

## MAJOR ACCIDENTS IN JULY-AUG 2021

### 1 Dead after Condo Explosion in Warren

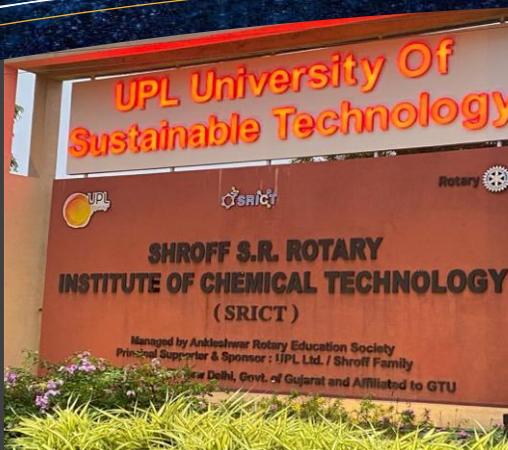


A condo explosion in Warren on 4<sup>th</sup> July 2021 left one person dead. According to the reports, authorities suspect a natural gas malfunction in the explosion.

### Second Chemical Fire at Bangkok Factory Highlights Health Risks



Chemicals at a factory just outside the Thai capital burst back into flames briefly, sending up another cloud of toxic black smoke and highlighting the continuing health danger from an industrial accident that killed one and injured dozens more.



## THIS ISSUE

Editorial P.1

CoE Activities P.2

Human Factor Influence in Operation Safety P.3

Evaluation of Accidents Based on PSM Elements P.4

The Hierarchy of Controls P.5,6

Process Safety Management (Part-I) P.7,8

Courses & Services Available P.9

## EDITORIAL

Dear Readers,

**“Safety brings first aid to the uninjured”** (F S Hughes) is a meaningful mantra akin to the idea of **“An ounce of prevention is worth a pound of cure”** with a deep message which can become a motivating factor for everyone.

The Centre of Excellence (CoE) in industrial safety established at SRICT by the congruous collaboration of UPL Ltd. with GEXCON, Norway is working on the same mantra by accepting the challenges for making industrial work-field a safer place through the sharing of relevant knowledge.

Zero accident, protecting human lives, environment and property are reachable targets of CoE when an attitude of caring and concern meets sharing of information regarding safety aspects through hands-on expert training, seminars and conferences.

With the subsidence of Covid-19 wave, the chemical sector has bounced back like never before and the safety sector has an important role to play in this regained impetus.

Industries are currently working hand in hand to provide the best conditions for the work force. Safer the industries, more efficiently the manpower can work with.

We are extremely overwhelmed by the responses and worthy suggestions received for the previous issues of Safexcellence. Safexcellence has an aim of not only sharing the details of industrial catastrophes but also spreading knowledge to avoid them by learning from the past accidents and preventing their reoccurrences.

We are contented to share Issue-7 of Safexcellence which brings experts from industries, government offices and academia to share their valuable views on safety aspects with an aim of reducing risks and hazards in chemical industries. Happy Reading!

Warm Wishes

**B. D. Dalwadi**  
C.E.O. BEIL, Ltd

## Blast at Thai Factory Kills One, Massive Evacuation Under Way



Thousands evacuated after a blast and fire at a plastics manufacturing factory amid the risk of further explosions. A huge explosion and a fire at a factory on the outskirts of the Thai capital has killed at least one person and wounded 29 others.

## Propane Explosion Levels Michigan House, No Injuries



A propane explosion leveled a Michigan house. The explosion took place in a 100 lbs Propane tank placed in the garage.

## Iranian Oil Field Explosion Kills 3, Injures 4



An explosion caused by a gas leak at a pipeline pumping station killed three workers and injured four in southwestern Iran.

# CoE ACTIVITIES

## TRAINING ON HAZARD AND OPERABILITY STUDY (HAZOP)

### About the Speaker



**Mr. ALOK KUMAR**

B.Tech. Chemical Engineering, IIT Kanpur.

