Chilworth Process Safety News

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***NEWS**!: Address by the Vice President, Fireproofing in petrochemical industries, A list of forthcoming training course, Asbestos Risk Assessment, Static charge accumulation and Discharge Mechanism ,Risk Management and services available from the Group*

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With sophisticated communication facilities, now a days the process facilities are under intense scrutiny. The public and government are pressuring the industries to improve the safety of processes involving hazardous materials to protect workers, public, equipment, and the environment. At the same time, organizations are probably facing the issues of aging facilities and depleted workforce, not to mention an ever-increasing regulatory environment. Chilworth is helping out its numerous clients with Process Safety Management (PSM) and Risk Management Programs to provide solutions to manage all these issues.

The process industry faces a number of obstacles to successful process safety management program implementation and maintenance. A one-size-fits-all approach is destined to fail since facilities—even those under the same corporate umbrella—operate in unique environments. Organizations are reaping the benefit from Chilworth's global experience with all aspects of process safety management and access cost-effective solutions to maximize their current practices and institutionalize best practices.

If you have any query or need any further information, please contact me at info-india@chilworthglobal.com
The role of Chilworth is to be a centre for Process Safety expertise & learning.

To make us your partners!

Jitendra Kumar
Vice President

FIREPROOFING IN PETROCHEMICAL INDUSTRY

Fireproofing is employed in refineries and petrochemical plants to minimize the escalation of a fire that would occur with the failure of structural supports and the overheating of pressure vessels. The damage that fire could potentially do very early on, could add significant fuel to the fire. What we really mean is fire resistant - we seek to resist potential fire situations for a given period of time. Fireproofing is passive, built-in protection that buys time to fight the fire, shut off the fire's fuel supply and shut down the process

Typically, fireproofing is designed to protect the structural steel which supports high risk or valuable equipment. The failure point is generally considered to be 1000°F, as this is the point where steel has lost approximately 50% of its structural strength. The aim then, is to prevent structural steel from reaching 1000°F for some period of time. Tanks, pressure vessels, and heat exchangers may experience a significant cooling effect from liquid contents and so, less fireproofing protection is generally required. Some thermal insulation systems may serve a dual role as fireproofing and this is common with some pressure vessels. Piping may be insulated but it is not generally considered to be fireproofed.

- For structural steel, a facility may require a fire test rating of two or three hours. Poured-in-place concrete or gunite is most common with a specified minimum thickness of 2.0 to 3.0 inches (50-75 mm). Lightweight cementitious products may also be used.

- For steel vessels, a facility may require a fire test rating of one to two hours. Gunite applied at 1.5 to 2.0 inches (40-55mm) may be required. Alternative fireproofing materials that provide a comparable fire resistance rating may be used, including systems that function as both thermal insulation and fireproofing.

- Electrical and pneumatic components (including manual initiators, valve actuators, aboveground wiring, cable and conduit) essential to emergency isolation, depressurization, and process shutdown are generally fireproofed to achieve a rating of at least 15-20 minutes. This equipment needs to function properly in the first few minutes of a fire.

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Upcoming Training Courses 2012

Month	Location	Topic
November	Delhi	Process Safety Management

For more information, please email us at Mamta.Sharma@dekra.com

Download our In-Company training courses & Training Calendar for 2012: Training Calendar 2012 **or visit www.chilworth.co.in**

Fireproofing materials

The excellent fire protection afforded by concrete has been demonstrated time and time again over 90 years of experience in the petrochemical industry. The high mass and low thermal conductivity of concrete make it very effective at reducing heat input to the underlying structure. Poured-in-place concrete, using forms, is common for columns and beams. Gunite is pneumatically applied to spheres and other structures where the use of forms for poured-in-place concrete is impractical. The principal drawback with gunite application is that it can be very messy

Post-fire inspections have shown that concrete spalls to various degrees but the general conclusion is that concrete/gunite performs satisfactorily with the steel structures well protected. Wire reinforcement is commonly used. Reinforcement does not prevent cracking and spalling of the concrete but it does minimize the loss of fractured material during a fire exposure.

