

# Transporting Chemicals for Lecture Demonstrations & similar purposes

2nd edition, 2013



## About the RSC

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The Royal Society of Chemistry (RSC) is the UK professional body for chemical scientists and an international learned society for advancing the chemical sciences. Supported by a network of over 43 000 members worldwide and an internationally acclaimed publishing business, its activities span education and training, conferences and science policy, and the promotion of the chemical sciences to the public.

If you require further information on the contents of this report, please contact us at our Cambridge office (refer to back cover for details).

## About CLEAPSS and SSERC

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CLEAPSS® and the Scottish Schools Equipment Research Centre are advisory services supporting practical science, D&T and art in schools and colleges. CLEAPSS provides for those in England, Wales and Northern Ireland (and overseas) and SSERC for those in Scotland. Both organisations, which are largely funded by local authorities and independent schools, have a particular focus on health & safety and produce a range of publications and resources for their members. These include bulletins and newsletters, handbooks and guidance on practical work and health & safety. These are available electronically on their respective websites. Both organisations have helplines and run many courses. The two organisations also have close links with the Association for Science Education, the Health and Safety Executive, the Health Protection Agency, the British Standards Institution, the Environment Agency, the Scottish Environmental Protection Agency, and also with those professional bodies with particular interests in different subject areas such as the SoB, the IoP, the RSC and the respective examination boards.



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## 1. Introduction

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It is often necessary to move chemicals around for the purposes of lectures, demonstrations, competitions or other hands-on practical activities. The Royal Society of Chemistry (RSC), CLEAPSS and SSERC all want to encourage such activities as a way of stimulating an interest in chemistry amongst young people and indeed the public at large. This document has been produced at the request of the RSC to support such activities. We are grateful to staff of the HSE in Edinburgh who clarified several areas when preparing the 1st edition, to a number of demonstrators who supplied information about the chemicals they use, to staff from CLEAPSS and SSERC and to members of various RSC committees for their comments on the drafts and to others who helped in the consultation processes. SSERC has produced a wider guidance document which is available on its website.

This second edition, dated September 2013, is closely based on the 1<sup>st</sup> edition (January 2008) modified to take account of detailed changes in the legislation.

Those involved in demonstration lectures etc come from a variety of backgrounds. Some may be volunteers who are retired or who are currently working in schools, industry or higher education. Although there will be no restriction on certain chemicals, some of those they wish to move around will be classified as "Dangerous Goods" and account must therefore be taken of the *European Agreement Concerning the International Carriage of Dangerous Goods by Road (ADR)*<sup>1,2</sup>, implemented in the UK via the *Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations (the Carriage Regulations)*<sup>3</sup>. These regulations apply when goods are transported in a vehicle (eg, a car, van or public transport) but do not apply if transported on foot or by bicycle – or, indeed, by horse! This legislation is aimed particularly at large commercial loads. For the small quantities likely to be required for demonstrations etc (see *Appendix 2*) there are, fortunately, complete or partial exemptions from the *Carriage Regulations*, providing certain rules are adhered to. However, since different exemptions apply in different contexts the position can be very complicated. The *Simple rules* in section 2 cover the most likely situations and in some cases do more than the law would require. This is all that most demonstrators will need. The justification for these rules is explained in section 5 on *Exemptions to ADR* and some *Special cases* are considered in section 8. The transport of a few items is effectively banned (see *Appendix A1.6*) A flow diagram summarising the options is given in section 9. The status of the individual can affect the exemptions and this is discussed in section 3. The status can also affect the vehicle insurance, discussed in section 4. Note that the use of trade names in this document, or references to a particular company, do *not* constitute an endorsement; they are given by way of example only.

Rather than the demonstrator transporting chemicals, **in some cases it will be most straightforward for the host venue to be asked to supply them.** If they are not available at the venue then it may still be possible to ask a supplier to deliver them directly to the venue although this incurs significant costs. After the event, it may be possible to leave any surplus chemicals as a gift to the host. However, it is important that schools do not accumulate unwanted, exotic chemicals and it may be necessary to arrange disposal, in accordance with relevant legislation.

If the hazards of transporting chemicals have been reasonably considered, appropriate measures taken to minimise risk and the simple rules given in Section 2 applied, then this will demonstrate an adequate duty of care.

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<sup>1</sup> The term ADR originated as an abbreviation for *L'Accord Européen Relatif au Transport International des Marchandises Dangereuses par Route*, the French translation of the *European Agreement Concerning the International Carriage of Dangerous Goods by Road*. However, neither term is used in UK legislation which universally refers to ADR.

<sup>2</sup> <http://www.unece.org/trans/danger/publi/adr/adr2011/11ContentsE.html>.

<sup>3</sup> *The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2009* ("CDG 2009"), SI 2009 No 1348 can be downloaded from <http://www.legislation.gov.uk/uksi/2009/1348/contents/made>.

In Northern Ireland, the almost identical *The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations (Northern Ireland) 2010* apply. Any reference in this document to the *Carriage Regulations* is intended to refer to both.

## 2. Simple rules

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These simple rules have been drawn up knowing the chemicals likely to be transported for lecture demonstrations and the quantities involved. They make use of the various exemptions from ADR. If followed they should cover all the likely situations.

### In summary:

- The demonstrator should try to avoid transporting chemicals. Where practicable, ask the host venue to provide them or have them delivered direct to the venue by a supplier.
- The driver should have an inventory of the chemicals carried.
- Chemicals which are being transported should be kept out of sight, eg carried in the boot of cars.
- Vehicles should be kept locked at all times when parked.
- Chemicals should not be left in vehicles overnight. If this is unavoidable, park the vehicle in as secure and well-lit an area as possible, in sight of any surveillance cameras present.
- Transport the smallest amounts of chemicals possible. For many (but not all) substances, if a total of less than 20 kg / 20 litres (see *Appendices 1* and *2*) of chemicals is being transported, very few of the Regulations apply (Small Load Exemption).
- Where possible, use the bottles and outer packaging in which the chemicals were originally supplied, complete with original labels and hazard warnings. (This is **essential** for a small number of chemicals – see Section 5.5 and *Appendix 1*). Where original bottles are not used, labels should comply with the requirements of the CLP Regulations.
- Caps and stoppers on bottles should be securely fastened and, if necessary, sealed with adhesive tape.
- Bottles should be supported with bubble-wrap or similar packing material in a robust outer container with a lid which is fastened closed (eg, with parcel tape). The container should carry a label indicating the contents and the hazards each presents.
- Support or pack outer containers so that bottles, or any box etc in which they are carried, cannot slide about or tip over.
- Chemicals should be separated by hazard type. Incompatible chemicals (eg, acids and bases, oxidising and reducing agents, alkali metals and water/aqueous solutions) and flammable should be in separate containers (eg, separate boxes).
- The demonstrator should be personally responsible for loading and unloading the chemicals and not delegate these tasks to others.
- For the more-hazardous loads, consider carrying a spills kit (see section 7) and ensure the person accompanying the chemicals knows how to use it to deal with a spill.

