Major OISD activities during January to March, 2013

External Safety Audits (ESA):

- **IOCL**
  - LPG plant, Port Blair during January 15-18, 2013.
  - POL terminal, Kondapalli (AP) during February 4-6, 2013.
  - POL terminal, Allahabad during March 18-20, 2013.

- **HPCL**
  - POL depot at Nandeswari, Gujarat during February 27, 2013- March 1, 2013.

- **BPCL**
  - POL depot, Surat during January 3 - 5, 2013.

- **NRL**

- **ONGC**
  - Jack up rig NKD & Modular workover rig Sandown-7 at Mumbai offshore during January 14 -17, 2013.
  - A&AA Asset of ONGC, Assam (2 production installations, 2 Rigs, 1 W/O rig) and SSC of one production installation during March 4 – 8, 2013.

Focus Energy-Rajasthan

ESA: Cross Country Pipelines

- **BORL**
  - Vadinar-Bina crude oil pipeline (937 Km) during January 7-12, 2013.

- **OIL**
  - Numaligarh-Siliguri product pipeline (654 Km, 16” Dia.) during March 18-23, 2013.

- **Petronet-Kochi-Coimbatore-Karur**
  - 293 km of Petronet-CKK’s product pipeline during February 4-8, 2013

Pre-commissioning Audit (PCSA):

- **IOCL**
  - 3X675 MT New Horton Spheres at LPG plant, Nabha (Punjab) during February 7-8, 2013.
  - POL terminal, Madurai for additional TLF bays (1x7 and 1x4) during March 11-12, 2013.
  - Additional crude tanks (5x85000 KL) and associated facilities at Vadinar pipeline terminal during March 28-30, 2013.

- **HPCL**
  - POL Depot, Bahadurgarh during January 7-8, 2013..

- **BPCL**
  - ATF pipeline at Kochi (Kochi refinery to Kochi airport) during January 21-23, 2013.
  - LPG plant, Bakania (Bhopal) during March 21-22, 2013.

- **GAIL**
  - NG pipeline (750Km Dabhol-Badai &175Km Gokak-Goa) during February 1-7, 2013.
110 Km section of Vijaypur-Kota NG pipeline during March 4-5, 2013.

**Pre-commissioning Audit of Gas Turbine Compressor:**
- Vijaypur-Dadri NG pipe line, Vijaypur station during January 13, 2013.

**Surprise Safety Checks (SSC):**
- **IOCL**
  - LPG plant, Nabha (Punjab) during February 7-8, 2013.
  - POL depot, Korukkupet (Tamilnadu) on March 9, 2013.
  - Viramgam intermediate storage & pumping facility during March 22-23, 2013.

- **HPCL**
  - POL depot, Thondaraj (Tamilnadu) on March 9, 2013.

- **BPCL**
  - LPG plant, Lucknow during January 11-12, 2013.

- **GAIL**
  - USAR Gas processing plan during February 28-March 1, 2013.

**Consent accorded to operate:**
- **ONGC**
  - Fixed offshore well platforms B-46, B-48, B-105, and B-188 on February 22, 2013.

- **BGEPIL**
  - MODU (jack up) rig ‘ENS CO-54’ on March 11, 2013.

**Review Meetings:**
- A presentation was made to Hon'ble Union Minister, P&NG on IOCL’s Hazira Terminal Incident on February 22, 2013.
- Secretary (Security), Cabinet Secretariat reviewed the status of OSR contingency plan of Coastal States/UT’s and other decisions of Cabinet Secretary meeting dated 02-12-2011 on February 21, 2013. The meeting was attended by representatives from Coast Guard, DG- Shipping, MOD, DGH & OISD.
- Special Secretary, MoP&NG reviewed the progress of implementation of MB Lal/OISD-STD-117 recommendations with industry on March 20, 2013. Special Secretary expressed concern in delay in implementation and advised to hasten up the process without any further delay.

**Training/Seminar/Workshop:**
- ED-OISD addressed HSE officers of BPCL on ‘Safety in Hydrocarbon Sector: Case Studies’ and also handed over location based HSSE Awards for Northern Region. The function was organized at India Habitat Centre, New Delhi on February 9, 2013.
- ED-OISD delivered key note address on “Process Safety Management’ at CCPS conference held at Goa on March 14, 2013.
- AD (Pipelines) took session for IOCL officers on “Pre-commissioning Safety Audit” on February 23, 2013.
- Director (MO) rendered faculty assistance to RGPT on “Managing HS&E in Petroleum Marketing” on March 7, 2013. AD (E&P) took seminar on “Safety in E&P Operations” on March 14, 2013.

**Others:**
- Functional committee meeting for revision of OISD-STD-153 ‘Maintenance & Inspection of Safety Instrumentation in Hydrocarbon Industry’ held on January 22, 2013 at OISD.
- OISD and Centre for Chemical Process Safety, USA (CCPS) signed Memorandum of Understanding on March 14, 2013 at Mumbai to collaborate in the areas of process safety, asset integrity, organizing seminars and conferences and sharing of data base on accidents/incidents. ED-OISD signed the MOU on behalf of OISD.
- 2nd Functional Committee meeting for OISD-STD-235 “Aviation Fuel Station” was held during March 5-6, 2013 at OISD.
- 49th Steering Committee meeting was held on March 19, 2013 at OISD office, Noida. Besides others OISD-STD-244 “Storage and Handling of Petroleum products at Depots and Terminals” was adopted by the Steering Committee.
- Consultancy job or transfer of work from PESO to OISD awarded to Ms Deloitte on March 30, 2013.
- Dr. T.K. Joshi, Occupational Health Expert, interacted with OISD and other oil company experts on March 25, 2013 for exploring an opportunity of organising conference on Occupational Health.
Dear Readers,

We have signed Memorandum of Understanding with Centre for Chemical Process Safety (CCPS), USA to become knowledge partners. CCPS is non-profit corporate membership organization within AIChE that addresses process safety within chemical, pharmaceuticals and petroleum industry. We as knowledge partners agreed to collaborate in areas of mutual interest viz. sharing practices in inherently safe design, operational safety and asset integrity; sharing data base on accidents/incidents and its root cause analysis (ROA); learning from various accident-incident investigations; providing technical clarifications in hydrocarbon safety issues; organizing seminars and conferences for proliferation of information on technical issues concerning operational safety etc. We firmly believe that through this MoU both the organisations will work in tandem to enhance safety in hydrocarbon sector.

