NRRC Specific Regulations

Release of Patients after Diagnostic or Therapeutic Procedures with Radionuclides or with Implanted Brachytherapy Radiation Sources

NRRC-R-01-SR17

2025

هيئة الرقابة النووية والإشعاعية
Nuclear and Radiological Regulatory Commission

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Preamble

In accordance with the provisions of the Radiation Safety Regulation (NRRC-R-01 Rev. 0.1), approved by the NRRC's Board of Directors in resolution No. (R/1/1/2022), dated 20 April 2022, in chapter (12) section (80). This specific regulation establishes specific criteria for the release of patients after diagnostic or therapeutic procedures with radionuclides or with implanted brachytherapy radiation sources.

This specific regulation has been prepared in consistent with International Atomic Energy Agency (IAEA) standards, international best practices, and in accordance with the Kingdom's international commitments, and it has been presented in "the Public Consultation Platform, Istitlaa" for public review, comments, and feedback.

This specific regulation has been approved by the NRRC's CEO Resolution No. 0312654 dated 08/09/2025.

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Chapter 1: Objective, Scope, and Definitions

Section 1: Objective

1. This specific regulation provides the applicant and/or the authorized person with specific regulatory provisions based on a graded approach for ensuring the justified release of patients who have undergone nuclear medicine diagnostic or therapeutic procedures or after the implantation of brachytherapy radiation sources.

Section 2: Scope

2. This specific regulation applies to the release of living patients from medical facilities after diagnostic or therapeutic procedures with radionuclides or the implantation of brachytherapy sources and does not extend to cases involving deceased individuals following such procedures.

Section 3: Definitions

Brachytherapy

Brachytherapy is a form of local radiation therapy where a sealed radiation source (seed, ribbon, or capsule) is placed permanently or temporarily inside the patient's body, in or next to the tumour.

Brachytherapy Implant

A sealed radiation source that is implanted into a tissue for brachytherapy purposes.

Carers and Comforters

Persons who willingly and voluntarily help (other than in their occupation) in the care, support, and comfort of patients undergoing radiological procedures for medical diagnosis or medical treatment.

Dose Constraint

A prospective and radiation source related value of individual dose that is used in planned exposure situations as a parameter for the optimization of protection and safety for the source, and that serves as a boundary in defining the range of options in optimization.

Most Exposed Person

The person who is not considered as a carer or comforter and is expected to be most exposed to radiation due to their close presence to a released patient.

Patient (For the purpose of this specific regulation)

An individual who has undergone a diagnostic or therapeutic procedure with radionuclides or the implantation of brachytherapy sources.

Radiological Procedure

A medical imaging procedure or therapeutic procedure, that involves ionizing radiation, such as a procedure in diagnostic radiology, nuclear medicine or radiation therapy, or a planning procedure, image guided interventional procedure or other interventional procedure involving radiation delivered by a radiation generator, a device containing a sealed source or an unsealed source, or by means of a radiopharmaceutical administered to a patient.

Radionuclide Therapy

The administration of radionuclide to a patient for therapeutic purposes.

Radiopharmaceutical

Biologically active molecules labelled by radionuclides that are applied in nuclear medicine diagnostic and therapeutic procedures.

Release of Patients

The authorization given to patients to leave a medical facility after the administration of radionuclides or the implantation of brachytherapy sources for diagnostic or therapeutic purposes.

Third Person

A person who might be exposed to radiation due to their presence close to a released patient without being a carer or comforter of this patient.

Chapter 2: Release of Patients

Section 4: Criteria for the Release of Patients after the Administration of Radionuclides or the Implantation of Radiation Sources for the Protection of Carers and Comforters and the most exposed person

3. The authorized person shall ensure that patients may be released only when:

    a. The administered or implanted radionuclide activity does not exceed the corresponding values of Column I in Appendix I (Radioactivity and Dose Rates Below Which a Patient May Be Released After Administration); or

    b. The measured external dose rate at 1 meter from the skin of the patients does not exceed the value of Column II in Appendix I (Radioactivity and Dose Rates Below Which a Patient May Be Released After Administration) corresponding to the administered or implanted radionuclide.

4. If a radionuclide administered to or implanted in a patient is not listed in Appendix I (Radioactivity and Dose Rates Below Which a Patient May Be Released After Administration), the authorized person, when releasing the patient, shall ensure that the administered or implanted radionuclide activity does not exceed the value which is calculated using equations 1 or 2 in Appendix II (Dose Rate Calculation Based on the Administered Radionuclide Activity).

