

GLOBAL HSE

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2017

HSE Excellence: A Foundation for Sustainable Growth



Hosted by



ऑयल इंडिया लिमिटेड
(भारत सरकार का उद्यम)

Oil India Limited
(A Government of India Enterprise)

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From The Chair

Dear Industry Colleagues,

I would like to take the privilege to invite all distinguished industry members to the 5th Edition of Global HSE, The International Conference & Exhibition for Health, Safety & Environment across the Petroleum and other major sectors of industries. The 5th edition will be held in association with the Ministry of Labour and Employment, Government of India, National Safety Council, PETROTECH Society, OISD and major corporate organisations, trade bodies & government entities, is scheduled from 21-22 September 2017 at the Hyderabad International Convention Center (HICC). Since its inception in 2013, Global HSE has built a growing reputation for being a significant technical and networking platform with an established track record in promoting the latest developments in the field of health, safety and environment. Keeping in mind present market conditions, it is imperative to seize any opportunity to interact, collaborate, innovate and build resilience in the industry as a whole.

This conference followed with workshops and exhibition will provide an excellent platform for stakeholders from different parts of the world to build partnerships and share knowledge in the field of HSE. I am confident that the event will provide a great opportunity for knowledge sharing and discussion around best practices that will further contribute to the creation of a proactive and dynamic safety culture in the workplace.

The 5th Edition will capitalize on the momentum generated by the previous editions that were extremely well received and supported by associations & organisations like OISD, National Safety Council, PETROTECH Society, GAIL, BAPCO, BANAGAS, Cairn India Ltd, Oil India Ltd, ONGCL, IOCL, HPCL, BPCL, TATA Motors, Shell India, ENOC, ADNOC, IOSH, IBM, NEBOSH, ASSE, Energy Institute, IChemE, IIRSM, AIChE etc.

OIL India Ltd is proud to be amongst those organisations that value health, safety & the environment, which is directly driven by the senior management throughout our journey, since first discovery of crude oil in the country in 1889. The leadership team across organisations has to take the key role in leading this paradigm shift in transforming HSE culture, in order to make business processes state of the art, safe & sustainable for the future.

On behalf of Global HSE and OIL India Ltd, I invite you to participate in Global HSE 2017 International Conference and Exhibition.

I look forward to seeing you at Global HSE – Hyderabad in September 2017.

Kind Regards,

Utpal Bora
Chairman, Global HSE 2017
Chairman & Managing Director, Oil India Ltd.



Foreword

India and other developing economies are on the rapid growth path. Everybody doing business in these countries wants to ride on the growth wave and do not want to be left out. The rapid growth in manufacturing, services and infrastructure sector will certainly improve the quality of life for people but the flip side is that it's exerting pressure on natural and human capital. The growth will not be sustainable if we don't strike a right balance between natural & Human and financial capitals. While there is a good buzz around 'climate change', people safety is still a local subject and is not discussed beyond the site management. Striking balance between growth and erosion of natural & human capitals have made role of HSE & Sustainability professionals very important, at the same time challenging.

Global HSE, a group of senior HSE & Sustainability professionals across the world recognized this challenge faced by our colleagues in the Industry and decided to provide a platform for learning sharing and networking in the form of Global HSE conference.

Starting its first edition in Delhi in 2013 and subsequent editions in Dubai, Delhi, Bahrain have reached to its 5th edition at Hyderabad(India). In four years of span Global HSE have become a truly global and a trusted brand in HSE.

The theme for the 5th edition of Global HSE conference is HSE Excellence: A foundation for Sustainable growth. In this event, besides the core sectors we will also be focusing on Infrastructure, IT and Pharma sectors.

During the two-day's conference and a day's work shop we shall be deliberating on various elements of HSE & Sustainability Management including:

Process Safety Management; Human Factors in HSE, Contractor Safety Management; Disaster Management; Competency Assurance; Fire Safety management; Environment; Sustainability; Organizational Learning: Near Misses, Incidents & Case Studies; Contractor Safety Management; Asset Integrity Management; Road Safety; Occupational Health & Wellness; HSE in Facilities Management; Employee Engagement in Safety etc.

There will be 80+ national and international speakers including Lawmakers, Government, CEOs and HSE & Sustainability experts sharing their views and experience with 600+ audience. We will also have 100+ technology partners showcasing their technologies and products to support HSE management in various sectors.

The steering committee in partnership with our partner ICONEX have worked very hard for last one year and made it sure that the participants get full value out of participation in the event.

Looking forward to see you during the event.

Arvind Bodhankar
Convener –Global HSE
Corporate Head HSE & Sustainability
Tata Motors Ltd.



Preface

Growing scale and complexities at workplaces are increasingly opening doors to multiple hazards which might be present in physical, chemical or biological form, and potentially impact the workers' health or put their safety under doubt. These include workplace dangers and chances of accidents occurring, physical exposure to harmful atmosphere and mental imbalances. Lack of proper management of waste and unsustainable exploitation of natural resources are environmental aspects to watch out for.

There are risks associated with every industry or workplace – where some might be relatively low risk, others might be more hazardous or accident prone. While these incidents can be a cause of immense personal grief on one end, they also result in huge financial losses for companies. Moreover, in today's times, companies are expected to conduct businesses responsibly. They cannot be allowed to ignore the impact of their business activities on their surroundings. While organizations need to make adequate provisions to ensure the occupational health and safety of their employees, and also see the environmental impact of its activities, the extent of safeguards adopted depends upon the cost of implementation that promoters or shareholders find justifiable for the cause.

Focusing on the Indian context, it becomes imperative to focus on the HSE perspective, especially in today's times where companies are expanding across sectors. As organizations grow, they expose themselves to increasing number of occupational health and safety issues. And in a country like India, where the unorganized sector forms a large chunk of businesses, managing health and safety aspect of businesses becomes even more challenging yet important. Even in the organised sector, there are immense opportunity areas for better HSE implementation, since compliance norms are still not taken very seriously.

In this pre-conference report to the 5th edition of Global HSE, we have comprehensively covered HSE related challenges across all major sectors in India including oil & gas, mining, power, pharmaceutical and manufacturing. In consonance with this year's theme, 'HSE Excellence: A Foundation for Sustainable Growth', the report observes the fact that sound HSE policies lay foundations on long term accelerated growth, striking an optimum balance between people, profit and planet. Accordingly, the report also discusses key dimensions which are characterising the HSE trend in the current scenario.

Alok R. Gupta
Founder & CEO
Envecologic – Spearheading Sustainable Growth

Health, Safety & Environment: Designing a Safety-net for Sustained Business Growth

Growing Importance of HSE

Economic growth does not depend upon value addition activities alone, but also on creating a culture and framework of practices which mitigate risks pertaining to health, safety and environment (HSE) at the place of work and operation. Without a supporting framework, any operating system is bound to expose itself to potential loss of productivity. Even a highly competent firm cannot achieve its growth endeavours if its growth decelerates due to falling productivity of employees, growing downtime, loss of reputation due to accidents or poor environmental management.

Industrial accidents create not only personal grief and distress but also result in huge financial costs and unwelcome negative publicity for the organisation and industry concerned. They are of great interest and concern to all stakeholders (employees, managers, shareholders, investors and suppliers).

Figure 1: High opportunity cost of ignoring HSE concerns



Occupational health and safety is primarily about ensuring the safety of employees from any harm along the line of work. The main objective is to restrain work related injuries and deaths by enforcing standards safeguarding health and security of the workforce. It is a multi-disciplinary area involving not just immediate employees at a workplace but also the community, customers, suppliers and the environment on which the operations of a firm may have direct or indirect impact. Health and Safety issues caused by degraded and polluted environment are another area of concern that is a burning issue for the human existence.

The definition of Occupational Health was first introduced by International Labour Organisation (ILO) and WHO at the first session in 1950 and then the revised version was shared during their twelfth session in 1995. The definition says: "Occupational health should aim at: the promotion and maintenance of the highest degree of physical, mental and social well-being of workers in all occupations; the prevention amongst workers of departures from health caused by their working conditions; the protection of workers in their employment from risks resulting from factors adverse to health; the placing and maintenance of the worker in an occupational environment adapted to his physiological and psychological capabilities; and to summarize, the adaption of work to man and of each man to his job."

Origin of HSE

The concept of HSE, or Health, Safety and Environment management was first formally introduced in 1985 in the chemical industry. The reason for its development were two catastrophic incidents –the Seveso disaster in 1976, and the Bhopal Gas Tragedy of 1984. It established the 8 fundamental aspects that assure product and plant safety, environmental protection and occupational health. The "Responsible Care", a worldwide voluntary initiative, was started in around 50 countries, which was coordinated by the ICCA (International Council of Chemical Associations). General concepts of the Health Safety Environment management were formulated in the 1990s and can be found in OHSAS 18001 for occupational health and safety management, ISO 14001 (international standards for environmental management), and the Environmental Health and Safety guidelines as formed by International Finance Corporation.

The environmental component of HSE has been getting growing attention over last few years as the overall discourse related to climate change and fast depleting natural resources has picked up pace. Furthermore, environmental regulations have also added gravity, leading to HSE professionals paying more attention to this particular aspect, which was heavily dominated by health and safety to begin with. From an environmental standpoint, it involves creating a systematic approach to complying with environmental regulations, such as managing waste or air emissions all the way to helping sites reduce company's carbon footprint, treat waste water from factories, heat management, to name a few. Directly or indirectly, it feeds back to the profit margins for the companies and also impacts employees' working conditions, even if to varying degrees.



HSE in the Indian Context

According to the 68th round of the NSSO survey data for 2011-12, about 17% of the total population, at that time, was engaged in the organized sector, out of which nearly 45% were engaged in the formal sector while remaining were in the informal sector. With a scale that large, currently the focus is on making the formal sector within the organized sector HSE risk proof, which entails a number of aspects, including (but not limited to) creating a skilled work force, training them, planning, strategising, execution, monitoring, and reviewing. Besides this, we need to bring the organised informal sector under the ambit. And this still does not include more than 80% workforce involved in the unorganized sector, most of which is represented by the primary sector (agriculture and related activities), where health and safety improvements will impact the strata at the bottom of the pyramid of India's working population.

The scale is too huge to be ignored. Over the last few decades, as the economy has grown, various sectors – from construction and iron & steel to mining and oil & gas, have scaled up, resulting in growing risks of occupational hazards. Emerging occupational health problems in the existing Indian public health scenario include silicosis, musculoskeletal injuries, coal workers' pneumoconiosis, chronic obstructive lung diseases, asbestosis, byssinosis, pesticide poisoning and noise induced hearing loss.

The statistics for the overall incidence of occupational diseases and injuries for the country are not easily compiled and stated. As per Annual Survey of India 2012 there are 32,000 registered industrial factories, of which over 23,000 hazardous factories had a workforce of over 19.7 lakh people till 2014. In the same year, DGFASLI (the Directorate General, Factory Advice Labour Institutes), in association with factory inspectors registered a total of 6,632 injuries in factories, of which 5,699 were non-fatal and 933 were fatal injuries. As per the Labour Bureau records, the maximum number of reported injuries had been under the head of “persons falling”. As per various judgements released by the honourable Supreme Court, Article 21 (right to life) supports the right of employees’ health. The Court has noted that, “occupational accidents and diseases remain the most appalling human tragedy of modern industry and one of its most serious forms of economic waste.”

Since liberalisation in 1991, numerous regulations with respect to economic growth and development have been implemented and enforced, but there has been minimal initiative towards enhancing the working conditions, safety and health of the workers. In spite of the increasing manufacturing, mining and chemical operations, the regulatory authorities safeguarding occupational health and safety merely include about 1400 safety officers, 1154 factory inspectors and 27 medical inspectors. These numbers are inadequate even while talking about the formal sector alone that employs just 10% of India’s total workforce.

As per the estimates, the unsafe working conditions are among the biggest factors causing deaths, casualties and disabilities among India’s working population. And the sad part is, these losses of life are preventable. As per the estimates of ILO, about 4 lakhs in India die every year at work which comes down to 46 every hour – a very grim scenario indeed.

However, the net result is that most of Indian workers are hardly protected from the occupational safety and health (OSH) risks and even in the few cases where legal protection of a certain kind is available, the procedure of attaining financial assistance is filled with bureaucratic obstacles.

