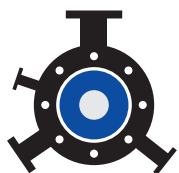


CHEMICAL ENGINEERING WORLD

www.jasubhaimedia.com


PTFE LINED SYSTEMS®
VALVES | PIPES | FITTINGS | COATINGS

www.ptfeindia.com

| PTFE | PFA | FEP | ETFE
| PVDF | ECTFE | PP | HDPE

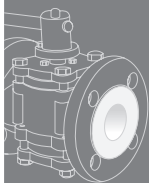


APPLICATOR

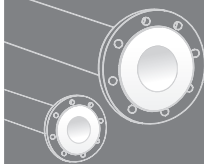
a Global Trusted Brand

YOUR SUSTAINABLE BUSINESS PARTNER
IN FLUOROPOLYMER LINED PRODUCTS SINCE 1994

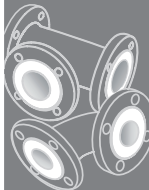
LINED VALVES



LINED PIPES



LINED FITTINGS



FLUORO-POLYMER HEAT EXCHANGER



Material options available on customer request from world renowned fluoropolymer suppliers



HI-TECH APPLICATOR

1102-B, Phase-3, G.I.D.C. Ind. Estate, Vatva, Ahmedabad - 382 445, Gujarat - India.

+91 79 4030 7621 / 2583 3040 / 2589 1740 | +91 97370 46491 | hitech@ptfeindia.com



The Shift of Capital Projects to Decarbonization Is On. **Are You Ready?**

The sustainability imperative demands a digital approach to capital project execution as the conventional way no longer works. AspenTech® Performance Engineering optimizes asset design and constructibility to achieve critical net zero, safety and profitability goals.

Read our sustainability survey report to see how the shift is changing the game.

www.aspentech.com/epcsustainability

CHEMICAL ENGINEERING WORLD

www.jasubhaimedia.com



ChemTECH
WORLD EXPO 2024

ChemTECH World Expo 2024
March 4-7 2024
Venue: Bombay Exhibition Center, Goregaon (East), Mumbai, India.



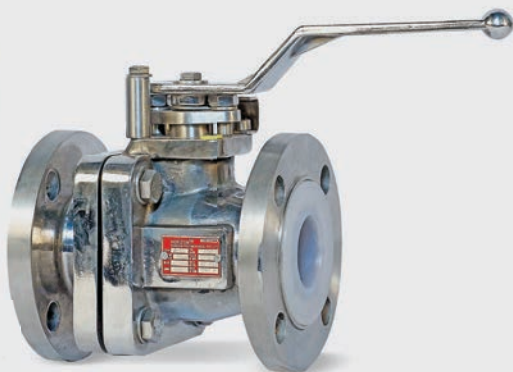
Sanicro® 35 Bridging the gaps



Good news! We've developed an all-new austenitic tube grade called Sanicro® 35 (Alloy 35Mo) that's easy to fabricate and bridges many of the materials properties gaps between stainless steels and costly nickel alloys. This structurally stable PRE 52 super-austenitic alloy offers comparatively higher pitting resistance and outperforms conventional 6Mo grades, with only moderate nickel content. An ideal choice for superior corrosion resistance and high strength in heat exchangers and hydraulic & instrumentation tubing. Find out more on our web landing page alleima.com/sanicro-35 and watch the film.

For further enquiries, please email our APAC Business Development Manager Sudhindra Hathwar, sudhindra.hathwar@alleima.com

India's Largest Processor of FLUOROPOLYMERS



Valves qualified
ISO 15848-Part I.



Pipework qualified
ASTM F 1545



Chemours Co FC LLC - Delaware appoints Horizon Polymer as TEFLON® Licensing Partner for India Under Trademark license agreement to promote and sell PTFE/PFA/FEP Lined Piping products using TEFLON® PTFE/PFA/FEP Fluoropolymer.

TEFLON and Teflon diamond brand logo are registered trademarks of The Chemours Company FC, LLC used under license by Horizon Polymer Engineering Pvt. Ltd.

Horizon Polymer Eng Pvt. Ltd.:

204, Sumer Kendra, Pandurang Bhudkar Marg, Worli, Mumbai - 400018. India

Contact: +91 22 24965031-36 | Fax: +91 22 24961073

Email: vp@horizonpolymers.com



**PLAN TO
VISIT**

Meet 175+ Exhibitors

Oil Gas & Power

World Expo 2023

Venue: Hall-3, Bombay Exhibition Center, Goregaon (East), Mumbai, India

SOME CONFIRMED EXHIBITORS & SUPPORTERS

3C CORPORATE CONSULTING
CONTRACTING
AARVI ENCON LTD
AB PROCESS TECHNOLOGIES
ABO CONTROLS PVT LTD
ABSR ENGINEERS & SERVICES PVT LTD
AIRMAX PNEUMATICS LTD.
ADVANCE VALVES PVT LTD
ADVANCED BOLTING SOLUTIONS
PVT. LTD.
AKER POWERGAS PVT.LTD
ALLEIMA INDIA PVT LTD
AQUA ENGINEERING
ASIAN SEALING PRODUCTS PVT LTD
AVANT - GARDE SYSTEMS AND
CONTROLS (P) LTD
BANARASWALA WIRE MESH
PVT LTD
BEND JOINTS PVT LTD
BHAGYANAGAR GAS LTD
BHARAT BIJLEE LTD
BHARAT ENTERPRISES
BHARAT PETROLEUM
CORPORATION LTD
BHAWAL STEEL AGENCY
BSB EDGE PVT LTD
BURNS & MCDONNELL ENGINEERING
INDIA PVT LTD
BUSCH VACUUM INDIA PVT.LTD
C&S ELECTRIC LTD
C. P. FLUID SYSTEMS PVT. LTD.

CALICO METAL ALLOYS LLP
CALISTO TECHNOCAST PVT LTD
CENLUB INDUSTRIES LTD
CHUGOKU MARINE PAINTS LTD
DEMBLA VALVES LTD
DENSO (WINN & COALES)
DIVINE TUBES PVT. LTD.
DOVER INDIA PVT LTD
DUTT ENGICON
D-VALVE ENGINEERS INDIA PVT LTD
DYNAMIC FORGE & FITTINGS
(I) PVT.LTD
ELLIOTT EBARA SINGAPORE PTE LTD
FABTECH PROJECTS & ENGINEERS LTD
FCS FLUORO CARBON SEALS PVT LTD
FLOWCHEM PROCESS EQUIPMENTS
FLUIDTEK & UHP SYSTEMS PVT LTD
FLUOR
G&C VALVES INDIA PVT LTD
GARDNER DENVER ENGINEERED
PRODUCTS INDIA PVT LTD
H2E POWER SYSTEMS PVT LTD
HAVI ENGINEERING INDIA PVT LTD
HEATMAN PRODUCTS PVT LTD
HENAN RESTAR SEPARATION EQUIPMENT
HI-FAB ENGINEERS PVT. LTD.
HMD SEAL/LESS PUMPS INDUSTRIAL
(I) PVT LTD
HP VALVES & FITTINGS INDIA PVT LTD
HYDROFAST
ICE (ASIA) PVT.LTD

IPAC AUTOMATION PVT LTD
IPCO PROCESS & BELT TECHNOLOGY
INDIA PVT LTD
ISMT LTD
JC VALVULAS INDIA PVT LTD
JCAM SYSTEMS PVT LTD
JINDAL PIPES LTD
JINDAL POWER
JINDAL STAINLESS CORPORATE
MANAGEMENT SERVICES PVT LTD
JUBILANT PIPING SOLUTIONS PVT LTD
KANAKBHUVAN INDUSTRIES LLP
KANOO ENERGY LLC
KHOSLA PROFIL PVT LTD
KOSO INDIA PVT LTD
LARSEN & TOUBRO LTD
MADRAS HARDTOOLS PVT.LTD
MARINE ELECTRICALS (INDIA) LTD
MASCOT DYNAMICS PVT LTD
MASCOT SYSTEMS PVT. LTD
MASK SEALS PVT LTD
MESON VALVES INDIA PVT LTD
MICRO PNEUMATICS PVT.LTD
MINIMAC SYSTEMS PVT LTD
MITTAL PRECISION HITECH STEEL
PVT. LTD.
MOKSHI INDUSTRIES PVT. LTD.
MTANDT LTD
NHPC LTD
NIRMAL INDUSTRIAL CONTROLS PVT. LTD.

NIVIC TECHNOCAST
NORD-LOCK INDIA PVT LTD
NORTH EASTERN ELECTRIC POWER
CORPORATION LTD (NEEPCO)
OPSWAT INC.
OUTOKUMPU INDIA PVT LTD
PARAS ENGINEERING WORKS
(MUMBAI) PVT LTD
PETROFAC INTERNATIONAL LTD
PMT MACHINES LTD
POWERTORC
PPI SYSTEMS
PRD RIGS INDIA PVT LTD
PURVA METAL SECTIONS PVT LTD
R & D THERM INDIA PVT LTD
RASHMI HEATERS PVT LTD
RESISTOTECH INDUSTRIES PVT. LTD.
RMZ OILFIELD ENGINEERING PVT LTD
ROLON SEALS
ROTEX MANUFACTURERS AND
ENGINEERS PVT LTD
ROXUL ROCKWOOL TECHNICAL
INSULATION INDIA PVT. LTD
RUHRPUMPEN INDIA PVT. LTD.
RURAL ELECTRIFICATION CORPORATION
LTD (RECL)
RYTEM PERFORMANCE POLYMERS
SAMSON CONTROLS PVT.LTD
SAWALKA KEL PVT LTD
SCHLUMBERGER ASIA SERVICES LTD
SEALMATIC INDIA PVT LTD

SEA
SEN
SEV
SHR
SHU
SIN
TEC
SPA
STA
SUN
SUP
SUP
SUV
PVT
TEC
TEC
PVT
THE
THE
UNI
UNI
UNI
UV
VEN
WIK
WOR
WRP
YOU
ZST

Principle Partner



Title Partner



Platinum Partners



Silver Partners



Bronze Partners



Financing Partner



Exhibition & Conferences

Exhibitors

SAVE THE DATE

WED THU FRI
1 2 3 MARCH 2023

Supported by:



INTERNATIONAL CONFERENCES 2023



Wednesday 1st March 2023

Oil & Gas E&P: Challenges & Opportunities

- Inaugural Session ■ Decarbonising Oil & Gas Production
- Greening of Oil & Gas Pursuits ■ Energy Security
- Technical Interventions - Case Studies
- Energy Transition : Government & Policies Intervention

Contact for Delegate Registration

Email: monisha_karkera@jasubhai.com, sales@jasubhai.com
Tel: +91-98704 41920, +91-22-4037 3611, 4037 3636



