

EXPERIENCES AND ISSUES IN ATEX AND DSEAR COMPLIANCE

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The DSEAR regulations have now been in place since 2002. The compliance date for new installations passed in July 2003 and the compliance date for existing installations (July 2006) is fast approaching. One of the key requirements of ATEX/DSEAR is the identification of hazardous locations (Hazardous Area Classification).

Whilst there is a considerable amount of guidance relating to hazardous area classification (BS EN 60079-10, IP15, IGE25 etc.), it cannot possibly cover all possible situations. There are also a number of areas in the guidance where the requirement for hazardous area classification and the size and type of zones is unclear. In many cases a risk assessment is required to decide on the basis of safety required for a specific area where conventional area classification methods cannot be applied for some reason.

This paper describes some of the challenges that have been encountered in the implementation of the ATEX and DSEAR regulations to installations in the UK and Europe and the approach taken to provide a resolution. A number of specific examples are given:

- ☐ Basis of safety for laboratories and other areas using small quantities of hazardous materials where ATEX compliant equipment is not available
- ☐ A material which decomposes explosively at a relatively low temperature
- ☐ Hydrogen compressor house where specific items of electrical equipment are not available to the correct standard
- ☐ Carriage of hazardous materials through a non-hazardous area
- ☐ A common situation where the process is operating normally above the autoignition temperature of the materials in process

Many of these situations are either not covered by the guidance or else the guidance is poorly understood. Some of the limitations of hazardous area classification are discussed in terms of the contribution made to safety. A number of common pitfalls that have been commonly found in hazardous area classification are highlighted.

The production and maintenance of a Basis of Safety for operation or "Explosion Protection Document" is discussed briefly.

INTRODUCTION

The Dangerous Substances And Explosive Atmospheres Regulations 2002 (DSEAR)[1] are the UK implementation of the ATEX directives[2]. These relate to the protection of personnel from fires and explosions. The key features of the legislation are:

- ☐ The requirement to identify areas where flammable compositions may occur and the extent frequency of occurrence of the flammable mixture (Hazardous Area Classification)
- ☐ Risk Assessment for the protection of personnel
- ☐ Hierarchy of prevention, protection and mitigation measures
- ☐ Requirement to produce an Explosion Protection Document

This paper describes a number of challenges that have been encountered in the application of Hazardous Area Classification since the legislation was enacted in 2002. These situations have been encountered in the UK and EU and across a range of industries.

HAZARDOUS AREA CLASSIFICATION

Hazardous area classification is basically a form of risk assessment detailing the size and frequency of occurrence of a flammable atmosphere. This information is used to specify an appropriate level of protection for electrical and mechanical equipment in the area with respect to the prevention of ignition sources. This is a key part of the Basis of Safety for areas handling flammable substances.

There are several guidance documents relating to hazardous area classification of which BS EN 60079-10[3] provides a basic outline. More detailed guidance relating to the petrochemical industries can be found in IP15[4] and for the gas industries in IGE25[7]. Whilst these documents provide guidance relating to many commonly found situations, there are still many circumstances for which there is no specific direction available. In a number of cases, the application of the guidance to a number of specific circumstances is particularly unclear, or else where conventional Hazardous Area Classification does not provide any significant improvement in the safety of the plant. In these circumstances, area classification may not be appropriate or even applicable.

BS EN 60079-10

This document forms the basic guidance for Hazardous Area Classification and contains the fundamental concepts plus a number of examples of commonly found situations. This is not an exhaustive guide to area classification and should not be regarded as such. Ventilation is covered in detail in 60079-10[3] since it is a key aspect of area classification and determines the size and persistence of a flammable atmosphere in any given situation.

INSTITUTE OF PETROLEUM

The Institute of Petroleum have produced three main guidance documents, these being References 4–6. Reference 4 gives numerous examples of zoning for many of the situations commonly encountered on petrochemical plants. This guidance is mainly applicable to larger plants such as oil refineries but also contains much useful information on such processes as road tanker unloading and tank venting which are applicable across a wide range of industries. It details two basic methodologies for area classification, these being (a) Direct Example and (b) Point Source.

The direct example approach relies on reference to worked examples (as shown in Reference 4) for generic industrial equipment. These examples can be applied directly to similar situations to give the appropriate zones. Examples of equipment are vessels, pumps, vessel vents and bunds. This methodology is relatively fast to apply given that the particular examples being considered are contained in the guidance. Reference 3 contains relatively few examples of direct examples but 4 and 7 (IGE25) contain a good selection covering many common industrial processes.

