Electrostatic Solutions

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INSIDE THIS ISSUE:

Electrostatic spark ignites flammable liquid during portable tank filling

Around 1p.m. on October 29th 2007, a fire and several explosions happened in a chemical distribution facility at Barton Solvents Des Moines, Iowa, U.S.A. The fire started in a packaging area while a 300 gallon portable tank was being filled with ethyl acetate.

A filling nozzle was placed in the top opening of the tank and wedged in place with a steel weight. During filling, the operator heard a "popping" sound and turned to seethe tank in flames and the filling nozzle on the floor discharging solvent. An unsuccessful attempt was made to extinguish the fire before evacuation.

The fire quickly spread to the contents of a wooden framed warehouse. One employee and one firefighter were injured. Smoke and "rocketing" barrels and debris caused evacuation of nearby businesses. Barton's main warehouse structure was destroyed and their business interrupted.

The U.S. Chemical Safety and Hazard Investigation Board (CSB) found that a flammable vapour-air mixture had formed near the tank filling opening. They concluded that a spark electrostatic discharge had probably occurred between the tank body and a metal part of the filling nozzle and hose assembly, including the steel weight.

The CSB case study highlighted the need for effective bonding and grounding and fire protection practices when handling flammable liquids.

Further information:

U.S. Chemical Safety and Hazard Investigation Board Case Study No. 2008-02-1-1A (September 2008)
http://www.csb.gov/completed_investigations/docs/Barton%20Case%20Study%20-%209.18.2008.pdf

Static caused glue factory fire

A fire at Caswell Adhesives factory in Corby, Northamptonshire , UK was found to have been caused by flammable vapours ignited by static electricity. The fire destroyed the building, businesses were evacuated and residents were told to keep their doors and windows shut as a precaution as thick black smoke engulfed part of Corby.

More than 60 firefighters were required to tackle the flames and 35 firefighters were treated in hospital after breathing chemical fumes. Two people were taken to hospital for smoke inhalation.

Video and audio reports can be viewed from the BBC web site.

Further information:

BBC News 15th May 2007
http://news.bbc.co.uk/1/hi/england/northamptonshire/6656561.stm
http://news.bbc.co.uk/1/hi/england/northamptonshire/6637295.stm

For more static electricity related incidents and case studies visit our web site:
http://www.electrostatics.net/hazards/electrostatic_fire_and_explosion_case_studies.htm

If you need advice or wish us to assess static electricity risks in your processes, please get in touch to discuss how we can help.

The best laid plans...

"The best laid plans of mice and men oft go awry", wrote Robert Burns in 1785. It's certainly true of this publication—when I wrote Vol. 1 No. 1 in January 2006 I intended to follow up about twice yearly with new issues. Three years later, I've got finally round to doing another one.

Still, it's not a bad thing to be busy….

Dr Jeremy Smallwood

2009: Electrostatic Solutions 12th Anniversary

Electrostatic Solutions Ltd celebrated its 12th Anniversary in March 2009. It has been a busy few years. We've found that the technical challenges of electrostatics are matched by the demands of building and running a small business.

Marketing is always a key challenge - especially for such a specialist business which serves many different industries. We've found ourselves in many different sites from electronics manufacture to airports, petrochemical, chemical and other industrial processes, printing works, car parks, offices and retail. We've worked in Singapore, Saudi Arabia, the USA and several European countries. Our web site has been an essential part of our marketing strategy right from the beginning. It's recently been through a make-over and we work hard to make it full of useful information and links to help anyone who is interested in static electricity issues. If you can suggest any way to improve it, please get in touch.

Static spark causes explosion in liquid storage tank

Around 9.a.m. on 17th July 2007, an explosion and fire started at the Barton Solvents Witchita facility, Valley Centre, Kansas U.S.A. Eleven resisdents and one firefighter were given medical treatment. About 6000 residents of the Valley Centre had to be evacuated and the tank farm was destroyed.

The US Chemical Safety and Hazard Investigation Board (CSB) investigated the case and found that an initial explosion occurred in a vertical above ground storage tank that was in the process of being filled with Varnish Makers and Painters naptha (FP 14°C). This material can form a flammable atmosphere inside storage tanks, and can also build up static electricity due to its low electrical conductivity (high resistivity).

The initial explosion took place after commencement of transfer of naptha from the final compartment from a tanker into a 15000 gallon tank. The explosion sent the tank into the air, landing 130 feet away. The explosion was heard several miles away. Two more tanks then ruptured and released their contents intothe fire inside a containment area. Other tanks subsequently overpressured or ignited, sending tank tops, vent valves and other debris off-site into the surrounding area.