5. In case the criteria in Articles 3 and 4 are not met, the authorized person may release a patient based on the measured dose rate and the anticipated post-release exposure scenario, and if the estimated dose to the most exposed persons due to the specific release is not likely to exceed 5 mSv, the following shall be considered:

    a. The actual dose rate used in the related calculations is measured at 1 meter from the skin of the patient;

    b. The dose rate measurements are performed with appropriate and calibrated measuring equipment;

    c. All calculations are based on scientifically approved methodologies, which must be documented;

    d. At least the parameters presented in Article 6 are used to model the post-release exposure scenario, and their values are based on scientific evidence and/or verifiable data; and

    e. Records, according to the provisions of Section 7, are maintained.

Section 5: Instructions and Information Card

6. The authorized person shall ensure that before any decision about the release of patients, the following parameters have been discussed with them (or their caregiver):

    a. The type of post-diagnosis/therapy accommodation/destination (e.g., family home, single home, hotel, etc.);

    b. Their travel plan (e.g., private car, taxi, train, border crossing, boats, public transportation);

    c. Their preference to travel alone or with other individuals;

    d. The household members (infant, pregnant woman, children, etc.);

    e. Their ability to delay returning to work; and

f. Their ability to keep a distance from others (household members, children, pregnant women).

7. The authorized person shall provide patients with appropriate instructions, as presented in Appendix III (Indicative Instructions List for Released Patients). In addition, the dose constraints of Appendix IV (Dose Constraints Per Episode for Different Categories) are not to be exceeded.
8. The authorized person shall ensure that patients have formally confirmed by signing a proof document before their release that they have acknowledged the following:

    a. The provision of instructions as indicatively presented in Appendix III (Indicative Instructions List for Released Patients);

    b. The period after their release during which the instructions under (8.a) shall be followed, as presented in Appendix V (Indicative Residual Radionuclide Activities and Time Periods for which Instructions shall be followed by the Patients after their Release);

    c. The receipt of a clear explanation of the procedure;

    d. The provision of information on the consequences of failure to follow the instructions;

    e. The provision of information on the need to limit exposure to others, especially to young children and pregnant women, and on how long they must exercise special care;

    f. The possibility of triggering the alarm of radiation detectors at airports, train stations, border patrol checkpoints, interior highway checkpoints, and other areas where there are radiation detection systems, and the need to present the information card in this case; and

    g. The provision of an information card as defined in article 9.

9. The authorized person shall ensure that released patients have been provided with an information card including, at least, the information presented in Appendix VI (Information Card for Released Patients).

Chapter 3: Special Situations

Section 6: Breastfeeding Patients

10. In addition to the above requirements of this specific regulation, the authorized persons shall:

    a. Make appropriate arrangements to ensure that female patients, before their release, are asked about their breastfeeding status.

    b. Ensure that, before the release of female patients:

        i. They are aware of the risks to the infant associated with the continuation of breastfeeding.

        ii. They are provided with additional instructions based on the administered radiopharmaceutical for the interruption or discontinuation of breastfeeding in accordance with Appendix VII (Radioactivity of Radiopharmaceuticals Requiring Instructions for the Interruption or Cessation of Breastfeeding when Administered to Patients who could Breastfeed an Infant or Child).

        iii. They are provided with information on the consequences of failure to follow the recommendation to interrupt or discontinue breastfeeding.

Chapter 4: Other Requirements

Section 7: Records of the Release of Patients

11. For the release of patients based on the administered or implanted radionuclide activity, the authorized person shall keep a record for a period of five years, including:

    a. The patient's identifier in a way that ensures that confidential patient information is not traceable or attributable to a specific patient;

    b. The type and radioactivity of the administered radionuclide;

    c. The date of the administration; and

    d. Whether written instructions were provided to them.

12. For the release of patients based on the measured dose rate at 1 meter from the patient, the authorized person shall keep a record for a period of five years, including:

    a. The patient's identifier in a way that ensures that confidential patient information is not traceable or attributable to a specific patient;

    b. The results of the measurement;

    c. The measuring equipment used; and

    d. The name and signature of the individual who performed the measurement.

13. For the release of patients based on a patient-specific calculation, the authorized person shall keep a record for a period of five years including:

    a. The patient's identifier in a way that ensures that confidential patient information is not traceable or attributable to a specific patient;

    b. The equation(s) used;

    c. The patient-specific factors (i.e., effective half-life and uptake fraction for each component of the biokinetic model, the time that the physical half-life was assumed to apply to retention, and the occupancy factor) and the basis for the selection of each of the corresponding values; and

    d. The basis for calculating the dose to the person exposed to the patient and the calculated dose.

Appendices

Appendix I: Radioactivity and Dose Rates Below Which a Patient May Be Released After Administration

The administered radionuclide activities and measured dose rates that shall be considered to determine the immediate release of patients from the authorized person control are listed in the following table.

