Hindustan Organic Chemicals Limited
( A Govt. of India Enterprise )

**SWACHHATA PAKHWADA**
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# Cleanliness & Hygiene for Safer Plant Operation

**Dr MP Sukumaran Nair FIE**
Director
Centre for Green Technology & Management
www.drmpsukumarannair.com

# Cleanliness & Hygiene

- Cleanliness is a practice

  A healthy practice of keeping ourselves and our environment free of debris, dirt, germs, dust, mud, and refuse matter.

- Cleanliness is also a habit.

  A habit of maintaining a hygienic and tidy surrounding free from contamination, pollution which sustain and improve physical health and ward off diseases.

- Pandemic impact

  A very important aspect for human life and wellbeing, inevitable to all our lives especially during the pandemic.

# Burden of being unclean

- Waste accumulation
- Beyond earth's carrying capacity
- Pollution
- Infection & Diseases
- Pandemics
- Climatic distortions
- Loss of biodiversity

# Cleanliness impact National Development.

- "**Swachh Bharat Mission",** or Clean India Campaign, (a large-scale government initiative focused on providing sanitation and hygiene facilities to all citizens) would make a significant impact on public health and in safeguarding the income of the poor, ultimately contributing to the national economy"

  Narendra Modi, Prime Minister of India.

# Cleanliness is important

- Protects  physical health from illness, keeping harmful bacteria and other germs at bay.
- Sustaining strong body and sharp mind.
- Clean potable water and keeping places without litters, spills etc
- A good waste- liquid and solid- disposal facility
- A good sewage handling and treatment system
- Clean environment imparts good quality  psychological health
- Dirt increase mental stress- says studies
- The crux of our environmental issues- local, national and global- arise out of improper waste dumping at the cost of C & H
- Global warming, Climate change, Ocean pollution, Biodiversity loss, diseases, crop loss ---
- Philosophical outlook :Believers say Clean and  pure hearts and minds are divine and ward off wicked  thoughts and plans.

# Factory Hazards

- Physical
- Chemical
- Biological
- Environmental
- Ergonomic
- Noise
- Radiation
- Occupational illness

# Physical hazards

- **Radiant Heat exposure:** Working in hot environments- furnace tops, steel mills etc. Reflective shields and protective clothing and goggles can help control this hazard.
- **Vibration** : Vibration from heavy equipment, compressor house, mining, cement mixers, construction equipment etc poses hazard to operators. Shock absorbers and suspension systems in vehicles, operational modifications etc help to reduce vibration.

# Hazardous chemicals

- Hazardous chemical compounds include gases, liquids, solids, dust, mists, vapors and fumes.
- They have harmful effects when employees ingest, inhale or absorb them through their skin.
- To help control chemical hazards, facilities that use them should maintain a material safety data sheet (MSDS) for each chemical.

# Chemical exposure

- Chemical hazards can take many forms, from liquid to fumes to dusts, and can be absorbed, inhaled, or ingested into a worker's system.
- Some chemicals are potentially hazardous - cleaning products, gasoline, metallic compounds and pesticides.
- Many chemicals can be harmless in small doses, but some common chemicals can cause symptoms- acute or chronic- in those who are particularly sensitive.
- Most chemicals can cause adverse effects- irritation, burns, breathlessness, fatigue, loss of coordination, loss of sleep, mental distortion- in large doses or when proper safety precautions are not taken.
- These precautions include ventilation, personal hygiene such as hand washing, which can reduce the amount of chemicals absorbed by the skin, and maintaining equipment in order to prevent leaks and breakdowns.

# Biological hazards

- Living organisms such as fungi, viruses, and bacteria, can enter the body and cause both acute and chronic infections.
- Workers who deal with plants or animals and laboratory or medical workers are particularly at risk for biological hazards, but all workers can be at risk for hazards such as mold, and bacteria that cause Legionnaire's disease.
- Proper hygiene such as hand washing, ventilation, personal protective equipment such as gloves or respirators, and in certain cases, isolation of the hazard, can all help minimize the risks associated with biological hazards.

