

Dangerous Substances and Explosive Atmospheres Regulations 2002 SI 2002/2776

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Summary

This OC provides advice to inspectors on the interpretation and enforcement of the Dangerous Substances and Explosive Atmospheres Regulations (DSEAR). DSEAR are concerned with preventing or limiting the harmful effects of fires, explosions and similar energy-releasing events. DSEAR are goal-setting regulations which replaced much specific legislation on flammable and explosive substances. They are supported by a set of ACoPs reflecting good practices in the old legislation. This document has been updated throughout to bring it into line with changes in legislation, associated guidance etc.

Background

1 DSEAR came into force on 9 December 2002 and implement the Explosive Atmospheres (ATEX 137) Directive and safety requirements of the Chemical Agents Directive (CAD). Some of the requirements were subject to transition periods.

2 CAD requires employers to protect workers from certain health and safety risks arising from chemical agents present in the workplace and from work activities involving chemical agents. The term 'chemical agents' is defined very widely and means any natural or artificial substance, or mixture of substances, whether in solid, liquid or gas form. The Directive is concerned with fire, explosion and health risks from chemical agents and applies to all industrial and commercial sectors.

3 The Explosive Atmospheres Directive (ATEX 137) requires employers to protect workers from the risk of explosive atmospheres. As a flammable substance must be present to create an explosive atmosphere there is considerable overlap between CAD and ATEX, hence the decision to implement both Directives through the same piece of legislation.

4 DSEAR deal with fires, explosions and similar energy-releasing events (eg exothermic chemical reactions) arising from dangerous substances. DSEAR are concerned with harmful physical effects arising from thermal radiation (burns), over-pressure effects (blast injuries) and oxygen-depletion effects (asphyxiation). DSEAR avoid the term chemical agents to make clear that a wide range of natural products, particularly dusts, are within scope.

5 HSE took the opportunity through DSEAR to revoke or repeal about 20 pieces of old legislation relating to flammable substances, including the Highly Flammable Liquids and Liquefied Petroleum Gases Regulations 1972. Safety standards achieved through the old legislation will be maintained by a combination of the requirements of DSEAR and the advice contained in Approved Codes of Practice. The ACoPs encapsulate many of the specific requirements of the old legislation. A list of the topics covered by the ACoPs is given at [Appendix 1](#).

6 DSEAR complement the Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations (EPS) 1996 as amended which implement Directive 94/9/EC (known as ATEX 95). These Regulations place duties principally on manufacturers (or importers if manufacturers are outside the EU) to supply equipment and protective systems that are suitable for use in explosive atmospheres. The 1996 Regulations came fully into force on 1 July 2003 and apply to all types of equipment - not just electrical equipment. More details of the requirements of these Regulations are given at [Appendix 2](#).

Overview

7 Other than for certain maritime activities, DSEAR apply whenever the following conditions have been satisfied:

- there is work being carried out by an employer or self-employed person;
- a dangerous substance is present or is liable to be present at the workplace;
- the dangerous substance presents a risk to the safety of persons (as opposed to a risk to health).

8 The main requirements of these Regulations are that employers and the self-employed must:

- carry out a risk assessment of any work activities involving dangerous substances;
- provide technical and organisational measures to eliminate or reduce the identified risks as far as is reasonably practicable;
- provide equipment and procedures to deal with accidents and emergencies;
- provide information and training to employees.

9 Overall, DSEAR can be seen to be an expansion of the general duty to manage risks under the Management of Health and Safety at Work Regulations 1999 (MHSWR), making explicit good practice for reducing the risk to persons from fires, explosions and similar energetic (energy releasing) events which are caused by dangerous substances.

Interpretation (Reg.2)

Dangerous substances

10 Substances or preparations which meet the criteria in the Chemicals (Hazard Information and Packaging for Supply) Regulations 2002 (CHIP) for classification as explosive, oxidising, extremely flammable, highly flammable or flammable, are defined as dangerous substances. However, DSEAR also apply to any substance or preparation with the potential to create a risk to persons from events such as fires, explosions, thermal runaway from exothermic reactions, etc. It is important to note that DSEAR apply to work activities involving products which are not dangerous under normal conditions, but become so because of an activity or process, such as heating, whether deliberate or accidental. An example would be solid residues in a duct which could give off flammable vapours when heated.