The point source release approach consists of a specific methodology to identify all possible release points and their associated release rates. This can be applied to all situations including those for which there is no direct worked example already available.

Reference 5 gives an alternative approach to hazardous area classification based on the risk to personnel in the area. This can be employed where there is no direct example or in special situations where traditional area classification methods may not be appropriate. Reference 6 gives background information to the size of zones contained in Reference 4 based on gas dispersion modelling.

INSTITUTION OF GAS ENGINEERS

The Institution of Gas Engineers has produced Reference 7 specifically relating to the hazardous area classification of natural gas systems. Again, this gives numerous direct examples of hazardous area classification. It also considers complex situations where there are numerous potential leak sources and cases where ventilation is limited for one reason or another.

HSE APPROVED CODES OF PRACTICE (ACOPs)

The HSE have produced a set of five ACOPs dealing with the specific requirements of ATEX and DSEAR (References 8–12). These contain much useful information however they are somewhat repetitive and some companies (generally in the non-chemicals sectors) have found them difficult to understand and apply.

COMMENTS ON GUIDANCE

It can be seen that there is a reasonable body of information on the hazardous area classification of various situations, however, whilst this guidance covers the majority of “normal” situations, there are a number of situations which are still relatively common, that are not covered by any of the guidance produced to date. It is, of course impossible for any guidance to cover all possible situations in detail. It is, however, possible to produce a set of guidelines indicating what steps to take when situations are encountered that are outside the available guidance.

DSEAR ACROSS INDUSTRIAL SECTORS

Experience has shown that there is a wide variation in the adoption and application of DSEAR across a range of industries. It has also been observed that the level of adoption and perception of DSEAR is highly variable across the various industrial sectors. The traditional chemical, petrochemical and pharmaceutical industries already (generally) had a high level of awareness of area classification and the control of fire and explosion hazards prior to DSEAR and therefore tend to have a relatively high level of compliance. Other industries have been found to have a much lower level of awareness and consequently a much lower level of compliance.

It has been noted since 2002 that the compliance issues tend to correlate to the particular industry. For example, the food industry tends to have an extremely low level of DSEAR awareness and therefore tend not to have identified hazardous materials or use "Ex" rated or ATEX compliant equipment. Within the pharmaceutical sector, the problem tends to relate more to the control of modifications, in particular with reference to the use of portable or semi-portable electrical equipment which is often moved between process rooms. In the fine chemicals sector, issues tend to relate to the inspection and maintenance of equipment especially in the often harsh environments found in outdoor locations or with regard to older equipment, some of which may be over thirty years old. The petrochemicals sector tends to have a problem in inspecting maintaining the large quantity of electrical equipment and instrumentation that is often installed on such plants, mainly due to lack of manpower.

EXAMPLES

LABORATORIES & AREAS HANDLING SMALL QUANTITIES OF FLAMMABLE MATERIALS

Laboratories and other areas such as pilot plants which handle relatively small quantities of flammable materials may not merit the expense of full area classification with the installation of ATEX approved equipment. Indeed, ATEX compliant equipment may not be available for the type of processes carried out in small process areas. Reference 4 suggests a practical lower limit for area classification of 25 litres of flammable liquid above its' flashpoint although this is "guidance". In practice this is usually a reasonable limit although it does not specify a maximum container size. In consideration of fire fighting, the spillage of 25 litres or even 5 litres of flammable liquid in a confined space could be extremely hazardous and therefore the guidance limit of 25 litres is subject to certain conditions to ensure the safety of personnel.

In practice, it is not generally feasible to area classify a laboratory because:

- ☐ Laboratories use a wide variety of materials and processes and therefore it is often impractical to specify maximum surface temperatures and ignition energy (Gas Group) for electrical equipment

- ☐ "Flameproof" or "intrinsically safe" electrical equipment for laboratory scale work is not generally available
- ☐ Experimental work often requires the dismantling of equipment e.g. if a reaction fails

It is, therefore suggested that, where area classification is not considered feasible and the quantities of hazardous materials are relatively small, a Basis of Safety needs to be put in place which takes into account the necessary safety precautions. This is based on the principles of inherent safety. The Basis of Safety should include the following topics:

