



## REGULATORY CONTROL OF RADIATION SOURCES AND RADIOACTIVE MATERIALS: THE UK POSITION

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**Abstract.** The paper presents the organizations involved in the regulation of the safety of radiation sources and the security of radioactive materials across the UK.

The safety of radiation sources is within the regulatory remit of the Health and Safety Executive, under the Health and Safety of Work Act 1974 and associated regulations. Any employer using radiation sources has a statutory duty to comply with this legislation, thereby protecting workers and the public from undue risk.

From a radioactive waste management perspective, the storage and use of radioactive materials and the accumulation and disposal of radioactive waste are regulated by the environment agencies of England and Wales, Scotland, and Northern Ireland, under the Radioactive Substances Act 1993.

Special regulatory arrangements apply to nuclear sites, such as power stations and fuel cycle plants, and some additional bodies are involved in the regulation of the security of fissile materials.

An explanation is given in the paper as to how these organizations work together to provide a comprehensive and effective regulatory regime.

An overview of how these regulators have recently started to work more closely with other enforcement bodies, such as the Police and Customs and Excise is also given, to illustrate the approach that is being applied in the UK to deal with orphan sources and illicit trafficking.

### THE SCALE OF USE OF RADIOACTIVE MATERIALS IN THE UK

Radioactive materials are widely used in the UK in the nuclear industry; medical/dental uses; manufacturing; construction; engineering; paper; offshore; education (colleges, schools) and non-destructive testing.

There are approximately 6000 permits relating to users of radioactivity in the UK, and some 400 000 movements of radioactive material are undertaken each year. In addition there are some 30 sites which are licensed under the Nuclear Installations Act 1965.

### THE REGULATORY FRAMEWORK

Regulatory responsibilities in the UK concerning the storage and use of radioactive sources and the management of radioactive waste are split between the environment agencies and the Health and Safety Executive (HSE). The regulation of transport of radioactive materials is the responsibility of the Department of the Environment, Transport and the Regions (Radioactive Materials Transport Division – RMTD).

The Health and Safety Executive (HSE) regulates the safety of any use of ionizing radiation, including uses associated with radioactive sources, under the Ionizing Radiation Regulations 1999. The HSE has further powers to regulate the operational safety of UK nuclear installations under the 1965 Nuclear Installations Act 1965.

Where radioactive waste is *stored* on sites licensed under the Nuclear Installations Act 1965, (NIA65, as amended), it is the HSE, rather than the Environment Agency, which has the statutory powers to regulate such storage. However, the Environment Agency is responsible for regulating *disposals* of all forms of radioactive waste (solids, liquids and gases) on or from the sites that HSE license.

The Environment Agency has a major role, under the Radioactive Substances Act 1993 (RSA93), as amended by the Environment Act 1995, in regulating the disposal and storage of radioactive waste in England and Wales. The Scottish Environment Protection Agency (SEPA) and the Industrial Pollution and Radiochemical Inspectorate (IPRI) have similar roles in Scotland and Northern Ireland respectively.

The HSE and the Environment Agency (EA) have set down and agreed on their responsibilities and working arrangements on matters of joint interest, within a Memorandum of Understanding, to ensure that the regulatory system is applied in a consistent and comprehensive manner.

This paper will not deal with nuclear licensed site issues, but will focus on the issues of the wider safety and security issues of sealed and unsealed sources. Special arrangements apply to nuclear sites, such as power stations and fuel cycle plants, and some additional bodies are involved in the regulation of the security of fissile materials.

The principles described in this paper are written from the perspective of the regulator for England and Wales, but the arrangements in the other environment agencies are identical for the purposes of environmental radiation protection legislation.

## **THE IONIZING RADIATION REGULATIONS 1999**

In 1996, the revised Basic Safety Standards (BSS) Directive of the European Union (96/29/Euratom) was adopted, allowing four years for implementation. The Directive reflected the 1990 recommendations of the International Commission on Radiological Protection.

In the United Kingdom, the BSS Directive is being implemented by a combination of existing and new legislation developed by several Government departments and agencies. The key legislation in the context of this paper is the Ionizing Radiation Regulations 1999.

