DSEAR IMPLEMENTATION

FOR THE WASTE MANAGEMENT INDUSTRY

INDUSTRY CODE OF PRACTICE

ESA ICoP 1, Edition 1: Nov. 2005

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FOREWORD

James Barrett, Head of the Manufacturing Sector of the Health and Safety Executive.

This code has been prepared by the Environmental Services Association in consultation with the Health and Safety Executive and has been endorsed by the Waste Industry Safety and Health (WISH) Forum which represents the interests of the industry.

This Code should not be regarded as an authoritative interpretation of the law, but if you follow the advice set out in it you will normally be doing enough to comply with health and safety law in respect of those specific issues on which the Code gives advice. Similarly, Health and Safety Inspectors seeking to secure compliance with the law may refer to this Guidance as illustrating good practice.

The HSE believes that the contents of this Code demonstrate good practice in the waste management industry and commends its use.

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In this report, footnotes are indicated with a letter [A] and endnotes (references to documents used) with a number [1].

1 SCOPE OF THIS DOCUMENT

This is a top-level document that introduces in general terms the requirements of DSEAR[1] (see section 2.2). The detailed requirements on how to comply with the more far-reaching regulation are contained in a number of subsidiary documents that are referred to as 'Industry Codes of Practice' (ICoPs). Those regulations that are more straightforward are fully covered in this document – see section 2.5.

The ICoPs are listed in section 2.5 and cover the main operations undertaken by the waste management industry. It is intended that more will be added to include the less commonly-encountered activities.

It is intended that the ICoPs will be sufficiently detailed to enable the Site/Facility Manager on any waste management industry site to undertake an assessment of the site and bring it into compliance with the legislation. The Site/Facility Manager has overall responsibility for compliance, but may decide to delegate responsibility to another person or a team; in some cases, third party assistance may be sought.

2 APPLICABLE LEGISLATION

2.1 The ATEX directives

There are two ATEX Directives. 'ATEX' stands for 'ATmosphere EXplosible', so the two ATEX Directives are concerned with explosive atmospheres. These may arise from flammable gases, vapours, mists or dusts mixed with air in a proportion that means they can explode if ignited. Examples include:

- landfill gas and air;
- petrol vapour and air;
- metal dust and air.

The two directives are:

1 ATEX 94/9/EC Directive[2], the ATEX 'Product' Directive, concerned with the manufacture of equipment and protective systems designed for use in potentially explosive atmospheres';

2 ATEX 1999/92/EC Directive[3], the Worker Protection Directive (also known as the 'ATEX 137' Directive), concerned with the "minimum requirements for improving the safety and health protection of workers potentially at risk from explosive atmospheres".

2.2 DSEAR

Member States of the European Union were required to implement both ATEX Directives with national regulations by 1 July 2003. In the UK, the ATEX Worker Protection Directive was implemented by means of the Dangerous Substances and Explosive Atmospheres Regulations (DSEAR), which were issued in December 2002 but which became mandatory on 1 July 2003. However, DSEAR includes a transition period, ending 30 June 2006, to enable existing plants to be brought into compliance. New plants must be immediately compliant with DSEAR before they become operational.

The ATEX Worker Protection Directive overlaps with the ATEX Product Directive with respect to the equipment to be installed in new plant. As well as including all the requirements of the ATEX Worker Protection Directive, DSEAR also includes those aspects of the Chemical Agents Directive 98/24/EC that deal with flammable risks.

DSEAR defines a "dangerous substance" as:

- a substance or preparation which meets the criteria in the approved classification and labelling guide[4] for classification as a substance or preparation which is explosive, oxidising, extremely flammable, highly flammable or flammable, whether or not that substance or preparation is classified under the CHIP Regulations[5];
- a substance or preparation which because of its physio-chemical or chemical properties and the way it is used or is present in the workplace creates a risk, not being a substance or preparation as defined above;
- any dust, in the form of solid particles, fibrous materials or otherwise which can form an explosive mixture with air or an explosive atmosphere, not being a substance or preparation as defined above.

It is clear from these definitions that the waste management industry falls under the scope of DSEAR. The primary 'dangerous substance' in the waste management industry is landfill gas, produced by the decomposition of organic matter and often subsequently used to generate power. However, the diversity of the waste management industry means that numerous other flammable materials are handled – in some cases, the identity of the material may not even be known.

2.3 Exclusions from DSEAR

Note that the flammable material must be mixed with air to form a potentially explosive atmosphere. Substances that are technically 'explosives' (such as 'Semtex', nitroglycerine, etc.) do ***not*** come under the definition of a potentially explosive atmosphere, since no air is required for an explosive mixture to occur. Explosives are subject to other legislation and will not be discussed further.

The ATEX Directives are concerned with potentially explosive atmospheres rather than fires. Therefore, materials such as paper, wood, coal, plastic and other solids that can catch fire but cannot give rise to an explosion are not within the scope of DSEAR. There is, however, overlap: for example, a leak of landfill gas from a faulty joint will mix with air and form a potentially explosive atmosphere, but if it is ignited, there will not be an explosion if the leak is outdoors (although in a confined area, an explosion might occur).

