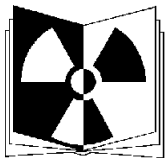

Association of University Radiation Protection Officers

TRANSPORT OF RADIOACTIVE MATERIALS BY ROAD

AURPO Guidance Note No. 6

2003 Edition

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C O N T E N T S

1. INTRODUCTION

These guidance notes are an interpretation of the requirements of the Radioactive Material (Road Transport)(Great Britain) Regulations 2002 which came into force on the 7th June 2002.

The British Regulations are based upon the International Atomic Energy Agency's (IAEA) Regulations for the Safe Transport of Radioactive Materials (Safety Series No.TS-R-1) 1996 edition (revised) and the European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR) (2001).

The basic philosophies behind the Regulations are that :-

a) package design should be such that the risk of any radioactive contamination or external radiation hazard should be kept to a minimum

b) that all shipments should be traceable back to the sender

c) that good quality assurance should produce public reassurance.

These guidance notes are intended for the university/hospital/research sector and do not cover the transport of fissile materials or nuclear industry waste.

1.1. *Main Implications of the Regulations*

1. New category of exempt radioactive material replaces definition of what is significant radioactive material under the transport regulations (formerly 70 Bq/g).

2. As there is no requirement to provide information to the carrier in relation to the transport of excepted packages, it would appear that it is now possible to use public transport whilst transporting an excepted package.

3. There is no professional user exemption and all persons must therefore conform fully with all the requirements of the regulations, but, display of smaller placards is allowed for cars carrying labelled packages (and other small vehicles up to 3500kg).

4. Consignment notes are required for all categories of radioactive package but a simple label should suffice for excepted packages.

5. The UN numbers and descriptors have been expanded so that they are more specific. All NOS (not otherwise specified) numbers have been de-listed.

6. There is a requirement for carrying fire extinguishers in some vehicles.(*this has still to be clarified*)

7. The Department of Transport have the power to inspect premises as well as vehicles, to ensure compliance with the Road Transport Regulations.

8. Contamination limits now the same for all types of package.

9. Two new items in the regulations are the 'criticality safety index' and 'Type C' packages. These will not affect the small user as they relate to the shipment of fissile material.

1.2. *Definitions*

Radioactive substance - what constitutes a radioactive substance under the Transport Regulations is defined in a seperate order (SI 2002 No.1092) and is stated as being 0.1kBq/kg. However this very low figure is only relevant for any radionuclide not listed in the regulations. Of more importance is what is defined as being radiologically significant and this is implied by the description of what constitutes exempt material. This varies with the radiotoxicity of the nuclide with some alpha emitters it is only 0.1Bq/g (hence the definition above of what is radioactive) but for tritium it is 1 MBq/g. (see Table 1 in section 2)

Road means any highway to which the public has unrestricted access. Therefore in a campus university if there are barriers to get passed before gaining access to the site, transport on the internal roads are not covered by the Regulations.

Transport of packages in these regulations covers much more than the transportation procedure and also includes the design, fabrication and maintenance of packaging, and the preparation, consigning, handling, carriage, storage in transit and receipt at the final destination of packages.

Transport Index (TI) is an indication of the external hazard that a package presents. It represents the maximum dose rate at 1 metre from a package measured in mSv/h and multiplied by 100. (i.e. it is the dose rate at 1 metre in the old mrem/h units)

Consignor is the person sending the goods.

Consignee is the recipient of the goods.

LSA is low specific activity material including waste.

SCO relates to surface contaminated objects.

A full and extensive description of all terms used in the regulations is given in the Interpretation to the Regulations (Regulation 2).

1.3. *Scope of the Regulations*

The regulations cover the transport by road of all non-exempt radioactive material in the form of sources or waste conveyed in a vehicle both within the UK and for journeys in other European countries covered by the ADR (an ADR journey). Exceptions to this are as follows:-

- transport on private roads
- transport of radioactive material contained in the body of a person undergoing medical treatment, a dead person or a live animal undergoing medical treatment
- transport of radioactive material that is an integral part of the means of transport
- transport of approved consumer products by a consumer
- transport of natural material and ores not destined for processing that are less than 10 times the values specified for exempt materials in Table 1 below
- transport in relation to instruments of war by approved armed forces, Government Departments or their contractors
- transport by the emergency services or by others in an emergency intended to save human lives
- transport in accordance with an approved derogation

2. EXEMPT RADIOACTIVE MATERIALS

TABLE 1 - Activity Limits For Exempt Radioactive Materials

Nuclide	Activity concentration for exempt material (Bq/g)	Activity limit for an exempt consignment (Bq)
H-3	$1x10^6$	1 GBq
C-14	$1x10^4$	10 MBq
Na-22	$1x10^1$	1 MBq
Na-24	$1x10^1$	100 kBq
P-32	$1x10^3$	100 kBq
P-33	$1x10^5$	100 MBq
S-35	$1x10^5$	100 MBq
Cl-36	$1x10^4$	1 MBq
K-42	$1x10^2$	1 MBq
Ca-45	$1x10^4$	10 MBq
Cr-51	$1x10^3$	10 MBq
Fe-55	$1x10^4$	1 MBq
Fe-59	$1x10^1$	1 MBq
Co-57	$1x10^2$	1 MBq
Co-60	$1x10^1$	100 kBq
Ni-63	$1x10^5$	100 MBq
Ga-67	$1x10^2$	1 MBq
Se-75	$1x10^2$	1 MBq
Rb-86	$1x10^2$	100 kBq
Tc-99m	$1x10^2$	10 MBq
In-111	$1x10^2$	1 MBq
I-123	$1x10^2$	10 MBq
I-125	$1x10^3$	1 MBq
I-131	$1x10^2$	1 MBq
Xe-133	$1x10^3$	10 kBq
Tl-201	$1x10^2$	1 MBq

For a shipment to be exempt either the activity concentration must be less than that specified in col 2 of Table 1 or the total activity in the consignment does not exceed the value specified in col 3 of Table 1 (see above).

