," "remove source vessel," and "add/change reagent kit") may be performed using a "dummy source vessel" (i.e., a vessel that does not contain radioactive material) provided the vessel contains material that can be detected in the event of loss of control of the liquid, e.g., contamination, leaks or spills. The "sterilization" and "add/change reagent kit" protocols do not involve the movement of Tc/Mo from the source vessels so they may be performed without an active source vessel.

**AND**

- D. In A. or B. above, obtains a written attestation, that he/she has satisfactorily completed the requirements in C(1) and C(2) of this section and is able to independently operate and perform the radiation safety related duties of an authorized individual for the RadioGenix™ System. The written attestation must be dated and signed and it should be signed by NorthStar or an individual certified by NorthStar to provide the training and proctor the protocols. Because there were no units of the RadioGenix™ System approved for medical use or commercial nuclear pharmacy use in the United States at the time this licensing guidance was published, there are no preceptors other than NorthStar and individuals certified by NorthStar to provide the training and proctor the protocols available to sign attestations. Therefore, the NRC is postponing requiring a written attestation from others until February 2023 (5 years after issuance of this guidance). NRC will continue to review the availability of preceptors and may revise this guidance if it determines that sufficient preceptors have become available.

## **5.2. Radiation Safety Officer**

The NRC has determined that individuals meeting the guidance provided below will be considered qualified to be the RSO for the RadioGenix™ System. Applicants may also submit alternative training and experience commitments to be reviewed on a case-by-case basis by NRC staff. The alternative information should include an explanation of why the applicant believes the alternative information demonstrates that the individuals are qualified to be the RSO. Identify the individual for whom the

applicant is seeking recognition as the RSO. If qualified, the individual will be listed on the license as the RSO authorized for the RadioGenix™ System. The individual shall be considered qualified to be the RSO for the RadioGenix™ System if the licensee demonstrates that the individual meets the following:

- A. (1) Is identified as a RSO on a Commission or Agreement State medical use or commercial nuclear pharmacy license or a medical use permit issued by a Commission master material license, or
- (2) Meets the criteria in 10 CFR 35.59, "Recentness of training," and is certified by a recognized specialty board listed on NRC's web site under 10 CFR 35.50, "Training for Radiation Safety Officer," or in 10 CFR 35.57, "Training for experienced Radiation Safety Officer, teletherapy or medical physicist, authorized medical physicist, authorized user, nuclear pharmacist, and authorized nuclear pharmacist," or
- (3) Meets the criteria in 10 CFR 35.59 and 10 CFR 35.50(b)(1), 35.50(c)(1), or 35.50(c)(2),

**AND**

- B. Successfully completed the following training and experience provided at a facility authorized to possess a RadioGenix™ System using a fully functional generator connected to a Mo-99/Tc-99m source vessel and producing Tc-99m:
  - (1) Training in the radiation safety, regulatory issues, administrative controls, and emergency procedures for the RadioGenix™ System. This training shall be provided by a NorthStar representative or an individual certified by NorthStar to provide the training, and
  - (2) Satisfactorily practice the emergency procedures applicable to the RSO at least once in the physical presence of a NorthStar representative or an individual certified by NorthStar to proctor the emergency procedures appropriate for an RSO,

**AND**

C. The proposed Radiation Safety Officer must obtain a written attestation that he/she has satisfactorily completed the requirements in B(1) and (2) of this section, and is able to independently perform the radiation safety related duties of a RSO for the RadioGenix™ System. The written attestation must be dated and signed by NorthStar or an individual certified by NorthStar to provide the training and proctor the emergency procedure. Because there were no units of the RadioGenix™ System approved for medical use or commercial nuclear pharmacy use in the United States at the time this licensing guidance was published, there are no preceptors other than NorthStar and individuals certified by NorthStar to provide the training and proctor the emergency procedure tasks available to sign attestations. Therefore, the NRC is postponing allowing written attestations from others until February 2023 (5 years after issuance of this guidance). The NRC will continue to review the availability of preceptors and may revise this guidance if it determines that sufficient preceptors have become available.

### **5.3. Supervised Individuals Operating the RadioGenix™ System [10 CFR 30.33(a)(3) and 10 CFR 35.27 ]**

The NRC has determined that individuals may work under the supervision of an authorized individual. The applicant shall commit to provide training to all supervised individuals working under an authorized individual in the operation of any component or handling of licensed material associated with the

RadioGenix™ System commensurate with the individual's duties to be performed. To provide flexibility for the licensee, these individuals operating the RadioGenix™ System will not be listed on the license.

