Chilworth India 2010
Process Safety News
Issue 2

News! Update on OSHA Standards, Introduction to Emergency Relief System designs, brief explanation on Compatibility of Chemicals and Safe Storage Risk Assessment, recent events in Jaipur and Safety Integrity Levels introduction & determination. Access to Upcoming events all over India and list of services available across the Chilworth Global!

Dr. Sampuran Singh
CHAIRMAN
Chilworth Group of Companies

New Horizons

Innovation and change are the life blood of any company. Here at Chilworth Global India office we are pleased to welcome Mr Jitendra Kumar, who joins us as Vice President of Chilworth Global India.

Jitendra is a Chemical Engineer who joins us with extensive experience in the oil & gas industry in India and throughout south-east Asia and has performed a great many consultancy projects in a variety of safety aspects including HAZOP, HAZID, SIL, QRA, Audits, Emergency Systems, Dispersion Studies and also Process Engineering.

Based in our New Delhi office, Jitendra will also be responsible for our offices in Mumbai and Chennai.

Dr Andy Starkie, Technical Director of Chilworth Global India will continue to bring European expertise to the dedicated team of expert Consultants in our India offices. Chilworth Global India being part of the Chilworth Global group provides access to over 60 process safety specialists from our offices in the USA, UK, France, Italy and Spain.

Our close collaboration with clients and access to international in-house specialist engineers makes Chilworth Global your expert partner in process safety.

New Product – Safety Team Selection (STS)

David Newton
Group Finance Director

As part of the Safety Culture consultancy range which includes PSM, the broad CSICB product and our Behaviour Based Safety (BBS) training programme, Chilworth India has recently introduced a new product, Safety Team Selection (STS).

STS is based on profiling personal styles of behaviour. We first identify the key behaviours that we would expect for a particular team to be successful; e.g. the ability to motivate others; the ability to build and apply standard operating procedures; a focus on results and deadlines; and the ability to cope with rapid change.

Chilworth invite clients to complete their online personal behavioural profiles using the internationally established Thomas International 'DISC' profiling software having Chilworth's Senior team members as licensed practitioners. Behaviour profiles generated by software's are substantiated by performing individual interviews which also includes a cross- referencing process to consider opinions of peer-group.

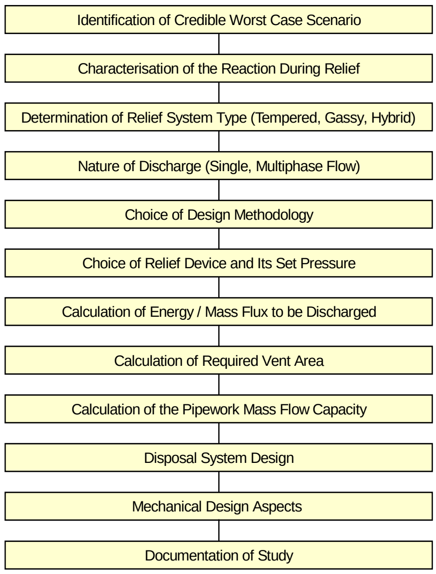
EMERGENCY RELIEF SYSTEM DESIGN

Introduction

An emergency pressure relief system is the most frequently employed Basis of Safety option for overpressure reactors and other processing equipment. However, the correct specification and operation of the emergency pressure relief system is critical for the safety of staff and the environment. The emergency relief system must be designed specifically for an individual process and installation; a "standard" size undertaken by an engineering contractor or equipment supplier will often be inadequate, unless all of the aspects of a process have been fully assessed. The design must consider all credible failure conditions, including runaway reactions, chemical decomposition and fire engulfment, as well as physical overpressure events. The sizing calculations will frequently have to be performed for a two-phase flashing fluid discharging from the relief device, with downstream treatment facilities being required to provide environmental protection. Mechanical construction of the vessel and pressure relief vent will need to take into consideration the large reaction forces associated with emergency venting.