11 DSEAR repeal the HFL and LPG Regs and define flammable liquids by their classifications under the CHIP Regulations.

12 Dangerous substances include petrol, liquefied petroleum gas (LPG), solvents, paints and varnishes. Dusts which can form explosive atmospheres are also dangerous substances. They are found in many industries such as food/animal feed, chemicals, woodworking, rubber and plastic processing, and metal powders with a range of end uses. They may be raw materials, intermediates, finished or waste products.

13 Many of these substances will create a health risk as well. For example, many solvents are toxic as well as being flammable. The health requirements in CAD have been implemented by changes to existing health legislation, mainly COSHH.

14 [Appendix 3](#), which is taken from the HSE web page on DSEAR, sets out the steps necessary for an employer to determine whether a dangerous substance is present in their workplace.

Petrol

15 DSEAR essentially remove licensing controls under the Petroleum Consolidation Act 1928 from the workplace storage of petroleum spirit except for petrol that is being kept for dispensing into motor vehicles, ships and planes.

16 Where licensing has been removed, enforcement has been transferred from Petroleum Licensing Authorities to HSE/LA Environmental Health Departments. The main change concerns regulation of the storage of petroleum spirit in can and drum stores and in underground tanks. See [OC 293/5](#) for more information.

Workplace

17 The definition of workplace is very wide and means any premises or part of premises used for work. Premises include all industrial and commercial premises. It also includes land-based and offshore installations as well as vehicles and vessels. Common parts of shared buildings, private roads and paths on industrial estates, and business parks are also 'premises' - as are houses and other domestic dwellings. In domestic premises the most common work activity involving a dangerous substance is probably gas fitting, and there is some overlap with gas safety legislation. DSEAR may also apply on public roads where the road itself becomes the workplace, for example during road repairing.

18 If there is a work activity in 'premises' as defined above then it is a workplace for DSEAR purposes

Work processes

19 In DSEAR 'work processes' means the technical aspects of work involving dangerous substances and includes: plant, machinery, control systems, equipment, protective systems, connecting devices (eg ductwork), materials, and warning, supervisory and communication systems. It excludes systems of work, eg management and non-technical supervisory arrangements.

Industries affected

20 The following examples illustrate the types of activities and substances, commonly found at work, that are covered by the new regulations:

- chemical manufacture, processing and warehousing;
- petrochemical industry - onshore and offshore;
- storage of highly flammable liquids, including petroleum spirit, in can and drum stores and in tanks;
- use of flammable gases, such as acetylene, for cutting and welding;
- filling, storage and handling of aerosols with flammable propellants, such as LPG;
- handling and storage of flammable wastes including fuel oils;
- spraying of paints containing HFLs in, eg motor vehicle repair;
- hot work on tanks or drums that have contained flammable or combustible materials;
- work activities that could release naturally occurring methane;
- dusts produced in the mining of coal, or burning coal in a powdered form;
- handling and storage of waste dusts in a range of manufacturing industries, such as woodworking;
- grinding, milling, blending and other powder processing;
- use of flammable solvents in pathology and school laboratories or as cleaning agents;
- transport of flammable liquids in containers around the workplace;
- storage of petrol as a fuel for cars, motor boats, horticultural machinery, or construction equipment;
- deliveries from road tankers, such as petrol into underground tanks or bulk powder into silos
- storage and display of flammable goods, such as paint and lacquers, in the retail sector.

Application (Reg.3)

21 DSEAR do not apply to the normal shipboard activities of a ship's crew which are carried out solely by the crew under the direction of the master, apart from shipbuilding, and ship repair when carried out in dry dock. Under DSEAR, equipment and protective systems may have to be provided to prevent or mitigate fires and explosions. Such equipment when on board a ship may also be subject to maritime law. Where inspectors come across any such equipment which may be defective they should take enforcement action in accordance with the [Memorandum of Understanding between the Health and Safety Executive, the Maritime and Coastguard Agency and the Marine Accident Investigation Branch](#).

22 [OC 780/1](#) also refers. If inspectors are still unclear about the action they should take, they should [contact the Manufacturing Sector](#).

23 Regulation 3(2) disappplies the ATEX-specific regs.5(4)(c), 7 and 11 from a number of activities, including explosives sites, mines and quarries and offshore installations. Regulation 3(3) gives a number of other disapplications at offshore installations (eg certain emergency arrangements). The basis of all the disapplications is the existence of other legislation which contains equivalent provisions.

Duties (Reg.4) (Persons Protected)

24 DSEAR is intended to protect not only employees at the workplace but also any other person whether at work or not who may be put at risk by dangerous substances. This includes employees working for other employers, visitors to the site, members of the public, etc.