Some of the occupational diseases – including cancers caused by various metals at workplace, including asbestos, carcinogenic chemicals, silica, cotton, dust and radiation, job stress and work shifts, all take a long time to develop into a disease. Given the short term tenures of the current employment regime, it becomes hard to create a linkage between the disease and the working environment. As per estimates, more people die as a result of work-related diseases than many infectious and childhood diseases.

In a country like India, where the state of public health and medicine is already acute, where the number of doctors available and serving is a crisis of its own, having OSH specialists is a big concern. This is the reason why so often many occupational diseases like byssinosis and silicosis are incorrectly diagnosed as tuberculosis. In the context of reporting of occupational accidents and hazards, there’s an immense underreporting. If we go on analysing the deaths occurring at work places, a majority of them are a result of cancer and other work related illnesses. This is in contrast to the widely held conventional belief that work-related deaths are a result of accidents. As a matter of fact, much attention is given to prevention and safety against accidents, but with focus missing on occupational diseases, an “accident free workspace” cannot be termed as a “safe workplace.”

Global HSE: Catalysing Growth

Global HSE's Path Defining Role

Global HSE is a cross industry gathering of organizational leaders, senior managers and HSE practitioners to discuss present and debate contemporary issues related to HSE industry, primarily focusing on the MENA Region and Asia Pacific Region. As emerging markets have become instrumental in leading the global economic growth and recovery, organizations across the globe are striving to balance the need to build a proactive safety culture to sustain resources and achieve business excellence. Health, Safety & Environment compliance is an important and integral discipline that responds to the need of providing a healthy and safe working environment to industrial workers.

The conference will deliver a varied number of topics and subjects that involve critical and current issues relating to HSE management globally and regionally. Senior business and industry leaders who have been involved in HSE transformations within their organizations will bring forth their experience and insights. This conference has been launched on an international platform which brings together international and regional experts under relevant themes. The conference will have a balanced mix of key notes, plenary sessions from organizational and HSE leaders, technical presentations, interactive panel discussions and pre conference workshops.

Global HSE Conferences are designed under the power packed flagship theme of "Creating Safe and Sustainable Future through Business Excellence". The conference continues to uphold its major objectives of spreading the HSE standards and protecting lives of people and environment. The conference also lays emphasis on the key role played by Quality Assurance function in achieving sustainable business. It also includes an innovative parallel exhibition along with the conferences, providing a major platform to showcase latest technology and products in the field of HSE to attendees from major industry sectors. The exhibitors are provided with the opportunity of networking and showcasing their product expertise to the crème de la crème of major industry sectors across the globe.





To create an international community and gathering of leaders & professionals focused on solutions to protect the lives of people and the environment for all major industries.

MISSION
MISSION

To create a global outreach across all regions of the world by collaborating all major industry sectors and prioritise a commitment for Health, Safety and the Environment.

VISION
VISION

Global HSE's Journey So Far

2013

New Delhi



The launch edition of Global HSE was held at Hotel Taj Palace in September 2013 under the patronage of H.E. Shri Veerappa Moily, Hon'ble Minister of Petroleum and Natural Gas, Govt. of India and was hosted by Cairn India Ltd. It was held under the Chairmanship of Mr. Hari Kumar, Director – EHSQ, Cairn India and under the theme of Lead-Collaborate-Transform.

2015

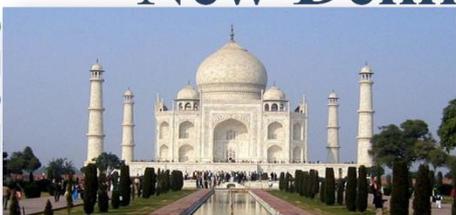
Dubai



The second edition was held at Dubai World Trade Centre in February 2015 under the patronage of the The Supreme Council of Energy, Govt. of Dubai and was hosted by Emirates National Oil Company (ENOC). It was held under the chairmanship of Dr. Waddah S. Ghanem, Executive Director – EHSSQ, ENOC and under the theme Driving Change, Creating Value.

2016

New Delhi



The third edition was held at Hotel Le Meridien in February 2016 under the patronage of H.E. Shri Bandaru Dattatreya, Hon'ble Minister of Labour & Employment, Govt. of India and was hosted by GAIL India Ltd. It was held under the Chairmanship of Mr. Hari Kumar, Director – EHSQ, Cairn India Ltd and under the theme of Creating Safe and Sustainable Future through Business Excellence.

2017

Bahrain



The fourth edition was held at The Gulf Hotel in April 2017 under the patronage of H.E. Shaikh Mohamed bin Khalifa, Minister of Oil, Kingdom of Bahrain and was jointly hosted by BANAGAS and BAPCO. It was held under the Chairmanship of H.E. Dr. Shaikh Mohamed bin Khalif Al Khalifa, CEO, BANAGAS and under the theme of Overcoming Challenges of Today to Build a Resilient Future.

Growing International Support for Global HSE

2017

- Ministry of Labour & Social Development, Bahrain
- Ministry of Health, Kingdom of Bahrain
- United Nations Environment Programme (UNEP)
- Supreme Council of Environment, Bahrain
- The Gulf Petrochemicals & Chemicals Association
- Gulf Downstream Association (GDA)
- Institution of Occupational Safety and Health, UK
- National Examination Board in Occupational Safety and Health (NEBOSH)
- Bahrain Health & Safety Society (BHSS)
- National Safety Council (NSC), USA
- American Society of Safety Engineers (ASSE)
- Energy Institute
- Institute of Chemical Engineers (IChemE)
- Bahrain Occupational Health Association (BOHA)
- International Institute of Risk & Safety Management
- National Safety Council (NSC)
- British Safety Council (BSC)
- Board of Certified Safety Professionals (BCSP)
- American Institute of Chemical Engineers (AIChE)
- Centre for Chemical Process Safety (CCPS)
- International Commission for Occupational Health
- IPIECA
- National Fire Protection Association (NFPA) USA
- Oil & Gas Safety Council (OGSC)
- ORC HSE
- Oil Spill Response Ltd (OSRL)
- RoSPA
- Society of Occupational Medicine (SOM)
- Society of Fire Protection Engineers (SFPE)
- World Safety Organisation (WSO)

2016

- Ministry of Labour & Employment, Government of India
- Institution of Occupational Safety and Health (IOSH), UK
- National Examination Board in Occupational Safety and Health (NEBOSH)
- Bahrain Health & Safety Society (BHSS)
- National Safety Council (NSC), USA
- American Society of Safety Engineers
- Energy Institute
- Institute of Chemical Engineers
- Bahrain Occupational Health Association (BOHA)
- International Institute of Risk & Safety Management (IIRSM)
- The Oil Industry Safety Directorate, Government of India (OISD)
- National Safety Council (NSC)
- Directorate General of Mines Safety, Government of India (DGMS)
- Directorate General Factory Advice Service and Labour Institutes, Government of India (DGFASLI)
- British Safety Council (BSC)
- Board of Certified Safety Professionals
- University of Petroleum & Energy Studies, India (UPES)
- Indian Chemical Council (ICC)
- American Institute of Chemical Engineers (AIChE)

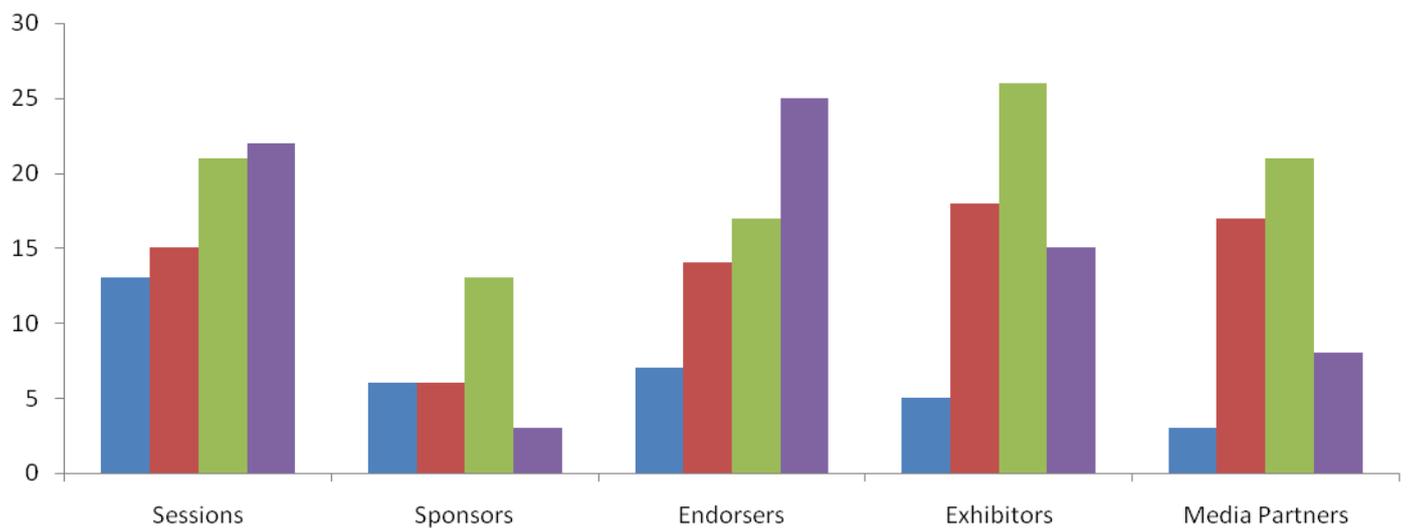
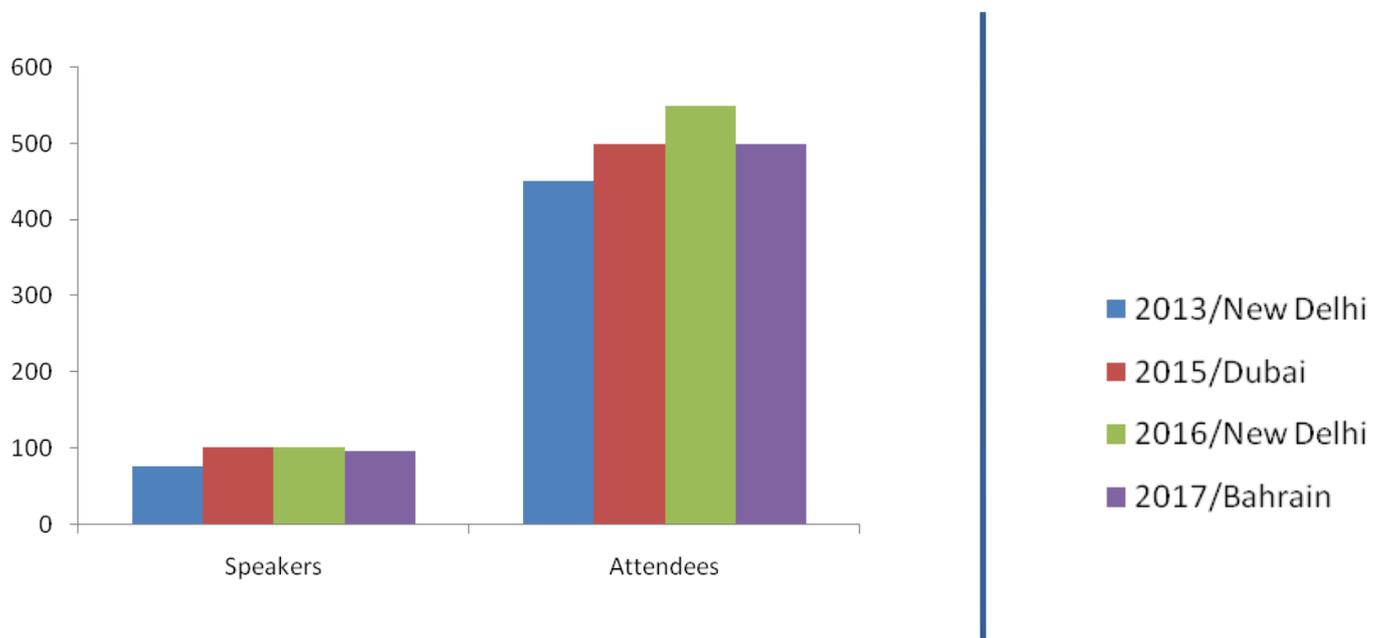
2015

- Ministry of Labour, Government of UAE
- Institution of Occupational Safety and Health (IOSH), UK
- National Examination Board in Occupational Safety and Health (NEBOSH)
- Society of Engineers - UAE
- Bahrain Health & Safety Society
- National Safety Council, USA
- American Society of Safety Engineers (ASSE)
- Energy Institute
- Institute of Chemical Engineers
- Bahrain Occupational Health Association (BOHA)
- International Institute of Risk & Safety Management (IIRSM)
- American Institute of Chemical Engineers (AIChE)

2013

- The Oil Industry Safety Directorate, Government of India (OISD)
- National Safety Council (NSC)
- Directorate General of Mines Safety, Government of India (DGMS)
- Directorate General Factory Advice Service and Labour Institutes, Govt. of India
- Petroleum & Natural Gas Regulatory Board, Government of India (PNGRB)
- Petrotech Society

Consistent Growth, Year After Year



Connecting With HSE Community Globally

Wide Spectrum of Global Speakers

Global HSE editions have been graced by speakers from nearly 20 nations across the world, making the conference truly international. Hundreds of speakers bring their rich experience as practitioners, policy makers or decision makers and enrich the conference with priceless exchange and dissemination of knowledge.