NB the limits apply to a consignment and are not package limits. This condition can only realistically be applied where the consignor and the carrier are the same person as an independent carrier will have no knowledge of the contents of an exempt package or how many, if any, they are carrying. This is acknowledged in Regulation 16 which states that

> 'there is no contravention of or failure to comply with these regulations by a person who neither knew nor had reaonable grounds for believing that the material in question was radioactive'.

3. TRANSPORT OF EXCEPTED PACKAGES

It should be noted that the Regulations do not differentiate between radioactive sources and radioactive waste when it comes to excepted package quantities. As long as the waste fulfils the requirements for excepted packages it can be transported as such.

The bulk of university transport requirements will be covered by excepted packages.

3.1. *Activity Limits for Excepted Packages*

As long as the packaging and documentation requirements are met in full, radioactive material in liquid or solid form with an activity not exceeding that given in Table2 and a surface dose rate not exceeding 5μSv/h, may be transported in an excepted package. When either of these criteria are exceeded then the material must be transported in a Type A package or an industrial package as appropriate.

TABLE 2 Activity Limits For Excepted Packages

Nuclide	**Ordinary Solid Form**	**Liquid Form**
H-3	40 GBq	4 GBq
C-14	3 GBq	300 MBq
Na-22	0.5 GBq	50 MBq
Na-24	0.2 GBq	20 MBq
P-32	0.5 GBq	50 MBq
P-33	1 GBq	100 MBq
S-35	3 GBq	300 MBq
Cl-36	0.6 GBq	60 MBq
K-42	0.2 GBq	20 MBq
Ca-45	1 GBq	100 MBq
Cr-51	30 GBq	3 GBq
Fe-55	40 GBq	4 GBq
Fe-59	900 MBq	90 MBq
Co-57	10 GBq	1 GBq
Co-60	400 MBq	40 MBq
Ni-63	30 GBq	3 GBq
Ga-67	3 GBq	300 MBq
Se-75	3 GBq	300 MBq
Rb-86	500 MBq	50 MBq
Tc-99m	4 GBq	400 MBq
In-111	3 GBq	300 MBq
I-123	3 GBq	300 MBq
I-125	3 GBq	300 MBq
I-131	700 MBq	70 MBq
Xe-133	10 GBq (gas)	n/a
Tl-201	4 GBq	400 MBq

NB For special form solid radioactive materials there are higher limits- see Schedule 1 to the Regulations for further details. For instruments containing radioactive materials the individual item limits are ten times the above limits. For gases the limits are the same as for solids, with the exception of tritium where there is a higher limit. A full list of limits for all radionuclides can be extrapolated from Table 1 of Schedule 1 to the Regulations by using the factors given in Table III of Schedule 1.

3.2. *General Packaging Requirements*

a) When necessary, shielding should be provided to ensure that the dose rate at the surface of the excepted package does not exceed 5μSv/h.

For instruments or manufactured articles containing an excepted quantity of radioactive material the above dose rate limit does not apply, but the dose rate 10cm from any external point of any unpackaged instrument or article should not exceed 0.1mSv/h

b) Non-fixed contamination of the external surface of the excepted package shall not exceed:-

i. 4 Bq/cm^2 for beta, gamma and low toxicity alpha emitters, e.g. natural uranium and thorium;

ii. 0.4Bq/cm^2 for all other alpha emitters.

c) The package shall bear the marking *radioactive* on an internal surface in such a manner that a warning of the presence of radioactive material is visible on opening the package.

d) The package shall be so designed in relation to its mass, volume and shape that it can be easily and safely handled and retain its contents under conditions likely to be encountered in routine transport, eg taking into account acceleration, vibration and braking. The volume of absorbent material should be always at least twice that of a liquid sample.

e) As far as practicable, the packaging shall be so designed and finished that the external surfaces are free from protruding features and can be easily decontaminated.

f) As far as practicable, the outer layer of the package shall be so designed as to prevent the collection and retention of water.

g) Any features added to the package at the time of transport which are not part of the package shall not reduce its safety.

h) The materials of the packaging and any components or structures shall be physically and chemically compatible with each other and with the radioactive contents. If applicable account shall be taken of their behaviour under irradiation.

i) In addition to the radioactive properties, any other dangerous properties of the contents of the package, such as explosive nature, flammability, pyrophoricity, chemical toxicity and corrosiveness, shall be taken into account in the packing.

j) If the gross weight of the package exceeds 50kg then the maximum weight shall be clearly marked on the package.

NB Additional labelling requirements might be required by the relevant Transport Regulations for Dangerous Goods, i.e. The Chemicals (Hazard Information and Packaging for Supply) Regulations 1994 (CHIP 2).

3.3. *Meeting the Packaging Requirements*

The screw top cans now used by Amersham are ideal for re-use, as are some of the moulded polystyrene blocks used by other manufacturers. NB if they are being sent to another establishment, then the original suppliers name should be obliterated. As an alternative,

polythene/polypropylene bottles or jars with screw fittings or other tight-fitting lids might prove useful. Examples of suitable excepted package designs are given in Figs 1 & 2 below.