There are some aspects of the waste management industry that are specifically excluded from compliance with certain parts of DSEAR. Regulation 3(2) lists these. Because other directives or safe operational procedures apply to such activities, regulations 5(4)(c) (suitable equipment, verification of safety), 7 (area classification, marking with signs and provision of personal protective equipment) and 11 (duty of co-ordination) of DSEAR do not apply to:

(a) areas used directly for and during the medical treatment of patients;

(b) the use of gas appliances burning gaseous fuel (that is to say, any fuel which is in a gaseous state at a temperature of 15°C under a pressure of 1 bar) which:

(i) are used for cooking, heating, hot water production, refrigeration, lighting or washing; and

(ii) have, where applicable, a normal water temperature not exceeding 105°C including forced draught burners and heating bodies to be equipped with such burners but not including an appliance specifically designed for use in an industrial process carried out on industrial premises;

(c) gas fittings located in domestic premises;

(d) the manufacture, handling, use, storage and transport of explosives or chemically unstable substances;

(e) any activity at a mine;

(f) any activity at a quarry;

(g) any activity at a borehole site[A];

(h) any activity at an offshore installation carried out for the purposes of the offshore installation; and

(i) means of transport, apart from fork-lift trucks.

2.4 Summary of DSEAR

The major duties associated with DSEAR compliance are found in the following regulations

- Regulation 5: risk assessment – see section 5
- Regulation 6: elimination or reduction of risk – see section 6
- Regulation 7: area classification, – see section 7
- Regulation 8: Accidents, incidents and emergencies – see section 8
- Regulation 9: Training and information – see section 9
- Regulation 10: identification of containers and pipes – see section 10
- Regulation 11: duty of co-ordination – see section 11

DSEAR is concerned with protection against risks from fire and explosion arising from dangerous substances used or present in the workplace. A workplace is defined as any premises or part of premises used for or in connection with work. DSEAR thus impacts on many aspects of the waste management industry and must

[A] This exclusion covers the mineral extraction industry, for which other regulations apply; drilling wells is not excluded from DSEAR.

be applied wherever flammable gases, liquids, mists and dusts may be present in such quantities that could cause a risk to workers' health.

The ATEX Worker Protection Directive requires a so-called 'Explosion Protection Document' (EPD) to be produced to bring together in a single document all the various aspects of compliance with the Directive. DSEAR does not specifically make reference to an EPD, but does require that documentation exists to detail significant findings of the explosion risk assessment and to demonstrate organisational arrangements. However, it is recommended that an EPD is produced. This need not, however, repeat risk assessments undertaken under other legislation such as COSHH[6] and the MHSW Regulations[7], but merely reference the appropriate documents. The EPD must be produced before the commencement of work and revised when changes occur in the workplace or organisation of work. For existing activities, the deadline is 30 June 2006.

2.5 Where to go for further guidance

The Health & Safety Executive has produced a number of 'Approved Codes of Practice ('ACoPs). The main ACoP, which includes all aspects of DSEAR compliance, is L138[8]. However, L133[9], L134[10], L135[11], L136[12] and L137[13] amplify certain key aspects and give more detailed information than that contained in L138.

This ICoP provides guidance on

- Regulation 9: information, instruction and training (section 9)
- Regulation 10: identification of hazardous contents of containers and pipes (section 10)
- Regulation 11: duty of co-ordination (section 11)

DSEAR regulations 1 to 4 and 12 to 17 have few or no additional requirements[B].

A range of guidance is currently available or in preparation for waste management and waste management related activities, including:

Activity	Guidance
Landfill gas management: area classification	ESA Industry Code of Practice 2 (ICoP 2): Area classification of landfill gas extraction, utilisation and combustion (November 2005)
Leachate management: area classification	ESA Industry Code of Practice 3 (ICoP 3): Area classification for leachate activities (publication due January 2006)
Drilling activities on landfill	ESA Industry Code of Practice 4 (ICoP 4) - to be developed
Landfill operations	ESA Industry Code of Practice 5 (ICoP 5) - to be developed
Treatment operations	ESA Industry Code of Practice 6 (ICoP 6) - to be developed
Solid waste non-destructive facilities	ESA Industry Code of Practice 7 (ICoP 7) - to be developed

3 OVERVIEW OF OPERATIONS WITHIN THE WASTE MANAGEMENT INDUSTRY

3.1 Landfill

Landfill activities involve the development of land to deposit waste in a environmentally safe manner. The waste is usually deposited in separate cells which are filled with compacted waste materials that are progressively covered and then sealed with a permanent cap. Biodegradable materials degrade to release landfill gas which is mainly composed of methane and carbon dioxide. This landfill gas is increasingly collected for combustion and energy conversion.

Decomposition of waste and the passage of water through the waste gives rise to leachate - a mixture of organic degradation products, liquid wastes and rainwater. Leachate is extremely variable in composition, depending on the nature of the waste in the landfill, the landfill design, etc. Leachate is collected in a network of pipes, removed from the landfill and treated.

B Regulations 1 and 2 are general in nature. Regulation 3 lists the exclusions already covered in section 2.3 of this document. Regulation 4 contains general duties that are further amplified in the regulations that follow. Regulations 12 to 16 have no specific requirements. Regulation 17 contains the provision to allow until 30 June 2006 for full compliance for plant that was already operational on 30 June 2003.

3.2 Thermal treatment

Thermal treatment technologies include incineration (energy from waste plants) and Advanced Conversion Technologies such as anaerobic digestion, gasification and pyrolysis. These technologies use a variety of processes to convert the waste into energy and/or by-product fuels for use in associated power generation activities.

3.3 Civic Amenity sites

Civic Amenity sites are controlled areas where the public delivers waste to directly. The waste accepted varies from site to site but typically includes bulky household items and material for recycling. Civic Amenity sites often also collect hazardous, explosive and flammable materials.

3.4 Transfer stations

Transfer stations are facilities where waste or recyclable materials from separate collection vehicles are combined into loads for transportation to waste treatment or disposal facilities. The waste or recyclable material may be compacted or bulked before transportation.

