In Association with the European Market Leaders for all of your Chemical and Hazardous Storage Requirements

Proudly Presents

The Implications of getting it Wrong
Legal foundations, rules, regulations

Why are regulations so Important?

So what is the difference between a Hazardous and a Dangerous substance?

COSHH Control of Substances Hazardous to Health 2002

- Occupational lung disease
- Silicosis and Asbestosis
- Chronic Obstructive Pulmonary Disease.
- Cancer...

DSEAR Dangerous Substances Explosive Atmosphere Regulation 2002

- Stored Energy
- Fire...
- Explosion...
- or Energetic Event...
Legal foundations, rules, regulations

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Legal foundations, rules, regulations

Why are regulations so important?

STATUTORY INSTRUMENTS

2002 No. 2776

HEALTH AND SAFETY

The Dangerous Substances and Explosive Atmospheres Regulations 2002

Made - - - - - - - - 7th November 2002
Laid before Parliament 15th November 2002
Coming into force - - - - - - - -
All regulations except for regulations
5(4)(c), 7, 11, 15(2), 16(2) and 17(1) to (3) 9th December 2002
Regulations 15(2) and 16(2) 5th May 2003
Regulations 5(4)(c), 7, 11 and 17(1) to (3) 30th June 2003
Legal foundations, rules, regulations

Why are regulations so Important?

But what are the implications of Ignoring the requirements of the LAW?

FIRE

Explosion

Energetic Event

These are the “consequences of failure” that DSEAR is aimed to both identify and mitigate against.
Legal foundations, rules, regulations

Why is *DSEAR* so Important - Example

Two Fire Fighters Killed

*Two men jailed for fireworks factory deaths*   *BBC News – 17th December 2009*
Legal foundations, rules, regulations

Why is *DSEAR* so Important - Example

Managing Director of a gas supply firm fined £25,000 for not looking after himself
Legal foundations, rules, regulations

Why is *DSEAR* so Important - Example

Brothers Ardian and Jashar Lamallari were working inside an industrial unit.

**Director jailed over the death of two illegal migrant workers in solvent vapour explosion**
Legal foundations, rules, regulations

Why is **DSEAR** so Important

Example

Wood Treatment Ltd - Bosley Mill Wood Dust Explosion 17\(^{th}\) July 2015

Four-storey building collapses in Explosion.

4 People die at the scene

2 other persons since.

The explosion was described by rescuers as the "worst incident of its kind" in a decade
Legal foundations, rules, regulations

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The explosion was described by rescuers as the "worst incident of its kind" in a decade.
But all this pales into insignificance compared to

What happened in Beirut
But all this pales into insignificance compared to what happened in Beirut.
Ship blasted out of water
Beirut blast damage
Damage assessment carried out 7 Aug

Site of explosion

- Severely damaged
- Badly damaged
- Slight damage

Source: ASA/JPL-Caltech/Earth Observatory of Singapore/ESA
https://www.youtube.com/watch?v=LNDhIGR-83w

So Why did it happened ??

Was It

In 2013 - A Russian Owned Un-Sea worthy Ship on route from Georgia to Mozambique was abandoned at the port

Taking on water, the 2750 tonne of Ammonium Nitrate was offloaded In accordance with Maritime Law

Or Was It

A total lack of understanding for Chemical Stability and Re-activity

A total lack of responsibility,
People do not learn !!

BASF Explosion Germany - Sept 1921 – 4500 tonne of Ammonium Nitrate

Outcome:

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<tr>
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<th>Germany</th>
<th>Beirut</th>
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<tr>
<td>Ammonium Nitrate Tonne</td>
<td>4500</td>
<td>2750</td>
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<td>Crater Dia</td>
<td>90 mtr</td>
<td>124 mtr</td>
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<tr>
<td>Depth</td>
<td>120 mtr</td>
<td>43 mtr</td>
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<tr>
<td>Dead</td>
<td>561</td>
<td>177</td>
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<td>Missing</td>
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<td>Injured</td>
<td>2,000</td>
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<td>Homeless</td>
<td>7,500</td>
<td>300,000</td>
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Part of any **DSEAR Risk Assessment MUST** start with a full understanding of the Dangerous Substances used.