FIG 1 Example of Excepted Package

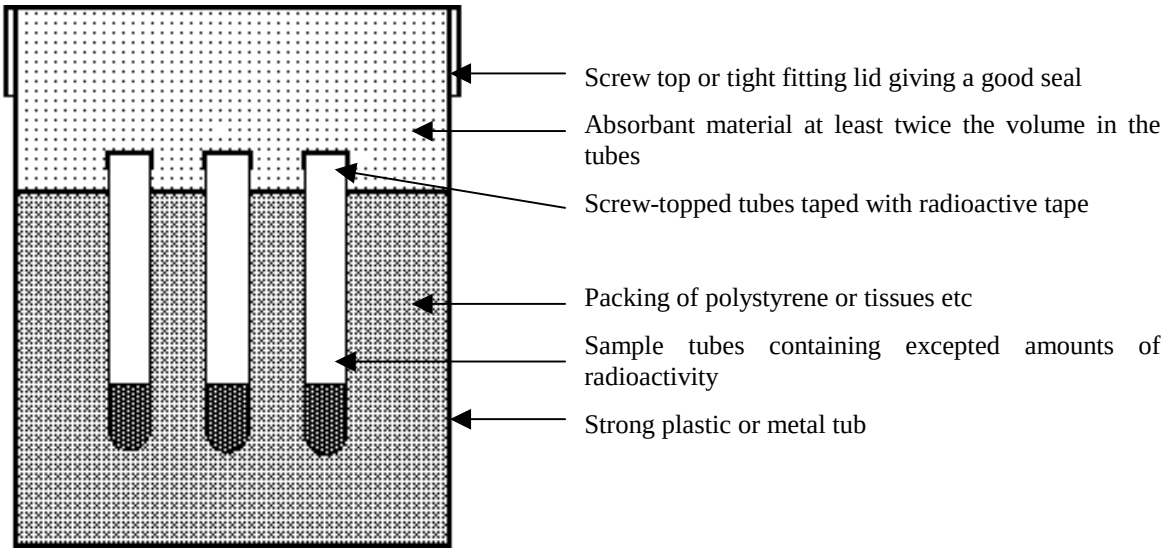
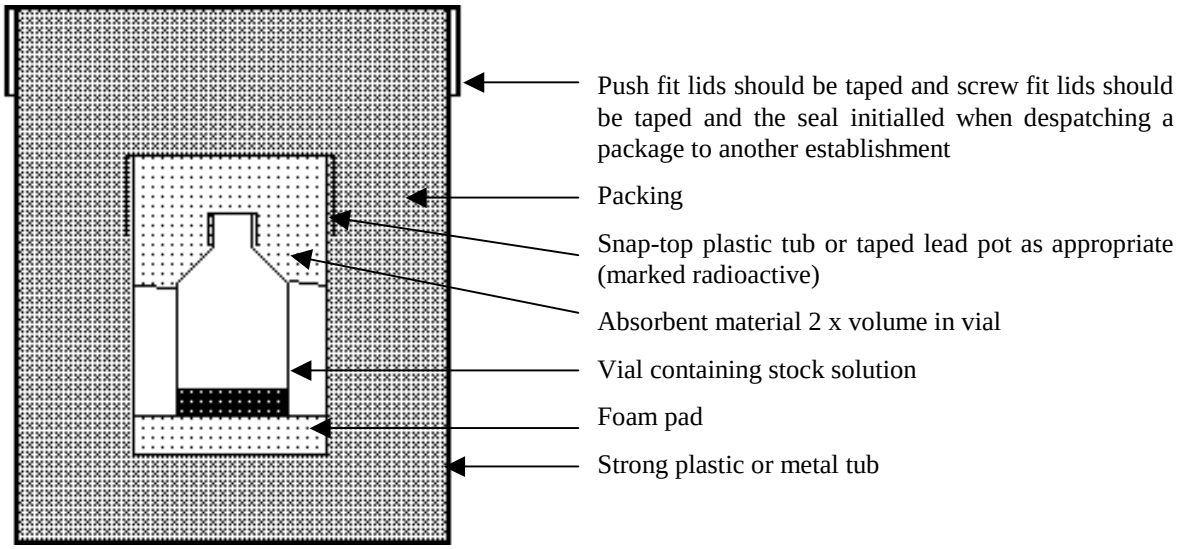


FIG 2 Example of Type A Package



Recommended minimum dimension of outer packaging is 10cms.

NB The packaging shown in Fig2 should meet the requirements for a Type A package provided it is robust enough to withstand the appropriate performance tests.

3.4. *Transport Documents and Labelling requirements*

All items and materials transported as excepted packages shall be described in the transport documents with the appropriate UN number and shipping name in accordance with the following four categories:-

- UN 2910 *Radioactive Material, Excepted Package - Limited Quantity of Material*
- UN 2908 *Radioactive Material, Excepted Package - Empty Packaging*
- UN 2909 *Radioactive Material, Excepted Package - articles manufactured from natural or depleted uranium or natural thorium*
- UN 2911 *Radioactive Material, Excepted Package - instruments and articles*

There should also be details of the consignor and consignee, the date of shipment and a signed declaration by the consignor (facsimile signature allowed).

In order to fully comply with the requirements of the transport regulations and the Ionising Radiation Regulations 1999, the following additional information should accompany an excepted package:

- a reference to the applicable transport regulations
- emergency contact details of consignor
- a description of the radioactive substance, e.g. the radionuclide, its activity on a specified date and its chemical and physical form;
- any additional information which would be required to enable the person opening it to do so safely.

The above will more than meet the requirements of the regulations and, as the UN number and either the consignee or consignor details must be displayed on the outside of the package, it is recommended that a label is made up as in Fig 3 for attachment to the outside of the package.

Any additional information that may be required can be included in an accompanying letter or technical note that should be found immediately on opening the package.

There is no specific requirement for a record to be kept of shipments of excepted packages but there is a requirement to keep records for 2 years relating to measurements of contamination of consignments. Therefor in order to meet this requirement it would be prudent to make a log of shipments combined with contamination measurements. All that should be needed is a statement that contamination is less than the permitted level. This will also be satisfactory for a record of other shipments - see example Table 3.

FIG 3 Label/Consignment Note for Excepted Packages

The Radioactive Material (Road Transport) Regulations 2002

RADIOACTIVE MATERIAL, EXCEPTED PACKAGE
UN 2910 - LIMITED QUANTITY OF MATERIAL

Date ..... **Physical form.....**

Isotope..... **Chemical form.....**

Activity.....

Dispatched by -
UNIV of SHEFFIELD, DEPT of ..... Postcode .....

Contact .....Tel .....

Deliver to .....

.....

I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name, and are classified, packed, marked and labelled, and are in all respects in proper condition for transport by road according to the applicable international and national governmental regulations.

For the Consignor .....

TABLE 3 Log Of Radioactive Material Consignments

Date	Type of shipment	Type of material	No. of packages	TI	Contamination check
19.08.02	Exempt	Beta	4	N/A	<4Bq/cm^2
20.08.02	Type A	Alpha	1	0	<0.4Bq/cm^2
20.08.02	IP-2 (waste)	Beta/gamma	10	0	<4Bq/cm^2

There are no requirements for the placarding of vehicles either internally or externally when transporting excepted amounts of radioactive material. However, please remember before transporting any radioactive material by car, check your car insurance policy (note there is a distinction between 'irradiated nuclear fuel' and other radioactive materials).

