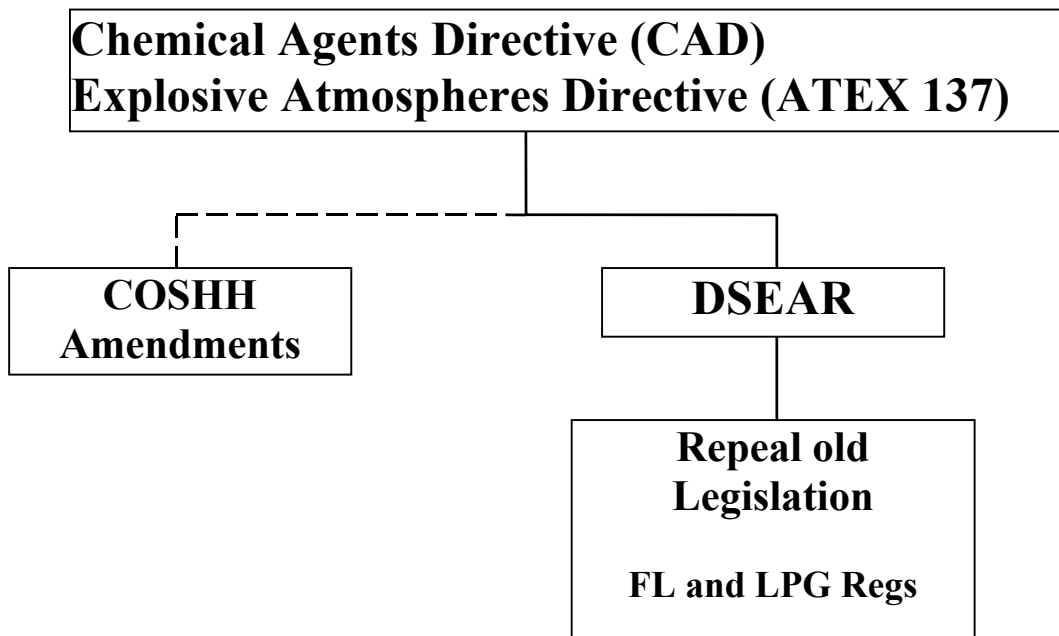


Presentation on "Dangerous Substances and Explosive Atmospheres Regulations (DSEAR) 2002"

By Andy Cox, HM Specialist
Inspector

Andy Cox introduced himself by saying that he had been in the specialist Advisory Section at HSE Birmingham for 14 years. The DSEAR legislation was the most significant change in that time, leading to the repeal or revocation, wholly or partially, of twenty other pieces of legislation. Despite the sweeping changes, Andy added, if employers already complied with the existing legislation and good practice, then it was very likely that they would already comply with DSEAR, as there were only a few, new duties.

Andy introduced his presentation to explain that he would be speaking about the origins of DSEAR, the three core regulations, the sources of advice, the likely impact of the new regulations and their application by HSE Inspectors to matters of concern to them, with practical examples taken from the food industry. Regarding the origins of DSEAR, these lay in the following legislation: -



The CAD Directive required that both the health and the safety risks of chemical agents be controlled. Some of the health aspects of the CAD have already been addressed via amendments to the COSHH Regs and other specialised legislation such as that on asbestos and lead. The safety aspects of CAD together with the requirements of the ATEX Directive are now being implemented through the DSEAR Regs.

At the same time, HSE is taking the opportunity to repeal about 20 pieces of legislation relating to flammable substances including the familiar HFL Regs. Some petrol legislation is also being amended. However, the intention is that the safety standards set out in the old legislation will be maintained by a combination of the DSEAR Regs and the supporting ACOs. DSEAR deals with fires, explosions and similar energy-releasing events arising from the use of dangerous substances. It doesn't cover energy events arising from compressed air or steam systems.