We can **START** with the Material Safety Data Sheet (MSDS or SDS)

**What data are we looking for?**

<table>
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<tr>
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<td>Upper Explosive Limit</td>
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<td>Minimum Ignition Energy Level</td>
<td><strong>- Critical Data</strong></td>
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<td>- Acetone</td>
<td>- 0.55 mJ</td>
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<td>- Xylene</td>
<td>- 0.20 mJ</td>
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<tr>
<td>- Acetylene</td>
<td>- 0.019 mJ</td>
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<td>- Hydrogen</td>
<td>- 0.011 mJ</td>
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<td>Minimum Ignition Energy Level</td>
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<td>Gas Group</td>
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<td>Conductivity or Die-electric Constant</td>
<td>Static Electricity Potential</td>
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<td>Solvent</td>
<td>Conductivity pS/m</td>
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<td>Isopropyl alcohol</td>
<td>350,000,000</td>
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<td>Methyl acetate</td>
<td>340,000,000</td>
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<td>Propylene glycol methyl ether</td>
<td>45,000,000</td>
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<td>Methyl alcohol</td>
<td>44,000,000</td>
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<td>Ethylene glycol monobutyl ether</td>
<td>43,000,000</td>
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<td>Octyl alcohol</td>
<td>13,900,000</td>
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<td>Methyl ethyl ketone</td>
<td>10,000,000</td>
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<td>Acetone</td>
<td>6,000,000</td>
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<td>Pyridine</td>
<td>5,300,000</td>
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<td>Methyl isobutyl ketone</td>
<td>5,200,000</td>
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<td>t-Butyl alcohol</td>
<td>2,660,000</td>
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<td>Diethyl carbonate</td>
<td>1,700,000</td>
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<td>Isobutyl alcohol</td>
<td>912,000</td>
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<td>Ethyl alcohol</td>
<td>135,000</td>
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<td>Ethyl acetate</td>
<td>46,000</td>
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<td>n-Butyl acetate</td>
<td>4,300</td>
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<td>Gasoline</td>
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<td>Solvent</td>
<td>Conductivity pS/m</td>
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<td>Nn-Butyl alcohol</td>
<td>910,000</td>
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<td>Diesel</td>
<td>&lt;50</td>
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<td>Diethyl ether</td>
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<td>V M &amp; P Naphtha</td>
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<td>Cyclohexane</td>
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<td>N-Pentane</td>
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<td>Xylene</td>
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<td>n-Heptane</td>
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<td>n-Hexane</td>
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<td>Benzene</td>
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<td>Cyclohexanone</td>
<td>0.0005</td>
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<tr>
<td>Mineral Spirit</td>
<td>&lt;1.0</td>
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<tr>
<td>Aromatic Solvent</td>
<td>&lt;10.0</td>
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</tbody>
</table>
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<td>Upper Explosive Limit</td>
<td>Minimum Ignition Energy Level</td>
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<td>Minimum Ignition Energy Level</td>
<td>Combustibility Rate</td>
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<td>Gas Group</td>
<td>Blast Over Pressure</td>
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<td>T Rating</td>
<td>Kst Value - Bar Metres / Sec</td>
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<tr>
<td>Conductivity or Die-electric Constant</td>
<td>Moisture Content</td>
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</tbody>
</table>

**Compatibility or Stability and Reactivity**
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Many typical MSDS are often lacking in data

Phrases like:

Not Known or Not Determined are used

Almost none contain Minimum Ignition Energy or Gas Group.

Few detail – Stability and Re-activity sufficiently or correctly

So who’s responsibility is it to find this missing data?

How and Where From?
A substance or preparation which is Flammable, Highly Flammable or Extremely Flammable, Oxidising or Explosive,

Whether or not that substance or preparation is classified under the CHIP Regulations;

Part of any DSEAR Risk Assessment MUST start with a full understanding of the Dangerous Substances used.

The primary purpose of DSEAR is to protect the safety of workers and others who may be at risk from dangerous substances that can cause a fire, explosion or similar energy-releasing event, such as a runaway exothermic reaction.