The Ionizing Radiation Regulations 1999 are made under the Health and Safety at Work Act 1974. Their purpose is to impose duties on employers to protect employees and other persons against ionizing radiation arising from work with radioactive substances and other sources of ionizing radiation. They are enforced by the HSE.

The regulations impose a number of controls on the use of sources of ionizing radiation, whether these are radioactive sources, or radiation generators.

The controls that are particularly relevant to this paper include:

- Notification — the HSE must be notified in advance of the intention to use radiation sources;
- Appointment of Radiation Protection Advisers (RPAs) and other competent people in accordance with the HSE's defined criteria for core competence;

- Requirements for co-operation between employers;
- Arrangements for the control of radioactive substances: including requirements for:
  - accounting for and recording the quantity and location of radioactive substances, and requirements to keep records following disposal;
  - requirements for radioactive materials to be kept in a suitable receptacle, both during transport and a suitable store when not in use;
- Requirements for notification to HSE of releases above prescribed thresholds, when the releases are not covered by the provisions of the Radioactive Substances Act; and to notify the HSE of losses or theft of those materials, and also a requirement to investigate the occurrence.
- Requirements in certain cases for contingency plans to ensure that the risks of exceeding a dose limit are minimized in the event of reasonably foreseeable accidents.

Finally, the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995 (RIDDOR95) is a separate piece of legislation under which certain types of incident must be reported to the HSE.

*Regulation under the Radioactive Substances Act 1993 (RSA93)*

The regulatory arrangements in use today can be directly related to the first Radioactive Substances Act of 1960. The basic structure of the legislation has been considered effective over forty years of regulatory experience.

The provisions of this legislation apply only to an “undertaking”. That is, any kind of trade, business or profession. Before a business can keep or use radioactive materials, it must apply for a permit from the EA.

This legislation provides two main types of permit: the registration of the possession and use of radioactive materials, and the authorization of the accumulation and disposal of radioactive wastes. A premises registered for storing and using radioactive materials may also be separately authorized under the act.

The only exceptions to these are where the user can establish that an Exemption Order (made under RSA93) is relevant to this use of radioactivity, or disposal of radioactive wastes. The user may then operate with exemption from holding a specific permission as normally required. Such exemptions apply when :

- a widespread use or disposal exists;
- either the use of radioactivity is justified, or its presence is unavoidable; *and*
- radiological hazards can be shown to be negligible, or can be made so by observance of conditions in an order. (Negligible means an individual dose no greater than 10 microSieverts per year; and a collective dose no greater than 1 man Sievert per year).

The Exemption Order system has the dual benefit of reducing the administrative burden, thus allowing more effort to be directed towards higher risk areas, and encouraging the conduct of a useful practice or product, rather than discouraging it by overregulation.

Where exemption is not an option, applications for permits made under RSA93 must be accompanied by the appropriate fee. For most types of permit, there is also an annual subsistence charge intended to cover the cost of enforcement.

Following receipt, the application is subject to the technical scrutiny of the purpose to which the material will be put, and the quantity and type of material that it is proposed to use. A key consideration is the issue of “justification” of a practice.

“Justification”, i.e. the concept of weighing the benefits from a practice involving the use of radioactive substances against its detriments, and considering whether a net benefit accrues to society, is a legal requirement in EC Directives, most recently the 1996 Basic Safety Standards Directive. In the UK, the High Court ruled in 1994 that justification had to be considered before the EA granted any authorization under RSA93. Over the past five years, the EA has considered justification when issuing its permits under RSA93.

The question of whether justification should be considered by Government or by the regulators is currently being reviewed by the UK Government.

When satisfied with the application, the regulator then issues a permission document to the responsible person in the undertaking. The document certifies that the undertaking is duly registered or authorized under the act, and it also prescribes limits on inventory and conditions under which the radioactive materials (or waste) must be managed and stored.

For the use of mobile radioactive sources, conditions are imposed to ensure that continuity of control of the radioactive material is maintained by a clearly identified and accountable registered owner. This includes restrictions on the sources being lent or let on hire to a third party.

A registration to keep or use radioactive materials includes conditions and limits. Conditions include:

- the provision of competent persons for the purposes of supervising the radioactive materials in use (in parallel to the requirements made by the HSE for a radiation protection supervisor);
- the requirement for copies of the permission document to be displayed on the premises of the user, so as to ensure that the limits and conditions can be conveniently read by persons whose duties might be affected;
- the keeping of detailed records of use, and audit checks of the source; and
- specific requirements prescribe the general security and conditions of storage.