The other significant development during the period entails Organisation Development Study being conducted by M/s Deloitte, related to transfer of PESO’s activity to OISD in line with the decision of providing statutory power to OISD for downstream sector of petroleum business. Secretary, PNG during series of review meetings with us on status of implementation of OISD 116 & 117 and MB Lal committee recommendations, status on identifying an equivalent system for Hollow Metallic Rim Seal fire Protection & Suppression System etc. also advised us to expeditiously prepare and submit a draft bill which can be tabled in the Parliament for providing statutory powers to OISD.

Friends, we met all our performance parameters (RFD targets) for the fiscal 2012-13 - even surpassed the target in many areas. We have been particularly focussing on increasing number of audits in Marketing Terminals and last fiscal we have significantly increased the number of such audits. During one such recent meeting with Ministry, we were advised to carry out Special Audits of all the balance marketing terminals of OMCs, those not audited, to identify gaps and recommend measures to further safety management practices. This fiscal, we plan to audit around 80-85 marketing installations which is a great challenge considering the limited manpower at our disposal.

The 49th steering committee meeting held on 19th March, 2013 adapted the all-important OISD standard 244 - a comprehensive standard on storage and handling of petroleum products at depots & terminal including standalone crude oil storage facilities. The standard has been circulated to Safety Council Members for their observations. I take this opportunity to thank Functional Committee members and all those involved in preparing this important standard. Special thanks to Shri Harish Mehta, HPCL for spearheading the task. We are sure that implementing the provisions of this standard will improve safety of oil installations.

In this issue, we bring out live case studies on some recent major accidents. The analysis & learnings from these incidents, I am sure, would benefit all our readers. You will observe that proper & timely maintenance, following good practices (engineering), improved field vigilance coupled with regular checks could have avoided the incidents.

The article written by Shri SS Maji, Head Safety, Essar Oil on Building Safety Culture is practical & informative. I would urge upon the readers to peruse; the steps for improving the Safety Culture and the issues and concerns thereof are very contemporary.

We solicit your views to improve the quality of the newsletter. See you till the next issue.

Hirak Dutta
32 Principal Panelists attended the 49th Steering Committee Meeting that was held on 19th March, 2013 at OISD office, NOIDA. ED, OISD chaired the meeting.

The Steering Committee adopted the all-important new OISD-STD-244: Storage and Handling of Petroleum Products at Depots and Terminals including standalone crude oil storage facilities. On behalf of the Functional Committee, Shri H.C. Mehta, ED, HPCL made a presentation on Draft-3 of OISD-STD-244 which was accepted by all the Steering Committee Members.

During the Steering Committee Meeting, OISD also reviewed the status of implementation of OISD-116 & 117 and MB Lal Committee recommendations and advised all the Oil Companies to hasten up the procurement process for balance items. Steering Committee members agreed that internal EFCV in bulk LPG TTs should be implemented; all operating TTs shall be fitted with internal EFCV by next five years and TTs those are inducted for the first time shall be required to be fitted on the date of induction. Deputy Chief Controller of Explosives in this context informed that as of now there are four approved vendors supplying EFCV.

The other important issues discussed in the Steering Committee Meeting included Oil Spill response facilities, review of status on Audit Compliance, carrying out periodic mock drills, nomination of auditors for undertaking Special Audit of Marketing installations those which have not been audited even once etc.
A Technical Expert Committee (TEC) was constituted by MoP&NG to arrive at an Equivalent System for automatic hollow metallic rim seal fire protection system. TEC upon detailed deliberations finalized the minimum performance criteria for evaluation of Equivalent System for Class 'A' Petroleum external floating roof tanks. Subsequently global tender was floated for getting offers from various vendors. The proposals submitted by the vendors were examined and evaluated by the Technical Expert Committee (TEC) and after due diligence it was concluded that none of the offered system is Equivalent to Linear Hollow Metallic Tube type Rim Seal Fire Detection System with foam based extinguishing media. However, TEC noted that Impolene Tube Type Rim Seal Fire Detection System can be considered equivalent provided the detection system is UL Listed and/or FM/VdS/LPC approved for the intended purpose of its use.

TEC members finalized the above decision in its meeting held at CBRI, Roorkee on 4th May, 2013. TEC members so formed by Ministry of PNG included Director, CBRI, Roorkee, Director, CSIR-IIP, Dehradun, Head Mechanical Engineering Department., IIT, Delhi, Executive Director, CHT, Director Process and Marketing Operation with ED, OISD as its convenor.

The exercise is aimed at providing choice and flexibility to the oil companies as well as for improved competition.

TEC members also suggested that steps should be taken to setup state of the art infrastructure for testing and certification of various firefighting equipment including the rim seal fire detection and suppression systems at CSIR-CBRI Roorkee. It was also suggested that selected critical aspects of technologies involved in firefighting systems may require basic research to enhance their efficacy.

Director, CSIR-CBRI mentioned that they agree to spare necessary space in their installation for setting up such testing facility which can be offered for the benefit of the Hydrocarbon Industry with requisite funding from the Petroleum Industry. This would pave the way forward for performance criteria based certification in contrast to proprietary third party (UL/FM/VdS/LPC) certification.

Prof. Kale of IIT-Delhi indicated that such basic research facility/work can be taken up by them subject to availability of funds.

ED CHT mentioned that necessary funding of such initiatives can be considered by CHT, CSIR-CBRI, IIT-Delhi, CHT and OISD agreed to work mutually in this direction. A separate meeting shall be convened in this regard in due course.
1.0 THE INCIDENT:

A major fire broke out in Crude Distillation Unit of a refinery. As per eye witness, initially the fire was around the crude booster pumps. Subsequently, the fire engulfed instrumentation & electrical cables, pipes in overhead pipe racks and heat exchangers in CDU.