Figure 2: Speakers from following nations have participated



Some Gems from Previous Editions



H.E. Shaikh Mohamed bin Khalifa Al Khalifa, Minister of Oil, Bahrain

A commitment to safety and operational integrity starts with the management. For a culture of HSE to flourish, it is important to remain vigilant and instil discipline from the management, cascading it down to the employees.

Badal Roy, GM - Safety, Offshore Operations, ONGC

ERM is the ability to sustain in a crisis and continue to stay in business even after the crisis.

Hari Kumar, Group EHS Assurance Directorate, ENOC, UAE

Substandard designs are resulted either from the systematic lack (reviewing process), lack of proper management, poor rule set or from competency in process safety. HSE integration is extremely important from the beginning; it saves operational down time and cost of shutdown

Dr. Richard Judge, CEO, Health & Safety Executive (HSE), UK

Utilising the time after an accident to drive improvement in the business is important. The shock acts as a catalyst for action even if it is too late.

Ahmed KhaliL, Manager - HSE & Fire, BAPCO, Bahrain

Set expectations at the outset from the contractors in their professional contracts. Communicate openly.

Teresa Budworth, CEO, NEBOSH, UK

The consequences of poor leadership are rather severe such as financial losses, loss of investor confidence and loss of shareholder value.

Ravi Shankar PN, Associate VP, Technip India

Managing contractors requires inculcating a safety culture and needs continued efforts, not an overnight process.

Dr. A. Vancheswaran, Senior Director, TERI, India

While businesses are worried about the cost of action to curbing climate change, they should evaluate risks of inaction and subsequent consequences.

Subba Rao, CEO, Cholamandalam Risk Services, India

Safety and health standards cannot be always treated as a business case. 70% of the people are in the reactive mode and only a few companies are pro-active about safety management.

Shaikh Mohamed bin Khalifa Al Khalifa, CEO, BANA Gas, Bahrain

This (translating words into actions) requires creation of global standards of health & safety and a common language of communication amongst the various industries.

L.K. Gupta, MD & CEO, Essar Oil, India

It is crucial to focus on the safety and security of the employees so as to ensure maximum productivity.

Trish Kerin , Director - Safety Centre IChemE, Malaysia

A competency framework needs to be established from the operators to the management. This will allow better dissemination of the knowledge and the learning outcomes in process safety among the workforce.

Surya Rau V. V., Group President, Safety and Operational Risk, Reliance Industries

Sustainability has two components: inheritance (what we acquire from our previous generations), and ex-heritance (what we leave for our future generations).

Dr. Waddah S Ghanem, Executive Director- EHSSQ & Corporate Affairs, ENOC, UAE

Awareness of HSE regulatory compliance comes as a result of partnership between regulator & industries. There should be clear demarcation between regulatory & implementation functions of a regulator to ensure there are no conflicts of interest.



HSE Check across Major Sectors in India

Oil & Gas Industry

There's probably no other industry where occupational HSE is more critical than the oil and gas industry. There are still many quarters which are yet to recognize the value of HSE preparedness, and hence this article is going to serve the purpose of unveiling the indispensability.

Workers in the oil and gas industry are very vulnerable to health, safety and environmental hazards given the nature of operations. The table below encapsulates the HSE impacts, impact channels, source activities and type of oil & gas operations.

Table 1: HSE Hazards in Oil & Gas Sector

Operation	Activities	Impact Channel	HSE Impact
Upstream	Seismic Survey and evaluation; Exploration and drilling; Development and production; Decommissioning	Pathogenic microorganisms; Infection transmitting vectors; Drilling mud; Petroleum products (Hydrocarbons); Radioactive sources; Chemicals and additives; Metals (Pb, Cd, Mn, etc.); Extreme temperatures; Silica/Asbestos; Noise/Vibration; Mechanical; Ergonomic; Psychosocial	Infectious and parasitic diseases (e.g., Hepatitis A, Cholera, Typhoid fever); Cumulative trauma disorders; Chronic obstructive pulmonary disease; Gastrointestinal disorders; Dermal and eye issues; Spinal disorders; Neoplasms/Cancer; Heat Stroke; Stress; Sleep deficits; Noise induced hearing loss; Drug and alcohol abuse
Midstream	Pipelines; Transport and storage; Marketing	Petroleum products (Hydrocarbons); Dust from filing and scaling (from cleaning of pipes and tanks)	Dermal and eye issues; Pulmonary disorders; Gastrointestinal disorders; Neoplasms/Cancer
Downstream	Product Refining; Petro chemicals; Sales and Distribution	Petroleum products (Hydrocarbons); Treatment chemicals; Metals (Pb, Cd, Mn, etc.); Silica/Asbestos; Solvents; Noise/Vibration	Dermal and eye issues; Gastrointestinal disorders; Neoplasms/Cancer; Noise induced hearing loss

While the possibilities of hazards exist at every stage of oil & gas operation, the market downturn makes the HSE risk profile more complex to deal with.

In the current scenario when oil & gas operators are struggling to cover the cost of production, intense financial pressures are mounting, making trade-offs and choices more challenging. And in these times of financial constraints, oil & gas companies tend to de-prioritize HSE management. However, industry leaders recognize that the return on investment well justifies the cost. They are actively seeking strategies to ensure the safety of their operations and their employees, while also

maintaining productivity and profitability in a challenging market. Risk based approach in HSE management among decision makers is also gaining importance where preventive efforts are being made based on data driven analysis.

In the context of India, HSE needs the support of strong policy backing. As India is aggressively working towards scaling up its hydrocarbon sector, untoward HSE outcomes will decelerate the pace of growth. It may be said that we already have an extensive policy framework and guidelines on HSE best practices but enforcement is the weak link. There are at least eight authorities that oversee different aspects of safety in the oil and gas sector. Nearly all of them have been set up under different laws that are not connected. Often times, there either overlaps or absence of differentiation in safety issues concerning oil and gas sector and others such as the explosives industry.



Five people, including two engineers, suffered burn injuries in a fire during oil exploration by Oil India Limited (OIL) in Assam's Duliajan area in August 2017. The victims were injured after an electric spark in a logging truck's AC unit triggered the fire. Another incident took place earlier this year in January, when one person died and four others were injured following an accident during drilling of oil at the state-run ONGC operated well near Chalsan village in Kadi taluka of Mehsana district in Gujarat. When the engineers were working on the rig, some heavy objects came flying out of the well due to internal pressure and hit the workers.

Oil Industry Safety Directorate at present is the key monitoring agency of safety standards but lacks legal teeth to penalise companies for failing to comply with directives. Other bodies focus on limited safety aspects and do not have an overarching approach towards safety in the oil and gas industry.



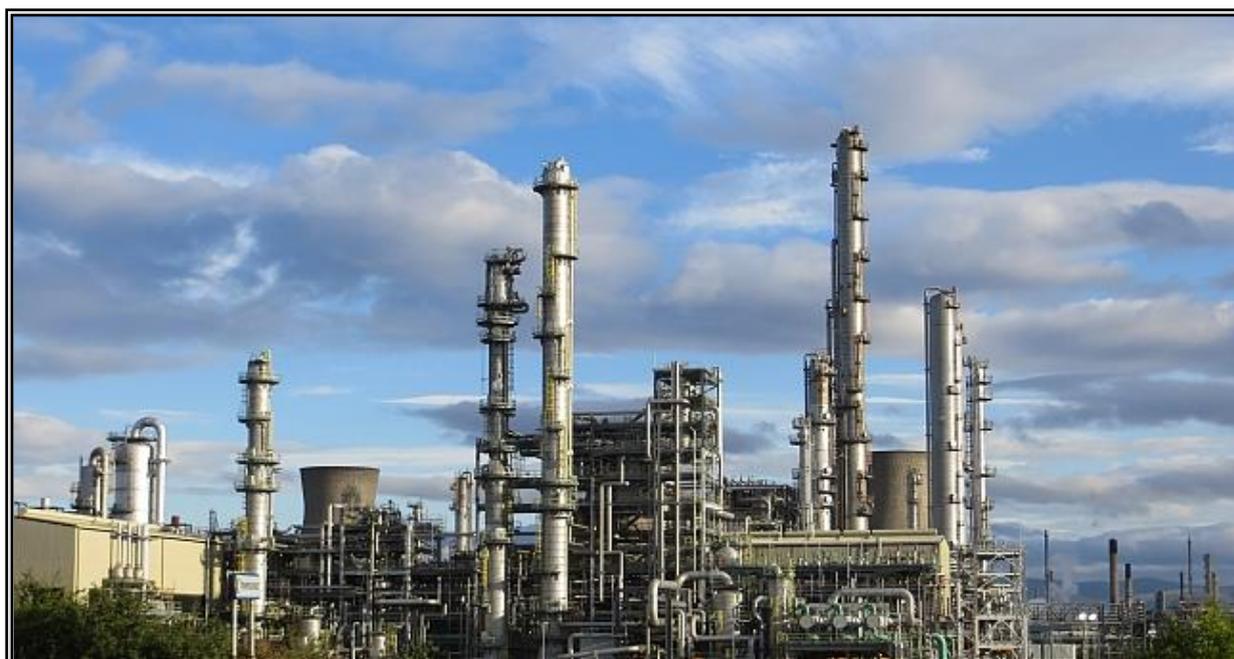
Petrochemical & Refineries

Petrochemical and refinery sector is by far the most important sector besides the oil & gas and power sectors, because these sectors impact the growth of many other industries. Used in everything from medication to plastics, petrochemicals are generally safe as finished products; in their raw form they can be highly corrosive, toxic and acidic, thus making their handling complex. Refineries refine crude oil into various usable petroleum forms, most critically petrol and diesel, which are lifeline of India's transportation system. Refineries also fall under high risk sites to work mainly because of the highly inflammable nature of the feedstock as well as refined products.

It is apparent that toxic chemicals in the petrochemical industry have resulted in health impacts, occupational diseases and unhealthy working environments by exposing workers and surrounding communities to numerous health, safety and environmental hazards. These hazards are mainly due to the toxic chemical products and associated poisonous gas fumes, which include sulphur oxide, nitrogen oxide, carbon monoxide, volatile organic compounds, fugitive hydrocarbons and dust. Known health impacts include cardiovascular, respiratory, reproductive and nervous systems. Long term health effects can include increased risk of mortality, lung cancer, chronic respiratory disease and heart disease, as well as damage to the liver and potentially the kidneys.



Two people died and eight others sustained grave injuries after a fire broke out at the refinery site of Reliance Industries in Gujarat's Jamnagar in November 2016. The fire broke out due to gas leak in RIL's Moti Khavdi refinery in Jamnagar early this morning. While the Reliance fire brigade extinguished the fire swiftly, this has resulted in injuries to 8 contract workers, who are being provided necessary medical treatment," the company said in a statement earlier today, and added that all operations of the refinery continue to be normal. The fire broke out at the company's fluid catalytic cracking unit (FCCU), a gasoline-making unit, at the 660,000 barrels per day (bpd) refinery, which was under planned maintenance.



In the context of safety in the type of industry in question, process safety management practices have evolved quite significantly. Major incidents in both the upstream and downstream industries have highlighted the importance of having robust processes and systems in place. Process safety is a disciplined framework for managing the integrity of operating systems and processes that handle hazardous substances. It relies on good design principles, engineering and operating and maintenance practices. It deals with the prevention and control of events that have the potential to release hazardous materials and energy.