Further regulation of the premises is based on the conditions prescribed by the registration document. Frequency of inspection is normally risk-based. Indicative frequencies are used for resource planning purposes. For example, a nuclear site will be inspected several times a year, a radiography user or major hospital radiotherapy unit is likely to be inspected once every two years, whereas a minor user may be inspected only once in five years. Full audits for major sites may involve several inspectors for up to two weeks of full time on-site work.

The planned frequencies for inspection are currently under review, and it is intended to increase the frequency for minor users.

On-the-ground inspection visits may demonstrate failures to comply with the conditions of permission issued under the provisions of RSA93. The inspector may manage compliance in a variety of ways. In the first instance, corrective action may be formally required by means of a statutory “enforcement notice”. In the event of evidence of imminent risk of pollution of the environment, or of harm to human health, a “prohibition notice” must be served on the undertaking to require that activity to cease immediately.

For serious offences, including failure to comply with the provisions of a statutory notice, the EA may prosecute an offender under RSA93.

### *Offences and penalties*

Offences under RSA 93 include:

- keeping and using radioactive materials without being duly registered under RSA93;
- accumulating or disposing of radioactive waste without due authorization under RSA93;
- failing to comply with the conditions laid down in the permit, including its display;
- exceeding a limit on keeping radioactive materials, or a limit on disposing of radioactive wastes;
- making false statements either in an application for permit under the Act, or in purported compliance with a requirement to furnish information imposed under the Act;
- intentionally making a false entry in any record required by a permission made under the Act.

Penalties vary according to the nature of the offence, the circumstances, and the type of court in which the charge is heard. In a magistrate’s court, a maximum fine of £20 000 may be imposed. For conviction on indictment (following a full trial), an unlimited fine may be imposed, or imprisonment for a period up to two years, or both.

### *The UK and Europe: transfrontier shipments*

RSA 93 provides for the “domestic” control of the possession and use of radioactive material, and the accumulation and disposal of radioactive waste. There are additional European provisions for the control of movements of radioactive materials between member countries of the European Union (EU).

As a member country of the EU, the UK complies with the requirements of Council Regulations made under European Directives. Council Regulation 1493/93/Euratom on shipments of radioactive substances between member countries, applies to transfrontier shipments of radioactive substances between EU member countries. Shipments to and from member countries and third countries outside the EU are not covered. The regulations apply to sealed sources, and open sources, but not radioactive waste, which is dealt with by separate regulations (described below).

For shipments of sealed sources, the holder of sealed sources has to obtain a prior written declaration from the consignee to the effect that the consignee has complied, in the member country of destination, with all applicable provisions of Article 3 of the Directive. The declaration must be noted and stamped by the competent authority of the member country to

which the shipment is being made prior to the declaration being sent to the holder of the sealed source.

For open sources, the suppliers are required to provide the competent authorities of member countries of destination with a summary of deliveries.

The transfrontier shipment of radioactive waste is regulated under UK statutory regulations (SI 1993 No 3031: The Trans-frontier Shipment of Radioactive Waste Regulations 1993). The regulations provide for a system of prior authorization and approval for the shipment of radioactive waste.

The EA is a competent authority for England and Wales. (The HSE is also a competent authority for the transfrontier shipment of radioactive substances in respect of nuclear licensed sites).

#### *Incidents involving loss of control of radioactive materials*

Despite the extensive regulatory provisions described above, incidents involving loss of control of radioactive materials inevitably occur. Two different types of incident will be described.

In the first case, (a wholly “domestic” incident), a waste incineration company, was recently prosecuted by the HSE and the EA following the loss of two radioactive sources from an old incineration plant.

The sources, each 740 MBq (original activity) of caesium-137, were in two level gauges installed in the feed chutes of the old incinerator plant at the site. When a new plant was commissioned on the same site, the old plant was demolished. The company failed to make arrangements for the safe removal or disposal of the sources, or to make other persons aware of their presence, and the sources were lost.

The company had previously been reminded by the EA of their responsibilities for safe removal and disposal of the sources from the plant pending its demolition.

