

# EVALUATING YOUR COMPANY'S INDUSTRIAL HYGIENE PROGRAM



# PURPOSE

During this critical issues presentation, we will review some basic assessment and management elements required by OSHA for a successful industrial hygiene program.

# REFERENCES

- National Safety Council, Fundamentals of Industrial Hygiene: Seventh Edition 2020
- OSHA 29 CFR 1910 General Industry
- OSHA 29 CFR 1926 Construction
- NIOSH Pocket Guide to Chemical Hazards
- Department of Transportation: Emergency Response Guide (ERG)

# DEFINITION

- “Industrial Hygiene” is the **relationship between the worker and the environment** where the worker performs work in.
- Protection of the work environment predominantly falls to OSHA.
- Protection of the environment external to the worker even if created by the worker falls to other agencies such as the EPA, DOT, NRA, etc.

# ENVIRONMENTAL WORKER HAZARDS

- Industrial Hygiene (IH) covers those factors or stressors that can cause sickness, impaired health, or significant discomfort in workers.
- These factors are divided into four hazard categories; **chemical, physical, ergonomics, and biological.**
- IH looks at these hazards' health impacts on the human body.
- OSHA covers both safety and health impacts.
- OSHA's standards in many instances address a macro industry or field but incorporate an IH component.

# Environmental Worker Hazards

- **CHEMICAL:** Arise from airborne concentrations of mists, vapors, fumes, gases, or solids.
- Takes the four routes of body entry:
  - Inhalation
  - Skin or ocular absorption
  - Ingestion
  - Injection



NOTE: Chemicals are looking to stabilize: think liquids evaporating to mists or vapors and then separating to gases. Solids come from mechanical actions: silica or welding fumes.



# Environmental Worker Hazards

- **PHYSICAL HAZARDS:** These are environmental hazards that target the worker by impact.
  - Noise
  - Ionizing Radiation
  - Nonionizing radiation
  - Vibration
  - Extreme Temperatures
  - Pressure variances



# Environmental Worker Hazards

- **ERGONOMIC HAZARDS:** These hazards focus on elimination of biomechanical hazards of repetition. Covers the following:
  - Physical Ergonomics: human anatomical, physiological, biomechanical: repetitive motion issues, workstation set up, etc
  - Cognitive Ergonomics: mental process such as perception, memory, reasoning. Covers decision making mental workload, decision making, work stress.
  - Organizational Ergonomics: Optimizing the structure, policies, and processes. Covers work design, teamwork, quality management, etc
- **BRAIN HURT:** Employee training and sequencing production process (time-in-motion) fall under ergonomics. Micro and macro motion studies were developed in the early 1900's.





# Environmental Worker Hazards

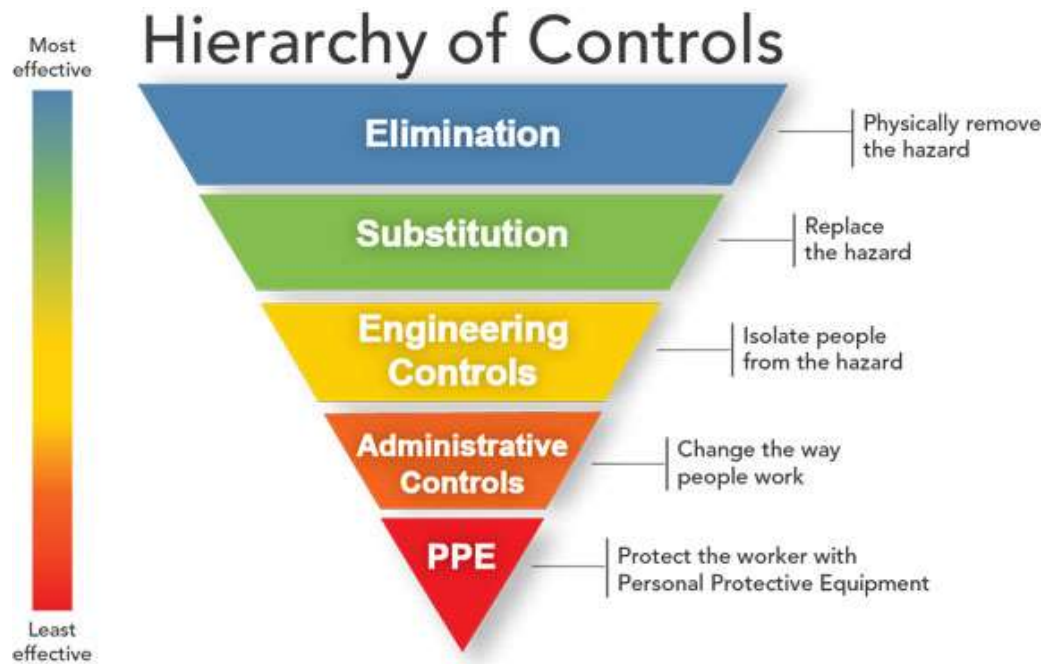
- **BIOLOGICAL HAZARDS:** Any organism, infectious particles that can cause an adverse response in humans. Some coverage areas:
  - Bloodborne pathogens
  - Tuberculosis
  - Legionnaires
  - SARs
  - Ebola
  - Building related bio-aerosols
  - Certain toxins created by molds or dust