There are a total of 17 Regulations set out within DSEAR - 2002 fully applicable as of mid 2003.

Regulations 1-3. Scope and Definition

What is a Dangerous Substance?
Part of any **DSEAR Risk Assessment** MUST start with a full understanding of the Dangerous Substances used.

Not until you understand what a Dangerous Substance is, can we start to understand what is required.

There are a total of 17 Regulations set out within DSEAR - 2002 **fully applicable as of mid 2003**.

Regulations 1-3. *Scope and Definition*

A substance or preparation which because of its **Chemical Properties** or in the Way it is Used or is Present at the Workplace Creates a Risk
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Regulations 1- 3. **Scope and Definition**

*Or*

**Any Dust**

*whether in the form of solid particles or fibrous materials or otherwise, which can*  
**Form an Explosive Mixture**  
*and is not defined under CHIP*
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Regulations 1-3. Scope and Definition

Or

Any Dust whether in the form of solid particles or fibrous materials or otherwise, which can

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Regulations 1 - 3. Scope and Definition

So what about Flammable Powders?

Most are aware of the dangers associated with flammable vapours,

However, only a few ever consider the dangers associated with potentially flammable powders such as powder paint coatings

Equally, they have the ability to form an Explosive Mixture

What is a Dangerous Substance?
Part of any DSEAR Risk Assessment MUST start with a full understanding of the Dangerous Substances used.

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So what about Flammable Powders?

Most - are aware of the dangers associated with flammable vapours,
However, only a few - ever consider the dangers associated with potentially flammable powders such as powder paint coatings

And most have the ability to create a secondary hazard in the event of Accident or Incident.
**Part of any DSEAR Risk Assessment MUST start with a full understanding of the Dangerous Substances used.**

The primary purpose of DSEAR is to protect the safety of workers and others who may be at risk from dangerous substances that can cause a fire, explosion or similar energy-releasing event, such as a runaway exothermic reaction.

**There are a total of 17 Regulations set out within DSEAR - 2002 fully applicable from the middle of 2003.**

**Regulations 1 - 3. Scope and Definition**

*Originally classified as flammable group - 4.1*

These are readily combustible solids that can be ignited by brief contact with a source of ignition, or

Are sensitive to friction, and that will continue to burn after removal of the source of ignition.
Part of any **DSEAR Risk Assessment** MUST start with a full understanding of the Dangerous Substances used.

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There are a total of 17 Regulations set out within DSEAR - 2002 *fully applicable from the middle of 2003.*

**Regulations 1 - 3. Scope and Definition**

*Originally classified as flammable group - 4.1*

This group includes a range of chemicals that must not dry out, such as Picric Acid

In effect, they are sensitive to heat or very dry conditions.
Part of any DSEAR *Risk Assessment* MUST start with a full understanding of the Dangerous Substances used.

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**Regulations 1 - 3. Scope and Definition**

*Originally classified as flammable group - 4.2*

Pyrophoric (spontaneously combustible) substances have packaging that is designed to exclude air.

If air enters a damaged package, the substance may start to burn at room temperature or when gently heated.

*What is a Dangerous Substance?*
The primary purpose of DSEAR is to protect the safety of workers and others who may be at risk from dangerous substances that can cause a fire, explosion or similar energy-releasing event, such as a runaway exothermic reaction.

There are a total of 17 Regulations set out within DSEAR - 2002 fully applicable from the middle of 2003.

Regulations 1 - 3. *Scope and Definition*

*Originally classified as flammable group - 4.3*

These substances react with water and evolve flammable gases.

Fire involving or in the vicinity of such materials should obviously not be tackled with water.
The primary purpose of DSEAR is to protect the safety of workers and others who may be at risk from dangerous substances that can cause a fire, explosion or similar energy-releasing event, such as a runaway exothermic reaction.

There are a total of 17 Regulations set out within DSEAR - 2002 fully applicable from the middle of 2003.

Regulations 1 - 3. **Scope and Definition**

*So let’s not forget.*

These Flammable Powders – despite their differing levels of reactivity in respect to Air or Water

are all now labelled with the same symbol.