25 However, when considering arrangements to deal with accidents, incidents and emergencies and the provision of information, instruction and training, employers only have duties under DSEAR to persons who are at their workplace.

Risk assessment (Reg.5)

26 DSEAR require employers (or self-employed persons) to carry out a risk assessment before commencing any new work activity involving dangerous substances.

27 An employer with five or more employees should record the significant findings of the assessment as soon as is practicable including:

- the measures (technical and organisational) taken to eliminate and/or reduce risk; sufficient information to show that the workplace and work equipment will be safe during operation and maintenance including:
 - details of any hazardous zones;
 - any special measures to ensure coordination of safety measures and procedures, when employers share a workplace;
 - arrangements to deal with accidents, incidents and emergencies; and
 - measures taken to inform, instruct and train employees.

28 The risk assessment required by DSEAR is an identification and careful examination of the dangerous substances present in the workplace, the work activities involving those substances and how conditions might fail dangerously so as to give rise to fire, explosion and similar events with the potential to harm employees and the public. Its purpose is to enable employers to decide what they need to do to eliminate or reduce to as far as is reasonably practicable the safety risks from dangerous substances. The assessment may form part of a wider risk assessment including, for example, general fire precautions and health risks.

29 Employers should check that their existing risk assessments cover all the elements required by DSEAR; they should identify and remedy any gaps found in the assessment.

30 The risk assessment is required to be carried out before commencing any new work activity and DSEAR also require that measures identified as necessary by the risk assessment are implemented before the work commences. One-off maintenance activities are likely to need a risk assessment to be carried out at the time the activity is being planned.

Safety measures (Reg.6)

31 Employers are required to ensure that the safety risks from dangerous substances are either eliminated or reduced to as far as is reasonably practicable. Where it is not reasonably practicable to eliminate risks, employers are required to take, so far as is reasonably practicable, measures to control risks and measures to mitigate the detrimental effects of a fire or explosion or similar event.

32 DSEAR therefore reflect the well-understood safety hierarchy of:

- elimination; or
- control and mitigation.

Elimination is the best solution and involves replacing a dangerous substance with a substance or process that totally eliminates the risk. In practice this is difficult to achieve. It is more likely that it will be possible to replace the dangerous substance with one that is less hazardous (eg a high flash point solvent for a low flash point one) or to design the process so that it is less dangerous - by, for example, reducing quantities of substances in the process (known as process intensification). However, care must be taken whilst carrying out these steps to ensure that no new safety or health risks are created or increased.

33 Elimination is particularly difficult to achieve where the dangerous substance is intended for use as a fuel. This requirement should not be used to promote the use of less volatile fuels (diesel/oil) in place of petrol or LPG.

Control measures (Reg. 6(4))

34 DSEAR reg.6(4) requires that control measures are applied in the following priority order consistent with the risk assessment and appropriate to the nature of the activity or operation:

- reduce the quantity of dangerous substances;
- avoid or minimise releases;
- control of releases at source;
- prevention of the formation of an explosive atmosphere;
- collect, contain and remove any releases to a safe place (eg by ventilation);
- avoid ignition sources;
- avoid adverse conditions (eg temperature or control parameters) that could lead to danger;
- segregate incompatible substances.

Mitigation (Reg.6(5))

35 DSEAR require that mitigation measures consistent with the risk assessment and appropriate to the nature of the activity or operation are applied including:

- reducing the numbers of employees exposed;
- providing plant which is explosion resistant;
- providing explosion suppression or explosion relief equipment;
- measures to control or minimise the spread of fires or explosions; and
- providing suitable personal protective equipment (PPE);

36 In practice, there are very few routine situations where PPE is an appropriate mitigation method to control the risks from dangerous substances.

General safety measures (Reg. 6(8))

37 Regulation 6(8) and Schedule 1 also specify that the measures taken to achieve the elimination or the reduction of risk should include:

- design, construction and maintenance of the workplace (eg fire-resistance, explosion relief);
- design, assembly, construction, installation, provision, use and maintenance of suitable work processes (the hardware aspects). Note the definition of 'work processes' (Interpretation, reg.2);
- equipment and protective systems with certain design features relating to power failure, manual override (where safe to do so), energy dissipation on emergency shutdown, and preventing confusion between connecting devices;
- written Instructions, permits to work and other procedural systems of organising work.

