



## Portable nuclear moisture/density gauges in the construction industry

This leaflet is aimed at employers of those people working with portable nuclear moisture/density gauges, and the self-employed. It may also be helpful to those managing road-building or repair projects where these gauges may be used.

Work including the use, keeping, transportation and disposal of the gauges is subject to the Health and Safety at Work etc Act 1974; the Ionising Radiations Regulations 1999 (IRR99);<sup>1</sup> the Radioactive Materials (Road Transport) (Great Britain) Regulations 1996 (RAMRoad); the Carriage of Dangerous Goods by Road (Driver Training) Regulations 1996; and the Radioactive Substances Act 1993 (RSA93).<sup>2</sup> This leaflet does not cover compliance with RAMRoad and RSA93.<sup>2</sup> The Dangerous Goods (Safety Advisers) Regulations 1999 are unlikely to apply to the transport of gauges.

It is a fundamental requirement of IRR99 that employers take all steps to ensure that exposure of employees (and other people) to ionising radiation is restricted to a level which is as low as reasonably practicable (ALARP) (regulation 8 IRR99).<sup>1</sup> This leaflet contains information to help employers to achieve this.

### Radiation risks

Gauges usually have two radioactive sources - typically a <sup>137</sup>Cs gamma source and a <sup>241</sup>Am/Be neutron source. When the gauge is not in use, some shielding of the sources is provided by the body of the gauge; however, the gamma source can be projected downwards out of the base of the gauge. The neutron source remains fixed within the body of the gauge.

Radiation levels around the gauge depend on:

- the type and activity of the sources;
- the mode of operation of the gauge, since the gamma source may be projected out from the base of the gauge;
- the amount of extra shielding (such as the plate guard and ground); and
- the direction in which the gauge is pointing.

Radiation levels are highest near the source and the base plate, and decrease with distance from the gauge. Damage to the gauge or poor work practices may lead to people receiving high radiation exposures, which could potentially cause harmful effects to their health. Nuclear density gauges have been involved in several

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incidents leading to an increased risk of radiation exposure for operators and other people.<sup>3</sup> These have included gauges being crushed by site vehicles, loss or theft, or failure of the shutter.

### Consultation with a radiation protection adviser (RPA)

You will need to consult and appoint a suitable RPA for advice on the steps you need to take to comply with IRR99<sup>1</sup> (regulation 13 IRR99).<sup>1</sup> You should consult your RPA for assistance in addressing the issues raised in this leaflet. The RPA may also be able to advise you with respect to RAMRoad, RSA93<sup>2</sup> and driver training. The RPA can be an employee or a consultant but must be competent and suitable, possessing the specific knowledge, experience and competence to advise you on your work. HSE has published a statement setting out criteria of competence for basic radiation protection adviser (RPA) capability.<sup>4</sup> You should check that the RPA satisfies the criteria of competence. To be suitable, an RPA must have knowledge of the use of the gauge and the working conditions in which it is to be used.

### Notification

You have to notify HSE in writing 28 days in advance of the first time you work with ionising radiation, ie the gauge (regulation 6 IRR99).<sup>1</sup> You should send this notification to your nearest HSE office.

RSA93<sup>2</sup> additionally requires employers using the gauges to register their keeping and use with the Environment Agency (EA) or Scottish Environment Protection Agency (SEPA) before taking delivery of them.

### Prior risk assessment

Before you allow employees to use the gauge, you must assess the risks of exposure to ionising radiation, both to employees and other people<sup>5</sup> (regulation 7 IRR99).<sup>1</sup> This is to ensure that all radiation exposures are kept ALARP. Your RPA should help you with your risk assessment. You should carry out a new risk assessment, or at least review the existing one, whenever your work with ionising radiation changes - for example, when you move to a new site or use a different piece of equipment.