Process safety involves the prevention of leaks, spills, equipment malfunction, over-pressures, over-temperatures, corrosion, metal fatigue and other similar conditions. In the petrochemical & refinery industry, programmes of process safety should focus on design and engineering, training and maintenance of equipment. Effective process safety is the outcome or result of a wide range of technical, management and operational disciplines.

Process Safety: Critical Practice for Oil, Gas & Petrochemical Industries

The process safety management program is divided into 14 elements according to the U.S. Occupational Safety and Health Administration (OSHA).

- Process Safety Information
- Process Hazard Analysis
- Operating Procedures
- Training
- Contractors
- Mechanical Integrity
- Emergency Planning and Response
- Management of Change
- Incident Investigation
- Compliance Audits
- Trade Secrets
- Employee Participation
- Pre-startup Safety Review
- Hot Work

Mining Industry

Mining industry in India has been plagued by mishaps and fatalities for as far back as large scale commercial mining started. In fact, going by the number and frequency of tragic mishaps that have happened, it is probably the most hazardous industry in India.

Even though the industry reportedly employs roughly 1 million workers, its health and safety aspects have unfortunately been ignored all these years. Sadly even the frequent health safety and environment disasters have not been incentives enough to shift focus on workers' security and welfare. Progressive improvements in the safety standard of India's coal mines notwithstanding, every ten days last year there was a mining fatality in the country. And every third day last year, on an average, there was a serious accident in the coal mining sector.

The records classify the location of accident as underground, open cast and surface. While the first two categories represent accidents occurring inside the mines, third category represents the mine related accidents occurring above the surface in vicinity of the mining area.

Table 2: Accidents and Casualties in 2015 by major minerals

Minerals	Number of Accidents		No. of Persons	
	Fatal	Seriously Injured	Killed	Seriously Injured
Coal	68	268	69	281
Copper	1	2	1	2
Galena & Sphalerite	2	4	2	4
Gold	1	4	1	4
Iron Ore	12	7	12	8
Lime Stone	2	1	2	1
Manganese	1	1	1	1
Stone	4	0	4	0
Others	17	3	18	5
Metalliferous	40	22	41	25
All Minerals	112	303	115	331

An analysis of the inquiry conducted by the Office of Directorate General of Mines Safety (DGMS), Ministry of Labour and Employment, of mining accidents between 2014-2017, shows that out of 181 major incidents, the management and/or the Subordinate Supervisory Staff, have been found responsible in an overwhelming 77 cases. Among the causes of these accidents, which have been compiled separately by the DGMS, an overwhelming 38% of the cases involved dumpers, loading machines and other heavy earth moving machines, while roof falls accounted for another 12% of the total 181 cases investigated.

Figure 3: Trend in death rate per 1000 persons employed in Coal Mines

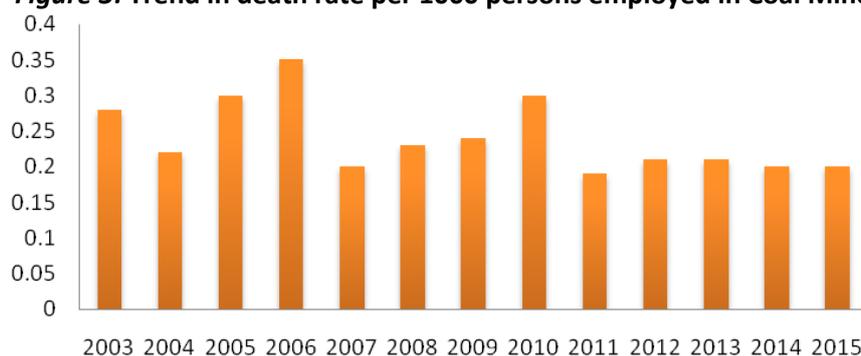


Figure 4: Number of Accidents in Non- Coal Mines

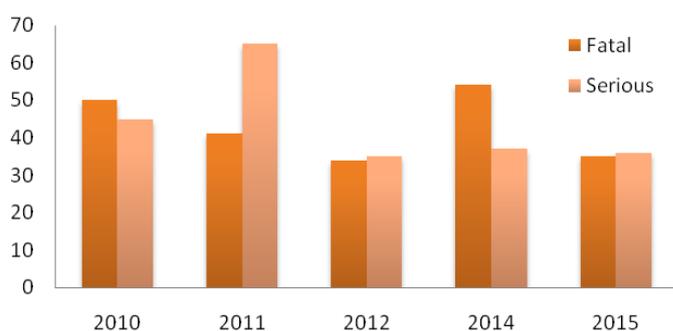


Figure 3 shows the trend in death rate on coal mines in India. We have not made much progress in the last 5 years. The situation is not very different in case of non-coal mines either, as depicted in Figure 4, where number of serious accidents have not come down in the last half decade.



In May 2016, 3 workers were killed at the Turamdih mines in Jamshedpur, in a mine operated by Uranium Corporation Limited. The workers got buried under wet radioactive slurry. Another mishap happened in December 2016, when around 820 feet of mine collapsed in Jharkhand's Godda district, resulting in over 25 people and several motor vehicles getting trapped under it, of which more than 7 people died. The mine was operated by Eastern Coalfields Limited, a govt owned company. These add up along with many other accidents in 2016 in the coal mining sector, making it the deadliest year till date, with 122 people reportedly meeting with serious accidents. That translates into a serious accident every third day.

Construction Industry

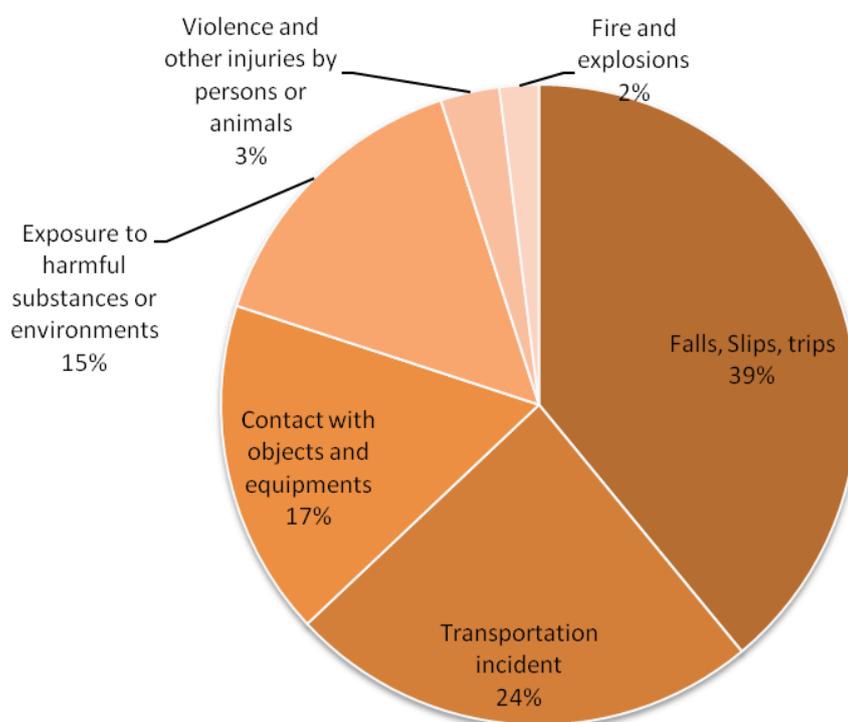
In India, the construction sector is legally governed by the ‘Building and Other Construction Workers Act (1996) and Rules (1998)’. Globally, it is one of the riskiest and most hazardous land based work sectors. Workers require protection from safety risks such as site excavation accidents, motor vehicle accidents, risk of electrocution while handling heavy machines and electronic equipment, danger of falling from heights, risk of being struck by falling objects or falling from height themselves during construction, and other such methods. Besides the risk of accidents and physical injury, health hazards of working closely with materials such as asbestos or solvents, or working with loud and noisy machinery, and risk of injury during manual handling activities are areas of prime concern.

Table 3: Accidents and Casualties in 2015 by major minerals

Types of Hazards	Examples
Mechanical	Fall of heights, fall of objects, etc.
Electrical	Electric shock, electrostatic discharges, etc.
Thermal	Heat, cold, fire, etc.
Radiation	UV radiation, ionizing, etc.
Noise	Exposure to noise, etc.
Chemical	Dust, fumes, gases, vapors, etc.
Biological	Pathogenic material, fungus, etc.
Other hazards/risks	Humidity, confined space, low visibility, etc.
Hazards/risks affecting health	Back injuries, skin diseases, etc.

Figure 5 below reveals that nearly 40% of worker fatalities are due to falls, slips and trips, followed by transportation accidents.

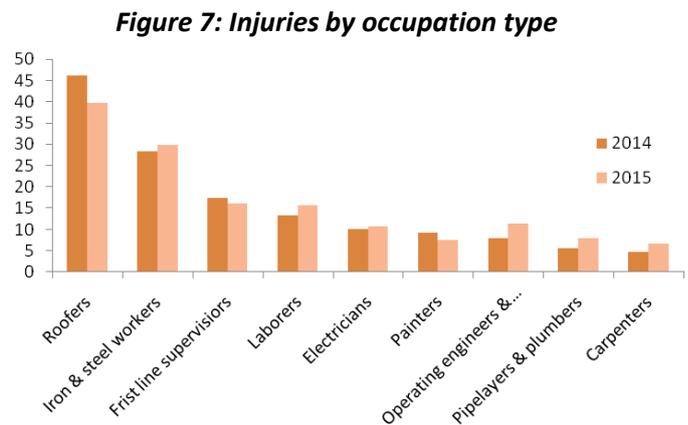
Figure 5: Construction Worker Fatalities by event or exposure





As per the data released by Bureau of Labour Statistics, their 2015 census of Fatal Occupational Injuries (CFOI), the construction industry had the largest number of working deaths (937 in number). This is the largest number of deaths reported, above 899 as in 2014.

If one is to look at Figure 7, it would be clear that rates of fatal injuries rose significantly from 2014 to 2015 in case of structural iron and steel workers, construction labourers, electricians, operating engineers and construction equipment operators. As the above pie chart clearly depicts, falls/slips/trips are the biggest causes of death among construction workers, closely followed by transportation incidents and others, including contact with harmful objects and equipments, exposure to harmful substances or environment etc.





Negligence and laxity with respect to providing the right safety equipment and gear to the workers are reasons for most of these accidents. An example of the same is a recent incident in Goregaon, Mumbai, where 2 workers fell from an under construction building and died. Another incident happened on the Taramani Road, Chennai, where a man fell to his death from site of an under construction flyover. Both these accidents could have been avoided had the construction workers been provided with proper safety equipments and belts/helmets, and in case of the Chennai accident, had proper safety nets been provided, the man's life could have been saved.

Pharmaceutical Industry

Pharmaceutical has been pegged as one of the fastest growing industries in India, but a lesser known fact is that our Environment Ministry has tagged pharma manufacturing a ‘red category’ activity because of the quantum of hazardous waste it generates.

In the absence of appropriate personal preventive equipment (PPEs), workers are exposed to ‘uncontrolled dose’ of drug being manufactured, leading to adverse health effects, including skin and respiratory complications. In the recent decades, India’s pharmaceutical sector has seen new heights owing to the rising Indian population and its low manufacturing cost being a lucrative option for the multinational companies.

Table 4: Categorization of hazards in pharmaceuticals

Category	Description
Eco-toxic	Damage is caused to the environment
Carcinogenic	Contribute to the causation of cancer
Persistent	Remain dangerous for a long time
Bio-accumulative	Accumulates as it makes it way up along the food chain
Disastrous	Due to a catastrophe, mishap, calamity or grave occurrence in any area

There are multiple serious impacts that workers in the pharmaceutical industry are exposed to. The long term impact of concentration of complex pharmaceutical mixtures on stream biota may result in acute and chronic damages, behavioral changes, reproductive damage, and inhibition of cell proliferation. One of the major impacts is on the marine life giving them long term abnormalities. The use of large volumes of pressurized steam and hot water are with compounding operations presenting potential for burns due to exposure to steam or direct contact with hot surfaces or heat exhaustion.