3.5 Waste support facilities

A number of facilities support waste management operations which may come under the requirements of DSEAR including motor vehicle workshops, spray booths, etc.

4 TIMETABLE FOR THE IMPLEMENTATION OF DSEAR

4.1 Arrangements for workplaces in use on or before 30 June 2003

Requirement	When	Action
Equipment and protective systems already in use/available at the workplace	By 30 June 2006*	Review equipment/protective systems against risk assessment requirements in regulation 5 of DSEAR. Equipment/protective systems at the workplace can continue to be used provided that the assessment indicates it is safe to do so.
Classification and zoning of hazardous areas	By 30 June 2006*	Classify places into hazardous and non-hazardous places and zone hazardous places in accordance with regulation 7(1) of DSEAR. However, places may need to be classified before this date if equipment available for the first time after 30 June 2003 is to be used there.
Marking hazardous places	By 30 June 2006*	Provide any signs required by regulation 7(3)/Schedule 4 of DSEAR. If the part of the workplace to be marked is modified after 30 June 2003, but before 30 June 2006, regulation 17(3) of DSEAR requires that signs are provided from the date of the modification.
Provision of work clothing	By 30 June 2006*	Provide antistatic work clothing as required by regulation 7(5) of DSEAR. However, if the part of the workplace in which it is to be worn is modified before this date it should be provided from the date of the modification.
Co-ordination of explosion protection measures	By 30 June 2006*	Co-ordinate any measures required by regulation 11 of DSEAR and, as required by regulation 5(4) of DSEAR, record the aim of the co-ordination in the risk assessment. However, if part of the workplace is modified before 30 June 2006, the co-ordination requirements in respect of that part apply from the date of the modification.

* Note that existing UK legislation already covers many aspects relating to running a site where flammable materials are handled and, if an incident were to occur before 30 June 2006, the site operator might be liable under existing legislation if found to be negligent.

4.2 Arrangements for workplaces used for the first time after 30 June 2003

All Regulations should be fully complied with before the workplace is used. In general, all installed electrical and non-electrical equipment should be marked in accordance with the ATEX 'Product' Directive, although there are certain exceptions for non-ATEX equipment that is not new or held in stock. Extensions to existing plant are likewise covered.

5 DSEAR REGULATION 5: RISK ASSESSMENT

DSEAR regulation 5 requires risk assessments that identify: -

a) the hazardous properties of the substance;
b) information on safety provided by the supplier, including information contained in any relevant safety data sheet;
c) the circumstances of the work including: -
    i.) the work processes and substances used and their possible interactions;
    ii.) the amount of the substance involved;
    iii.) where the work will involve more than one dangerous substance, the risk presented by such substances in combination; and
    iv.) the arrangements for the safe handling, storage and transport of dangerous substances and of waste containing dangerous substances;
d) activities, such as maintenance, where there is the potential for a high level of risk;
e) the effect of measures which have been or will be taken pursuant to these Regulations;
f) the likelihood that an explosive atmosphere will occur and its persistence;
g) the likelihood that ignition sources, including electrostatic discharges, will be present and become active and effective;
h) the scale of the anticipated effects of a fire or an explosion;
i) any places which are or can be connected via openings to places in which explosive atmospheres may occur; and
j) such additional safety information as the employer may need in order to complete the risk assessment.

The risk assessment requirements of DSEAR should already have been largely met by compliance with the Management of Health & Safety at Work (MHSW) Regulations 1999. Consequently, this requirement applies to existing workplaces with immediate effect. DSEAR also requires that the significant findings of the risk assessment should be communicated to employees.

Risk assessments should be updated if the nature of the activity changes.

For a list of available guidance documents, refer to section 2.5.

6 DSEAR REGULATION 6: ELIMINATION OF RISK

DSEAR requires employers to reduce risk as far as reasonably practicable. Substitution of flammable materials with non-flammable is rarely practical in the waste management industry. Reducing the quantity of flammable material on site is likewise not practical and, in the case of flammable dusts, does not significantly reduce the risk, since the explosion hazards only arise when the dust is transported or used in a process.

6.1 Maintenance work

Maintenance work is frequently when there is the greatest risk of the release of a flammable material. Consequently, potential ignition sources must be very carefully controlled.

6.2 Control of ignition sources

Ignition can be initiated by, for example:

- Unprotected fixed electrical apparatus.
- Spark producing portable equipment.
- Electrostatic discharges.
- Electrical equipment that is overheating or sparking due to a fault.
- Hot surfaces of heating equipment.
- Hot surfaces or sparks from mechanical equipment (by design or failure).
- Smoking.

- Open flames.
- Spontaneous combustion.
- Lightning.

EN 1127-1[14] lists thirteen type of ignition source:

Ignition source	Possible controls[C]
Live flames, e.g. arc welding, smoking	Close supervision by trained personnel, removal of flammable hazard, hot-work permit, no smoking policy on certain areas of the site
Sparks and hot surfaces from electrical equipment	Suitably-protected equipment, designed for hazardous area use, or otherwise assessed as compliant
Electrostatic discharges – equipment. See CLC/TR 50404:2003[15] clause 11.3.1.1.	Earthing normally inherent in the building structural steelwork. Earth bonding is not normally required, but could be required for items mounted on non-conducting supports.
Electrostatic discharges - personnel See CLC/TR 50404:2003 clause 9.3 (footwear) and CLC/TR 50404:2003 clause 9.4 (clothing)	In spite of the fact that modern clothing, made from synthetic textiles, can readily become electrostatically charged it is not, in general, an ignition risk providing that the wearer is earthed by means of suitable footwear and flooring. However, clothing should be as close fitting as is practical and should not be removed or unfastened in areas where there could be flammable atmospheres.
Lightning	Site buildings in hazardous areas may need to be fitted with lightning protection.
Sparks and hot surfaces arising from engineering activities	Sites should operate a permit to work system for such hot work
Chemical reactions	Unexpected exothermic or other potentially violent reactions are unlikely to be carried out in the waste management industry, but this possibility should be considered. HSE guidance will be published in the near future.
Stray electric currents, cathodic corrosion protection	Unlikely to be present
Electromagnetic fields in the frequency range from 9 kHz to 300 GHz	Unlikely to be present
Electromagnetic radiation in the frequency range from 3×10^{11} Hz to 3×10^{15} Hz or wavelength range from 1000 µm to 0.1 µm (optical spectrum)	Unlikely to be present
Ionising radiation	Unlikely to be present
Ultrasonics	Unlikely to be present; if present, unlikely to be at an energy level sufficient to cause an ignition
Adiabatic compression, shock waves, gas flows	Unlikely to be present

For a list of available guidance documents, refer to section 2.5: L136 is particularly relevant.

[C] This list is for guidance only and is not exhaustive

7 DSEAR REGULATION 7: AREA CLASSIFICATION & SELECTION

7.1 Area classification

It is a legal requirement for area classification to be carried out. In summary, this requires the Site/Facility Manager to identify locations where potentially explosive atmosphere do or could occur and to record this information on suitable drawings.

7.2 Selection of equipment for use in explosive atmospheres

For *existing* electrical equipment, which covers the vast majority of plant, there is no requirement to replace it with ATEX-marked equivalents provided a risk assessment shows that the equipment is suitable for its location. In the case of *certified* electrical equipment, it is easy to justify its continued operation in a hazardous area provided it is in good condition, since its certification assures an appropriate level of protection.

In some cases, *uncertified* equipment is permitted, but only in zone 2 and only when the operator has sufficient knowledge, information and experience to assess the equipment as providing a suitable level of protection. More information is given in APPENDIX 2.

Prior to ATEX, there were no requirements for non-electrical equipment to meet specific constructional requirements and it was left to the site operator to perform a risk assessment as to its suitability for use in a hazardous area. This has changed under ATEX, and now all new non-electrical equipment should be ATEX-marked. However, existing non-electrical equipment may be retained subject to a risk assessment. This will involve an ignition hazard assessment. Further guidance is given in APPENDIX 1.

For *new* plant, DSEAR states that equipment and protective systems (electrical and non-electrical) must be selected on the basis of the requirements set out in ATEX Product Directive, unless the risk assessment finds otherwise. However the DSEAR Approved Code of Practice L138 states that risk assessment cannot be used to justify equipment built to lower standards than that specified by the ATEX Product Directive. Consequently in the UK, new equipment must be appropriately marked dependant on the zone in which it is installed, unless its use is temporary or workers are excluded.

Equipment manufactured against the ATEX Product Directive is marked to indicate its 'Category'. The category is used to select the zone or zones in which it may be used.

ATEX Category	Permitted zones of use	Design requirements
1G	0, 1, 2	safe with two independent faults or safe even when rare malfunctions are considered
1D	20, 21, 22	
2G	1, 2	safe when foreseeable malfunctions are considered
2D	21, 22	
3G	2	safe in normal operation
3D	22	

Definitions of the zones and a fuller treatment of the subject of area classification is contained in the area classification ICoP.

7.2.1 Marking example 1

The marking could include:

 II 2G

where 'II' refers to the group, in this case indicating that the equipment is for non-mining use (group I is for mining)
2 refers to the category
'G' refers to the fact that the equipment is suitable for flammable gases and vapours

Putting together the 2G, it can be inferred that the equipment can be used in zones 1 and 2.

7.2.2 Marking example 2

The marking could include:

 II 3D

where 3 refers to the category
'D' refers to the fact that the equipment is suitable for flammable dusts

Putting together the 3D, it can be inferred that the equipment can be used in zone 22 only. This equipment is not, therefore, suitable for gas/vapour zones.

7.2.3 Marking example 3

The marking could include:

 II 1GD or  II 1G
1D (T100°C)

where 1 refers to the category
'G' refers to the fact that the equipment is suitable for flammable gases and vapours
'D' refers to the fact that the equipment is suitable for flammable dusts
T100°C refers to the surface temperature of the equipment.

Putting together the 1G and 1D, it can be inferred that the equipment can be used in all zones. Note that other selection criteria apply: the equipment must also be suitable for the apparatus group and temperature class for gases and vapours or the layer and cloud auto-ignition temperatures for dusts.

7.2.4 Other selection considerations

It is not sufficient to select equipment solely on whether it is suitable for the zone of use. There are at least two more selection criteria, namely:

- is the equipment compatible with the apparatus group of the flammable material
- is the equipment compatible with the temperature class of the flammable material

Consideration should also be given to environmental factors, such as the likelihood of corrosion, water ingress, etc.

Equipment should only be specified and installed by suitably qualified persons.

7.2.5 Inspection of equipment

Electrical equipment should be periodically inspected against EN 60079-17 to confirm that its explosion protection is still effective. Non-electrical equipment should be checked against the manufacturer's instruction manual.

For further available guidance, refer to section 2.5.

7.3 Marking of zones

The purpose of signs is to warn of areas where an explosive atmosphere may occur in such a quantity that employees need to be warned of its presence, so that they can take the necessary precautions in relation to the risk. Zoned areas should be marked with the sign shown whenever such marking might make the site safer for workers.

Currently, zoned areas are generally not marked; where needed, this should be done by 30 June 2006.