### Controlled areas

You must designate a controlled area when the gauge is in use (regulation 16 IRR99).<sup>1</sup> This will include when the gauge is within its transport container, eg during storage

or transport. A controlled area is one in which anyone required to enter it has to follow special procedures to restrict significant exposures. In particular, a controlled area should be designated if radiation levels in an area to which people can gain access exceed 7.5 µSv per hour. Radiation levels around the gauge will exceed this figure and your risk assessment should therefore conclude that a controlled area will always be necessary. The size of the area will depend on the type of gauge but, as a rough guide, it is usually about 2 metres around the gauge when in use.

Only classified persons or those working under written arrangements can enter controlled areas (regulation 18 IRR99)<sup>1</sup> but they should not remain inside the area when it is not necessary to do so; for example, during measurements. You must ensure that other people are kept out of the area. Your risk assessment should help you identify the best way to achieve this - either by using barriers and warning signs or, if the work is of short duration, by the operator's constant supervision.

### **Local rules, radiation protection supervisor (RPS)<sup>6</sup> and training**

You must write local rules (regulation 17 IRR99).<sup>1</sup> These are clearly written procedures including arrangements for designating, demarcating and working in controlled areas, together with suitable contingency plans for reasonably foreseeable radiation accidents and incidents. You must also appoint an RPS<sup>6</sup> to supervise that work is carried out in accordance with those rules (regulation 17 IRR99)<sup>1</sup> and provide them with appropriate training to enable them to do so (regulation 14 IRR99).<sup>1</sup> The local rules should include the name of the RPS. The local rules should also record the received radiation dose that would prompt you to carry out an investigation into the causes (investigation level). You should ensure that all operators and drivers are trained in safe working practices, including the requirements of the local rules (regulations 14 and 17 IRR99).<sup>1</sup>

### **Classified persons and personal monitoring**

If doses for adult employees are likely to exceed certain levels\*, you have to designate them as classified persons (regulation 20 IRR99).<sup>1</sup> You will then have to use an Approved Dosimetry Service to assess and record their doses (regulation 21 IRR99).<sup>1</sup> If people who are not classified work with the gauges, you still have to show that their exposure is ALARP and below the level that would require them to be classified. To do this, you should provide personal dosimeters or use other appropriate means to assess their exposures to both neutron and gamma radiations. Your RPA should be able to advise you on this.

\* 6 mSv effective dose or 3/10 of any dose limit specified in Schedule 4 IRR99.

### **Area monitoring**

You will need to provide a suitable monitor for checking radiation levels around the controlled area periodically (regulation 19 IRR99),<sup>1</sup> and also checking that the gauge shutter is closed before leaving the area after use. A gamma radiation monitor is sufficient to check shutter closure and gamma levels around the gauge, but you must also consider neutron radiation when designating controlled areas during gauge use, transport or storage. Your RPA should be able to advise you. Records of dose rates and testing and maintenance of the monitor will need to be kept. Employees should receive appropriate training in use of the monitor and interpretation of results (regulations 14 and 19 IRR99).<sup>1</sup>

### **Storage and location records**

You will need a store to prevent theft and provide shielding from both gamma and neutron radiation (regulation 29 IRR99).<sup>1</sup> A locked vehicle is only acceptable as a store for short periods when the gauge is in transit. Furthermore, keeping gauges in a vehicle overnight is only acceptable if it is not reasonably practicable to provide or make use of a proper store and if the vehicle is locked and kept in a secure place, such as a locked compound.

Any controlled area should not extend outside the store, which should be locked and marked with an appropriate radiation warning sign. You may need to designate the inside of the store as a controlled area, particularly if more than one gauge is in store.

You must know where the gauge is at all times and keep source location records (regulation 28 IRR99).<sup>1</sup> The records should be sufficient to easily locate the source and quickly identify loss or theft and should be updated daily when the gauge is in use. Any loss or theft must be reported immediately to HSE, EA or SEPA, and if lost in transit, also the police and the Department for Transport.

### **Working on site**

When the gauge is used on a site controlled by another employer, both employers will need to co-operate to manage the work properly. Local rules and contingency plans should be modified as appropriate, and arrangements for local overnight storage should be made as necessary. The site manager (or person responsible for site health and safety) may want proof of the operator's competence. When on site, the operator should contact the site manager, who can ensure that other site workers know that the gauge is being used and do not enter the controlled area. When in transit, the gauge should always be transported in its box and with the base of the gauge as far away from the vehicle occupants as possible.