# METHODS OF CONTROL

- Two step process.
  - Identify the hazard
  - Control the hazard
- The second step always fails if step one is not accurate.
- OSHA cites the hazard because the control failed:
  - On or about October 15, 2019 for the employees exposed to (111 Trichloroethylene) while manually cleaning parts with rags on conveyor line two where inadequate respiratory protection was provided at 1234 Safety Drive, Bismarck ND 58501.

# METHODS OF CONTROL



# METHODS OF CONTROL

- The National Safety Council in the 1950s started to define the concept of a Hierarchy of Controls.
- OSHA identifies only three types of controls: Engineering, Administrative, and PPE.
- OSHA includes elimination and substitution under engineering controls.
- NIOSH, ANSI, API identify more than three levels of control.



# METHODS OF CONTROL

- Elimination:
  - Removing the worker from the hazard. Automation.
  - Removing the hazard from the worker. Automation or process flow.
  - Prevention through design.
- Substitution:
  - Replace the hazard with a less hazardous substance.
    - Chemicals
    - Noisy machines



# METHODS OF CONTROL

- Engineering Controls:
  - Ventilation
  - Isolation by barriers or enclosures
- Administrative Controls:
  - Limited exposure work schedules: Time
  - Distance away from source
  - Increased housekeeping



# METHODS OF CONTROL

- Personal Protective Equipment:
  - Least effective.
  - Does not eliminate the hazard.
  - Individualized barrier.
  - Increased probability of failure by number of employees



# THE PPE PROBLEM

- THE LAST LINE OF DEFENSE
- OSHA believes you have made the hazard assessment to determine the routes of entry.
- OSHA believes your determination includes the rate of worker exposure. (baseline PEL for the TWA)
- OSHA believes you are continuously updating your monitoring and evaluation based on work changes and product changes.
- NOTE: OSHA also believes if you have not used PPE your hazard assessment shows which of the other hierarchy of controls you used to prevent the exposure. This is easy to justify and prove.



# OSHA EXPECTATIONS

- The OSHA General Duty Clause, Section 5(a)(1) of the Occupational Safety and Health Act, **requires that each employer furnish to each of its employees a workplace that is free from recognized hazards that are causing or likely to cause death or serious physical harm.**
- Remember this is the standard before OSHA writes a standard for its expectations.
- NOTE: Lets review OSHA Expectations by Environmental Hazard and then discuss how we get there.

# CHEMICAL HAZARDS

## Inhalation

- Inhalation: 29 CFR 1910. Toxic and Hazardous Substances: Air contaminants.
  - Before it even identifies paragraph (a) it states, “An employee’s exposure to any substance listed in Tables Z-1, Z-2 or Z-3 of this section shall be limited in accordance with the requirements of the following paragraphs of this section”.
  - There is an implied task to sample for the chemicals listed in these tables if you use them

# CHEMICAL HAZARDS

## Inhalation Z-1

Substance	CAS No. (c)	ppm (a) <sup>1</sup>	mg/m <sup>3</sup> (b) <sup>1</sup>	Skin designation
Acetaldehyde	75-07-0	200	360	
Acetic acid	64-19-7	10	25	
Acetic anhydride	108-24-7	5	20	
Acetone	67-64-1	1000	2400	
Acetonitrile	75-05-8	40	70	
2-Acetylaminofluorine; see 1910.1014	53-96-3			
Acetylene dichloride; see 1,2-Dichloroethylene.				
Acetylene tetrabromide	79-27-6	1	14	
Acrolein	107-02-8	0.1	0.25	
Acrylamide	79-06-1		0.3	X
Acrylonitrile; see 1910.1045	107-13-1			
Aldrin	309-00-2		0.25	X
Allyl alcohol	107-18-6	2	5	X