This type of chemical require a special consideration and .... **Protection**
Part of any DSEAR Risk Assessment MUST start with a full understanding of the Dangerous Substances used.

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What is a Dangerous Substance?
Chemical Segregation - UK - HSG 71

Ensure you read section 10 of the Material Safety Data Sheet PROPERLY……

(Reactions and Incompatibilities)
## Additional Data Source - 2

### Chemical Segregation – VCI Concept

<table>
<thead>
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<th></th>
<th>1</th>
<th>2 A</th>
<th>2 B</th>
<th>3 A</th>
<th>3 B</th>
<th>4.1 A</th>
<th>4.1 B</th>
<th>4.2</th>
<th>4.3</th>
<th>5.1 A</th>
<th>5.1 B</th>
<th>5.1 C</th>
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**2 different flammable liquid groups**
Ammonium Nitrate

Chemical Segregation - UK - HSG 71

Pyrophoric - Fireworks
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Pyrophoric - Fireworks

Ammonium Nitrate Chemical Segregation - UK - HSG 71
These combinations should not be kept in the same outdoor storage compound or building compartment. Compartment walls should be imperforate, of at least 30 minute fire resistance and sufficiently durable to withstand normal wear and tear. Brick or concrete construction is recommended. An alternative is to provide separate outdoor storage compounds with an adequate space between them.

This is used for Organic Peroxides, for which dedicated buildings are recommended. Alternatively, some peroxides may be stored outside in fire resisting secure cabinets.
These combinations should not be kept in the same outdoor storage compound or building compartment. Compartment walls should be imperforate, of at least 30 minute fire resistance and sufficiently durable to withstand normal wear and tear. Brick or concrete construction is recommended. An alternative is to provide separate outdoor storage compounds with an adequate space between them.

This is used for Organic Peroxides, for which dedicated buildings are recommended. Alternatively, some peroxides may be stored outside in fire resisting secure cabinets.
Ammonium Nitrate  

Storage – **Ammonium Nitrate:**

Accessible Storage only for authorised persons.

Keep container tightly closed.

Storage temperature: **Without any limitation.**

Store in a dry place. Substance is hygroscopic, protect from moisture – Rain?

Store away from sources of ignition and heat.

Substance is sensitive to light, **protect from exposure to light.**
Storage – Ammonium Nitrate:
Store away from:

- Highly flammable gases.
- Highly flammable liquids
- Flammable dusts or granulates.
- Other Oxidizing substances.
- Highly toxic and toxic substances.
- Lubricating oils, vegetable oils, paint, varnishes.
- Combustible materials, paper, carton, wood.
These combinations should not be kept in the same outdoor storage compound or building compartment. Compartment walls should be imperforate, of at least 30 minute fire resistance and sufficiently durable to withstand normal wear and tear. Brick or concrete construction is recommended. An alternative is to provide separate outdoor storage compounds with an adequate space between them. This is used for Organic Peroxides, for which dedicated buildings are recommended. Alternatively, some peroxides may be stored outside in fire resisting secure cabinets.

Segregation from ISOLATE

Chemical Segregation - UK - HSG 71

What about the outside conditions?

The definition of a Fire Wall verses a Blast Wall is very important. Walls designed and certified explicitly for blast resistance will cost 5-10 times more than a normal Brick / block wall.

Regulation 6 – Para 276 states:

Fire walls, storerooms, workrooms, cabinets, ovens, cupboards, bins, ducts, trunks and casings must be sufficiently robust so that their integrity in respect of fire resistance will not be damaged by any foreseeable event.

This includes wear and tear from normal operational activities such as collision damage from vehicles or forklift trucks and blast over-pressure when the risk assessment identifies an explosion as a likely event.

Question

Will a Timber / Plasterboard Stud Fire Wall, withstand the impact from a Fork Lift Truck?

NO ....

Therefore a brick / block wall should be used as a minimum.
Part of any DSEAR *Risk Assessment* MUST start with a full understanding of the Dangerous Substances used.