The sign to be used has black letters on a yellow background with black edging (the yellow part to take up at least 50% of the area of the sign).

7.4 Verification

The purpose of verifying overall explosion safety is to confirm the workplace can operate in accordance with these Regulations. It applies to new or existing plant and equipment but verification of a new plant must be done before the plant becomes operational.

Verification can be carried out through a variety of means, for example by an examination of documents, visual inspection, or physical checks and measurements. Much of the work may be a normal part of the commissioning process. Examples of the work involved could include: -

a) checks that mechanical ventilation systems produce the air flows intended;
b) checking with the manufacturer that suitable explosion mitigation measures have been applied
c) inspection of records showing that process equipment is leak-tight before dangerous substances are introduced for the first time;
d) ensuring that a hazardous area classification drawing has been prepared, and a visual inspection that electrical equipment is of the correct type or category for the zone where it has been installed, has been installed correctly; and
e) ensuring that appropriate information is available about the flammable properties of materials to be handled in the plant.

For new workplaces to be used for the first time after 30 June 2003 there is a requirement for explosion safety to be verified by a person competent in the field of explosion protection as a result of experience and professional training.

7.5 Anti static clothing

The DSEAR ACoP L138 requires that anti-static footwear and clothing should be provided when the risk assessment identifies that it is required. Paragraphs 263 and 264 are particularly relevant and the requirements may be interpreted as follows: anti-static footwear and flooring (e.g. concrete, metal grids) are generally sufficient for areas where there is a flammable gas or vapour risk; anti-static footwear is not generally required for dusts, since they are not easily ignited, but flooring must not be highly insulating. Such a summary must, however, not preclude consideration of specific high-risk gases or activities.

For a list of available guidance documents, refer to section 2.5.

8 DSEAR REGULATION 8: ACCIDENTS, INCIDENTS AND EMERGENCIES

Arrangements must be in place to deal with accidents, incidents and emergencies. The following points should be addressed, amongst others:

- Occupied buildings should have a fire alarm system that is tested regularly
- Evacuation and assembly points should be designated and clearly marked
- Emergency exits should be marked and housekeeping standards are such that exits are unobstructed.
- Fire drills should be held at suitable intervals
- Visitors should be alerted to escape routes and muster points
- Notice boards in every workplace should detail the local emergency arrangements

For a list of available guidance documents, refer to section 2.5.

9 DSEAR REGULATION 9: TRAINING AND INFORMATION

DSEAR requires information on the hazardous properties of substances to be made available. The hazardous properties of all flammable liquids, vapours and dusts should be identified and made available at the workplace where this is practical. Specifically, employees should be made aware of the potentially explosive nature of landfill gas and measures taken to reduce the risk of ignition. Training is required to cover such areas as:

- the no-smoking policy in or near hazardous areas
- the prohibition of the use of uncertified electrical equipment in hazardous areas, such as test equipment, mobile phones, pagers, personal audio equipment, etc.
- the correct use of intrinsically safe test equipment, e.g. oxygen analysers

It is recommended that such persons attend a hazardous area awareness course.

Those installing, maintaining and inspecting electrical and non-electrical equipment in hazardous areas require more detailed training that gives an understanding of the methods of protection of equipment and the corresponding checks and precautions to be applied. It is recommended that such persons attend a training course offering the required level of detail.

10 DSEAR REGULATION 10: IDENTIFICATION OF CONTAINERS AND PIPES

Identification of pipes and containers, particularly those that are visible, alerts employees and others to the presence of a dangerous substance so that they can take the necessary precautions. Identification can also help to avoid confusion over contents and thereby avoid incorrect mixing of contents.

Containers and pipework containing hazardous materials should be marked according to the appropriate regulations[16].

11 DSEAR REGULATION 11: CO-ORDINATION

Where there are two or more employers sharing a workplace, regulation 11 requires the employer responsible for the workplace to co-ordinate the implementation of measures taken under DSEAR to protect employees and others at the workplace from risks from explosive atmospheres.

In the waste management industry, the situation is complicated by the fact that a waste is received from a number of different companies. In many cases on landfill sites, the employees from outside contractors and visitors may be unaware of their responsibilities under DSEAR since there is no widely-held perception of a landfill site as a hazardous area. This situation can be addressed by segregating such persons and their vehicles from zoned areas by careful routing of the access roads sufficiently far away from wells and other locations where landfill gas collects. Suitable warning signs at the entrance to the site and a no-smoking policy may be sufficient.

Where access to zoned areas is part of the work of outside contractors (e.g. drilling, pipe-laying, work within parts of the Gas Management Compound), then contractors must be required to provide risk assessments and method statements and only send in suitably-qualified persons for such work.

Compliance with this regulation may also be achieved by means of a site induction (verbal or audio-visual), a permit-to-work system, accompanying visitors, or other methods deemed appropriate to the level of risk.

12 CONCLUSION

The waste management industry has a legal obligation to comply with DSEAR. The first step is to undertake an area classification of the site, without which, the other necessary steps cannot be taken. In summary, these remaining steps are:

1 Conduct risk assessments of activities involving flammable materials and establish whether the existing safe systems of work are adequate; methods of risk reduction should be studied;
2 Record the measures already in place (or required to be implemented) to control ignition sources;
3 Justify the existing electrical and non-electrical equipment in the zoned areas; ensure new equipment (both electrical and non-electrical) is ATEX-marked;
4 Set up an inspection system against EN 60079-17 for electrical equipment and a similar system for non-electrical equipment;
5 Ensure staff are adequately trained; and
6 Ensure hazardous areas are marked where appropriate.