[There is no requirement for carrying a fire extinguisher for small loads of upto 10 packages. If carrying more than 10 excepted packages then one 2kg dry powder extinguisher must accompany the load.] - *this is the old old requirement, the current position re fire extinguishers is not clear and there is a derogation pending on their use for small loads.*

There are no restrictions regarding: the mixed contents of packages, carrying a mixed load on the vehicle, travel of persons in the vehicle or parking of the vehicle.

3.5. *Transport of Empty Packaging as Excepted Packages*

The requirements for empty packaging are generally designed for re-usable packages where there may be contamination of some of the internal surfaces or where depleted uranium forms part of the shielding and containment system. The general conditions are that:-

a) the internal non-fixed contamination does not exceed -

- 400 Bq/cm^2 for beta/gamma/low toxicity alpha emitters
- 40 Bq/cm^2 for other alpha emitters

b) the packaging shall be in a well maintained condition and securely closed

c) any depleted uranium shield should be covered in an inactive sheath

d) any previous radioactive labels should be obliterated

e) all the other conditions for the transport of excepted packages should be followed.

4. TRANSPORT OF TYPE A PACKAGES

4.1. *Activity Limits for Type A Packages*

TABLE 4 - Activity Limits for Type A Packages

Nuclide	Special Form - A_1	Other Forms - A_2
H-3	40 TBq	40 TBq
C-14	40 TBq	3 TBq
Na-22	0.5 TBq	0.5 TBq
Na-24	0.2 TBq	0.2 TBq
P-32	0.5 TBq	0.5 TBq
P-33	40 TBq	1 TBq
S-35	40 TBq	3 TBq
Cl-36	10 TBq	0.6 TBq
K-42	0.2 TBq	0.2 TBq
Ca-45	40 TBq	1 TBq
Cr-51	30 TBq	30 TBq
Fe-55	40 TBq	40 TBq
Fe-59	0.9 TBq	0.9 TBq
Co-57	10 TBq	10 TBq
Co-60	0.4 TBq	0.4 TBq
Ni-63	40 TBq	30 TBq
Ga-67	7 TBq	3 TBq
Rb-86	0.5 TBq	0.5 TBq
Sr-90	0.3 TBq	0.3 TBq
In-111	3 TBq	3 TBq
I-123	6 TBq	3 TBq
I-125	20 TBq	3 TBq
I-131	3 TBq	0.7 TBq
Xe-133	20 TBq	10 TBq
Cs-137	2 TBq	0.6 TBq
Tl-201	10 TBq	0.7 TBq
Am-241	10 TBq	1 GBq

NB see Schedule 1 to the Regulations for full nuclide list.

Packages whose activity exceeds the limits for excepted packages (Table 2) or whose surface dose rate exceeds 5μSv/h will have to be transported as Type A packages as long as the activity being carried does not exceed the limits specified in Table 4 above.

4.2. *Packaging of Type A Packages*

As well as conforming to the general packaging requirements as outlined in the section for excepted packages, Type A packages have to meet the requirements of Schedule 8 (Part X) to the Regulations and undergo various performance tests to demonstrate an ability to withstand the normal rigours of transport.

Key items of the design are that there should be a minimum external dimension of 10cm, that the outer packaging should incorporate a seal which will give evidence that the package has not been tampered with and that for packages containing liquids there should be at least twice the volume of absorbant material as of the liquid contents which should be contained within a multiple containment system. The package must withstand temperatures ranging from -40^{o}C to +70^{o}C and a reduction of pressure down to 60 kPa. (Fig 2 design recommended for excepted packages would meet the requirements for Type A provided it could pass the performance tests.)

The design has to be robust enough to ensure that after being subjected to the performance tests it would prevent:

a) loss or dispersal of the radioactive contents;

b) no more than a 20% increase in the radiation level at any external surface

The performance tests for Type A packages are given in Schedule 9 Part IV paras, with special requirements for liquids given in para 13. The tests are summarised as follows:-

a) water spray test - simulated exposure to rainfall

b) free drop test - normally from height of 1.2m for solids and 9m for liquids

c) stacking test - to simulate storage conditions

d) penetration test - by a 6kg bar from a height of 1m for solids and 1.7m for liquids.

If you are going to produce your own Type A packages you will need to refer to Schedules 8 and 9 to the Regulations for full details. There are companies who type test and supply Type A and Type B packages - see appendix 1 for details. There is also the option of re-using Type A packaging which you may have been sent, but you have to be careful as you are then responsible for declaring it as being in a proper condition for transport. Amersham state that their packaging is for one use only. If you were to re-use it as Type A you would have to satisfy yourself that: it was in an as new condition, that the containment system was complete and in place, and that it was being used to transport the same material for which it was designed. One would also need to obliterate any Amersham labelling.

NB old packaging is unlikely to meet the new standard and it would be advisable to restrict the re-use of old Type A packaging for the use of excepted packages only.

4.3. *Categorisation and Labelling of Type A Packages*

Except for ‘exclusive use’ shipments the radiation levels for Type A packages shall not exceed:-

a) 0.1mSv/h at 1m from any external surface; or

b) 2mSv/h at the surface.

Under ‘exclusive use’ (i.e. only radioactive items under the control of a single consignor are being shipped in a freight container or vehicle whose minimum length exceeds 6m) these limits can be extended to :-

a) 10mSv/h at 1m from any external surface; or

b) 2mSv/h surface dose level can be exceeded if the package is securely retained within a secure enclosure and there are no intermediate loading/unloading operations involving the shipment.

Type A packages are categorised and labelled according to their Transport Index (TI) which represents a measure of the external radiation hazard (see Table 4 below). It is the dose rate at

1 metre in the old mrem/h units. In the new SI units TI is the number of mSv/h multiplied by 100.