There are three categories that define a dangerous substance under the DSEAR Regs. The first category which defines a dangerous substance or preparation is one that meets the criteria in the **CHIP Regs** for classification as explosive, **extremely flammable, highly flammable or flammable**. One important change to note here is the change in the definition of a **highly flammable liquid**. With the repeal of the **HFL Regs** a highly flammable liquid, in accordance with the CHIP regulations, is now one with a flashpoint **below 21C rather than 32C**. This also helps to resolve some of the confusion that existed previously but, as DSEAR applies to flammable as well as highly flammable liquids, this is less of an issue.

The second category are substances which in their natural state are not classified as dangerous but where **the way in which they are used** may bring them into the category. An example is where hot work being carried out on a vessel or tank raises the material above its flashpoint. This next slide shows a good example where welding was carried out on a tank for storing Diesel fuel, which is not normally considered to be highly flammable. In the food industry, Andy added, "I can imagine some oils coming into this category when heated either during the cooking process or during maintenance work."



This a close up of tank removed from vehicle showing the tank that had split. In its working position the workers face was very close to the point at which the tank split. He had the option of using a cold repair method or emptying and cleaning the tank but he chose to do neither. Under previous legislation diesel would not have been specifically designated as a dangerous substance. Under DSEAR there is a requirement to **consider whether the way in which materials are being used brings them into the category of dangerous.**

Dusts that form explosive atmospheres are also categorised as **dangerous substances** and virtually all dusts encountered in the food industry will be classified as explosible. DSEAR applies to all workplaces and effectively includes any premises or parts of premises used for work. Generally speaking, if there is a work activity going, on then DSEAR applies. There are a limited number of exemptions but **DSEAR will apply to all food premises.** DSEAR is intended to cover not only employees but also any other persons whether at work or not who may be put at risk. This includes employees working for other employers, visitors and members of the public.

One of the core DSEAR requirements is **Regulation 5 – Risk Assessment.** First of all the employer should be doing it any way under his duties under the **Management of Health and Safety at Work Regulations (MHSWR).** All that DSEAR does is to make explicit reference to dangerous substances within the assessment process. So, in the same way that you have a COSSH assessment to consider the health-related hazards of a substance, you will now also have a DSEAR assessment to consider the fire and explosion risks. In order to carry out the assessment the employer, first of all, needs to establish the hazardous properties of materials used. For most substances used in the food industry the data will already be available through safety data sheets. But the assessment also needs to consider waste materials, and other substances brought in, such as cleaning materials.

When considering work activities the employer needs to consider not only day-to-day activities but also less common activities such as cleaning or disinfection of vessels and equipment. The assessment needs to keep a record of what measures have been taken to reduce risk and this might include strict working procedures for some activities. The assessment needs to consider the extent of hazardous areas that may arise from some activities, such as storage of flammable liquids and handling of dusts. In addition, it needs to consider all sources of ignition that might arise and this should include the use of portable equipment such as grinding tools, welding equipment and hand lamps, as well as naked lights and fixed electrics.

The assessment needs to consider the number of people affected and the consequences. There is a duty to inform, instruct and train employees in the protective measures arising from the assessment. Importantly, in keeping with general risk assessment duties, there is a duty to record the assessment where there are more than 5 employees.

The second core requirement is **Regulation 6, Elimination or reduction of risks from dangerous substances**. This requires the widely accepted three-step strategy to hazard management of **Elimination, Control and Mitigation**. Firstly, you should try to avoid the use altogether of hazardous substances or processes. If that can't be done, suitable **control measures** should be applied to prevent fires, explosions and adverse events occurring. Adverse events here could refer to processes going out of control, or the mixing of incompatible materials. Finally, if having applied control measures, there is still a risk of a fire or explosion or other adverse event occurring, **mitigate** the risks by protecting the people from the detrimental effects.

This three-step approach is in accordance with the fundamental safety concepts as required by the EC Framework Directive in the form of the MHSWR. Under Regulation 6(1), employers are now required to ensure that the risk is either eliminated or reduced as far as is reasonably practicable. This is a new requirement under DSEAR and has not appeared before in legislation for flammable materials, although we as inspectors have always asked for it. The employer's decision on whether to eliminate the hazardous material or activity should take account of the potential benefits of substitution but also of any other risks introduced. e.g. if the substitute material has toxic or irritant properties then that needs to be weighed up against the flammable substance in deciding whether to substitute. There is also always the test of **reasonable practicability** that means that unreasonable cost may be used to argue against elimination or substitution.