# Environmental

- **Dust:** Dust is the tiny solid particles that form through activities such as abrading, blasting, crushing, drilling and grinding.
- **Fumes:** Fumes form when a solid becomes volatilized â€" as by burning â€“ and then the volatilized particles condense in the air. Most of the time, these solid particles react with the air to form oxides.
- **Mists:** Finely separated liquids that hang suspended in the atmosphere. They form atomizing, foaming or splashing which disperse a liquid into fine particles or when substances condense from a vapor back into a liquid suspension.
- **Gases:** Poisonous gases like carbon monoxide from improper burning in internal combustion engines and welding gases acetylene, nitrogen, helium and argon.
- **Vapors:** Vapors form when substances that exist in solid or liquid states under normal temperature and pressure conditions they evaporate. Cleaning substances, paints and solvents are particularly susceptible to vaporizing, especially when under pressure or at high heats.
- **Aerosols:** Particulate contaminants of tiny liquid particles. Aerosols are a specific, exceptionally respirable kind of mist.
- **Fibers:** Fibers are long thin, solid particles. Cg: in cotton processing. They are several times bigger in length than in diameter.

# Ergonomic

- Ergonomic hazards are associated with poor posture and task-performing techniques in the workplace.
- Holding lifting, pushing, reaching and even walking can all pose ergonomic hazards because their motions stress the body, especially when performed incorrectly.
- Activities such as working on high-speed assembly lines, performing repetitive motions and being subjected to vibrations or shocks can pose ergonomic risks. Even activities like focusing on a computer screen or some other fixed space can lead to eyestrain.
- Facilities can design their job site with ergonomic best practices in mind. Office workstations should contain ergonomically correct, adjustable chairs and keyboards. Workstations in more active environments should minimize excessive strain.
- Facilities can also provide their employees with equipment to ease the physical strain of their duties. These might include hand carts or mechanical lifters and loaders that absorb much of the burden of material handling.

# Noise

- Long-term exposure to noise can lead to hearing loss for workers. Noise levels in the workplace become hazardous when employees are exposed to significant decibel levels over an extended time.
- Noise issues can be addressed in several ways, including designing a facility to minimize noise, separating workers from noisy machinery as much as possible, and using devices, such as ear muffs or ear plugs, to protect workers.
- Facilities can reduce noise hazards by installing silencers, mufflers or baffles to reduce noise levels. They can also try enclosing noisy machinery, or they can custom-engineer their machinery for quiet operation.

# Radiation

- There are two types of radiation – non-ionizing radiation and ionizing radiation.
- Ultraviolet (UV) radiation and laser radiation are the types of non-ionizing radiation most dangerous , cause burns for workers
- UV radiation is a particular problem for outside workers, such working in the hot sun
- Ionizing radiation damages cells, and possible long term effects include cancer and sterility.
- Radiation hazards exist in workplaces that contain equipment like X-ray machines and lasers, as well as in the nuclear, defense, aviation and oil and gas industries.
- Exposure to ionizing radiation should be limited as much as possible, and workers should be shielded from radiation by materials such as lead or concrete.

# Occupational illnesses

- **Skin diseases or disorders.** Caused by exposure to chemicals, plants or other substances. This includes contact dermatitis, eczema, rashes, blisters or chrome ulcers. ( Eloor Study)
- **Respiratory conditions.** These can occur when workers are exposed to chemicals, dust, gases, vapors or fumes. Examples of such illnesses are rhinitis, tuberculosis, chronic obstructive bronchitis, asbestosis or pneumonitis. (Eloor Study)
- **Poisoning.** Abnormal concentrations of toxic substances are ingested or absorbed and then found in blood, tissues or bodily fluids. Poisoning may be caused by gases such as carbon monoxide or hydrogen sulfide; metals such as mercury, lead or arsenic; solvents such as benzene; insecticide sprays such as parathion or by other chemicals such as formaldehyde.
- **Hearing loss.** Loud noise levels that happen only once or on a continual basis that lead to a change in hearing threshold.
- **Other occupational illnesses.** These include anthrax, bloodborne pathogenic diseases such hepatitis B or hepatitis C, or malignant or benign tumors.

# C&H concerns: Factory environment

- Factory pollutants- solid waste, effluents,  emissions, sound, pathogens, spills, radioactive waste, e-waste etc
- Office waste- stationeries, ink, plastics,
- Stores waste- packaging, spent items, expired items
- Sanitary waste- offices, canteen
- Rainwater disposal without contamination
- Carbon & Energy intensity- processing
- Spent oil- transformers, lubricants
- Hazardous  waste- classified
- Contagious diseases- pathogens

# Industrial Hygiene- AIHA

- The science and art devoted to the anticipation, recognition, evaluation, and control of environmental factors or stresses arising in or from the workplace which may cause sickness, impaired health and well-being, or significant discomfort and inefficiency among workers or among citizens in the community.