TABLE 4 Categories of Type A Package

CATEGORY LABEL	TRANSPORT INDEX	MAXIMUM DOSE RATE on EXTERNAL SURFACE
I - White	0	< 0.005mSv/h
II - Yellow	0 - 1	> 0.005 < 0.5mSv/h
III - Yellow	> 1 < 10	> 0.5 < 2mSv/h*

***** Exclusive use Yellow III could have dose rates upto 10mSv/h on external surface.

Therefore it can be seen that there will only be an external hazard with the Yellow label packages and that Yellow III packages can have quite high dose rates and must be handled with care.

Each Type A package shall be clearly marked 'Type A' and if its weight exceeds 50kg the weight of the package must be clearly stated as well.

The appropriate category labels shall be affixed to two opposite sides of the package with details of the contents, activity and transport index marked on them. Full details of label design are given in schedule 14 to the regulations and examples are displayed opposite.

In addition, details of the consignor and consignee should be clearly indicated, the correct UN number and proper shipping name must be clearly and durably displayed and the package labelled as 'Type A'.

If the weight of the package exceeds 50kg this should also be clearly marked on the package.

4.3.1 *UN numbers for Type A packages*

Type A package descriptions have been split into fissile and non-fissile and special form and non-special form. The most commonly used ones will therefore be as follows:-

UN 2915 RADIOACTIVE MATERIAL, TYPE A PACKAGE - non-special form, non fissile

UN 3332 RADIOACTIVE MATERIAL, TYPE A PACKAGE, SPECIAL FORM - non fissile

4.4. *Transport Documents for Type A packages*

The full requirements to be complied with are specified in Schedule 6 to the Regulations. This is generally done by the production of a consignment certificate. Please see appendix 2 for an example. In addition to the consignment certificate there is a requirement to provide the carrier with a statement regarding any special precautions required for the transport of the package together with details of emergency procedures.

There is no actual requirement to retain details of the transport documents but records of any contamination measurements made should be kept for 2 years. It would seem prudent however to keep a copy of the consignment certificates or keep a log of shipments together with records of monitoring as in Table 3 above.

4.5. *Placarding of Vehicles*

All vehicles transporting any type of labelled radioactive package other than excepted packages must display vehicle placards. There are no professional user exemptions. Three placards (as in Fig 6 Schedule 14 to the Regulations - see opposite) must be displayed, one each side of the vehicle and one at the rear. The standard size of these is 25cm x 25cm. There is however a derogation for vehicles which have insufficient area to display this size of sign. No definition of this is given but we can take it to mean that if you are using a car for the transport of radioactive materials then you are permitted to use smaller placards - 10cm x 10cm is the minimum size permitted. The best way of placarding the car is then to use signs which will adhere to the inside of the glass windows of the vehicle - you then will not lose signs which could otherwise fall off the outside and you will avoid damaging the bodywork of the car.

In addition to displaying the radiation trefoil placards, there is now also a requirement to display orange plates (400mm x 300mm or for small vehicles 300mm x 120mm) at the front and rear of the vehicle, or, [as is most likely, carry the fireproof cab notice which also serves to tell the driver what to do in an accident situation. This can best be made out of stainless steel with the lettering either stamped or embossed on.]

The bracketed statement is from the old regulations and has been requested as a derogation for these regulations - this has now been approved, June 2003.

4.6. *Other Requirements for Type A Packages*

Non-fixed contamination of the external surface of Type A packages shall not exceed the general levels specified for excepted packages (see para 3.2).

Schedule 7 to the regulations specifies the requirements for carriers of Type A packages and above and the main ones are as follows:-

- Dose rates external to the vehicle shall not exceed 2mSv/h at any point and shall not be greater than 0.1mSv/h at 2m from the vehicle.
- Travel in the vehicle should generally be restricted to the driver and his assistant(s) in a passenger compartment with the packages in a goods compartment.
- The vehicle shall not unnecessarily be left unattended, and if it is, it shall be for as short a period as possible and the stowage compartment must be kept locked.

- For vehicles less than 3.5 tonnes 2 x 2kg dry powder fire extinguishers must be carried. For vehicles greater than 3.5 tonnes 1 x 6kg and 1 x 2kg fire extinguishers must be carried. [NB there is a derogation from the fire extinguisher requirement for small vehicles carrying small loads. Therefore if not more than 10 packages are transported and the sum of the transport indices is less than 3 the fire extinguisher requirement can be ignored.] *This derogation is from the old regulations and its reinstatement has been asked for - approval still pending.*

5. TRANSPORT OF TYPE B PACKAGES

Material whose activity exceeds the limits specified for Type A packages in Table 4 must be transported in Type B packages.

The design of Type B packages requires competent authority approval. Type B packages have to comply with all the general requirements for package design as previously outlined together with specialised requirements as outlined in Schedule 8 of the Regulations

They also have to comply with the placarding and labelling requirements as described for Type A packages except that the packages need to be marked 'Type B' together with a unique serial no. and an embossed or stamped radiation trefoil.

All the other requirements outlined for Type A packages also apply.

6. TRANSPORT OF WASTE

Low activity wastes can be transported in excepted packages as long as you can satisfy the excepted package limits (see Table 1). As these are quite generous, the most limiting factor will be the external dose rate limit of 5μSv/h.

It is strongly recommended that you try and keep your waste within these limits as this then avoids the need to label the packages with radiation trefoils and also means that no vehicle placards or cab notice are required. See section 2 for all the details.

If your waste cannot satisfy the excepted package limits then you will need to use the appropriate 'industrial package' and transport the waste as either 'LSA' material or 'SCO' material or a combination of the two.

The most appropriate category of 'LSA' will be 'LSA-II' as this covers liquids, solids and gases of all radionuclides. (LSA-I is essentially for uranium and thorium ores and compounds and rare earth materials, and LSA-III is essentially for consolidated wastes from the nuclear industry.)