	COLUMN I Radioactivity at or below which patients may be released	COLUMN II Dose rate at 1 m, at or below which patients may be released
Radionuclide	**(MBq)**	**(μ Sv/h)**
Ag-111	19000	80
Au-198	3500	220
Cr-51	4800	25
Cu-64	8500	275
Cu-67	14300	225
Ga-67	8700	180
I-123	6000	265
I-125	250	10
I-125 implant	320	10
I-131	1100	75
In-111	2400	205
Ir-192 implant	65	10
Pd-103 implant	1500	35
Re-186	28500	155
Re-188	29000	205
Sc-47	11400	175
Se-75	90	5
Sm-153	25900	300
Sn-117m	1100	45

	COLUMN I Radioactivity at or below which patients may be released	COLUMN II Dose rate at 1 m, at or below which patients may be released
Radionuclide	**(MBq)**	**(μ Sv/h)**
Tc-99m	28200	580
Tl-201	15700	190
Yb-169	370	20

Appendix II: Dose Rate Calculation Based on the Administered Radionuclide Activity

For administered radionuclides with a physical half-life greater than 1 day, the following equation shall apply to calculate the Radioactivity leading to an effective dose to the most exposed persons due to the specific release equal to 5 mSv:

$$Q_0 = \frac{5000}{34.6 \times \Gamma \times T_p \times 0.25} \qquad (1)$$

For radionuclides with a physical half-life less than or equal to 1 day, and if an occupancy factor of 1.0 is used, the following equation shall apply:

$$Q_0 = \frac{5000}{34.6 \times \Gamma \times T_p} \qquad (2)$$

where:

34.6 = conversion factor of 24 hours per day times total integration of decay

Γ = Specific gamma-ray constant for a point source in μSv/MBq-hr at 1 m

Q_0 = initial radioactivity at the start of the time interval in MBq

T_p = physical half-life in days

The equations above do not apply to the dose to breastfeeding infants or children who continue to breastfeed.

Appendix III: Indicative Instructions List for Released Patients

Indicatively, the understandable and patient-specific release instructions to be provided to a released patient and followed for a period defined by the authorized person may include the following:

a. Wash hands frequently and take a shower every day for at least 2 days after treatment;

b. Wash laundry separately from others;

c. Use dedicated or disposable kitchen utensils, and do not share them with others;

d. Use a dedicated sole use bathroom, if possible. Always sit on the toilet. Flush the toilet twice after each use. Flush toilet paper and wipes. Wash the hands well after the toilet.

e. Wash hands after brushing the teeth;

f. Use disposable gloves and flushable wipes when cleaning;

g. Discard trash separately and hold it to allow for radioactive decay;

h. Sleep alone in a separate bedroom;

i. Abstain from any intimate contact;

j. Avoid preparing or sharing food with others;

k. Use plastic gloves for cooking (if cooking is necessary) and dispose them in a special plastic trash bag;

l. Avoid using public transportation and public places;

m. Maintain good hydration, as directed by a physician;

n. Minimize the amount of time near other people, especially children and pregnant women;

o. Maintain distance from other persons;

p. Avoid holding or cuddling children if you have received a permanent brachytherapy implant;

q. Avoid using fingers to handle a seed that falls out (for patients with implanted seeds); and

r. Also follow the additional instructions of point b) ii of Article 10 in case of released breastfeeding patients.

Appendix IV: Dose Constraints Per Episode for Different Categories

The dose constraints per episode for different categories, that to be considered before the release of patients, are listed in the following table.

Type of person	Reason for dose constraint	Dose constraint (mSv)
Third person (Family and close friends)	A fraction of the dose limit for the public	0.3/episode
Pregnant women	Protection of the unborn child	1/year
Children up to two years old	Close physical contact with parents	1/year
Children between three and ten years old	Same risk as that for the unborn child	1/episode

Appendix V: Indicative Residual Radionuclide Activities and Time Periods for which Instructions shall be followed by the Patients after their Release

The following table includes residual radionuclide activities and time periods for which instructions shall be followed by patients* after their release.

Ag-111		**Au-198**	
Corresponding residual radioactivity (MBq)	**Period for which instructions must be followed**	**Corresponding residual radioactivity (MBq)**	**Period for which instructions must be followed**
<11500	25 d	<2100	10 d
<5700	15 d	<1000	6 d
<2900	10 d	<500	4 d
<1500	2 d	<250	24 h
Cr-51		**Cu-67**	
Corresponding residual radioactivity (MBq)	**Period for which instructions must be followed**	**Corresponding residual radioactivity (MBq)**	**Period for which instructions must be followed**
<3000	90 d	<8600	10 d
<1400	65 d	<4300	6 d
<700	35 d	<2100	3 d
<350	10 d	<1100	24 h
Ga-67		**I-125**	
Corresponding residual radioactivity (MBq)	**Period for which instructions must be followed**	**Corresponding residual radioactivity (MBq)**	**Period for which instructions must be followed**
<5200	10 d	<150	200 d
<2600	8 d	<75	140 d
<1300	4 d	<40	80 d
<650	24 h	<20	20 d
I-131		**In-111**	
Corresponding residual radioactivity (MBq)	**Period for which instructions must be followed**	**Corresponding residual radioactivity (MBq)**	**Period for which instructions must be followed**
<700	25 d	<1400	10 d
<350	20 d	<700	7 d
<200	10 d	<350	4 d
<100	3 d	<200	24 h