The tank had flammable vapour in its head space. CSB found that stop-start filling, air in the transfer piping, and sediment and water in the tank had caused rapid charge build-up in the tank. A liquid level guage system in the tank had a loose linkage that had probably separated during filling, causing a spark.

The CSB also commented that the Material Safety Data Sheet for the naptha product did not adequately communicate the explosive hazard. Where non-conductive flammable liquids are used, they recommended additional precautions such as inerting of the vapour space, adding antistatic agents to the liquid and reduction of flow velocity.

Further information:

U.S. Chemical Safety and Hazard Investigation Board Case Study No. 2007-6-I-KS
http://www.csb.gov/completed_investigations/docs/CSB_Study_Barton_Final.pdf

Editorial

Our work has taken us all over the world, from Singapore to Saudi Arabia, the USA and many European countries

News

The Inside Story

A key requirements of 61340-5-1 and ESD S20:20 are to have three "Plans" – an ESD Program Plan, a Compliance Verification Plan, and a Training Plan.

IEC 61340-5-1:2007 and ESD S20:20-2007 – the new worldwide ESD standards

It may come as a surprise to realise that the EN61340 -5-1 standard "Protection of electronic devices from electrostatic phenomena – General Requirements" that has been current in Europe since 2001, has now been superceded! The new IEC 61340-5-1 was published in 2007. At the same time, a new version of the ESD Association's S20:20 standard was published— these two standards are now nearly identical. The 61340-5-1 standard is accompanied by a 61340-5-2:2007 User Guide, which helps the user develop an effective ESD Control program and comply with the standard.

Dr Smallwood in conversation with M. Giles Bonnot ,the French Chief Delegate at the Munich IEC TC101 meeting.

The thought of a new ESD standard might fill with dread the heart of even a hardened ESD Coordinator – with the possibility of changes in requirements and specifications of equipment for the ESD Protected Area. Fortunately the main technical requirements of the new document are very similar to the old 61340-5-1. However, the document itself looks very different – it has been substantially rewritten to increase its flexibility and change its approach to compliance.

Flexibility is perhaps the key challenge that the IEC team needed to consider. To be accepted as a world standard the document needed to allow for the differences in industrial processes, equipment, culture, climate and environment that may be present in any member country. An ESD program designed for a cold dry Finnish winter may need to be very different from Singapore or Malaysia. Some types of ESD equipment may not be required in some processes and some clothing or footwear requirements may not be necessary or culturally acceptable in a Far Eastern climate and culture. Another objective was to update the approach to be in line with modern QA practice such as ISO9001.

The new version 61340-5-1 draws on the experience of the ESD Association ESD S20:20 standard. With some of the ESD Association standards writers also working on the IEC team, and with a new version of S20:20 also due, "unofficial" harmonisation of the two standards was

How the standards world works

The 61340-5-1 document and its User Guide 61340-5-2 originate from the International Electrotechnical Commission (IEC) Technical Committee (TC) 101 Electrostatics, who are responsible for all IEC 61340-x-x electrostatics related standards. IEC is mandated by the World Trade Organisation to produce international electrotechnical standards. IEC standards are adopted by most IEC member countries to become their national standard.

Since 1998 when 61340-5-1 was first published as a Technical Report (which does not have the status of a standard) TC101's Working Group 5 have been preparing the new version, intended to become the first truly world wide international ESD prevention Standard. When accepted by the European standardisation body CENELEC, it became a European Norm replacing the previous EN 61340-5-1:2001, and in the UK replaced BS EN 61340-5-1:2001.

IEC TC101 members are National Committees representative of participating countries, who send experts to work in the TC101 Working Groups. For the UK, the BSI committee GEL101 fulfils this role, commenting and voting on draft documents produced by IEC TC101. GEL101 comprises a variety of UK experts including representatives of the British Electrostatic Control Association (BECA), MOD and industry.

IEC tends to adopt and adapt national or industry standards. Many TC101 standards for the electronics industry are based on ESD Association standards—this also helps to harmonise these standards world wide.

(Continued from page 3)

achieved. Harmonisation of worldwide standardisation will benefit electronics manufacturers who these days often have facilities in many countries and regions.

The "requirements" of 61340-5-1 have been pared down to the minimum considered essential by the participating National Committees and experts. In contrast, the 61340-5-2 User Guide has been expanded, containing about 70 pages of excellent quality guidance.

The three plans

One of the key requirements of 61340-5-1 is that each site has to have three "Plans" – an ESD Program Plan, a Compliance Verification Plan, and a Training Plan. The old 61340-5-1 in effect gave you these plans in one document. The new 61340-5-1 expects the ESD Coordinator to write their own Plans according to their processes, facilities and needs. The ESD Program Plan will cover aspects such as the ESD equipment and EPA requirements, personnel grounding, and packaging systems used.