ASBESTOS RISK ASSESSMENT

There is sufficient evidence on the carcinogenicity of asbestos and all commercial forms of asbestos on humans. There have been numerous studies which suggest that Asbestos is a serious health hazard commonly found in our environment today. It is therefore pertinent that companies should know where it is likely to be found in their process and how to avoid its workplace exposure

In India, asbestos is regulated under the Factories Act (1948), in which asbestosis is listed as a notifiable disease in the schedule 3 of the Act. Asbestos is also regulated under the Hazardous Wastes (Handling and Management) Rules 1989 under the Environment Protection Act (1986). Besides, the Bureau of Indian Standards (BIS) has also brought out a number of national standards and specifications relating to asbestos mining, manufacturing and handling.

Asbestos and Health Effects

Asbestos is a naturally occurring hydrated mineral silicate that crystallizes in fibrous form Minerlogically; it is classified into two major groups, namely the Serpentine, which includes the most abundant variety of asbestos that is Chrysotile and the Amphibole which includes Amosite, Crocidolite, Actinolite, Anthophyllite and Termolite. Owing to its unique attributes like heat resistance, high tensile strength, and low cost compared to man-made materials it finds application in a variety of industrial applications. It is used in the manufacture of a wide variety of products like asbestos-cement (AC) sheets, AC pipes, brake linings, textiles etc. It is also incorporated into fiction materials like brake linings, clutch pad, jointing and gaskets, sealants etc.

Asbestos in air at workplace is a major cause of concern, inhalation of asbestos fibers can be associated with three serious, and often fatal, diseases. Two of these, lung cancer and asbestosis, affect the lungs, while the third, mesothelioma, is a rare form of cancer that affects the lining of the thoracic and abdominal cavities. According to the Factories Act, 1948 the permissible exposure limit of asbestos in the workplace is 2 f/cc.

Asbestos Risk Management

The usage of asbestos is being curtailed by stringent legislation around the world. (It is banned in countries like Greece, Germany, and France etc.), however it is still an important component in many process and construction industries. The key element of concern is control of work place exposure by proper work practices and engineering controls along with their monitoring. Continued health surveillance will also add to further reinforcement of the controlled usage theory.

STATIC CHARGE ACCUMULATION AND DISCHARGE MECHANISM

Today, industries are well aware of hazards due to static electricity but still every year fire and explosions, initiated by static electricity cost them dearly. The crux lies with lack of understanding of fundamentals of electrostatics, the lack of systematic approach to the identification and control of ignition hazards and even the common misconception that static electricity is unpredictable.

In this article we focus on the Static charge accumulation, different discharge mechanisms and energy related to these discharge.

Classification of Materials

Generally, materials are divided into 3 groups depending on their ability to retain electrostatic charge even if the material is in contact with an electrically grounded conductive surface. This ability is known as volume resistivity:

- Materials with volume resistivities up to about 106Ωm are considered to have low resistivity (conductive),

- Materials with volume resistivities in the range 106 Ωm to 109 Ωm, are of medium resistivity (semi-conductive or static dissipative),
- Materials with resistivities above 109 Ωm are of high resistivity (insulating).

Electrostatic charge will accumulate on plastic surfaces if the charge generation rate exceeds the rate at which the charge dissipates (relaxes) to ground.

Electrostatic discharges

The generation and accumulation of electrostatic charge is not generally in and of itself hazardous. Rather, a hazard is created when the accumulated charges give rise to electrostatic discharges that are sufficiently energetic to ignite a surrounding flammable atmosphere, hurt operators, or create quality problems. Different Types of Electrostatic Discharges can be:

i. Spark discharges

The charge generated can cause conductors that are isolated from electrical ground - such as conductive piping and equipment - to become electrostatically charged. Charges that accumulate on isolated conductive equipment can give rise to spark-type electrostatic discharges when exposed to another nearby conductor at a lower electrical potential (voltage), such as adjacent conductive equipment that is electrically grounded, i.e., at zero electrical potential. The effective energy, E, of spark discharges is approximated as the energy stored on the isolated conductor, which can be modeled as a simple capacitor:

$$E = 0.5CV^2$$

Where E is the energy in Joules; C is the capacitance in Farads; and V is the voltage in Volts.

