



THE UNIVERSITY OF
WESTERN AUSTRALIA

Safety and Health Office

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GUIDELINES FOR USE OF NUCLEAR MOISTURE/DENSITY GAUGES

REVISED

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Acknowledgement: Agriculture Department of WA



1. INTRODUCTION

Nuclear moisture gauges utilise radioactive sources for the determination of the moisture content of soils. Though the radioactivity of the sources is sufficiently low to present a negligible and acceptable risk to the operators, the gauges are classified as potentially hazardous devices and may only be used, repaired or adjusted by trained and authorised persons. These guidelines specify the working practices, procedures and safety rules to be followed when handling nuclear moisture gauges. All handling, operation, maintenance and repairs must be carried out in accordance with these procedures.

With the exception of replacing faulty fuses, repairs to a nuclear gauge or replacement of parts must not be carried out without the prior formal approval of the Radiation Safety Officer (portable gauges). In the first instance, approval may be sought by telephone but this must be confirmed by fax or by letter as soon as practicable thereafter. Under no circumstances should untrained or unauthorised persons attempt to use, repair or adjust nuclear moisture/density gauges.

2. RESPONSIBILITIES

2.1 The University of Western Australia

2.1.1 Registrant

Under the provisions of the Radiation Safety Act 1975-1981 and the Radiation Safety (General) Regulations 1983, the Vice Chancellor is registered as the owner of premises where the nuclear gauges are stored or operated.

2.1.2 Radiation Safety Officer

The Radiation Safety Officer (Mr Michael Rafferty 2307) acts on behalf of the Vice-Chancellor (registrant) to ensure that relevant radiation safety systems are set up and maintained. The Radiation Safety Officer is responsible for matters relating to radiological safety, training of operators and for transportation, operational use, maintenance and repairs of nuclear gauges.

2.1.3 Licensed operator

The licensed operator shall be responsible for the safe handling and operation of the nuclear gauge in the field, and must be present during its use, and ensure that all log books are current.

2.1.4 School Radiation Safety Officer (SRSO)

The SRSO is responsible for the nuclear gauges in their School. The SRSO shall ensure that only trained and 'experienced' operators under the supervision of a licensed operator can use the nuclear gauges.

SRSO's responsibilities for nuclear gauges are:

- Security of the nuclear gauges;
- Distribution and collection of radiation monitoring TLD badges;
- Handling and operation of the gauges in accordance with the relevant safety procedures;
- Operation of the nuclear gauges in accordance with appropriate test methods;
- Nominating the licensed operator to be in charge of the nuclear gauge in the field;



- Performing or arranging maintenance and repairs only after authorisation by the Radiation Safety Officer (portable gauges);
- Recording of all pertinent data in the log book of the nuclear gauge (Appendix C);
- Forwarding records and data to the Radiation Safety Officer as required.

2.1.5 Licensed operators and operational experience

Before a licensed operator is classed as 'experienced', they must have had operational experience with a nuclear gauge on at least 2 days under the supervision of an experienced, licensed operator. Any operator must conform to operational procedures as described in the relevant gauge's operational manual. The licensed operator must be in the field at the site of the gauge's use.

Licensed operator's responsibilities for nuclear gauges are:

- Correct handling and care of radiation monitoring TLD badges.
- Security of the nuclear gauges in the field.
- Handling and operation of the nuclear gauges in accordance with the relevant safety procedures.
- Locking the probe into its shielded position using the padlock supplied for transport and storage.
- Monitoring of nuclear gauges, on removal and return to store as required.
- Recording all pertinent data in the log books of the nuclear gauges (Appendix C).
- Carrying out emergency procedures in case of an accident.
- Reporting at the earliest possible opportunity all accidents (Section 8).

3. RADIATION MONITORING

3.1 Personnel monitoring - TLD badges

The thermoluminescence dosimeters badges are individually wrapped in blue plastic holders. These are **NOT** to be removed from the holder. TLD badges provide a record of the exposure of the operator to radiation emitted by a nuclear gauge. TLD badges are issued by the Australian Radiation Protection and Nuclear Safety (ARPANSA) and shall be worn by all personnel operating nuclear gauges and by other persons, who during their work, may be exposed to radiation emitted by the gauge. Each badge is identifiable by its serial number and name of the person to whom it was issued and may only be worn by that person. All TLD badges will be exchanged with new ones at intervals of three months as prescribed by ARPANSA.