Recommended management practices include insulation, labeling and regular inspection of steam and thermal fluid pipelines, design of steam vents, pressure release valves away from the areas where workers have the access. The risks of occupational exposure to chemicals in manufacturing activities are potentially complex. In API manufacturing, employees may be exposed to airborne dusts during the handling of the product as well as during the processing of various stages like dispersing, drying, milling and mixing operations. A potential inhalation exposure to chemical

Quick Facts

Geographically, the bulk drug industry established a strong hold over the outskirts of Hyderabad. The situation is quite contrasting in terms of the environment and health effects on the local inhabitants and workers. Hyderabad is now, known as the ‘bulk-drug capital’ of India, accounting for nearly one-fifth of India’s pharmaceutical exports. It is the source of severe water pollution and was prohibited to expand further in 2010 and 2013 owing to its status of ‘critically polluted’ area. Hazardous wastes – in the form of liquids, solids, contained gases or sludge. As a general measure, approximately 200 kg of waste is generated per metric ton of active ingredient manufactured by the pharmaceutical industry.

emissions during routine plant operations is also a risk where the employees inhale the product at an unacceptable range. API manufacturing involves the use of reagents that are extremely reactive to moisture and oxygen and extreme care must be taken to prevent their exposure to air, which can lead to spontaneous ignition. A trained and knowledgeable team of workers can avoid fire and explosions, for which workers must have knowledge which chemicals he is using and how they must be treated and handled.

In term of environmental damage in pharmaceutical sector, waste generation is quite significant, sometimes as much as 20% of the total output by weight. Though it has recently caught attention in public consciousness, contamination of water is one of most critical research area in scientific studies, as the negative effects of the accumulated pharmaceutical waste ranges from the near elimination of entire species and the spread of anti-microbial resistance.



Blatant violations of safety norms have been reported at a number of facilities where workers have been left severely injured or even died.

Two persons were killed and two others injured in a blast at Sun Pharma's unit in Ahmednagar, which manufactured active pharmaceutical ingredients (APIs) used in formulations, in December 2016.

In another accident involving blast and subsequent fire at Nitika Pharmaceutical's facility in Nagpur, 9 workers were severely burnt and 1 died, in December last year.

Earlier in February 2016, another incident occurred where six workers were killed and one another was injured following an explosion in a reactor in a pharma unit on the city outskirts in Hyderabad.

Over half of India's pharmaceutical exports are to the regulated markets of U.S and EU. In order to export to such regulated markets, the Indian pharmaceutical industries have to comply with the regulation of the 'Good Manufacturing Practices' (GMP), specifying the minimum threshold that the companies must comply in their production processes. However, there are currently no GMP provisions regulating the environmental emissions from the production of pharmaceutical products, implying formally the authorities in the country have no regulatory power to monitor the environmental impact of the pharmaceutical production processes.



Power Industry

Occupational hazards refer to potential risks to health and safety of workers working in conditions which might cause personal harm, injury, death or property damage. Depending upon their occupation, there are 5 types of occupational hazards in the power industry that employees may be exposed to. These include physical hazards, chemical hazards, biological hazards, mechanical/electrical hazards, and psychosocial hazards.

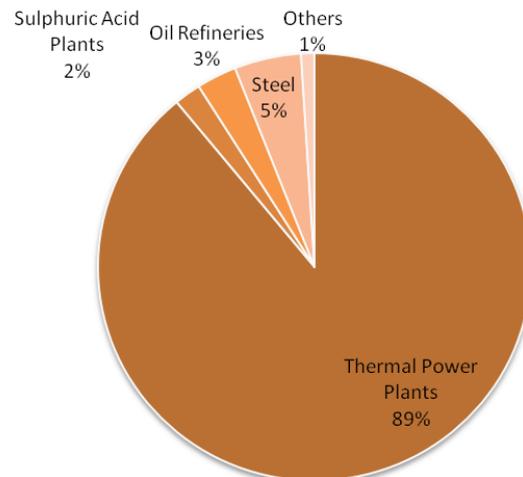
Table 5: Physical Hazards in power sector

Physical hazards	Examples
Heat	Heatstroke, cramps, exhaustion, burns, fatigue, etc.
Noise	Palpitations, nervousness, annoyance, fatigue, deafness, etc.
Vibration	HAVS, tingling, numbness, spinal and0 nervous disorder
Illumination	Blurring vision, discomfort, lacrimation
Radiation	Conjunctivitis, keratitis, anemia, leukemia, ulceration, cancer

Thermal power plants are among the largest contributors towards air pollution in the country, (particularly towards CO2 emissions), and major contributors towards global warming. Besides this, the pollution caused by these plants contains hazardous matters such as particulate matter (like fly ash), various nitrogen oxides, sulphur oxides, oxides of carbon (CO, CO2) etc. In fact, as the below diagram clearly shows, thermal power plants are the largest contributors towards emissions of sulphur dioxide.

Figure 8: Share of sulphur dioxide load by different

 In April 2016, 21 people suffered severe burn injuries when a boiler pipe burst at the Adani Power plant in Mundra, Gujarat, resulting in spilling of scalding hot water, resulting in the unit being shut down. Another case in point is the boiler explosion in Tuticorin in October 2016 which resulted in the death of 2 workers.



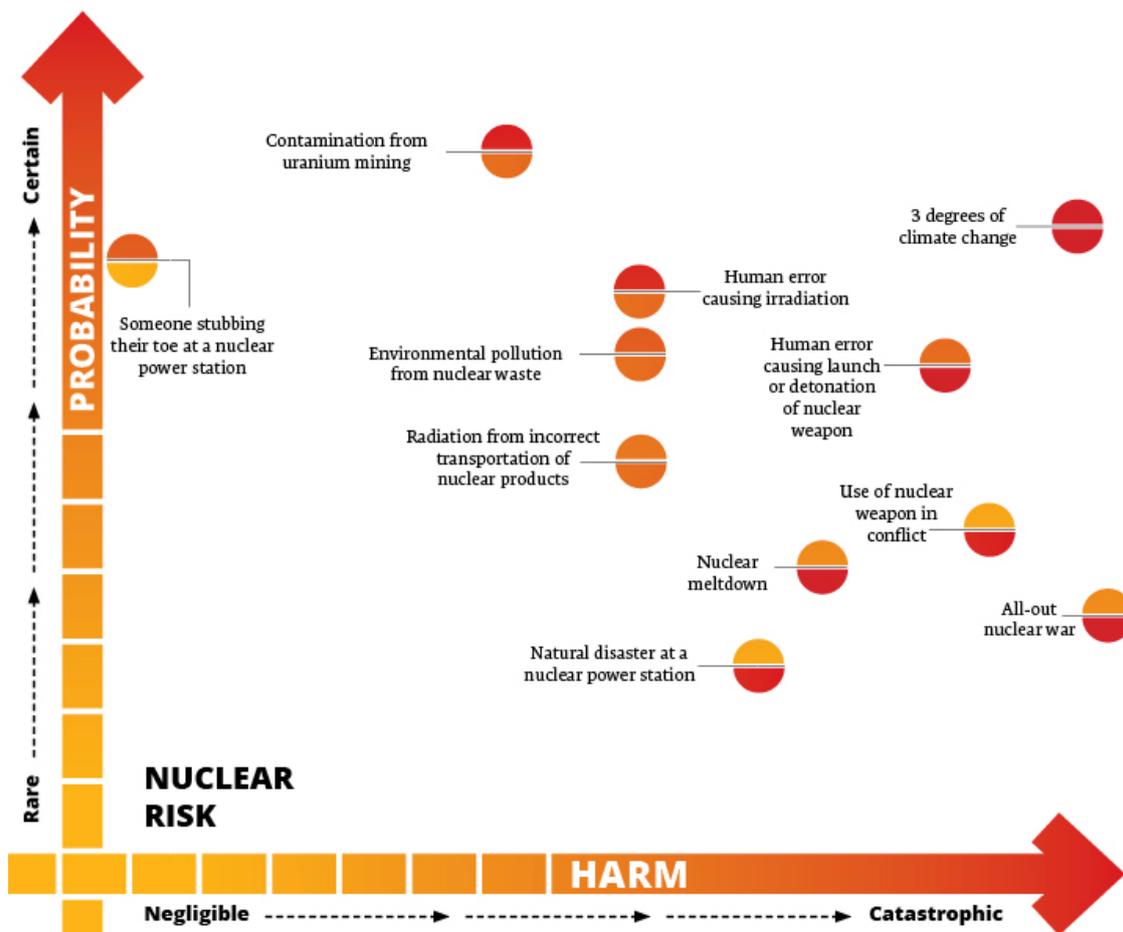
These harmful emissions as well as residual particulate matter that's present in the physical environment of the plants is a big health hazard for the workers and therefore a major cause of concern for the companies. Besides the harm caused by pollutants present in the air, proper maintenance of big capital equipment used is an equally big concern, as lack of proper attention to its maintenance might result in big accidents.

In order to support its economic growth and commitment to environment, India needs to depend on 40% power generation from renewable sources by 2030. The quantum of power required is so large that we must focus on large capacity projects and drive them home instead of small ones. The government has set a target of generating 63 GW of nuclear power by 2032, which is very ambitious

given our history thus far. We have managed to construct only 20 reactors in the 46 years since its first civilian reactor went critical in 1969. Besides, there is a credible concern over Nuclear HSE preparedness of India, which needs serious attention. The manual on emergency preparedness at Kalpakkam, despite being revised in April 2011, still includes a regulatory guideline with intervention levels based on Publication 40 of the International Commission on Radiological Protection (ICRP) adopted in 1984, well before the Chernobyl disaster. There have been updates to these international guidelines in 1992, and then again in 2007. However, India's nuclear regulatory body, Atomic Energy Regulatory Board (AERB), has not updated its guidelines for 26 years. The following 'Nuclear Risk Matrix', originally developed by Sydney based green fund managers called Australian Ethical, brilliantly captures the overall HSE risk profile of nuclear power plants. This risk matrix is a way to measure the potential harm that could be expected to occur with respect to a given type of harm and its probability.

 A recent incident was reported when one of the two 220 MW units of Kakrapar Atomic Power Station (KAPS) in Gujarat's Surat district shut down in March 2016 after leakage of heavy water and was not operational for more than four months. Unfortunately, the exact reason of the leak is still not deciphered even after several months of investigation. The Kakrapar accident proved that India's nuclear accident plans are not in line with international standards. Only four public updates were provided in 21 days of continued plant emergency at Kakrapar nuclear station. A big concern emanating from incidents like these is the lack of an independent nuclear regulator, which has already been highlighted by the International Atomic Energy Authority (IAEA).

Figure 9: Nuclear Risk Matrix



Manufacturing Industry

The launch of 'Make in India' and 'Skill India' initiatives envisages establishment of high-class manufacturing facilities and enhancement of skills. While these would contribute to increased output of the manufacturing sector, the human capital should also be looked after by improving the occupational health scenario. India has a large and complex manufacturing sector but with meager occupational health services. While a gradual decrease in the incidence of accidents has been reported, the proportion of fatalities has increased. Though 44 legislations and programmes related to occupational health and safety of workers are in place, many of their provisions are left unimplemented. There is a major shortfall in manpower needed to assess and address occupational health and safety of workers.