### 3. Status of the volunteer

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The status of the individual transporting the chemicals is important because:

- private individuals are exempt from some of the regulations governing the transport of chemicals by road; and
- the insurance cover of the driver may also be affected.

A retired volunteer will not be in employment and thus can be regarded as a private individual. However if volunteers accept fees, as opposed to expenses, then they may be considered in employment. In any case, a private individual would not be able to obtain some chemicals. In that situation, a school or university might supply them (free of charge) but it does raise questions about the status of the individual.

A university lecturer, for example, may be encouraged by her/his department to give lectures to feeder schools, may be supplied at no cost with the relevant chemicals but may still be regarded as a private individual working in her/his own time. Similarly, some teachers in secondary schools may be encouraged, or even required, to liaise with feeder primary schools. Needless to say, few of these distinctions have been tested in court.

### 4. Motor insurance considerations

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Some of the more popular private motor insurance policies do not appear to have any specific restrictions with regard to the carriage of chemicals (although radioactive materials may be treated differently). There is a general duty to take reasonable care to prevent loss or damage. Therefore, if chemicals were transported in an inappropriate manner then a claim might be rejected. The *Simple Rules* in Section 2 give guidance on good practice.

The car insurance held by most school teachers will cover them for business use as a teacher (but this needs to be stated on the certificate of insurance). Named drivers on another person's insurance policy (eg, spouses) are unlikely to be insured for business use unless this is explicitly stated. Primary school liaison is an important part of the job of some teachers in secondary schools and hence occasionally moving a few chemicals to a neighbouring feeder school should be covered by their insurance. University staff may also be covered for undefined business use, although most universities will have vans routinely employed for transporting chemicals between sites which it may be possible to use. In some cases different rules apply when employers are transporting chemicals between their own sites, even if public roads are involved.

When insurance cover is being arranged, questions are asked relating to the occupation of the proposer and the requirement for cover. The policy is then framed around this. Therefore, someone without a paid job, who stays at home to care for children or others, is likely to have a policy that restricts cover to Social, Domestic and Pleasure purposes only and this may be similar for a retired person. Beyond that there is a range of uses allowing for Social, Domestic and Pleasure purposes together with commuting and / or full business use. Sometimes "commuting" is restricted to a permanent place of work, therefore travel to alternative sites is not always allowed for. It could be argued that an unpaid volunteer travelling to a lecture / demonstration would be Social, Domestic and Pleasure purposes as there is no payment involved, whereas a paid volunteer is acting in a business capacity. Note, however, that some Social, Domestic and Pleasure policies do not cover a volunteer working unpaid for a charity.

Therefore, it is important that individuals check their policies (and certificates of motor insurance) to ensure they have the correct cover for their activities. For example a retired person might add the term, "volunteer lecturer in chemistry" to his "occupation".



## 5. Exemptions from ADR

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The rules governing the transport of chemicals by road are extremely complex and not always entirely logical to the chemist's mind. In general, carriage must conform to the requirements of ADR as implemented by the *Carriage Regulations*<sup>4</sup>.

Terminology can be very complicated. A partial *Glossary* is given in *Appendix 1*. Labelling and packaging which must conform to Part 4 of ADR. Table A [3.2.1] of ADR<sup>5</sup> is known as the *Dangerous Goods List*. It runs to 266 pages!

There are exemptions from ADR (section 1.1.3) under several categories, of which the most relevant in the context of this document are as follows.

- Private individual
- Ancillary to main activity
- Limited quantities
- Excepted quantity
- Small loads

The issues are discussed in more detail below, but the above list is given in order of preference for demonstrators needing to transport chemicals by road. As you descend the list, the legal requirements become more onerous.

### 5.1 Private individuals

Whilst there are limits on the total quantity that may be carried under this exemption, private individuals are exempt from ADR [ADR 1.1.3.1(a)] if **carrying dangerous goods packed for retail sale and intended for personal, domestic and leisure use**, provided steps have been taken to prevent leakage. This should cover individuals carrying out lectures and similar activities as a hobby as long as the original containers are used but obviously some chemicals are not available for retail sale to private individuals. If a university, for example, provided the chemicals for a former lecturer, that lecturer might be regarded as working (unpaid) for the university.

In addition, private individuals are allowed to carry up to 50 kg of fireworks (or a combination of 30 kg of fireworks and other explosives) [*Carriage Regulations* 3(9)].

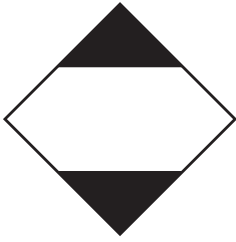
### 5.2 Ancillary to main activity

Carriage by organisations which is "ancillary to their main activity" [ADR 1.1.3.1(c)] is also exempt from ADR, providing quantities are restricted. Thus if the main activities of a university are research and degree-level teaching, a lecture for school students could be seen as ancillary to their main activity. However, there is no clear definition of "ancillary to their main activity" and, for example, outreach work might be seen as part of the recruitment process of a university.

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<sup>4</sup> *The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2009* can be downloaded from [http://www.opsi.gov.uk/si/si2007/uksi\\_20071573\\_en.pdf](http://www.opsi.gov.uk/si/si2007/uksi_20071573_en.pdf)

<sup>5</sup> <http://www.unece.org/fileadmin/DAM/trans/danger/publi/adr/adr2011/English/Part3.pdf>



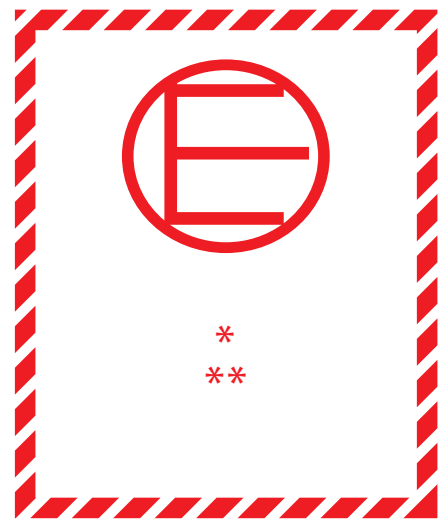
### 5.3 Limited quantities

Limited quantities (LQ) of most substances are exempt from the provisions of ADR providing they are well-packaged and labelled in a specified way. The previous system of 28 different categories has now been simplified to a limited list of quantities (in g or kg, ml or l). Unfortunately, for a few substances, the quantity is 0 g and this category includes some that demonstrators might want to transport. Examples include the alkali metals and compressed gases such as hydrogen.

The total allowed in any one box is also restricted but unlikely to be an issue in the context of this guidance. The Limited Quantity amount of the chemicals reported to be used by demonstrators is given in *Appendix 2*. It is generally preferable to use the LQ exemption if possible as fewer regulations would then apply. For example, the hazard warning diamond is not required on the outside of the vehicle. However, each package should have on its outside a warning diamond, 100 mm x 100 mm<sup>6</sup>. The line defining the outside of the diamond must be at least 2 mm thick. Note that this is a different design to that shown in the previous edition of this publication (which can continue in use only until June 2015).