The capability of the isolated conductor to store charge and the extent to which it becomes charged (i.e. its capacitance and voltage, respectively), the effective energy of spark discharges is often sufficient to ignite flammable atmospheres.

It should be noted that the human body is an electrical conductor, so electrostatic discharges from charged personnel are spark-type discharges. Personnel can be isolated from electrical ground by footwear and flooring that are insulating in electrostatic terms. Isolated personnel can become electrostatically charged by contact electrification as they walk around the process area, by conduction while holding electrostatically-charged containers and tools, or by induction simply by being near an operation where electrostatic charge is generated. Such discharges can have an effective energy of the order of 20 to 30 MilliJoules (mJ) and thus are sufficiently energetic to ignite most vapor/air mixtures.

ii. Brush discharges

Brush-type electrostatic discharges occur between charged items made from non-conductive, insulating materials, such as plastics, and nearby conductors at a lower electrical potential (voltage), such as grounded conductive equipment and personnel. The resistivity of nonconductive materials is described according to NFPA 77, and is shown in Figure below.

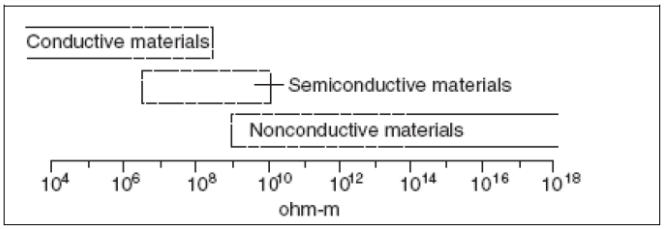

Fig 1: Resistivity of Materials

Brush discharges can have an effective energy of as much as 4 mJ, and thus can be sufficiently energetic to ignite flammable gases and the vapors evolved from flammable liquids, many of which have MIEs that are much less than 4 mJ.

The plastic items can become electrostatically charged: (a) by contact with an electrically insulating liquid during filling, pouring (emptying), and stirring; and (b) when handled, wiped or rubbed by personnel. For example, a plastic container may become electrostatically charged during the pouring of an insulating liquid. The charged plastic container could give rise to a brush discharge as it is brought close to the vessel into which the liquid is being poured.

Brush discharges can also pose an ignition hazard in the event of a leak or spill around a plastic item, or when plastic items such as containers, plastic sheeting, and drum pumps are used to clean up spills and leaks of flammable liquids.

iii. Propagating brush discharges

Breakdown voltage is the voltage at which the insulating property of a material fails, and an electrical arc is able to puncture or cause a pinhole in the material. These highly energetic discharges have effective energies of as much as 2 to 3 Joules, and can ignite flammable mixtures, including vapors evolved from flammable liquids.

Both propagating and brush-type discharges arise from electrostatically charged insulators. The difference is that brush discharges arise when there is a single-layer charge on one side of the insulator, while propagating brush discharges arise when there is a double-layer charge - i.e., charge on both sides of the insulating surface. The second layer of charge can be provided either by image charge or by ionization of the atmosphere on the opposite side of the insulator.

An image charge is the opposite-polarity charge that is attracted to the charge on an insulator as a result of the polarization of the otherwise-balanced charge in the conductor. The double layer charge enables more of the charge to "propagate" to the primary discharge channel (perforation of the insulating barrier), and accounts for the higher energy of propagating brush discharges. It is known empirically that the insulating materials with a thickness of less than 8 millimetres (about 1/3 inch) and having a breakdown voltage of 4 kV or greater are capable of giving

rise to propagating brush discharges
Thus, in order to produce propagating brush discharges, a material must be relatively thin, but have a high dielectric strength. For Example, the PTFE liners, and glass-lined conductive vessels.