Operators engaged in field activities shall secure the TLD badge after working hours at a distance of at least 10 m from the nuclear gauge. Outside of working hours the nuclear gauge must be stored in a secure area, with a distance of at least 10 m from the operator or members of the public. TLD badges must not be exposed to high temperatures or left exposed to strong natural or artificial light. In particular, they should not be left in the sun on the dashboard or rear window ledge of a vehicle.

TLD badges must be protected from moisture, fuels and oils.

The operator should ensure that the TLD badge holder is securely fixed to his/her clothing. It should be worn on the waist. The attachment of the TLD badge holder should be checked regularly. If a TLD badge and holder is lost, every effort must be made to recover it.



A TLD badge should be returned immediately to the Safety and Health Office if there is reason to believe that it is faulty, or if it is suspected that the person to whom it was issued received a dose in excess of 1,000 μSv . The operator shall not then work with the gauge until a new badge is issued or the dose is determined by ARPANSA.

3.2 Monitoring of nuclear gauges - Wipe tests

Annual wipe tests on nuclear gauges are to be carried out by the Safety and Health Office. In case of accidents, additional wipe tests may be requested to check the integrity of the source containment.

4. TRANSPORT OF NUCLEAR GAUGES

4.1 General

Nuclear gauges shall be transported in accordance with the requirements of the Code of Practice for the Safe Transport of Radioactive Substances (2001) promulgated under the Environment Protection (Nuclear Codes) Act 1978. Prior to the transport of nuclear gauges the following shall be complied with:

- The appropriate warning labels and placard are attached to the shell of the nuclear gauge (Appendix A; Figures 1 and 2).
- The probe of the nuclear gauge is secured in the shielded position.
- Locking the probe into its shielded position using the padlock supplied for transport and storage.
- The nuclear gauge is in its transport case and is clipped shut.
- Category II yellow warning labels with the legible relevant information are attached to the two sides of the box. This will describe the source, type of container, name of contact telephone number of owner.
- Details of the transport are entered in the log-book of the gauge store.
- Observe general handling rules outlined in Appendix B.

4.2 Transport in University of Western Australia vehicles or in vehicles under the control of the University of Western Australia

Nuclear gauges may be transported in utilities or station wagons. The utility must have a sturdy weather proof cover and the gauge in its carry case is to be securely stowed at the rear of the vehicle with the shield end facing outward. Transporting in a station wagon, the gauge is to be securely stowed in the rear compartment. The distance of the gauge from the driver and passengers should be at the maximum possible but not less than 1.2 m and the dose rate less than 20 $\mu\text{Sv/h}$.

Vehicles transporting nuclear gauges must carry warning placards attached to each side and rear of the vehicle (Appendix A, Figure 3). The signs can be supplied by the Safety and Health Office. Every reasonable effort must be made to recover any lost signs. Fuel with the exception of that required for the transport vehicle, explosive, combustible or corrosive material must not be carried in the vehicle.

4.3 Transport in non University of Western Australia vehicles



It is preferable to transport gauges in University of Western Australia vehicles. A completed Dangerous Goods form plus instructions on the action to be followed in case of an emergency must be given to the driver of the transport vehicle. A second envelope containing a copy of the above Dangerous Goods form plus emergency instructions must also be attached to the outside of the transportation box. Transport on aircraft is not permitted without prior permission of the Radiation Safety Officer.

5. STORAGE OF NUCLEAR GAUGES

5.1 University of WA Nedlands Campus

Gauges are to be stored in the Plant Biology storage shed across the car park on the north side of Plant Biology South on the University Campus. All relevant information shall be entered into the log book for that particular gauge whenever the gauge is placed into or removed from the store.

5.2 Storage at off Campus Sites

The probe shall be secured into the shield and the instrument inside its carry case. The store should be of a secure construction with a lockable door and not be within two metres of an area that is likely to be used by any person for more than four hours per day. The store shall have a warning placard attached in the proximity of the entry to the store (Appendix A, Figure 4). Fuels, explosives, combustible and corrosive substances shall not be stored in conjunction with nuclear gauges.