### 5.4 Excepted quantity exemptions

Excepted quantities (EQ) is a new concept [ADR 3.5] which did not appear in earlier versions of the regulations. It assumes chemicals will be in combination packages (e.g. a bottle in a box). A new code (E0 to E5) appears in column 7(b) of table A (see Appendix 1.5). This links to paragraph 3.5.1.2 where what is allowed by the codes is set out. For example code E0 means that no EQ provisions are applicable. Code E1 means that the substance may be carried in inner packagings up to 30g or 30ml in outer packagings with a maximum net contents of 1000g or 1000ml – and so on for the other codes. It seems that this new category is unlikely to offer any great advantage to those at whom this document is aimed, unless they are carrying really quite small containers (less than 30 ml or 30 g) in large numbers. The packages have to be marked with the “EQ Symbol” (which can be black or red) and documents (where carried) must state “dangerous goods in excepted quantities” and indicate the number of packages.



\* The first or only label number shown in column (5) of Table A of Chapter 3.2 shall be shown here.

\*\* The name of the consignor or of the consignee shall be shown here if not shown elsewhere on the package.

<sup>6</sup> The dimensions can be reduced the package so requires but must be at least 50 mm x 50 mm.



## 5.5 Small loads

There are also exemptions for small loads, i.e. where the total quantity of dangerous goods carried is restricted [ADR 1.1.3.6.2]. It is the transport category of each substance, listed in ADR Table A (see Appendix 1.4), which determines what is regarded as a small load. There is a weighting system to deal with a mixed load having substances in different categories. For the situations covered in this document the Small Load Exemption will almost certainly apply (see Appendices 1 and 2). This means that many of the requirements of ADR do not apply. However, some of the requirements **do** apply which is why it is generally preferable to use the Limited Quantity Exemption if possible. **The following requirements of ADR must be followed even for small loads unless the private individual or other exemptions apply.**

- The driver must have awareness training [ADR 8.2.3] and a record of this should be kept [ADR 1.3.3]. The legislation assumes that that driver is in employment. Awareness involves both an understanding of transport legislation and of the hazards of the goods being transported. Familiarity with the joint Department for Transport / HSE publication<sup>7</sup> *Working with ADR. An introduction to the carriage of dangerous goods by road* should suffice for the former. As far as the latter is concerned, since the driver will be using the goods her- or himself in demonstrations or similar, s/he should self-evidently be fully aware of the hazards.
- The vehicle should carry one 2 kg dry powder fire extinguisher or equivalent [ADR 8.1.4.2].
- The goods should be stowed properly [ADR 7.5.7], ie to prevent sliding etc.
- For some categories of chemicals the full ADR packaging requirements must be met, irrespective of the quantities carried. This includes UN approved containers, combination packaging, hermetic seals, etc. It is very unlikely this could be satisfied except by use of the original packaging in which the chemicals were supplied. Chemicals likely to be used by demonstrators etc for which the full packaging requirements would apply include sodium, potassium and bromine<sup>8</sup>.

## 6 Use of specialist contractors or carriers

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In many cases the lecturer will transport her/his own chemicals and equipment. This obviates most of the need for driver training as the lecturer will certainly know the properties of the chemicals very well, including how to handle them and deal with emergencies. However, this will NOT be the case if a carrier is used. Some chemical suppliers do have trained drivers but some suppliers have ceased supplying particular chemicals because they do not have trained drivers. Trained drivers are not required for all chemicals and so in principle a carrier could be used. However, there may be difficulties in persuading the carrier that this is the case. It may be possible to pay a carrier to move chemicals between sites. Firms specialising in waste disposal, especially the smaller ones<sup>9</sup>, are sometimes willing to do so.

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<sup>7</sup> [http://adlib.eversite.co.uk/resources/000/157/714/working\\_with\\_adr.pdf](http://adlib.eversite.co.uk/resources/000/157/714/working_with_adr.pdf)

<sup>8</sup> <http://www.unece.org/fileadmin/DAM/trans/danger/publi/adr/adr2011/English/Part3.pdf>. Look for the Limited Quantities code 0 in column 7(a).

<sup>9</sup> For example, Chemgo, tel: 07739 415061; fax: 0121 453 7887; web site: [www.chemgo.org](http://www.chemgo.org); e-mail: [enquiry@chemgo.com](mailto:enquiry@chemgo.com).

## 7 Spills kit

The following general purpose kit is suggested, although modification may be needed for particular loads.

Item	Explanation
Mineral absorbent, eg 'cat litter'	<p>1 kg is enough to soak up about 400 ml of liquid and, if sprinkled around the spill, it will stop a larger spill spreading.</p> <p>The cheapest supply of mineral absorbent is cat litter. One type is based on Fuller's Earth, which is often red, and the other on clay, which is often white or grey; either is suitable and safe but the latter is preferable as it does not break up once wet. It can be bought in 10 kg bags from most supermarkets. Some cat litter may be calcined and thus effervesce for a short time when applied to an acid but this is not hazardous. Other possibilities include Vermiculite and sand.</p>
1 plastic bucket	Many of the items may be carried in the bucket.
1 plastic dustpan & brush	
1 pair chemically-resistant gloves	Nitrile preferred.
1 chemical scoop	
Scissors & adhesive tape	
Eye protection	Goggles preferred to BS EN 166 3.
3 'floor' cloths	
(1 pack of) plastic 'pedal-bin' bags	Choose a size which fit over the bucket, for the disposal of small amounts of wet absorbent.
0.5 kg of anhydrous, technical-grade sodium carbonate	To neutralise up to 250 ml of concentrated sulfuric(VI) acid, for example.
0.5 litre of undiluted dispersing agent	Teepol is a general-purpose detergent for laboratories but others will suffice and may be cheaper.
0.5 kg of citric acid	To neutralise up to 250 ml of concentrated ammonia solution or 2.5 l of 2 M sodium hydroxide solution.

## 8 Special cases

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### 8.1 Fireworks and explosives

Under section 9(4) of the *Carriage Regulations* private individuals are allowed to carry up to 50 kg of fireworks or 30 kg of other explosives (or mixed loads), ie they are covered by exemption 1.1.3.1(a) of ADR. They must be loaded, stowed, carried and unloaded in a manner which does not significantly increase the risk to any person. Unauthorised access must be prevented and there should be no smoking and naked flames in and near the vehicle.

### 8.2 Gas cylinders

To avoid potential problems it is much simpler if lecturers use the very small non-refillable canisters (sometimes called “disposable cylinders” in catalogues). For example, a standard 50 litre water capacity refillable cylinder filled to 200 bar will yield 10 000 litres of gas when released as against the mid-range non-refillable canister containing 34 litres of gas from a company such as Cryoserve<sup>10</sup>.