RISK MANAGEMENT

Risk management is the identification, assessment, and prioritization of risks (defined in ISO 31000 as the effect of uncertainty on objectives, whether positive or negative) followed by coordinated and economical application of resources to minimize, monitor, and control the probability and/or impact of unfortunate events. Risks can come from project failures (at any phase in design, development or production, accidents, natural disasters as well as deliberate attack from an adversary, or events of uncertain or unpredictable root-cause. Several risk management standards have been developed including the National Institute of Standards and Technology, ISO standards etc.

Identification & Assessment

After establishing the context, the next step in the process of managing risk is to identify potential risks. Risks are about events that, when triggered, cause problems. Hence, risk identification can start with the source of problems, or with the problem itself. Once risks have been identified, they must then be assessed as to their potential severity of impact (generally a negative impact, such as damage or loss) and to the probability of occurrence

Create a risk management plan

According to ISO/IEC 27001, the stage immediately after completion of the risk assessment phase consists of preparing a Risk Treatment Plan, which should document the decisions about how each of the identified risks should be handled
Effective risk management is not something easily accomplished for any project organization and the larger your group the more work it will take to develop and implement an effective risk management program. To develop such a program requires a systematic approach to allow the development of various interrelated processes that must reflect your projects organizational structure. It is difficult but the effort is worth it as it will lower your project risk exposure in all risk areas which will ultimately result in reduced costs and a good reputation (for you and your company).
The goal of risk management is to first ensure all your project hazards are identified and assessed; the identified risks are mitigated to as low as reasonably practicable; and then to ensure the identified mitigations are implemented effectively. Risk management is required at all stages of a project. It is required for managing design risks, construction risks and operating risks. There are many synthesis techniques that are required in order to ensure effective risk management

The most common technique is the risk assessment, which itself consists of a variety of synthesis processes. Oil and Gas projects are typically very complicated, requiring years to design and build with many years of operation. There are many complicated activities that require effective risk management and the most effective risk assessment will vary, depending on the type of activity to be assessed

Types of Risk Assessments for Oil and Gas Projects

There are many different types of risk assessments used on oil and gas projects. They can be categorized into two types: Quantitative and Qualitative.
Quantitative risk assessments (QRA) examine the design from a leak frequency perspective. They quantify the number of leak sources on a facility and the type of equipment and then utilize historic equipment failure databases to determine leak or failure frequency and the resulting consequences of those leaks or failures based on calculations and computer modeling. Such typical QRA's are: Fire Consequence Assessments, Blast Overpressure Assessment, and Dropped Object Assessment.

Qualitative risk assessments examine the design based on a structured peer review process, where a group of experts gather to examine the relevant details and then collectively assess the potential for an event and its consequences. The most common types of qualitative risk assessments are: Hazard Identification review (HAZID), Hazard and Operability review (HAZOP), Risk Scenario Analysis (RSA) and What-if review. Each has their benefits and some fits better at certain phases of a project. HAZID is more common in early project phases and RSA and What-if are more common in middle to later phases of a project. HAZOP is common for all project phases.

Risk management regarding natural disasters

It is important to assess risk in regard to natural disasters like floods, earthquakes, and so on. Outcomes of natural disaster risk assessment are valuable when considering future repair costs, business interruption losses and other downtime, effects on the environment, insurance costs, and the proposed costs of reducing the risk. For the offshore oil and gas industry, operational risk management is regulated by the safety case regime in many countries. Hazard identification and risk assessment tools and techniques are described in the international standard ISO 17776:2000, and organizations such as the IADC (International Association of Drilling Contractors) publish guidelines for HSE Case development which are based on the ISO standard. Further, diagrammatic representations of hazardous events are often expected by governmental regulators as part of risk management in safety case submissions; these are known as bow-tie diagrams. Chilworth Technology Pvt. Ltd. provides services that help our oil and gas industry clients manage their risk in a prioritized manner, and then communicate risk judgments effectively