At the time of the incident, 02 booster pumps (276m³/hr. capacity each) were in operation. During site visit, it was observed that the pump casing was totally damaged and torn into two pieces; dislodged towards the suction side by about 8 inch. The impeller was found detached from the shaft. The pump casing is made up of carbon steel, A-216 WCB.

The fire lasted for about four hours and caused extensive damage to all the 03 crude booster pumps, technological structures, pipe racks with piping, insulation, electrical and instrument cables are damaged due to fire. However, there was no injury / loss of life due to the fire incident.

2.0 SITE VISIT & OBSERVATIONS:

- The fire continued for more than four hours due to burning of the hold-up liquid in the flash drum, crude and product lines.
- Subsequently, fire spread to the nearby areas leading to major fire and consequential damage to pipe, fittings etc.
- The failed crude oil booster pump, at the time of the site visit, was not shifted to mechanical workshop and dismantled.
- The other observations/ inferences are as under:
  a. Casing of crude booster pump was totally damaged & torn into 02 pieces.
  b. The casing plate was cut circumferentially; there is no welding joint in the casing at the location of failure.
  c. The thickness of the casing at the detached / cut location throughout the circumference is about 1.0 mm.
  d. Such failure of the casing plate into two pieces is a clear indication of mechanical failure of the casing due to rubbing of impeller against the pump casing.
  e. No significant internal corrosion was observed in the casing plate in general.

All the three booster pumps and motors were affected due to fire. Technological structures of piping rack were also found severely damaged.

During the discussion with field operators on duty, it revealed that there was an explosion in the early morning hours (end of night shift).

The shift in-charge after getting the information of fire, took action for emergency shutdown of the unit. The furnace was tripped from the control room. However, since there is no facility to isolate crude / product lines from control room, the lines were isolated manually, which is time consuming.

The power supply to the unit was switched off from the substation by electrical personnel.
Process piping on the overhead rack like vacuum residue, kerosene, flushing oil, safety valve discharge line and HGO lines were opened up due to impact of the fire.

Instrumentation and electrical cables of the nearby area were found fully burnt and damaged.

3.0 DISCUSSION:

DCS records prior to the incident indicate unit was in normal operation. The graph showing crude flow rate, pressure, temperature and level of flush drum was steady. During the fire, the instrument and electrical cables which were passing through near the crude booster pumps got burnt & thus there was no indication to control room / DCS after the fire.

The failed booster pump was running at a pressure of 31.5 Kg/Cm² and 179 degC temperature; sudden release of crude to atmosphere at this condition resulted in a major fire and explosion.

The history of the booster pump indicates the problem of high vibration and shaft jamming for which the pump was taken to mechanical work shop for repair/maintenance. Subsequently the pump was taken on service & since then the pump was running.

The failure/loosening of the lock nut allowed the impeller to detach; it moved towards the suction end (casing side) by the hydraulic pressure on the back of the impeller. This resulted in significant rubbing action of the impeller against the pump casing plate; the impeller acted like a cutting tool that cut the casing plate circumferentially into two pieces. This would have resulted in very high noise around the pump and high current.

As a result, the impeller of the pump got detached due to shearing of the shaft near the lock nut. The friction between impeller and the casing is a possible source of spark generation to ignite the crude oil.

Failure of Lock nut of the Impeller is due to any one or combination of following:

(a) Axial vibration resulting in Load on the Lock nut leading to its failure.
(b) Inadequate tightening torque on the Lock nut at workshop during the overhauling.
4.0 ROOT CAUSE ANALYSIS OF THE INCIDENT:

1) The root cause of the major fire is the failure of lock-nut of the Impeller. Failure occurred due to any one or combination of following:
   (a) Axial vibration resulting in load on the lock-nut leading to its failure.
   (b) Inadequate tightening torque on the lock-nut at workshop during the overhauling.
   (c) Integrity failure of the washer of the lock-nut or thread damage.

   Failure of the nut caused the impeller to move towards the suction end (casing side) and touch the casing plate by the hydraulic pressure on the back of the impeller. This resulted in significant rubbing action of the impeller against the casing plate and the impeller acted like a cutting tool to cut the casing plate circumferentially into two pieces.

2) Vibration of the piping connected with this pump.

3) The motor also did not trip on overload during cutting action of casing plate by the impeller. Therefore, the motor trip logic and trip current setting was not proper/faulty.

5.0 RECOMMENDATIONS/ LEARNING FROM THE INCIDENT:

1) During pump overhauling, through inspection of the locking arrangement of the impeller with the shaft must be done to check for any deterioration or abnormality. It is to be ensured that impeller locking is done with appropriate torque and the same must be properly supervised for all critical pumps.

2) Preventive/predictive maintenance of pumps to be strengthened to avoid such incidents.

3) The motor trip logic and trip current setting must be looked into so that in case of any overloading, the motor is tripped automatically.

4) Vibration of the suction piping connected with the pump must be eliminated.

5) Periodic checks and vigil by field Operator during normal shift and shift change over time is essential to take timely corrective action.

6) A detail analysis of the pump failure is to be done in consultation with the OEM and other technical experts for establishing preventive/predictive maintenance procedure and actions to avoid such failure.

7) To minimize the adverse consequences from such incident, quick isolation at the suction of such critical pump is required thru ROV operable from field/control room.

Always aim at complete harmony of thought and word and deed. Always aim at purifying your thought and everything will be well.  
- Mahatma Gandhi
Investigation report on GGS fire incident

Mr. Anup Walia, Dir.(E&P)

1. **The incident:**
   A major fire incident took place at Heater Treater unit of a GGS at around 2120 hrs.

2. **Loss due to incident:**
   Damage to the three numbers of heater treaters & associated equipment, and production loss due to stoppage of operations.