The Factories Act, 1948 is the legal statute in India governing regulations pertaining to OSH. Even though reporting regarding occupational diseases is rarely done as required by law, there are many studies which have been conducted regarding the same, which highlight existence of various occupational diseases, and these are mainly respiratory diseases caused due to exposure to fine dust particles. The biggest challenge lies in diagnosing these diseases and problems as occupational diseases. The following table lays down some of these hazards and the industries they plague:

Table 6: Occupational health hazards in the manufacturing sector

Sectors	Occupational health hazard reported
Leather/tanning industry	Dermatological problems, respiratory illnesses, gastro-intestinal problems, oxidative stress, occupational skin diseases, contact dermatitis, asthma, hepatic/neurological disorders, malignancies
Chemical industry	Skin disease, mental stress, liver problems, tuberculosis, breathing trouble, hi urinary and serum fluoride, poisoning, hepatotoxicity and nephrotoxicity
Metal & Allied Industry	Musculoskeletal problems, gastro-intestinal problems, respiratory problems, dust/smoke/ultraviolet rays related eye problems, skin problems, noise related to hearing problems, high blood and urinary lead levels, decreased serum calcium/phosphorus/vitamin D levels, increased parathyroid hormone levels, raised systolic and diastolic blood pressure
Plastic and rubber industry	high blood and you deanery lead decreased haemoglobin levels, raised liver enzymes reduced lung volume and lower rates, reduced physic-reducing ability of plasma, reduced Blu-Tack Taiwan level and increase level of oxidative stress, cytogenetics damage and carcinomas next para next para para change
Textile and weaving industry	Aches, respiratory diseases, musculoskeletal disorders of upper and lower back (women) or knee (men), persistent cough, expectoration, backache, common cold, joint pains
Asbestos industry-	Carcinomas, parenchymal lung disease, asbestosis and pleural disease
Automobile manufacturing	Heat stress related health impairment, carcinomas and genetic changes

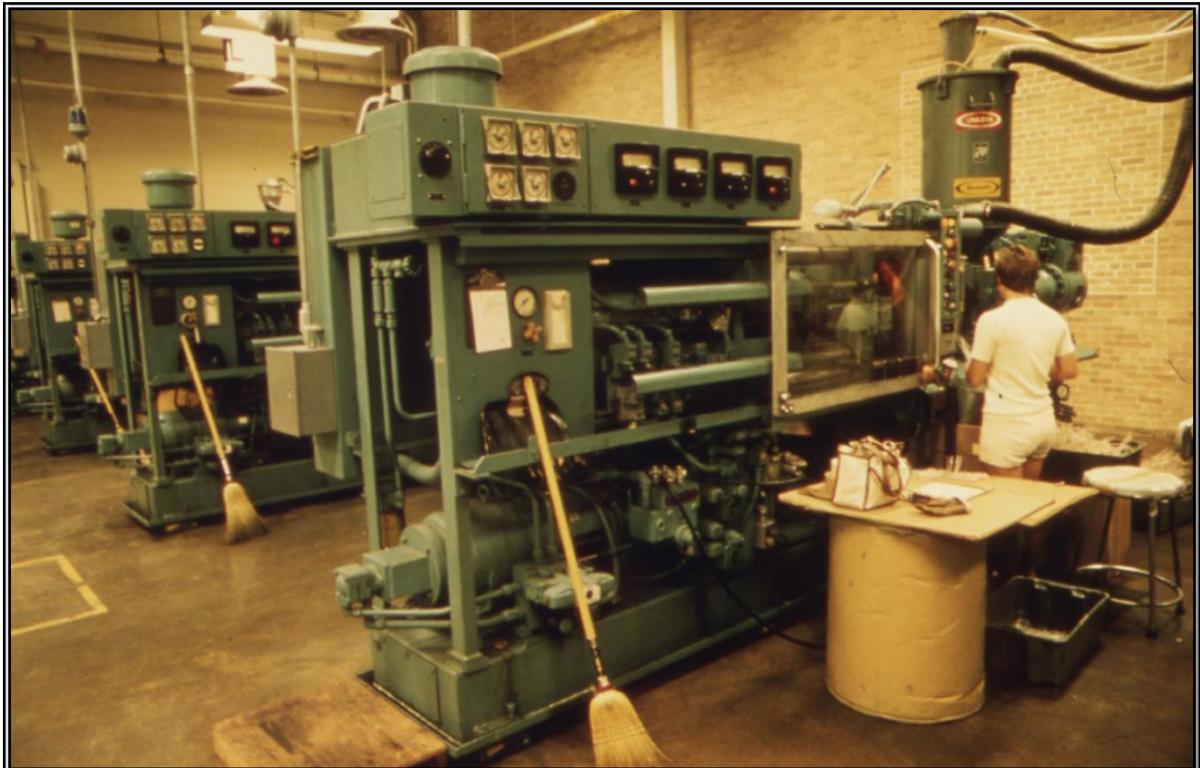
While the past performance in the OSH domain might not have been very bright, the future does seem encouraging. There is a paradigm shift in manufacturing culture as a whole, wherein companies are themselves realizing the importance of investing and maintaining healthy OSH practices. For example, Coca Cola has been dedicatedly working towards mitigating all conditions which might result in fatal workplace accidents. The company has invested considerable time and resources in studying and understanding the factors responsible for these incidents, and then worked towards preventing them. They have also implemented a specialized program called the Quality, Safety and Environment (QSE) program, where people are trained intensively in field development.

Understanding that workers face safety risks due to the nature of work involved, companies throughout the manufacturing sector are now also recognizing the need and importance of employee training as one of the most crucial elements towards ensuring workplace safety.



At least 23 people were killed and 10 were severely injured after an explosion in a firecracker factory in Balaghat, about 440km southeast of Bhopal, in Madhya Pradesh in June 2017. The blast sparked a blaze which couldn't be tamed for two long hours.

In January 2017, a 29-year old, mechanical engineer was killed while working in the assembly line of the plant. The junior engineer was crushed to death by a hydraulic press while he was inspecting the machine.



Water Treatment Industry

The term 'sewage' refers to used water containing waste matter, including human waste or solid waste or any form of refused liquids. Now, sewage may be domestic waste water or industrial waste water. Waste water treatment has always been considered a dangerous field, especially when it involves manual scavenging. Even though the current situation is better, it's still a big health hazard. This hazardous nature is especially visible in 2 cases: exposure to harmful chemicals in the sewer systems and exposure during water treatment processes.

Some of the chemically related health problems are usually mainly of the following kinds:

- Short term exposures or complaints involving eyes, throat or nose irritations, or
- More chronic problems caused by constant exposure which may result in organ damage or occupation related allergies.

Inhalation and Skin Contact have been reported to be the major route causes for chemicals or microbes entering the body. Inhalation:

- Exposure to chemical infested air in the aerated tanks, dewatering processes and other sludge processes causes the polluted air to be inhaled, thus entering throat or bronchial tracts, resulting in respiratory or gastrointestinal exposure.
- Skin Contact: Chemicals can be absorbed by the skin on coming in contact with the sludge or any other form of water waste, as also with the various disease causing microorganisms.

Studies suggest that the physical layouts of most sewage plants involve open tanks or basins, allowing harmful volatile organic waste (including carcinogens and/or mutagens) to be vaporized during treatment, thus putting the sewage workers at a higher risk of cancer or birth defects/outcomes.

Table 7: Organisms present in waste and the diseases they may cause

Disease	Types of Infection	Agents
Gastroenteritis	Viral	Enteroviruses, rotavirus, astrovirus, etc.
Infectious Hepatitis	Viral	Hepatitis A, Hepatitis B
Cirrhosis, Liver cancer	Viral	-
Respiratory Disease	Viral	Adenoviruses, Reoviruses, Coronaviruses
Poliomelitis	Viral	Polio viruses
Typhoid Fever	Bacterial	Salmonellae
Cholera	Bacterial	Vibrio Cholerae
Gastroenteritis	Bacterial	E-coli
Amoebic Dysentery	Protozoan	Entamoeba lamblia
Giardiasis	Protozoan	Giardia lamblia
Balantidiasis	Protozoan	B-coli
Meningitis	Protozoan	Naegleria fowleri

One waste water and sewage treatment plant manages the waste for a very large number of industries, which means a huge number of different types of chemicals/particles/organisms are present in the industrial sludge waste. The chemicals could include pesticides, heavy metals, flame retardants, asbestos, dioxins, radioactive materials, nitro compounds, petroleum hydrocarbons, etc. Besides these, there could also be other chemicals which aren't a part of direct industrial waste, but formed by microbiological processes on some other waste, and these may sometimes be even more toxic than the original waste material. Besides these, the waste may contain various disease causing microbes which are present in the sludge puts workers at an increased risk of infection of these diseases. Organizations need to work towards reducing the risk of chemical exposure to their employees, and thus the resultant risk of diseases. They can start by enforcing strict pre treatment regulations to reduce concentration of harmful chemicals in the waste disposed. They can plant more trees around the treatment facility aeration basin so that the trees can capture the droplets/particles. Even small steps like disinfecting airborne particles using UV rays or labeled piping to distinguish the potable and non potable water helps. Workers should be encouraged to use proper protective clothing and equipment, including heavy duty gloves and boots etc to prevent them from coming in direct contact with waste and sludge. They should be encouraged to clean and disinfect themselves immediately, as well as treat any cuts or abrasions promptly.



Lack of proper safety gear can lead to fatal casualties, even loss of life. Case in point is the accident in Wakad, Pune, in November 2014. Two workers died while cleaning a sewage treatment plant, due to inhalation of toxic fumes. They had not been wearing any safety masks or protective clothing. A similar incident happened in Kodungaiyur, Chennai, where two workers died due to asphyxiation when they went inside a 6 feet deep sewage tank while treating sludge. Again, proper safety equipment and clothing had been missing, due to which they ended up inhaling poisonous gases. Moreover, besides lack of proper clothing and protective equipment, accidents also happen due to lack of maintenance of property, as well as negligence of law and guidelines. An example of this is an accident which occurred in Vellore, Tamil Nadu, where ten workers were killed and buried alive while sleeping when a tank overflowing with effluent waste collapsed on the compound of an adjacent wall. The 75,000 cubic feet tank had been constructed without permission from the government, and held more quantity of waste than it could hold, which is the reason it crashed.



Exploring Various Dimensions of Health, Safety & Environment

Dynamics within the industrial space have been changing very fast, particularly in response to fast changing markets. Even in the context of HSE, the challenges and threats have been changing and new ones emerging. Hence, it is important to understand various dimensions of health, safety and environment, which are currently relevant to organisations at large.

In this section, we will be discussing some of the most important areas which define HSE landscape. They include:

- Contractor Safety Management
- Asset Integrity Management
- Fire Safety
- Competency Assurance
- HSE in Facilities Management
- Human Factors in HSE Management
- Occupational Health & Wellness
- Road safety
- Disaster Management
- Cyber-security – a fast growing HSE threat



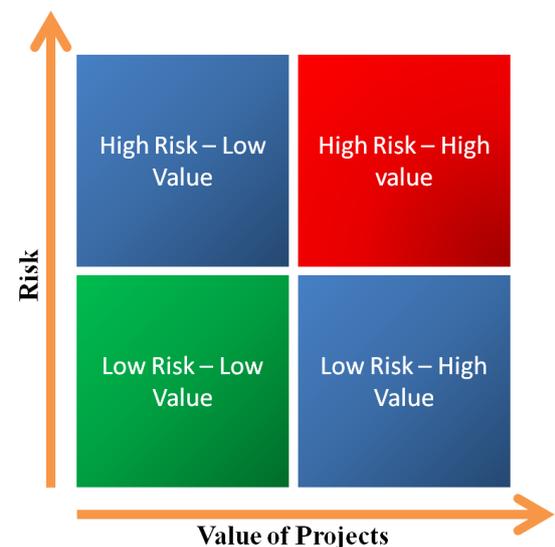
Contractor Safety Management

Contractor Safety Management System categorizes and manages contractors on basis of work undertaken by them. This system helps the organization deal with risks that involve exposing company employees to any occupational hazards that might exist on the contractor’s facility, and conversely helps the contractors safeguard their personnel from any unfamiliar hazards they might face while undertaking new work activities, such as unique chemical hazards, or x-ray sources. Besides this, sometimes the facility safety controls might not be strong enough for the projects underway and thus be unintentionally bypassed. Hence, in order to protect employees from all such similar challenges, companies need to select contractors cautiously and apply adequate controls, so that they are able to manage the contractors.

Following the below steps might be the prudent approach:

- **Pre-Project Planning:** In order to ensure successful incident-free completion of the project, safety requisites should be shared with the contractor in the initial stage itself. This should include an in depth risk assessment and analysis, to identify possible risks and hazards, and then implement various checks and balances to reduce the same to acceptable levels. Best means to do the same is to create awareness among workers and train them, so that they can deal with any unforeseen circumstances that might arise to best of their ability.
- **Prequalification:** The most important step is to study the safety performance specifics of a contractor before selecting one, using “lagging indicators” (e.g. incidents rates, EMRs, etc.) and “leading indicators” (management systems in place, the contractor’s internal training programs, etc.). The job in hand should be the criteria to decide which risks matter, keeping in mind that more indicators be in place for riskier job profiles.
- **Orientation:** This means ensuring the contractor recognizes the requirements to perform the job safely. It’s important to acknowledge the safety system already in place, and establishing a relationship of mutual respect and cooperation, which is vital for developing the focus on safety.
- **Monitoring, Evaluation & Feedback:** The HSE aspects of the contracted project should be monitored through course of the project, and a post-work evaluation should incorporate data from the contractor’s periodic observations and findings, with due attention being paid to feedback on the project.