Chilworth Consulting Capability

Safety Management
- Regulatory Compliance Support

Technical Specialist Areas
- Hazard Assessment and Risk Analysis
- Explosion Prevention & Protection
- Modelling
- Chemical Reactions
- Energetic Materials
- Electrostatics
- Fire Prevention & Protection
- Occupational Health & Safety
- Reliability
- Protection & Equipment
- Inert Gas Protection
- Instrumentation and Equipment
- Pressure Vessels

Project Engineering

Incidents & Support
- Incident Investigation
- Litigation Support

Insurance Risk

Environment

Testing Capabilities

Process Safety

Special Testing
- Laboratory Testing
- Field Tests (Large Scale)

Explosion (Deflagration)
- Dust
- Gas / Vapour
- Hybrid
- Aerosol

Thermal Stability / Chemistry
- Chemical Reaction Hazards
- Powder Thermal Stability
- Chemical Process Optimisation

Explosion (Detonation)
- Propellants / Pyrotechnics
- ExplosivesFire
- Mattress / Furniture
- Custom Tests
- Full Scale Simulation

Electrostatics
- Process Problems
- Applications
- Safety Test

Regulatory
- UN / DoT Transportation
- Classification Packaging Labelling (CPL)
- MSDS
- Notification Registration Evaluation
- REACH

Training Capabilities

Organisation & Compliance
- Process Safety Management
- Process Safety Culture
- COSHH
- OSHA Dust Explosion Prep Training
- ATEX 137 / DSEAR
- Environment / Integrated Management Systems
- Process Hazards Analysis

Technical Specialist
- Dust Explosion Prevention & Protection
- Control of Static Electricity
- Gas & Vapour Explosions
- Chemical Reaction Hazards / Thermal Stability
- Hazardous Area Classification
- HAZOP

Protection & Equipment
- IEC 61508/11 SIL Levels
- ATEX 94/9
- Hazardous / Electrical Area Classification
- Vent Design (Explosion, Pressure, Reactor Protection)

Instrument / Equipment Supplies (Chilworth Systems & JCI)

Process Safety Laboratory Equipment (Chilworth Systems)

Special Equipment
- Large Scale Explosion
- High Pressure / Temperature
- Custom Design

Explosions
- Dust / Gas / Vapour
- Explosion Testing

Thermal Stability Chemistry
- Reaction Hazard Screen Tools
- Adiabatic Calorimeter
- Powder Thermal Stability

Fire
- i-Cal (Fire Calorimeter)

Electrostatic Equipment (JCI)

Laboratory Equipment
- Electric Field Meter / Volt Meter
- Charge Relaxation Time
- Charge Measurement

Field Test Equipment
- Lightening Warning
- Adverse Conditions Equipment

Regulatory (Systems)
- Physical or Chemical Properties Measurement

Client Base:

The client base of Chilworth Group covers well over 55 countries and 800 companies. The client base of CTPL covers many Asian countries and includes companies in the sectors such as petrochemicals, refineries, fine chemicals, pharmaceuticals, bulk organics, food stuffs, paints & resins, dyestuffs, pigments, agrochemicals, soaps & detergents, oil and gas, buildings. Over last 6 years CTPL has worked for more than 200 reputed companies; **to name few** –

Jubilant Life Science, Hikal Ltd., GFL,Ranbaxy, Nicholas Piramal, GSK, Mylan Labs, Arch Pharma, Actavis, Astra Zeneca, Reliance Industries, Greater Nile Petroleum Operating Company (Sudan), Petroleum Development of Oman, Abudhabi Oil Company, Merck Ltd., Tata Chemicals, Dr. Reddy's, Syngenta, United Phosphorus, Pidilite, Sandoz, MGL, IOCL, ONGC, HPCL, GAIL, Atul, GE India, MoEF, APWD, Orion Corporation Adani Petronet, Maruti Suzuki India Ltd., Technip, Cairn Energy, HCL, ACC,NPCC,Gujarat Fluorochemicals Ltd.