Thursday, 2nd March 2023

Challenges in Energy Transition

- Inaugural Session
- Future fuels for Decarbonization amidst energy transition
- Petrochemicals and Refinery Integration
- Improving Sustainability & Profitability of Refinery operations with Digitalization
- Net Zero Pathways : Preparedness of Indian Refineries

Contact for Delegate Registration

Email: afrah_shaikh@jasubhai.com, sales@jasubhai.com
Tel: +91-22-4037 3617, 4037 3636



Friday, 3rd March 2023

Realizing Logistics Value from Inland Waterways & Ports

- Inaugural Session
- Understanding Needs & Expectations of Stakeholder from Inland waterways transport
- Inland waterways and their potential in tourism & in public transport
- Demand side Stimulation for IWT : Key Sectoral & Policy Interventions ■ Augmenting IWT vessels capacity to complement transport capacity

Contact for Delegate Registration Email: brenda_fernandes@jasubhai.com, sales@jasubhai.com, Tel: +91-22-4037 3620, 4037 3636



Theme: Sustainable Energy Transformation For Economic Growth

Wednesday, 1st March 2023

- Inaugural session ■ Energy Transition
- Renewable Energy
- Decarbonizing coal based power generation
- Roadmap for hydrogen economy

Thursday, 2nd March 2023

- Opening session ■ Boosting investor confidence in sector for investor growth
- Power generation ■ Transmission & Distribution
- Energy storage ■ Case studies: Emerging trends across materials, equipment & technology



Thursday, 2nd March 2023

Theme: Gas Based Economy for Growth & Sustainability

- Inaugural Session ■ User Perspective : Applications Of Gas Towards Greener Future
- Role Of Gas : Emerging Sources & Infrastructure
- Regulatory, Policy And Energy Transition Framework

Contact for Delegate Registration

Email: chanda_rawat@jasubhai.com, Tel: +91-11-4708 6252



Friday, 3rd March 2023

Theme: Corrosion Mitigation: A National Mission - Challenges & Innovations

- Inaugural Session
- Panel Discussion: Corrosion Prevention & Control
- P Case Studies: Users
- P Case Studies: Solutions Providers (case study presentation by Coating Companies)
- P Panel Discussion: Corrosion Mitigation : A National Mission

2023

SHELL LOGISTICS PVT LTD
KOKO TECHNOLOGIES INC.
ERN GLOCON VALVES PVT LTD
IRANG AUTOMATION AND CONTROLS
BHILAXMI METALS TUBES PVT LTD
OSTEEL STAINLESS STEEL PIPE
HNOLOGY (SHANXI) CO., LTD
RKTECH
UBLI TEC SYSTEMS INDIA PVT LTD
MARK STAINLESS PVT LTD
ERIOR STEEL INDUSTRIES
INCO AUTOMATION PVT LTD
IDYA INSTITUTE OF TECHNOLOGY
LTD
HNIP ENERGIES INDIA LTD
HSHARP HYDRAULIC SOLUTIONS
LTD
MAITRI METALS PVT. LTD.
RMOPADS PVT LTD
FLOW CONTROLS PVT LTD
PHOS ENVIROTRONIC PVT LTD
QUE DIECASTING PRODUCTS PVT. LTD.
INTERNATIONAL
US PIPES & TUBES LTD.
A INSTRUMENTS INDIA PVT.LTD
RLEY INDIA PVT LTD
ENCH SOLUTIONS PVT LTD
NGMAN INDIA PVT LTD
FIBER GLASS PIPES PLANT

& Many more

Gold Partners



Support Partners



es@jasubhai.com | Exhibition - Entry Free | Visit Timings 1-2 March 2023 : 10.00 am to 6.00 pm and 3rd March 2023 : 10.00 am to 4.00 pm

CHEMICAL ENGINEERING WORLD
RNI REGISTRATION NO. 11403/66

CHAIRMAN

Maulik Jasubhai Shah

PUBLISHER & CEO

Hemant K. Shetty

EDITOR

Mittravinda Ranjan

CREATIVES

Arun Parab

GENERAL MANAGER SALES

Prashant Koshti
Amit Bhalerao

BRAND MANAGER

Sudhanshu Nagar

SALES

Godfrey Lobo
Priyaranjan Singh
Chandahas M Amin
Yonack Pradeep

The Publishers and the Editors do not necessarily individually or collectively identify themselves with all the views expressed in this journal. All rights reserved. Reproduction in whole or in part is strictly prohibited without written permission from the Publishers.

JASUBHAI MEDIA PVT. LTD.

Registered Office: 26, Maker Chambers VI, 2nd Floor,
Nariman Point, Mumbai 400 021, INDIA.
Tel.: 022-4037 3737 Fax: 022-2287 0502
E-mail: sales@jasubhai.com

PUBLISHED BY:



CHEMICAL ENGINEERING WORLD

Dynamic Platform
to
Connect with Chemical
Industry Ecosystem

Direct Reach
to
>200,000 Readers
across
>25 countries

sales@jasubhai.com

www.jasubhaimedia.com



CONTENTS

FEATURES

Increasing safety and sustainability for a better tomorrow 16



Kunal Ruvala
President, Honeywell Technology Solutions
(HTS) Global

Importance of lifecycle approach to safety system maintenance 20



Sandeep Redkar
Consultant Leader
Rockwell Automation India

Strengthening commitment towards HSE 24



Prabhanjan Dixit
Head-HSEF
Nayara Energy Limited

Digital Twin Transforming the Safety Equipment performance & its lifecycle 33



Aniket Kumar
Manager - Digital Transformation
Yokogawa India Limited

AD INDEX 9

NEWS 10

CHEMICAL ENGINEERING WORLD

AD INDEX

Alleima India Private Limited 4

Aspentech 2

Hi-Tech Applicator 1

Horizon Polymer Engineering Pvt Ltd 5

HSE Management Systems for Safe Operation of LNG Terminal 40



Chetak Nawale
Head- HSE
Dhamra LNG Terminal Pvt Ltd
(Subsidiary of Adani Total Pvt Ltd)



Bandita Samal
Sr. Environmental Engineer
Dhamra LNG Terminal Pvt Ltd
(Subsidiary of Adani Total Pvt Ltd)

IMPACT FEATURE

Alleima 28

Advancing Industries through Materials Technology - Improving the Lifecycle of Crude Distillation Unit Overhead Condenser Tubes

Talcher Fertilizers Project will be India's largest and first coal gasification plant



New Delhi, India: TFL has been mandated by the Government to revive the erstwhile Talcher plant of FCIL by setting up a new coal gasification-based Urea Plant with the installed capacity of 12.7 Lakh Metric Ton per annum (LMTPA).

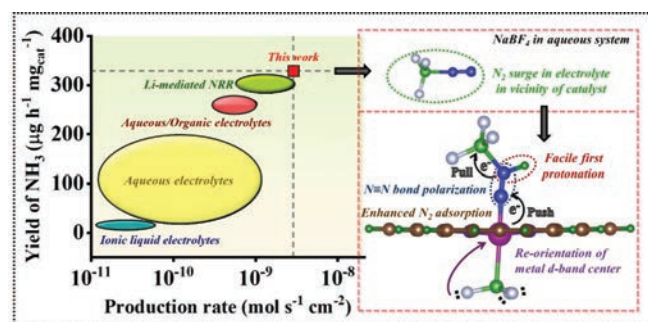
Since the project promotes coal gasification, it shall also aid in meeting the stated aim of gasifying 100 MT of coal by 2030. The project shall also provide impetus to the economy of Odisha in particular and eastern India in general thereby also propelling India towards Atma Nirbharta (self-reliance)

Coal gasification plants are strategically important as coal prices are non-volatile and domestic coal is abundantly available. Talcher plant shall also reduce dependence on imported Natural Gas for production of urea leading to reduction in natural gas import bill. Further the gasification process adopted in under construction Talcher unit is more environment friendly as compared to directly coal fired processes thereby

supporting commitments made by India under Conference of Parties (CoP).

The revival of closed units of FCIL and HFCL had been the top priority agenda of the Modi Government to augment the availability of domestically produced urea. Start of all five plants of FCIL/HFCL would add 63.5 LMTPA indigenous urea production capacity in the country. Out of five, four plants i.e. Ramagundam, Gorakhpur, Sindri and Barauni Fertilizer Plants have already started urea production in the country and Talcher Plant is expected to start by Sept 2024.

New electrolyte found can help better ammonia synthesis



New Delhi, India: A new aqueous electrolyte that can help make electrochemical ammonia synthesis more efficient will be useful for industries producing green energy or hydrogen.

The electrochemical ammonia synthesis is largely limited by the poor solubility of nitrogen (N_2) in the aqueous electrolyte environment as well as the competitive hydrogen evolution reaction. The obstacle faced was that reduction of N_2 has actually occurred in the aqueous medium. In an attempt to solve these issues, the "ambient" conditions are mostly overseen. Researchers mostly work on catalyst development, while

electrolyte improvisation still remains in infancy. According to a recent report, 90.7 % of the research works related to: Nitrogen reduction reaction (NRR) have focused on the suitable catalyst development, while only 4.7 % have been devoted to work on the electrolytes.

Scientists from Institute of Nano Science and Technology (INST) Mohali, an autonomous institute of Department of Science and Technology (DST), have introduced a new electrolyte called (NaBF₄), which not only acts as an N₂-carrier in the medium but also works as a full-fledged “co-catalyst” along with active material transition metal-doped nanocarbon (MnN₄) to deliver high yield of ammonia (NH₃) at absolutely ambient experimental conditions. The high production rate of NH₃ approached industrial scale and exceeded almost all the standard catalysts in any other electrolyte medium. The source of NH₃ was thoroughly studied and confirmed to be chiefly from the electrochemical reduction of the purged N₂ gas (make it N₂ saturated electrolyte to convert N₂ to NH₃).

This research published in the journal PNAS is a novel approach to get through the long-standing issues about the solubility of N₂ in aqueous medium and achieve industrial scale production rate of ammonia by NRR at ambient condition.

This work supported by DST SERB brings a user-friendly aqueous electrolyte (NaBF₄) which can encourage researchers to work more on aqueous electrolyte designing towards an even improved NRR performance of the electro catalysts. A patent has been filed for this work and the scientists are

now working towards making electrolyzers for rapid rate of ammonia production at an industrial scale.

A New “Digital Twin” of Laser-Directed Energy Deposition Repair Technology

Tokyo, Japan: Researchers develop a numerical processing analysis system that automatically determines optimum forming conditions. Conventional metal 3D-printed repair of damaged mechanical parts in machines requires bulky equipment and wastes metal powder. Although laser-directed energy deposition overcomes this challenge, the optimum forming conditions had to be hitherto determined by trial and error. To this end, a team of researchers from Tokyo University of Science have developed a numerical method that automatically generates metal powder deposition elements and predicts forming process conditions, temperature distribution, deformation state, and residual stress distribution in advance.

