

American Society of Safety Engineers
Professional Development Conference June 3-6, 2012



**Fundamentals of SH&E:
Workplace Health 101E**

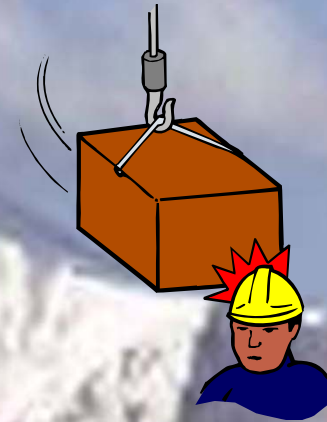
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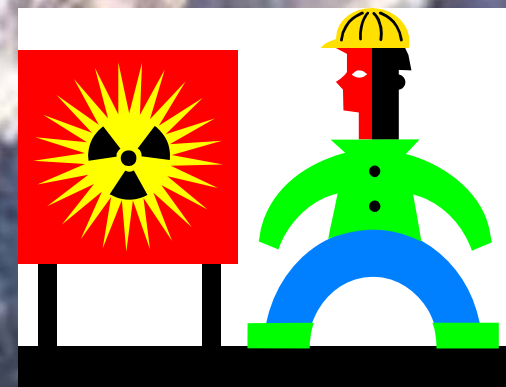


Workplace Health

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

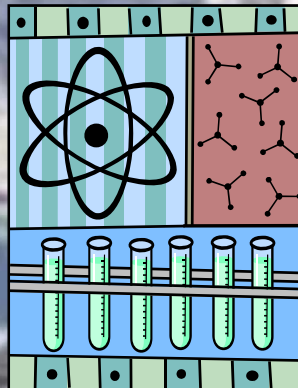


States of Matter

Solids – definite shape and volume

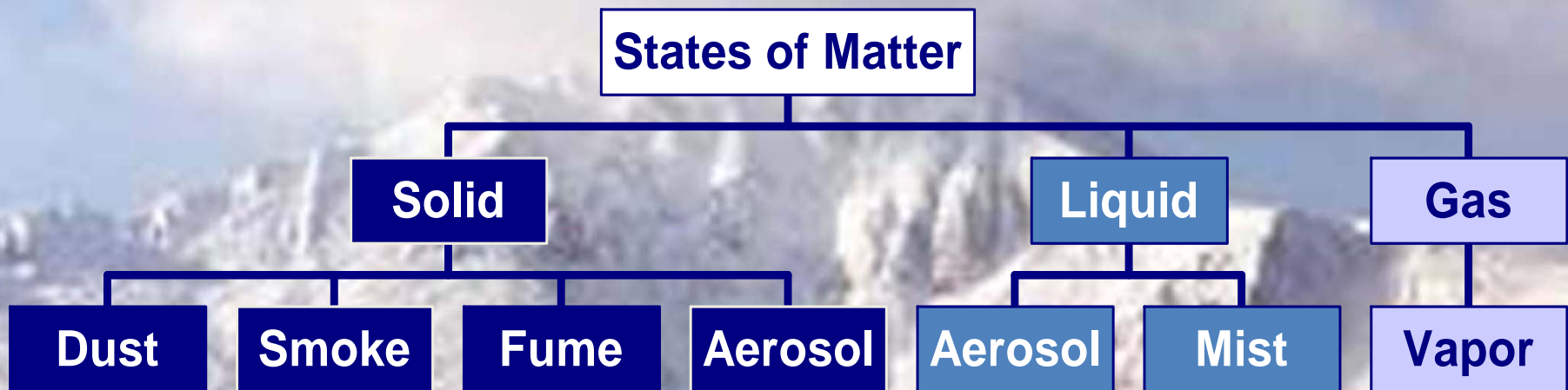
Liquids – definite volume but no definite shape

Gases – neither definite volume nor shape





Chemical Stresses Chart





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)



Chemical Stresses

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/m^3 – 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)

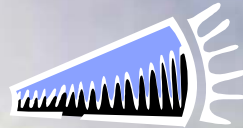
Teratogens – affect the fetus (lead)

Mutagens – affect the species (radiation)

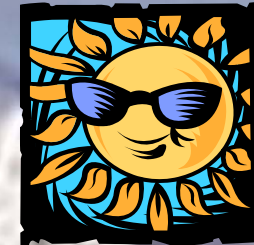


Physical Stresses

Noise



Temperature extremes



Ionizing radiation



Non-ionizing radiation





Noise

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 ($20\mu\text{N}/\text{m}^2$)

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





Radiation

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

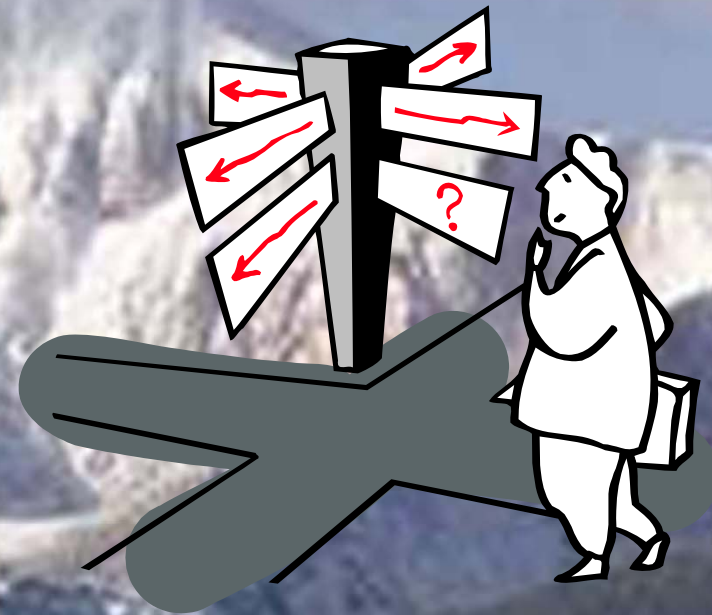
Process change

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