Design Procedure

The state-of-the-art design methods for relief systems are based upon the work of DIERS (Design Institute for Emergency Relief Systems) and subsequent supporting research. The principle steps in a procedure for the design of an emergency relief system follow an established flow chart:



How Chilworth can help

Chilworth Technology has a team of specialists with significant expertise in performing emergency pressure relief vent sizing studies.

Chilworth Technology Pvt. Ltd
Delhi office: 011 2613 6979; Mumbai office: 022 6694 2350; Chennai office: 044 4212 5445
Email: info@chilworth.co.in Web: www.chilworth.co.in

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We are able to conduct or offer advice on all aspects of emergency pressure relief design. Notably, we can integrate the initial hazard assessment and choice of worst case design scenario with the generation of the necessary data in our specialist laboratories. This means that we are particularly well placed to interpret the results in the context of their influence on the relief system design. Further, we can undertake the design of appropriate secondary treatment facilities, provide data to enable mechanical engineering calculations to be performed, and can provide the full specification for the whole emergency relief vent system. Finally, we can provide in-company training courses on emergency pressure relief design tailored to your specific requirements.

COMPATIBILITY OF CHEMICALS AND SAFE STORAGE RISK ASSESSMENT

Introduction

Handling and storage of dangerous chemicals is an inherent part of chemical manufacturing industry. Dangerous chemicals are used as raw materials, intermediates, catalysts and other inputs in production process. Reactivity of these chemicals under controlled & intended conditions is the main driving force to produce newer molecules. Compatibility of Chemicals is the major concern for any chemical manufacturing unit in their day to day storage, handling and processing

Classification under Dangerous Substances

- Orange book created by U.N, divides the dangerous substances into risk groups.
- Dangerous chemicals are accorded four digits identification number termed as UN number, according to accepted UN categories for transport of dangerous substances. Example: Ammonia has UN No. of 1005

Classification under Risk groups

Risk Group 1 – Explosive substances
Risk Group 2 – Gases
Risk Group 3 – Flammable Liquids
Risk Group 4 – Flammable Solids
Risk Group 5 – Oxidizing Substances
Risk Group 7 – Radioactive Substances
The above risk groups are further subdivided into various sections

How Chilworth can help

Chilworth can offer assistance for the documented system to carry out safe storage based on the compatibility of chemicals while they are been handled, used or stored anywhere. Chilworth can help their customers to identify and prepare the Risk matrix and safe separation distances while storing in the facility.

Dr. Andrew Starkie presenting seminar on Protecting Against Runaway Reactions at Vadodara in May 2010

Mr. T M Anand presenting seminar on Dust Explosion Hazard Assessment at Rudrapur in February 2010

JAIPUR STORAGE TERMINAL FIRE ACCIDENT

Introduction:

Storage tanks in refineries and chemical plants contain large volumes of flammable and hazardous chemicals. A small accident may lead to million dollar property loss and a few days of production interruption. A large accident results in lawsuits, stock devaluation. Learning from the past history is definitely important for the future safe operation of storage tanks.

Large-scale tank fires are very rare, they present a huge challenge to fire fighters, oil companies and the environment. As the burn out procedure will result in a fire that is likely to last several days, complete loss of the stored product, environmental problems, large cooling operations to protect fire spread to adjacent storage tank.

Common tank fire hazards:

The types of fires that were identified such as partial rim seal fires overfill fire, vent fire.