Mechanical parts in industrial machinery and structures that develop thinning or cracks need to be replaced with new ones. In recent years, attempts to repair them have been considered, in order to improve industrial sustainability. So, repair technology for machines has been a hot topic of research and development. Conventional metal 3D-printed fabrication uses the surface of a mechanically laid powder bed that is irradiated with a laser or electron beam to melt the metal particles and fuse them. However, this method requires bulky fabrication equipment. Also, a large amount

of metal powder is disposed after the fabrication process. However, laser-directed energy deposition (LDED) is a promising technology that overcomes the challenges. In this technique, metal powders are deposited at the focus of a laser beam, then melted and stacked.

The advantages of LDED are not only related to the compactness of the equipment, but also the significant reduction of metal powder waste. Furthermore, this technology enables in-situ metal powder fabrication in a 3D shape on the surface of a substrate. This means it can be used to repair machines made of metal as well!

CSIR-IICT, Hyderabad and Luminous Power Technologies join hands to develop Sustainable Battery

Hyderabad, India: Aligning with the 'Make in India' and 'Innovate India' programmes, Luminous Power Technologies Pvt. Ltd., Gurugram and CSIR-Indian Institute of Chemical Technology, (CSIR- IICT), Hyderabad have joined hands to develop a Rechargeable Aluminium Battery (RAB). An MOU was signed and exchanged between Ms. Preeti Bajaj, MD, Luminous Power Technologies, and Director, CSIR-IICT in the presence of Mr. Amlan Kanti Das, Sr Vice-President; Mr. Abhishek Choudhury, IP & Technology Consultant on behalf of Luminous Technologies and Dr. D. Shailaja, Chief Scientist & Chair, Business Development & Research Management, Dr. J Vatsala Rani, Principal Scientist and Dr. Pratyay Basak, Sr Principal Scientist from CSIR-IICT. Luminous Power Technologies has a strong

market presence in providing energy storage solutions for solar and inverter applications. Over the years, the company has created a strong product portfolio in power backup solutions including the recently launched advanced Lead-acid gel batteries.

CSIR-IICT, with its proven track record as a knowledge partner to the chemical sector, is involved in developing materials that are used in alternate battery chemistries as next-gen technologies.

Citroën India Signs Strategic EV Charging Partnership with Jio-Bp

Mumbai, India: Citroën India has announced a strategic partnership with Jio-bp, a fuels and mobility joint venture between Reliance Industries Limited (RIL) and bp to build EV infrastructure and services across its network. Jio-bp will install DC fast chargers across Citroën's key dealership network and workshops across the country in phases. These chargers will also be open to the entire universe of EV car customers to help boost EV adoption among consumers.

With the New Citroën ë-C3 All Electric scheduled for launch in Q1 2023, this partnership will ensure Jio-bp's charging infrastructure network is accessible via the My Citroën Connect app. Jio-bp currently operates a rapidly expanding network of EV charging and swapping stations under the Jio-bp pulse brand. The entire range of Jio-bp pulse offerings can be accessed via its mobile app that helps customers easily locate EV charging stations in their vicinity, facilitates digital payments amongst others. Driven by the vision to be among India's largest

EV charging network, Jio-bp is creating an electric mobility ecosystem that will benefit stakeholders across the EV value chain and is expanding its Jio-bp pulse branded EV charging network by setting up charging facilities at multiple touch points within cities and major highways to ensure smooth intra-city and inter-city commutes for EV owners.

Covestro and LANXESS co-operate to produce more sustainable raw materials with reduced CO2 footprint

Mumbai, India: Chemical companies Covestro and LANXESS are cooperating in the energy-intensive production of basic chemicals at their Lower Rhine sites in Germany and make them more climate friendly. LANXESS sources chlorine, caustic soda, and hydrogen from the ISCC PLUS-certified sites of Covestro in Leverkusen and Krefeld-Uerdingen. With immediate effect, Covestro is manufacturing around one-third of the volume of products it supplies using energy from hydropower based on guarantees of origin." Covestro is pursuing the goal of completely converting its production to electricity from renewable sources on its path to operational climate neutrality in 2035," says Dr. Klaus Schäfer, Chief Technology Officer of Covestro. "A particular focus is on the energy-intensive production of basic raw materials. In cooperation with LANXESS, we use energy in our electrolysis plants in North Rhine-Westphalia on a pro-rata basis, which enables us to reduce our reported emissions by up to 120,000 metric tons of CO2 per year."

"The joint project with Covestro is an important building block in making our entire value chain climate neutral. By sourcing raw materials for these products with a significantly reduced carbon footprint, we will be able to reduce our reported indirect emissions by up to 120,000 metric tons of CO2 equivalents per year," says Dr. Hubert Fink, member of the LANXESS Board of Management. With its Net Zero Value Chain Initiative, the specialty chemicals company plans to eliminate Scope 3 emissions within its upstream and downstream supply chain by 2050. This includes indirect emissions, particularly from purchased raw materials, but also in logistics or disposal. For Scope 1 and 2 emissions, the company aims to be climate neutral by 2040. "With this program, we are taking the next step towards a climate-neutral product portfolio and are also supporting our customers, who are increasingly looking for sustainable solutions," says Fink.

Topsoe and Fidelis New Energy form Carbon Neutral Hydrogen Technology Alliance

Houston, Texas: Topsoe A/S ("Topsoe") and Fidelis New Energy, LLC ("Fidelis") have entered into a global alliance for technology used for producing carbon neutral hydrogen. The alliance pairs Topsoe's hydrogen process portfolio with FidelisH2™ technology for reduction of lifecycle carbon emissions in hydrogen production. Combined, the alliance solution enables the production of hydrogen from natural gas with a lifecycle carbon intensity of 0 kgCO2e / kgH2.

Producing decarbonized products, materials, and fuels through proven technologies such as the Topsoe Blue Portfolio and FidelisH2 is a critical contribution to decarbonizing carbon intense sectors of society, including industry, digital infrastructure, agriculture, energy, and transportation. Topsoe and Fidelis are dedicated to continuing to play their roles in this important endeavor to accelerate the energy transition and to join forces to provide an offering for life cycle carbon neutral hydrogen utilizing renewables and natural gas.

Henrik Rasmussen, Managing Director, The Americas, Topsoe, said "This is an exciting partnership to lead the way to achieve net-zero in 2050. I look forward to working with Fidelis in setting the bar high regarding transitional energy technologies. With this alliance, we can offer clients across all industrial sectors, a proven and exceptional carbon neutral hydrogen solution."

Co-Founder and CEO of Fidelis, Dan Shapiro, said "We are excited to partner with Topsoe, the leading provider of hydrogen production technology and catalysts. After several years of work with Topsoe leadership, catalysts, and technologies, we are pleased to formally join forces with them through this Global Alliance Agreement to deliver carbon neutral hydrogen produced from Topsoe's Blue Portfolio and the innovative and novel FidelisH2™ process."

Linde Commences Construction of its New Air Separation Plant at Ludhiana, Punjab

Ludhiana, India: Linde India Ltd. inaugurated the mechanical construction work at its new, upcoming Air Separation unit at Ludhiana, Punjab. The event took place at the Hi-Tech Cycle Valley venue of the site in presence of InvestPunjab officials, representatives of Linde's key industrial and healthcare customers, Moloy Banerjee, Head – South Asia and ASEAN, Linde, Abhijit Banerjee, Managing Director - Linde India Limited and other Linde officials.

This will be Linde's second plant in northern region of India, the other one being at Selaqui, Uttarakhand. This 250 TPD new ASU is expected to start up towards the end of 2023. The additional supply will support the expansion of Linde's footprint in the northern India. This plant would also significantly enhance the capacity of Liquid Medical Oxygen production in Punjab state.

"This new ASU is an important investment for Linde," said Moloy Banerjee, Head – RSE, Linde. "By building additional capacity, we will cater to both industrial and healthcare market in the region."

BASF breaks ground on MDI capacity expansion project at Geismar site

Geismar, Louisiana: BASF has broken ground on the third and final phase of the methylene diphenyl diisocyanate (MDI) expansion project at its Verbund site in

Geismar, Louisiana, announced in July 2022. The company will increase production capacity to approximately 600,000 metric tons per year by the middle of the decade to support the ongoing growth of its North American MDI customers.

The investment for this final expansion phase, which takes place from 2022 to 2025, amounts to \$780 million. Including the first and second phases, the investment volume totals around \$1 billion, making the MDI expansion project BASF's largest wholly owned investment in North America.

"BASF already ranks among the largest and most forward-looking chemical companies in the United States," said Michael Heinz, Chairman and Chief Executive Officer, BASF Corporation. "Through this investment, we demonstrate our commitment to meeting the needs of our customers while strengthening our foundation for continued growth in the important U.S. market."

BASF welcomed Clay Schexnayder, Speaker of the House for the Louisiana State Legislature for a ceremonial 'tilling-of-the soil' to officially mark the ground-breaking of the final phase of the expansion.

JSW Paints to set up greenfield unit worth ₹ 750 crore

Uttar Pradesh, India: JSW Paints, a subsidiary of the JSW Group, is exploring land parcel in North and Central India (i.e., Uttar Pradesh, Haryana, and Madhya Pradesh) to construct its third plant, with a capex of Rs 750-1,000 crore. The company expects to grow production capacity by 200,000 kilo litres per year.

Also, a proposed unit at Kosi Kotwan Industrial Area in Mathura district of Uttar Pradesh will spread over 24 acre of land parcel with capacity to produce 1,20,000 KLPA of water-based paint. The project will be implemented in two phases. In November 2022, JK Paints & Coatings has received environment clearance for the project. The proposed plant will manufacture both decorative and industrial paints. In November 2022, JK Paints & Coatings has received environment clearance for the project.

Asian Paints to invest Rs 2,000 crore in a new plant

Madhya Pradesh, India: The proposed plant Asian Paints plant will have a capacity of four lakh kilo litres per annum at an approximate investment of Rs 2,000 crore. The facility is expected to be commissioned in three years, post land acquisition. The company is exploring the possibility of making this investment and setting up the manufacturing facility in the state of Madhya Pradesh, subject to grant of requisite incentives by the government of Madhya Pradesh and such other approvals and clearances, as may be required. The company would use latest manufacturing technology to produce paints and intermediates in the proposed manufacturing facility in an environment friendly manner. ■

Increasing safety and sustainability for a better tomorrow

A staggering number of people work in dangerous and unsafe conditions every day, and they depend on their safety gear to get them home each night. India's safety and security sector has been expanding steadily, with some categories expected to rise between 10 and 15 percent annually. Expectations for stronger safety and security measures are being driven by population growth, urbanisation, industrialisation, and the expansion of infrastructure and mass transit networks, particularly in connection with important national infrastructure projects.