# CHEMICAL HAZARDS

## Inhalation

- 1910.1200(h)(1) Employers shall provide employees with effective information and training on hazardous chemicals in their work area at the time of their initial assignment, and whenever a new physical or **health hazard** the employees have not previously been trained about is introduced into their work area. Information and training may be designed to cover categories of hazards (**e.g., flammability, carcinogenicity**) or specific chemicals.
- *Training:* 1910.1200(h)(3)(i) Methods and observations that may be used to detect the presence or release of a hazardous chemicals in the work area (such as monitoring conducted by the employer, continuous monitoring devices, visual appearance or odor of hazardous chemicals when being released, etc.)
- 1910.1200 requires proving or disproving the existence of a chemical health hazard.



# CHEMICAL HAZARDS

## Inhalation

- 29 CFR 1910.134(d)(1)(iii) The employer shall identify and evaluate the respiratory hazard(s) in the workplace; this evaluation shall include a reasonable estimate of **employee exposures to respiratory hazard(s) and an identification of the contaminant's chemical state and physical form**. Where the employer cannot identify or reasonably estimate the employee exposure, the employer shall consider the atmosphere to be IDLH.

NOTE: If you have employees in respirators, you better have base line testing and a continuous monitoring program.

# CHEMICAL HAZARDS

## Skin Absorption

- The skin designation which appears with some of the chemical hazards in 29 CFR 1910.1000 Table Z-1 is **only given to a substance, which may be absorbed through the skin**. The use of skin designation may or may not indicate that the substance may irritate the skin.
- 29 CFR 1910.1200 (h)(3)(iii) The measures employees can take to protect themselves from these hazards, including specific procedures the employer has implemented to protect employees from exposure to hazardous chemicals, such as appropriate work practices, emergency procedures, and personal protective equipment to be used:
- \*\*\*Absorption can include eyes and radiation.

# CHEMICAL HAZARDS

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# CHEMICAL HAZARDS

## Skin Absorption

- 29 CFR 1910.132(d)(1) The employer shall assess the workplace to determine if hazards are present, or are likely to be present, which necessitate the use of personal protective equipment (PPE).
- 29 CFR 1910.138(a) General requirements. Employers shall select and require employees to use appropriate hand protection when employees' hands are exposed to hazards such as those from **skin absorption** of harmful substances; severe cuts or lacerations; severe abrasions; punctures; chemical burns; thermal burns; and harmful temperature extremes.
- NOTE: 1910.132 requires an assessment to protect against skin absorption in 1910.138 or as identified in Table Z-1 or on the SDS.



# CHEMICAL HAZARDS

## Ingestion

- 29 CFR 1910.141(g)(2) Eating and drinking areas. No employee shall be allowed to consume food or beverages in a toilet room nor in any area exposed to a **toxic material**.
- 29 CFR 1910.141(g)(4) Sanitary storage. No food or beverages shall be stored in toilet rooms or in an area exposed to a toxic material.
- 1910.141 covers changing rooms, food handling, and washing facilities.
- Multiple specialty standards such as 1910.1029 Cadmium, 1910.1026 Chrome (VI), 1910.1025 Lead and others discuss ingestion protection measures under “Hygiene Areas and Practices”

# CHEMICAL HAZARDS

## Injection

- Physical injection hazards indicate a failure of another system that cut your skin for the chemical to be injected
- 29 CFR 1910.242(b) requires that **compressed air used for cleaning purposes must be reduced to less than 30 psig (pounds per square inch gauge, 204 kPa)**. This can puncture the skin and create air bubbles in the blood stream
- Compressed gasses and solvents under pressure are the most common injection hazards.
- The assessment requirement under 29 CFR 1910.132 is applicable to injection hazards.