The applicant must commit that any individual that performs protocols shall receive the training and hands-on experience listed in the "Authorized Individuals" training and experience paragraphs C (1) and (2).

Under the guidance, the applicant must commit that the records of the successful completion of each protocol training and experience shall be maintained for 3 years after the individual is no longer working under the supervision of an authorized individual. The record must include a list of the topics covered, the date of the instruction, the name(s) of the attendee(s), and the name(s) of the individual(s) who provided the instruction.

#### **5.4. RadioGenix™ System Administrator and RadioGenix™ System Administrator Designee [10 CFR 30.33(a)(3)]**

The RadioGenix™ System is fully computer driven with specific protocols that must be performed in a set sequence and by individuals with specific radiation safety training and experience for each protocol. Because of this, the RadioGenix™ System software application limits what protocols can be initiated and the software hierarchy allows a System Administrator (system administrator account) to assign what protocols an individual with an account (i.e., user account) can initiate.

The applicant is responsible for ensuring that an individual initiating a protocol meets the training and experience outlined in this guidance for that protocol. NRC recognizes that the System Administrator may not always be available when there is an equipment failure that requires access to the service door and transfer door, and has identified another individual, the System Administrator designee, who has control of the key for the service door and transfer door in the absence of the System Administrator. To provide the licensee flexibility in training and appointing a replacement System Administrator and System Administrator designee, the individual will not be listed on the license for either of these positions. This individual must meet the same training and experience criteria as the System Administrator.

The applicant must commit to the following:

1. Use the accounts and roles structure of the RadioGenix™ System's software to limit what protocol can be initiated by an individual.
2. Assign a unique user account to each individual using the system.
3. Designate an individual, who meets the following criteria, as the applicant's RadioGenix™ System Administrator.
  - Successfully complete training in the radiation safety, the training and experience requirements of an authorized individual, the administrative controls, and the emergency procedures for the RadioGenix™ System. This training shall be provided by a NorthStar representative or an individual certified by NorthStar to provide the training, and
  - Satisfactorily demonstrate how to assign user roles in the RadioGenix™ Application and identify when the RadioGenix™ key for the service door and transfer door may be used by

the licensee. The evaluation of this demonstration shall be determined by a NorthStar representative or an individual certified by NorthStar to provide the training.

4. Designate an individual who has successfully completed the training and experience described in paragraph 3 above as the System Administrator designee.
5. Designate the following responsibilities to the applicant's RadioGenix™ System Administrator:
  - Assign and maintain the user roles assigned to each user account in the RadioGenix™ software application.
  - Ensure that an individual's assigned user role is limited to their qualified training and experience as outlined in this guidance.
6. Designate the following responsibility to the applicant's RadioGenix™ System Administrator (or to the RadioGenix™ System Administrator designee in the absence of the RadioGenix™ System Administrator):
  - Ensure that the RadioGenix™ key for the service door and transfer door is only used in the physical presence or in the direct audio or video communication of a NorthStar service representative.
7. Have the RadioGenix™ System Administrator and System Administrator designee agree, in writing, to their respective responsibilities listed in 5 and 6 above.
8. Maintain a record of the successful completion of the training and experience described above for the RadioGenix™ System Administrator and RadioGenix™ System Administrator designee. Records shall be maintained for 3 years after the individual is no longer the RadioGenix™ System Administrator or RadioGenix™ System Administrator designee. The record must include a list of the topics covered, the date of the instruction, the name(s) of the attendee(s), and the name(s) of the individual(s) who provided the instruction.
9. Maintain the signed record that the individual accepted the responsibilities of the RadioGenix™ System Administrator or RadioGenix™ System Administrator designee for 3 years after the individual is no longer the RadioGenix™ System Administrator or RadioGenix™ System Administrator designee.

## **6. License Commitments for the RadioGenix™ System**

The NRC has determined that the commitments provided below will provide the basis for an adequate radiation safety program for the use of the RadioGenix™ System. Applicants may also submit alternative information and commitments for review on a case-by-case basis by NRC staff to make a licensing determination. The alternative information should include an explanation of why the applicant believes the alternative information demonstrates an adequate radiation safety program. The information will be included in the license and reviewed during routine inspections.