3. **Brief back ground of the incident:**
   Fire in heater treater shed area (between boundary wall and heater treater no. 1) was noticed by shift crew with a couple of blast sound at 21:20 hrs. Firefighting was started with internal resources and with the help of fire tenders from nearby (company owned) fire station, but fire spread to master pit, tanker unloading and transformer area via storm water channel. Firefighting team from local civil authority also participated in firefighting operation and fire was finally controlled by 23:05 hrs.

   Heater treater shed area was cordoned off by local police authority for collecting samples for forensic analysis; hence heater treaters could not be inspected closely during the investigation. However, the damage to the heater treaters appeared to be external.

4. **Observations:**
   i. Heater treaters are located very close to the boundary wall of the installation. Inter-distance requirement as per OISD-STD-118 is not being met and this was pointed out by OISD audit team which visited the installation in July, 2010. Also, there was a lot of crude oil spilled in the area
   ii. Storm water channel was full of oil which caused the fire to spread. Audit team had observed the same in July 2010 also and the company had informed in January 2011 that the audit observation has been complied with, and drain channel cleaning is being done at regular interval.
   iii. Plant is more than 30 years old and equipment maintenance was found to be poor during the site visit.

5. **Investigation Modalities:**
   - Visit to the incident location
   - Interaction with the concerned persons
   - Housekeeping was very poor with lot of vegetation and crude oil spillage at many places.
6. **Cause of the incident:**

Though the exact source of ignition could not be ascertained, as the area of fire ignition is very close to the boundary wall, the possibility of source of ignition being external (from outside the boundary wall) cannot be ruled out. [Incidentally, based on forensic analysis, concerned state authority have ruled out the use of explosives, as per the information received later on]

There was sign of considerable amount of crude oil spillage near the heater treater area which added fuel to the fire, and crude oil in storm water channel caused the fire to spread from one corner of GGS to another.

7. **Recommendations:**

I. The process equipment should be relocated to safe area, maintaining the inter-distance requirements as per OISD-STD-118 on 'Layouts for Oil and Gas Installations'. Alternately, additional control measures should be put in place, based on quantitative risk assessment.

II. Engineering and procedural control measures should be taken to avoid the abnormal spillage/leakage of crude oil.

III. Crude oil in storm water channel is unacceptable. Immediate measures to be taken to stop spillage of crude oil in the storm water channel.

IV. Housekeeping in the plant needs lot of improvement.
MoU signed:
CCPS & OISD are Knowledge Partners

A Memorandum of Understanding (MoU) was signed between Oil Industry Safety Directorate (OISD) and Centre for Chemical Process Safety (CCPS), a nonprofit organization with the American Institute of Chemical Engineers (AIChE) on 14th March, 2013 for enhancing safety in Hydrocarbon Sector. The MoU was signed by Ms Louisa Nara, Technical Director, CCPS and Hirak Dutta, Executive Director, OISD during the CCPS Asia Pacific workshop in presence of representative from various Private Hydrocarbon and Construction industry like Reliance, CAIRN, L&T, ABS Consultancy, TATA Chemicals etc. The objectives of the MOU are:

- Providing a platform for sharing of the knowledge and the latest developments in the field of process safety,
- Exchanging experience,
- Providing technical clarifications in hydrocarbon safety matters,
- Conducting process safety related trainings and workshops,
- Organizing conferences with the objective of propagating process safety knowledge in the industry.
- Sharing lessons learned in downstream sector particularly in respect of refining and gas processing.

The MoU with CCPS besides others will provide OISD an opportunity to access CCPS’s process safety incident data base which will be beneficial in terms of framing/amendment of OISD Standards.

Apropos signing of the MoU, ED-OISD made a brief presentation on Safety Issues in Hydrocarbon Industries. It was been noted that too much emphasis to achieve throughput beyond 100% percent capacity to maximize GRM negatively impact safety as many a times some of the vital process conditions are stretched beyond the safe limits.

With a view to avert accidents and improve safety, ED-OISD recommended the followings:

- A holistic approach to HSE and Asset Integrity Management is needed to avert major accidents.
- Hazardous industry like ours must ensure that the lessons learnt from the accidents are incorporated into the management system.
- Benchmarking the safety performance parameters is needed to achieve improvements in Process Safety Management.
- There is no substitute for high diligence thus employee engagement is foremost.
Building a Safety Culture in the organisation:
Issues & Challenges

S S Maji

S S Maji is VP – HSEF at Essar Oil Limited (EOL) heading Health, Safety, Environment and Fire functions including Process Safety. Before joining EOL in 2006, he has worked for 24 years in Indian Oil Corporation Ltd. in various functions including Operations, Safety & Environment and Process.

He has worked as Manufacturing Manager for 2 years at Kenya Petroleum Refineries Ltd, a Essar Oil JV with Govt. of Kenya.

He is a Chemical Engineer from Jadavpur University.

Introduction

Traditionally, with industrialization accidents in work place became an integral part. It was recognised that potential for accident is always present in work place and means adopted to prevent accidents are guarding the machines, protecting the worker from hazard etc. It was believed that relevant knowledge, skill and safety education will prevent accidents. Legislative controls and engineering solutions came in to being to protect the workmen. In the industrial scene, nature of the industry was also changing – large scale chemical process plants and nuclear plants started appearing. In 1980’s, many major devastating incidents with incredible consequences took place that raised the question of the efficacy of the whole system of safety management. Some of the major incidents are:

- Mexico (San Juanico) LPG disaster on 19 November, 1984 killing 500-600 peoples and 7000 injuries.
- Bhopal Gas Tragedy on 2-3 December, 1984 resulting 3787 deaths and more than 55800 injuries.
- Chernobyl Nuclear Disaster on 26 April, 1986 with 31 direct deaths and 3940 deaths from radiation-induced cancer and leukaemia.
- Space Shuttle Challenger Disaster on 28 January, 1986 killing all the seven crew members with seconds.
- King’s Cross Railway Station fire on 18 November 1987 killing 31 people.
- Piper Alpha explosion on 6 July 1988 killing 167 people and total insured loss of US$3.4 billion.