The British Compressed Gas Association (BCGA) produces a number of Codes of Practice<sup>11</sup>. These industry codes are non-statutory but a court would probably decide that they represent good practice. However, there may well be alternative, and equally safe, ways of complying with the actual requirements of the Regulations, which in the end is what matters. One of the main requirements is that gas cylinders should be transported in open vehicles, or, if that is not possible, only in a well ventilated vehicle. Small canisters obviously require much less ventilation than larger cylinders.

### 8.3 Liquid nitrogen

Under the *Carriage Regulations*, liquid nitrogen must only be transported in vessels which are suitable for this purpose. Open vessels are **not** suitable, because of the risk of splashing and spills. Equally, ordinary vacuum flasks (‘thermos’ flasks) are **not** suitable. 2 litres of liquid nitrogen will become 1366 litres of gaseous nitrogen. In an enclosed vessel this will give rise to a huge increase in pressure. Because liquid nitrogen is cold, it will condense any moisture in the atmosphere, possibly forming a water-ice plug which may seal an open vessel, causing the pressure to build up. To our knowledge this has caused at least two explosions in schools/colleges. Liquid nitrogen therefore must be transported, kept and used only in a vented Dewar flask, specially designed for cryogenic work with a pressure relief valve.

If liquid nitrogen is transported by road, the *Carriage Regulations* require that the driver shall have had special training. The BCGA Code of Practice CP30 *The Safe Use of Liquid Nitrogen Dewars up to 50 litres*<sup>12</sup> states that Dewars must be transported separately from driver or passengers. Flat-back pick-ups, or vehicles fitted with a separating bulkhead should be used - cars are not considered suitable, although perhaps a trailer or roof rack might be considered. It is important to remember that small-capacity Dewars have a relatively low base area. Thus there is a distinct risk of the Dewar falling over, eg, if the driver has to brake suddenly. This could lead to a major spill of liquid nitrogen, increasing greatly the risk of asphyxiation. Thus the Dewar must be transported in such a way that it cannot fall over or spill, for example, by standing it in a large, deep cardboard or plastic box filled with crumpled newspaper or similar packing material.

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<sup>10</sup> Available from Scientific & Chemical Supplies Ltd, tel: 01902 402402; fax: 01902 402343; web site: [www.scichem.co.uk](http://www.scichem.co.uk); e-mail: [education@scichem.co.uk](mailto:education@scichem.co.uk).

<sup>11</sup> BCGA Leaflet L1 Guidance for Carriage of Gas Cylinders on Vehicles. (British Compressed Gases Association, 2010). Can be downloaded from <http://www.bcgga.co.uk/preview/publications.php>.

<sup>12</sup> BCGA Code of Practice CP30 *The Safe Use of Liquid Nitrogen Dewars up to 50 litres: Revision 1* (British Compressed Gases Association, 2008). Can be ordered from <http://www.bcgga.co.uk/preview/products.php?g1=3ff921&n=2>.

## 8.4 Radioactive materials

The legislation concerning the transportation of radioactive substances (UN Class 7, see *Appendix 1.1*) has now been merged with that discussed elsewhere in this document, ie the *Carriage Regulations* [ADR 1.6.6]. All the sources needed in the context of this document are likely to be regarded as an “Excepted Package” under the Regulations. Because the effective dose is so low and the quantities so small, no special driver training is required. Even so, the driver should be responsible for the safety and security of the sources throughout, ensuring that they are stored properly when they reach their destination.

Regulations require the package to retain its contents under conditions likely to be found in routine transport. Also, the dose rate at any point on the external surface of the package must not exceed a specified limit (5  $\mu\text{Sv/h}$ ). If the guidance in *Appendix 3* is followed, these requirements will be met.

## 9 Summary of Options

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This flow diagram summarises the options for transporting chemicals. It has been adapted, with permission, from a document produced by SSERC<sup>13</sup>.

For many substances, the classification is given in *Appendix 2*. For those not listed, the most accessible source of information is the (English-language) version of the (German) GESTIS Substances Database, <http://gestis-en.itrust.de/nxt/gateway.dll?f=templates&fn=default.htm&vid=gestiseng:sdbeng>. This is useful as it gives both the new GHS (CLP) hazard classification as well as the old CHIP classification, in addition to much other useful information.

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<sup>13</sup> SSERC, 2 Pitreavie Court, Pitreavie Business Park, Dunfermline, Fife. KY11 8UB. Tel: 01383 626070; fax: 01383 842793; web site: [www.sserc.org.uk](http://www.sserc.org.uk); e-mail: [sts@sserc.org.uk](mailto:sts@sserc.org.uk). SSERC fulfils a similar role in Scotland to CLEAPSS in the rest of the UK.

Carriage of substances for personal use or transport which is ancillary to the main activity may be exempt from ADR. These options may often be unavailable. See sections 5.1 and 5.2 of this document.

*If not for personal use nor ancillary to the main activity*

To see if Limited Quantity or Small Load Exemptions apply, look up

- (i) the list in ADR 3.3 to see if substance is "not subject to the requirements of ADR" and
  - (ii) the Packing Group in Transport section (14) of a reputable supplier's Safety Data Sheet.
- See Appendix 1.5 of this document.

Look up the chemical in alphabetical index of the Dangerous Goods List in Table B in ADR 3.2.2 and obtain its UN number. See Appendix 1.2 of this document.

Go to Dangerous Goods List in Table A in ADR 3.2.1 which contains chemicals in order of their UN number and consult column 7 ("*Limited quantities*"). See section 5.3 and Appendix 1.3 of this document.

*If column 7 contains LQ and a number not zero*

It will be exempt from the provisions of ADR provided:

- it is packed in "Limited quantities" with the quantities in table ADR 3.4.6 not being exceeded for both inner packaging and the outer package;
- the packaging is stout and suitable;
- the outer package is clearly labelled with the LQ diamond.

Other general legislation always applies, eg *Health & Safety at Work Act*, including the duty of care, *COSHH Regulations*, *Management Regulations*.

*If the entry in column 7 is zero*

It is not exempted from most provisions even for small quantities, unless specifically stated elsewhere for that chemical. But it may still attract some exemptions via the "Small Load" exemptions. See section 5.4 of this document.

Look up the transport category in column 15 in Table A in ADR 3.2.1. See Appendix 1.4 of this document.

Consult the three column table in ADR 1.1.3.6.2 as modified by the *Carriage Regulations*. The maximum quantity of dangerous goods in each Transport Category, which can be carried and still attract some exemptions, can be found in Column 3.

Consult ADR for exemptions and remaining restrictions which apply under this route.

See if there are any other special provisions needed for the chemical by consulting Table A in ADR 3.2.1.

The other columns in Table A may show restrictions and provisions which apply to that chemical.

Note that many are blank. That means those types of provisions do not exist for the chemical concerned.

## Appendix 1: Glossary

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### A1.1 UN hazard codes

Dangerous Goods are categorized according to their UN Class Number, as follows.