There were no records indicating that the gauges had been removed from the plant and stored safely on site pending disposal by an authorized route; and there was no evidence to suggest that the demolition consultant or the demolition contractors were informed of the continued presence of the two radioactive sources on the plant.

The key factors contributing to all these failures were changes in management and weak arrangements for control of radioactive sources. Employees who were familiar with the local rules and operation of the gauges had been moved off the old plant as soon as it ceased operation, sometime before it was demolished. Local rules appear to have been abandoned. Indeed, there was no evidence of any management control over the gauges; it appears that they had simply been forgotten!

The second type of recent incident is illustrated by the next example:

A terminal from a lightning conductor system, containing nine radium-226 sources, was detected at a weigh-bridge monitoring system. Surface dose rates at the surface of the skip

containing the scrap were up to 100 microSv/h. Activity was estimated at around 1.85 GBq. The sources are alleged to have originated in a load of non-ferrous scrap imported into the UK from Angola.

Under arrangements that have recently been adopted in the UK, details of the discovery of these orphan sources were compiled into a report known as an “ECO-MESSAGE”. A blank pro-forma ECO-MESSAGE is given in Appendix 1, together with notes for users. The ECO-MESSAGE is the product of Interpol.

There is an increasing awareness in the UK of the hazards associated with radioactive contamination finding its way into the scrap metal chain. The EA, the HSE and other Government departments are working with intermediaries in the ferrous and non-ferrous industry in the UK to raise awareness of the radiological and financial implications of such incidents, and to emphasise how they may be avoided by the deployment of radiation monitoring equipment and associated procedures at key stages in the supply chain. Existing systems have already detected several orphan sources which have probably originated from scrapped industrial equipment containing radioactive material.

#### *The Interpol ECO-MESSAGE system*

The organizations listed in Appendix 2 have agreed to use the ECO-MESSAGE arrangements to communicate with relevant enforcement bodies in other countries around the world, using the channels of Interpol to promulgate the information.

There are two objectives of the ECO-MESSAGE system. The first is to alert regulators in the country where the radioactive material is alleged to have originated in case they wish to establish whether an offence may have occurred under their own legislation. Should they choose to use it, the regulators will have as much information made available to them as the UK regulators can provide, within the legal, evidential and operational constraints of a given case.

The second objective is to ask the overseas regulator for information that may be useful for enforcement against any breaches of UK legislation. This facility is infrequently used at present since most cases of illicit imports of radioactive material have not involved any offence by the recipient, under RSA93. Indeed, almost invariably, it is because of the proactive co-operation of a recipient trader in the metal recycling industry supply chain that such incidents have been detected and reported to the EA and HSE. The trader may accrue commercial liabilities in these cases, but rarely has there been a legal liability under RSA93. The EA encourages industry to take control of orphan sources and welcomes their support in protecting the environment.

Experience indicates that the ECO-MESSAGE system still has to achieve widespread use, and outgoing UK ECO-MESSAGES exceed those received from other countries. However, one case from an EU member country notified the EA of an undertaking in the UK that warranted investigation to ensure that the undertaking in question was not in breach of the Radioactive Substances Act.

The downstream effects of orphan sources have been described elsewhere. Like many countries, those of the UK are concerned about the safety and environmental implications of orphan sources. There are risks to the workforce of ports, haulage, and metal recycling companies, and potentially significant impacts on the UK environment.

In order to address these risks, the major stakeholders in “environmental crime” issues in the UK have been working together to overcome the lack of knowledge, and then to provide a proportionate response to the prevailing threat.

### *The UK Interpol Environmental Crime Groups*

The Association of Chief Police Officers (ACPO) for England and Wales chairs a UK wide Environmental Crime Group, which draws on the communication channels of Interpol, and makes them available to all legitimate organizations concerned with threats to the UK environment, in the widest sense of the term.

The aim of the group is to strengthen the fight against any environmental crime, by improving the sharing of information and co-operation between stakeholders. The main group (the UK Interpol Environmental Crime Group – UKIECG), has three subgroups. These address the specific issues of:

1. wildlife crime;
2. hazardous waste; and
3. radioactive substances.

ACPO chairs the first of these subgroups, and the EA chairs the other two. For the purposes of this paper, only the work of the Radioactive Substances Subgroup will be explored further.