### **6.1. Routine and non-routine activities**

The applicant must commit to the following:

1. Complying with the provisions of 10 CFR 35.200.
2. Following the manufacturer's daily and routine quality assurance procedures and routine maintenance processes. Routine maintenance does not include checks or handling of any components that are normally inaccessible to the licensee such as behind the service door, transfer door, or enclosed in permanent shielding.
3. Using only manufacturer approved consumable replacement parts. Authorized consumables are verified by integrated barcode and Radiofrequency Identification systems and the compatible kit part numbers are listed in the RadioGenix™ System Operator Guide.
4. Only performing routine activities specified in the manufacturer's current operators manual for the model in use. Examples of non-routine activities that are not authorized include: replacing fluid control device, component replacement /troubleshooting opening sterile fluid path, component replacement /troubleshooting opening non-sterile fluid path, replacing supporting hardware, etc.
5. Only allowing individuals specifically trained and authorized by the manufacturer to perform non-routine maintenance activities.
6. not modifying the device from the original design.

### **6.2. Mo-99 concentrations at time of elution**

The applicant must commit to measuring the Mo-99 concentration at the time of each elution and reporting any Mo-99 concentration that exceeds the limit in 10 CFR 35.204 at the time of elution to the NRC within 7 days. The applicant must also commit to maintain a record of the Mo-99 concentration tests for 3 years. The record will include for each measured elution of Tc-99m, the ratio of the measures expressed as kilobecquerel of Mo-99 per megabecquerel of Tc-99m (or microcuries of Mo per millicurie of Tc-99m), the time and date of the measurement, and the name of the individual who made the measurement of the results of the test.

### **6.3. Training in licensee procedures**

The applicant must-commit to provide training in the licensee's procedures to all individuals involved in the use of the RadioGenix™ System, commensurate with the individual's duties to be performed. This training is in addition to the training required for operating the RadioGenix™ System and includes, as a minimum, performing surveys, responding to spills, determining maximum permissible concentrations of Mo-99 for each elution, and reporting of generator elution concentrations that exceed the limits in 10 CFR 35.204 within 7 days of the measurement.

### **6.4. Updated training for individuals resulting from safety and operational changes to the RadioGenix™ System**

The NRC expects that with use and increased operational experience, NorthStar will make software, hardware, or procedural changes to the RadioGenix™ System that affect the safety and operation of the system. After these changes are made and before use at the licensee's

facility, training must be provided to key individuals (i.e., at least one authorized individual, the Radiation Safety Officer, supervised individuals initially using the updated system, RadioGenix™ System Administrator and RadioGenix™ System Administrator designee). All other individuals need to complete the training before they can use or supervise the use of the RadioGenix™ System.

With respect to training, NRC has determined that the NRC licensee/applicant does not need to apply for an amendment to use the RadioGenix™ System as a result of these changes, provided the applicant or licensee commits to the program described below. [Note: The Agreement State applicant or licensee should check with the Agreement State to see if it will accept the following commitments in lieu of an amendment.]

The applicant shall commit to the following:

1. Additional training is provided for all authorized individuals, the Radiation Safety Officer, RadioGenix™ System Administrator and RadioGenix™ System Administrator designee and supervised individuals if there are software, hardware or procedure changes to the RadioGenix™ System that affect the safety and operation of the generator.
2. Individuals must successfully complete the training on the changes prior to first operation of any component or first handling of licensed material associated with the system.
3. The training is provided by NorthStar or an individual certified by NorthStar to provide the training on the changes to the safety and operation of the generator.
4. Records of the successful completion of this training are maintained for 3 years and that the record as a minimum includes a list of the topics covered, the date of the instruction, the name(s) of the attendee(s), and the name(s) of the individual(s) who provided the instruction.

#### **6.5. Annual Emergency Procedures Refresher Training**

The applicant shall commit, under the guidance, to provide instructions in emergency procedures, initially and at least annually, to all individuals who operate the RadioGenix™ System, as appropriate to the individual's assigned duties. The applicant shall also commit that the records of this training be maintained for 3 years and as a minimum, the records include a list of the topics covered, the date of the instruction, the name(s) of the attendee(s), and the name(s) of the individual(s) who provided the instruction.

#### **6.6. Revision to NRC's Training and Experience Guidance**

If the NRC staff revises the training and experience criteria, an individual who was previously considered qualified to be an authorized individual or RSO for the RadioGenix™ System will not have to meet the revised criteria. However, the applicant must commit that such individuals will have to receive training and experience on new or different RadioGenix™ System to include software, hardware, safety, and operational changes before the first use of the system. [Note: The Agreement State applicant or licensee should check with the Agreement State to see if it will accept the following commitments in lieu of an amendment.]



