



Learning Objectives

- Briefly explain the relevance and importance of the practice of industrial hygiene in society today and throughout history.
- Explain the types of sciences and studies that comprise the field of industrial hygiene.
- Describe the differences between **pathways** of exposure and **routes** of exposure to hazardous agents.
- List general types of workplace hazards.
- Identify the basic health effects of hazardous exposures in the workplace.
- Describe the concept of risk and the fundamental principles that it is based upon.
- Discuss the basic tenets of industrial hygiene hazard assessment and control.
- Recognize the types of careers and industries available for professional industrial hygienists.

 Briefly describe the various government agencies and professional organizations with roles in industrial hygiene.

What is an Industrial Hygienist?



Industrial



Hygienist



Industrial Hygienist?



Dick VanDyke as "Bert" in *Mary Poppins*, 1964



What does hygienic mean?



Industrial Hygiene and Industrial Disease

1775 Percival Pott described occupational cancer among English chimney sweeps, identifying soot and the lack of hygiene measures as a cause of scrotal cancer. The result was the Chimney-Sweeps Act of 1788.



FIG. 1. Percival Pott. An engraving published in 1780 from a portrait by Sir Joshua Reynolds.



Chimney Sweeps Were Boys



>240 Years Later

Cancer is the number one killer of firefighters in the US

Most commonly:

- multiple myeloma
- non-Hodgkin lymphoma
- prostate or testicular cancer

Daniel, R., Travis, L., Kubale, James, H. Yin, Matthew M. Dahm, Thomas R. Hales, Daley Burns, Sheila H. Zahm, James J. Beusmans, Kathleen M. Waters, and Lynne E. Plukerton. 2013. "Mortality and Cancer Incidence in a Pooled Cohort of US Firefighters from San Francisco, Chicago and Philadelphia (1950-2009)." *Occupational and Environmental Medicine*, 71(6):388-397.



What is Industrial Hygiene?

The Profession (AIHA)

Industrial hygienists anticipate health and safety concerns and design solutions to prevent them. They are the guardians of workplace safety, applying science to identify and solve health and safety problems. Industrial hygienists also unite management, workers and all segments of a company behind the common goal of health and safety.



What is Industrial Hygiene?

The Practice (AIHA)

The anticipation, recognition, evaluation, and control of environmental factors arising in or from the workplace that may result in injury, illness, impairment, or affect the well-being of workers and members of the community



Simply Put

The mission of industrial hygiene is to prevent occupational disease.



Anticipate

The dose makes the poison.

Paracelsus, *Dritte Defensio* (Strait Defense), 1538 a.d.

The father of toxicology



Philippus Aureolus Theophrastus Bombastus von Hohenheim

What is your occupation?

Bernardino Ramazzini, *De Morbis Artificum Diatriba* (Discourse on the Diseases of Workers) 1700 a.d.

The father of occupational medicine

>315 years ago

Tobacco,

Standing/

Sitting workers



Pictures from Creative Commons public domain

Recognize

Industrial Processes

Gases

Aerosols (mists, vapors, fumes, dusts)

Energy (sound, ionizing radiation, non-ionizing radiation, heat)

Force (lifting, pushing/pulling, static postures, repetition)

What workers are saying

Rashes, hives, dermatitis

Malaise, disorientation, fatigue

Respiratory distress

Burns, blisters, fever, chills

Soreness, soft tissue injuries

Epidemiological approach

Trends

Similar jobs, similar problems?



Evaluate

Environmental monitoring

Chemical and Physical agents
Observations and sampling

Occupational Exposure Limits

OSHA PELs
ACGIH TLVs

Biological Monitoring

ACGIH BEIs (heavy metals, ketones)
OSHA (hearing, eye exams)
NRC/FDA/OSHA (radiation monitors)

Results drive monitoring

Results drive controls



Control

Hierarchy of Control

Elimination (Ethics of outsourcing?)
Substitution
Engineering controls (Dilution, ventilation)
Administration (job rotation)
Protection (PPE)
Toleration

Last line of defense

Respirator fit test
Spirometry/PFT
Audiograms
Radiation Badges
Laser eye exams
Post-offer, pre-employment exams
Functional capacity exams

Watch for symptoms



Industrial Hygiene Today

Chemistry	Epidemiology
Physics	Engineering
Physiology	Psychology/organizational behavior
Anatomy	Social science
Toxicology	Ergonomics
Mathematics	Risk assessment
Biology	Management
Statistics	Ethics