Figure 10: Safety Risk Matrix

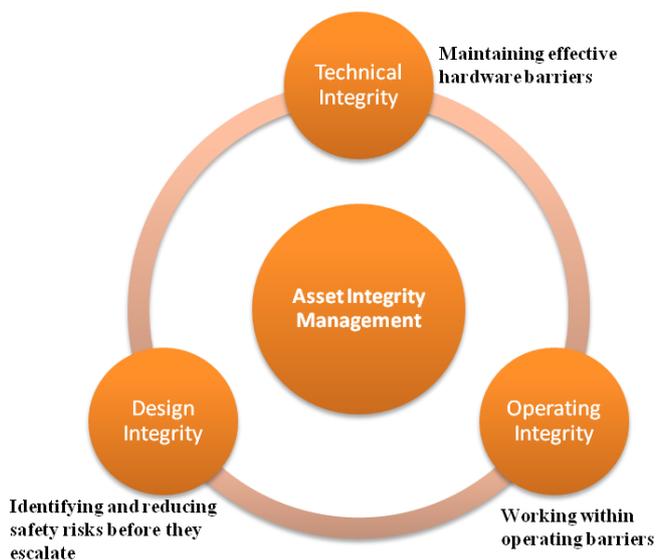


Asset Integrity Management

Asset Integrity is the ability of an asset to perform its required function effectively and efficiently while safeguarding life and environment. A well shaped asset integrity management is a strong preventive approach aimed at mitigating HSE risks. From the time equipment is brought into the business and put to use, various aspects such as product lifecycle, depreciation, productive capacity, operational & maintenance costs etc. require attention. In order to ensure that the integrity of the engineering systems of these capital equipments is maintained throughout the expected life of the assets, these practices have been designed which look to maximize returns on the assets while minimizing risks associated with the equipment. The usual phases of this process include identification, development, execution of inspection, monitoring and continuous

improvement.

Figure 11: Components of Asset Integrity



There are two primary approaches to implement asset integrity management. First, risk-based inspection (RBI), whose key facet is the detailed analysis of risk factors and the development of action plans that are aligned with the relative risk. The second approach is reliability-centered maintenance, which analyzes condition and performance data to determine which maintenance tasks to perform and when for more complex machinery when there are many failure modes and consequences.



Competency Assurance

Competence Assurance refers to a structured way of identifying, assessing, developing, and managing the continuous competence of company personnel and ensure they're capable of completing assigned tasks to predetermined standards.

Success of a project depends upon the people executing it. Similarly, success of organizational safeguards also depends upon its people to utilize their skills and competence in equipping the organizations with checks and measures which help prevent any HSE lapses, and are able to manage any mishap that might occur. In this ever evolving and increasingly complex business environment, competence has become even more critical.

'Competency Assurance' practice involves selecting skilled personnel and focusing on upgrading their competitiveness regularly to ensure their skills and diversity are always up to date. This is critical because the ability to learn and adapt is as important in an individual as it is in case of an organizer.

HSE in Facilities Management

A healthy facilities management (FM) is one which looks at preparedness as one of the basis of an organization, and helps keep various HSE hazards at bay. The main objective is to ensure a safe, eco friendly and congenial/hygienic environment.

Some important points to note:

- FM department should ensure maintenance, inspection and testing for all of the fire safety equipment and systems, keeping records and certificates of compliance.
- Security infrastructure should be such that ensures protection of employees.
- Maintenance, testing and inspection schedules are required to ensure that the facility is operating safely and efficiently.
- Building maintenance is required for the upkeep and modernization / improvement of the facility keeping in mind the safety parameters as well as evolving organizational needs for welfare of the workers.
- Cleaning operations for maintenance of the facility shall be undertaken and provision may be made during times of occupations for the cleaning of toilets, replenishing consumables plus litter picking, etc.
- Organizations usually have a business continuity plan so that in event of a fire or major failure the business can start operations with minimum loss of time. The facilities management department would be one of the key players in setting up such a backup facility.

Fire Safety

Fire is one of the most critical safety risks across many industries. Whether it is the hydrocarbon industry or sectors which use fuel to power the process or power sector itself or workplaces operating on power supply, chances of fuel leakage, a sparkle, blast, short-circuiting etc. always exist. According to the World Health Organization, an estimated 1, 80,000 deaths every year are caused by fire burns, the vast majority of which occur in low and middle-income countries. In India, nearly 20,000 people die and over 1 million people are moderately or severely burnt every year.

Fire risk assessment should be the foundation for all the fire safety management practices. When considering fire risk assessment it is useful to understand that fire hazard has two main components balanced against each other, one is the possibility of a fire occurring and the other the magnitude of consequences of that fire. When evaluating the measures needed or proposed and deciding what would be acceptable then the principle of ALARP (as low as reasonably possible) should be given attention. Prime objectives of risk assessment include identifying fire hazards, people at risk and ways to minimize impacts in case of fire. Fire Safety Audit is found to be an effective tool for assessing fire Safety standards of an organization or occupancy. In other words, it is aimed to assess the building for compliance with the National Building Code of India, relevant Indian Standards and the legislations enacted by State Governments and Local Bodies, on fire prevention, fire protection and life safety measures.

Possible sources of ignition are:

- Defective electrical fittings and defective or misuse of electrical apparatus
- Matches, Lighters, Candles and Smoking materials
- Flame or sparks from a work process such as welding, cutting, grinding etc.
- Electrostatic discharges
- Ovens, kilns, open hearths, furnaces or incinerators
- Boilers, engines and other oil burning equipment
- Portable heaters
- Cooking equipment, including deep fat fryers
- Combustible fuels such as paper, wood, cardboard etc.
- Highly combustible fuels such as thinners, solvents, polyurethane foam etc.
- Persons undertaking unsafe acts such as smoking next to combustible materials
- Bad housekeeping may lead to start or spreading of fire, which could be avoidable



Human Factors in HSE Management

According to a definition by World Health Organization, human factors “refer to environmental, organizational and job factors, and human and individual characteristics which influence behavior at work in a way which can affect health and safety.” These factors can include tasks and work patterns, workplace environment, workspace culture, policies, programs, worker competency, workers/employee attitude, etc.

While looking at human factors, it's important to factor in the fact that workers are fallible, and can occasionally commit mistakes, which can be any of the following 3 types:

- Errors and unintentional mistakes
- Poor judgement and bad decision making
- Disregard for procedures

In context of HSE, *Ergonomics* plays a significant role which includes looking out for the facility as well as individuals, and this can be done by looking towards records of workers' compensation, illnesses, injuries, etc. The biggest concern under Ergonomics pertaining to HSE is that of MSDs (musculoskeletal disorders), which may be caused due to extreme work environments such as excessive use of bodily force, awkward postures, extreme temperatures. Ergonomics is indispensable while understanding the employees' efficiency in order to understand the reasons behind errors that might occur during work and factors which might make them worse if they go unattended. Maintaining a safe workplace is primarily the responsibility of top management, which needs to create a culture for zero-tolerance towards any deficits in the workplace safety.

Occupational Health & Wellness

These days many companies are running corporate wellness programs, with a view to encouraging and promoting good health and wellness among their employees and their families. The focus is on ensuring an overall wellbeing of the employees, as that too directly impacts their contribution at work. There are proven records the world over which show that about 30% employees have been saved from lifestyle disorders caused by problems of obesity, hyperlipidemia, diabetes, etc due to these wellness programs. These companies realize and understand the importance of promoting good health and wellness among employees, as it has a direct impact on their work output. For, every extra penny spent in working towards the wellbeing of employees results in huge additional returns to the company.

Here are some of the most successful programs run by some global companies:

- Apollo Life offers various pathological tests, scans, Ayurveda, dietary advice, personalized counselling sessions as well as tele-counselling sessions which help employees maintain a healthy lifestyle. They even have programs to help employees quit smoking and alcohol dependency.

- TCS conducts regular health screening for their employees with an effort to promote healthy living, as poor health leads to poor performance at workplace. They also have screening tests, counselling sessions, physical activities, etc. For better output at work, they also have stress management counselling and sleep management sessions which provide employees the extra edge to manage their health.
- L&T Infotech's Health and Wellness Solutions offer various corporate programs which take into consideration long term illnesses and the unfit nature of most employees. It integrates seamlessly technology with healthcare to provide optimal benefits to employees.
- Wipro corporate wellness program seeks to incorporate wellbeing of the employees as well as their families with complete health check up for the employee as well as coverage for the basic treatments used during the entire working year.



Road safety

Globally, road traffic injuries are believed to be the eight leading cause of death. Over 1.2 million die due to road injuries across the world, averaging around 3,400 deaths per day caused due to road accidents and crashes. India has the highest number of road accidents anywhere in the world. In 2005, 98,000 people died due to road accidents as per the National Crime and Records Bureau, and increased sharply to over 140,000 deaths in 2014, and this rise is faster than the population growth rate during that same period.

Road traffic injuries place a huge economic burden on low and middle income countries, and estimated to cost around \$65 million, which is way above the amount received in development assistance. In India, majority of victims are in the age group of 15 to 45 years, which a) puts their families under financial stress, and b) also impacts the GDP growth of the country significantly.

The United Nations 2030 Agenda for Sustainable Development includes the target of reducing road traffic deaths and injuries by upto 50% till 2020 (SDG target #3.6). This is expected to leverage the omentum for the Decade of Action for Road Safety 2011-2020.

In its path to achieving these targets, India can learn a lot from some of the successful road safety strategies adopted by other countries, such as Vision Zero, a comprehensive road safety strategy pioneered by Sweden in 1997. While implementing this strategy, Sweden has made many path breaking decisions on the path to zero road fatalities, including the policies of road designing and transport planning. This strategy is based on

India can stand to learn from some of the successful road safety strategies adopted by other countries. Once such popular approach is called Vision Zero. Vision Zero is a comprehensive road safety strategy, pioneered in Sweden in 1997. Under this strategy, Sweden has made many far-reaching and path- breaking decisions, on the path to zero road fatalities, including reassessing their priorities in transport planning and road design. Vision Zero is based on 4 guiding principles.

- The Vision Zero approach pegs human life and health above all other transportation challenges. It states that when solving for issues like traffic flow, congestion or road capacity, safety for all road users must be never be compromised.
- Vision Zero accepts the inherent fallibility of human-beings. It states that transportation systems need to be designed taking into account that people might make mistakes, so that when crashes occur owing to human error, it does not result in fatalities or serious injuries.
- Vision Zero accepts that there is a joint responsibility for safety between the road user and road authorities.
- Vision Zero is based on a comprehensive and consolidated strategy to road safety that involves all authorities and agencies responsible for road transport systems. Vision Zero recognises that departments working in silos will have limited impact.



Disaster Management

Disaster management means management of resources and responsibilities for dealing in all humanitarian aspects of emergencies such as preparedness, response and recovery, in order to minimize the harmful effects of all hazards which arise as a result of disasters.

Disasters can either be natural or manmade, and because they can be catastrophic and doesn't allow much reaction time, it is very crucial. Over years, as businesses have scaled up operations and level of operations of facilities, extent of potential loss due to disasters has also gone up significantly. Some examples of recent disasters include the Gulf of Mexico oil spill, flooding of Australian mines, damages caused by hurricanes like Irene or Sandy or Katrina, etc.

In 2007, Dr. Wayne Blanchard of FEMA's Emergency Management Higher Education Project, at the direction of Dr. Cortez Lawrence, Superintendent of FEMA's Emergency Management Institute, convened a committee which aimed to formulate comprehensive principles of emergency management. This was the first time ever that any standard principles in this domain were being codified. The group mutually ratified eight principles to be used to guide the development of a doctrine of emergency management. A brief summary of the same is as follows:

Table 8: Principles guiding disaster management

Principles	Description
Comprehensive	Consider and take into account all hazards, all phases, all stakeholders and all impacts relevant to disasters.
Progressive	Anticipate future disasters and take preventive and preparatory measures to build disaster-resistant and disaster-resilient communities.
Risk-driven	Use sound risk management principles (hazard identification, risk analysis, and impact analysis) in assigning priorities and resources.
Integrated	Ensure unity of effort among all levels of government and all elements of a community.
Collaborative	Create and sustain broad and sincere relationships among individuals and organizations to encourage trust, advocate a team atmosphere, build consensus, and facilitate communication.
Coordinated	Synchronize the activities of all relevant stakeholders to achieve a common purpose.
Flexible	Use creative and innovative approaches in solving disaster challenges.
Professional	Value a science and knowledge-based approach; based on education, training, experience, ethical practice, public stewardship and continuous improvement.