## 6.7. Specific Information on Radiation Safety Precautions and Instructions

The applicant must submit the information required by 10 CFR 35.12(d) [or 10 CFR 30.33(a)(2) and (3)]. The applicant may simplify its submission by confirming the following:

**6.7.1. Surveys/survey meters/monitors:** Because the RadioGenix™ System can contain up to four Mo sources (each containing curie quantities of Mo-99) at any one time and elution of the generator involves replacing certain components on a frequent basis, workers have to routinely open eight of the shielded cabinet doors and remove certain shields. This increases the potential to have workers exposed to higher radiation fields than normally associated with conventional fission Mo-99/Tc-99m generators. For this reason, it is necessary for the licensee to routinely perform additional surveys to identify higher than expected radiation fields and system failures.

Therefore, applicants must commit to develop, implement and maintain survey procedures that as a minimum address:

- (1) Having radiation monitor(s)/survey meter(s) (in addition to the radiation monitor in the RadioGenix™ System) with the ability to monitor and detect greater than expected transient radiation levels (expected transient radiation levels may go up to 15 milliroentgen per hour at 30 centimeters for a 6 curie source).
- (2) Ensure that each radiation monitor/survey meter is checked every day before use of the RadioGenix™ System to verify it is calibrated and operational.
- (3) Ensure that a radiation monitor/survey meter is on, operating, the readout is visible and readable, and within arm's reach of the RadioGenix™ System.
- (4) Surveying/monitoring shall be performed immediately before approaching the RadioGenix™ System, running any protocol, servicing the unit, and after removal of the final product.
- (5) Radiation monitor/survey meter has an audio indicator that is on and used when the monitor/meter readout is not in the operator's line of sight, after the surveys in item (4) above are performed.
- (6) If only one stationary radiation monitor/survey meter is used, it must meet all five criteria above and the readout must be visible and readable before entering a potential radiation field.

### 6.7.2. Emergency Procedures

To reflect the unique components and operation of the RadioGenix™ System, the applicant must, under the guidance, commit to develop, implement, and maintain written emergency procedures that are based on information specific to the RadioGenix™ System's likely failure modes (this includes but is not limited to spills and loss of shielding). In addition to the standard components such as notifying the RSO, the emergency procedures should also as a minimum address the following:

1. Specific examples in the emergency procedures that address when the licensee has to report under 10 CFR Part 20, 10 CFR 30.50, and 10 CFR Part 21.
2. Confirm compliance with the Operator Guide and additional safety recommendations from the manufacturer (such as revisions to the Operator Guide, safety recommendations and technical service bulletins) that improve and do not reduce safety. Specifically, the licensee will commit to the following:

- Performing an assessment to determine if a NorthStar representative is needed to assist in returning the RadioGenix™ system to a serviceable state in situations when the stop button has been used.
  - Contacting NorthStar for any system faults or perceived faults to determine the severity, and to provide corrective action, when needed.
  - Contacting NorthStar for any fluid leaks that occur.
  - Not removing permanent shielding or modify existing shielding ensuring that all required shielding is in place prior to operating the device.
  - Confirming that individuals will not under any circumstances tamper with, modify, or extract the internal materials of the device.
  - Confirming that no open, used, or partially used disposables containing radioactive materials will be returned for evaluation without prior approval from NorthStar.
3. Written emergency procedures that provide instructions for responding to major and minor spills or leaks of radioactive materials. These could result from but are not limited to process line failures and leaks, general spills, spillage of source container contents, accidental withdrawal of tube from source container, dropped vials and columns, and operator/human errors.

At a minimum, these procedures must, under the guidance:

- Provide operator instructions in the event of an emergency or apparent system failure to:
  - Press and hold the stop button.
  - Close all cabinet doors (if possible) to ensure that any possible spills or leaks of radioactive materials are retained within the recessed cabinets and to reduce elevated radiation levels by maximizing use of available shielding in the cabinet doors.
  - Notify adjacent personnel in case of the leakage or spillage of radioactive material and elevated radiation levels in the vicinity of the RadioGenix™ System, to evacuate the immediate vicinity and to establish access controls.
  - Address surveying personnel for contamination and the means for personnel decontamination, if necessary.
- List all available emergency response equipment (e.g., spill kits).
- Provide instructions for notifying personnel in the event of an emergency which include the NorthStar contact information.