- ☐ Limitation of the quantity of flammable materials stored in the lab area and limitations on the maximum size of container that can be stored in the area
- ☐ Adequate and properly designed storage areas for flammable materials
- ☐ Reduction of the frequency of occurrence and sizes of flammable releases by training of personnel in appropriate material handling techniques and the prevention of spillages
- ☐ Appropriate use of fume cupboards to control process and larger scale releases. Fume cupboards should be designed to appropriate modern standards
- ☐ Good area ventilation in order to prevent the build up of a flammable atmosphere in stagnant pockets and also minimise the extent of any flammable atmosphere
- ☐ Means to isolate electrical equipment in the event of a spillage or leak. The isolation point should be remote from the source of any fires
- ☐ Suitable equipment for dealing with small fires e.g. fire extinguishers & blankets and appropriate training in the use of fire fighting equipment for personnel
- ☐ Awareness of fire risks among staff working in the area along with training in dealing with spills and leaks efficiently
- ☐ Close supervision of work handling flammable materials e.g. no lone workers when handling hazardous materials in any quantity

One the basis of the points above, it is suggested that a realistic guide for the maximum amount of flammable materials that should be handled in a laboratory situation is that which, if it caused a fire, could be handled by a single fire extinguisher or fire blanket.

In practice, however, during inspections a number of significant issues have been found in areas described as "laboratories". In one particular laboratory, two compressed gas cylinders, one containing 25 kg of hydrogen and another containing 40 kg of nitrous oxide were stored inside the laboratory and connected up to analysis equipment by flexible plastic hoses with no means of rapid isolation. Compressed gas cylinders should always be located outside because they are a major explosion risk in the event of a fire.

In another laboratory area, there was up to 120 litres of Methanol and Ethanol contained in three glass distillation columns without any secondary containment in a non-hazardous area. These columns were equipped with non-certified electric heating mantles and were regularly operated at reflux under atmospheric pressure. There was no means of rapidly isolating the electrical equipment. In the same room were various items of non-hazardous area equipment including a transistor radio, telephone, laboratory balance etc and no less than 20 domestic 13 amp sockets. No risk assessment had been carried out for the laboratory and there was no written Basis of Safety for operation or Safe Working Practice document for the area. Up to three personnel were working in the area at any one time. Fire extinguishing was provided by two hand-held extinguishers which would have been totally inadequate in the event of one of the glass columns being broken.

The above examples highlight one of the common problems with laboratories in that, although hazardous area classification may not be appropriate, DSEAR still applies. Laboratories are often neglected because the hazards of handling "small" quantities of hazardous materials are underestimated. Also, the quantities of flammable materials stored in laboratory areas are often misjudged and it is not uncommon to find up to 200 litres of flammable and highly flammable solvents stored in containers of up to 25 litres capacity. This is sufficient to cause a good size conflagration if ignited.

Safety in laboratories appears to be a common blind spot for many companies in the application of DSEAR. The standard of training of laboratory staff in DSEAR has also found to be lacking in many cases.

EXPLOSIVE DECOMPOSITION HAZARD

One of the materials added to diesel fuel as a Cetane improver is known to decompose explosively at a temperature below the Auto-Ignition Temperature. The Material Safety Data Sheet (MSDS) gives an AIT of $>230^{\circ}$C. Using the AIT for this material would give a temperature class for equipment of T3 (200°C). However, on the MSDS it is also stated that the material may decompose explosively at 160°C. This may seem contradictory, however the AIT is measured under a specific set of laboratory conditions under which explosive decomposition may not occur. Thus, although equipment may be specified correctly for the AIT, there is still the potential for a decomposition reaction to occur causing an ignition and explosion hazard.

In the event, when the installation was examined, several pieces of equipment installed had a temperature class of T3. The T3 rated equipment was not generally available in a T6 temperature class and it would have been prohibitively expensive to rebuild the whole installation. Although nominally suitable for the AIT of the material, a Risk Assessment indicated that there was potential for the liquid in the system to come into contact with a hot surface above the decomposition temperature due to leaks from pipe joints and instrument connections. It was considered that this was not an acceptable situation as the conditions relating to when an explosive decomposition could occur were not well defined and thus such an event could not be excluded from the risk assessment. Since the vapour pressure of the liquid was low and the liquid well below its' flashpoint under all foreseeable operating conditions, the main hazard was believed to be from a leak of liquid falling onto a hot surface. This gave a potential route by which the potential for an explosive decomposition could be avoided.