Experienced Professional in the Chemical & Process Industry worked at level of SBU leader responsible for business objectives. Working experience in Agrochemicals, Bulk Pharma Chemicals, Organic Chemicals, EPC, Pulp & Paper, and Common Environment Infrastructure Industries during the past 38 years. Possess a participative and action focused leadership style supported by flexible and creative thinking style, & process oriented execution skills

### Experience in the following Key Skills & Competencies

Effective & Efficient Multi Site Manufacturing Operations Management for both continuous & batch process., Green Field & Brown Field Project Planning, & Implementation & start ups Product Process scale up from Lab to Commercial, Safety and Environment engineering & management including Corporate EHS.

**Shroff S.R. Rotary Institute of Chemical Technology**

UPL Center of Excellence in Process Safety

ORGANISES  
**Training on Hazard and Operability study (HAZOP)**

From, 17 and 18<sup>th</sup> August, 2021  
Time 2.00 pm to 5.00 pm

**For More information Contact**

Website: www.sRICT.in  
Block No. 402, At & Po- Vataria, Tal- Valia, Dist- Bharuch, Gujarat, Phone No. +91 8975033066, Email- ravindra.kanawade@sRICT.in.

Training will be conducted on virtual platform

HAZOP study is a systematic review of processes or operations to examine the possibilities of any undesirable consequences that can occur due to the deviation in the actual design or operational intent. After the review process, the HAZOP team lists out causes and consequences of deviation along with already existing safeguards that protect against deviation. In case of insufficient or poor safeguards, the team suggests relevant actions to minimize the severity of the risk.

HAZOP Study and Risk Analysis Certification are specially designed for engineers who had prior knowledge related to hazard & operability study and wish to enhance their knowledge in hazard and risk analysis. The total duration of this course was 2 days with 3 hours of class per day and total 57 participants from different industries have attended this training program.

## POSTER DRAWING COMPETITION

### “Industrial Safety Awareness”

Department of Chemical Technology, SRICT, organized Online “Drawing Competition” on “Industrial Safety Awareness” under the banner of Co-Curricular activity on 23<sup>rd</sup> July 2021 from 3.00 pm onwards via google meet. Total 08 students were registered in this event. The judges of this activity were Mr. Amol Lakare (Manager Process Safety, UPL-Unit-5) and Mr. Govind Patil (Research Scientist - Process Safety Consulting, Gexcon India).



Ms. Ankita Shah (5<sup>th</sup> Sem EST),



Mr. Virajkumar Patel (2<sup>nd</sup> Sem CE)



Mr. Vivek Gajara (2<sup>nd</sup> Sem EST).

**Four Minors Among Nine Killed in Explosion Caused by Leaking LPG Cylinder**



Four children & five other have succumbed to severe burn injuries in an explosion & fire that was triggered by leakage of gas from an LPG cylinder in a room on the outskirts of gujrat's ahemdabad city.

**2 Dead, 4 Missing After a Blast at Buyer Chemical Complex in Germany**



At least two people were killed & 31 injured after an explosion at an industrial park for chemical companies in German city of Leverkusen on 27<sup>th</sup> July 2021.

**Fire Accident at Haldia Petrochemicals, None Injured**



A fire broke out on the premises of Naptha cracker unit at the Haldia Petrochemicals refinery in West Bengal on 4<sup>th</sup> Aug 2021. The plant was under technical shutdown.

**HUMAN FACTOR INFLUENCE IN OPERATION SAFETY**

**1] Observation:**

It is Analysed that all major accidents include Human Factors which is the most root cause. The major accidents can be prevented by improving the Human Factor/ Performance. If the Human Factor is not good, it will increase the chances of major Accident even the plant is highly automized.

Even training and procedures are in place, Human Errors may possible. Below are some responsible factors for Human Error:

**1.1. Task, Workload and Working Culture**

Workload problems may occur if person has many things to do in a short time or specified time. Workload can be saturation limit of mental, or physical, or both, and it will depend on various factors, such as:

- Time – Number of task in specified time
- External Pressure to complete the task
- Social and organisational stressors
- Task Planning/ Scheduling
- Experience and Perceptions of Operator
- Workspace Condition
- Environmental Conditions (e.g. noise, temperature, Odour)

Problems with workload can occur when workload is too high (Excessive) or too low (Insufficient). Some examples of causes of workload are shown in Table:

**1.2. Human Errors:**

Human errors can be predicted, but many Human Errors will not able to predict. Below are some responsible factors for Human Error:

- Equipment testing errors
- Operating errors
- Analytical Error

EXCESSIVE WORKLOAD	INSUFFICIENT WORKLOAD
Many tasks in the specified time or continued scheduling of new tasks for same person.	Slow or intermittent task scheduling (e.g. downtime).
Many Alarms in a shift	Alarms from instruments occurring irregular.
Improper planning, unskilled person	Person with highly-skill.
Complex Activity, Many suggestions at a time, Complex procedures etc.	Very Simple procedure with required details

**1.3. Human Errors:**

Human errors can be predicted, but many Human Errors will not able to predict. Below are some responsible factors for Human Error:

- Equipment testing errors
- Operating errors
- Analytical Error

**1.4. Reducing Human Error:**

Human Errors can be control and reduced by changing people's behaviour and performance. Below are the Steps to reduce human errors:

- Addressing the conditions and reducing the stressors
- Designing plant and equipment to prevent slips and lapses occurring
- Making certain that arrangements to check effectiveness of training
- Designing jobs to avoid the need for tasks which involve very complex decisions, diagnoses or calculations
- Ensuring proper supervision particularly for inexperienced staff
- Equipment Design (if practicable) considering the possibility of human error
- Avoid reputation of incident caused by Human error identified as per Route Cause Analysis
- Monitoring System that measures taken to reduce error are effective

**Reference Document:**

- OGP Risk Assessment Data Directory
- HSE, Reducing Error and influencing Behaviour

**Amol Lakare**  
**Manager Process Safety,**  
**UPL Ltd.**

**Explosion at SRF Ltd's Dahej Facility, One Killed**



An explosion inside the manufacturing facility of chemicals player SRF Ltd. at Dahej in Bharuch district claimed one life and injured two others on 3<sup>rd</sup> Aug 2021.

**Massive Fire in the Gulf of Mexico Extinguished**



A massive fire in the Gulf of Mexico caused by a gas leak in the submarine pipeline was extinguished after a five hour operation.

**Plastic Production Plant Destroyed in Dramatic Fire**



A Jackson, MS Plastic manufacturing plant collapsed during a massive blaze at the facility on 18<sup>th</sup> Aug 2021. One firefighter received minor burn injuries during the response.

# ELEMENTS OF PROCESS SAFETY MANAGEMENT

In the 1st Issue of SAFEXCELLENCE, SRICT CoE has selected 17 process safety elements and based on these elements and published literature, an attempt is made to analyze the disasters taken place during the months for the probable cause/s. SAFEXCELLENCE team points out the missing process safety element/s in

## MISSING PSM ELEMENTS WHICH CAUSED THE ACCIDENTS

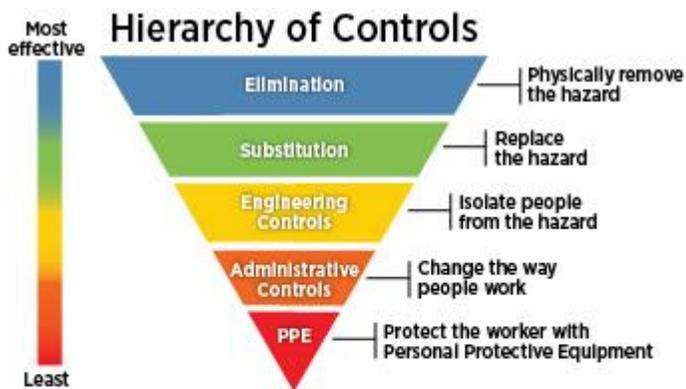
Accidents	Missing PSM elements																
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Condo Explosion in Warren	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Second Chemical Fire at Bangkok Factory	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Blast at Thai Factory	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Propane Explosion Levels Michigan House	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Iranian Oil Field Explosion	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Buyer Chemical Complex Germany	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Fire Accident at Haldia Petrochemicals	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Explosion at SRF Ltd's Dahej Facility,	1	2		4	5	6	7	8	9	10	11	12	13	14	15	16	17
Massive Fire in the Gulf of Mexico	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Plastic Production Plant Destroyed in Dramatic Fire	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17

# THE HIERARCHY OF CONTROLS

Strategy for safety singles out hazards before work starts. A hazardous substance splashes onto a chemical plant operator while taking a sample. The worker is not seriously injured, and the ensuing investigation focuses on training, personal protective equipment and the particulars of the sampling station. But did anyone ever ask whether the worker needed to take the sample at all?