Re-186		Sc-47	
Corresponding residual radioactivity (MBq)	**Period for which instructions must be followed**	**Corresponding residual radioactivity (MBq)**	**Period for which instructions must be followed**
<17000	15 d	<6800	10 d
<8500	10d	<3400	8 d
<4200	5 d	<1700	4 d
<2100	24 h	<850	24 h
Se-75		**Sm-153**	
Corresponding residual radioactivity (MBq)	**Period for which instructions must be followed**	**Corresponding residual radioactivity (MBq)**	**Period for which instructions must be followed**
<55	400 d	<15500	6 d
<30	280 d	<7800	5 d
<15	160 d	<3900	3 d
<10	40 d	<1900	24 h
Sn-117m		**Tl-201**	
Corresponding residual radioactivity ty (MBq)	**Period for which instructions must be followed**	**Corresponding residual radioactivity (MBq)**	**Period for which instructions must be followed**
<650	45 d	<9400	10 d
<300	30 d	<4700	7 d
<150	20 d	<2400	4 d
<100	4 d	<1200	24 h
Yb-169			
Corresponding residual radioactivity (MBq)	**Period for which instructions must be followed**		
220	110		
110	70		
60	40		
30	10		

*For Cu-64, I-123, Re-188 and Tc-99m the period for which instructions must be followed is 24 hours.

Appendix VI: Information Card for Released Patients

The information card for patients released after a diagnostic or therapeutic procedure with radionuclides shall include the following:

a. Patient's name;

b. Name of the procedure;

c. Date of the procedure;

d. Type of the administered or implanted radionuclide;

e. Radioactivity of the administered radionuclide or the implant(s);

f. Name and contact number of the Radiation Safety Officer (RSO) or the medical physicist (24 hour);

g. Any significant information or instructions that are related to the movement or transportation of the patient;

h. Statement: Administered radionuclide activity is no longer considered significant for radiation protection purposes after DD/MM/YYYY;

i. Additional information for individual situations (case-by-case); and

j. Responsible person's signature.

Appendix VII: Radioactivity of Radiopharmaceuticals Requiring Instructions for the Interruption or Cessation of Breastfeeding when Administered to Patients who could Breastfeed an Infant or Child

The following table lists the radioactivity of radiopharmaceuticals above which instructions shall be provided to patients who could breastfeed an infant or child regarding the interruption or cessation of breastfeeding.

RADIOPHARMACEUTICAL	Radioactivity Above Which Instructions are Required (MBq)	Indicative Duration of Interruption of Breastfeeding
I-131 NaI	0.01	Complete cessation (for this infant or child)
I-123 NaI	20	3 days
I-123 MIBG	70	24 hours for 370 MBq
Tc-99m DTPA	1,000	24 hours
Tc-99m MAA	50	24 hours
Tc-99m Pertechnetate	100	24 hours
Tc-99m DISIDA	1,000	24 hours
Tc-99m Glucoheptonate	1,000	24 hours
Tc-99m HAM	400	24 hours
Tc-99m MIBI	1,000	24 hours
Tc-99m MDP	1,000	24 hours
Tc-99m PYP	900	24 hours
Tc-99m Red Blood Cell In Vivo Labeling	400	24 hours
Tc-99m Red Blood Cell In Vitro Labeling	1,000	24 hours
Tc-99m Sulphur Colloid	300	24 hours
Tc-99m DTPA Aerosol	1,000	24 hours
Tc-99m MAG3	1,000	24 hours
Tc-99m White Blood Cells	100	24 hours
Ga-67	1	28 days
In-111 White Blood Cells	10	6 days
Tl-201 Chloride	40	4 days
C-11, N-13, O-15, Rb-82	Any administrated radioactivity	No interruption
F-18 FDG	Any administrated activity	4 hours
Lu-177 Octreotate, diagnostic or therapeutic	Any administrated radioactivity	Complete cessation (for this infant or child)
Ra-223 and all alpha emitters	Any administrated radioactivity	Complete cessation (for this infant or child)
Zr-89	Any administrated radioactivity	28 days
Ga-68 Octreotate	Any administrated radioactivity	4 hours
In-111 Octreotate	Any administrated radioactivity	6 days
I-124 NaI	Any administrated radioactivity	Complete cessation (for this infant or child)

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