16



Safety in a processing facility is an important factor not just for employees' right to work in a safe workplace, but also for controlling public exposure to danger. Process operations always involve some level of risk, and when that risk manifests itself in an accident, it has the potential to seriously disrupt corporate operations. Protecting workers with comprehensive safety services built on knowledge of the sector and unwavering commitment to innovation is a top priority. Innovative solutions for safety such as first aid supplies, electrical safety, fall protection, gas and flame detection, hand protection, head/eye/face protection, hearing

protection, protective footwear, and respiratory protection among other things, is what the workers need to adapt to the changing conditions.

Automated Mobile Robots Enabling Higher Safety and Productivity

A wise course of action is to make adequate investments in safety procedures to prevent future accident costs. The process industry's present approach to these investments is essentially determined by basic risk-based heuristics, insurance market prices, corporate culture, and management discretion. However, a comprehensive approach to support

such an effort is needed. In order to enable systematic and optimal allocation of financial resources across all key risk aspects within a process plant, a strong decision-making framework must be developed.

For Instance: Autonomous mobile robots (AMR) have been developed to boost productivity, eliminate accidents, and enhance security. By automating the movement of carts used to deliver selected orders or returns, these AMRs significantly increase productivity. They can move across any floor surface that is smooth enough to support a conventional cart pulled by a person. These AMRs also provide a versatile and effective means of moving pallets, which is normally done primarily with forklifts and conveyor systems. Workers may just park carts in predetermined pickup areas around the complex and summon robots to collect them, preventing them from having to travel for more than half the day.

These AMRs may do repetitive and often lengthy activities, enabling labour resources for higher-value jobs that are in higher demand. This alone has numerous advantages, such as increasing worker satisfaction and minimising accidents and turnover rates. Companies are rethinking how they conduct business as a result of the pandemic and its long-

term implications on workforce shortages. According to a survey, more than half of the businesses are now more eager to spend money on automation as a result of the pandemic and its long-lasting impacts. According to the same report, businesses view automation's top three benefits as increased speed, personnel utilisation, and productivity.

Safety Through Sustainability

In addition to this, companies all across the world are working to optimise energy use and lower or eliminate their greenhouse gas emissions in today's climate-conscious environment. The necessity to maximise the use of energy, gas, oil, and water to meet emissions reduction targets drives investments aimed at emission monitoring and reduction. Through preventive maintenance, tracking and lowering emissions can increase process uptime and lower product losses throughout the process.

Government regulations, investors interested in environmental, social, and governance issues, as well as expert company objectives, are just a few of the factors driving emissions reductions. Additionally, emission leakage may result in a loss of income or, more crucially,

safety concerns.

The market is split when it comes to moving forward. On the one side, you have businesses that require assistance in beginning their sustainability journeys, and on the other, you have those that have depended on process modifications and now want in-depth knowledge of how to approach more challenging issues. The real potential is in moving ahead with a technology-driven strategy for sustainability, regardless of how established a company is. To enable businesses to embrace practises that offer sustainable production, we have shifted our focus toward the creation of technologies that will shape the future of sustainability.

Oil and gas corporations claim they are getting ready to increase expenditures in new technologies and sustainable energy this year after reporting record earnings in 2022. The energy sector is also looking for methods to reduce the number of greenhouse gases, most notably methane, emitted by its historic natural gas production. To reach net zero emissions, the transportation sector has long sought a carbon-free alternative. Over the years, the sector has seen the introduction of numerous new fuel options. The automotive industry has focused on

BEVs (battery electric vehicles), hydrogen fuel cells, compressed natural gas (CNG), liquefied natural gas (LNG), and ethanol, among other alternatives. Alternative fuel sources for aviation, however, have not yet been fully uncovered. The issues in the aviation sector are much more complicated than those in the automobile industry, despite the introduction of a number of solutions, including electric power. SAF (sustainable aviation fuel) is used by the industry as a stoppage to cut emissions until a real carbon-neutral fuel source is found.

India's newest and fastest-growing vertical is the production of ethanol. The country is investing extensively in ethanol because it believes that it is a more feasible solution for a developing nation like India. By 2025, the Ethanol Blended Petrol (EBP) Programme is expected to blend 20% ethanol, according to the National Policy of India on Biofuels 2018. Being a part of this government initiative underlines a company's commitment to sustainability. Making the switch to renewable energy sources like ethanol and biofuels will contribute to the creation of a greener planet. For instance, process technologies enable firms to use energy more effectively, increase environmental compliance, reduce emissions, and improve overall business

performance with automation solutions. Process technologies are built to optimise operations, and improve efficiency, and safety.

A Global Priority

Reducing the global carbon footprint by concentrating only on the mode of transportation is not going to be as effective. It's important to look past this moving equipment. Air quality is a crucial global safety concern because of the significant pollution and emissions that factories, plants, and warehouses produce. The improvement of industrial operations, energy efficiency, the management of the burning of agricultural waste, and fuel conversion are crucial elements in lowering emissions of pollutants. Burner Management Systems (BMS), Emissions Management Solutions, Gas Cloud Imaging, and Gas sensors that are intended for use in environmental applications that can detect a range of gases- Sulphur dioxide (SO₂), Nitrogen dioxide (NO₂), Carbon monoxide (CO), and Ozone are all urgently needed.

To address the demand for long-term energy storage in this regard, Flow Batteries may be the future. These batteries function with renewable energy sources like solar and wind. Depending

on the amount of energy needed and the required discharge rate, the battery's two electrolyte tanks circulate at various rates. When wind and solar electricity aren't available, there are power outages, or the power networks are overburdened, it stores energy that can be used in those situations. It outperforms lithium-ion batteries and can store and discharge electricity for up to 12 hours.

We anticipate that over the next decade, sustainability will continue to be given top priority through both policy and increased investment by the world's most successful businesses to highlight the value of sustainable practises and turn them into a global standard for customers, investors, and company boards. ■

Author



Kunal Ruvala

President
Honeywell Technology Solutions (HTS)
Global

Importance of lifecycle approach to safety system maintenance

To reduce the risk of plant operation, most plant operators use a third-party certified safety system with an appropriate Safety Integrity Level (SIL) rating. Most follow a rigorous selection process based on scientific principles and guidance of process functional safety standards IEC61511 (Functional safety - Safety instrumented systems for the process industry sector). While a fair amount of attention and deliberation goes into the selection and implementation of the safety functions in the plant, the same level of rigour is oftentimes missing when the system becomes old. Since safety systems are seldom called into action, it is common to lose sight of their importance in keeping the plant operating safely.

20



s plants grow older, due to an increase in maintenance activities, proper scientific maintenance of safety systems

may become difficult and costly. Aging and poorly maintained safety-related equipment can be unreliable. This can lead to:

- Greater risk of process equipment damage, and near-miss incidents or accidents (personnel or environmental)
- Increased downtime, leading to a loss of production and off-spec product

Inadequate process safety lifecycle management leads to unknown risks.

Without a well-communicated functional safety management plan, workers make decisions based on individual experiences rather than operational needs. Bypasses are often left unaddressed due to shift changes and personnel rotations.

Frequent changes in production demands can lead to poorly implemented modifications. Increases in production or regulation changes require process modifications. If implemented incorrectly, this can cause:

- Equipment damage that results in unplanned outages
- Increase in process incidents or environmental releases
- Operating with unacceptable levels of risk

One aspect of this may be due to management's aspiration to keep the plant operational for as much time as possible and to disallow any reasonable or adequate downtime to maintain the system and regain the system's original level of safety performance through proper maintenance. This typically happens when parts of the safety system cannot be tested due to the plant being in operation

or material being in the vessel or pipeline.

The SIL rating of any safety instrumented function depends on several factors, such as:

- Failure rates of components used in the system
- Ability of device manufacturers to reduce systematic failures
- Established statistics of systematic failure, i.e., failures related to the inherent design of the system
- Safe and dangerous failure rates of system components
- Automatic diagnostics capability of the devices



- Automatic diagnostics capability within the Safety Instrumented function (SIF)
- Proof testing of the devices and the SIF – the quality of testing i.e., percentage of functionality that is tested, and part of each component that is tested and the part which is not tested
- Redundancy in the components of the system
- Common cause failure prevention capability such as - diversity of redundant components and physical separation of redundant components
- Use of trip philosophy, like energize to trip or de-energize to trip
- Response time of components
- Time to repair
- Lifecycle activities such as maintenance, safety assessment, change management, and verification

While it is difficult to quantify all the above parameters, the functional safety standard provides requirements for protection against systematic failure as well as requirements to do probabilistic calculations to protect against random failures. Of the above set of parameters, some are related to components of the system, failure rates, and automatic

diagnostics, which are fixed with the selection of the system. Some of the items on the list may get fixed with the design and engineering of the system, like response time, trip philosophy, etc.

The verification of the system done when the system is new, gives us confidence that adequate precautions are taken to ensure that the desired safety performance will be provided by the system based on the selection, design, and engineering of the system.

The parameters that vary during a system's life are those that cannot be restored to their original levels of performance. Examples of this include testing only a portion of the safety function or not testing the safety function's constituent elements for all features. A shutdown valve might, for instance, be tested in situ for open and close functionality using simply limit switch feedback without also evaluating the valve for passing. Another factor is changes to the system design that have been unconsidered, which somehow compromise safety leading to performance deterioration. An example could be to change the design of the system to introduce a common cause failure mode in redundant components.

Users must follow the guidance provided in the functional safety standards

to establish a system to account for the above parameters and provide necessary directions and support for the disciplined execution of the safety lifecycle management program. Best-in-class companies take a lifecycle approach to process safety. They recognize that:

- Leadership plays a key role, and a culture that supports and maintains these rigorous processes is essential
- A clearly defined process improves safety and maximizes productivity, and there are steps required to accurately assess and mitigate risks
- Through functional safety management, audits, and lifecycle planning, levels of safety are maintained at current design levels throughout the lifecycle

Management of Change (MOC) processes

Safety systems require a methodical approach to the lifecycle of the system. Using the Management of Change (MOC) processes ensures established processes and procedures are consistently followed when a change is implemented. Specific procedures may change for each facility or unit, but the methodology should remain the same. Competent workers and a well-

defined process are vital to maintaining performance levels, even as changes are implemented.

Conclusion

For avoiding accidents while the plant is in operation, strict lifecycle management procedures must be followed for safety systems. Accidents at plants cause loss of life, and property, harm to the environment, and reputation damage to the company. Therefore, maintaining properly engineered, maintained, and tested safety systems is crucial for seamless operation and achieving any plant's ESG objectives. ■



Author

Sandeep Redkar

Consultant Leader
Rockwell Automation India

Strengthening commitment towards HSE

Nayara Energy owns India's second largest single site refinery at Vadinar, Gujarat with a capacity of 20MMTPA. Being one of the world's most modern and complex refineries, Health, Safety and Environment (HSE) is a key priority for Nayara Energy. We are committed to provide safe operations and workplaces, to protect the health and safety of our employees and contractors, as well as to mitigate any environmental impact of our operations.