The Training Plan defines personnel who require ESD training, the type and frequency of the training and a requirement for maintaining training records. Methods used to ensure the training is adequate, and to evaluate trainee comprehension, must be specified.

The Compliance Verification Plan covers the periodic tests and measurements, and their frequency, that are required so that compliance to the ESD Program and Training Plans can be established and maintained in good working order.

ESD Program Requirements

A variety of essential technical and other requirements are specified in the document. It is mandatory to have an ESD Coordinator appointed to be responsible for implementing the standard each site.

It is recognised in the new standard that not all parts of the document may apply to all applications. "Tailoring" , by evaluating each requirement for the user's specific application, is encouraged. Requirements may be added, deleted or modified as a result of this evaluation, and the rationale and technical justification documented in the ESD Control Program Plan.

Handling ESD susceptible devices must be done within an ESD Protected Area (EPA). No personnel will be allowed to enter an EPA unless they have completed ESD training or are accompanied by a trained person. All non-essential insulators such as plastics and paper and personal items must be removed from a workstation where ESD susceptible parts are handled. It is recognised that not all insulating materials can be removed from the EPA – those that are essential to the process must have the ESD risk evaluated and mitigated if necessary.

The resistance and other test limits specified for equipment such as work surfaces, racks, flooring, ionisers, seats and garments are generally similar to, or the same as the old 61340-5-1., although there are a few differences.

Within the EPA, all conductive or dissipative items must be connected to ground (earth). Three types of earthing/grounding arrangement are described – grounding using the mains protective earth, grounding using a functional ground such as a rod, and equipotential bonding where no earth facility is available.

All personnel must be grounded when handling ESD susceptible components. When seated at a workstation, wrist straps must be used. When the person is standing, they can be grounded via footwear and flooring. In contrast to the old 61340-5-1, footwear-flooring grounding will be evaluated in two ways. Either the resistance from person to ground must be less than 35 MΩ, or the resistance can be up to 10^9 Ω providing the person's body voltage can be shown not to exceed 100V.

ESD packaging is one area that the standard leaves deliberately vague, saying that it must be "in accordance with customer contracts, purchase orders, drawing or other documentation." When the documentation does not define ESD protective packaging, the ESD Program Plan must do so. One reason for this flexibility is the wide range of ESD protective packaging options available to modern electronics industry. It would be difficult to specify requirements and test methods for all the types and combinations of packaging that could be used. The new 61340-5-2 User Guide gives about 8 pages of guidance on the subject.

So what does it mean for the ESD Coordinator?

In practice, if the existing ESD Program truly complies with the current 61340 -5-1 or ESD S20:20, then it will probably comply with the new 61340-5-1 in most things. Where there are differences, the ESD Coordinator should plan to update their ESD Program as soon as practicable. Where the old standard was used as the main ESD program reference document, the three plans may need to be written.

Other users may already have in-house ESD Control

The Inside Story

"Tailoring" by evaluating each requirement for the user's specific application is encouraged . Requirements may be added, deleted or modified as a result.

Program, Compliance Verification and ESD Training Plans (although they may be called something different!) which need to be checked and updated for compliance with the new standard.

When auditing to the new 61340-5-1, the auditor must first check that the 3 Plans are present and compliant with the standard. They will then check that the observed practice complies with that documented in the 3 Plans.

The ESD Coordinator of the future will have greater flexibility to make decisions to optimise their ESD Program according to their facilities and need. Some risks are that to get this right, they will need good technical understanding of ESD issues (with the help of 61340-5-2 guidance) – and the ability to resist possible pressure to rewrite the ESD program with the main objective of reducing expenditure on ESD protection!

Further information:

IEC 61340-5-1:2007. Electrostatics– Part 5.1: Protection of electronics devices from electrostatic phenomena—General requirements. ISBN 2-8318-9259-7

IEC/TR 61340-5-2:2007 Electrostatics. Protection of electronic devices from electrostatic phenomena. User guide. ISBN 2-8318-9175-2

ANSI/ESD S20:20-2007. ESD Association Standard for the development of an electrostatic discharge control program for—Protection of electrical and electronic parts, assemblies and equipment (Excluding electrically initiated explosive devices). ISBN 1-58537-121-1

Standards under development

Some projects currently under development at IEC include:

IEC/TR 61340-1 Electrostatics—Part 1: Electrostatic phenomena - principles and measurements

IEC 61340-5-3 Electrostatics—Part 5-3: Protection of electronic devices from electrostatic phenomena – Properties and requirements classifications for packaging intended for electrostatic discharge sensitive devices