If the dangerous substance cannot be eliminated then a variety of control measures should be applied and these are set out in Reg 6. The list is not exhaustive and equally effective alternatives can be chosen. It is the overall package of measures that is important but the list provides a logical sequence for consideration of appropriate control measures. Some examples are given here: -

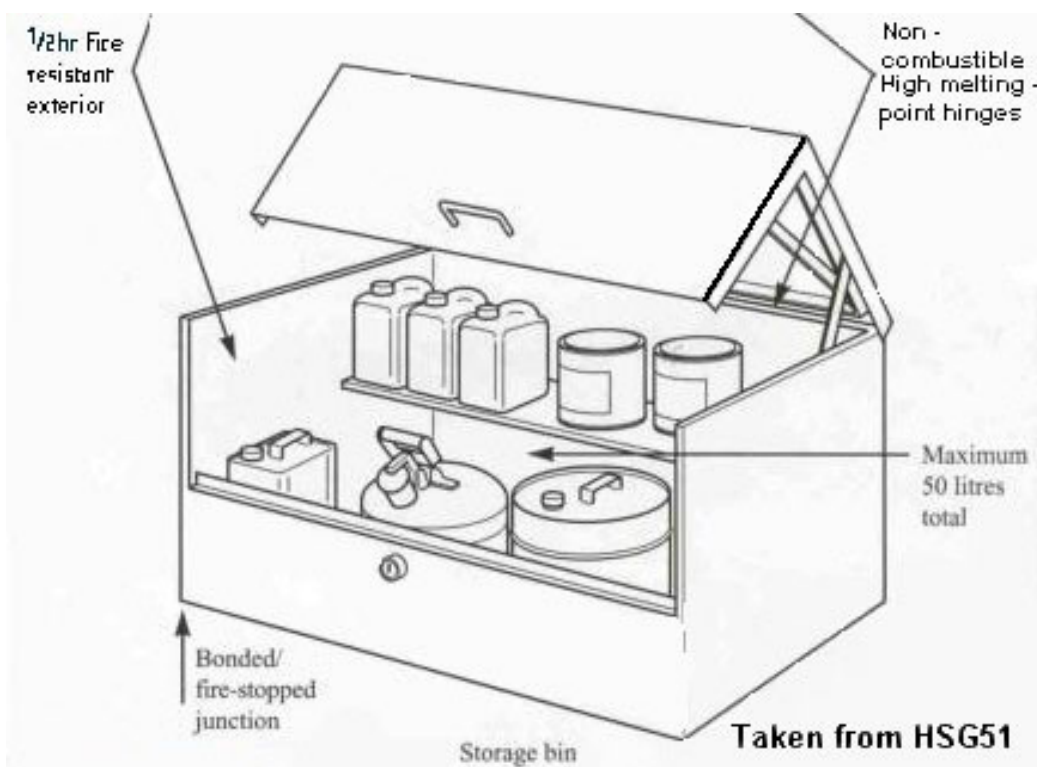
- Reduce quantities of DS to a minimum – use smaller containers in workroom.
- Control release at source - keep stocks outside workroom, e.g. pipe in from outside.
- Avoid or minimise release of DS - keep lids on containers.
- Prevent formation of explosive atmosphere – low-level ventilation in flammable liquid store or where flammable liquids are kept.

When flammable liquids are regularly dispensed, we prefer the use of these special purpose containers for flammable liquids. They incorporate spring caps, which close if the container is dropped. Some also have flame arrestors fitted, which prevent an external flame propagating into the container. The can at the front is a plunger can for safe dispensing of flammable liquids onto cleaning rags.



To continue with the preventative measures under Regulation 6, **Ignition sources** should be avoided. When we talk about ignition sources we mean not only naked flames but also hot surfaces on which some materials could spontaneously ignite. Sparks can arise from poorly maintained mechanical equipment or they may arise from maintenance equipment such as angle grinders. Also, electrical equipment, both fixed and portable, can give rise to sparks. By selection of appropriate equipment this can be avoided.