APPENDIX 1: ASSESSMENT OF ALREADY-INSTALLED NON-ELECTRICAL EQUIPMENT

The following appendix is supplied for information only
and is not intended in itself to impart a level of training necessary for a competent person

A1.1 General obligations

Article 9 of the ATEX 1999/92/EC ('Worker Protection') Directive has requirements for electrical and non-electrical equipment already installed when the Directive came into force. Paragraph 4 states:

> "Where workplaces which contain places where explosive atmospheres may occur, are already in use before 30 June 2003, they shall comply with the minimum requirements set out in this Directive no later than three years after that date."

Annex II(2)2.5 states:

> "All necessary measures must be taken to ensure that the workplace, work equipment and any associated connecting device made available to workers have been designed, constructed, assembled and installed, and are maintained and operated, in such a way as to minimise the risk of an explosion...."

With specific regard to non-electrical equipment, the ATEX manufacturing directive 94/9/EC gives constructional requirements and the ATEX Worker Protection Directive requires non-electrical equipment already installed to be assessed for its ignition capability, although it is not required to meet the constructional requirements of new equipment. The assessment should be completed by 30 June 2006. EN 1127-1 lists thirteen type of ignition source:

1 hot surfaces
2 flames and hot gases
3 non-electrically-generated sparks
4 electrical apparatus
5 stray static currents, cathodic corrosion protection
6 static electricity
7 lightning
8 electromagnetic fields in the frequency range 9 kHz to 300 GHz
9 electromagnetic radiation in the frequency range from 300 GHz to 3000 GHz or wavelength from 100 μm to 0.1 μm (optical spectrum)
10 ionising radiation
11 ultrasonics
12 adiabatic compression, shock waves, gas flows
13 chemical reactions

New non-electrical equipment should be marked as ATEX-compliant. What follows is guidance of how non-electrical equipment that is already installed can be assessed as suitable for continued use. Typical examples that require an assessment are:

- pump
- coupling (e.g. between a motor and the associated pump)
- conveyor belt
- hoist
- solenoid valve
- gearbox
- brake

The ignition hazard assessment for equipment in the following zones will now be discussed:

Gas/vapour zone	Dust zone	Probability of explosive atmosphere	Requirements
2	22	low	Safe in normal operation
1	21	medium	Safe even with 'expected malfunctions'
0	20	high	Safe even with 'rare malfunctions'

A1.2 Non-electrical equipment in zones 2 (flammable gases/vapours) and 22 (flammable dusts)

Zones 2 and 22 are the low risk zones where an explosive atmosphere arises only very occasionally, usually as a result of the failure of plant equipment (e.g. leaking flange or seal) or human error (accidental spill). As such, the requirements for the installed equipment are not excessively onerous and often are easily met by normal well-designed industrial equipment. The requirements for equipment in these zones can be broadly summarised as follows:

in normal operation, the equipment should not spark
and should not have excessively hot surfaces;
its ingress protection should be suitable for the environment

Refer also to the list of 13 possible sources of ignition listed above; however, most or all will not apply to non-electrical equipment in normal operation.

When considering non-electrical equipment, and whether it is acceptable for continued use in zone 2 or 22 a hazardous area, it is usually self-evident whether it sparks or not. With regard to temperature rise, very few of those parts exposed to the flammable gas or dust will exceed even 100°C, which makes the item acceptable for the vast majority of flammable materials[D]. It should be stressed that only normal operation needs be considered for these zones; fault conditions (such as a seized bearing) are not taken into account, due to the low probability of such a fault occurring at exactly the same time as the explosive atmosphere.

For non-electrical equipment, the problem of ingress protection is usually simple to assess, since ingress of water will not cause sparking or a rise in temperature. With regard to dusts (whether flammable or not), the equipment is almost certainly designed to withstand such environmental factors, so seals will be provided to keep dust out of bearings and other moving parts. If this is not the case, then the equipment should not be installed in this location in the first place.

It is important to stress that the above assumes that the equipment is properly maintained.

A1.3 Non-electrical equipment in gas zones 1 and dust zones 21

Unlike in zones 2 and 22, foreseeable malfunctions should be considered when assessing non-electrical equipment in zones 1 and 21. Thus, the situation is somewhat more complicated.

When first considering the issue, the difficulty usually arises as to what constitutes a 'foreseeable malfunction' and whether such should be tolerated in a zone 1/21. Useful guidance on how to do the ignition hazard assessment can be found in EN 13463-1:2001, which is one of a suite of standards giving the constructional requirements for hazardous area non-electrical equipment. It should be stressed that there is no suggestion in the ATEX Directive that existing equipment should either be made to comply with these standards or else replaced, but they can be used for guidance.

A note in EN 13463-5 section 5.1 is included here because it gives guidance that is of general use:

[D] For those flammables with very low auto-ignition temperatures (e.g. carbon disulphide, CS_2), then a more careful approach will be required, possibly involving actual measurement of the surface temperature or contacting the manufacturer. Regarding flammable dusts, be aware that a 75 K safety factor must be applied to the AIT of the dust layer and a 2/3 safety factor to the AIT of a cloud.

"Slow-moving parts with a circumferential speed of less than 1 m/s do not normally require protection against heating by friction and non-electrical sparks".

A1.3.1 Example: ignition hazard assessment of a solenoid valve (reference EN 13463-1 Annex B1)

Normal operation	Expected malfunction
Friction producing heat	Frictional ignition following the breakage of the spring Compression/shock-wave ignition

Normal operation is highly unlikely to produce an ignition for the reasons outlined in the previous sub-section. For malfunctions, some element of judgement is required by a suitably-qualified person to assess the likelihood of these becoming an ignition source in the valve under consideration.