24



Nayara has always been at the forefront in implementing innovative ideas, investing in safety of assets and people,

having exhibited proven track record in the past, continually sustaining and progressing ahead, with process safety and digitization as its prime aspect and setting benchmark at an early outset.

At Nayara, significant importance is given to each safety element and towards imbibing best practices. Some of the best practices and innovations at Nayara include:

Online (Digitized monitoring) web-based platforms- Implementation of a digitized web based platform for accessing all process safety information,

operating procedures, training validations, management of change, mechanical integrity, emergency response and planning, monitoring work permits, asset performance and audit compliances, executing incident investigation and hazard analysis tracking etc.

Setting up PSM Centre: Nayara Energy has set up a PSM Center of Excellence in collaboration with Premier Indian Institute of Technology (IIT Delhi) & Gexcon, thereby setting a benchmark for other industries. The Company is developing the required infrastructure for carrying out extensive safety training programs, framing safety course curriculum, conducting process safety related studies and audits by sharing industrial expertise & experience.

Safety Audit: The Company conducts an assessment audit every five years to identify the gaps in the Process Safety Management Implementation based on OSHA PSM & CCPS RBPS systems. A renowned third-party consultant is invited to conduct the assessment, study and to create an action plan for implementation.

Competency Mapping and Assessment: Competency Mapping and Assessment of employees and contractual employees has been core for Nayara. This includes online validation, psychometric evaluations, training need-identification, job rotations etc.

Best of Best Scheme: To promote operational excellence through healthy competition amongst the Units, "BEST OF BEST" scheme has been developed wherein the participating teams are challenged and motivated to inculcate Safety & Operational Excellence in day-to day activities. The scheme evaluation is based on HSE and Maintenance & Reliability criterion.

Implementation of Process Safety

Management System: 13 Process Safety Management System Elements have been implemented at our Refinery since 2008. The Refinery started monitoring Process Safety Performance using the Leading & Lagging Indicator Metrics espoused by

the Center for Chemical Process Safety (CCPS) of the American Institute of Chemical Engineers (AIChE) in 2010-11.

Investing in Safety: The top-most priority at Nayara, the company undertakes continuous and extensive endeavours to protect workers by from workplace injuries and illnesses. The Company has made some key investments includes enhancing the Safety features of Process Plants by installing Retractable Grounding Assembly (RGA) for Class A product tanks.

Provision of full surface Fire Fighting

System: In view of safety of highly flammable storage tanks, the firefighting ability for full surface fire extinguishment has been enhanced at Nayara energy by implementing provision of Full Surface Fire Fighting System for Crude Oil Tankages.

Rim Seal Fire Protection System for

Storage Tanks: On detection of the smallest fire, an alarm is triggered, and the extinguishing media is actuated immediately. Rim Seal Fire protection system has been installed for class-A product storage tanks in various locations.

Environmental Safety: The Refinery has well established Pollution Monitoring & Control Systems in place with Ambient Air Quality Monitoring Stations, Emission Monitoring System for Stacks hooked

up with CPCB enabling Real Time Data Monitoring and a sophisticated Leak Detection & Repair (LDAR) program which is an integral part for VOC emission monitoring and control from refinery.

Waste Management: The practice of keeping recyclable waste material category wise in separate bin at the source of waste generation is followed extensively and the behaviour ingrained in the team through regular campaigns. Hazardous Waste Pits and hazardous waste Storage Sheds have been developed in the refinery for storage of waste. Standard Operating

Procedure has been implemented for handling and disposal of waste.

Mangrove Afforestation: Nayara Energy Limited has done voluntary Mangrove Afforestation in 175 Ha. Land.

Rainwater harvesting & ground water recharge: Six reservoirs / ponds have been developed within the Refinery premises for storage and recharging of ground water along with building of ground water recharge wells within the Refinery.

GUMPS sensors for monitoring pipeline



corrosion: Implementation of Guided Ultrasonic Monitoring Pipeline System (GUMPS) sensors for monitoring and getting precise information on corrosion of pipelines, leading to a more detailed inspection of concern area. GUMPS sensors system takes first reading of pipe cross section at the time of installation and establishes a signature reading. The subsequent measurements are then compared to the new data to establish reduction in area of pipe cross section. This not only helps in maintaining real time monitoring on corrosion of pipelines but also keeps track the growth of defects in the pipeline.

Use of radiotracer technique:

Radiotracer technique has been adopted to identify any leaks in heat exchanger circuit. Collimated radiation detectors are placed on the tube side outlet pipes of heat exchangers to detect ingress.

Implementation of safety monitoring

of activities: To enhance the safety monitoring of turnaround activities, drones and cameras are used for monitoring critical activities at non-approachable locations. In case of non-compliance in the safety requirements, the camera captures photos and sends a mail to the configured users, which helps to immediately fulfil the safety requirements.

Case study

The company reported zero major Process Incidents (Tier 1) since 2014 and \witnessed more than 75% reduction in Minor Process events Incidents in last 5 years. In addition, the number of Trip Interlocks bypassed was brought down to zero.

The Company also completed 2 full cycles of Re-HAZOP studies till date and 3rd Re-HAZOP study of the Refinery is currently under progress

While QRA studies are now included as part of PHA revalidation programs in the Refinery complex, the refinery conducted SIL Classification and Verification studies for its Safety Instrumented Functions (SIFs).

The company also achieved more than 98% compliance with Inspection, Testing, and Preventive Maintenance (ITPM) Plans for Super-critical Equipment. ■



Author

Prabhanjan Dixit

Head-HSEF
Nayara Energy Limited



Advancing Industries through Materials Technology - Improving the Lifecycle of Crude Distillation Unit Overhead Condenser Tubes

Advances in Modern Materials

Crude oil contains impurities that can cause heavy corrosion in various parts of the refinery. Refiners must deal with multiple challenges if they want to process the heavier, or so-called “opportunity” crudes. A range of corrosion problems can arise in Crude Distillation Units (CDUs) and overhead condensers because of crude impurities and inefficient desalting. Some overhead systems experience severe corrosion and fouling that increase the atmospheric column operating pressure, reduce the distillate yield, or require tube bundle changes at intervals less than 4-6 year turnarounds. Some crude columns must be shutdown to remove salts deposited on internal surfaces.

Material selection for any equipment depends on service conditions in terms of temperature, pressure, and corrosive media such as sulfur, chlorides, and acids. The material selection of equipment built many years ago was based on past prevailing conditions. In many cases where the selected materials were a

borderline choice, the increased severity of operating conditions could result in failures, necessitating an upgrade in metallurgy. Carbon steel, Admiralty Brass, Monel, Stainless Steels (including the duplex family), Nickel alloys and Titanium have traditionally been used to make CDU overhead condenser tubes. Advances in modern materials technology are empowering chemical engineers and asset managers to reduce corrosion in CDU overhead condenser tubes and to improve the performance and life of condensers.

Conventional Challenges

The most severe corrosion problems happen at the top of the distillation tower and overhead condensers, where a corrosive condensate can form. When processing difficult-to-desalt crudes, salt content entering the heater can be high. Ca and Mg chloride salts hydrolyze in the atmospheric heater, producing large amounts of HCl. Below the dew point, water condenses into droplets and can dissolve the HCl gas in the overhead column. It makes the liquid acidic and can

cause severe corrosion in carbon steel. Ammonia or amine neutralizer is used for the neutralization of acidic conditions. However, this can cause stress corrosion cracking (SCC) in admiralty brass and other copper alloys. The formation of Ammonium Chloride can also result in under-deposit corrosion.

These conditions necessitate using materials resistant to general corrosion, pitting corrosion, under-deposit corrosion, fouling, SCC, and Naphthenic Acid corrosion. Some of these corrosion mechanisms could cause failures much before the regular major maintenance shutdown schedules every 4-6 years and could cause loss of production.



Carbon steel tube bundle after three years in service in overhead condenser, waiting for retubing.



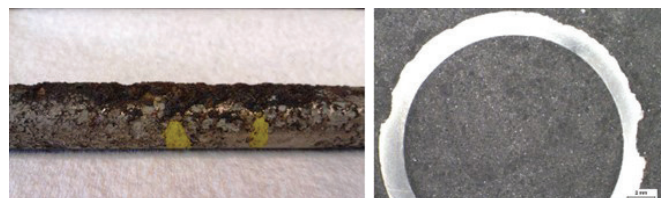
Stress corrosion cracking in Cl and S.



Failure due to general corrosion and formation of sulfides.



Duplex steel has a good surface in comparison with corroded carbon steel tie-rod (red colour tube at bottom) in overhead condenser after seven years of service.



Thick scale formation with corrosion due to HCl condensation.



Underdeposit corrosion of tubes – sulfur found in deposits.



Pitting corrosion.

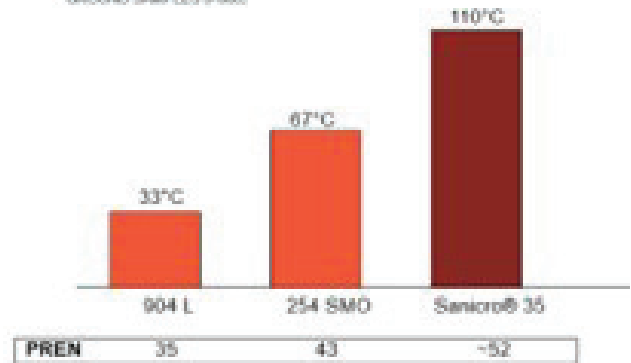
Innovative Changes

Alleima, formerly Sandvik Materials Technology, a world-leading developer and manufacturer of advanced stainless steel and special alloys, has pushed ahead with a breakthrough material solution to solve problems faced in such challenging applications.

Sanicro® 35 (UNS: N08935 from Alleima) is an alloy combining the best features of stainless steels and nickel alloys. This grade has excellent corrosion resistance for service in CDU overhead condenser tubes, seawater applications, and other highly corrosive environments. Sanicro® 35 has a stable, fully austenitic microstructure.

Critical Pitting Temperature (CPT)

ASTM G150_{modified}
3 M MgCl₂
GROUND SAMPLES (PREN)



The high Pitting Resistance Equivalent Number (PREN) of 52, a Critical Pitting Temperature (CPT) of 110°C, and a Critical Crevice Temperature (CCT) of 100°C means that it can handle pitting and crevice corrosion challenges. PREN of Sanicro® 35 is even higher than Alloy 625.