Tank Type	Floating Roof Internal	Floating Roof External	Doomed	Fixed Roof
Overfill Fire	Yes	Yes	Yes	Yes
Vent Fire	Yes	No	Yes	Yes
Rim seal Fire	Yes	Yes	Yes	No
Obstructed full surface fire	Yes	Yes	Yes	Yes
Unobstructed full surface fire	No	Yes	No	Yes

Jaipur Fire Incident:

In the evening shift of October 29, 2009, the Indian Oil Corporation's (IOC) Terminal at Sanganer in Jaipur was preparing to transfer Kerosene (SKO) and Motor Spirit (MS) to the neighbouring BPCL Terminal, a routine operation for these Installations. Kerosene was "lined up" first and thereafter the operating crew proceeded to prepare the MS tank (tank 401-A) for pumping to BPCL installation In the process of lining up the MS tank, at about 6.10 PM, a huge leak of the product took place as a jet of liquid from the "Hammer Blind Valve" on the delivery line of the tank leading to the MS pump. After about an hour and 15 minutes of the leak having started, there was a massive explosion followed by a huge fireball covering the entire installation. It is estimated that in this one hour and 20 minutes of uncontrolled leak, about 1000 tons of MS could have escaped out, which would have generated enough vapour to cause an explosion with the equivalence of 20 tons of TNT. The source of ignition, which triggered the explosion and fire, could have been from one of the non flame proof electrical equipment in the Administrative Block, or from a vehicle being started in the installation. 11 people lost their lives in the accident – 6 from IOC and 5outsiders, and several others were injured. The total loss estimated on account of the fire and explosion as reported by IOC is Rs. 280 crores.

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The fire which followed the explosion soon spread to all other tanks and continued to rage for about 11 days. The management of IOCL had taken a considered decision to allow the petroleum products to burn out to avoid further possibilities of accident in the installation in the interest of public safety. Ultimately the entire, about 60,000 KL of petroleum products stored in the Terminal at the time of the accident was consumed in the fire, and the installation was totally destroyed. Buildings in the immediate neighbourhood were heavily damaged with minor damages and window panes breakages occurring up to around 2 Km from the site.

Source: IOSD Investigation report

Conclusion:

It is impossible to eliminate the risk of storage tank fires, the risk can be substantially reduced by ensuring that proper design, operation and maintenance guidelines are in place and are followed.

Most of those tank accidents would have been avoided if good engineering in design, construction, maintenance and operation has been practiced and safety management program has been implemented and executed.

UPCOMING SEMINAR

Date	Venue	Topic
July 27, 2010	Kolkata	BBS
July 28, 2010	Baddi	Process Hazard Analysis
October 6 & 7, 2010	Aurangabad	Process Safety Symposium
October 7, 2010	Chennai	Process Safety Symposium

SAFETY INTEGRITY LEVEL

Introduction

Safety instrumented systems (SIS) are used to provide safe control functions for processes, e.g. emergency shutdown (ESD), fire detection and blowdown functions. SIS typically are composed of sensors, logic solvers and final control elements. Due to the critical nature of such systems, OSHA recognizes compliance with the standard ANSI/ISA S84.01 - Application of SIS for the Process Industries - as a good engineering practice for safety instrumented systems. This is a consensus standard for the application of SIS for the process industries, which is based on international standards from the International Electro technical Commission (IEC).One of the standards is IEC 61508, Functional Safety of Electrical/Electronic/Programmable Electronic Safety-Related Systems, Parts 1-7, 1998. It is an umbrella standard applicable to all industries. IEC is in the process of developing a process-industry-specific version of IEC 61508 based on ANSI/ISA S84.01 i.e. IEC 61511, Functional SIS for the Process Industry Sector. Part 1 of the standard, IEC 61511-1 (Ed. 1.0) "Framework, definitions, systems, hardware and software requirements" is now available from IEC. Part 2 of the standard, IEC 61511-2 (Ed. 1.0) "Guidelines in the application of Part 1" will be published shortly and Part 3, IEC 61511-3 (Ed. 1.0) "Guidance for the determination of safety integrity levels" is scheduled to appear in June 2003.

What is a SIL?

A SIL is a statistical representation of the reliability of the SIS when a process demand occurs. It is used in both ANSI/ISA-S84.01 and IEC 61508 to measure the reliability of SIS. Both ISA and IEC have agreed that there are three categories: SILs 1, 2 and 3. IEC also includes an additional level, SIL 4, which ISA does not. The higher the SIL is, the more reliable or effective the system is.