## **7. Notes to Licensees**

### **7.1. Alterations to the RadioGenix™ System**

This licensing guidance is based on the engineering evaluation summarized in the SER. Medical or commercial nuclear pharmacy licensees cannot make any changes to the RadioGenix™ System or commitments by NorthStar that form the basis of the SER. The manufacturer's commitments include, but are not limited to, software, internal components, reagent solutions, materials of construction, dimensions, tolerances, activity level, isotopes, radiation safety components, manufacturing process, Quality Assurance, and Quality Control program.

### **7.2. Use of Other Mo-99/Tc-99m Solutions or Other Generator Systems**

The licensee's authorization will only be for the use of the NorthStar Mo-99/Tc-99 solution in the RadioGenix™ System. Use of any other Mo-99/Tc-99m solution with the RadioGenix™ System or any other device with the NorthStar Mo-99/Tc-99m solution will require an amendment to a limited specific medical use or commercial nuclear pharmacy license. A broad scope licensee will have to perform its own engineering and radiation safety evaluation if any other Mo-99/Tc-99m solution is used with the RadioGenix™ System or any other device is used with the NorthStar Mo-99/Tc-99m solution.

### **7.3. Change in Physical Conditions of Use**

If the physical conditions of use exceed those reported in the SER, the limited specific medical use licensee should request an amendment for the new conditions, and a broad scope licensee should perform its own engineering and radiation safety evaluation addressing those differences.

### **7.4. Notification for AUs and ANPs**

The NRC recognizes that if an AU or ANP satisfies the training and experience listed in the NRC's licensing guidance for the RadioGenix™ System and is currently listed on a Commission or Agreement State medical use license or permit or NRC Master Materials permit for the RadioGenix™ System, the AU or ANP should be allowed to work under a different license for the medical use of the RadioGenix™ System. A limited specific medical use applicant initially applying for authorization for the medical use of the RadioGenix™ System or an existing licensee applying for an amendment may request authorization to notify the NRC in the future that it has permitted an AU or ANP to work at its facility without the need to request an additional license amendment, provided the following conditions are met:

- (1) The AU or ANP meets the training and experience criteria listed in NRC's licensing guidance for the RadioGenix™ System; and
- (2) The AU or ANP is currently listed for RadioGenix™ System use on a Commission or Agreement State license, a permit issued by a Commission master material license, a permit issued by a Commission or Agreement State licensee of a broad scope, or a permit issued by a Commission master material license broad scope permittee; and
- (3) The licensee provides the NRC a copy of the license or permit on which the AU or ANP was originally listed for the RadioGenix™ System; and

- (4) The licensee provides documentation to the NRC for each AU or ANP of the above listed conditions no later than 30 days after the date that the licensee allows the AU or ANP to work as an AU or ANP for use of the RadioGenix™ System.

#### **7.5. Revisions to Existing RadioGenix™ System Radiation Safety Programs to Conform to Future Changes in Licensing Guidance and Additional Safety Recommendations from the Manufacturer**

Requesting authorization in accordance with the following guidance will permit a licensee to make certain changes under 10 CFR 35.26, "Radiation protection program changes," to the RadioGenix™ System safety program that might otherwise require a license amendment. This authorization may also be used by the commercial nuclear pharmacy to make limited changes to the radiation safety program without needing to submit a license amendment.

The above licensing guidance and safety recommendations from the manufacturer may be revised as additional experience is gained regarding medical use of the RadioGenix™ System by the regulator and manufacturer. A licensee already authorized to use the RadioGenix™ System and committed by license condition to follow the provisions in the guidance and Operators Manual existing at the time of commitment must apply for and receive an amendment to its license prior to making changes to conform to the revised guidance and additional radiation safety recommendations.

An applicant initially applying for authorization for medical or commercial nuclear pharmacy use of the RadioGenix™ System (or a licensee applying later for an amendment to conform to revisions in this guidance) may request authorization to allow future changes to its radiation safety program, provided the following conditions are met:

- (1) The revision is in compliance with the regulations of the NRC or Agreement State;
- (2) The revision is based on the current guidance for the RadioGenix™ System medical use under 10 CFR 35.1000 or commercial nuclear pharmacy use posted on the NRC website or the current operators manual and additional safety recommendations from the manufacturer;
- (3) The revision has been reviewed and approved by the licensee's Radiation Safety Officer and management;
- (4) The affected individuals are instructed on the revised program before the change is implemented;
- (5) The licensee will retain a record of each change for 5 years; and
- (6) The record will include a copy of the appropriate website guidance, the old procedure, the new procedure, the effective date of the change, and the signature of the licensee's management representative who reviewed and approved the change.

If this authorization is approved, these conditions will be incorporated as license conditions in the licensee's license. This may be done by incorporating the commitments in the tie down condition.