C	Si	Mn	P	Cr	Ni	Mo	Cu	Other	Fe
<0.03	0.2	0.64	<0.03	27	35	6.5	0.16	N=0.3	Balance

The grade is characterized by:

- Excellent resistance to pitting and crevice corrosion
- Excellent resistance to stress corrosion cracking (SCC)
- High resistance to general corrosion in acid and caustic environments
- High resistance to erosion-corrosion
- Very high mechanical strength
- Good weldability using nickel alloy consumables

Due to its extremely good pitting and crevice corrosion properties, Sanicro®35

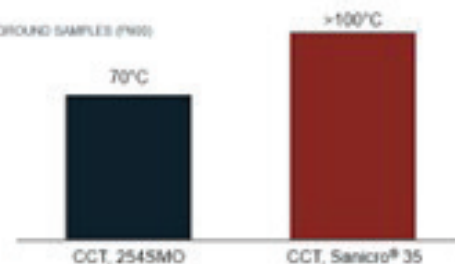
is particularly suitable for applications where seawater is used for cooling or heating. It has been proven in corrosion tests in natural and chlorinated seawater

Critical Crevice Temperature (CCT)

ASTM G150

The critical crevice temperature (CCT) has been evaluated in the standard ASTM G150 (1 M NaCl) test

GROUND SAMPLES (PREN)



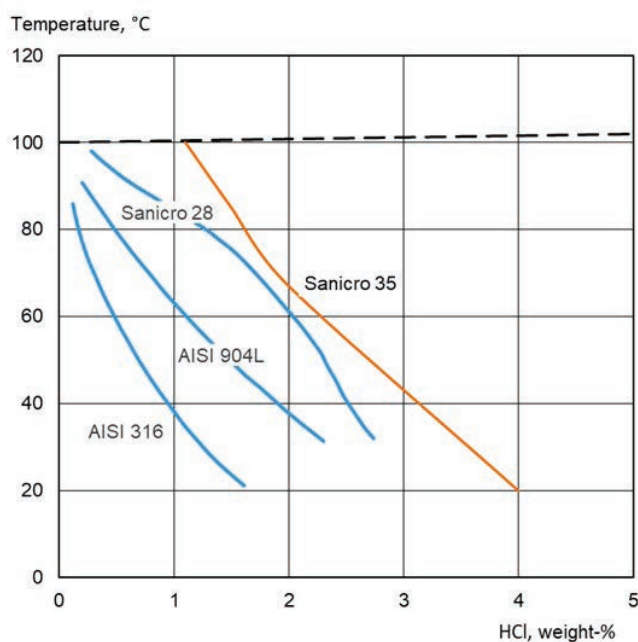
Seawater condition	Sanicro®35		Alloy 625	
	Pitting	Crevice	Pitting	Crevice
30°C Natural	OK	OK	OK	Not OK
45°C Chlorinated (0.5 ppm Cl)	OK	-	OK	-
80°C Chlorinated (0.5 ppm Cl)	OK	-	OK	-

at higher temperatures. The alloy performed better than Alloy 625 in natural seawater at 30°C.

The grade has good resistance to hydrochloric acid compared to stainless steels with a lower chromium and molybdenum content. It can be helpful in environments where hydrochloric acid is present. Below the dew point, water condenses into droplets in the overhead column and can dissolve large amounts of HCl gas. This makes the local conditions acidic. Sanicro® 35 has very good

resistance to corrosion due to HCl.

Ordinary austenitic steels of the ASTM 316 type are susceptible to chloride-induced SCC in chloride-bearing solutions at temperatures above about 60°C (140°F). This susceptibility declines with increasing nickel content. Chromium contents above 20% can also be beneficial. In a 40% calcium chloride solution, Sanicro®35 showed no cracking or corrosion after 500 hours of constant load testing, corresponding to 90% of the actual ultimate tensile strength (UTS) at 100°C.



Isocorrosion in hydrochloric acid. The curves represent a corrosion rate of 0.1 mm/year (4 mpy)

Welding

Sanicro® 35 has good weldability and preheating and post-weld heat treatment



Weld joint of Sanicro® 35 obtained with UNS N06059 filler wire

are not required. A suitable method for fusion welding the material is TIG welding (GTAW). Ar + 2% N₂ is recommended as shielding gas and backing gas to achieve the best combination of mechanical properties and corrosion resistance of the welded joints. Nickel alloy UNS N06059 (ERNiCrMo-13, NiCr23Mo16) wire or rod is recommended as filler material for gas shielded arc welding. Welding should be undertaken with low heat input, a maximum of 1.2 kJ/mm, and an interpass temperature of 100 °C. The weldability is verified in ASME IX testing and the joints with high structural stability are obtained.

Making a Difference

32

Sanicro® 35 is an effective and economical solution for CDU overhead condenser tubes. It is available in bar, tube, and plate and has good weldability compared to other grades used in this way. It also has excellent or high resistance to challenges such as pitting, crevice, SCC, and acid corrosion and represents an important advance in materials technology. ■

Authors

By Sudhindra Hathwar, Business Development Manager, Alleima India and Rohit Ojha, Lead Scientist, Alleima

CHEMICAL ENGINEERING WORLD

Dynamic Platform
to
Connect with Chemical
Industry Ecosystem

Direct Reach
to
>200,000 Readers
across
>25 countries

sales@jasubhai.com

www.jasubhaimedia.com



Digital Twin Transforming the Safety Equipment performance & its lifecycle

Digital technologies make safety equipment smarter, and we can also call it "Smart Safety Equipment". The market size of smart safety equipment varies depending on the specific product and region, but it is generally a rapidly growing industry. According to a report by renowned research group (Marketsandmarkets), the global smart safety equipment market size was valued at USD 5.97 billion in 2020 and is projected to reach USD 14.55 billion by 2025, at a CAGR of 19.8% during the forecast period. Factors such as increasing awareness about safety, technological advancements, and government regulations are driving the growth of the market.

33



Digital technologies have significantly increased the resilience of safety equipment in several ways

▪ Remote monitoring and diagnostics

Safety equipment can be remotely monitored and diagnosed using digital technologies, which allows for early detection of potential issues and proactive maintenance. This helps to ensure that equipment is always in good working condition and reduces the likelihood of equipment failure during critical moments.

▪ Predictive maintenance

Digital technologies such as IoT sensors

and machine learning algorithms can analyze data and predict when equipment needs maintenance, allowing for scheduled maintenance and minimizing downtime.

▪ Real-time data and analytics

Safety equipment can now be equipped with sensors and other digital technologies that provide real-time data and analytics. This allows for real-time monitoring and quick response to potential issues.

▪ Digital Thread & Single Source of Truth (SSOT)

The digital thread in smart safety

equipment refers to the integration of digital technologies, such as sensors, IoT, and analytics, into personal protective equipment (PPE) to enhance safety and improve performance. These technologies allow for the collection, analysis, and sharing of data in real-time, enabling workers to make more informed decisions and take proactive measures to prevent accidents. Creating a single source of truth (SSOT) helps in maintaining the right data which is easily accessible to enterprise.

▪ Smart sensor and alarms

Digital technologies can also be used to create smart alarms and notifications that alert operators or maintenance personnel of potential issues. This allows for quick response and helps to minimize the impact of equipment failures.

▪ Self-diagnosis and repair

Some safety equipment is now equipped with self-diagnosis and repair capabilities, which allows for quick and easy resolution of issues without the need for human intervention.

▪ Cloud or Edge-based data storage

Digital technologies allow for the storage of data in the cloud or edge, which can help ensure that important information is not lost in the event of equipment failure.

▪ Advanced analytics

Digital technologies can analyze data from safety equipment to identify patterns and trends that can help improve safety and reduce the risk of incidents.





Digital twin technology

A digital replica of a physical product or system that allows for real-time monitoring and analysis. This technology has the potential to revolutionize the way safety equipment is designed, manufactured, and maintained.

In the Design phase, digital twin technology can be used to simulate and test the performance of safety equipment before it is even built. This allows for early detection of potential issues and the ability to adjust before the equipment is even manufactured. This not only saves time and money but also ensures that the equipment is as safe and efficient as possible.

In the Manufacturing phase, digital twin technology can be used to monitor and analyze the production process, ensuring that the equipment is being built to the correct specifications. This can also help

identify any potential issues with the equipment before it is even shipped out.

Once the equipment is in use, digital twin technology can be used to monitor and analyze its performance in real-time. This allows for early detection of any issues and the ability to adjust or repair before they become a major problem. This not only increases the lifespan of the equipment but also ensures that it is always operating at its optimal level of safety.

Overall, digital twin technology has the potential to revolutionize the way safety equipment is designed, manufactured, and maintained. It allows for real-time monitoring and analysis, ensuring that the equipment is always operating at its optimal level of safety. This not only saves time and money but also increases the lifespan of the equipment and keeps the people using it safe.

Uses cases using digital twin for Smart Safety Equipment

Predictive maintenance

By using digital twin technology, safety equipment can be monitored in real-time to detect potential issues before they become critical. This allows for proactive maintenance and repairs to be carried out, reducing the likelihood of equipment failure and potential accidents.

Employee and machine downtime is incredibly costly

upwards of billions of dollars. In 2017 alone, the National Safety Council estimates the total cost of work injuries was \$161.5 billion. On top of that, one survey found that a single hour of downtime can cost a plant more than \$100,000 in personnel, equipment, and materials.

With the comprehensive view provided by a digital twin, plant owners can increase asset uptime by at least 20%, cut inspection and maintenance costs in half, and reduce equipment failure by as much as 95%

Training and simulation

Digital twin technology can be used to create virtual simulations of safety equipment, allowing workers to practice operating and maintaining the equipment

before working with the real thing. This improves their skills and reduces the risk of human error.

Asset management

Digital twin technology can be used to track the location and condition of safety equipment, making it easier to manage and maintain inventory. This ensures that the right equipment is always available when needed and reduces the risk of equipment being lost or stolen.

Safety analysis

Digital twin technology can be used to simulate scenarios and analyze potential hazards, allowing safety teams to identify and mitigate potential risks before they occur. This improves overall safety and reduces the likelihood of accidents. For example, smart hard hats equipped with sensors can monitor the wearer's head movements, temperature, and humidity, and alert them of any potential hazards. Smart safety vests can also be equipped with sensors that track the wearer's location, movements, and vital signs, providing real-time data to managers and supervisors for monitoring and risk management.

Remote monitoring

Digital twin technology can be used to monitor safety equipment remotely, allowing workers to keep an eye on

equipment while they are away from the site. This improves safety and reduces the risk of equipment being tampered with or stolen.

Digital technologies like digital twin are not only transforming markets and creating new paradigms of doing business but are also providing organizations with solutions to sustainability challenges. Therefore, sustainability is an overarching value discipline or business model.

Segmentation, Target, and Positioning (STP)

Focused segmentation, target, and positioning (STP) is required for smart safety equipment because it allows safety equipment designing companies in reaching the right customers, positioning themselves effectively in the market, and ultimately driving sales.

Segmentation

Industry: Smart safety equipment can be segmented by the industry it is targeted towards, such as Chemical & Petrochemical, construction, manufacturing, transportation, and healthcare.

Demographics: The target audience can also be segmented by demographics such as age, gender, and income level.

Occupation: Smart safety equipment can be targeted towards specific occupations

such as construction workers, industrial workers, and healthcare professionals.