The most appropriate category of 'SCO' is 'SCO-I' which relates to relatively low levels of fixed and loose contamination on surfaces of waste items. Most contamination will be relatively fixed and the limit for beta and gamma emitters averaged over 300cm^2 is 40kBq/cm^2. (For more details on LSA and SCO see Regulation 2 - Interpretation)

To cover all likely eventualities when transporting LSA-II and SCO-I waste you will need to use an IP-2 package. An IP-2 package must meet the general requirements for all packages as previously outlined together with the requirements as specified in Schedule 8, Part VII of the Regulations. A sealed drum that can withstand a small drop test and a stacking test is most commonly used.

Placarding and labelling etc is as required for Type A packages except that in addition on the labels the category of LSA or SCO must be specified (Schedule 18 para 7 to the Regulations).

All other requirements previously outlined for Type A packages also apply except that the containers must be labelled as 'TYPE IP-1 or TYPE IP-2' as appropriate.

6.1. *UN numbers used for waste*

UN 2912	RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-I) - non fissile
UN 3321	RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-II) - non fissile
UN 3322	RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-III) - non fissile
UN 2913	RADIOACTIVE MATERIAL, SURFACE CONTAMINATED OBJECTS (SCO-I OR SCO-II) - non fissile

7. REGULAR CONSIGNMENTS

Where the same radioactive source is being transported on a regular basis in the same packaging by the same cosignor, who is also the carrier, then a ‘regular consignment certificate’ can be used. There is now no need to seek approval from the Dept of Transport for use of these regular consignment certificates.

The consignment certificate will include all the details normally required (see para 17 of Schedule 6 to the Regulations) except that consignee details do not need to be specified. The certificate should specify that it is a ‘regular consignment certificate’ and give an issue date and an expiry date. Such a certificate produced by the consignor can only be valid for up to 3 months. When a ‘regular consignment certificate’ is being used a log must be kept with it in which details of all destinations and dates of shipment are recorded.

Copies of regular consignment certificates used by the consignor together with the log of journeys must be retained for inspection for a period of 2 years from the date of issue.

It is envisaged that these ‘regular consignment certificates’ will be of most use to people transporting mobile radiography sources or neutron density gauges.

8. DRIVER TRAINING

The level of training required for drivers should be appropriate to the hazard presented by the load carried. The Carriage of Dangerous Goods by Road (Driver Training) Regulations 1996 (as amended 1999) contain special provisions relating to the carriage of radioactive material (NB there is no exemption for vehicles less than 3.5 tonnes any more). Three categories of driver can be deduced:-

i. those who will only be involved with the transport of excepted packages - training is at the discretion of the employer (no legal requirement for training)

ii. those transporting excepted packages and up to 10 Type A packages at any one time (where the sum of the Transport Indexes is less than 3) - they will require training and must hold a certificate provided by the employer confirming that they have received instruction and training enabling them to -

a) understand the hazards presented by the goods they are transporting and the action to be taken in the event of an emergency

b) know their duties under Sections 3, 7 and 8 of the Health and Safety at Work etc Act 1974

c) know their duties under the Radioactive material (Road Transport)(Gt Britain) Regulations 1996 (now 2002 edition)

iii. those transporting higher activities of material - they will be required to attend a 2 day City & Guilds course to obtain a vocational training certificate valid for 5 years

It is envisaged that most people transporting radioactive material in a university or hospital context will fall within the first two categories and the level of training will largely be left to the individual institution to decide what is appropriate.

The Institution of Physics and Engineering in Medicine and Biology have drawn up a 2 hour course which they recommend for hospital drivers. This may also be applicable for other large establishments transporting material which they have dispensed themselves.

An outline syllabus suitable for the training of drivers involved in the transport of radiopharmaceuticals is given in Appendix 3 with details of the actual procedures for the drivers given in Appendix 4 (both courtesy of South Glamorgan Health Authority).

For the average university where most packages will be excepted or Type A packages, the driver's job should be very straightforward and the amount they need to know about radiation protection will be limited. Don't forget the packages will have been designed so that even in an accident situation the radiation hazard should be minimal. A short talk together with a list of reminders for the driver should be all that is required (see example in Appendix 5). (In this example the driver is just responsible for completing the transport process started by the manufacturer and all packages will have a consignment certificate with them.)

Drivers should have their reminder sheets with them at all times for reference and in case of emergency. This document should also meet the requirements of para 23, Schedule 6 to the Regulations in relation to 'Information for Carriers'.

An annual check on the driver's knowledge of dealing with radioactive shipments should form part of a quality assurance system.

There are now no duties or responsibilities defined under the Regulations for drivers (except under Regulation 69 - action to be taken in the event of an emergency) as the legal responsibilities lie with the 'Carrier' (i.e the driver's employer). Responsibilities of carriers are defined in Schedule 7 to the Regulations and relate to segregation of packages, their correct stowage, undeliverable consignments. These are all things that the driver will need to know about however as he acts on behalf of the carrier.

The driver has responsibilities under Regulation 69 to report accidents and incidents to the police and (where appropriate) the fire brigade and the the consignor. In most circumstances he will be following his emergency procedures and reporting to his institution/carrier who will carry the ultimate responsibility for the reporting of accidents/incidents. See Regulation 69 for full details.

9. QUALITY ASSURANCE PROCEDURES

The key requirements of a quality assurance programme are to have all procedures affecting quality fully documented, to make sure that everyone involved in the process is aware of their responsibilities, to have a system of checking to see that procedures are being observed and then applying corrective actions as and when required.

The best guide on 'quality assurance for the safe transport of radioactive materials' can be found in IAEA Safety Series No.113. It gives excellent summaries of requirements for a range of different scenarios.

The quality assurance process starts with the design of the packaging, its manufacture and performance testing (if necessary).

Those who make their own Type A packaging will need to carry out the appropriate performance tests and have documentary evidence to show that the design has passed the tests. This is an expensive business for one-offs and an alternative is to buy certificated packages from the suppliers listed in appendix 1. Most universities will not be involved in this aspect of transport.

9.1. *Outline Quality Assurance Program Suitable for a University*

1) General *policy statement* - provision of a transport service on behalf of university departments in compliance with the current transport regulations.

2) *Nature and Scope of Activities* - what aspects of the transport procedures are involved and the operations involved e.g. waste disposal.