#### Class 1 Explosive

- 1.1 Substances with a mass explosion hazard
- 1.2 Substances which present a projection hazard but no mass explosion hazard
- 1.3 Substances which present both a fire hazard and a minor blast or projection hazard (or both) but not a mass explosion hazard
- 1.4 No significant hazard (**This would include 'domestic' fireworks**).
- 1.5 Very insensitive substances with a mass explosion hazard
- 1.6 Very insensitive articles with no mass explosion hazard

#### Class 2 Gases

- 2.1 Flammable gases
- 2.2 Non-flammable, non-toxic gases
- 2.3 Toxic gases

#### Class 3 Flammable liquids

#### Class 4 Flammable solids

- 4.1 Flammable solids, self-reactive substances and solid desensitized explosives
- 4.2 Materials liable to spontaneous combustion
- 4.3 Substances which, in contact with water, release flammable gases

#### Class 5. Oxidizing substances and organic peroxides

- 5.1 Oxidizing agents
- 5.2 Organic peroxides

#### Class 6 Toxic and infectious substances

- 6.1 Toxic substances
- 6.2 Infectious substances

#### Class 7 Radioactive substances and articles

#### Class 8 Corrosive substances

#### Class 9 Miscellaneous dangerous substances

### A1.2 UN numbers

For transport purposes, common and/or industrially important hazardous chemicals are assigned "UN Numbers". These are listed alphabetically in Table B of section 3.2.2 of ADR<sup>14</sup>. A mixture of IUPAC and older chemical names is used. For less common chemicals, or for some mixtures and solutions the list includes categories such as *Amines, solid, corrosive, not otherwise specified*. If required, the UN Number is given in section 14 of manufacturers' safety data sheets or can be found from the GESTIS Substances Database<sup>15</sup>.

Demonstrators often want to transport solutions. A few of these are listed in Table B of section 3.2.2 of ADR. If not listed (and with a few exceptions) ADR 2.1.3.3 states that for solutions and mixtures composed of a single predominant substance mentioned by name in Table A of Chapter 3.2 and one or more substances not subject to ADR or traces of one or more substances mentioned by name in Table A of Chapter 3.2 shall be assigned the UN number of predominant substance.

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<sup>14</sup> <http://www.unece.org/trans/danger/publi/adr/adr2011/11ContentsE.html>.

<sup>15</sup> <http://gestis-en.itrust.de/nxt/gateway.dll?f=templates&fn=default.htm&vid=gestiseng:sdbeng>

### A1.3 Limited quantities

The coding system for the maximum size of the innermost packaging of different categories has been abolished in the current version of ADR. Instead, column 7(a) of Table A [ADR 3.2.1] now simply lists the maximum mass or volume for each substance. It can be 5 kg, 1 kg, 500g, 5 litres, 1 litre, 500 ml, 120 ml, 100 ml – or 0. Generally, demonstrators should easily be able to keep within the limited quantity amounts, unless it is zero. There are also restrictions on the total outer packaging size and slightly different rules for shrink-wrapped packaging. Neither of these will be relevant in the context discussed in this document and are omitted.

### A1.4 Small loads

Small loads are exempt from some of the requirements of ADR. What constitutes a small load depends on the Transport Category. Again, this has been simplified in the current version of ADR. The following is a simplified extract of the Table appearing in 1.1.3.6.3.

Transport Category	Maximum total quantity per vehicle
0	0
1	20
2	333
3	1000
4	unlimited

- For articles, the quantity is the gross mass in kg (except for articles in UN class 1, where it is the net mass of explosives in kg);
- For solids, liquefied, refrigerated or dissolved gases it is the net mass in kg;
- For liquids and compressed gases it is the nominal capacity in litres.

The Table applies if all the substances are in the same Transport Category. If they are not, the following weighting system applies

*The sum of [50×(the quantity in category 1)] + [20×(the quantity category 1, note a)] + [3×(the quantity in category 2)] +[1×(the quantity in category 3)] shall not exceed 1000.*

Even when transporting mainly Transport Category 1 items, lecturers should be able to stay within the 20 kg or 20 litre limit.

### A1.5 Excepted quantities

The following Table is taken from ADR 3.5.1.2.

Code	Maximum net quantity per inner packaging (in g for solids and ml for liquids and gases) Maximum net quantity per outer packaging (in g for solids and ml for liquids and gases or sum of g and ml for mixed packaging)	Maximum net quantity per outer packaging (in g for solids and ml for liquids and gases or sum of g and ml for mixed packaging)
E0	Not permitted as Excepted Quantity	
E1	30	1000
E2	30	500
E3	30	300
E4	1	500
E5	1	300



## A1.6 Packing group

The Packing Group for a chemical indicates the degree of hazard associated with its transportation. The highest group is Group I (great danger); Group II is next (medium danger), while Group III chemicals present the lowest hazard (minor danger). The Transport Category is nearly always the same as the Packing Group but the Packing Groups are often shown on safety data sheets for chemicals under the heading "Transport Information". Some chemicals can be in different packing groups, depending on the nature of the packaging used. This can also affect the Transport Category and the LQ Category.

## A1.7 Substances not accepted for carriage

Chemically-unstable substances in UN Class 5.1

"shall not be accepted for carriage unless the necessary steps have been taken to prevent their dangerous decomposition or polymerisation during carriage. To this end it shall in particular be assured that receptacles and tanks do not contain any material likely to promote these reactions" [ADR 2.2.51.2.1].

ADR specifically lists the following substances and mixtures, although some would be of little relevance in the context of this document. Note that where mixtures are referred to, the components could be transported separately and mixed on site.

- Oxidizing solids, self-heating, assigned to UN No. 3100; oxidizing solids, water-reactive, assigned to UN No. 3121; and oxidizing solids, flammable, assigned to UN No. 3137, unless they meet the requirements for Class 1 (see also ADR 2.1.3.7).
- Hydrogen peroxide, not stabilized or hydrogen peroxide, aqueous solutions, not stabilized containing more than 60% hydrogen peroxide.
- Tetranitromethane not free from combustible impurities.
- Perchloric acid solutions containing more than 72% (mass) acid, or mixtures of perchloric acid with any liquid other than water.
- Chloric acid solution containing more than 10% chloric acid or mixtures of chloric acid with any liquid other than water.
- Halogenated fluor compounds other than UN Nos. 1745 bromine pentafluoride, 1746 bromine trifluoride and 2495 iodine pentafluoride of class 5.1 as well as UN nos. 1749 chlorine trifluoride and 2548 chlorine pentafluoride of Class 2.
- Ammonium chlorate and its aqueous solutions and mixtures of a chlorate with an ammonium salt.
- Ammonium chlorite and its aqueous solutions and mixtures of a chlorite with an ammonium salt.
- Mixtures of a hypochlorite with an ammonium salt.
- Ammonium bromate and its aqueous solutions and mixtures of a bromate with an ammonium salt.
- Ammonium permanganate and its aqueous solutions and mixtures of a permanganate with an ammonium salt.
- Ammonium nitrate containing more than 0.2% combustible substances (including any organic substance calculated as carbon) unless it is a constituent of a substance or article of Class 1.
- Fertilizers having an ammonium nitrate content (in determining the ammonium nitrate content, all nitrate ions for which a molecular equivalent of ammonium ions is present in the mixture shall be calculated as ammonium nitrate) or a content in combustible substances exceeding the values specified in special provision 307 except under the conditions applicable to Class 1.
- Ammonium nitrite and its aqueous solutions and mixtures of an inorganic nitrite with an ammonium salt.
- Mixtures of potassium nitrate, sodium nitrite and an ammonium salt.