### *The Work of the UKIECG Subgroup on Radioactive Substances*

The subgroup meets four times per year, and its membership includes senior representatives of the organizations listed in Appendix 2.

The first agreement of the membership was the need to co-operate so as to ensure a co-ordinated approach by all those involved in the UK. The second agreement, already mentioned, was the adoption of the Interpol ECO-MESSAGE system.

The next output from the group was a position paper, explaining the nature and scale of the problem of illicit trafficking. The position paper particularly highlights the high probability of the first point of detection of an orphan source being at a scrap metal yard or metal melting works. It is for this reason that the subgroup places great importance on having industry representatives amongst its members.

The position paper has been presented to UK government departments, and is being used as a basis for developing wider interdepartmental policies to ensure “joined-up” arrangements at government level.

The subgroup is now working up a “National Response Plan” which has two facets.

The first facet is the existence of arrangements internal to the UK for the effective sharing of any intelligence relating to illicit trafficking acquired by a stakeholder organization that may be of use to the others. The aim is to increase the probability of finding an orphan source, for example due to association with other illegal activity.



A hypothetical example illustrates the principle: the EA may detect a case involving fissile material. This may be of interest not only to the Office of Civil Nuclear Security, but may have implications for counter-terrorist stakeholders, and / or Customs and Excise. More routinely, the arrangements also ensure the effective dissemination of incoming ECO-MESSAGES from other countries.

The second facet comprises a basic response plan to ensure the effective co-ordination of the various stakeholder organizations in the event of a discovery of an orphan source. This may involve a few, or many of the organizations that contribute to the subgroup.

The need for these co-ordinated arrangements arises from two issues. Firstly, as already explained, more than one government body may have an interest in some types of potential cases. To ensure all interests are protected, a co-ordinated response will mean that a lead investigator will neither neglect the interest of other bodies, nor find their own interests compromised by the activities of others.

Secondly, and more fundamentally, the statutory powers of the various bodies are diverse, and none of them can meet all the potential enforcement needs. It is hoped, though not yet tested, that by sharing knowledge in the form of a “powers and interests “ matrix, which is a key part of the plan, staff at operational level will be able to obtain support from colleagues in other organizations.

An example that occurred before work on the plan was started may illustrate this. Customs officers at a port in England became aware of radioactive contamination in a consignment of containerized scrap metal intended to be imported to the UK from a former Soviet Union country. They have statutory powers only where fissile materials are involved. They therefore sought advice and support from the EA, and the broker was apprised of his potential obligations under the RSA93. The broker then decided to arrange for the return of the consignment to its point of origin, so that his UK customer did not acquire unforeseen and unwanted liabilities. The local regulators were apprised of the situation.

At the time of writing, the plan is still being formulated but it is expected to enable the stakeholders to draw on the technical knowledge, legal powers, and networking of each other when it is implemented.

## **CONCLUSION**

The UK operates a comprehensive and generally highly effective regulatory regime to ensure the safety of radiation sources and the security of radioactive materials. This involves the environment agencies and the HSE of the UK.

Despite this strong regulatory framework, the UK enforcement bodies recognize the probability that sources will be lost from control, creating threats to people (especially workers) and to the environment. In some cases, there may be other regulatory interests to be met also.

The UK approach to these cases is for enforcement bodies to work collaboratively, not only with each other, but with representatives of the industries where orphan sources are most probably detected. UK regulators are also committed to collaborating with regulators in other countries as part of a managed approach to this problem.