Targeting

Chemical-Petrochemical Industry:

Smart safety equipment such as hard hats with built-in cameras and sensors can be targeted towards construction workers to improve safety and increase productivity.

Manufacturing Industry: Smart safety equipment such as industrial robots with built-in sensors can be targeted towards manufacturing workers to improve safety and increase efficiency.

Healthcare Industry: Smart safety equipment such as medical devices with built-in sensors can be targeted towards healthcare professionals to improve patient care and increase efficiency.

Positioning Smart Safety Equipment as a Solution: Smart safety equipment can be positioned as a solution to improve safety and increase productivity in various industries.

Smart Safety Equipment as a Necessity: Smart safety equipment can be positioned as a necessity for companies to comply with safety regulations and improve overall safety in the workplace.

Smart Safety Equipment as an Investment: Smart safety equipment can be positioned as an investment for companies to improve efficiency and increase productivity in the long run.

The digital paradigm shift in smart safety equipment

Has brought about significant changes in the way safety equipment is designed, manufactured, and used. The integration of digital technologies such as sensors, IoT, and AI has enabled the development of more advanced and intelligent safety equipment that can better protect workers in hazardous environments.

One of the main benefits of digital smart safety equipment is its ability to provide real-time monitoring and data collection. This allows for more accurate and efficient risk assessments, as well as improved incident response and emergency management. Additionally, smart safety equipment can also be connected to other digital systems, such as building management systems and emergency response systems, to provide a more comprehensive and integrated approach to safety. Another benefit of digital smart safety equipment is its ability to provide workers with more accurate and reliable information.

However, there are also challenges associated with the digital paradigm shift in smart safety equipment. One of the main challenges is the need for adequate cybersecurity measures to protect against hacking and data breaches. Additionally, there is also a need for proper training and education for workers on how to properly use and maintain digital smart safety equipment.

Conclusion

Overall, the transformation by digital twin in smart safety equipment has the potential to greatly improve worker safety and enhance incident response and emergency management. However, it is important that proper measures are taken to ensure the security and reliability of these systems. In an era where so much is changing in industries—from technology to the makeup of the workforce—risk remains the one constant. To protect employees and physical assets, investment in digital twin technology allows management to better prepare for the unexpected. ■

Author



Aniket Kumar

Manager - Digital Transformation
Yokogawa India Limited

ChemTECH

WORLD EXPO 2024

31st International Exhibition & Conferences

4-7 March 2024

Venue: Bombay Exhibition Center, Goregaon (East), Mumbai, India

50
CHEMTECH
FOUNDATION
1974-2024
Inspiring Intelligence...
..Igniting Innovation

**Join us for
50th Years
Celebration**

LEADERSHIP FOR CHEMTECH 2024

- Jury Chairman** Chemtech Leadership & Excellence Awards 2024
- Dr. R A Mashelkar**
Scientist, Former Director General, Council of Scientific and Industrial Research (CSIR)
- Chairman**
Specialty Chemicals World Expo 2024
- Mr. Nadir Godrej**
Managing Director, Godrej Industries Ltd & Chairman, Specialty Chemicals World Expo 2024
- Chairman**
EPC World Expo 2024
- Mr. B Narayan**
Group President Projects & Procurement, Reliance Industries Ltd
- Co-Chairman**
EPC World Expo 2024
- Mr. Subramanian Sarma**
Whole time Director & Sr. EVP Energy Larsen & Toubro Limited
- Chairperson, Refining & Petrochemicals World Expo 2024**
- Ms. Sukla Mistry**
Director (Refineries), Indian Oil Corporation Ltd
- Co-Chairman**
Refining & Petrochemicals World Expo 2024
- Mr. Sanjay Khanna**
Director (Refineries) Bharat Petroleum Corporation Ltd
- Chairman, WaterEX World Expo 2024**
- Mr. P Raghavendra Rao, IAS**
Chairman, Haryana State Pollution Control Board, Ex Secretary (Chemicals & Petrochemicals)
- Convener,**
Specialty Chemicals World Expo 2024
- Dr. Raman Ramachandran**
Head of Management Development Programmes K J Somaiya Institute of Management
- Key Board Member**
Specialty Chemicals World Expo 2024
- Mr. Rajendra Gogri**
Chairman & Managing Director Aarti Industries Ltd

EXHIBITOR GROUPS

- Chemical & Pharma Processing
- Process Plants & Equipment
- Thermal & Mechanical Processing
- Engineering Procurement & Construction
- Technology Licensors
- Project Management Consultants
- Refining
- Chemicals & Petrochemicals
- Specialty Chemicals
- Chloroalkali
- Fertilizers
- Water & Waste Management
- Environment Technologies & Services
- Digital Services
- Industrial Automation
- Instrumentation & Process Automation
- Electrical Equipment
- Research & Development
- Biotechnology
- Green Chemistry
- Banking Finance & Insurance
- Lab & Analytical Instruments

PHARMA & BIOPHARMA

- Ingredients
- Bulk drugs

- R&D
- Warehousing
- Cold chain
- Packaging
- Contract Research & Manufacturing

CLEAN ENERGY

- Hydrogen
- Biofuels
- Methanol
- Carbon Capture Utilization & Storage
- Renewables - Solar Wind & Hydro

LOGISTICS

- Logistics Services
- Containers
- Supply Chain Management
- Packaging
- Material Handling
- Storage & Warehousing
- Cold Chain Management

CORROSION CONTROL

- Industrial Coatings
- Corrosion Control Technologies & Services
- Surface Engineering Solutions
- New metallurgies
- Inspection & Monitoring Technologies

Concurrent Events



ChemTECH World Expo 2022

- | | | | | | | |
|--------------------------------------|--------------------------|-------------------------|------------------------|--------------------------|------------------------|------------------------|
| 300+
EXHIBITORS & PARTNERS | 19350
VISITORS | 6
CONFERENCES | 150
SPEAKERS | 650+
DELEGATES | 200
STUDENTS | 27
COUNTRIES |
|--------------------------------------|--------------------------|-------------------------|------------------------|--------------------------|------------------------|------------------------|

Organised by:

Jasubhai Media Pvt Ltd

Taj Building, 3rd Floor, 210, Dr. D N Road, Fort, Mumbai – 400 001, INDIA.
Tel: +91-22-4037 3636, **Email:** sales@jasubhai.com

Ahmedabad - 09833104834 | Bangalore - 09892644177 | Chennai - 09176963737 | Delhi - 09818148551
Hyderabad / Pune - 09822209183 | Vadodara - 09820544904



sales@jasubhai.com



www.chemtechie.com

HSE Management Systems for Safe Operation of LNG Terminal

The safe operation of an LNG terminal is of paramount importance, as it involves the handling of highly volatile and potentially hazardous materials. The hazards, risks, and consequences associated with LNG terminals are significant, and thus it is essential to implement robust engineering design, selection of equipment, and various project safety studies and standard operating practices to ensure the safe and efficient operation of the terminal.

40



hamra LNG Terminal Pvt. Ltd (DLTPL) in District Bhadrak, Odisha is nearing commissioning and poised to become India's 7th operational

5 MMTPA LNG import terminal, meeting a crucial gas infrastructure requirement for the country. Given this strategic importance, with consideration to the strength of the promoters and the high standards of the global LNG industry, DLTPL is gearing up to set the pace in safety standards.

DLTPL has implemented advanced safety measures and safeguard systems to mitigate risks and minimize the potential for accidents. The company's Health, Safety, and Environment (HSE) management structure is in compliance with all relevant statutory and regulatory requirements, such as Factories Rules,

Major Accident Hazards, PESO, and PNGRB, in line with industry best practices.

DLTPL's operational excellence program, which is based on the PDCA (Plan, Do, Check, and Act) cycle, has been implemented to ensure safe operations throughout the terminal. This includes the implementation of Health, Safety, and Environment Management Systems (HSEMS) & Process Safety Management (PSM) to continuously monitor and improve safety performance.

Health, Safety and Environment Management Systems (HSEMS)

The HSEMS is an apex level document of the organisation which lays down a set of standards and procedures to measure the risks and opportunities according to the



activities. It contains 10 key elements as follows:

Process Safety Management (PSM)

The process safety management means the identification, prevention, control, and mitigation of unintended release of hazardous materials or loss of primary containment which has potential to become serious incidents like fires, explosions, mass injuries, fatality etc. PSM



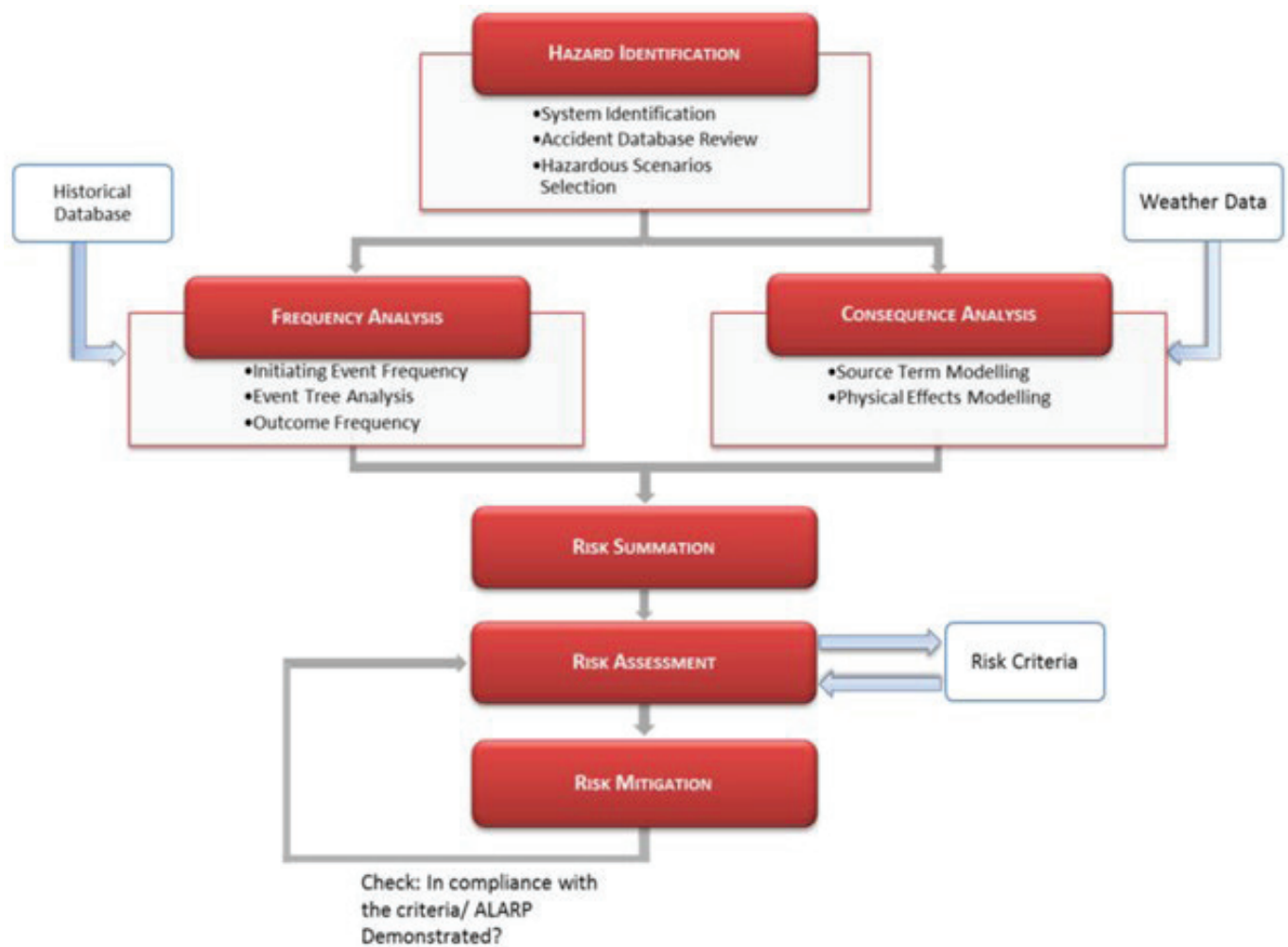
covers 14 process safety elements which are relevant to manage and identify hazard and risks.

