South African Health Products
Regulatory Authority
Building A
Loftus Park
Arcadia
Pretoria

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GUIDELINE ON THE SAFE USE OF SOIL MOISTURE AND DENSITY GAUGES CONTAINING RADIOACTIVE SOURCES

This guideline deals with the safe and secure handling by operators of soil density, moisture, and asphalt gauges. The RPO and ARPO of the Authority Holders are also guided in the administrative and legal requirements of which they are subjected to.

Document History

Final Version	Reason for Amendment	Effective Date
0	First issue and published for implementation	May 2019
1	- Content structured on the new SAHPRA Guideline Template - A unique document number SAHPGL-RDN-RN-03 allocated to this Guideline - Form RC010 changed to **GLF-RDN-XR-10A,** RN525 changed to **GLF-RDN-RN-13C**, RN526 changed to **GLF-RDN-RN-20A**, RN784 changed to **GLF-RDN-RN-28A**, RN787 changed to **GLF-RDN-RN-07A** and RN900 also changed to **GLF-RDN-RN-12A**.	January 2024

DR BOITUMELO SEMETE-MAKOKOTLELA
CHIEF EXECUTIVE OFFICER

Contents

Glossary

Abbreviation/ Term	Meaning
RPO	Radiation Protection Officer
ARPO	Acting Radiation Protection Officer
ALARA	As low as reasonably achievable
NLM	Nuclear Liabilities Management
XR-10A	**GLF-RDN-XR-10A (Old RC010) form**
13C	**GLF-RDN-RN-13C (Old RN525) form**
20A	**GLF-RDN-RN-20A (Old RN526) form**
28A	**GLF-RDN-RN-28A (Old RN784) form**
07A	**GLF-RDN-RN-07A (Old RN787) form**
12A	**GLF-RDN-RN-12A (Old RN900) form**
18A	**GLF-RDN-RN-18A (Old RN785) form**

1. INTRODUCTION

Radioactive sources used in soil density, moisture and asphalt gauges are subject to regulatory control in terms of the South African Hazardous Substances Act, 1973 (Act 15 of 1973) and Regulations R2471 related to the above-mentioned act. The body responsible for administering this legislation is SAHPRA - Radiation Control.

The radioactive sources used in these gauges are generally sufficiently radioactive to constitute a significant health hazard unless adequately shielded and handled with proper care. Standards have been set to limit the risk of radiation over-exposure to operators as well as to the public. The standards also ensure that radiation doses are kept as low as reasonably achievable (ALARA principle).

1.1 Purpose

The purpose of this Code is to establish working practices, procedures and protective measures and to ensure the safe use and security of radioactive sources. This will ensure that the Equipment specifications, Storage requirements, and Handling procedures are adhered to. In addition, the Code will assist in keeping radiation doses arising from a portable density/moisture gauge containing radioactive sources as low as reasonably achievable.

Radioactivity is a natural phenomenon and natural sources of radiation are features of the environment. Radiation and radioactive substances have many beneficial applications, ranging from power generation to uses in medicine, industry and agriculture. The radiation risks to workers and the public and to the environment that may arise from these applications have to be assessed and, if necessary, controlled. Regarding nuclear gauges, the operating organization is typically the owner of the industrial facility in which fixed nuclear gauges are installed, or the company undertaking activities with portable nuclear gauges. The operating organization has the prime responsibility for protection and safety and is required to ensure that protection and safety is optimized.

1.2 Scope

The guideline deals with soil density, moisture and asphalt gauges are subject to regulatory control by providing code of practice which are legally enforceable. The key issues for this controls address the administrative requirements, storage requirements, handling procedures and equipment specifications.

[1] Regulations relating to Group IV Hazardous Substances, made in terms of section 29 of the Hazardous Substances Act 15 of 1973 and published under Government Notice R247 in Government Gazette 14596, dated 26 February 1993.

2. LEGAL PROVISION

The following are the relevant regulatory documents with necessary provisions:

- Hazardous Substances Act 15 of 1973
- R246, R247 Regulations related to Group IV Hazardous Substances

3. ADMINISTRATIVE REQUIREMENTS

3.1. An application for authority to possess and use a soil gauge must be submitted to SAHPRA on **Form GLF-RDN-RN-07** (old form RN787). It is illegal to be in the possession or use any radioactive source without a valid Authority.