3) *Organisational Structure* - who does what and what are their responsibilities.

4) *Document Control/Records* - details of the documentation of the QA program and of the documentation of records.

5) *Instrument and Test Control* - details of instruments used to measure dose rates and contamination .

6) *Procedure Control* - details of procedures for each transport operation. These are likely to cover :-

a) waste disposal

b) ordering, receipt and delivery of isotopes

c) one-off non-routine shipments

7) *Staffing and Training* - details people involved and training given

8) *Audits* - an external audit should not be necessary however brief details of an internal auditor should be specified. Annual audit appropriate.

10. BIBLIOGRAPHY

1. The Radioactive Material (Road Transport) (Great Britain) Regulations 2002
SI 2002 No. 1093 http://www.hmso.gov.uk/si/si2002/20021093.htm

2. The Radioactive Material (Road Transport)(Definition of radioactive Material) Order 2002
SI 2002 No.1092 http://www.legislation.hmso.gov.uk/si/si2002/20021092.htm

3.The European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR) 2001. http://www.unece.org/trans/danger/publi/adr/adr_e.html

4. The Carriage of Dangerous Goods by Road (Driver Training) Regulations 1996 SI No.2094 (as amended 1999). http://www.hmso.gov.uk/si/si1996/Uksi_19962094_en_1.htm#end

5. The Carriage of Dangerous Goods (Amendment) Regulations 1999 SI 1999 No.303.
http://www.hmso.gov.uk/si/si1999/19990303.htm#note9

6. IAEA Safety Standards Series No.TS-R-1 (ST-1, Revised) - Regulations for the Safe Transport of Radioactive Materials,1996 Edition (revised).

7. IAEA Safety Standards Series No. TS-G-1.1 (ST-2) - Advisory material for the IAEA Regulations for the Safe Transport of Radioactive Material.
http://www.iaea.org/worldatom/Books/NewReleases/book50.shtml

8. IAEA Safety Series 113 - Quality Assurance for the Safe Transport of Radioactive Material (1994)

9. BS 5750:part8:1991 - Quality Systems, Part 8. Guide to quality management and quality systems elements for services.

10. Procedure for the Transport of Radiopharmaceuticals. G.S.Saggu and I.H.Davies, South Glamorgan Health Authority Dept of Medical Physics and Bioengineering.

APPENDIX 1

The following list is not comprehensive but gives details of some companies who manufacture containers for the transport of radioactive materials.

1. Air-Sea Containers
318 New Chester Road
Birkenhead — Tel: 0151 644 0636
L42 1LE — Fax: 0151 644 9268
Email: sales@air-sea.co.uk
Website: http://www.air-sea.co.uk

2. CP Mega Ltd
Worton Hall Industrial Estate
Worton Road
Isleworth — Tel: 020 8568 1881
Middlesex TW7 6ER
Email: info@cpcases.com
Website: http://www.cpcases.com/

(*manufactures cases*)

2. C.S. Products
Unit 5, Blair Road
Ivybridge — Tel: 01752 896222
Devon PL21 0BR

Sell type tested containers and offer a maintenance and repair service.

3. Croft Associates Ltd
Mr Ron Hows
B2 North Culham Estate
ABINGDON — Tel 01865 407740
Oxon OX14 3GY — Fax 0870 133 5088
Email: postroom@croftltd.com
Webpage: http://www.croftltd.demon.co.uk/

4. Gravaton Projects Ltd
Sareham Heights
Standard Way
Sareham — Tel: 01329 822905
Hampshire PO16 8XT

Suppliers of Type A and Type B packages.

5. AEA Technology Plc
Building 424.4
Harwell
Didcot
Oxon OX11 ORA
Tel: 01235 433556

AEA Technology have a testing facility for Type A packages and will carry out QA on design and manufacturing of packages. They will also assess suitability of packaging by calculation for clients.

6. Key Industrial Equip Ltd
Blackmoor Road
Ebblake Industrial Estate
Verwood
Wimbourne
Dorset BH21 6AT
Tel: 01202 827 616

Sell metal containers for use as reusable excepted packaging and other packaging.

7. Medical Equipment Manufacturers Ltd
9 Holbrook Avenue
Holbrook Industrial Estate
Sheffield S19 5EF
Tel: 0114 247 5725/6

Type A transport cases and placards/fireproof notices.

8. Safeguard International
Culham
Abingdon
Oxon OX14 3EB
Tel: 01235 464046

In addition

University of Sheffield make signs suitable for affixing to the outside of vehicles and also inside to the glass. For further details contact T.J.Moseley Tel: 0114 2226190, Fax: 0114 2768741, or e-mail: t.j.moseley@sheffield.ac.uk

Chris Pursey (DGSA) can provide smaller size magnetised orange plates (300mmx120mm) Contact Chris at cd.pursey@ntlworld.com Sept 2002 price £10+VAT.

APPENDIX 2 - Example of Consignment Certificate

CONSIGNMENT CERT FOR CLASS 7 RADIOACTIVE MATERIAL Ref.No: 2002/.....

The Transport of Radioactive Material (Road Transport) Regulations 2002

	FROM CONSIGNOR	**TO CONSIGNEE**
Name	.....	**Name** .....
Address	.....	**Address** .....
	.....	.....
Contact	.....	
Tel No	.....	

1. Description of Consignment:

(Appropriate UN number and descriptor)

Maximum dose rate at the surface of any container

..... MicroGray per hour in air

2. Activity at Despatch: Mega Becquerels

.....

3. Isotope:

.....

4. Physical Form: Liquid Solid

.....

5. Chemical Form: Inorganic Compound Organic Compound Elemental

.....

6. Package Type: Excepted

.....

7. Category: N/A (for excepted)

.....

8. Transport Index: N/A (for excepted)

.....

I hereby declare that the contents of this consignment are fully and accurately described by proper shipping name, and are classified, packed, marked and labelled, and are in all respects in proper condition for transport by road according to the applicable international governmental regulations.

Signed: ..... Print Name: ..... Date: .....