Places where explosive atmospheres may occur (Reg.7)

38 Subject to certain exceptions¹, DSEAR require that any workplaces where explosive atmospheres may occur are:

- classified into hazardous zones (Schedule 2 refers);
- protected from sources of ignition by selecting equipment and protective systems on the basis of the categories set out in the Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations (EPS) 1996 (DSEAR Schedule 3); and
- where necessary, marked with a specified 'EX' sign (Schedule 4).

39 Employees should be provided with clothing that does not give rise to electrostatic discharges in zoned areas. For a large majority of cases, where there is any risk from static, antistatic footwear is all that will be needed.

40 Before workplaces where explosive atmospheres may occur come into operation for the first time, they should be verified as meeting the requirements of DSEAR by a person competent in the field of explosion protection. This may be a contractor who built the plant, an employee of the site owner, or an independent person.

41 Zoning is hazard-based: it considers the likelihood of a flammable atmosphere being present, ie it identifies areas where control over ignition sources is required. Employers should carry out hazardous area classification as an integral part of the risk assessment to identify those places where such controls are needed and those that are not.

42 Advice on hazardous area classification is contained in Standards - BS EN 60079-10 for gases, and BS EN 50281-3 for dusts supplemented by some codes from professional bodies and industry associations. Some SIMs on zoning have also being produced for the rubber and plastics, and food industries. See [SIM 03/2003/67](#) and [SIM 01/2003/54](#).

43 DSEAR Schedule 3 gives the criteria for the selection of equipment and protective systems. Para 1 of this Schedule recognises that there may be circumstances where the risk assessment made under reg.5 finds that the selection criteria are inappropriate or unnecessarily restrictive. In such cases, equipment of a lower category than that normally required for that zone may be used, subject to certain conditions, eg if workers can be excluded from the hazardous area and will not be at risk from any ignition of an explosive atmosphere.

44 If employers use the flexibility provided by Schedule 3, their decision must be fully justified in the risk assessment. Further guidance is given in the general DSEAR ACoP L138, paras 239-243.

45 The EPS Regulations allow existing equipment which was in use before 30 June 2003 and which the risk assessment indicates is still safe for use in an explosive atmosphere to continue to be used.

46 The requirement to mark hazardous zones is a new one, although HSE has long required no smoking signs at storage sites for LPG and HFLs. The circumstances where it may be appropriate are discussed in the ACoP. It is not generally helpful or appropriate to provide EX signs at the main gates of large sites. If they are necessary, they should be provided at the edge of a zone where special controls over sources of ignition are needed.

Prevention of dust explosions

47 While zoning for flammable vapour hazards was well-established, DSEAR introduced the concept of zoning for dust explosibility, which was new for most industries. The zoning system is analogous to that for vapours with zones 20, 21 and 22 for dusts corresponding to zones 0, 1 and 2 for vapours.

48 Zoning for both vapours and dusts has to consider non-electrical ignition hazards as well as the electrical ones. Non-electrical ignition hazards can include sparks from hot work or the formation of hot surfaces, eg from the frictional heating of moving parts of process plant such as bucket elevators.

49 In most dust handling plants the inside of the dust handling system will be zone 20 or 21, but rooms within the building, if they need to be zoned, should only be the less onerous zone 22, except for very small areas where dust escapes in quantity in normal operation.

50 Electrical and non-electrical ignition equipment that creates a potential ignition risk, supplied after June 2003 and designed for use in explosive dust atmospheres, should be marked with the sign of explosion protection (Ex in a hexagon), a category number (1, 2 or 3) followed by the letter D for dust, a temperature rating expressed as a T class (eg T4 or T6) and other codified identifying marks. Details of the marking scheme for electrical apparatus are contained in standards (reference BS EN 50281 - several parts).

51 Note that equipment which according to the Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations 1996 can be operated safely in an explosive gas/air mixture is not necessarily suitable for operation in places where there is a dust explosion hazard.

52 For further information see HSE Booklet HSG 103 The safe handling of combustible dusts.

Arrangements to deal with accidents, incidents and emergencies (Reg.8)

53 DSEAR require that employers make arrangements to protect employees (and others who are at the workplace) in the event of accidents, etc. The scale and nature of the emergency arrangements should be proportionate to the level of risk. The provisions are based on existing requirements in the Management of Health and Safety at Work Regulations reg.8 and require employers to make arrangements including:

- suitable warning (including visual and audible alarms) and communication systems;
- escape facilities - if required by the risk assessment;
- emergency procedures to be followed in the event of an emergency;
- equipment and clothing for essential personnel dealing with the incident;
- practice drills; and
- making information on the emergency procedures available to employees and the emergency services.