3.2. The applicant must nominate a radiation protection officer as well as an acting radiation protection officer. Identification documents and proof of competence of the appointed Radiation Protection Officer (RPO) and Acting Radiation Protection Officer (ARPO) must also be submitted. The appointed RPO as well as ARPO must provide evidence of completing a course in radiation safety/security covering at least the following topics:

3.3. What is radiation?

3.4. Factors that will influence radiation dose

3.5. Procedures and design of equipment to reduce the chances for unnecessary exposure:

3.5.1. What is an emergency and how do you handle it?

3.5.2. Security

3.5.3. Risk analysis – compile and implement Internal Rules to reduce risk.

3.5.4. Legal requirements.

3.6. When applying for a new authority a copy of the applicant's Internal rules for the safe handling of radioactive sources must be attached. The Internal rules must be compiled according to Regulation 7 of R247[2] relating to Group IV Hazardous Substances. The Regulations, Code of Practice and minimum requirements for internal rules should be utilized in compiling the internal rules. These

[2] Regulations relating to Group IV Hazardous Substances, made in terms of section 29 of the Hazardous Substances Act 15 of 1973 and published under Government Notice R247 in Government Gazette 14596, dated 26 February 1993.

rules must be specific to address radiation safety/security requirements of the applicant.

3.7. Submit a service agreement between the Authority Holder and the appointed RPO as well as that with the ARPO. This agreement must state the RPO/ARPO's responsibility regarding radiation safety and security.

3.8. Authorities are valid for a limited period. Applications for the renewal of authorities must be submitted to SAHPRA on **Form GLF-RDN-RN-07A** (old form RN787) one month before the date of expiry. Attach a copy of all the latest leak test certificates of all the sources on your authority.

3.9. Should the RPO or ARPO change at any stage, SAHPRA must be informed of the change on form 18A. Identification documents as well as proof of the competence of the appointed RPO and ARPO must also be submitted. The same person will not be allowed to act at the same time as an RPO and ARPO of the Authority Holder.

3.10. Once a year, the holder of the authority must furnish SAHPRA with a declaration, on **Form 28A** (old form RN784), confirming the status of all the sealed sources, and that the details on this authority. This declaration is due each year before 31 January.

3.11. A copy of the Act, Regulations, authority, internal rules, and any amendments must be kept on the premises of the holder in a place accessible to all employees. The above documents can be found at **www.sahpra.org.za.**

4. EQUIPMENT SPECIFICATIONS

4.1 All soil gauges must be of a design, approved by SAHPRA. Any changes in this design must be reported to SAHPRA - Radiation Control. Modifications on the gauges will only be allowed if proof can be presented that these modifications does not influence the original requirements for approval.

4.2 If the gauge incorporates a source assembly (e.g. a source rod), which is not permanently built into the body of the gauge, the source assembly must be capable of being locked in the shielded or "off" position. Padlocks and/or keys must be available for this purpose.

4.3 All gauges must bear a radiation warning sign as well as a durable label indicating the type, activity and the serial numbers of the radioactive sources. The serial number of the gauge must also be clearly visible.

4.4 When the sources are in the shielded or "off" position, the dose rate shall not exceed the following

limits (ref 1):

500 µSv/h (50 mR/h) at any point 5 cm from the gauge surface

10 µSv/h (1 mR/h) at any point 100 cm from the gauge surface

4.5 A lockable carry-case must be available for storage and transportation of the soil gauge. The carry-case must be locked during storage and transportation. Padlocks and/or keys must be available for this purpose.

5. STORAGE REQUIREMENTS (REGULATION 12)

5.1 No radioactive material or instrument or apparatus containing such material may be stored on any premises zoned for domestic purposes.

5.2 When in storage the source assembly must be locked in the "off" or fully shielded position.

5.3 The international symbol that indicates presence of ionising radiation must be displayed at the entrance to the storeroom or storage area. The "trefoil" symbol must appear on this sign and it should also include the wording "Danger - Radiation".

5.4 Dose rates outside the store should not exceed 2.5 µSv/h (0.25 mR/h).

5.5 A notice containing the names and telephone numbers of the persons who can be telephoned in the event of an emergency, must be displayed at all storage facilities for radioactive material.

5.6 The storage facility must be lockable and unauthorised entry must be prevented.

5.7 A logbook must be provided in which the instrument/s are signed into and out of the storage facility.

5.8 No radioactive material may be stored with, or in close proximity to any corrosive, combustible or explosive material.

5.9 In the case where an instrument must be stored in a laboratory, the user must ensure that a distance of at least two meters be maintained between the instrument and the working area (or any place where people linger). The same dose rate as in 4.4 applies.