## Appendix 2: Chemicals list

The following list was originally compiled from lists supplied by about a dozen demonstrators who recorded what they sometimes used in their demonstration lectures. It has been supplemented by contributions from a similar number of further demonstrators for the 2<sup>nd</sup> edition. No one individual ever uses more than a tiny fraction of what is listed here and the *Maximum Quantity Carried* column is just that – many lecturers carried much less. The total load was rarely more than one tenth of the 20 kg / 20 litre small load limit.

The original list gave the Hazard Label and Risk Phrases required under the *CHIP Regulations*. However, these are being phased out and replaced by new labels based on the *CLP Regulations* (the implementation in the EU of the globally harmonised system, GHS). The new labels will contain the following:

- Symbol(s) - Printed in black on a white background within a red diamond frame,
- Signal Word - DANGER, WARNING, or no word at all, alerting the user to the severity of the most significant hazard for that substance,
- Hazard statement(s) - replace the CHIP risk statement(s), with or without numbers,
- Precautionary statements - replace the CHIP safety statements.

Unfortunately, there can be significant discrepancies in the way different suppliers categorise their chemicals and at present any attempt to list the relevant information would be unhelpful. We have, however, added the UN number of each substance.

Some chemicals can be in different Packing Groups, depending on the nature of the packaging used and this can also affect the Transport Category and the LQ Category. In such cases, in the following table, all categories are included but the one most likely to be relevant in this context is the one *not* given in parentheses.

Maximum quantity carried	Name	UN number	LQ	Transport category	Packing group
-	alginate acid	-	not subject to ADR		
	Alka Seltzer (commercial)	-	not subject to ADR		
11 g	aluminium powder (uncoated)/ (coated)	1396/1309	500 g, (1 kg)	2, (3)	2, (3)
0.7 g	3-aminobenzene-1,2-dicarboxylic hydrazide (luminol)	-	not subject to ADR		
1000 ml	3-aminobenzene-1,2-dicarboxylic hydrazide (luminol) (0.5 g per litre 0.1 M sodium hydroxide)	1824	1 litre, 5 litre	2, 3	II, III
100 ml	ammonia solution (conc "880")	2672	5 litre	3	III
20 ml	ammonia solution (household, < 6 M)	-	not subject to ADR		
600 ml	ammonia solution (2M)	-	not subject to ADR		
100 g	ammonium chloride	-	not subject to ADR		
100 g	ammonium dichromate(VI)	1439	1 kg	2	II
4 g	ammonium nitrate(V)	1942	5 kg	3	III
10 g	ammonium thiocyanate	-	not subject to ADR		
10 g	barium chloride-2-water	1564	500 g, 1 kg	2	II, III
32 g	barium hydroxide-8-water	1923	0, 1 kg, 5 kg	1, 2, 3	I, II, III
19 g	barium nitrate(V)	1446	1 kg	2	II
?	bicarbonate indicator	-	not subject to ADR		
10 g	black powder (coarse)	0027	You need an Explosive Certificate to acquire & keep explosives and a POMSTER document ( <i>Placing On the Market and Supervision of Transfers of Explosives Regulations 1993</i> ) or a Recipient Competent Authority Transfer Document (RCA) to transport them.		
10 g	black powder (fine)	0027			
250 g	black powder substitute (Pyrodex)				

Maximum quantity carried	Name	UN number	LQ	Transport category	Packing group
1000 ml	bleach (domestic, 1%)	1791	1 litre, 5 litres	2, 3	II, III
10 g	boric acid	-	not subject to ADR		
?	bromine	1744	0	1	I
?	bromothymol blue	-	not subject to ADR		
?	buffer solutions (pH 4, 6, 7, 9.2)	-	not subject to ADR		
2 canisters	butane gas	1011	0	2	-
?	butanol	1120	1 litre, 5 litre	(2), 3	(II), III
100 gt	calcium carbonate (marble chips)	-	not subject to ADR		
100 g	calcium chloride (anhydrous)	-	not subject to ADR		
5 g	calcium dicarbide	1402	(0), 500 g	(1), 2	(I), II
100 g	carbon (charcoal)	-	not subject to ADR		
300 ml	carbon dioxide (dry ice)	1845	not subject to ADR		
5 ml	carbon disulfide	1131	0	1	I
250 ml	chlorine (gas)	1017	0	1	-
13 ml	chloric(VII) acid (perchloric acid) (<50%)	1802	1 litre	2	II
?	chromium(III) oxide	-	not subject to ADR		
?	cobalt(II) chloride-6-water	3077	5 kg	3	III
20 mg	coomassie red 2B	-	?	?	?
20 ml	copper(II) chloride solution in methanol	1230	1 litre	2	II
2 g	copper(II) nitrate(V)-3-water	1477	1 kg, (5 kg)	2, (3)	II, (III)
50 g	copper(II) sulfate(VI)-5-water	3077	5 kg	3	III
50 ml	copper(II) sulfate(VI) solution in methanol	1230	1 litre	2	II
?	copper turnings	-	not subject to ADR		
	cyclodextrin	-	not subject to ADR		
2 ml	decanedioyl dichloride (sebacoyl chloride)	3265	0, 1, 5 litre	1, 2, 3	I, II, III
50 ml	Dettol (commercial)	-	not subject to ADR		
20 mg	diazol light blue (C.I.Direct Blue 78)	-	not subject to ADR		
?	1,2-diaminoethane	1604	1 litre	2	II
14 g	disodium disulfate(IV) (sodium metabisulfite)	-	not subject to ADR		
8 g	disodium tetraborate-10-water (borax)	-	not subject to ADR		
1000 ml	disodium tetraborate (borax) (4% - 5% solution)	-	not subject to ADR		
1 g	dispersal yellow AG	?	?	?	?
0.1 g	eosin	-	not subject to ADR		
30 ml	ethanoic acid (glacial)	2789	1 litre	2	II
2000 ml	ethanoic acid (vinegar, 1 M)	-	not subject to ADR		
1000 ml	ethanol (including methylated spirit and surgical spirit)	1170	1 litre, (5 litres)	2, (3)	II (III)
10 ml	ethoxyethane	1155	0	1	I
25	fireworks, commercial (but see section 8.1)	0333 to 0337	0	1, 2 or 4	-

