Chilworth

ASIA
Experts in Environment, Health & Process Safety

Newsletter, June 2009

2009 Issue 1

Welcome to CHILWORTH ASIA's Newsletter – 2009, Issue-1.
Issue Includes: NEWS BYTES ⊃ EMERGENCY RELIEF SYSTEMS ⊃ FIRE WATER HYDRAULICS ⊃ WASTE MANAGEMENT IN INDUSTRIES

Mr. Ravi Hariramani –
Vice President,
Chilworth Technology

Dear Friends,

Newsletters are our endeavour to keep you alongside the progress made at Chilworth. We at Chilworth are grateful, to our patrons for showing continuing faith and confidence in us, as we enter our sixth year of providing solutions for process safety and environment in the Asian region.

Successfully completing its first year of operations, our Chennai office has made our foundation even stronger. Beyond the Indian boundaries, Chilworth spreads its knowledge in China and Malaysia through international projects on Process Safety.

Given that economic slowdown is an excuse to avoid safety measures, preventive and proactive actions are important to ensure safe and healthy working conditions even during these troubled times. *"IF YOU THINK SAFETY IS COSTLY, TRY AN ACCIDENT!"*

If you need expert advice on safety make Chilworth your trusted HSE partner. You can send your queries / feedback / suggestions to me at info@chilworth.co.in.

Mr. Ravi Hariramani & Mr. Nigel Allen presenting at the PSM Seminar at China Lighting Power, Beijing

NEWS BYTES

➢ ARTICLES PUBLISHED

January 2009 - Static Electricity and the Pharmaceutical Industry in Chemical News by Mr. Ian Pavey

January 2009 – Process Safety Indicators in Chemical Engineering World by Mr. Ravi Hariramani

March 2009 - Hazard Identification and Risk Analysis in Chemical Industry Digest by Mr. Narayanan

Please CONTACT us for copies of the articles at info@chilworth.co.in

➢ RECENT EVENTS

Our UK Operations Manager, Dr. Steve Rowe presenting at the "Protection against Thermal Runaway Reactions Seminar" in Hyderabad and Mumbai.

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Our Technical Manager, Ms. Rekha Sharma, conducting workshop on BBS in Mumbai

UPCOMING EVENTS on Page 3

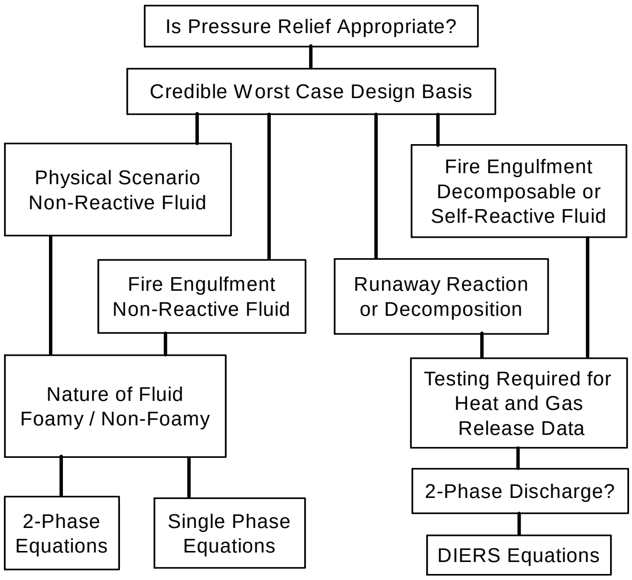
EMERGENCY RELIEF SYSTEMS

An emergency pressure relief system is the most frequently employed Basis of Safety option for overpressure protection in the chemical, pharmaceutical and allied industries. It can provide protection to reactors, storage tanks, dryers 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. This whole design procedure requires a structured approach in order to reliably assess the system requirements and generate a comprehensive design dossier.

Design Procedure

The design philosophy to achieve this must be systematic as the flow chart below shows.



In the case of exothermic reactions or thermal decompositions, loss of control will often result in a self-accelerating reaction and consequent exponential rise in the heat release rate. If one of the products of the reaction is a gas, as often happens with decomposition, the pressure in a closed vessel will rise; equally, as the temperature rises, the solvent vapour pressure will increase. For calculations to be performed, it is important to be able to distinguish the dominant mode of pressure generation and assess its rate. Once the emergency relief vent opens, the discharge is generally a multi-phase fluid, with a high proportion of liquid accompanying the vapour or gas, and possibly solids as well. Some systems will continue to disengage vapour during relief, whilst naturally foamy materials will discharge two-phase throughout the venting period often completely emptying the vessel. These characteristics must be known in order to apply the appropriate calculation method. As the pressure falls along the vent line, the gas phase will expand and the saturated liquid phase will flash to vapour, often leading to multiple choking that reduces the relieving capacity. The calculation procedure must be able to recognise and account for this behaviour.