The general approach, which takes care of most of the ignition hazards, is as follows:

ensure that the equipment is maintained in accordance with the manufacturer's guidelines and that all parts with a potential to become ignition sources are replaced at or before the specified interval

A1.3.2 Example: ignition hazard assessment of a conveyor belt (reference EN 13463-1 Annex B2)

A conveyor belt is a more complex example, which includes a number of non-electrical devices. Possible ignition sources are:

Normal operation	Expected malfunction
♦ temperature rise of bearings ♦ frictional heat from moving parts inside the gearbox ♦ frictional heat from the brakes ♦ dust entering the brake housing ♦ frictional heat from the belt idler rollers ♦ dust deposits on the gearbox ♦ static electricity discharge ♦ surface temperature of all moving parts	• bearing failure due to loss of lubrication • belt rubbing on spilled product • ingress of stones or metal fragments to gearbox • unacceptable oil loss from the gearbox • brakes left on too long after the drive motor has started • brake disengagement fails • clutch slippage • belt idler roller seizes and is rubbed by the moving conveyor belt • slippage of conveyor belt on the driving drum due to loss of tension or stalling of the belt • belt driven at overspeed • friction between the belt and fixed parts • moving parts close together, gap filled with dust

Most of these will have been covered by the original design of the conveyor. Again, the general approach outlined above will usually suffice.

Static discharges are, arguably, the commonest cause of unintentional sparking and special attention should be paid to this particular ignition source.

A1.4 Non-electrical equipment in gas zones 0 and dust zones 20

Such equipment is relatively rare, but certain examples will require consideration, e.g.

- grinder in a mill classified as a zone 20
- agitator in a process vessel classified as zone 0

For dust zone 20, it is often not possible to classify the internal non-electrical equipment as safe with rare malfunctions. The grinder in a mill is a prime example: a metal fragment introduced by accident is quite likely to produce a spark when it comes into contact with the grinder wheels. Another problem is that of static build-up produced by the flow of dust itself. The usual approach is to have explosion venting since the probability of an ignition-capable spark cannot be reduced to a sufficiently low level. Assuming this is present and suitably-located and maintained, this is probably sufficient.

For zone 0, the ignition hazard assessment should consider 'rare malfunctions' as well as 'expected malfunctions'. To take the example of an agitator, the mechanical seal protecting the bearings could be in contact with the zone 0. Possible approaches could be:

- monitoring the barrier fluid level or pressure or flow
- an analysis of past failure rates
- periodic vibration or temperature monitoring

As for equipment in lower risk zones, the routine maintenance and scheduled replacement of the bearings should be as recommended by the manufacturer.

An assessment of the agitator blade is also required. Its potential for producing a spark should be assessed, considering such mitigating factors as:

- are the blades always immersed?
- are the blades and shaft made from alloys containing insignificant quantities of 'light' metals such as magnesium, aluminium, zirconium, titanium?
- is the rotation speed less than 1 m/s?

A1.5 Summary

An assessment of non-electrical equipment in zones 2 and 22 is straightforward but a more careful analysis is required for the higher-risk zones. It is not possible to give a detailed approach for all situations, but the application of sound engineering judgement and implementation of reasonable precautions, proportionate to the zone classification, to prevent potential ignition sources becoming active is sufficient to comply with the requirements in the ATEX Worker Protection Directive.

APPENDIX 2: ASSESSMENT OF ALREADY-INSTALLED UNCERTIFIED ELECTRICAL EQUIPMENT

The following appendix is supplied for information only
and is not intended in itself to impart a level of training necessary for a competent person.

A2.1 The legal situation

Article 9 of the ATEX 1999/92/EC Directive (Worker Protection Directive, WPD) has mandatory requirements for electrical and non-electrical equipment installed in hazardous areas. This article can be paraphrased as follows:

> (1) Equipment that was already in use on 30 June 2003[E] must comply with the minimum requirements laid down in Annex II Part A of the Directive. The requirements for fitting ATEX-compliant equipment are in Part B, so *there is no requirement to retro-fit ATEX equipment.*
>
> (2) Equipment installed after 30 June 2003 in new or extended plant must comply with Annex II Parts A and B. In effect, this requires it to be ATEX marked by the manufacturer[F] as suitable for the hazardous area into which it is being installed.

Article 9(2) is clear: with very few exceptions, ATEX-marked equipment must be used for new installations. However, Article 9(1) requires further discussion.

For existing equipment, the ATEX WPD requires the equipment (whether electrical or non-electrical) to be assessed for its continued suitability for the zone into which it is installed. It is convenient to divide the equipment into electrical and non-electrical (mechanical); only electrical equipment is dealt with below.

A2.2 Uncertified electrical equipment in zone 2

This section deals with equipment installed in zone 2 before the ATEX directives came into force on 1 July 2003. The requirements for zone 2 were and are considerably more relaxed than for zone 1 and EN 60079-14:2003[17] clause 5.2.3c permitted the use of uncertified equipment in zone 2, provided it is assessed as meeting the requirements of the relevant standard. These requirements can be summarised as follows for the commonest form of Type n equipment ("Ex n non-sparking"):

1 the enclosure is normally required to be IP54 minimum, though protection by location (e.g. indoors) permits a lower level of ingress protection

2 the equipment shall contain no sources of ignition in normal operation, i.e.
- **hot surfaces:** no surfaces hotter than the ignition temperature of the hazard gas
- **sparks:** no normally-sparking components are permitted, e.g. switches, relays unless encapsulated), contactors, circuit-breakers, potentiometers (unless the spark is current-limited) and easily-separated connectors (secure with adhesive if necessary). Such items are acceptable if certified to another concept, e.g. Ex d switches.