▪ QRA

Terminal has adopted a structured Quantitative Risk Assessment (QRA) approach considering potential leaks and major releases due to fracture of process pipes, equipment, and vessels. The QRA study has adopted following methodology to identify specific risks and hazards.

The QRA includes

- **Hazard identification** considering hazardous properties of materials stored & process involved in the operation. Terminal has carried out safety studies to identify all relevant hazards and the ways of realizing the hazards.
- **Consequence Analysis** to predict the size, shape, and orientation of hazard zones. It is calculated on basis of Source term modelling, Dispersion modelling, Fire & explosion modelling, Effects modelling and mitigation. The consequence has been determined for fire, heat radiation or overpressure levels.
- **The likelihood** of each loss of containment event identified is estimated in the frequency analysis. By the use



of generic failure frequency data, the initiating frequency of the loss of containment has been estimated.

▪ Design Safety

Considering LNG hazards, risks, and worldwide previous incidents, DLTPL has state-of-art engineering design and controls systems such as

- Use of 9% nickel with steel alloy to avoid brittle failure in the LNG storage tank.
- Provision of continuous LNG level, temperature, density monitoring, provisions for bottom or top feeding based on tank cargo density to avoid rollover phenomenon in the tank.
- Drip pan with thermocouple to trigger alarm has been set underneath major flanges to avoid LNG discharge at the seal during the transfer operation using unloading arms.
- LNG tanks are provided with multiple pressure sensors and an independent

high-pressure trip in order to initiate shutdown of the unloading operation during Tank Over-pressure.

- Adoption of welded design in process piping minimizing probability of leaks.
- Ensuring high pressure pipeline integrity by considering excess design piping thickness
- Provision of necessary isolation and containment for effective management of loss of primary containment.

In view of reducing the risk to **“As Low As Reasonably Practicable (ALARP)”**, DLTPL had organized an “ALARP Demonstration Workshop” so that individual and societal impacts are within the ALARP limit considering Intolerable, Tolerable and Broadly Acceptable Risk as per the figure below

Tolerability of risk criteria was adopted to ensure the individual risk and societal risk are within

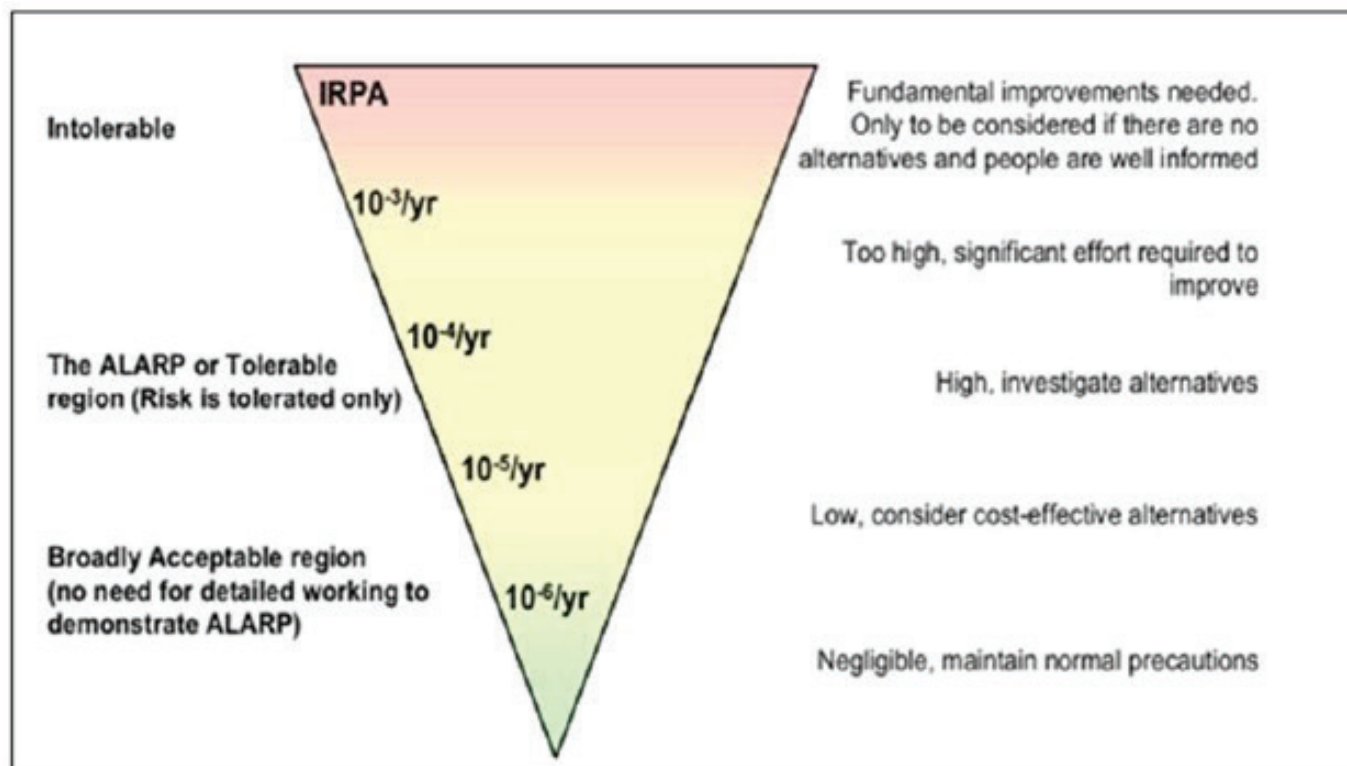
$1 \times 10^{-4}/\text{yr}$ and $1 \times 10^{-5}/\text{yr}$ respectively.

Occupational Health and Safety

Occupational health and safety issues associated with LNG terminal include Fires and explosions, Contact with cold surfaces, Chemical hazards etc

▪ Fires and Explosions

Emergency Risk and Disaster Management Plan (ERDMP) has been prepared and demonstrated for emergency situations. Advanced Fire safety training for suppression and evacuation has been conducted. Regular mock drills are also being carried out for different scenarios.



- **Contact with Cold Surfaces**

Training is provided for handling or dispensing of LNG regarding the hazards of contact with cold surfaces (e.g., cold burns, frost bite etc).

- **Chemical Hazards**

Hazardous material like LNG, NG and Diesel may result in liquid jet fire, pool fire, flash fire, vapour cloud explosion, fireball or BLEVE, depending on release conditions and time of ignition.

MSDS are readily available and accessible for every chemical including its handling.

44 Process Safety Controls

The process safety controls include Pressure Safety Valve, Pressure Rupture safety disc, Solenoid Operated Valve (SOV), Motor Operated valve (MOV), Emergency shutdown, Isolation valves, Fire & Gas Detectors, Flame arrestor.

F&G detectors: Fire detectors, low temperature LNG spillage detectors, gas leak detectors and manual "break glass" points are provided in strategic locations of the Terminal.

Emergency Shutdown: Individual equipment shutdown are logically handled by a PLC dedicated to equipment.

- **Partial Terminal shutdowns:** When specific operation like ship unloading or send-out is potentially unsafe but

the potential consequences are limited to the respective area or system.

- **Process sub-systems:** When the hazardous condition is only related to one process sub-system.
- **Process systems:** Emergency shutdown sequences ESD1, ESD2, ESD3 which cause partial terminal shutdowns and include some of the valves and equipment that are associated within the individual safety systems.
- **Terminal shutdown:** Emergency shutdown sequence ESD4 is dedicated to a total process shutdown if the continuation of ship unloading, and gas deliveries is unsafe due to large gas escape.

Isolation Valves:

- **Single Seat Isolation Valves:** One tight shut-off isolation valve for segregation of non-hazardous utilities.
- **Double Seat Isolation Valve (IDB):** Provided to isolate a major piping system from a high-pressure gas line.

The isolation valves are provided in HP/LP LNG – HP Gas, LP Boil-Off Gas and LNG and Gas Arms.

Flame Arrestor: Deflagration flame arrester is provided on vent lines of small vessels and plant equipment which is not pressurized for protection against atmospheric deflagrations

Safety Studies Conducted:



HSE Training and Mock Drills

DLTPL has developed full-fledged HSE training plan which covers

- HSE induction
- Working at Height & Scaffolding
- Confined Space
- PTW Training
- ERDMP
- HSEMS & PSM
- Hot Work Safety and Inspection
- Basic and refresher Fire Fighting

CONCLUSION

Safety & Integrity of any new project like DLTPL is primarily determined by the adoption of high design standards. Implementation of an early HSE management system (HSE MS) is a key to improve overall safety performance of a company during operations stage. This involves implementation of procedures, adequate training, competency development and compliance to legal requirements. However, the success of an HSE MS depends on strong leadership/management support, active employee participation and a conducive, organizational culture. A visible and felt leadership shall go a long way in creating a proactive HSE culture that will minimize the risk to harm people, the environment, its assets, or reputation, while remaining in pursuit of the company's business objectives. ■

45

Authors

Chetak Nawale

Head- HSE

Dhamra LNG Terminal Pvt Ltd
(Subsidiary of Adani Total Pvt Ltd)



Bandita Samal

Sr. Environmental Engineer

Dhamra LNG Terminal Pvt Ltd
(Subsidiary of Adani Total Pvt Ltd)



Dynamic Platform
to
Connect with Chemical Industry Ecosystem
Direct Reach
to
>200,000 Readers
across
>25 countries



Embed Product Video



Choose the embedded features: insert all
embedded features Contact: sales@jasubhai.com