5.3 Vehicle storage

The unoccupied vehicle containing a nuclear gauge shall be fitted with the appropriate warning signs displayed each side and rear of the locked vehicle. Nuclear gauges should not be left in a vehicle overnight unless **NO** other storage facility is available, e.g. Research Station.

6. OPERATION AT FIELD SITES

The licensed operator in charge of the nuclear gauge must ensure that the gauge is not endangered by vehicles or mobile equipment. The following requirements must be adhered to:

- The operator(s) should keep a distance of at least two metres away from the nuclear gauge except when:
 - carrying the instrument;
 - carrying out monitoring, maintenance or repairs of the instrument.
 - carrying out the procedures of Test Methods;
 - carrying out any other work requested or authorised by the Radiation Safety Officer
- All persons not wearing a radiation monitoring TLD badge must keep a distance of at least five metres from the nuclear gauge.
- The nuclear gauge must at all times remain in full view of the operator. The distance of the nuclear gauge from the operator must not exceed ten metres.

7. MAINTENANCE AND REPAIRS OF NUCLEAR GAUGES



- With the exception of replacing faulty fuses, repairs to a nuclear gauge or replacement of parts must not be carried out without the prior formal approval of the Radiation Safety Officer (Mr Michael Rafferty 2307).
- The Officer in Charge of the gauge should make regular checks of the free movement of all components.
- Radioactive sources may only be removed from gauges by Radiological Council approved persons who have been nominated by the Radiation Safety Officer.

8. ACCIDENTS

- Contact the Radiation Safety Officer as soon as possible.
- Restrict access to the site of the damaged instrument by roping the area off (a 5 m radius is sufficient).
- The operator shall record all information considered to be relevant.
- If the nuclear gauge appears to be undamaged and in danger of imminent damage then it should be moved to a secure location.
- If the gauge is under a vehicle then the vehicle may only be moved if it will not sustain further damage in the process. If there is any doubt then the Radiation Safety Officer should be contacted to assess the situation.
- If the instrument is damaged, in particular the source rod, cover the instrument with plastic or a tarpaulin to reduce the spread of possible contamination and wait for the Radiation Safety Officer to take charge. Do not pick up or move the pieces.

9. LOSS OR THEFT

If the gauge is lost or stolen the Radiation Safety Officer, Radiation Health Section and the Police must be notified as soon as possible.

10. RADIATION SAFETY OFFICER

Mr Michael Rafferty
Safety and Health Office
University of Western Australia
Crawley WA 6009
Telephone: (08) 6488 2307, Mobile; 0417 094 860, E-mail: Michael.Rafferty@uwa.edu.au

In his absence the following should be contacted:

Jonathon Thwaites
Radiation and Safety Officer
University of Western Australia
Crawley WA 6009
Telephone: (08) 6488 7932
Mobile: 0419 924 355

Radiation Health Section
18 Verdun Street
(Locked Bag 2006)
Nedlands WA 6009
Telephone: (08) 9346 2260
Facsimile: (08) 9381 1423

EMERGENCY (08) 9346 3333 (all hours)

11. FURTHER INFORMATION AND ADVICE



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For further information or advice on radiation safety or nuclear gauges in general, contact the Radiation Safety Officer.

The following codes of practice can be downloaded from http://www.arpansa.gov.au/rps_pubs.htm

- Code of Practice for the Safe Transport of Radioactive Substances (2001).
- Code of Practice and Safety Guide for Portable Density/Moisture Gauges Containing Radioactive Sources (2004).