  *American Industrial Hygiene Association*

# C&H indicators

- Personal hygiene
- Health check up- regular
- Precaution against contagious diseases
- Sterilizing work area - routine
- Process leaks- accidental releases, spills
- Spitting- bad habits
- Littering and careless handling
- Spilling while  handling

# Needed: safe & hygienic workplace

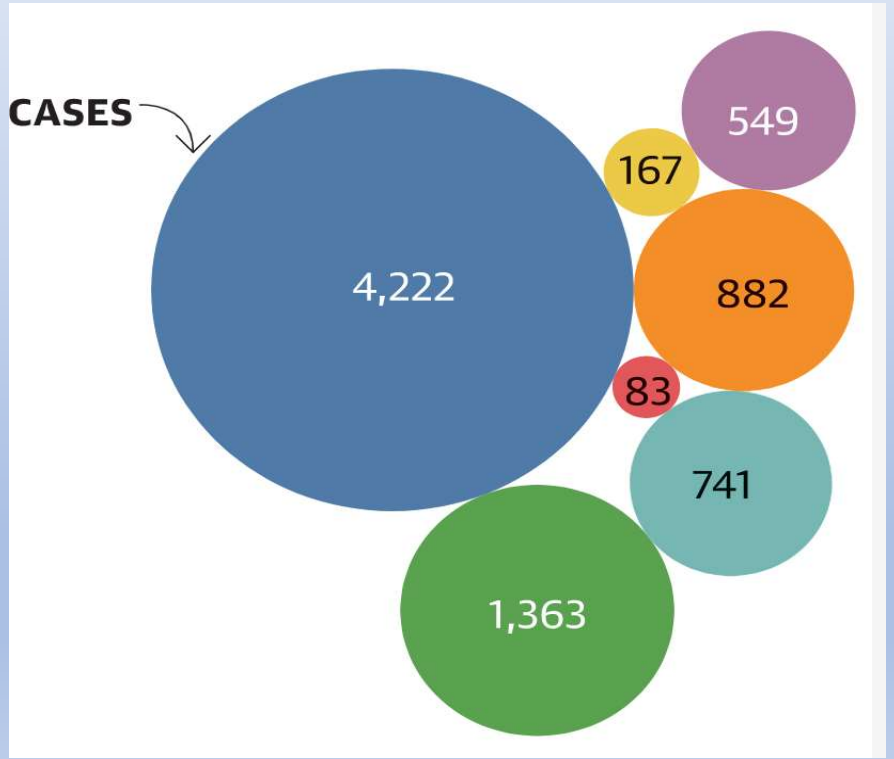
- Workplace priority: Keep  employees safe and healthy.
- But in practice, this is not so an easy task
- In the US in 2018, 5,250 workers died from workplace-related injuries in 2018, and 2.8 million nonfatal workplace injuries and illnesses occurred in the private sector alone.

  *U.S. Bureau of Labor Statistics (BLS), 2018*
- Proper industrial hygiene in the workplace can help a lot
- A robust industrial hygiene and chemical safety program helps reduce hazard levels in the workplace, and it gives employees the tools and protection they need to stay safe when they encounter hazards