**APPENDIX 1**

**UNITED KINGDOM**

**Information from:**.....

**INTERPOL ECO-MESSAGE  
Radioactive Substances**

|  |  |
|--|--|
| <p>1. Subject<br/>Code name/ Reference number<br/>Legislation violated</p>   |  |
| <p>2. Place and circumstances of discovery</p>   |  |
| <p>3. Date/Period</p>  |  |
| <p>4.<br/>(a) Radioactive Substances<br/>(b) Number or quantity and value</p>  |  |
| <p>5. Identity particulars of person(s) involved<br/>(a) Date of arrest<br/>(b) Family name (and maiden name for women)<br/>(c) Forenames(s)<br/>(d) Sex<br/>(e) Aliases<br/>(f) Date and place of Birth<br/>(g) Nationality<br/>(h) Address<br/>(i) Information appearing in passports and on identity documents<br/>(j) Occupation<br/>(k) Position in one of the companies listed under 6, if any<br/>(l) Other information</p> |  |
| <p>6. Particulars of companies involved<br/>(a) Type of company<br/>(b) Name<br/>(c) Activities<br/>(d) Business address and telephone/fax number<br/>(e) Address and telephone/fax number(s) of Head Office</p>   |  |
| <p>7. Route and means of transport</p>   |  |
| <p>8.<br/>(a) Country and town of origin<br/>(b) Country from which the substances arrived<br/>(c) Transit country or countries<br/>(d) Country and town of destination</p>  |  |

|                                     |  |
|-------------------------------------|--|
| 9. Particulars of documents used    |  |
| 10. Law enforcement agency involved |  |
| 11. Modus operandi                  |  |
| 12. Additional information          |  |
| 13. Information requested           |  |

Additional information attached:

1. Contents checked for correctness so far as can be determined:

Signed.....

Date.....

Tel: (+44).....Fax: (+44).....

2. Forwarded to

(a) Environment Crime Office

Signed.....

Date.....

(b) NCIS

Signed.....

Date.....

APPENDIX 1 (cont.)

**NOTES FOR COMPLETION OF ECO-MESSAGE FOR RADIOACTIVE SUBSTANCES**

The following numbers refer to the sections of the Eco-message form. Please enter as much information as is available and if further enquiries are in hand regarding any point, please indicate this.

1. Brief account of the case.  
Code name given to the operation, if any, reference number of the case.  
Reference of applicable laws or regulations and maximum and minimum penalties imposable.
2. Port of entry into the territory and exact address where discovery occurred.  
If the discovery occurred on a motorway, or a waterway, or in territorial waters, specify the distance of that location from the nearest town and its position in relation to that town.  
Specify how the offence was discovered (eg. by X-ray examination of baggage, checking of documents, profiling of offenders, etc.).
3. If appropriate, specify the period of time over which the offence was committed.
4. (a) Specify the substance(s) and radionuclide(s) involved.
5. (b) Information on quantity and, if possible, the value.
6. (i) Numbers, places and dates of issue, expiry date.  
(ii) Telephone and fax numbers, vehicle registration numbers, etc.  
  
(NB Items 5(a) and 5(l) should be filled in for every person involved in the offence.)
7. Legal status of the company.  
Both full official name and name currently used.  
  
(NB Items 6(a) to 6(e) should be filled in for every company involved in the offence.)
8. Please give as many details as possible.
9. For waste products, specify place of production.  
(c) If the specimens were taken from the sea, please state "sea"  
Specify both the destination declared on the transport documents and the real destination.
10. Specify the types of documents, eg. authorisations, transport documents, permits and certificates, invoices, analysis reports, etc.  
Specify if documents were counterfeit, forged or invalid.

11. Name and full address

12. Give full details of the modus operandi including the concealment technique, type of packaging, method used to forge documents, financial backing of the companies involved, estimated value of the substances or specimens, possible links with other cases.

If possible, attach photocopies of false documents and photographs (e.g. of containers) illustrating the modus operandi.

13. Please add any other details considered relevant.

14. Do your investigators need information that may be available in other countries?

APPENDIX 2

| <b>Membership of the UK INTERPOL Environmental Crime<br/>(Radioactive Substances) Sub-Group</b> |
|---|
| Environment Agency (Chair and Secretariat)  |
| Scottish Environment Protection Agency (SEPA)   |
| Northern Ireland Environment and Heritage Service (IPRI)  |
| National Radiological Protection Board (NRPB)   |
| Health & Safety Executive (HSE)   |
| HM Customs and Excise   |
| National Criminal Intelligence Service (NCIS)   |
| Metropolitan Police Special Branch  |
| ACPO Scotland   |
| Office of Civil Nuclear Security (OCNSy)  |
| Department of the Environment, Transport and the Regions (RMTD)                                 |
| Department of Trade and Industry  |
| UK Atomic Energy Authority (UKAEA)  |
| British Steel   |
| British Secondary Metals Association  |
| British Metals Federation   |