Investigation of these incidents pointed out the weakness in the systems and suggested that system approach will be required to correct the situation. It was understood that process safety is complex in nature and is linked to various organs of the organisation. While investigating Piper Alpha explosion, Lord Cullen stressed the need for creating a corporate culture where safety will be accepted as a number one priority. Management was held responsible and many pieces of legislation on major hazard control to that effect were framed. Management approach to process safety and safety culture surfaced during this period. OSHA PSM (Process Safety Management) is a direct outcome and was introduced in 1992. Oil and Gas Industry in the US and many companies outside US have implemented this. Lots of efforts and money were spent in developing PSM programs. As expected, implementation is not uniform. Major incidents continue to happen and also in the companies where PSM implementation is stated to be adequate. Investigation reveals gap in some elements. But then, there will always be a cause for accidents and that can be related to a gap in PSM system. It raises question on effectiveness of PSM in preventing catastrophic incidents. Here lies the issue of organisational safety culture particularly process safety culture. PSM needs the cultural support, the whole organisation need to value PSM for continual improvement. Concept of safety culture which started in the industry in later part of 80’s mainly after Chernobyl disaster is yet a major concern.

Safety Culture

Defining safety culture is not easy. Many definitions have been suggested by the safety experts and the commonly accepted definition given by UK HSE is as under:

"The product of individual and group values, attitudes, perceptions, competencies, and patterns of behaviour that determine the commitment to, and the style and proficiency of, an organization’s health and safety management."

We need to define this in practical language so that the same is understood by the wide cross-section of the employees. Simply put, safety culture means the way
we typically do things around here. To understand the issues and challenges, we will consider the simple definition. A strong safety culture will have tremendous impact on new employees and new contractors. They will automatically follow the prevailing rules and procedures and will tune their behaviour to align with that of the organisation.

Culture as such is a subjective term and hence cannot be defined and measured very objectively in a sense that is used for objective sciences like mathematics, physics or chemistry. However, we all understand what safety culture means and its basic purpose is to ensure high levels of safety performance in the organisation. While adoption of proven technology, sound engineering practices in design, proper construction, trained and skilled manpower for operation are essential ingredient for achieving high level of safety standard, it is equally important that strong safety culture drives all the activities through commitment to safety at all levels.

All organisations do have safety culture though its effectiveness in preventing accidents may be at different levels. Lots of researches have been done and many methods have been suggested to improve the culture. Safety culture deals with attitude and behaviour of employees. Behavioural change process is slow. Many experts advocate that the safety culture should be ingrained in the organisation as a core value. Hence, it will be heavily influenced by the personal commitment, responsibility and communication by senior level management.

Promotion of safety culture is a long term strategy which requires sustained effort and interest. It is possible to strengthen safety culture in an organisation and the issues involved and challenges faced are discussed in this article.

Issues

Organisations select proven technology, perform hazard assessment at different stages of the project, provide adequate funding for safety instrumented system and enhance Safety Integrity Level (SIL), carry out risk analysis and provide competent manpower for operation and maintenance. Hence, there is complacency that nothing untoward can happen and which is further strengthened by the good safety record which is more often the case. The belief is that whatever best possible measures could have been taken is already implemented and there is nothing much which can be done. These are obviously necessary conditions but not sufficient to ensure good safety performance. It is a fact that safety issues at technical level have been addressed but unless it is backed up by appropriate safety culture, long term safe performance is not assured. Bureaucratic hierarchical organisation structure prevents pro-active measure and is an impediment to develop safety culture.

Management Commitment and Leadership

This is an essential ingredient for building healthy safety culture in the organisation. Management is to provide adequate resources and give direction otherwise safety initiatives will not go far. Seeing the catastrophic impacts, it is only natural that management will be committed to safety because of sheer business interest and for company image. The issue is what the management is exactly required to do. To demonstrate visibility, activities like signing a safety policy statement, uttering the top most priority of safety in the speeches, carrying out symbolic audits etc. do not produce desired effect in the minds of the employees. Mismatch between speech and reality will not create the right impression. Though it is said that management leadership should be visible, in fact management’s commitment should be so deep that it almost becomes invisible. Employees should not have any doubt about management’s sincerity. What is required is a genuine commitment reflected by the actions, decisions taken on the crucial matters related to safety.

Management safety leadership should be felt by the employees and safety should be visible in day to day activities. The issue is whether top management is devoting sufficient time to review safety matters and communicating to the employees. Repeated communication to group of employees will create a shared vision that will help achieving clarity about expectations and goals. Top managements frequent visit to work place, enquiring about safety in the field, appreciating safety achievements and spending considerable time in conversation with employees will be helpful to reinforce safety. Top management is to invest it’s most precious resource ‘time’ to keep constant focus in safety. Creating or changing culture means changing people’s attitude, behaviour and awareness level and communication is the best enabling factor for this. Leadership is to inspire all managers to spend lot of time in conversations with the team members instead of reading mails and attending meetings. Top management also need to find time to enhance their competency in safety particularly process safety related issues.
As it is said that more than 90% of message is non-verbal, direct conversation is the best method. Email is a poor medium of spreading safety message across the organisation. In large organisation, this is a constraint, however, technological means like video conferencing can be used frequently. It is to be ensured that quality conversations take place at all levels within and across the departments. This will create right culture for always maintaining safety awareness. Needless to mention that these communications should be open, transparent and friendly so that employees raise right questions. Many a times, very presence of CEO acts as hindrance to questioning. Top management to be seen surrounded by people who are capable of raising questions. ‘Yes sir’ culture has to go. This will make the management credible to the employees. This in fact will be a great achievement.

Too much importance on human error is counterproductive. In retrospect, accidents are easily identifiable with failures of individuals. Top management may fall into the trap of believing that these are caused by stupidity, negligence and even intentional on the part of the employees. This will have a negative impact on the moral of the employees. Systems are operated and maintained by human beings and hence it is easy to attribute any failure to human error. To develop a culture of openness where employees come forward to share undesirable events without any fear of punitive measures and management acts on the early warning is always desirable.