5.10 The gauge should never be left unattended unless it is in its approved storage facility. However, if such a situation is unavoidable, for example, if it is necessary to store the gauge in a vehicle overnight, the holder of the authority shall take steps to ensure that the gauge is not stolen. For example, the

vehicle could be parked on the premises of a police station, or in a lock-up garage.

5.11 All the above requirements are also applicable when a gauge is stored temporarily at ‘n construction site. Additional security measures must be implemented to reduce the chances for theft.

6. HANDLING PROCEDURES

6.1 General Requirements

6.1.1 No activity with radioactive sources is allowed to take place without a valid Authority to possess, use, convey and cause to convey. This will also imply that a legally appointed RPO and ARPO are in place.

6.1.2 No activity with radioactive sources is allowed without up-to-date Internal Rules for the safe handling of radioactive sources.

6.1.3 The radiation protection officer shall ensure that all persons handling the gauge/s are familiar with the correct operating procedures. Proof of training for all operators must be filed. The content and frequency of training will also for part of the internal rules of the Authority Holder.

6.1.4 A gauge must never be placed where it may be damaged by vehicles or machinery. A red flag must be mounted on a pole so as to be clearly visible to all operators of vehicles or earth moving equipment. The pole must be placed adjacent to the instrument while in use.

6.1.5 Operators must not stay near the gauges unnecessarily and should not waste time when conducting measurements.

6.1.6 The number of people assisting with the measurement should be kept to a minimum and all persons not required to assist with measurements must be excluded from the vicinity of the gauge (to a distance of at least 4 m) before the source is moved to the unshielded position.

6.1.7 During the course of his work, a person who handles a soil gauge which incorporates a source rod should never be in a position where he can directly observe the end of the rod (where the source is situated), as this will lead to excessive radiation exposure.

6.1.8 After use, and before storing the gauge, a visual check should be carried out to confirm that the shutter is properly closed. A mirror must be used to perform this check, as direct observance of the shutter mechanism could result in unnecessary exposure to radiation.

6.1.9 The gauge/s must be locked in the "off" position when not in use.

6.2 Repairs and Maintenance

6.2.1 Repairs and maintenance on soil gauges containing radioactive sources may only be carried out by appropriately authorised service providers.

6.2.2 Routine cleaning of the shutter mechanism may be performed by the operator provided that a mirror is used during the cleaning procedure so that the shutter mechanism can be examined without exposing the operator to the uncollimated radiation beam.

6.3 Leak Tests

6.3.1 Leak tests must be performed annually (24 months when in long term storage.)

6.3.2 Leak tests may be performed by trained technicians, or by any company who offers a leak testing service.

6.3.3 If the company has access to a suitable contamination monitor, the analysis of the leak test samples may be performed and recorded by the company themselves.

6.3.4 If the company does not have a suitable monitor, the wipe samples must be sent to a company or institution that performs such analyses. Samples should be placed in sealed plastic bags before dispatching. Samples may not be sent via the post.

6.3.5 If a source is found to be leaking (i.e. a positive result) SAHPRA – Radiation Control must be notified immediately.

6.3.6 The results of all leak tests must be recorded and available for inspection purposes at all times.

6.4 Radiation Monitoring Requirements

6.4.1 Users of soil gauges are not required to obtain a radiation monitor. However, in cases where companies possess a large number of gauges, the acquisition of a radiation monitor is recommended.

6.4.2 It is not a requirement to wear personal dosimeters (TLD Badges). Operators of soil gauges need not be registered as radiation workers. SAHPRA - Radiation Control will inform Authority Holders if this requirement has changed.

6.5 Transport

6.5.1 An enclosed vehicle must be used for day to day transport of the gauge. If a bakkie is used, a lockable canopy must be installed or the transport container must be secured on the back of the bakkie.

6.5.2 The vehicle may not be left unattended with the gauge in (or on) it.

6.5.3 Three removable transport radiation warning signs (See Annexure 1 - Fig 5) must be displayed on the vehicle during transportation; one sign on each side and one on the rear of the vehicle. The name and telephone number of a person to be contacted in the event of an emergency must appear adjacent to each sign. These signs must be removed when radioactive material is not being transported.

6.5.4 The shutter of the soil gauge must be locked in the shielded ("off") position and must be transported in its locked carry-case.