## 7.6. Waste Disposal

Most medical use licensees use the provisions of 10 CFR 35.92 to hold short half-life radionuclides such as Mo-99 and Tc-99m for decay-in-storage before disposal without regard to their radioactivity.

Commercial nuclear pharmacies have a standard license condition that also permits decay-in-storage of short half-life radionuclides before disposal without regard to their radioactivity. Applicants are reminded that they must perform surveys to verify that the radioactivity cannot be distinguished from background before disposal. These surveys are necessary because impurities in the nonradioactive Mo used to produce Mo-99 may become activated and have longer half-lives.

## 8. Notes to Regulators

### 8.1. Inspection Frequency

A new licensee authorized for the RadioGenix™ System will receive an initial inspection. An initial inspection is usually conducted within one year after a new license is issued. For an existing licensee, the regulator may perform a near-term onsite inspection for a significant licensing action. Significant licensing actions include, but are not limited to, the licensee recently increasing the types, quantities, or uses of radioactive material. Adding the RadioGenix™ System to a medical use or commercial nuclear pharmacy license would be a significant change to its licensing program.

In accordance with Enclosure 1 of inspection Manual Chapter 2800, medical use licenses authorizing emerging technology under 10 CFR 35.1000 are assigned a Priority 2 inspection code. Therefore, medical use licensees who are authorized the RadioGenix™ System will be inspected every 2 years. The commercial nuclear pharmacy licensees who are authorized for the RadioGenix™ System will also be inspected every 2 years. This is the normal inspection frequency for a commercial nuclear pharmacy.

### 8.2. Program Code

NRC regions should use program code 02240 for medical use licensees authorized to use the RadioGenix™ System. The commercial nuclear pharmacies will continue to use the program code 02500.

### 8.3. License Authorizations

#### 8.3.1. Radionuclides, Form, Possession Limits\*

|   |  |
|---|--|
| <b>Radionuclides:</b><br>(Authorization 6)            | A. Mo-99/Tc-99m<br>B. Depleted Uranium   |
| <b>Chemical/Physical Form:</b><br>(Authorization 7)   | A. Liquid NorthStar Mo-99/Tc-99m to be used in the RadioGenix™ System<br>B. Metal  |
| <b>Maximum Possession Limit:</b><br>(Authorization 8) | A. 7.5 curies of Mo-99/Tc-99m per source vessel, not to exceed 40 curies total (includes waste and decayed source vessels)<br>B. 162 kilograms total |

|   |   |
|---|---|
| <b>Authorized Use:</b><br>(Authorization 9) | A. For 35.1000 medical use elution of Tc-99m in a NorthStar RadioGenix™ System (or for the commercial nuclear pharmacy - elution of Tc-99m in a NorthStar RadioGenix™ System).<br>B. For shielding in a NorthStar RadioGenix™ System. |
|---|---|

(\*) The intent is to license the NorthStar RadioGenix™ System including the liquid NorthStar Mo-99/Tc-99m solution as a separate line item. For the licensee that has both the RadioGenix™ System and conventional Mo-99/Tc-99 generators, there will be three line items: one will be for the RadioGenix™ System, one for the Mo-99 in conventional generators and the final line item for the total amount of Tc-99m eluted from both sources used to prepare radiopharmaceuticals. The Tc-99m that is eluted from the RadioGenix™ System is no different than the Tc-99m eluted from fission generators. [Note to license reviewer: Ensure the total Tc-99m authorization includes the total Tc-99m from both the RadioGenix™ System and the traditional generator elutions.]

### 8.3.2. License conditions

12. [Authorized User Physician's Name] for the elution of Tc-99m from the RadioGenix™ System

OR

[Authorized Nuclear Pharmacist's name] for the elution of Tc-99m from the RadioGenix™ System

The licensee shall not modify the RadioGenix™ System from the original design and shall only use manufacturer approved consumable replacement parts.

The commitments made by the applicant can be included in the tie down condition or must be stated as separate license conditions.

### Paperwork Reduction Act Statement

The information collections contained in this guidance are covered by the requirements of 10 CFR Parts 30, 32 and 35, which were approved by the Office of Management and Budget, approval numbers 3150-0017, 3150-0001, and 3150-0010, as well as, 3150-0120 for filling out the NRC Form 313 .

### Public Protection Notification

The NRC may not conduct or sponsor, and a person is not required to respond to, a request for information or an information collection requirement, unless the requesting document displays a currently valid OMB control number.