APPENDIX A

RADIATION SIGNS

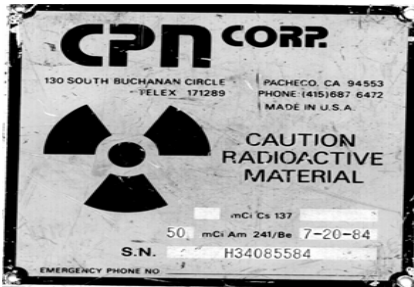


Figure 1
Label attached to the housing of
neutron source

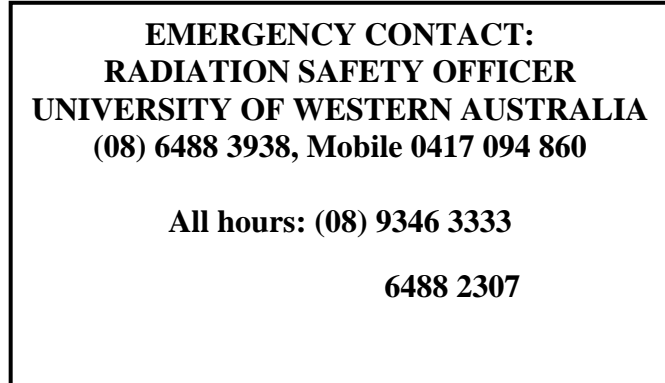


Figure 2
Label attached to the rear of housing
of neutron source, lid of carry case and in the cab of
the vehicle

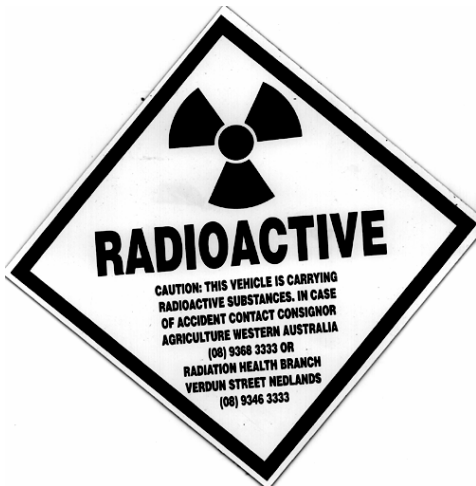


Figure 3
Placard attached to the sides and to the
rear of the vehicles transporting nuclear
gauges

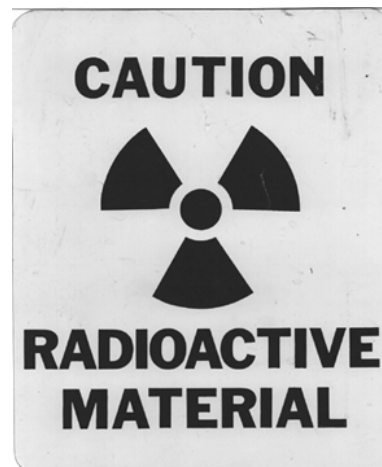


Figure 4
Placard attached to stores of nuclear
gauges



APPENDIX B

HANDLING AND TRANSPORT RULES

The radioactive materials presented for transportation are packaged in accordance with the IAEA Regulations that ensure that they are safe to handle under normal conditions. Nevertheless, to prevent unnecessary exposure to radiation there are certain basic rules which you should know and follow in your work as the radiation exposure you received depends on how long you stay near, and how close you stay to, the packages containing radioactive materials.

- Only authorised personnel may use gauges under the supervision of a license holder.
- Neutron gauges must be returned promptly to store when work is completed.
- Log book details must be completed on pickup and return of gauges.
- The log book is to be kept in a separate location to the store.
- TLD monitors must be worn by personnel using the gauges.
- Security of the gauge from theft or damaged must be ensured at all times.
- Gauges must not be left unattended at any time.
- Transport labels are required on both sides and the back of the vehicle.
- Labels are required on the housing of the gauge and in the cab of the vehicle.

TO MINIMISE RADIATION EXPOSURES:

- Keep your contact time with the package to the minimum necessary.
- Do not stand around, sit near or it on a radioactive material package.
- Store package well away from officer, rest rooms and occupied work areas.
- When transporting package over any long distance, use a vehicle that will allow you to keep a metre or more between you and the package.
- Secure package in the vehicle so that it will not move during transport.

IN CASE OF AN ACCIDENT:

If the package has been damaged, and you suspect that the damage may allow leakage of radiation or spillage of radioactive material:

- Stay away from the package and **DO NOT TOUCH IT**.
- Keep other people away from it by establishing a cordon around the site (5 m radius).
- Notify the Safety and Health Office as soon as possible. Also inform them of any person who might have been contaminated.
- Wash your hands thoroughly if you have touched the damaged package or objects near it and advise the Safety and Health Office.
- Note any vehicles involved in the accident, the vehicles should remain at the accident site until cleared by the police or a competent person.
- **DO NOT** eat, smoke, drink or leave until checked for possible contamination.
- Advise the competent authority of details of the accident as soon as possible and follow any instructions subsequently issued.