6.5.5 The carry-case must bear approved transport labels, in accordance with the maximum radiation levels on the surface of the carry-case with the gauge. (See Annexure 1 Fig 2, 3, 4)

6.5.6 A Fig 2 for dose rate less that 5 µSv/h on the surface of the container. Fig 3 for dose rates 5 - 500 µSv/h and Fig 4 for dose rates 500 - 2000 µSv/h. Under normal circumstances Fig 3 will be used.

6.5.7 The gauge shall not be transported in the passenger's compartment of the transport vehicle and shall be positioned as far as possible from the driver and passengers in the vehicle.

6.5.8 Soil gauges may be despatched by public transport (i.e. by ship, air freight or road) provided that the above requirements are met and the gauge is accompanied by properly completed transport documents specifying the radioactive content.

6.5.9 It is important to note that the National Road Traffic Act (Act 93 of 1996) is applicable for the transport of all dangerous goods including radioactive sources, as used in soil/moisture/asphalt gauges. Compliance with this act is therefore essential.

6.5.10 Adherence to the IAEA document "SSR-6 Regulations for the Safe Transport of Radioactive Material" is required for the transport of all radioactive material.

6.6 Emergency Procedures

6.6.1 SAHPRA - Radiation Control must be notified of the occurrence of any incidents/accidents involving radioactive sources, immediately. This notification can take place via telephone, e-mail or facsimile.

SAHPRA - Directorate:
Radiation Control can advise on further action to be taken and can provide radiation monitoring equipment, if required. During office hours, phone 021-015 5511; E-mail radionuclides@SAHPRA.org.za. After hours, call the NECSA 24-hour National Emergency Centre on 012-305 3333.

6.6.2 The RPO/ARPO is responsible for the on-site management of the incident.

6.6.3 Priority must be given to the rendering of first aid and other actions to protect human life or to limit injury BEFORE the radiation hazard is considered.

6.6.4 If the area where soil gauges are stored is threatened by fire, or some other potential hazard exists, the gauges must be moved to a safe place and secured against unauthorised access.

6.6.5 If it is suspected that there has been loss of, or damage to the shielding material, a distance of 5 m should be maintained from the gauge. However, the gauge could be approached more closely, without significant risk, if the emergency situation requires it.

6.6.6 If it is suspected that the sources may have been damaged (e.g. if the gauge is SEVERELY crushed or burned) the following precautions should be taken to avoid the spread of radioactive material:

6.6.7 Care should be taken not to touch the gauge, or anything in the vicinity of the gauge, unless with a gloved hand. The gauge should not be approached unless the emergency situation requires it. A barrier should be erected around the gauge (at a distance of approximately 5 m) in order to control access to it.

6.6.8 If available, a mask with a filter should be worn by persons who have to approach the gauge, to prevent possible inhalation of airborne radioactive particles.

6.6.9 Once the emergency has been dealt with, persons who were in the vicinity of the gauge should gather in a central place. Clothing or shoes suspected of being contaminated must be removed and placed in a plastic bag and sealed.

6.6.10 If any person is overexposed or suspected of being overexposed all the requested information must be reported to the SAHPRA within 7 days on **Form GLF-RDN-XR-10A** (old form RC010).

6.6.11 If a radioactive source and/or container are lost, stolen or damaged, **Form GLF-RDN-RN-12A** (old form RN900) must be submitted to the Directorate.

6.6.12 Use "SAHPGL-GLN-RN-01 Guidelines for reporting National Radiation occurrences" as a guide when compiling the Radiation Occurrence report **GLF-RDN-RN-12A** (old form RN900).

6.7 Disposal

6.7.1 SAHPRA strongly recommends that any unused radioactive sources be disposed of in the prescribed

manner. Any Radiation Control office may be contacted should you require more information on the disposal of radioactive sources.

6.7.2 The holder of authority shall not dispose of a soil gauge without the approval of SAHPRA. "Dispose" here includes sale, lend, donate, exchange, as well as return of the gauge to the supplier. An application **Form GLF-RDN-RN-20A** (old form RN526) to dispose of the gauge must be submitted to in the above cases.

6.7.3 Should the holder wish to send a gauge for "final disposal" to the Nuclear Liabilities Management (NLM) section of NECSA at Pelindaba, application must be made to SAHPRA on **Form GLF-RDN-RN-13C** (old form RN525).

7. REFERENCES

7.1. Code of Practice for the Safe Use of Soil Density and Moisture Gauges containing Radioactive Sources, NH & MRC, Canberra, Australia, 1984.