Further examination of the installation indicated that there were only three pieces of equipment which had temperature ratings of T3 in the area, all of the others being temperature class T6 and therefore rated well below the temperature at which explosive decomposition may occur. The physical layout of the installation indicated that it would be a relatively simple and cheap modification to install shielding around the T3 rated equipment. This shielding was not meant to be gas tight but simply to prevent the impingement of any liquid on the equipment from foreseeable leak points. It was also important that the shielding did not result in an increase in the surface temperature of the equipment.

This modification was installed and inspected by qualified electrical and process engineering personnel to ensure that the design intent had been met and that the basis of safety for ATEX certified equipment had not been compromised.

This problem is somewhat unusual because very few materials have similar decomposition properties to this one. It does, however, highlight one problem whereby reference to the Auto Ignition Temperature on the MSDS can result in equipment being installed which is unsafe because it has a maximum surface temperature which could result in an explosive decomposition in the event of a leak of liquid. It is essential that all of the hazardous properties of materials are assessed by someone who has a clear understanding of flammability and explosion hazards rather than just looking at the obvious parameters of Auto Ignition Temperature and Minimum Ignition Energy.

HYDROGEN COMPRESSOR HOUSE

A Hydrogen compressor on an oil refinery was powered by taking a gas side stream and using this in a reciprocating internal combustion engine with spark ignition. There were two separate IC engines, one a V8 and the other a V12 with two and three compressor cylinders respectively. The compressor cylinders were directly coupled to the crankshaft of the engine in the horizontal plane. The gases in the system were mainly Hydrogen, Propane, Butane and Ethane which were being compressed to about 20 barg.

Hazardous Area Classification indicated that this area was classified as Zone 1/2 with a gas group of IIC (based on Hydrogen) with a temperature class of T3 (Propane). The zone extended 3 m around the high pressure hydrogen flanges.

A problem was identified by the electrical engineer who found that it was not possible to source an ignition system for the compressor gas engine which was compliant with Gas Group IIC. The only available unit was classified as Gas Group IIB. This was deemed to be unacceptable due to the potential risk if ignition.

On this basis, it was clear that Hazardous Area Classification did not provide an adequate basis of safety for this area. A decision was, therefore, taken to carry out a hazardous area classification using a risk assessment approach using the methodology contained in Reference 5. This involved a detailed examination of the potential release sources in the area and the occupancy of the particular area. The risk assessment process is relatively lengthy but it concluded that the risk to personnel from fires and explosions was well within the acceptable band.

CARRIAGE OF HAZARDOUS MATERIALS THROUGH A NON-HAZARDOUS AREA

On occasion it may be necessary to convey flammable materials through non-hazardous areas. This was the case on a paint spraying facility where paint was mixed in a room which was classified as a Hazardous Area. The paint was mixed in a 205 litre capacity drum which then had to be transported through a corridor containing a variety of non-hazardous area electrical equipment including control cabinets, light switches etc into the paint spraying booth, which is classified as a hazardous area. There was concern that a spillage of the paint, which contained a high proportion of flammable solvents, in the non-hazardous area of the corridor, could cause an ignition and fire in the factory area.

A risk assessment was carried out on the transport process which took into account various factors such as:

- The means of securing the drum lid – drums are not moved without a secured lid
- Frequency of transport through the non-hazardous area – only done twice per day
- Means of transportation – Heavy duty manual drum truck used. This is a high-quality item which provides stable and secure location for the drum in the upright position and minimises the potential for toppling
- Hazards & obstructions in the non-hazardous area – There are no obstructions in the area and doors are double opening
- Emergency arrangements – Spill kits, emergency response teams and fire extinguishers all available in the area
- Access to the area – The is limited access to the area for personnel not directly involved in working in the area
- Previous accidents and incidents – No previous incidents e.g. spillages, or leaks have been recorded

Careful consideration of all the factors concluded that the hazard due to transport of the material was very low. This was significantly aided by the high quality drum lifting and moving equipment in use on the site and the high level of training in mechanical training techniques. The requirement for transportation is a relatively frequent occurrence and has parallels in the offloading of drums of flammable material from road vehicles and the use of non-flameproof fork lift trucks for handling flammable materials.

PROCESS OPERATING ABOVE THE AIT

A number of cases have been found where the process equipment is operating well above the Auto Ignition Temperature of the materials within the process. This is a particular problem within certain distillation processes where the still bottoms may be at a high temperature. The atmosphere within the equipment is not flammable, usually being well below the Minimum Oxygen Concentration for combustion and hence there is no internal explosion issue under normal operating conditions.