Carrying on with the preventative measures under regulation 6, it is also important to avoid adverse conditions. What does this mean? Well, I would take it to mean keep your stored materials and those in use or in production within the recommended limits by using a storage bin like this: -



Avoiding adverse conditions, Andy continued, might involve taking a close look at control and emergency systems to ensure that they prevent these adverse events

from occurring. A typical example might be a heating vat I came across one last year, he recalled, where the thermocouple had broken and so the controller was deliberately by-passed, therefore having no control function. Eventually an operator who did not know the controller was bypassed was asked to work on the vat. Sure enough the vat overheated and he was showered with hot caustic material.

It is also vital to segregate incompatible materials. Many food premises can be found with acids and alkalis stored and possibly chlorine-based disinfectants. Accidental mixing of some of these can give rise to exothermic reactions. The ways in which these materials are stored and used needs to minimise the risk of their mixing and HSG71 gives some good advice on this.

Where the assessment shows an unacceptable risk, even after control measures have been applied, Reg 6 requires appropriate **mitigation measures** to be provided but the list it contains is not exhaustive. The first thing to do is to reduce the number of people exposed by moving either the people or the equipment. Another issue to consider is to avoid propagation of fires & explosions. This can be achieved in some instances by fire resisting enclosures that are important for flammable liquid stores. Where explosible dusts are handled inside equipment it is important to ensure that an explosion initiated in one area of the plant cannot propagate through other connected pieces of equipment and ductwork. **Explosion relief** is used to protect plant and equipment that is not strong enough to withstand explosion overpressures. Explosion relief panels should be designed to appropriate standards and be positioned so that they discharge into safe unoccupied areas.

Also under Reg 6 there is a new requirement in law to consider appropriate **Personal Protective Equipment (PPE)**. This may simply be eye/hand protection but could also be fire-retarding overalls for hazardous activities. There are special requirements to provide anti-static footwear under **Regulation 7 Places where explosions may occur**. Andy referred, then, to his previous remarks about about excluding people and providing explosion relief on a slide showing both of these aspects. They were explosion relief panels on the top of a grain silo. These panels clearly discharge into a room or enclosed space at the top of the silo. So it is important to keep people away such as by allowing access to this area only under a **permit to work scheme** (as specified in Reg 6(8)). Alternatively it could be argued that the highest risk occurs during grain transfer and that access should be prevented during those periods. There is another issue here, he added, not related to DSEAR – there should be warnings of the dangers of standing on the panels.

Reg 7 is all about defining and controlling places where explosive atmospheres may occur and most parts of the regulation derive directly from the ATEX directive using the same definitions. **Under Reg 7(1)** an employer must classify places where explosive atmospheres may occur into hazardous & non-hazardous areas. He must then classify those hazardous areas into zones.

Reg 7(2) ensures that equipment and protective systems for use in such zones meet appropriate standards. **Reg 7(3)** requires that where hazardous areas have been identified they should be marked at their points of entry. **Reg 7(4)** calls for hazardous areas to be verified as safe to use by a competent person. And **Reg 7(5)**

has specific requirements for the provision of antistatic clothing for use in hazardous areas.

Andy went on to say that that the concept of hazardous area classification has been used in the chemical industry for many years and some of the audience may be familiar with the terminology. This is the first time, however, that there has been any reference to it in law. Once the employer has determined that an explosive atmosphere can occur and it is deemed to be hazardous **and** that special precautions are required to protect the health & safety of the workforce, then those areas are to be classified into zones. The zoning criteria are based on the likely frequency and/or duration of the explosive atmosphere.