Environmental pressures make it unacceptable to discharge reacting, flammable or toxic materials directly to atmosphere and consequently secondary

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treatment facilities have to be considered. The presence of secondary treatment plant will often adversely affect the flow capacity of the relief system and must be accounted for in the design. 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.

Provision of Data

Clearly any emergency relief system designed to accommodate an exothermic event will require a certain minimum data set to permit the design calculations. This data will describe the overall kinetics, thermochemistry and physical property characteristics under the relief conditions. This is achieved by conducting adiabatic calorimetry to simulate the failure condition

Special Cases

In addition to the straightforward approach of the 'standard' DIERS methodology, a number of more complex cases are occasionally encountered in industrial situations. These include systems where the fluids increase in viscosity during reaction (e.g. polymerisations), fluids containing a high proportion of solids, fluids with immiscible liquid phases, systems having a significant degree of dissolved gas and those close to the thermodynamic critical condition of the solvent. These cases are more complex and will require more detailed consideration and additional data.

➢ UPCOMING EVENTS

September 08, 2009 – Kolkata - Behaviour Based Safety Workshop

September 10, 2009 – Chandigarh – Flash Fire and Explosion Hazards Workshop

Please contact us for reservation at info@chilworth.co.in. ***Register early to avail Early Bird Discounts!***

FIRE WATER HYDRAULICS

Fire Hydraulics is the branch of fire safety where, the theoretical water demand, actual water demand and appropriate line sizes are calculated, for

1. The Fire Water ring mains.
2. The Deluge Spray System.
3. The Sprinkler System.

The Fire Water Ring Main:

The ring main is the spine of the entire fire fighting system that conveys the required extinguishing water from the pump/reservoir to the area on demand.

It is sized by calculating the maximum water demand for the unit as per local, national and international standards.
The best engineering practice is to provide a ring of uniform diameter around the outer periphery of the unit, with networks for maximum reliability.
The parameters for line sizing once the demand is calculated is the velocity and pressure loss, which are to be adjusted as per best design.

The Deluge Spray System:

The design development for the deluge system is as per the following calculations:

- ➢ Preliminary estimate of water demand based on surface area and water density, which is performed at an initial stage of the project, at the time of deluge valve grouping. The following steps are followed while performing the same:

1. The surface area of the equipment is calculated.
2. The density of water application has to be used as per the local, national or international standards such as OISD, TAC, NFPA 15 etc.
3. The theoretical water demand is calculated by multiplying the area and the density of application.
4. An allowance of 10% to 20% is considered in order to compensate for the loss of water during operation.
5. The nozzle orientation has to be decided by making markups on the equipment datasheets. The rule governing the nozzle placements are regulated by the standard followed in the entire procedure. Usually the bulb detectors are placed at a distance of 300 to 400 mm from the vessel surface, and the spray nozzles are placed at a distance of 600 to 800 mm from the vessel surface. The distance between the two nozzles shall be governed using the nozzle datasheet.
6. The minimum pressure at the top most nozzle shall be atleast 1.4 bar and atmost 4.1 bar, so as to produce a proper water pattern. Thus, while deciding the K Factor of the nozzle, we assume a pressure of 3 bar, as a

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conservatory basis, because we don't include the upstream pressure losses during the calculations.

Nozzle discharge formula: The discharge of a nozzle shall be calculated by the formula,

$Q = K P^{0.5}$

Q = flow in L/min from the nozzle
K = nozzle *K*-factor
P = total pressure in bar at the flow *Q*

7. After finalizing the total number of nozzles and the K factor, the actual water demand is calculated.
8. Finally it is checked whether the actual demand is greater than the required demand.

Line Size Calculations:

Once the demand is estimated, the next step is line sizing; the limiting factor for the same would be the maximum allowed velocity.

Optimization based on hydraulic calculation shall be finalized balancing the additional engineering work with the saving of materials. This can be done using PIPENET.

Friction Loss Formula:

Pipe friction losses shall be determined on the basis of the Hazen and William's formula,

$P = 6.05 * (Q^{1.85} / C^{1.85} * d^{4.87})*10^5$

P **=** frictional resistance in bars per meter of pipe.
Q = flow in L/min.
C = frictional loss coefficient.
d = actual diameter in mm.