Management should be action oriented. There are situations when underlying safety issues are well understood and deliberated in the meetings at a great detail on what is required to be done but at the end nothing happens. Nobody acts! Unless translated into actions, discussions have little value.

Whole approach to safety is to be changed and managing change is a critical issue. During the journey many changes will take place like changes in top management, changes in priorities etc. Safety organisation need to transform from inspection/policing role to internal consultant’s role. They are to advise management on safety culture and act as a catalyst to implement in the field in collaboration with operating and maintenance personal. No need to punish for safety violations; punishment has never changed a culture. If we can draw a parallel, under tremendous repression also people have not changed their religious culture. It may be suppressed for some time but eventually, it will come out.

➤ Reporting Culture

An important characteristic of a good safety culture is reporting culture. This demands that all incidents including near-misses are reported, investigated to determine root causes, remedial actions are taken and findings are shared in the organization for lessons learnt. If all these requirements are fulfilled sincerely, performance of safety systems will improve. Findings of incidents occurred in the organization is a powerful communication tool. Employees can immediately relate. Total management support and openness in the organization can make it a success. Management is to encourage employees to report. There are instances where reporters of the incidents are held responsible – shooting the messenger is not a good practice. Victimizing or disciplining employees for reporting incidents will kill the effort for improving safety culture. Sometimes peculiar situation arises; CEO becomes aware that a senior management member is encouraging his department employees not to report an incident. What action CEO takes determines the state of safety culture. The actions taken in delicate situations, in fact, will have lasting impact.

Management should resist the temptation of achieving best safety record when the ground reality is otherwise and should never emphasis on safety awards. On one hand safety award creates complacency in the top management about prevailing safety standard and on other hand employees tries to hide bad information and at times a section of management encourages this. Not that safety awards and safety records are bad and one should not aspire for these. To management, performance has to be genuine. Once top management tacitly accepts non reporting of incidents in order not to lose the safety record, employees will understand the hollowness of value attached to safety in the organization. Top management will not have the moral courage to demonstrate safety leadership.

What we gain in these laurels is very small compared to what we lose. Incidents and near-misses which could have given powerful signals about the weakness in the system thus scope for correction are lost. Employees will doubt the management’s sincerity. Safety records have hardly any value which their own employees do not attach any value. The issue is management’s willingness to create transparency in the organization. The question is whether the management will allow the employee to report a lost time incident of a contractor worker to destroy the ongoing record of many million man-hours of safe work? These are the situations which give the scope for demonstrating leadership. Any compromise will dilute the spirit of safety culture. Management needs to cultivate the attitude to hear bad news as this gives the reality.
Accident Investigation and Auditing

Investigation of the incidents and objective auditing are the rich sources of accurate information about the performance of the prevailing safety systems. Do we investigate incidents fully to understand all the factors involved and to identify failures of the system? Are auditing of systems very rigorous and intensive? Are these reports reviewed thoroughly? Many of the cases, we know what happen. Accident investigation will justify that somehow the accident occurred and there was hardly anything could have been done to prevent it. It generally tells what we already know. Recommendations are directly related to the immediate causal factors. Nobody asks the question as to why the existing systems failed to prevent it.

Audits are generally performed to assure that everything is ok. Barring a few audits, major recommendations for changing the system are not made.

A good recommendation has no value unless it is implemented. Whatever recommendations are generated out of investigations and audits, there is a tendency to show that the recommendations are implemented. There are situations where audits are carried out to check the veracity of implemented recommendations. This is certainly a bad indicator of safety culture.

We talk about learning lessons from incidents and make our investigation report ‘highly confidential’. This is highly hypocritical.

Learning culture

Organisational learning and sustaining the knowledge is extremely difficult. Organisations make conscious effort to adopt best practices and continual improvement but many of these changes dilute over time. We need to recognise that organisational memory is short. It is therefore required that employees are encouraged to translate these achievements into systems and employees are trained on this. Employees are to work as a team for sustainable solution.

Like any systems, safety systems are liable to deteriorate and needs to be put back on stream. In process safety, it is very hard to identify onset of decline unless we consciously look for it. Visible safety failures are easy to recognise and considerable management time is spent in analysing and understanding slip, trip and falls. However, invisible safety failures having potential of catastrophic incidents are difficult to recognise and normally not discussed in management reviews. Management need to be more focussed on subtle changes.

Knowledge and expertise is a necessary prerequisite for process safety. Without appropriate knowledge and expertise, best system will hardly yield any result. However, without effective systems also, knowledge and expertise will give most of the results; obviously full potential will not be realised. In the matters related to process safety, tremendous emphasis is required on knowledge and expertise. Employees should be encouraged to take advice or to seek more information when they have doubts about safety. In Bhopal, half of the skilled employees left the organisation as their promotions were halted.

Safety performance and complacency go hand in hand. Critical appraisal of safety performance is essential. Absence of incident does not necessarily indicate a good safety culture. Leadership need to be very cautious about overconfidence and complacency. Once it is there in the environment, most of failure indications will be ignored. Even there can be a tendency of denial on the face of an accident terming it as normal accident or freak accident. Thorough investigations will not be made putting the system into danger zone. Maintaining safety vigil during success is difficult unless the management is extremely committed to safety. Normal human tendency is to focus on the immediate issues. Management to nurture a culture to expect the unexpected and maintaining safety awareness all the time.

Another caution is initiative overload. Cultural change processes are slow by nature and what is required is coherence, consistency and sincerity. Unless efforts are properly resourced, plans are prioritised and there is clarity on expectations from employees and contractors, chances of success will be limited.

Understanding safety performance

Normally the organisations set aspirational targets like no injuries to any personnel, no damage to property and minimum impact on environment. These are noble objectives and often lack appropriate plans and programmes to achieve those targets. There is nothing wrong in ‘Goal Zero’ but it needs to be appreciated that this is not sufficient in itself.