Maximum quantity carried	Name	UN number	LQ	Transport category	Packing group
?	flash paper (Le Maitre theatre effect)	2555	0	2	II
0.1 g	fluorescein	-	not subject to ADR		
5	gas discharge tubes (low pressure)	-	not subject to ADR		
?	gin (commercial)	-	not subject to ADR		
	glow sticks (commercial)	-	not subject to ADR		
26 g	D-glucose	-	not subject to ADR		
500 ml	glucose solution	-	not subject to ADR		
30 x 1.5 g strips	gun cotton	2555	0	2	II
3x balloons	helium (not refrigerated and not under pressure)	-	not subject to ADR		
5 g	hexane-1,6-diamine	2290	5 kg	3	III
1000 ml	hydrochloric acid (1 M)	1789	1 litre, 5 litre	2, 3	II, III
1000 ml	hydrochloric acid (2 M)	1789	1 litre, 5 litre	2, 3	II, III
2000 ml	hydrochloric acid (4 M)	1789	1 litre, 5 litre	2, 3	II, III
20 ml	hydrochloric acid (6 M)	1789	1 litre, 5 litre	2, 3	II, III
200 ml	hydrochloric acid (conc.)	1789	1 litre, 5 litre	2, 3	II, III
1 lecture bottle	hydrogen (compressed)	1049	0	2	-
1 balloon	hydrogen	-	not subject to ADR		
1 balloon	hydrogen/oxygen mixture	-	not subject to ADR		
1000 ml	hydrogen peroxide (100 volume)	2014	1 litre	2	II
500 ml	hydrogen peroxide (20 volume)	-	not subject to ADR		
200 ml	hydrogen peroxide (9 volume)	-	not subject to ADR		
1000 ml	hydrogen peroxide (2 volume)	-	not subject to ADR		
250 g	2-hydroxypropane-1,2,3-tricarboxylic acid (citric acid)	-	not subject to ADR		
?	indigo carmine	-	not subject to ADR		
10 ml	iodine solution	-	not subject to ADR		
50 g	iron(II) sulfate	-	not subject to ADR		
?	iron(III) chloride (anhydrous) (ferric chloride)	1773	5 kg	3	III
?	iron metal powder (fine) (pyrophoric)	1383	0	0	I
35 g	iron(III) oxide	-	not subject to ADR		
3 g	lead(II) nitrate(V)	1469	1 kg	2	II
200 ml	lead(II) nitrate(V) (0.1 M)	-	not subject to ADR		
250 ml	lead(II) nitrate(V) (0.01 M)	-	not subject to ADR		
1000 ml	lemonade	-	not subject to ADR		
500 ml	lemon juice	-	not subject to ADR		
75 ml	light machine oil	3295	500 ml, 1 litre, 5 litre	1, 2, 3	I, II, III
3 x 110 ml	lighter fluid (light petroleum distillate)	1057	0	2	-
1 g	lithium	1415	0	1	I
0.5 g	lithium chloride	-	not subject to ADR		
20 ml	lithium chloride in methanol	1230	1 litre	2	II



Maximum quantity carried	Name	UN number	LQ	Transport category	Packing group
	magnesium hydroxide (milk of magnesia, commercial)	-	not subject to ADR		
50 g	magnesium powder	1418	0	2	II
25 g	magnesium ribbon or turnings	1869	5 kg	3	III
20 g	magnesium sulfate(VI)-7-water	-	not subject to ADR		
5 g	manganese(II) sulfate(VI)-7-water	3077	5 kg	3	III
5 g	manganese(IV) oxide	1479	(0), 1 kg, (5kg)	(1), 2, (3)	(I), II, (III)
3 g	mercury(II) chloride	1624	500 g	2	II
200 ml	mercury(II) chloride (0.1 M)	2024	0, 100 ml, 5 litre	1, 2	I, II, III
1000 ml	mercury(II) chloride (3 g/litre)	2024	0, 100 ml, 5 litre	1, 2	I, II, III
2 g	mercury(II) thiocyanate	1646	500 g	2	II
100 ml	methanol	1230	1 litre	2	II
50 ml	methylene blue (1% in ethanol)	-	not subject to ADR		
570 ml	milk	-	not subject to ADR		
100 ml	nail varnish remover (commercial)	1883	0, 1 litre, 5 litre	1, 2, 3	I, II, III
?	nickel(II) chloride-6-water	3288	(0, 500 g), 5 kg	(1, 2), 3	(I, II), III
100 ml	nitric acid (conc,)	2031	1 litre	2	II
10 litres	nitrogen (liquid)	1977	120 ml	3	-
glass tube	nitrogen monoxide (nitric oxide) (not compressed)	1975	0	1	-
300 ml	oil, baby	-	not subject to ADR		
500 ml	oil, cooking	-	not subject to ADR		
1 lecture bottle	oxygen	1072	0	3	-
250 ml	oxygen, liquid	1073	0	3	-
20 g	Persil	-	not subject to ADR		
20 ml	petrol	1203	1 litre	2	II
0.1 g	phenolphthalein	-	not subject to ADR		
150 ml	phenolphthalein solution (0.2% in ethanol)	-	not subject to ADR		
0.1 g	phosphorus (white) (under water)	1381	0	0	I
2 g	phosphorus (red)	1338	5 kg	3	III
1000 ml	polyethenol (polyvinyl alcohol)	-	not subject to ADR		
500 ml	polyethylene oxide solution	-	not subject to ADR		
40 g	polyurethane mix (daltafoam)	-	not subject to ADR		
40 g	polyurethane mix (suprasec)	-	not subject to ADR		
1 g	potassium	2257	0	1	I
4 x 5 g	potassium bromate(V)	1484	1 kg	2	II
50 g	potassium chlorate(V)	1485	1 kg	2	II
2 g	potassium chloride	-	not subject to ADR		
20 g	potassium hexacyanoferrate(III)	-	not subject to ADR		
16 g	potassium hydroxide	1813	1 kg	2	II
43 g	potassium iodate(V)	1479	(0, 1 kg), 5 kg	(1), 2, (3)	(I), II, (III)
	potassium iodate (0.07 M)	-	not subject to ADR		