For gases vapours and mists:

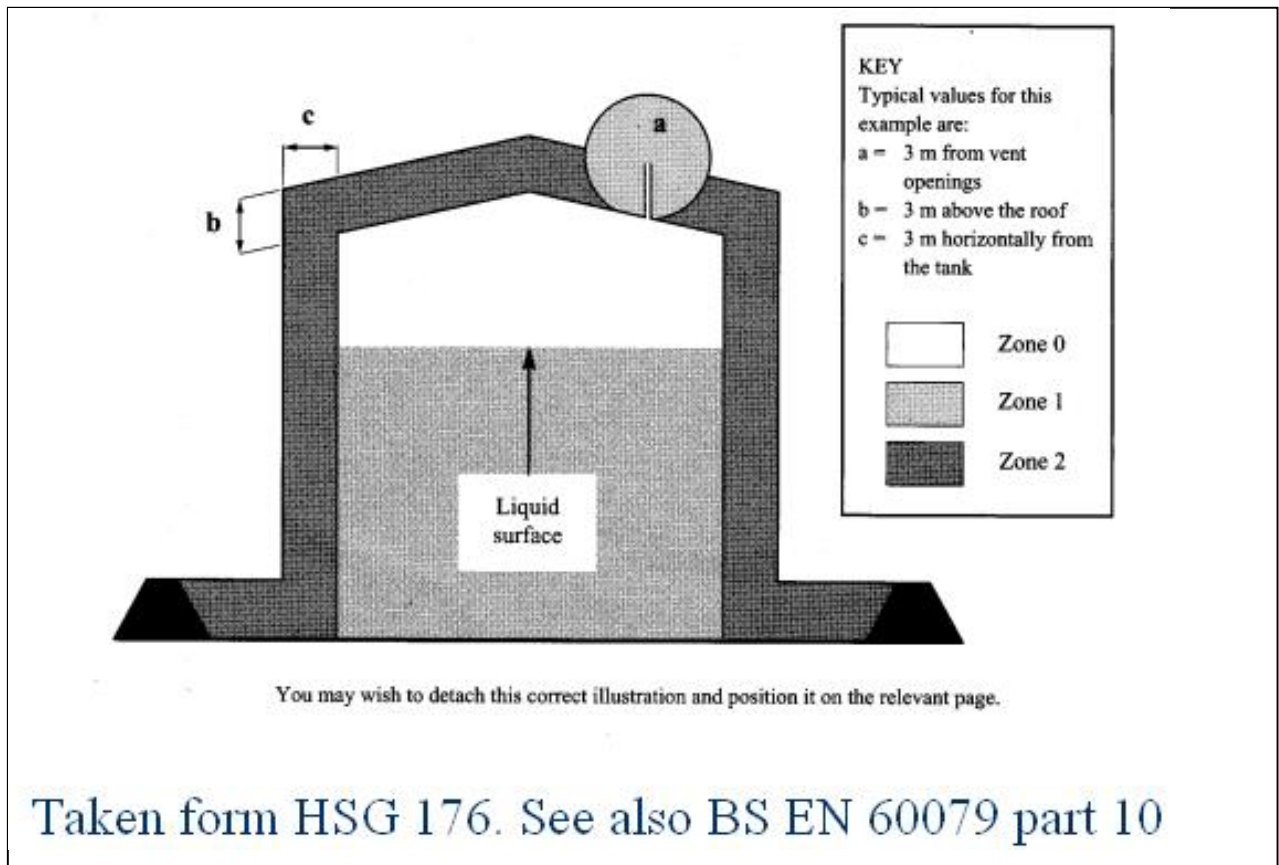
Zone 0 is defined as a place where an explosive atmosphere consisting of a mixture of air and a dangerous substance is present continuously or for **long periods or frequently**.

Zone 1 is defined as a place where the explosive atmosphere **is** likely to occur during normal operation but only **occasionally**.

Zone 2 is defined as a place where the explosive atmosphere is **not** likely to occur during normal operation but if it does occur will persist for a **short period only**.

Andy then referred to an example of a hazardous area classification for a flammable liquid tank with which many would be familiar from HSG176. Inside the tank, above the surface, where flammable vapour is present at all times, the classification is **Zone 0**.

This tank has a breather vent and so, during normal use but not always, there may be vapour present as when it is being filled or subjected to temperature variations. So a **Zone 1** has been defined around the vent and, in this case, the suggested extent of the zone is **3m**. Recognising that the vapour is heavier than air, it may also be present in an area extending to ground level after being released from the vent and this is designated as **Zone 2**.