In the event of a leak from such a system, there is a high probability that the released material may ignite. The leak may ignite immediately on release, in which case a jet flame may result or, in the event of a leak occurring in another adjacent part of the plant, there may be a delayed ignition of the vapour cloud causing a Vapour Cloud Explosion hazard.

This problem has also been found on a high-temperature exothermic reaction process where the surface temperature of the reactors was above the AIT of the reactants.

The case of hot oil heat transfer systems is another particular example of this problem where the oil may well be operating well above the AIT of the process materials. It should be noted that the presence of insulation, however well sealed, does not remove the ignition hazard since it is, to all intents and purposes, impossible to make insulation gas-tight.

In this case, although it is important to identify hazardous areas, it should be understood that hazardous area classification and the avoidance of ignition sources may not be the primary basis of safety. It may be necessary to carry out a risk assessment to identify the magnitude of the risk to personnel operating in the area and also with regards to the ignition of releases emanating from other areas of the plant. The risk assessment may identify additional prevention, protection and mitigation measures that need to be applied.

EQUIPMENT STANDARDS

A new control panel was ordered for a steel annealing system which operated on a 96% hydrogen/4% nitrogen mix. Hydrogen was supplied to the panel at 8 barg pressure via a 2" NB line and was let down to approximately 15" w.g. in two stages within the control panel. The panel was intended to replace an old mechanical mixing panel with a better control system and links into the plant PLC and Scada systems. Several tenders were obtained and a vendor was selected who was an experienced kiln manufacturer.

When the panel arrived on its skid, an examination showed that the electrical equipment installed was not ATEX approved. The manufacturer had supplied equipment suitable for natural gas systems (see below) which is, of course, totally unsuitable for hydrogen. (Methane is Gas Group IIA whilst Hydrogen is Gas Group IIC). Advice was given not to install the panel until the non-ATEX compliant equipment had been replaced.

This is a fairly typical case of a manufacturer of natural gas-fired equipment supplying equipment which, although it may be suitable for use with natural gas, is totally unsuitable for use with the process. The manufacturer in this case had a complete lack of awareness of ATEX and DSEAR and is an example of the lack of understanding of a number of manufacturers of the hazards of dealing with flammable gases.

POWDER MILLING

A crystalline substance was milled to an extremely fine powder in a hammer mill. From the hammer mill the product was extracted to a sack filling unit located next to the hammer mill. The final product was explosive with a Kst value of 180 bar.m/s and a maximum explosion pressure in excess of 8 barg.

Since the hammer mill was very noisy, an acoustic enclosure was required because the operator doing the sack filling was in close proximity. The engineer charged with constructing the acoustic enclosure understood that there was an explosion risk and therefore decided to build a "strong" enclosure to provide protection to the operator. The enclosure was made from 5 mm thick steel plate reinforced with angle iron profiles. The door to the enclosure was also constructed from steel and secured with domestic garage door type hinges and bolts. No ventilation system or explosion relief was installed to the enclosure.

In the event of an explosion, the acoustic enclosure would amplify the effect of the explosion, probably resulting in the disintegration of the structure due to the overpressure. At the very least, the door (weighing 60 kg) would fail and be projected across the building. This is a typical case of a lack of understanding of explosion hazards resulting in the application of a "safety system" actually increasing the hazard.

NEW/OLD EQUIPMENT

All new hazardous area equipment should, of course, be ATEX compliant and have the relevant labelling attached. On plants pre-existing the legislation, equipment will probably be a combination of "flameproof" or US "FLP" marked equipment. There is a common misconception in some quarters that old non-ATEX equipment has to be replaced. This is not correct. If a piece of equipment was designed to the correct standards for the hazards in the area at the time then it will, in all probability, remain safe for use. This should be confirmed by:

☐ Reference to the original documentation and certification
☐ Inspection and maintenance records
☐ Hazardous Area Classification
☐ Any modifications carried out to the equipment
☐ A risk assessment
☐ Would replacement equipment give an increase in safety

It is disappointing to note that some suppliers have been suggesting the complete replacement of existing flameproof standard equipment for ATEX certified units even where a detailed inspection indicates that the equipment remains fit for purpose.