Maximum quantity carried	Name	UN number	LQ	Transport category	Packing group
100 g	potassium iodide	-	not subject to ADR		
200 ml	potassium iodide (0.1 M)	-	not subject to ADR		
2000 ml	potassium iodide (0.01 M)	-	not subject to ADR		
100 g	potassium manganate(VII) (permanganate)	1490	1 kg	2	II
5 g	potassium nitrate(V)	1486	5 kg	3	III
?	potassium persulfate (peroxodisulfate)	1492	5 kg	3	III
200 ml	propane-1,2,3-triol (glycerol)	-	not subject to ADR		
25 g	propanedioic acid (malonic acid)	-	not subject to ADR		
200 ml	propanone (acetone)	1090	1 litre	2	II
?	PVA (polyvinyl alcohol)	-	not subject to ADR		
1000 l	PVA solution (4%, high RMM)	-	not subject to ADR		
1	red cabbage	-	not subject to ADR		
750 ml	refined paraffin lamp oil	3295	500 ml, 1 litre, 5 litre	1, 2, 3	I, II, III
5 ml	resazurin	-	not subject to ADR		
200 mg	rhodamine	-	not subject to ADR		
100 g	serpentine (powder)	-	not subject to ADR		
9 g	silver nitrate(V)	1493	1 kg	2	II
50 g	sodium alginate	-	not subject to ADR		
4 g	sodium arsenite	2027	500 g	2	II
250 g	sodium carbonate, anhydrous	-	not subject to ADR		
100 ml	sodium chlorate(I) (5%) (domestic bleach)	1791	1 litre, 5 litre	2, 3	II, III
5 g	sodium chlorate(V)	1495	1 kg	2	II
10 g	sodium chloride	-	not subject to ADR		
50 ml	sodium chloride in methanol	1230	1 litre	2	II
4 g	sodium ethanoate	-	not subject to ADR		
125 g	sodium ethanoate-3-water	-	not subject to ADR		
500 g	sodium hydrogencarbonate (bicarbonate)	-	not subject to ADR		
700 ml	sodium hydroxide (1M)	1824	1 litre, 5 litre	2, 3	II, III
100 ml	sodium hydroxide (2M)	1824	1 litre, 5 litre	2, 3	II, III
50 ml	sodium hydroxide (6M)	1824	1 litre, 5 litre	2, 3	II, III
10 g	sodium hydroxide (solid)	1823	1 kg	2	II
1 g	sodium metal	1428	0	1	I
10 g	sodium nitrate(V)	1498	5 kg	3	III
5 g	sodium peroxide	1504	0	1	I
500 g	sodium polyacrylate	-	not subject to ADR		
250 ml	sodium sulfate (1 M)	-	not subject to ADR		
200 ml	sodium sulfide (0.1M)	-	not subject to ADR		
?	sodium thiocyanate-2-water	-	not subject to ADR		
200 g	sodium thiosulfate-5-water	-	not subject to ADR		
250 ml	sodium thiosulfate (0.1 M)	-	not subject to ADR		
2000 ml	sodium thiosulfate (0.01 M)	-	not subject to ADR		



Maximum quantity carried	Name	UN number	LQ	Transport category	Packing group
1000 ml	Solution: 500 ml 0.1 M potassium iodide, 200 ml 0.01 M sodium thiosulfate, 30 ml 1% starch solution, 30 ml ethanoic acid (glacial), 4.1 g anhydrous sodium ethanoate, water to make up to 1000 ml.	-	not subject to ADR		
1000 ml	Solution: 4 g soluble starch, 13.7 g sodium metabisulfite, water to make up to 1000 ml.	-	not subject to ADR		
2000 ml	Solution: hydrogen peroxide (3%), hydrochloric acid (1 M)	-	not subject to ADR		
4000 ml	Solution: 30 ml ethanoic acid, 4.1 g sodium ethanoate, 50 g potassium iodide, 9.4 g sodium thiosulfate in 4 000 ml water.				
	sparklers (commercial) (but see section 8.1)	0333 to 0337	0	1, 2 or 4	-
0.2 g	starch	-	not subject to ADR		
20 ml	starch solution				
10 g	strontium chloride-6-water	-	not subject to ADR		
50 ml	strontium chloride in methanol				
10 g	strontium nitrate(V)-4-water	1507	5 kg	3	III
100 g	sucrose (sugar)	-	not subject to ADR		
200 g	sulfur	1350	5 kg	3	III
75 ml	sulfuric(VI) acid (conc.)	1830	1 litre	2	II
800 ml	sulfuric(VI) acid (2.5M)	2796	1 litre	2	II
250 g	superglue (methyl 2-cyanoacrylate)	-	not subject to ADR		
40 ml	tetrachloromethane	1846	100 ml	2	II
100 mg	thymolphthalein	-	not subject to ADR		
12 g	thyodene iodine indicator	-	not subject to ADR		
?	tonic water (commercial)	-	not subject to ADR		
20 g	turmeric	-	not subject to ADR		
250 ml	trichloromethane	1888	5 litre	2	III
500 ml	universal indicator solution	1170	1 litre, 5 litre	2, 3	II, III
?	vitamin C tablets	-	not subject to ADR		
50 ml	washing up liquid (commercial)	-	not subject to ADR		
50 g	yeast	-	not subject to ADR		
4 g	zinc powder	1436	0	(1, 2), 3	(I, II), III
20 g	zinc sulfate(VI)-7-water	3077	5 kg	3	III



## Appendix 3: Radioactive materials

Strontium-90, plutonium-239 and americium-241 cup sources, in their normal containers, can be transported in any outer container.

Radium-226 and almost new cobalt-60 sources will require shielding to bring the surface dose rate below specified limits. This can be achieved by using a large cardboard box, packed with smaller boxes, such that the wooden source box is at least 15 cm from the surface of the outer box.

A uranium or thorium compound (in an appropriate container) must be carried inside a robust container, usually metal (eg, a tool box) such that damage is extremely unlikely in event of a road accident.

Transportation of radioactive material in solution should be restricted to a 30 ml protactinium generator. This should be kept upright and surrounded by a mineral absorbent (eg, cat litter) sufficient to absorb twice the volume of liquid in the container, in a sturdy, water-tight outer container, inside a strong plastic bag. This is tied and securely packed in robust containers, usually metal (eg, a tool box) such that damage is extremely unlikely in event of a road accident.

All packages should be loaded securely, as far as possible from the occupants, and out of sight, in the boot of the vehicle. The vehicle must be locked whenever it is left unattended.

There should be a regular check of the packages used for transport of radioactive material to confirm that they have not become contaminated. Records must be kept for at least two years.

No external signs are required on the vehicle.

The outside of an excepted package should show the United Nations (UN) number and the name and address of the consignor and consignee, as below.

Name of consignor: School address: Telephone:
Excepted package, UN Class: 7, UN Number: UN 2910

Name of consignor: School address: Telephone:
Excepted package, UN Class: 7, UN Number: UN 2911



The UN number is:

**UN2910** for sealed sources, protactinium generators, uranium and thorium compounds, cloud chamber sources or radioactive substances.

**UN2911** for 'instruments and articles', eg, spinthariscopes, expansion cloud chambers with non-detachable radioactive material, clocks or instruments with radioluminescent paint.

The package itself must be marked 'Radioactive', with the standard radioactivity warning symbol on the internal surface, in such a way that a warning of radioactive material is visible when the package is opened. Each item inside the package should be suitably labelled.



A transport document must be prepared, and taken by the driver. A copy should be kept at the school and the driver must take one with the package. The only information legally required is the name and address of the consignor and consignee, and the UN number. However, it is good practice to sign and date the document and give a brief description of the contents of the package. See below for an example of a suitable document. Use the correct UN number (UN 2910 or UN 2911) depending on how the package has been labelled.

<b>Transport document</b>	
<i>The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2009</i>	
Consignor	Consignee
<i>(Name and address of school sending the package)</i>	<i>(Name and address of person receiving the package)</i>
Contact phone number	Contact phone number
Contact name - RPS (Schools)	Contact name
United Nations number	UN 2910 / UN 2911 (delete inapplicable)
Description of radioactive substances	
Signed	
Date of commencement of journey	







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