A similar classification is to be carried out if the processing of dusts results in the formation of an explosive atmosphere. The zonings are defined in this way with the addition of a number '2' for each zone. So, instead of zones **0, 1 and 2** we have zones **20, 21 and 22**. So a zone **21** for a dust is directly analogous with a zone **1** for a flammable vapour, in terms of the frequency and duration of the release. This new approach through DSEAR attempts to achieve a consistent terminology for all dangerous substances. For dusts, nothing outside a vessel should be classified as Zone 20 or 21 except around feed or product discharge points. Experience shows that almost all explosions start **inside** process equipment. To define the whole of large workrooms as **zone 22** and upgrade electrical equipment would **not** help to reduce these incidents, although it might reduce the risk of fire. **The majority of dusts handled in the food industry are considered as explosible** although factors such as particle size and moisture content can reduce explosibility.

Once areas have been zoned the classification requires special precautions for the construction, installation and use of equipment to control ignition sources. **Schedule 3** of DSEAR requires that equipment must be selected in accordance with the **Equipment and Protective Systems for use in Potentially Explosive Atmospheres Regulations (EPS) 1996**. New equipment must comply with EPS. And for much electrical equipment employers will notice little change except the detail on some of the markings. The EPS Regs also apply to mechanical equipment that is a potential ignition source. This is a new requirement – previously there has been no mechanical equipment that has been “Ex” marked. Schedule 3 sets out the categories of equipment which may be used in each zone, provided they are suitable for gases, vapours and dusts as appropriate.: -

- **Category 1 for Zone 0 or 20**
- **Category 2 for zone 1 or 21**

- **Category 3 is intended for zone 2 or 22**

But you can argue that category 3 is acceptable in Zone 1 if the risks assessment shows that the consequence of an ignition is not a serious risk to people, or that some protective system will prevent the hazard. There may also be cases where items of equipment are simply not available in a form intended for use in potentially explosive atmospheres and a lower category can be used in conjunction with other protective measures. The degree of flexibility is also intended to allow equipment to be moved into an area temporarily under strict controls.

A standardised marking scheme is widely used to identify equipment suitable for a specific location and has been in existence for many years. With the advent of DSEAR and EPS there are many similarities but also some changes. First the equipment will carry the explosion protection symbol – **“Ex” in a hexagon**. It will also include the equipment category number – **1,2 or 3** and also the letter **G** or **D**, depending on whether the equipment is intended for use with gas or dust. There may also be other safety information such as the equipment group. For most purposes this will be represented by number a two in Roman numerals followed by a letter **A, B or C**. And there may also be a temperature rating designated as **T1 to T6**. So the final designation may look like this: -

CE Ex IIA 3 D

Andy added a reminder that the **CE** mark alone tells you very little. It could relate to many other directives, e.g. **machinery, electromagnetic compatibility**. It is important that those who specify, issue and install this type of equipment are familiar with and understand the new marking scheme.

Reg 7(3) requires employers to place signs, if necessary at the entry points to places that have been classified as hazardous. The purpose of the signs is to warn of areas where an explosive atmosphere might occur in such quantities that employees need to take precautions in relation to the risk. Signs are useful to identify places where **special workplace or site rules exist e.g no smoking, antistatic footwear or to restrict access to authorised people**. They are also useful to identify where mobile or portable equipment needs to be of an explosion-protected type, e.g. torches and cleaning machines. If the risk assessment says that even after appropriate measures have been taken there is still a risk then a sign is needed. If a sign will not help to reduce the risk or if there is no significant risk a sign is not needed.



The new sign is **Ex in black** on a yellow triangle, not to be confused with the **Ex in a hexagon** which is the symbol used on equipment.

We've long asked, Andy commented, for no smoking, no naked lights signs at HFL stores. We would now expect the new sign to be used in similar places but there should also be some explanatory text giving details of the nature of the hazard. For a few years at least, no one will know, otherwise, what the new sign will mean.

