

PROCEDURE

V5 MAY 2023

LEAKAGE TEST FOR SEALED SOURCES

INTRODUCTION

This procedure is intended for employees of the institutions that participate in the complex license Randwyck, who are involved in the handling and management of sealed sources.

The requirements that apply to the process of checking sealed sources for leakage are formalised in this procedure and in compliance with the current legislation and the 'Randwyck Regulations'. This procedure is supplementary to the procedure: 'Directions for sealed sources'.

SEALED SOURCES: LEAKAGE TEST

A sealed source is a radioactive component that is either embedded in or adhered to a solid carrier material, or enclosed by a different material. It is understood that either the carrier material or the material enclosing the radioactive substance offers adequate resistance to spreading of radioactive substances, when used under regular circumstances.

Submitting sealed sources to an inspection is obligatory; this is performed when receiving the source, as well as periodically, meaning at least once a year. Lastly, when a sealed source is definitively not used anymore, a leakage test is mandatory before storing it in the storage room or before sending it to the waste disposal or the company which processes the sealed source.

These inspections are described as follows:

1. At least once a year a visual inspection of the sealed source. In case the sealed source is used in a (permanent) container; the container is subjected to a visual inspection.
2. At least once a year, a check on leakage, or
3. At least once a year, a check on radioactive contamination of the source holder, and
4. At least once a year, a check on the dose rate equivalent on the outside of the container the sealed source is kept in.

By doing this, damage of the sealed source is prevented¹ in all situations mentioned.

The following results of these inspections must be registered:

- The date of inspection;
- The source identification number;
- The way the inspection was performed;
- The name of the person performing the inspection;
- The results of the inspection.

The test for leakage does not have to be performed in the case of sealed sources that hold less than 1 MBq in activity (or less than 0.02 Re_{inh}), nor if the sealed source contains a gaseous radioactive substance.

The test for leakage is obliged for all sealed sources from the age of 15 years, even if their activity at that time is less than 1 MBq. There is a risk of porosity or degradation of the carrier material, resulting in leakage.

According to legislation, a sealed source is considered leaking, if a wiped activity of more than 185 Bq (Becquerel) is determined.

¹ ANVS regulations on basic safety standards radiation protection (ANVS-verordening basisveiligheidsnormen stralingsbescherming), article 4.11

RESPONSIBILITIES AND LEVEL OF EXPERTISE

The annual inspection of sealed sources, as described above, must be performed by an employee that has at least the expertise of a radiation protection officer (RPO) with a diploma of Coordinating Expert (CD or level 3)². The results of the inspection are assessed by a radiation protection expert (RPE) (CD or level 3)³ and subsequently registered in the Nuclear energy law dossier (Kernenergiwetdossier in Dutch) of the department that owns the source.

EXECUTION

For checking a sealed source for leakage and contamination, a (departmental) protocol is drawn up.

Method for checking for leakage and contamination (smear test):

When checking for leakage, a surface of at least 5 cm² is wiped, focussing on the spots where leakage most likely occurs, such as seams.

Method for measuring smear tests:

The measuring devices that are used for this purpose must be suitable for the energy range of all isotopes that are used in the department, including the isotopes of the sealed sources. In addition, the reliability of the measurement must be guaranteed with a minimum detection limit of 2 Bq.

DETECTING LEAKAGE

A sealed source is considered as leaking if an inspection in the form of a smear test results in a wiped off activity of 185 Bq⁴.

In case the assessed activity exceeds 185 Bq, the source is being disposed of following the procedure 'Collection, storage and transference of radioactive waste'.

DETECTING CONTAMINATION

A source is considered to be contaminated if a wiped off activity of 0.4 Bq/cm² (in the case of a contamination with an alpha-emitter) or 4 Bq/cm² (in the case of a contamination with either a beta- or gamma emitter) is determined.

In that case, actions need to be taken to remove the contamination from the source, under the supervision of the RPE.

LIST OF ABBREVIATIONS

Dutch		English	
SBD	Stralingsbeschermingsdeskundige	RPE	Radiation Protection Expert
TMS	Toezichhoudend Medewerker Stralingsbescherming	RPO	Radiation Protection Officer

² Complex license Randwyck, 4.II.6

³ ANVS regulations on basic safety standards radiation protection (ANVS-verordening basisveiligheidsnormen stralingsbescherming), article 4.35

⁴ Complex license Randwyck, chapter 3

REFERENCES

- Complex license Randwyck (2017/0511-12) and all changes to the license
- Regulations Randwyck (Regeling Randwyck)
- Procedure 'Guidelines for sealed sources'
- ANVS-decree on basic safety standards for radiation protection (Dutch only)
<https://wetten.overheid.nl/BWBR0040581/2023-02-24>