IEC 61340-4-9 Electrostatics—Part 4-9: Standard test methods for specific applications – Garments

IEC 61340-4-6 Electrostatics—Part 4-6: Standard test methods for specific applications – Wrist straps

IEC 61340-4-7 Ed.1.0: Electrostatics—Part 4-7: Standard test methods for specific applications – Ionization

IEC 61340-4-8 Ed. 1.0: Electrostatics - Part 4-8: Standard test methods for specific applications – Discharge Shielding - Bags

Where to get Standards

IEC standards	IEC standards can be purchased online and downloaded from http://www.iec.ch
ISO standards	ISO standards can be purchased online and downloaded from http://www.iso.org
ESDA Association Standards	http://www.esda.org
MIL-STD-1686 and MIL-HDBK-263B	These are available on the web. We've linked to them from our web site: http://www.electrostatics.net/library/Links.htm

We can obtain and supply many English language versions of ISO, IEC, EN or BS standards for you if you wish. Phone or email us for prices and availability:

Email: standards@electrostatics.net Tel: +44 23 98090 5600

Oops!

In Issue 1 we mistakenly referred to the MIL-HDBK-256 handbook. It is in fact MIL-HDBK-263B that is the handbook associated with MIL-STD 1686. Our thanks to our astute readers who pointed out our error!

Standards

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"Excellence in electrostatic technology expertise providing client oriented solutions"

Check our web site for current seminar dates.

On-line registration is now available. A 10% earlybird discount is offered for advance registrations.

Electrostatic Solutions Ltd

Electrostatic Solutions Ltd was founded in 1998 to provide top quality electrostatics expertise in R&D and consultancy services. Our main activities are:

- ESD in electronics manufacture
- Seminars and education
- Electrostatic nuisance shocks and hazards avoidance
- Electrostatic applications and new technology development
- Specialist electrostatic R&D support to other organisations
- Electrostatic test and measurements

We are active in British and international standards development and promoting best practice and electrostatic safety in industry.

If you'd like to talk about an electrostatics or ESD issue, phone or email Dr Jeremy Smallwood: jeremys@electrostatics.net +44 23 8090 5600

Achieving a highly effective ESD Program—two day ESD management seminar

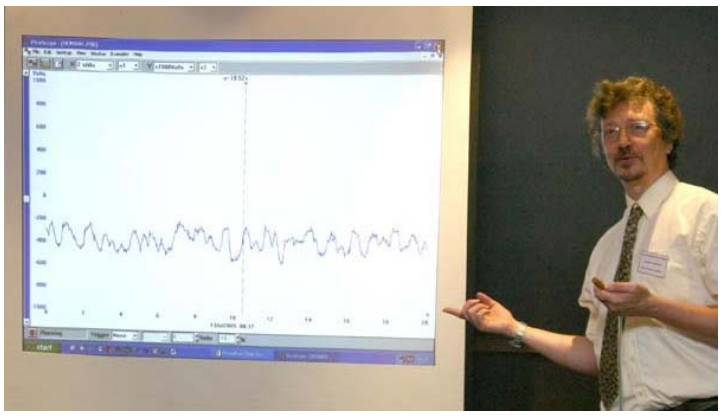
Our two day ESD Coordinator Seminar is now a regular event, attracting delegates from all over Europe.

This course is suitable for engineers and ESD professionals who need to have a good understanding of how to implement an ESD Program in electronics manufacture, including ESD Coordinators, Production engineers, Quality engineers, and anyone who needs to understand how to set up and operate a highly effective ESD program for electronics manufacture.

Delegates gain deeper understanding and awareness of static electricity and its action in the electronics manufacturing environment, and the principles of an effective ESD prevention program.

The seminar covers

- The seven habits of a highly effective ESD program
- How to achieve and assess compliance with an ESD Program
- How to make ESD measurements
- Implementing a checks, test and audit program



Dr Smallwood demonstrates live the voltage developed on a person's body while they walk

On Day 1, Dr Jeremy Smallwood's presentations and practical demonstrations use electrostatic instruments to show the reality of static and ESD. Even experienced ESD practitioners are often surprised and gain better insight from these demonstrations. The key principles of ESD prevention are concisely and clearly expressed as "the seven habits of a highly effective ESD program".

Day 2 focuses on aspects of assessment, checks and audit of the ESD program and ESD measurements required by 61340-5-1. Delegates use checklists to assess ESD program compliance, and try a selection of the most frequently used test methods "hands on".

Email: seminars@electrostatics.net

On-line registration:

http://www.electrostatics.net/seminars/Seminar101.htm