



**DEPARTMENT OF HEALTH**  
*Republic of South Africa*

**CODE OF PRACTICE  
FOR THE SAFE USE OF  
SOIL MOISTURE AND DENSITY GAUGES  
CONTAINING RADIOACTIVE SOURCES**

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## 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 R247<sup>1</sup> related to the above mentioned act. The body responsible for administering this legislation is the Directorate: Radiation Control, Department of Health.

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).

## 2. ADMINISTRATIVE REQUIREMENTS

- 2.1 An application for authority to possess and use a soil gauge must be submitted to the Department on form RN787. It is illegal to be in the possession or use any radioactive source without a valid Authority.
- 2.2 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:
  - 2.2.1 What is radiation?
  - 2.2.2 Factors that will influence radiation dose
  - 2.2.3 Procedures and design of equipment to reduce the chances for unnecessary exposure.
  - 2.2.4 What is an emergency and how do you handle it?
  - 2.2.5 Security

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<sup>1</sup> 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.

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

2.2.7 Legal requirements.

2.3 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<sup>2</sup> 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 rules must be specific to address radiation safety/security requirements of the applicant.

2.4 Submit a service contract between the Authority Holder and the appointed RPO as well as that with the ARPO.

2.5 Authorities are valid for a limited period. Applications for the renewal of authorities must be submitted to the Department on 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.

2.6 Should the RPO or ARPO change at any stage, the Department must be informed of the change on form RN785. 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.

2.7 Once a year, the holder of the authority must furnish the Department with a declaration, on 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.

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 following the following link: <http://tinyurl.com/pne5nyv>

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<sup>2</sup> 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

### 3. EQUIPMENT SPECIFICATIONS

- 3.1 All soil gauges must be of a design, approved by the Department. Any changes in this design must be reported to the Directorate Radiation Control. Modifications on the gauges will only be allowed by the Regulator if proof can be presented that these modifications does not influence the original requirements for approval.
- 3.2 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.
- 3.3 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.
- 3.4 When the sources are in the shielded or "off" position, the dose rate shall not exceed the following limits (ref 1):
- 500  $\mu\text{Sv/h}$  (50 mR/h) at any point 5 cm from the gauge surface
  - 10  $\mu\text{Sv/h}$  (1 mR/h) at any point 100 cm from the gauge surface
- 3.5 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.

### 4. STORAGE REQUIREMENTS (REGULATION 12)

- 4.1 No radioactive material or instrument or apparatus containing such material may be stored on any premises zoned for domestic purposes.
- 4.2 When in storage the source assembly must be locked in the "off" or fully shielded position.
- 4.3 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".
- 4.4 Dose rates outside the store should not exceed 2.5  $\mu\text{Sv/h}$  (0.25 mR/h).

- 4.5 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.
- 4.6 The storage facility must be lockable and unauthorised entry must be prevented.
- 4.7 A logbook must be provided in which the instrument/s are signed into and out of the storage facility.
- 4.8 No radioactive material may be stored with, or in close proximity to any corrosive, combustible or explosive material.
- 4.9 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.
- 4.10 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.
- 4.11 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.

## **5. HANDLING PROCEDURES**

### **5.1 General Requirements**

- 5.1.1 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.
- 5.1.2 No activity with radioactive sources is allowed without up to date Internal Rules for the safe handling of radioactive sources.
- 5.1.3 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.

- 5.1.4 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.
- 5.1.5 Operators must not stay near the gauges unnecessarily, and should not waste time when conducting measurements.
- 5.1.6 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.
- 5.1.7 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.
- 5.1.8 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.
- 5.1.9 The gauge/s must be locked in the "off" position when not in use.

## **5.2 Repairs and Maintenance**

- 5.2.1 Repairs and maintenance on soil gauges containing radioactive sources may only be carried out by appropriately authorised service providers.
- 5.2.2 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.

## **5.3 Leak Tests**

- 5.3.1 Leak tests must be performed annually (24 months when in long term storage.)
- 5.3.2 Leak tests may be performed by trained technicians, or by any company who offers a leak testing service.
- 5.3.3 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.

- 5.3.4 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.
- 5.3.5 If a source is found to be leaking (i.e. a positive result) the Department must be notified immediately.
- 5.3.6 The results of all leak tests must be recorded and available for inspection purposes at all times.

## **6. RADIATION MONITORING REQUIREMENTS**

- 6.1 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.
- 6.2 It is not a requirement to wear personal dosimeters (TLD Badges). Operators of soil gauges need not be registered as radiation workers. The Directorate Radiation Control will inform Authority Holders if this requirement has changed.