Why should we be so concerned with chemical Stability and Re-activity
Part of any DSEAR Risk Assessment MUST start with a full understanding of the Dangerous Substances used.

Many Chemicals are reactive with others

Raw Lithium in water Forms Hydrogen Gas

An typical AA size battery will burn for just one minute
Part of any DSEAR Risk Assessment MUST start with a full understanding of the Dangerous Substances used.

Lithium - Highly Flammable and potentially Explosive.
Part of any DSEAR Risk Assessment MUST start with a full understanding of the Dangerous Substances used.

The primary purpose of DSEAR is to protect the safety of workers and others who may be at risk from dangerous substances that can cause a fire, explosion or similar energy-releasing event, such as a runaway exothermic reaction.

There are a total of 17 Regulations set out within DSEAR - 2002 fully applicable from the middle of 2003.

Regulations 8. Accidents, Incidents and Emergencies - Specific Hazards:

Consequences of chemical reactivity

Exothermic reaction or energetic events, that result from chemical incompatibility, are conditions every employer should consider as part of the DSEAR risk assessment.

How can you plan for an Accident? if you don’t understand the implications of how different Chemicals may “React” or “Mix” - in a fire?

Potassium Permanganate - - - - - - Glycerol?
Part of any DSEAR Risk Assessment MUST start with a full understanding of the Dangerous Substances used.

Whether it is applicable to a small warehouse or large COMAH site, the requirements in respect to Chemical Stability and Re-activity are the same.

DSEAR requires appropriate precaution to be taken to ensure Chemical reaction cannot and does not occur.

 Suppliers have a responsibility to disclosure correct MSDS data, so that persons can understand risk, however, still there are some who for what ever reason, consider this un-necessary

Some suppliers of small package quantities of Dangerous Substances, also hide behind the UN Packaging System and do not disclose appropriate data on bulk packaging.

Flammable substances are under the present system allowed to carry no flammable warming symbol on the bulk outer packaging, leading warehouse operatives into a false sense of security.
Part of any DSEAR Risk Assessment MUST start with a full understanding of the Dangerous Substances used.

Whether it is applicable to a small warehouse or large COMAH site, the requirements in respect to Chemical Stability and Re-activity are the same.

It is every Company's responsibility to ensure employees and other are properly protected from the hazards associated with a Dangerous Substance on their respective facilities.

Ignorance of the Risk is no excuse

It still equates to NEGLEGENCE
Additional Data Source - 3

https://www.dguv.de/ifa/gestis/gestis-stoffdatenbank/index-2.jsp

IFA – European Insurance Industry Data Base.
SECTION 10: Stability and reactivity

10.1. Reactivity
Concentrated solution reacts exothermically with water (moisture).

Decomposes on exposure to temperature rise: release of toxic and corrosive gases/vapours (nitrous vapours).

Violent to explosive reaction with many compounds e.g.: with (strong) reducers, with (some) bases, with organic material and with combustible materials with risk of spontaneous ignition.

Reacts violently with (some) metals.

Decomposes slowly on exposure to light: release of toxic and corrosive gases/vapours (nitrous vapours). Violent to explosive reaction with (some) metal powders: release of highly flammable gases/vapours (hydrogen).

10.2. Chemical stability
Unstable on exposure to light. Hygroscopic.

10.3. Possibility of hazardous reactions
May react violently with reducing agents.

10.4. Conditions to avoid
Direct sunlight. Incompatible materials.

10.5. Incompatible materials

10.6. Hazardous decomposition products
Nitrogen oxides. oxygen.
Don’t under-estimate the power of Chemical Reaction

Stability and Re-activity is a key issue in reviewing DSEAR

Explosions do happen!

People Do Die
DSEAR has many differing principles

Elements can change, depending on the chemicals stored,

Process and work condition,

Temperature and pressure.

The requirements for Ex Zones

The requirements for ATEX

The ATEX Coding dependant on the Chemicals used

Don’t get caught out – Training is ESSENTIAL
Our next DSEAR 3 Day Training Course

15-17th Sept
Cannock - Staffs

DSEAR with a BANG

Book On-line @ www.dsc-ltd.co.uk

or

Call 01952 947682