Hazen and Williams C Value for Pipe and Tube	
Pipe or Tube	Hazen and Williams C Value
Unlined cast or ductile iron	100
Galvanized steel (all)	120
Plastic - underground	150
Cement lined cast or ductile iron	140
Copper tube or stainless steel	150

The Sprinkler System:

Unlike the spray system, sprinkler is used for occupancies were the Class A fire is predominant and where there is always human occupancy. The demand is calculated for the biggest area in the building/occupancy, with design demands as specified in NFPA -13.

WASTE MANAGEMENT IN INDUSTRIES

Wastes are generated from a wide range of industrial, commercial, agricultural and domestic activities in the form of solids, liquids or sludges. These wastes can be broadly classified as hazardous and non- hazardous based on their effects caused to human health and materials.

Industries of various classifications like large, medium and small – scale are major cause for environmental pollution. According to the types of waste generation they can be further classified as industries causing air and water pollution and industries producing solid wastes.

Concept of Waste Management:

Zero Waste is a goal that is both pragmatic and visionary, to guide people to emulate sustainable natural cycles, where all discarded materials are resources for others to use. There are a number of concepts of waste management which vary in their usage between countries. Some of the most general, widely-used concepts include:

- **Waste hierarchy** refers to the "3 Rs" ***reduce (at source level), reuse and recycle***, which classify waste management strategies according to their desirability in terms of waste minimization. The waste hierarchy remains the cornerstone of most waste minimization strategies. The aim of the waste hierarchy is to extract the maximum practical benefits from products and to generate the minimum amount of waste.

- **Extended producer responsibility** (EPR) is a strategy designed to promote the integration of all costs associated with products throughout their life cycle (including end-of-life disposal costs) into the market price of the product. Extended producer responsibility is meant to impose accountability over the entire lifecycle of products and packaging introduced to the market. This means that firms which manufacture, import and/or sell products are required to be responsible for the products after their useful life as well as during manufacture.

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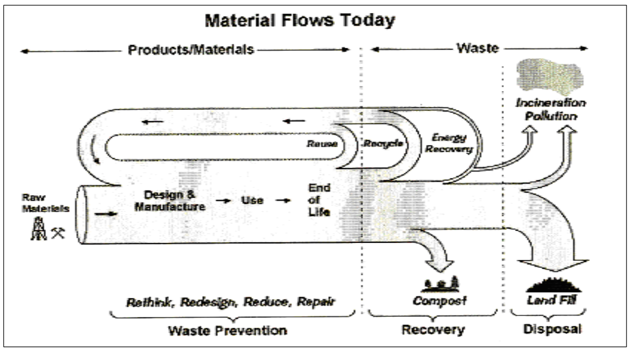
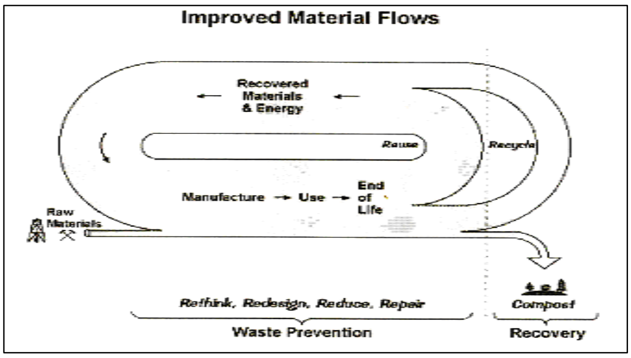
- **Polluter pays principle** is a principle where the polluting party pays for the impact caused to the environment. With respect to waste management, this generally refers to the requirement for a waste generator to pay for appropriate disposal of the waste.





Control System

Every industry needs a control system for Waste Management. Such a system must provide four vital components if it is to be successful.

- Should follow the legislation and regulations
- Should have proper implementation and enforcement procedures in place
- The provision of adequate facilities for waste recycling,
- Treatment ,disposal and measures to encourage their use
- Introduction of training schemes to the plant operators and managers and/or public awareness educational programs.

Chilworth's Waste Management Services

- Waste Management Audits
- Preparation of Detailed Project Report (DPR)
- Impact Assessment for Common disposal facilities for waste management
- Waste Management Plan (WMP) Preparation
- Detailed Investigation and inventory of Waste generation
- Monitoring and Implementation of waste management systems
- Imparting training to create awareness on waste management.

New Joinees

Delhi office:

- Ms. Sharmili Dutta - Dy. Manager Technical
- Dr. Alok Singh - Consulting Engineer, Environment

Mumbai Office:

- Mr. Vijay Chandratre – DGM, Technical
- Mr. Sagar Epari - Consulting Engineer

Chennai Office:

- Mr. P.V.V. Ramesh - Consulting Engineer

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