Top management sets high standards of performance and while reviewing safety statistics clubs both occupational and process safety performance together. Now, occupational safety performance is closely linked to the initiatives taken. However, process safety incidents are infrequent and statistical validation is not possible. Absence of
process safety incident does not indicate a good process safety standard in the organisation. Baker Panel Report on BP Texas City explosion reviewed this aspect in great detail. BP management took big initiative to improve safety performance of five BP refineries in US and performance started showing encouraging improvements. Till the BP Texas city incident on 23 March, 2005, BP Board was under the impression that safety improvement plan is yielding desired result. There was no in-depth review of process safety performance and hence Board was not aware of the state of process safety culture in the refineries. Baker Panel advocated for development of uniform leading indicators to be used in the industry for process safety performance review in January 2007. CCPS published Process Safety Leading and Lagging Metrics in December, 2007 based on which API RP 754 was finalised and released in April, 2010. Internal review of process safety using four layered Safety Pyramid will help organisations to benchmark their performance.

Challenges

➢ Conflict of interest in senior management group
Senior management group need to act in a coherent manner and always give consistent directions in the matter of safety. In reality, this is extremely difficult as the individuals in this group will have different responsibilities and priorities and many of them will be in direct conflict with safety in short term. Production head will like to surpass his targets and similarly maintenance head will always strive to reduce down time. These are the potential situations where individuals will be tempted to take short cuts. Pertinent questions are

  a) On the face of not meeting production targets, whether safety interlocks will be bypassed? Limits of operating parameters will be violated?
  b) When maintenance activities are running behind schedule, approved procedures will be followed? Short-cuts will not be adopted in testing and inspection?

Honest answer to these questions will tell the state of safety culture. Many a times, achievements like highest ever throughput, near 100% on stream factor etc. are appreciated paving the way for further short-cuts. Employees always sense this correctly. Middle level management and the persons in the field will act to fulfill these objectives of their bosses to achieve targets. This creates a split in the safety culture in the organisation. While stated object will remain ‘safety first’, ground reality will be completely different. Individuals will be guided by self interest. It will be incorrect to assume that the senior management group will provide adequate leadership to safety.
CEO and the Board are to give unambiguous direction and then only situation will change in the field. Once CEO demonstrates ‘zero tolerance’ on safety, senior management group and by extension the employees will fall in line.

➢ Procedure compliance
Compliance to the approved procedure is a great challenge. Procedures drift over time, redundant checks are ignored and over time, shortcuts become the established system. Failure to challenge, particularly by managers and supervisors, not only fails to eliminate the particular shortcoming which has been observed, but also creates a culture in which failures, oversights and shortcuts become the norm. In most of incident investigations, one of the common finding is the non-compliance of procedures. Not that it was not followed prior to the incident, rather this is the state of affair. Reasons could be many:

- Operation and maintenance procedures are existing on paper or in computer and easily accessible to the employees. However, procedures are too many and might have been written without the involvement of the concerned persons those who will be using them. Ownership is lacking.
- In many cases, procedures are written to satisfy the requirement of system certification agencies.
- Procedures are not well rehearsed and operators are not trained on the procedures.
- Procedures are not concise, effectively written in operational terms and in many cases consequences of not following the procedures are not well written.

Procedure non-compliance goes on with the full knowledge of all concerned including the management and over a period it becomes an accepted norm. Safety culture demands that procedures are totally followed at all times. What is required is to develop simple operating procedures in association with the operators, impart training on the procedures and always encourage them to comply it fully. Management to provide resource to continuously review and update the procedure and to make it amply clear that any procedure violation will not be tolerated.

➢ Sustaining lessons learnt
A major challenge is learning from past incidents and improving the systems to prevent recurrence.
Whenever a major incident occurs in the industry, organizations review their facilities and operating systems to ensure that all shortcomings are addressed. However, it is extremely difficult to sustain these improvements.

London Underground introduced smoking ban in 1985 after Oxford Circus fire in 1984 because of smoking but that could not prevent King Cross Station fire in 1987 due to same reason. Even for top class organisation like NASA, this is a great challenge. After Space Shuttle Challenger disaster in 1986, Rogers Commission, a special commission was appointed by US President Ronald Reagan to investigate the accident. The Rogers Commission found NASA’s organizational culture and decision-making processes had been key contributing factors to the accident. The accident taught NASA much about the vulnerabilities of the shuttle and how to make space travel safer, space specialists say. But some lessons were eventually forgotten and Space Shuttle Columbia disaster occurred on February 1, 2003. The space shuttle disintegrated during re-entry into the Earth’s atmosphere, resulting in the death of all seven crew members. The loss was a result of damage sustained during launch when a piece of foam insulation broke off from fuel tank and struck the leading edge of the left wing. Foam loss happened in earlier missions also but engineers gradually accepted foam loss as routine, just as they had gradually accepted O-ring damage in Challenger case as routine. Changes made after the shuttle’s first fatal accident were undone over time.

Here are a few examples in the process industry:

- The overall systems for tank filling control must be of high integrity, with sufficient independence to ensure timely and safe shutdown to prevent tank overflow.

The Buncefield fire in UK on 11 December 2005 damaged 20 storage tanks and continued for 5 days. This was the largest explosion after World War-II. The terminal was managed by Total and Texaco. This was caused by a tank overflow while receiving Gasoline. The level gauge did not work, high-level switch failed to shut off the supply and the high level alarm also failed.

Similar incident happened 4 years later in San Juan Puerto Rico on 23 October, 2009. 21 tanks were destroyed and the fire continued for 3 days. Gasoline spilled while receiving from a ship. Automatic tank gauging system and high level alarm was disabled.

Jaipur Depot fire within a week after San Juan on 29 October, 2009 is a grim reminder of the danger of vapour cloud explosion though the initiating events were not identical.

- Working on leaky line in operating plant is a dangerous proposition.

On February 23, 1999, a major fire occurred in the crude unit at the Tosco Corporation Avon refinery in Martinez, California which killed 4 persons. A pinhole leak was discovered in the crude unit on the inside of the top elbow of the naphtha piping, near where it was attached to the fractionator at 35 m above grade. The line was extensively thinned and corroded. While attempting to replace the line without taking a shutdown, leak increased and a large fire erupted.