NATURAL GAS SYSTEMS

Heating systems and furnaces using natural gas are found in many industrial sectors. In most cases the gas pressure in the system is less than 100 mbarg. Reference 7 from the Institution of Gas Engineers gives details of hazardous area classification for natural gas systems regardless of the pressure. From this guidance, it may be inferred that all natural gas systems should be equipped with ATEX compliant equipment e.g. solenoid valves, control systems, even operating at 100 mbar or less pressure. (In comparison, domestic systems, which are exempt from ATEX, typically operate at 20–25 mbar). Examination of the majority of natural gas systems has shown that there are extremely few installations where hazardous area "Ex" or "flameproof" equipment has been installed. This is true even on new installations where established manufacturers and suppliers are still installing non-ATEX compliant equipment on gas systems, technically in breach of the regulations. It is unclear whether some manufacturers of low-pressure natural gas systems are even aware of the DSEAR legislation.

There is a general feeling within the natural gas industry that the risk of a significant leakage is sufficiently small that hazardous area equipment is not required on low-pressure systems. Within the UK it has generally been accepted that a significant part of the risk associated with gas systems is directly related to the pressure within the system and experience within the gas industry has shown that low-pressure natural gas installations have a very low incidence of major flammability and explosion hazard problems.

The Institution of Gas Engineers and Managers (IGEM) are currently in the process preparing a set of generic risk assessments to manage the case for plant operating below 100 mbar and installed in well ventilated areas. Individual plant items or installations might still need a specific risk assessment, but a generic assessment may be sufficient in many cases. In this case compliance with the relevant engineering standards, Codes of Practice and procedures would be taken as a sufficient means of controlling risks. The use of these risk assessments, it is understood, would be to justify the use of non-ATEX equipment on natural gas systems operating below 100 mbar pressure. It is unclear whether this will also be applicable to dual fuel systems such as natural gas/propane or natural gas/fuel oil.

This illustrates the particular approach of the natural gas industry to the DSEAR regulations where strict adherence to the letter of the law would result in a high level of costs in terms of new equipment and standards without providing a significantly improved level of safety. Obviously the exception to this case would be where a natural gas system was located with the zone from another material in which case the hazards of the other material would require the use of ATEX compliant equipment and standards of protection. This is indicative of several outstanding issues relating to low-pressure natural gas systems which are not adequately covered by the existing guidance.

EXPLOSION PROTECTION DOCUMENT

The HSE do not generally use the term "Explosion Protection Document" (EPD) however it is considered to be a useful term for describing the documentation system whereby information relevant to ATEX/DSEAR compliance can be stored and easily accessed. Reference 2 states that the EPD shall demonstrate:

☐ That explosion risks have been determined and assessed
☐ That adequate measures will be taken to attain the aims of the directive
☐ Area classification will be carried out (Ref.1, Annex 1)
☐ Certain steps will be taken to reduce risks
☐ The maintenance of the workplace and equipment

A typical EPD might contain the following information:

☐ Hazardous Area Classification report and drawings
☐ Risk Assessments

- ☐ P&IDs
- ☐ Process flowsheet
- ☐ Material Safety Data Sheets
- ☐ Equipment data sheets
- ☐ Equipment certificates
- ☐ Intrinsically safe loop drawings and calculations
- ☐ Inspection schedules & reports
- ☐ Emergency plans

The EPD should be a "live" document which is continuously updated as modifications are made to plant processes and working practices.

CONCLUSIONS

Experience of ATEX and DSEAR across a number of industrial sectors and processes has shown that there are several problems that occur commonly. These can be summarised as follows:

- ☐ The principles of inherent safety are not being applied by a significant minority of companies in respect of the handling of hazardous materials leading to situations where there is an unnecessary risk of fire or explosion.
- ☐ Whilst there is guidance available for the hazardous area classification of many "normal" situations, the guidance on what to do in abnormal situations is far more limited. In practice, this means either a detailed risk assessment or else special precautions for the protection of personnel.
- ☐ There are a number of situations where the application of hazardous area classification does not necessarily provide an increased level of safety or risk reduction e.g. where there are high temperature sources present as a necessary part of the process. Again, there is little guidance available for this situation.
- ☐ Training and education of personnel, operators, managers and engineers in the requirements of DSEAR must remain a priority as there is evidence of a lack of overall awareness of the legislation (particularly outside the chemical and process industries) and, in a number of cases there is a serious lack of understanding of the fundamentals of flammability and explosion hazards.
- ☐ ATEX and DSEAR assessments and the specification of prevention, protection and mitigation measures should not be carried out by personnel who have an inadequate understanding of the fundamentals of fire and explosion hazards.
- ☐ There is scope for further guidance relating to "non-standard" situations and alternative bases of safety to the elimination of ignition sources.

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