# Industrial accidents-India

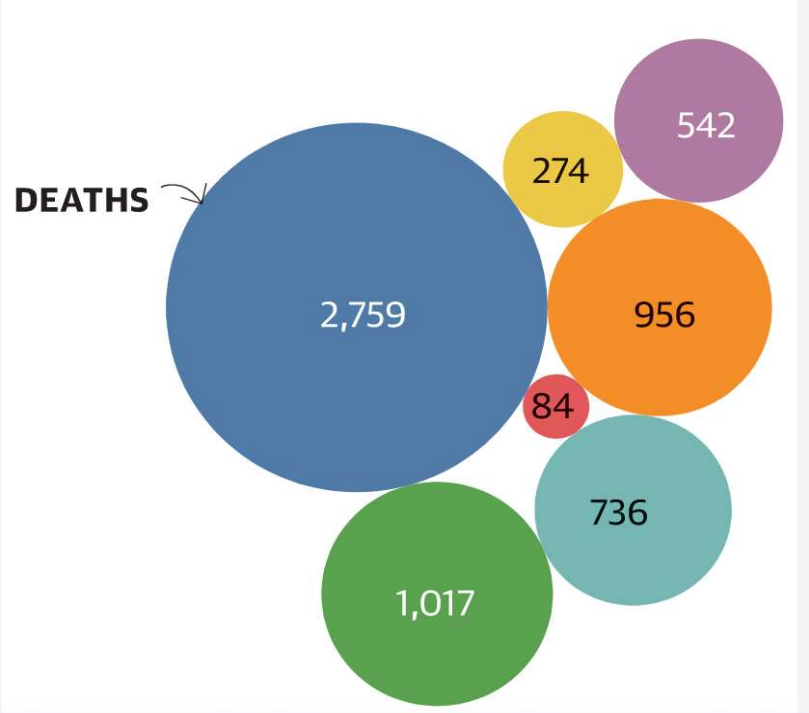
- Pandemic Covid 19 increased the accident situations
- Since May 2020, there have been 30 industrial accidents in India, killing at least 75 workers says *IndustriALL*, a global union of workers.
- 6368 employees dies in 8004 accidents during 2014 to 2017.
- Delhi (1,529), Maharashtra (1,239) and Rajasthan (946) recorded most such industrial accidents during the period.
- Rajasthan (948), Gujarat (629) and Maharashtra (557) witnessed the highest number of deaths

# Cases (2014-’17)




- While operating machinery
- General industrial accidents
- Fire in cracker/matchbox-manufacturing
- Fire in mines
- Industrial boiler/cylinder explosions
- Mining disasters
- Fire in other types of factories

# Casualties (2014-’17)

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# What to do?

- Control hazardous workplace conditions to prevent employees from becoming sick or injured.
- Recognize, evaluate and adjust workplace situations to keep off hazards so that employees are safe and healthy.
- It require monitoring and analysis of workplaces to know the levels of industrial hygiene and hazards exposure.
- Engineered solutions and safe workplace practices are needed

# Concerns of Industrial hygiene

- **Nonfatal illness:** Skin, lung and gastrointestinal diseases , blood-borne illnesses typical of plants and laborotaries
- **Respiratory illness:** chronic bronchitis, asbestosis and pneumonitis are common occupational hazards, especially in industries like mining where inhaling dust is common. Industrial hygiene mandate the use of personal protective equipment (PPE) which provides respiratory protection.
- **Skin diseases:** Skin diseases like dermatitis, eczema, rashes and blisters are common in industries where workers' skin comes into contact with hazardous chemicals. PPEs offer a good order of protection.

# Concerns of Industrial hygiene

- **Poisoning:** Poisoning arise out of ingestion of  toxic chemicals like pesticides, herbicides, formaldehyde or cleaning agents. Workers might also absorb those chemicals through their skin. Industrial hygiene mandate specific guidelines for storage and handling of poisonous materials.
- **Hearing loss:** Hearing loss can occur when employees are exposed to high-decibel sounds in the factory environment Industrial hygiene mandate use of  PPE, measuring hazards with sound level meters and offering guidelines about noise exposure in the workplace.
- **Repetitive stress injuries:** Repetitive stress injuries occur when employees perform the same motions many times throughout the workday. Industrial hygiene offer guidelines about correct posture and lifting techniques and provide for breaks during tough and repetitive tasks.

# Impact of unhygienic workplace

- **Absenteeism:** leading to loss of man-days
- **Loss of productivity:** sickness lower productivity and on return may be slower and less productive because they still don't feel their best.
- **Poor morale:** High numbers of injuries and illnesses in the workplace tend to put a damper on employee morale. A low employee morale can lead to further diminished productivity, as well as distraction. Edness.
- **Loss of revenue and profits:** Sick leave wages, cost replacement workers depress revenue earned and profits

# Chemical plant: Hygiene plan

- Chemical plants are to have hygiene plans.
- A written document that outline the probable disruptive factors of C & H such as likely hazards in plant and laboratory
- Explain the processes, protocols, tools, and equipment that are available to help workers guard against those hazards
- The purpose is to minimize chemical exposure in plants and laboratories and promote worker safety.

# Controls for industrial hygiene hazards

1. **Elimination**

   Stop using a chemical or eliminate the use of radiation in its operations.