Recently on August 6, 2012, a large fire occurred causing extensive damage in the Crude Distillation Unit of Chevron’s Richmond Refinery. Workers were removing insulation from leaky diesel line. The leak which appeared drop-wise suddenly increased resulting a vapour cloud and subsequent explosion. The line was heavily corroded (80% metal loss) and was scheduled to be replaced in the next shutdown. The unit was in running condition.

In both the incidents, it was known that the pipe line involved is severely corroded even then attempt to repair was made without shutting down the process plant. Probably, Richmond is not the last incident of this type. Lure of calculated risk taking is difficult to resist.

- Operation of columns with disturbances in liquid outlet

Texaco Refinery, Milford Haven Explosion

An explosion occurred on July 24, 1994 at Texaco Refinery at Milford Haven, UK. After a severe electric storm, all the units were shutdown except FCC. A disturbance in the control system of FCC caused release of hydrocarbon (naphtha and gas) from the outlet pipe of flare knock out drum. The resultant explosion caused severe damage to the plants, buildings and storage tanks and fire continued for two and a half days under control burning.
Contributing factors were many like control valve being shut was indicated as open in the control panel, graphics was not displaying complete overview, modification without assessing proper consequences and attempts to keep the plant running when it should have been shut. Due to control system malfunction and improper operator action, liquid released to flare knock out drum thrice and even then all efforts were made to avoid a shutdown.

One of the recommendations was that the operators should know how to carry out simple volumetric and mass balance checks when level and flow problems are experienced. Another recommendation was to provide adequate pumping arrangement for flare knock out drum to prevent overfilling.

BP Texas City Explosion

On March 23, 2005, a fire and explosion occurred at BP's Texas City Refinery killing 15 workers. The explosion occurred in an isomerization unit. Overfilling of the raffinate splitter with liquid and the subsequent overpressurization and pressure relief of hydrocarbon to the blowdown drum. The attached atmospheric vent stack released liquid and gas to atmosphere causing a vapour cloud, which was ignited by a contractor's pickup truck as the engine was left running.

The operators started the tower while ignoring open maintenance orders on the tower's instrumentation system. The high level alarm of the column was disabled. Here also, the operator did not carry out the simple volumetric and mass balance checks as recommended in Milford Haven explosion. When the operator realised about high level and opened the bottom valve which caused more harm by adding heat to the column. The unit was allowed to be operated with undersized blow down drum with atmospheric vent.

The challenge is to empower employees to take shutdown for safety reasons and not to interfere with their decisions. This might be the stated stand of the management on paper but the reality is different.

Accept failure and courage to move on

Failures in any system are inevitable. Courage is to accept those failures and move on. When an organisation is sincerely making effort in improving safety culture, an incident should not discourage and raise questions on the efforts. We observe failures in almost all systems. Consider the corruption/fraud in investment banking sector. A group of highly educated and skilled individuals manage the system; best consultants design the systems and procedures and state of the art software/gadgets are used to identify the symptoms of any wrong doing at the earliest. Even then, these organisations experience failure.

Failures have been experienced in nuclear installations and space programmes as well. Best available technologies, best manpower and adequate resources failed to eliminate incidents.

Challenge is to maintain equidistance from success and failures. Let success not bring complacency in the system and failure lead to frustration. These outcomes are all part of the journey; focus to be maintained all the time.

Conclusions

Only that shall happen, Which has happened,
Only that occur, Which has occurred;
There is no new thing under the sun.

1:9 Ecclesiastes

Belief is deep seated in our mind. It is there since thousands of years in our system. It is not dependent of any knowledge, proof or rationality. Mind simply accepts this as truth because of past conditioning. Whether it is religious belief or otherwise, nature of belief is same. When knowledge confronts belief, we behave from the standpoint of belief and not knowledge. It is easier said than believed that all accidents are preventable. Changing belief or introduce new belief will require tremendous amount of effort. Creating a safety culture requires management's total commitment, openness, transparency and sincerity. Effective communication, frequent conversation with the employees, friendliness and investing management's 'time' will develop a healthy relationship which will keep focus and maintain awareness on safety issues and sustain high standard of safety culture. All these efforts are justified as safety failure means death, destruction of property and environment and huge business loss.

Business climate is changing, traditional safety management with limited leadership is no longer producing desired outcome. Since we have built world class facility, there is no reason to doubt that we should achieve world-class safety performance. Given our strong cultural base, an inspiring leadership can make all the difference.
Farewell to SK Nandy & PK Khurana

OISDiants bid fond farewell to two of its long associates S/Shri SK Nandy, Additional Director (PPL & ED’s Sect.) and PK Khurana, Additional Director (Administration).

Both Shri SK Nandy and PK Khurana had a fairly long stint at OISD. They were witness to various developments that happened at OISD. Shri SK Nandy, a sound technical expert in Pipelines and Engineering made tremendous contribution not only in developing OISD standards, undertaking numerous audits but also many developmental activities. Shri Nandy was the focal point of several important projects that include lining up of consultant for OD study in context of transfer of job from PESO to OISD, member of the committee on Hazira fire incident as well as provided tremendous support in evaluating an equivalent system for Hollow Metallic Rim Seal fire Protection System. Matured, amicable and pleasant Shri Nandy joined IOCL, Pipeline, HQ as Deputy General Manager in Safety Department on promotion.

Shri PK Khurana managed the administrative function of OISD almost single handed. He played a pivotal role in ensuring smooth shifting of OISD office from New Delhi House to OIDB Bhawan, Noida. Shri Khurana had the unique distinction of publishing OISD’s first Hindi Magazine “Suraksha Chetna”, Shri Khurana joined Panipat Refinery as Head of HR.

OISDiants wish them all the success in their future endeavours.
PHOTO GALLERY

ED, OISD signing documents with M/s Deloitte

Demonstration of Fire Fighting Facility at CBRI, Roorkee

Technical Discussion at OISD

ED, OISD with the delegates: CCPS Conference

Review Meeting by Secy., MOP&NG

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