The regulation says that warning signs should be placed to mark those areas where explosive atmosphere may exist. What we do not want is “Ex” signs at the

gatehouse of large sites, and then to allow people to drive past in normal cars, or walk in with their mobile phones. If the signs have a purpose, it is to identify the place where special rules or restrictions start, and that means the door to a process room, or the edge of a storage compound.

To support the implementation of DSEAR there will be a series of ACOPs. There is a general overarching ACOP and guidance on how employers can meet their duties under DSEAR, but it has also been decided to issue these further four ACOPs giving practical advice on various aspects of plant design and operation.

- L133 specifically for petrol tanker unloading has already been issued.
- L134 gives advice on risk assessment and the design and use of plants handling dangerous substances, including how to make redundant equipment safe.
- L135 gives advice on identifying hazards and putting into place appropriate ventilation, ignition control and separation measures to control risk.
- L136 gives advice on risk assessment and control and mitigation measures for places where dangerous substances, including waste materials, are stored.
- L137 gives advice on providing appropriate systems of work for maintenance, repair and cleaning, including hot work.
- L138 Dangerous substances and Explosive Atmospheres Regulations 2002 ACOP and Guidance

Andy emphasised the ready availability of guidance on the HSE Website and recommended a small leaflet, INDG 370, aimed at small businesses that was a good starting point.

Andy went on to talk about the hazard from static electricity. It is well known, he said, that some clothing including footwear can cause electrostatic discharge that has the potential to ignite an explosive atmosphere. The risk can be reduced if the wearer is earthed by means of suitable footwear and flooring such as concrete or steel grids. From July this year, where it is needed, the employer must provide antistatic footwear, but the floors need to be suitable as well. The intention is to avoid a person becoming charged, then creating a spark when they touch a metal object, which might have an explosive atmosphere in the vicinity, e.g. a bucket full of solvent. You can get sparks when peeling off acrylic jumpers or nylon overalls, but the advice is usually that they need not be banned. Where there is concern over this point, cotton clothing is unlikely to cause a spark.

For dust industries this really is not a problem except in some very isolated cases with very sensitive dusts, which are often explosive type materials. Advice is available in British standards and published documents.

What sort of impact would we expect these new regulations to have? Although there are some new duties, most of the requirements are covered by existing legislation and we would expect good companies to be meeting most of these already. As ever, those who have never heard of DSEAR are most likely to find themselves in breach. However, we recognise that most of the dust handling industries (and that means much of the food industry) will be significantly affected

and we are prepared to be relatively flexible in enforcement of the zoning issues. We are of course available and happy to give advice whenever it is sought. Of course we are losing a lot of familiar legislation particular the HFL Regs and we as inspectors are going to have to learn to live without them.

Members' Questions

Bob Cole of Morgan EST asked whether the DSEAR applied to substances emanating from the ground in tunnels. Andy said that they did apply and quoted an incident in a tunnel in Mansfield where petrol had escaped from tanks at a redundant petrol station.

Jim Hathaway of Beiersdorf asked about the risk of aerosol propellants in hairdressing salons being ignited by hairdryers. Andy said that there was a low risk from the transient clouds associated with that type of use. He said that there was a higher risk in laboratories and from paint spraying with aerosols.

Denis Walley of South Staffs Water requested clarification of the storage limit of 50 litres for highly flammable liquids. Andy said that the definitions had been changed by CHIP and anything with a flashpoint (FP) in excess of 40°C was no problem and the capacity limit could be larger at the higher FPs. He added that retail outlets posed a different problem and the insurers might have other standards to work to.

Mark Hoare of Birmingham University asked about the treatment of a combination of hazards under COSHH and DSEAR. Andy said that combined risk assessment was always the best approach and added that some employers assumed that there was no risk if there were controls in place but that ignored the need to see if more controls were required. On the question of containers he said that there was a risk of glass being broken and defeating control measures. He also said, on the subject of zoning, you always had to ask “can I walk away from any fire/explosion if there was a mishap?”

The Chairman closed the questions at this stage and thanked Andy for an extremely detailed and informative presentation and asked the members to join with him in showing their appreciation