## **7. TRANSPORT**

- 7.1 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.
- 7.2 The vehicle may not be left unattended with the gauge in (or on) it.
- 7.3 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.
- 7.4 The shutter of the soil gauge must be locked in the shielded ("off") position and must be transported in its locked carry-case.
- 7.5 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)

Figure 2 for dose rate less than 5  $\mu\text{Sv/h}$  on the surface of the container. Figure 3 for dose rates 5 – 500  $\mu\text{Sv/h}$  and Figure 4 for dose rates 500 – 2000  $\mu\text{Sv/h}$ . Under normal circumstances Figure 3 will be used.

- 7.6 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.
- 7.7 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.
- 7.8 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.
- 7.9 The IAEA document "SSR-6 Regulations for the Safe Transport of Radioactive Material" must be used as a guide for the transport of all radioactive material.

## 8. EMERGENCY PROCEDURES

- 8.1 The Directorate 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.

The Department of Health - Directorate: Radiation Control can advise on further action to be taken and can provide radiation monitoring equipment, if required. During office hours, phone 021-957 7458; Fax: 021-946 1589. After hours, call the Necsca 24-hour National Emergency Centre on 012-305 3333.

- 8.2 The RPO/ARPO is responsible for the on-site management of the incident.
- 8.3 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.
- 8.4 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.
- 8.5 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.

- 8.6 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:
- 8.7 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.
- 8.8 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.
- 8.9 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.
- 8.10 If any person is overexposed, or suspected of being overexposed all the requested information must be reported to the Directorate within 7 days on form RC010.
- 8.11 If a radioactive source and/or container are lost, stolen or damaged, form RN900 must be submitted to the Directorate.
- 8.12 Use "RN-GLN-EPR-001 Guidelines for reporting National Radiation occurrences" as a guide when compiling the Radiation Occurrence report (RN900).

## **9. DISPOSAL**

- 9.1 The Department 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.
- 9.2 The holder of authority shall not dispose of a soil gauge without the approval of the Department. "Dispose" here includes sale, lend, donate, exchange, as well as return of the gauge to the supplier. An application form RN526 to dispose of the gauge must be submitted to the Department in the above cases.
- 9.3 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 the Department of Health on form RN525.

## 10. REFERENCES

1. Code of Practice for the Safe Use of Soil Density and Moisture Gauges containing Radioactive Sources, NH & MRC, Canberra, Australia, 1984.
2. Working Safely with Nuclear Gauges, Atomic Energy Control Board, Canada.
3. Government Gazette No. 14596 26 February 1993.

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ANNEXURE 1

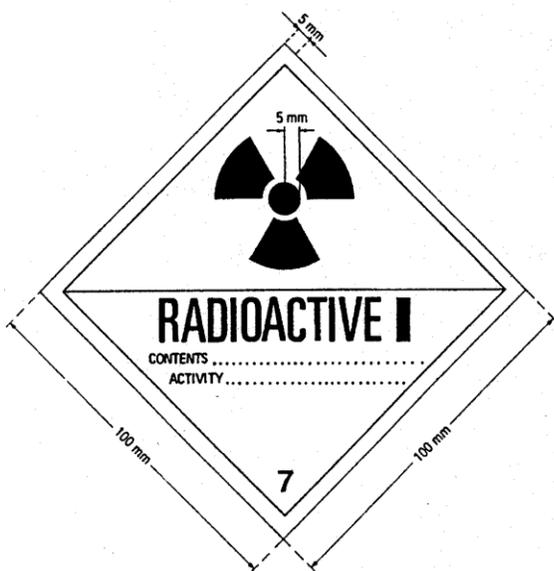


Fig 2: Category I-WHITE label. The background colour of the label shall be white, the colour of the trefoil and the printing shall be black, and the colour of the category bar shall be red.



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.

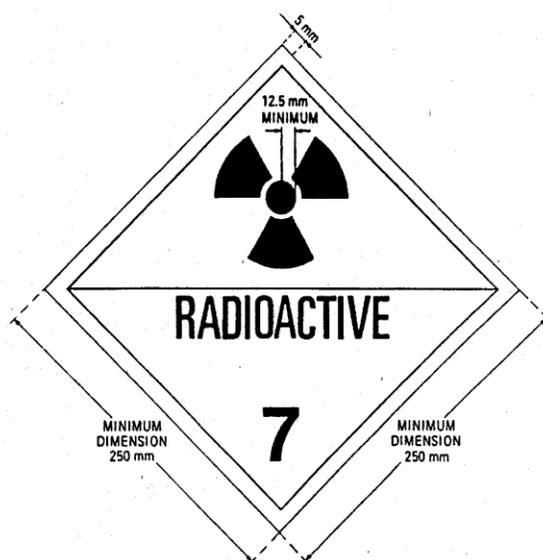


Fig 5: Placard. Minimum dimensions are given; when larger dimensions are used the relative proportions must be maintained. The figure '7' shall not be less than 25mm high. The background colour of the upper half of the placard shall be yellow and the lower half white, the colour of the trefoil and the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