SILs are correlated to the probability of failure of demand (PFD), which is equivalent to the unavailability of a system at the time of a process demand.

What is Target SIL?

ANSI/ISA S84.01 and IEC 61508 require that companies assign a target SIL for any new or retrofitted SIS. The assignment of the target SIL is a decision requiring the extension of the Process Hazards Analysis (PHA). The assignment is based on the amount of risk reduction that is necessary to mitigate the risk associated with the process to an acceptable level. All of the SIS design, operation and maintenance choices must then be verified against the target SIL.

Standards and Regulations relating to SIL Analysis

ANSI/ISA-SP-84.01, "Application of Safety Instrumented Systems for the Process Industries," Instrument Society of America Standards and Practices, 1996. IEC-61508,"Functional Safety: Safety Related Systems," International Electrotechnical Commission, Technical Committee (1998). IEC-61511, "Functional Safety: Safety Instrumented Systems for the process industry sector", International Electrotechnical Commission, Technical Committee (Draft). "Programmable Electronic Systems in Safety Related Applications", Health and Safety Executive, U.K., 1987. 29 CFR Part 1910, "Process Safety Management of Highly Hazardous Chemicals; Explosives and Blasting Agents", Occupational Safety and Health Administration, 1992

When should you use SIL?

ANSI S84.04 requires that companies assign a target SIL for all SIS. As well, after a PHA study, the study team may determine that certain critical systems require that a SIL be assigned. The assignment of the target SIL is a decision requiring the extension of the Process Hazards Analysis (PHA). The assignment is based on the amount of risk reduction that is necessary to mitigate the risk associated with the process to an acceptable level. All of the SIS design, operation and maintenance choices must then be verified against the target SIL.

SIL Methodology

The first step for assignment of Target SIL is to use your (updated) PHA's or conduct new PHA's to screen for the hazards. HAZOP is most commonly used methodology. If the risk is unacceptable then it is reduced or eliminated using non-SIS or SIS elements. You consider SIS only after all the non-SIS protection layers has been considered. HAZOP's identify risks in terms of the likelihood and the severity of the hazards. Target SILs are assigned to SIF's of the SIS identified in the PHA studies. Various methodologies are available for assignment of target SILs. As in the case with PHA studies, the assignment of Target SILs must involve people with the relevant expertise and experience. Methodologies used for determining SILs include, but are not limited to:

- Consequence only
- Risk Graph
- Layered Risk Matrix
- Risk matrix
- Layer of protection
- Fault tree analysis

How Chilworth can help

Chilworth can offer quality SIL determination in accordance with the functional safety requirements of the IEC 61508/11 lifecycle phases: -

For New Projects:-

- Hazard Studies for the necessary Lifecycle Phases.
- Development of Risk Matrices to ensure risk reduction values as determined meet ALARP principles.
- SIL Determination studies and supporting documentation.
- Development of the overall Basis of Safety including contribution from other layers of protection e.g. Mechanical Relief.
- Technical reviews of proposed new Instrumented Architectures and Proof Test Frequencies.
- Functional Safety Assessments and/or verification of Basis of Safety assumptions.

For Existing Plants:-

- Review of the current operating Basis of Safety.
- Identification of PFD average values for existing trip and alarm loops.
- Verification between existing risk reduction measures and corresponding analysis of existing hazards expressed as a required SIL for the existing trip systems.

Re-design or improvements to meet necessary levels of risk reduction covering all layers of protection, i.e. Trips, Relief Valves, Bunds and Emergency

CHILWORTH GLOBAL SERVICES

Consulting Capability

Organisation & compliance

- 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
  - Powder Thermal Stability
  - Chemical Process Optimisation
- Explosion (Detonation)
  - Propellants / Pyrotechnics
  - Explosives
- Fire
  - Mattress / Furniture
  - Custom Tests
  - Full Scale Simulation

Electrostatics

- Process Problems
- Applications
- Safety Test

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