It should be stressed that the assessment takes account only of normal operation, and not fault conditions (e.g. a conductor coming loose from a terminal or a fuse blowing), since it is considered a sufficiently low risk that such a fault could occur at exactly the same time as a flammable gas is present in the enclosure. The enclosure is not required to be gas-tight for this method of protection.

There is no upper voltage limit and uncertified terminals are permitted. It is also possible to use test-disconnect terminals (non-sparking in normal operation), fuse terminals and other terminals incorporating components such as diodes. However, it is usual to use test-disconnect and fuse terminals that are *certified* as Ex n/N, since these are readily available.

E 1 July 2003 was the date on which both ATEX Directives came into force; most, if not all, of the equipment on the site was already in use on this date.

F This rule is not absolute and there are a number of exceptions, but, in the interests of clarity, these will not be discussed.

Common examples of uncertified items of equipment that may be thus assessed are:

- A.C. induction motors (paying particular attention to maximum temperature; sometimes a guide is that the limiting temperature for the wiring insulation is stated on the marking plate as a "Class"[G])
- Junction boxes
- Non-purged panels with no sources of ignition
- Panels containing potential ignition sources that are protected by the pressurisation principle

This relaxation in EN 60079-14 clause 5.2.3c does not apply to zone 1: all electrical equipment should be certified.

Note that the ATEX 1999/92/EC Worker Protection Directive requires *new* equipment (electrical and non-electrical) for zone 2 to be marked as ATEX-compliant.

A2.3 Uncertified equipment already installed in dust zones 20, 21 and 22

Before the advent of the ATEX Directives, there was no mechanism for certifying electrical equipment for flammable dust areas and hence no requirement to use certified equipment. The approach used in the UK is found in HSG103[18], which permits equipment that is merely protected against dust.

Zone 21: Paragraph 37 states: "…. in zone 21 …. existing equipment …. with a dust-tight enclosure made to IP6X is still likely to be suitable".

Zone 22: Paragraph 38 states: "In [zone 22]….older equipment made with a dust resistant enclosure to IP5X may remain in service".

Thus, provided the equipment is in good condition and no further ignition hazards are identified, if it meets these fairly modest requirements, it may be considered satisfactory for continued use; it is not necessary to replace it with ATEX-marked equipment.

For equipment in zone 20, BS 7535[19] was applied. The approach can be summarised as follows:

For flammable dust zones, install equipment that is suitable
for the equivalent flammable gas zone and is also dust-tight.

Thus, for zone 20, intrinsically safe equipment that is also IP6X may be appropriate for continued use, provided due consideration is given to factors such as the ruggedness of the enclosure, ohmic heating of the dust, etc.

It should be stressed that the definitions of flammable dust zones are concerned only with the presence of flammable clouds of dust and take no account of dust layers. The smouldering risk of the dust layer on the external surfaces of equipment should be addressed separately. Dust layers are significant in zoning if they can be stirred up to form an explosive cloud; such a risk can be removed by good housekeeping.

[G] Class A = 105°C, class E = 120°C, class B = 130°C, class F = 155°C, class H = 180°C, class N = 200°C (values from EASA Electrical Engineering Handbook).

APPENDIX 3 REFERENCES

The following publications were referenced in compiling this report:

1 Dangerous Substances Explosive Atmospheres Regulations:2002 ('DSEAR')

2 ATEX Directive 94/9/EC: Equipment and protective systems for use in potentially explosive atmospheres

3 ATEX Directive 1999/92/EC: Minimum requirements for improving the safety and health protection of workers potentially at risk from explosive atmospheres

4 Approved Guide to the Classification and Labelling of Dangerous Substances and Dangerous Preparations, 5th edition, April 2002

5 Chemicals Hazard Information and Packaging for Supply Regulations, 1994

6 Control of Substances Hazardous to Health (COSHH) Regulations, 2002

7 Management of Health & Safety at Work Regulations, 1999

8 L138. Dangerous substances and explosive atmospheres regulations 2002: approved code of practice and guidance. HSE books. ISBN 0 7176 2203 7

9 L133. Dangerous substances and explosive atmospheres regulations 2002: Unloading petrol from road tankers. HSE books. ISBN 0 7176 2197 9

10 L134. Dangerous substances and explosive atmospheres regulations 2002: Design of plant equipment and workplaces. HSE books. ISBN 0 7176 2199 5

11 L135. Dangerous substances and explosive atmospheres regulations 2002: Storage of dangerous substances. HSE books. ISBN 0 7176 2200 2

12 L136. Dangerous substances and explosive atmospheres regulations 2002: Control and mitigation measures. HSE books. ISBN 0 7176 2201 0

13 L137. Dangerous substances and explosive atmospheres regulations 2002: Safe maintenance repair and cleaning procedures. HSE books. ISBN 0 7176 2202 9

14 EN 1127-2:1998: Explosive atmospheres – explosion prevention and protection: Part 1: Basic concepts and methodology

15 PD CLC/TR 50404:2003. Electrostatics - Code of practice for the avoidance of hazards due to static electricity.

16 The Health and Safety (Safety Signs and Signals) Regulations 1996 (S.I. 1996/341)

17 EN 60079-14:2003 - Electrical apparatus for explosive gas atmospheres - Part 14: Electrical installations in hazardous areas (other than mines)

18 HSG103: Safe handling of combustible dusts: precautions against explosions, HSE Books, 2003

19 BS 7535:1992 – Guide to the use of electrical equipment complying with BS 5501 or BS 6941 in the presence of flammable dusts.