7.2. Working Safely with Nuclear Gauges, Atomic Energy Control Board, Canada.

7.3. Government Gazette No. 14596 26 February 1993.

8. VALIDITY

This guideline is valid for a period of 5 years from the effective date of revision and replaces the old Code of Practice for The Safe Use of Soil Moisture and Density Gauges Containing Radioactive Sources, revised May 2019 It will be reviewed on this timeframe or as and when required.

9. ANNEXURE

9.1 Annexure 1: The carry-case with the gauge

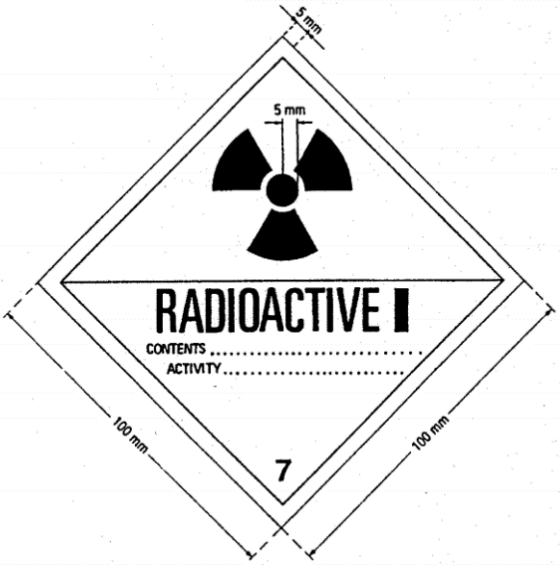

Fig 2: Category I-WHITE label. The background colour of the label shall be white, the colour of the trefoil and the printing shall be black, and the colour of the category bar shall be red.

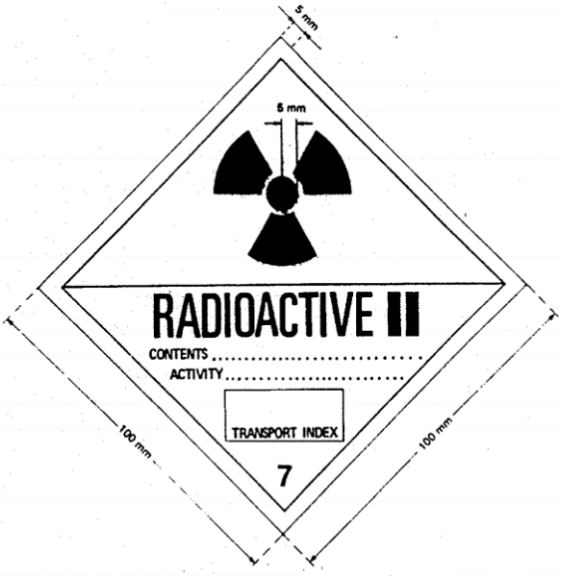

Fig 3: Category II-YELLOW label. The background colour of the upper half of the label shall be yellow and of the lower half white, the colour of the trefoil and the printing shall be black, and the colour of the category bars shall be red.

Fig 4: Category III-YELLOW label. The background colour of the upper half of the label shall be yellow and of the lower half white, the colour of the trefoil and the printing shall be black, and the colour of the category bars shall be red.

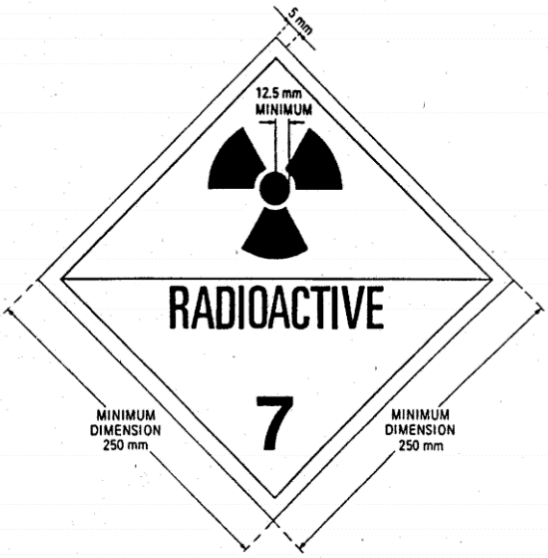

Fig 5: Placard. Minimum dimensions are given; when larger dimensions are used the relative proportions must be maintained. The figure '7' shall not be less than 25mm high. The background colour of the upper half of the placard shall be yellow and the lower half white, the colour of the trefoil and the printing shall be black.