Fundamentals of SH&E: Workplace Health 101E

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Workplace Health

Safety – usually associated with acute injuries, short-term, traumatic exposures

Health – usually directed at chronic exposures, persistent, prolonged, repeated
Definition

Industrial Hygiene – “that science and art devoted to the anticipation, recognition, evaluation, and control of those 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 the citizens of the community”
Environmental Stresses

Chemical – environmental concentrations

Physical – noise, heat, ionizing, etc.

Ergonomic – man-machine interface

Biological – micro living organisms
States of Matter

Solids – definite shape and volume
Liquids – definite volume but no definite shape
Gases – neither definite volume nor shape
Chemical Stresses Chart

States of Matter

Solid
- Dust
- Smoke
- Fume
- Aerosol

Liquid
- Aerosol
- Mist
- Vapor

Gas
Chemical Stresses

Dusts – solid particles from handling, grinding, crushing, impact (1-25 microns) (cotton, grain, grinding wheels)

Smoke – carbon or soot particles less than .1 microns in size and are the products of incomplete combustion (fire, gas engines)
Chemical Stresses

Fumes – solid particles generated by condensation from the gaseous state (welding, soldering, brazing)

Aerosols – solid particles or liquid droplets of fine enough size to remain dispersed in air for a prolonged period of time (powder sprays, paint sprays)
Mists – suspended liquid droplets generated by condensation of liquids, or by breaking up a liquid into a dispersed state (mixing vats, maintenance degreasers)

Vapors – volatile form of a substance normally a liquid or solid at STP (paint thinners, nail polish remover)
Terms to Express Concentrations

TLV – threshold limit value - airborne concentration under which it is believed that nearly all workers may be repeatedly exposed day after day without adverse effect (ACGIH)

PEL – permissible exposure limit (OSHA)
Terms to Express Concentrations

TWA – time weighted average – average exposure over a workday

C – ceiling – level not to be exceeded at any time

STEL – short term exposure limit (15 minute exposure not producing harm)
Terms to Express
Concentrations

REL – recommended exposure limit, NIOSH
term to designate agency’s maximum
concentration

BEI – biological exposure index; advisory levels
adopted for some substances by ACGIH based
on blood, urine, or expired air – TLV-TWA for
eight hours
Terms to Express Concentrations

ppm – parts per million

mg/m³ – milligrams per cubic meter
Routes of Entry

Inhalation – breathing, most common

Ingestion – swallowing

Absorption – penetration through the skin

Injection – forcing by mechanical means
Effects of Exposure

Concentration of substance

Probability of substance to produce injury

Rate of generation of material

Control measures
Toxicity

Capacity of a material to produce injury or harm; Depends on dose, rate, method, site of entry, general health of individual, diet, temperature
Toxic Effects

Irritants – inflame surfaces of the body

Systemic poisons – attack organs or system

Depressants – affect the central nervous system
Toxic Effects

Asphyxiants – prevent oxygen from reaching body cells (simple – nitrogen; chemical – carbon monoxide)

Carcinogens – cancer causing (benzene)

Teratogens – affect the fetus (lead)

Mutagens – affect the species (radiation)
Physical Stresses

Noise

Temperature extremes

Ionizing radiation

Non-ionizing radiation
Noise – Unwanted sound

Sound – pressure variation in air or other medium, that humans can detect
Noise

Decibels – pressure related to 20 micronewtons per square meter (20μN/m²)

Frequency – one cycle per second (hertz)

PEL – OSHA enforcement 90 dBA/ 8 hrs

NIOSH – Recommends 85 dBA/ 8 hrs
Temperature Extremes

Climatic conditions

Work demands

Clothing
Ionizing – electromagnetic or particulate radiation capable of producing ions, directly or indirectly, by interaction with matter

Non-ionizing – magnetic fields, radio-frequency/microwave, optical radiation, lasers
Ergonomics

The study of human characteristics for the appropriate design of the living and work environment

Matching the person to the task, as opposed to matching the task to the person
Ergonomic Stresses

Mental workload
Physical workload
Energy cost
Work classification
Work/rest cycles
Biological Stresses

Microorganisms – bacteria, viruses, fungi, and their products

Arthropods – crustaceans, arachnids, insects; bites and stings

Allergens and toxins from higher plants – poison ivy, poison oak
Biological Stresses

Bacteria – single-cell plants living in soil, water, organic matter, plants, or animals

Virus – microscopic agents able to live only in living cells
Biological Stresses

Fungus – parasitic lower plants including molds, mildews, mushrooms

Parasite – organism living in/on another living organism
Biological Stresses

Protein allergens from vertebrate animals; urine, feces, hair, saliva

Current topics - OSHA bloodborne pathogens, sick-building syndrome, weapons of mass destruction
Industrial Hygiene Controls

Substitution
Process change
Isolation
Wet methods
Local exhaust
General ventilation
Industrial Hygiene Controls

PPE
Personal hygiene
Housekeeping
Waste disposal
Special controls
Medical controls
Conclusion

Questions
Comments
Evaluation form
References