Cyber-security: a fast growing HSE threat

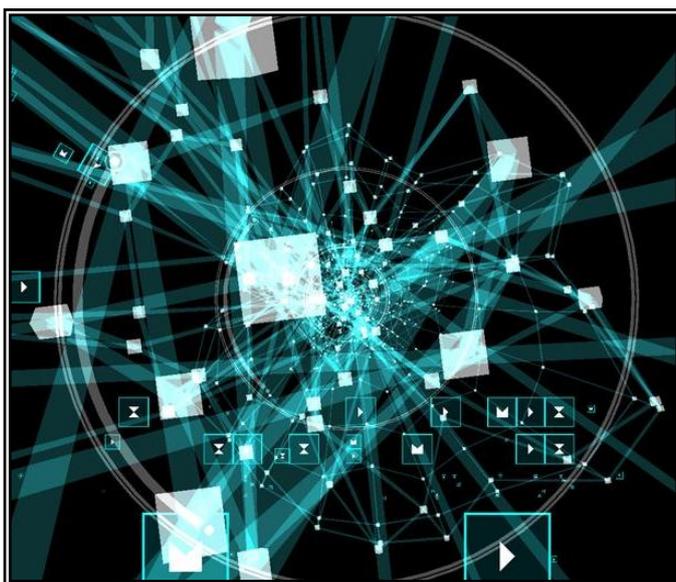
The industrial world is becoming increasingly reliant on IT based technologies for monitoring, reporting, storage and processing of data and even decision making. It has already been recognised that we are heading towards the fourth industrial revolution, after three revolutions that led us from manual practices to mechanized processes to power driven mass production. This is being recognised as the Industrial Internet of Things or IIoT which can be defined as a network of physical devices, machines, equipment, systems, vehicles or any other item, which are embedded with electronics, software, sensors, actuators, and network connectivity that enable these objects to collect and exchange data.

However, IoT walks the path of security vulnerability. Any device that is controlled by network communication via the internet is exposed to risks of being hacked. IoT devices are in no way exempt from this. The brief period of time it takes to plug in a laptop (that has an internet connection) to a flow computer in order to download a software upgrade is all it takes to upload malicious malware such as BlackEnergy or Stuxnet.

Critical infrastructure based operation of power, oil & gas, refinery and petrochemicals are all prone to cyber attacks. The ultimate threats could even mean shutting down of the entire facility as the controls can be remotely taken over by cyber-criminals. Crimes such as data theft and infecting the system with malwares have already been done plenty of times.

In 2012 and 2013, Russian hackers successfully sent and received encrypted commands to U.S. power generators. In 2015, unauthorized cyber hackers injected malicious software into the grid operations that allowed spying on U.S. energy companies. And also, in 2015, US law enforcement officials reported a series of cyber attacks that were attempted by ISIS targeting the U.S. power grid. The U.S. Department of Homeland Security, responsible for protecting the nation from cybercrime, received reports of more than 350 incidents at energy companies between 2011 and 2015. In most cases, a hacker infiltrated or tried to infiltrate the control systems of energy firms. During that period, the agency identified nearly 900 security vulnerabilities within U.S. energy companies, more than any other industry.

This trend is prompting top management in many corporations to take up cyber-security more than ever. Protection against potentially serious threats translates into taking care of top imperatives like safety of assets, people, and environment; an uninterrupted availability and reliability of assets; and creating new value from assets (see figure 6). The next step involves rallying everyone in the enterprise around a holistic cyber risk management program.



Latest Trends in HSE Landscape

HSE & Sustainability

Sustainability is gradually changing the business landscape. Decision makers are beginning to realize that integrating sustainability principles with business processes is that missing link in supply chain management or for that matter operations management which can improve shareholders' interests and minimize cost ridden negative externalities. Interestingly, HSE principles bear immense relevance in this context. All three legs of HSE — health, safety and environment are integral components when analyzing the sustainability performance of an industry. It is no surprise that in many corporations, HSE components form a part of the overall sustainability pursuits of the firm. Talking of fundamentals, the triple bottom line definition of sustainability is the best reference to make where striking a balance between people, profit and planet is the endeavor. Correspondingly, wellbeing of people is taken care of by ensuring good health and all round safety, whereas tackling environmental concerns and responsibly using our resources takes care of the environment.

One of the most important social aspects of sustainability of an organization is ensuring the health and safety of its employees. Stakeholders consider health and safety as important aspects of non-financial reporting. In fact, most global companies today include targets for safety and health in their sustainability reporting. Fatality reduction, safety improvisation, promoting healthy living among employees, and occupational health are being increasingly part of corporate reporting. Addressing the intertwined challenges of ensuring environmental sustainability has been an ever increasing priority for sustainable development. The environment and socio-economic development are so intricately linked that development cannot be sustainable without considering the environment.

Adherence to HSE practices will also accelerate efforts towards achieving Sustainable Development Goals (SDGs). On September 25th 2015, UN countries adopted a set of goals to end poverty, protect the planet, and ensure prosperity for all as part of a new sustainable development agenda. Each goal has specific targets to be achieved over the next 15 years.

Figure 12: Sustainability Development Goals (2015-2030)



High Reliability Organisations (HRO)

In recent years, a number of companies are pioneering in establishing a robust HSE culture and are committed to transform the HSE culture at their sites into a high reliability organization. A high reliability organization (HRO) is one that has succeeded in avoiding catastrophes in an environment where normal accidents can be expected due to risk factors and complexity.

Table 9: Features of High Reliability Organizations

HRO Characteristics	Description
Effective anticipation of potential failures	<ul style="list-style-type: none"> • Pre-empt failure • Reluctance to simplify • Sensitivity to operations
Leadership	<ul style="list-style-type: none"> • Multiple communication channels • Proactive commission of audits to identify problems in the system • Balance profits with HSE investment • Engagement with front-line staff • Investment of resources in HSE
Successful containment of unexpected events	<ul style="list-style-type: none"> • Deference to expertise • Redundancy • Oscillation between hierarchical and flat/decentralised structures • Training and competence • Procedures for 'unexpected' events
Just Culture	<ul style="list-style-type: none"> • Encouragement to report without fear of blame • Individual accountability • Freedom to abandon work on safety grounds • Open discussion of errors
Orientation	<ul style="list-style-type: none"> • Continuous technical training • Open communication • Root Cause Analysis of accidents /incidents • Procedures reviewed in line with knowledge base

The HRO approach is not only relevant for high hazard industries in a demanding organisational environment, but can be useful for other organizations as well. Businesses that have to deal with complexity, but are not operating in a harsh unforgiving environment may seek high performance as well. In these organizations, failure, while not catastrophic, may occur associated with poor service rendered to the customer or public.

Concluding Remarks

Summing Up

The report has attempted to offer an understanding of Health, Safety & Environment as a fast growing practice to mitigate the risks of occupational hazards. While importance of integrating HSE principles with workplace norms have been very well realised in developed countries, it is still catching up in India. However, the relevance and dire need for a robust HSE culture in the Indian landscape is increasingly being felt. More so because India is on a road to aggressive economic growth. With government's flagship programs such as 'Make in India' and ongoing expansion of industries, operations are becoming more prone to hazards of various kinds. Lack of preparedness to address these challenges will only translate into deceleration of pace of growth.

The rate of accidents, fatalities and injuries to people are much higher in India than many other nations. Causes such as fire, fall, toxic environment and road safety are some of biggest cause crippling the occupational health, safety and environment.

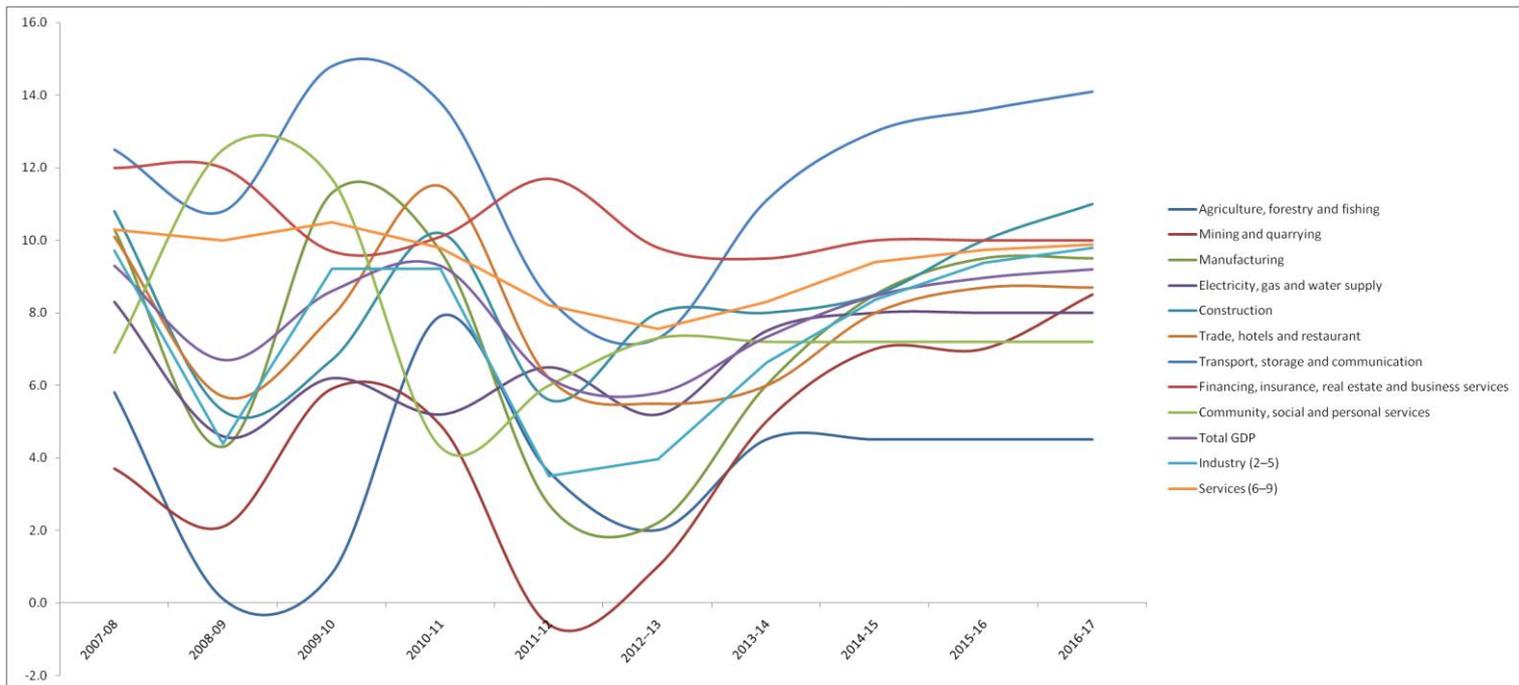
While some of the industry leaders are making efforts to becoming a high reliability organisation (HRO), it must be noted that, at large, many companies still need to work on having a formal HSE policy in place. HSE practices such as contractor safety management or asset integrity management can straight away be integrated with the supply chain management of the company, which can even contribute positively to the financial bottomline.



Way Forward

Steering through aggressive GDP growth even during a global lacklustre economic sentiments, India is looked at as one of the fastest growing countries in the world. Needless to say, most of its sectors are also expanding at fast rate. As evident from the graph (figure 13), since 2012-13, economic growth has been significant, especially against the backdrop of global crises. But if India needs to keep its growth rate consistent, other enabling factors, such as HSE, need to be looked at as well.

Figure 13: India's sectoral GDP growth



Liberalisation, privatisation and globalisation, with extreme competitiveness have impacted the working life in India and consistently present new occupation health, safety and environmental challenges across a diverse range of professions. Following are the three most important HSE needs which need to be addressed immediately.

- Legislation to expand HSE covering all sectors of working life including the unorganised sector
- Spreading the awareness about HSE amongst the stakeholders
- Development of HSE infrastructure and professionals

There are at least four key recommendations for improving the OSH context in India including:

- Since existing health and safety legislation covers at most only 10% of the Indian workforce, the most immediate need is to bring as much part of both formal and informal economic sectors under the HSE legislation purview.
- Proper dissemination of HSE knowledge is indispensable, but in order to achieve effective enforcement, incentive for complying and penalties for violations must be implemented.
- Public expenditures for adequate staffing of HSE agencies must be increased. At the same time, HSE infrastructure in terms of institutions skilling and training HSE professionals must be developed.



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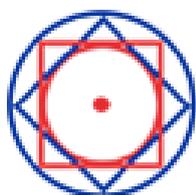


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