Identifying and mitigating exposures to occupational hazards before work begins is the objective of all safety and health professionals. NIOSH offers a basic outline through its interpretation of the Hierarchy of Controls.

The hierarchy starts with the controls perceived to be most effective and moves down to those considered least effective. As defined by NIOSH, it flows as follows:



Source: NIOSH

You can't eliminate every hazard, but the closer you get to the top, the closer you can reach that ideal and make people healthier and safer.

## Collaborate to Eliminate

Referring to the chemical splash example, it may be possible to take the sample elsewhere in the plant, where the material can be found at a lower concentration. Changing thought patterns may pave the way to less hazardous processes.

## Substitution -Replace the Hazard

Elimination and substitution is often more difficult to enact after work has begun. The goal of substitution is to replace a hazardous product or process with a safer one. Examples include using non-toxic or less toxic chemicals and upgrading aging machinery with newer equipment.

## Make the Work Easier by Engineering Control

In industries numerous hazards for which engineering controls can be effective. They include noise, falls, silica, aerosols, organic fumes, formaldehyde, hazardous drugs, lead, asbestos, carbon monoxide and nitrous oxide.

Establishing local exhaust ventilation to isolate and remove airborne emissions. Another is using machine guarding to protect operators.

Well-designed engineering controls can be highly effective in protecting workers and will typically be independent of worker interactions. They typically do not interfere with worker productivity or personal comfort, and make the work easier to perform rather than more difficult.

**Column Fire Reported at Biodiesel Plant**



A fire broke out at the Seaboard Energy Biodiesel plant due to overheating of a five-story column. Because of the nature of the fire foam was used to douse the flames.

**Asphalt Plant Explosion Leaves 1 Worker Dead**



Firefighters were sent to the Asphalt Express asphalt plant after an explosion was reported in the facility. Heavy black smoke and flames were observed in the facility's tank farm.

**Equipment Failure Causes Explosion at Chemical Plant**



Equipment exploded during maintenance work at Kureha PGA LLC Chemical unit. The equipment involved in the blast is used for processing heat. The ductwork inside the plant was damaged during this incident.

**Changing Work Habits-Administrative Control**

Administrative controls limit exposure to hazards by adjusting work tasks or schedules. examples include:

- Limiting the time a worker is exposed to a hazard
- Creating written operating procedures
- Installing alarms, signs and warnings
- Using a buddy system

**Know Your PPE**

OSHA states that use of PPE – considered the last line of defense against worker injury and illness – is acceptable when controls higher in the hierarchy don't eliminate the hazard or are in development. Numerous types of PPE are available, depending on work conditions and the part of the body that might be susceptible to a hazard.

**Sanjay Joshi**  
Sr. Manager-SHE  
BEIL Infrastructure Ltd  
(Source: NIOSH)



## UPL University of Sustainable Technology

(ESTABLISHED UNDER GUJARAT STATE PRIVATE UNIVERSITY ACT, 2009)







### Shroff S.R. Rotary Institute of Chemical Technology

<div style="background-color: #e91e63; color: white; padding: 2px; text-align: center;"><b>Diploma Engineering</b></div> <ul style="list-style-type: none"> <li>• Chemical Engineering</li> <li>• Computer Engineering</li> <li>• Mechanical Engineering</li> <li>• Electrical Engineering</li> <li>• Environment Engineering</li> <li>• Fire Technology &amp; Safety</li> </ul>	<div style="background-color: #008080; color: white; padding: 2px; text-align: center;"><b>Bachelor of Engineering</b></div> <ul style="list-style-type: none"> <li>• Chemical Engineering</li> <li>• Computer Engineering</li> <li>• Electrical Engineering</li> <li>• Mechanical Engineering</li> <li>• Environmental Science &amp; Technology</li> <li>• Chemical Technology</li> </ul>	<div style="background-color: #e67e22; color: white; padding: 2px; text-align: center;"><b>Master of Engineering</b></div> <ul style="list-style-type: none"> <li>• Mechanical Engineering (Thermal)</li> <li>• Chemical Engineering</li> <li>• Environmental Management</li> </ul>
--	--	---