## Maintenance and cleaning

You should ensure that the gauge and its safety features are properly maintained and tested as appropriate (regulation 27 IRR99).<sup>1</sup> Your RPA and gauge supplier should be able to advise you on what you need to do.

Dirt on the base of the gauge may stop the shutter closing, leaving the gamma radiation source exposed. If the base is cleaned by the operator, point it away, view with a mirror and use long-handled tools. The operator should be trained in the safe performance of this operation. Only people trained in the additional radiation risks should do further maintenance work on the gauge - for example the gauge supplier. In addition to routine gauge maintenance, the radioactive sources within the gauges should be tested for leakage of radioactive material at least every two years.

## Contingency plans

These must deal with any radiation accidents that you consider could happen. For example:

- shutter jammed open;
- gauge run over or gauge body damaged;
- gauge lost or stolen;
- transport vehicle involved in road accident;
- unretracted source; and
- fire on site or in transit.

You must have plans to handle these contingencies (regulation 12 IRR99).<sup>1</sup> The operator will need training on how to deal with them, but the RPA should be available for further advice. You should provide an emergency kit which includes long-handled tools, a mirror, extra barrier tape and warning signs.

## Disposal

You must dispose of the gauge safely, in accordance with the requirements of RSA93.<sup>2</sup> For advice on disposal, contact the EA, SEPA, or the supplier.

If you intend to sell the gauge on to another company, you have certain responsibilities. These include the supply of information on the safe use and testing of the gauge, and on the requirements of IRR99. You should also confirm that anyone to whom you intend to supply the gauge is aware of the requirement for registration with EA/SEPA under RSA93.<sup>2</sup>

## References

- 1 *Ionising Radiations Regulations 1999* SI 1999/3232 Stationery Office 2000 ISBN 0 11 085614 7
- 2 *Radioactive Substances Act 1993* HMSO ISBN 0 10 541293 7
- 3 *IRID: Ionising Radiations Incident Database. First review of cases reported and operation of the database.* Joint HSE, EA and NRPB publication. NRPB 1999 ISBN 0 85951 436 6 Available from National Radiological Protection Board, Chilton, Didcot, Oxon OX11 0RQ. Tel: 01235 831600. Fax: 01235 833891.
- 4 HSE Statement on radiation protection advisors at [www.hse.gov.uk/hthdir/noframes/state.htm](http://www.hse.gov.uk/hthdir/noframes/state.htm)
- 5 *Five steps to risk assessment* Leaflet INDG163(rev1) HSE Books 1998 Single copies free or priced packs of 10 ISBN 0 7176 1565 0
- 6 *Radiation protection supervisors* Ionising Radiation Information Sheet IRIS 6 HSE Books 2000

## Further reading

*Work with ionising radiation. Ionising Radiations Regulations 1999. Approved Code of Practice and guidance* L121 HSE Books 2000 ISBN 0 7176 1746 7

While every effort has been made to ensure the accuracy of the references listed in this publication, their future availability cannot be guaranteed.

## Further information

HSE priced and free publications are available by mail order from HSE Books, PO Box 1999, Sudbury, Suffolk CO10 2WA Tel: 01787 881165 Fax: 01787 313995 Website: [www.hsebooks.co.uk](http://www.hsebooks.co.uk) (HSE priced publications are also available from bookshops.)

For information about health and safety ring HSE's InfoLine Tel: 08701 545500 Fax: 02920 859260 e-mail: [hseinformationservices@natbrit.com](mailto:hseinformationservices@natbrit.com) or write to HSE Information Services, Caerphilly Business Park, Caerphilly CF83 3GG. You can also visit HSE's website: [www.hse.gov.uk](http://www.hse.gov.uk)

This leaflet contains notes on good practice which are not compulsory but which you may find helpful in considering what you need to do.

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