# PHYSICAL HAZARDS

## Ionizing Radiation 29 CFR 1910.1096

- Alpha, Beta, Gamma
- OSHA requires employers to protect workers from exposure to ionizing radiation sources that are not regulated by the NRC or other federal agencies, such as [X-ray equipment](#), some [accelerators](#), incidental accelerator-produced radioactive materials, ion implanters, and some [naturally-occurring radioactive material \(NORM\)](#)
- (Example) 1910.1096(b)(2)(iii) The employer maintains adequate past and current exposure records which show that the addition of such a dose will not cause the individual to exceed the amount authorized in this subparagraph.
- This standard requires constant monitoring of air and biological sampling.

# PHYSICAL HAZARDS

## Nonionizing Radiation 29 CFR 1910.97

- Non-ionizing radiation is a series of energy waves composed of oscillating electric and magnetic fields traveling at the speed of light. Non-ionizing radiation includes ultraviolet (UV), visible light, infrared (IR), microwave (MW), radio frequency (RF), and extremely low frequency (ELF). Lasers commonly operate in the UV, visible, and IR frequencies.
- The standard requires an assessment under 1910.97(a)(2) using the formulas under the Radiation Protection Guide.

# PHYSICAL HAZARDS

## Extreme Temperatures

- Currently OSHA has no specific standards related to heat and cold work stress.
- When cited it is under 5(a)(1) General Duty Clause
- Multiple citations have been issued for these environments. Case law.
- Charts from NIOSH, CDC, and on the OSHA web page show how to conduct the assessment.
- Wet Bulb and Dry Bulb
- A standard has been submitted for review.

# PHYSICAL HAZARDS

## Vibration and Pressure

- Vibration and Pressure
  - Covered in 5a(1)
  - Some exceptions:
    - Vibration associated with ergonomics.
    - Pressure: 1910.401 Commercial Diving Operations
    - Blasting standard
    - Noise pressure
    - Compressed Gas pressure



# ERGONOMIC HAZARDS

- OSHA does not have a standard in Federal States. California and Washington do have an ergo standard.
- OSHA will use 5(a)(1) General Duty for ergonomic hazards.
- Ergonomics injuries are directly related to lost productivity.



# BIOLOGICAL HAZARDS

- Bloodborne pathogens means pathogenic microorganisms that are present in human blood and can cause disease in humans. **These pathogens include, but are not limited to**, hepatitis B (HBV), hepatitis C (HCV) and human immunodeficiency virus (HIV).
- Ebola, SARS, Rabies, etc. - Regardless of route of entry into the body if blood or other body fluids can transmit it to another human it fits here. Bio waste to decontamination clean up.
- Bloodborne Pathogens-1910.1030 requires exposure determination under (c)(2). Requires exposure control plan which covers all levels of the hierarchy of controls.
- 29 CFR 1904.11 TB Must record it and refer it to Public Health Department



# BASIC MANAGEMENT ELEMENTS

- Adequate Hazard Assessment:
  - Chemical
  - Physical
  - Ergonomics
  - Biological
- Exposure
  - Prove or disprove exposure
  - Routes of entry
  - Verify exposure: acute or chronic



# BASIC MANAGEMENT ELEMENTS

- Hierarchy of Controls
  - What's the fix: PPE to substitution
  - Did the fix eliminate the exposure-prove it-testing
- Training
  - Employees know the hazard/exposure.
  - Employees know the means of protection: focus on why and how.
  - Feed back loop-process or machine changes



# BASIC MANAGEMENT ELEMENTS

- Re-evaluation
  - Consistent-scheduled
  - Re-performing testing
  - Re-evaluating training changes from testing
- NOTE: A good IH program will have years of air testing data and noise testing data to prove the company controls are working

# COMMON FAILURES

- Chemical Testing
  - Facility ventilation not mapped or determined
  - Air sampling just on one or two employees
  - No supporting area samples
  - No samples for worst and best scenario days-summer versus winter
- Noise
  - Noise sampling on just one or two people
  - No area sampling
  - No machine specific sampling



# COMMON FAILURES

- Ergonomics
  - Matching 300 logs to ergo hazard locations
  - Not realizing that repetitive job equals automation opportunity
  - Correlation between slowest productivity areas and increased ergo hazards.



# QUESTIONS?

- This has been a basic presentation on assessment and management elements required by OSHA for a successful industrial hygiene program.
- Feel free to ask NDSC how we can help you with this process.

**Thank You!**