**SRICT Institute of Science & Research**

<div style="background-color: #27ae60; color: white; padding: 2px; text-align: center;"><b>Bachelor of Science</b></div> <ul style="list-style-type: none"> <li>• Chemistry</li> </ul>	<div style="background-color: #8e44ad; color: white; padding: 2px; text-align: center;"><b>Master of Science</b></div> <ul style="list-style-type: none"> <li>• Chemistry (Regular)</li> <li>• Chemistry (Evening)</li> </ul>
--	---



 www.srict.in
 adm@srict.in
 9727745875/76

# PROCESS SAFETY MANAGEMENT

## Part-I

### What Is Process Safety Management?

Process Safety Management is a disciplined framework for managing the integrity of operating systems and processes that handle hazardous substances.

The term Process Safety Management (PSM) became prominent because of an OSHA regulation, in USA and Bhopal tragedy in India that requires businesses to properly manage hazardous chemicals, with the goal of creating safe workplaces and preventing “unexpected releases of toxic, reactive, or flammable liquids and gases” that can cause disasters.

Process Safety Management systems are usually a blend of technology platforms, specific procedures and management frameworks.

Other versions of the PSM have since appeared as the implications were better understood. In the United States, the Center for Chemical Process Safety (CCPS) model includes 20 elements categorized into four pillars is Risk Based Process Safety (RBPS) Management approach.



**The Four Pillars Include:**

1] Commit to Process Safety

3] Manage Risk

2] Understand Hazard and Risks

4] Learn from Experience

**The Elements are:**

- ❖ Process Safety Culture
- ❖ Compliance with Standards
- ❖ Process Safety Competency
- ❖ Workforce Involvement
- ❖ Stakeholder Outreach
- ❖ Process Knowledge Management
- ❖ Hazard Identification and Risk Analysis
- ❖ Operating Procedures
- ❖ Safe Work Practices
- ❖ Asset Integrity and Reliability
- ❖ Contractor Management
- ❖ Training and Performance Assurance
- ❖ Management of Change
- ❖ Operational Readiness
- ❖ Conduct of Operations
- ❖ Emergency Management
- ❖ Incident Investigation
- ❖ Measurement and Metrics
- ❖ Auditing
- ❖ Management Review and Continuous Improvement
- ❖ Implementation and the Future

There are several other models that are used around the world. In the United Kingdom, the Control of Major Accident Hazards (COMAH) Regulations 2015 cover PSM. In the Middle East several countries have opted for Safety Management Systems (SMS), which have PSM embedded. Within Australia, process safety is largely controlled through Occupational Health and Safety Acts and regulations pertaining to Dangerous Goods and Major Hazard Facilities. And The American Institute of Chemical Engineers (AIChE) is helping Japan design such a system there, too.

*Ashok Dashputre  
Safety Consultant*

FOR MORE INFORMATION ABOUT TOTAL SAFETY SOLUTION MODEL, CONTACT Us



# COURSES AND CONSULTANCY SERVICES AVAILABLE IN PSM

TRAINING PROGRAMME ON PROCESS SAFETY MANAGEMENT



ASSISTING INDUSTRIES IN IMPLEMENTATION OF PROCESS SAFETY MANAGEMENT

PSM CONSULTING ASSIGNMENTS TO MEDIUM/LARGE CHEMICAL COMPANIES



ASSISTING INDUSTRIES TO CONDUCT HAZARD AND OPERABILITY STUDY (HAZOP)

(SCAN QR CODE)

OR

DR. OMPRAKASH MAHADWAD (CoE-COORDINATOR)

+918975033066

OMPRAKASH.MAHADWAD@SRICT.IN

## COE NEWSLETTER EDITORIAL BOARD

### EDITOR IN CHIEF

Mr. Piyush Shah (Head-Health & Safety, UPL Ltd.)

Prof. Shrikant J. Wagh (Principal, SRICT)

### EDITOR AND DESIGNER

Prof. Omprakash Mahadwad (CoE Coordinator, SRICT)

### CONVENER

Dr. Shina A. Gautam (Associate Professor, SRICT)

Ms. Monika Patel (Assistant Professor, SRICT)

### EXECUTIVE STUDENT MEMBERS

Juily Pawaday (Chemical Engineering, Designer)

Ankita Shah (Environment Science & Technology)

Richa Patel (Chemical Technology)