APPENDIX 3 -Outline Syllabus for Driver Training

A. Introduction

1. General understanding of the drivers duty to transport dangerous goods safely through knowledge, skill and careful driving.
2. Understanding the existence and requirements of relevant national and international regulations and agreements applicable to the transport of radioactive materials as they relate to the duty of the driver.

B. Nature of Goods

1. Understand the nature and use of radioactive materials.

C. Hazardous Effects

1. Understand the dangers presented by radioactive substances and the steps necessary to minimise the dangers.

    1.1 Inverse square law
    1.2 Shielding
    1.3 Time
    1.4 Containment

D. Preventative Measures

1. Understand the operating procedures to be followed throughout a ***normal*** journey as required by current regulations and approved codes of practice.

    1.1 Procedure at the vehicle loading point
    1.2 Package types and labels
    1.3 Stowage and load security
    1.4 Vehicle documents
    1.5 Vehicle placarding
    1.6 Checks before setting out
    1.7 Carriage of passengers
    1.8 Checks during journey
    1.9 Supervision & parking rules - when / if
    1.10 Action in the event of a breakdown
    1.11 Procedure at the vehicle unloading point
    1.12 Procedure on return to base

2. Understanding handling and delivery procedures.

3. Understand the administration of basic emergency aid procedures and techniques.

   3.1 Care of the unconscious casualty (CPR)
   3.2 Control of bleeding
   3.3 Burns
   3.4 Contamination.

4. Understand the use of radiation monitors.

5. Understand the action to be taken in an emergency involving a vehicle carrying radioactive materials.

6. Understand relevant Quality Assurance procedures.

7. Loads to be handled in accordance with the ‘Manual Handling of Loads Regulations’.

South Glamorgan Health Authority

APPENDIX 4 - Procedure for Drivers Transporting Radiopharmaceuticals

To comply with current Transport Regulations and to ensure that packages containing radioactive materials are transported safely the driver must adhere to the following procedure.

1. **Before commencement of the journey the driver must ensure that:**
   a) Radioactive signs (placards) are attached only to the sides and the back of the vehicle.
   b) A fireproof sign is present in the vehicle, alongside the driver, indicating the presence of radioactive material.
   c) There is a Consignor's Certificate for each package.
   d) The information on the package conforms with the Consignor's Certificate.
   e) He/she has signed for the packages.
   f) All packages are labelled and stored in a suitable manner in the luggage compartment of the vehicle.

2. The driver must hand over the Consignor's Certificate to the recipient department when handing over the package. A signature should be obtained by the driver to acknowledge receipt of the package.

3. **When the vehicle no longer contains radioactive packages the driver must:**

   a) Remove radioactive signs (placards) from the windows or the outside of the vehicle.
   b) Turn the fireproof sign over to indicate the absence of radioactive materials.

4) Once a week, even if no spill has occurred, contamination checks must be carried out on the surfaces of the vehicle's compartment in which the radioactive packages are transported. A record of these checks must be kept.

5) General responsibilities when transporting radioactive materials:

   a) Take 'reasonable' care against the theft or loss of the radioactive material carried.
   b) Inform Medical Physics at UHW and the Police if loss, theft or severe damage of the packages has occurred(e.g. fire or packages bursting open leaving broken syringes or vials on the road).
   c) In the event of vehicle breakdown or immobilisation, leave a sign in the vehicle to say 'driver has gone for help', then telephone Medical Physics at UHW as soon as possible.
   d) Do not leave the vehicle unattended in a public place, except when (c) applies or when carrying out deliveries to radiology departments. Vehicles must be locked when unattended.

e) Do not carry passengers unless authorised to do so by Medical Physics, UHW.

f) Be aware of the meaning of all radioactive package signs.

g) Be aware of the measures to be taken in the event of a radioactive spillage.

6. To ensure compliance with this procedure, drivers must acquaint themselves with the Driver's Checklist (*SGHA document*).

South Glamorgan Health Authority

APPENDIX 5
RADIOISOTOPE DELIVERIES - DRIVERS' RESPONSIBILITIES

These guidelines have been drawn up from the requirements of the 2002 Radioactive Material Road Transport Regulations, taking into account the type of material which we usually transport and our in-house administrative arrangements.

General

The driver is in charge of the vehicle and is responsible for the safe transport of the goods he is carrying. He should ensure that none of the material is lost, escapes or is unlawfully removed from the vehicle or from any package.

Guarding the Vehicle

When in a public place, the driver must not leave unattended or out of sight any vehicle containing radioactive material, without reasonable cause. If he should have to leave the vehicle, the storage compartment must be locked or the packages otherwise secured so as to prevent unlawful removal.

Stowage of Goods

The driver should ensure that the packages are not roughly treated, and are properly stowed. It is permitted to carry non-dangerous goods in the same vehicle (dangerous goods and photographic film are not permitted). However, radioactive goods should be stowed together and not intermingled with non-radioactive goods. In a mixed load, the radioactive materials should always be to the rear of the vehicle.

Display of Placards and Notices

The driver must ensure that the fireproof warning notice is exhibited in the cab and that the vehicle placards are properly displayed (each side and rear of the vehicle). The vehicle placards or cab notice are not required when only transporting excepted packages. Excepted packages can easily be recognised as they **do not** have radiation warning signs on them.

Signing for and Hand-over of Goods

When the radioisotopes are collected from Safety Services, the driver will be given an inventory of the packages he is taking. He should check that the number of packages he receives tallies with that displayed on the inventory before signing for them. When delivering the isotopes, he should ensure that they are handed over to an authorised recipient, and that they are signed for.

In the Event of an Accident

The driver must notify Emergency Control Centre, Sheffield 2728887 immediately if he suspects that:

a) any radioactive material has been lost, stolen, or has escaped from the vehicle;

b) any package containing radioactive material has been damaged in a road accident or otherwise; and

c) the vehicle and its load is in danger e.g. from fire.

NB If a vehicle involved in a road accident is carrying radioactive material, there need be no undue alarm on that account. All packaging for radioactive material is specially designed for the job, and the more hazardous the material, the tougher the packaging which is used.

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