54 Some of the requirements of Regulation 8 concern general fire precautions and apart from certain special cases, enforcement responsibility for these will be with local fire authorities under the Regulatory Reform (Fire Safety) Order 2005 or the Fire (Scotland) Act 2005. The existing advice on liaison ([OC 217/6](#)) should be consulted.

55 These requirements are intended to clarify what already needs to be done in relation to the safety management of dangerous substances and will not require any duties in addition to those already present in existing legislation.

Information, instruction and training (Reg. 9)

56 Employers are required to provide employees and other people at the workplace with:

- name of the substance and risk it presents;
- access to any relevant safety data sheet;
- details of legislation that applies to the hazardous properties of those substances;
- the significant findings of the risk assessment; and
- suitable information, instruction and training on precautions and actions to be taken by employees to safeguard themselves and others.

57 Much of this is already required by other health and safety legislation. Information, instruction and training need only be provided to non-employees, for example students, where it is required to ensure their safety. Where it is provided it should be in proportion to the level and type of risk.

Identification of hazardous contents of containers and pipes (Reg.10)

58 The identification²of the hazardous contents of containers and pipes is required under Reg.10. It is not intended to use this requirement to enforce extensive new labelling of pipework in, for example chemical sites, but there may be good justification for labelling connection points, where confusion could cause danger.

Enforcement

59 Enforcement of DSEAR is by HSE or Local Authorities depending on the allocation of premises under the Health and Safety (Enforcing Authority) Regulations 1998. There are exceptions relating to general fire precautions and the dispensing of petrol into vehicles, ships and planes ([OC 293/5](#)).

60 This section gives advice on the general approach to the enforcement of DSEAR, to assist inspectors in determine the appropriate enforcement response when applying the [Enforcement Management Model \(EMM\)](#).

61 Many of DSEAR's requirements are direct replacements for those in earlier legislation (or were enforced using HSW Act powers). Therefore, inspectors should not change their approach to the enforcement of those regulations which are direct replacements for some existing legislation. The majority of the new requirements, such as those concerning zoning, came into force on 1 July 2003 for new workplaces or between 1 July 2003 and 30 June 2006 for existing workplaces.

62 As with all enforcement action, that taken under DSEAR should be proportionate to the risks and the extent to which the duty holder is failing to comply with the law. The EMM provides a framework for informing inspectors' enforcement decisions. However, in general:

- Inspectors should seek to enforce individual regulations to the extent that there is a risk and that the specific regulation can have a practical effect. In general, the word 'risk' should be interpreted to mean 'significant risk', meaning that a failure could foreseeably result in major injury or fatality. In EMM terms, the actual risk will be possible multiple serious injuries from a fire or explosion within an occupied building.
- The benchmark to be applied is a nil/negligible chance of a serious personal injury occurring as a result of a fire or explosion incident.

Further information

- The **DSEAR** area on the HSE website: gives further information for dutyholders including publications, research and FAQs.
- HID Delivery Guide for sub-COMAH sites

Also visit:

- **Equipment and Protective Systems intended for use in Potentially Explosive Atmospheres (ATEX) Directive 94/9/EC**
for guidance on the Equipment and Protective Systems intended for Use in a Potentially Explosive Atmosphere Regulations 1996.

References

1. **DSEAR ACOPs** (see also **Appendix 1**)
2. HSG 103 The safe handling of combustible dusts 2003 ISBN 0-7176-2726-8
3. BS EN 1127 -1 2007 Explosive atmospheres, explosion prevention and protection, basic concepts and methodology
4. BS EN 60079-10 2003 Electrical apparatus for explosive gas atmospheres. Classification of hazardous areas
5. BS EN 13463-1 2001 (being revised) Non-electrical equipment for use in potentially explosive atmospheres - basic method and requirements
6. BS EN 50281-3 2002 Classification of areas where combustible dusts are or may be present

Notes

1. The exceptions are for: areas used for and during medical treatment of patients; use of gas appliances for cooking, hot water production, refrigeration, lighting or washing; manufacture, handling use, storage and transport of explosives or chemically unstable substances; activities at Mines, Quarries and Offshore Installations.

2. Many pipes/containers will already be marked or labelled under existing EC legislation eg the Supply Directives implemented in GB through the CHIP Regulations, and that would satisfy this requirement. For those that are not, 'identification' could include training, information, or verbal instruction, but in some cases may require labelling or marking or warning signs.

Cancellation of instructions

OC 284/7 Version 2 - cancel and destroy