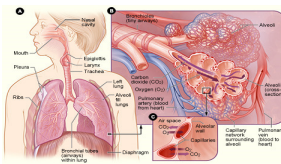
Pathways of Exposure

Air
Water
Food
Animals
People
Surfaces



Significant Routes of Exposure

Inhalation
Skin and eye absorption
Ingestion
Percutaneous
(injection)



Source: National Institutes of Health, <http://www.nhlbi.nih.gov/health/health-topics/topics/cvhs/system>



Chemical Hazards

Flammable
Reactive
Corrosive
Toxic
Explosive
Carcinogenic
Sensitizing



Physical Hazards

- Noise
- Ionizing radiation
- Nonionizing radiation
- Thermal stress (hot/cold)
- Vibration



Musculoskeletal Hazards

- Force
- Duration
- Awkward posture
- Repetitive



Biological Hazards

- Infectious
- Disease causing



Injury versus Disease

Injury = direct physical outcome

Disease = may involve a progression

Injuries have a specific date when the harm occurred

Illness have a date of diagnosis, but we typically don't know the day that hearing loss occurs; it is a process that occurs over time.



Acute Exposure

An exposure that occurs over a short period



Chronic Exposure

A lower level exposure that occurs over a long period

Days, weeks, months, years



Acute Health Effects

Seen shortly after exposure
May be reversible
Hearing loss
Headache
Dizziness
Skin redness



Chronic Health Effects

May take a long time to occur or notice
Cancer
Bone degeneration
Hearing loss
Silicosis
Emphysema



Risk

Probability

a branch of mathematics that measures and describes the relative likelihood or frequency of an event and looks at the distributions of the event's occurrences within a given population.

Severity

The level of hazard associated with a possible exposure



Anticipation

Identifying potential or actual hazards through knowledge of materials, operations, processes, and conditions in the workplace.

Using available information from a variety of sources.



Recognition

The observation and discovery of the hazardous materials and conditions in the workplace.

Using observation and process mapping to understand and document processes and possible exposures to workplace hazards.



Evaluation

Measure exposures and doses, and comparing the measurements to regulatory, professional, and other exposure standards and limits.

Measures could include air monitoring, ergonomic observations, review of accident and injury records, and worker interviews.

Quantitatively evaluate and document levels of exposure.

Prioritize jobs with the most significant hazards.



Control of Hazards

The elimination or reduction of identified and measured hazards.

Use the hierarchy of controls to eliminate or reduce hazards.



Elimination and Substitution

Completely eliminate the hazard from the workplace.

Stop the use of a particular toxic or flammable chemical used in the process or product.

Reduce the quantity of a particular hazardous chemical used.

Change the chemical to a safer or less hazardous one.

Change the work process to cut out the hazardous activity or materials used.



Engineering Controls

Structures, systems, or devices that physically separate, or protect the worker from the hazard.

Barriers, walls, enclosures, covers, guards, shields.

Ventilation systems, fume hoods.

Distance (moving the hazard farther away from the workers).



Administrative Controls

Programs
Policies
Procedures
Labels
Warning signs or lights
Training



Personal Protective Equipment

Respirators
Gloves
Lab coats
Eyewear
Footwear
Lead aprons
Face shields
Ear muffs



Tolerate Residual Risk

Tolerate, not accept!
Continue to reduce other risks
Return to residual risks to make more improvements



Industry Careers

- Manufacturing
- Health care
- Research/education
- Transportation
- Insurance
- Agriculture
- Public utilities
- Construction
- Energy
- Waste management
- Mining



Government Careers

Environmental Protection Agency
Federal Communications Commission
Nuclear Regulatory Commission
National Institutes of Health's Center for Disease Control and Prevention
Public Health Service
Chemical Safety Board
National Institute for Environmental Health Studies
Consumer Product Safety Commission
Department of Energy
Mine Safety and Health Administration
National Transportation Safety Board



Job Paths

Consulting
Laboratory analysis
Management
Exposure assessment and control
Research
Policy and regulation development and analysis
Quality assurance
Ergonomics
Noise assessment and control
Radiation safety



Professional Organizations

American Industrial Hygiene Association
American Society of Safety Engineers
American Conference of Governmental Industrial Hygienists
National Safety Council
Health Physics Society
Human Factors and Ergonomics Society
American National Standards Institute



Have a great day!