2. **Substitution**

   Replace the hazard with a safer alternative. For example, a workplace might switch from toxic chemicals to non-toxic ones to protect its employees.

3. **Engineering Controls**

   Isolating employees from the hazard through structural or design changes. Install a protective shield Creating confined workspaces and installing robust ventilation systems

4. **Administrative Controls**

   Rotate employee assignments or implement training procedures to give employees the tools and knowledge they need to protect themselves.

5. **Personal Protective Equipment**

   Strictly enforcing use of PPE like gloves, masks, face shields, coveralls, steel-toed boots, flame-resistant clothing, harnesses and respirators depending on the specific work environment.

# Strictly enforce SOPs

- Each chemical has a unique set of hazards which may contribute to a C & H disruption and needs to be handled properly to ensure worker safety.
- Plants and laboratories that handle a variety of chemicals, establish separate protocols for each chemical and it often complicates and increases the likelihood of mishandling and exposure.
- A standard operating procedure (SOP) for use of correct personal protective equipment, safe handling, safe use, and proper disposal can cover all chemicals
- Flip charts, signs, or other literature can then be used to remind workers of specific chemical hazards.

# Work place air quality

- **Air Flow**
  Air quality is a major problem in plants and laboratories.
- The plant environment shall be well ventilated
- Well ventilated means the system should be capable of at least 8 to 10 air changeouts per hour when the space is occupied.
- Besides, the general exhaust system for the laboratory, exhaust hoods are another tool to increase safety.
- The US National Research Council's *Prudent Practices for Handling Hazardous Chemicals in Laboratories* recommends "2.5 linear feet of hood space per person should be provided for every 2 workers if they spend most of their time working with chemicals. Each hood should have a continuous monitoring device to allow convenient confirmation of adequate hood performance before use."

# Housekeeping

- Exposure to chemicals –skin contact, inhalation, ingestion
- Keeping floors clean and dry will help prevent slip and fall injuries -- the third-leading cause of worker injury and lost work time.
- Absorbent pads, irrigators and wipers shall be kept near spill-prone locations so that employees can clean up spills quickly and avoid fall incidents
- Cleaning work surfaces throughout the day either manual or automated keeps work spaces uncluttered, decreasing the likelihood of spills etc.
- Avoid storing excess chemicals on countertops so that workers will have adequate space to perform their duties
- Waste disposal procedures should also be established, with wastes being removed to a central storage area on a regular basis.
- Workers should be taught not to pour liquids down drains or use hoods to get rid of volatile chemicals.

# Stores  safety

- Store room is a regular  accident hot spot
- A well-organized store room promotes safety and is more efficient.
- One person shall be responsible to facilitate proper organization and storage within the area.
- He shall ensure that proper inventory levels are kept, and expired chemicals are disposed of properly.
- Even when storage space is at a premium, segregating incompatible chemicals in storerooms and providing containment for shelves are both important factors for worker safety.
- Before a chemical enters a lab, have a plan for properly handling, storing, and disposing of it.
- Spill response plans should address spill prevention strategies, containment procedures, proper ventilation, when to evacuate, how to obtain medical care, and reporting requirements.

# Training

- Having a chemical hygiene plan and making sure that workers understand the plan and how it helps them to avoid exposure to hazardous chemicals.
- Impart induction training on C&H for all workers prior to their assignment in a laboratory.
- Regular health monitoring of employees
- Training should be a regular activity that addresses the many different aspects of avoiding exposure.

# To sum up: tips for clean & hygienic plant operations

Educate workforce on the importance, need, advantages of C& H in the work environment

Policy and adherence to strict use of PPEs while at work

Ward of infection by using protective gear, sterilizing agents, safe distancing

Adopt Right work practices specific to the environment

Conduct regular Plant safety audit- mock drills, have working emergency plans

Beware of hidden hazards: Have a plan for Abnormal situation management

Guard against Accidental toxic material release

Signs and container labels reinforce safety and serve as a constant reminder of specific handling, use, and disposal procedures.

Properly maintain eyewash stations, drench showers, fire extinguishers, and first aid kits

Regular training - focus on existing and new comer employees

Periodic health check of employees

Develop a C&H culture specific to the organization

# Thank You

Centre for Green Technology & Management
Cochin, India
+91 9447154540
www.drmpsukumarannair.com