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Evaluation and Control of Health Hazards in the Work Environment

USF University of South Florida

Industrial Hygiene

Science and art

devoted to the anticipation, recognition, evaluation and control of work place factors

that may cause illness and injury, impaired health and well-being, or significant discomfort.

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Question

What is a fundamental premise in occupational and environmental health?

A. If we do not anticipate or recognize a hazard, we cannot control it.
B. We must control all agents (chemical, physical, biological) that we find.
C. The evaluation step follows the control step.
D. By definition, an occupational health professional can do anything.

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OHS Professionals

Occupational Health and Safety Professionals

- Industrial Hygiene
- Safety
- Occupational Health Nursing
- Occupational Medicine Physicians

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IH Code of Ethics

Follow recognized scientific principles

Counsel affected parties factually

Maintain confidentiality

Avoid conflict of interest

Practice in area of expertise

Uphold the integrity of the profession

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The “Carrot”

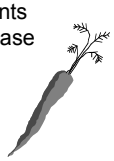
Workers Compensation Laws

Fundamentally, no-fault insurance

Evolved through the 1900s

- Each state has individual approach
- Driver: Public response to accidents
- Evolution: Compensation for disease

Cost Control as Carrot



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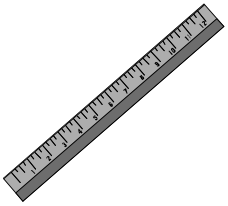
… and the Stick

Occupational Safety and Health Administration (OSHA)

Evolution of span of control

Requirements
- Promulgated
  - Safety
  - Health (eg, lead)
- General Duty



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General Duty

Employer obligation to provide a workplace… "free from recognized hazards likely to cause death or serious physical harm."

Employee obligation to comply with occupational safety and health standards….

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Other Features of OSHA Act

National Institute for Occupational Safety and Health (NIOSH),
CDC, Dept of Health and Human Services
- Research
- Health Hazard Evaluations
- Recommended Standards
- Training

Bureau of Labor Statistics (BLS),
Dept of Labor

State Programs

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Some Health Standards

14 Carcinogens

Coke Oven Emissions

Lead

Noise and Hearing Conservation

Asbestos

Confined Space Entry

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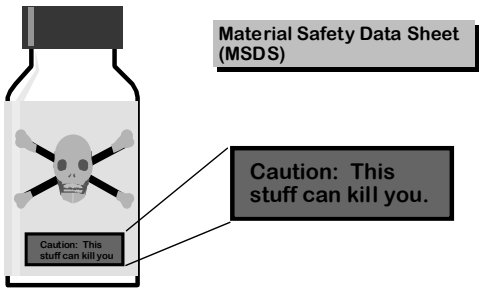
Right to Know



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Violations

Degree
- *de minimis*
- Serious
- Willful
- Egregious

Reason
- Actual situation
- Record keeping

Other
- **Imminent Danger**
- **Criminal**

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Agents

Chemical Agents: Major Industrial Hazards

Physical Agents
- Ergonomics

Biological Agents

Accidents -- Acute Injury from unplanned exposure to a hazard

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Chemical Agents

Health Effects
- Dermal Effects
- Asphixiants
- Irritants (Primary and Secondary)
- Narcotic
- Systemic Poisons
- Sensitizers
- Fibrogenic
- Reproductive
- Mutogenic and Teratogenic
- Carcinogenic

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Physical Agents

Non-Ionizing Radiation
- Electric and Magnetic Fields
- Radiofrequency and Microwave Radiation
- Optical Radiation: IR, Visible, UV

Ionizing Radiation
- Background, Mostly Radon
- Human-Generated

Noise
Thermal Stress
Vibration
Pressure

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Ergonomics

Matching work demands to population and individual capabilities.

Features
- Psychological
- Anatomical
  - Design of Work Space
  - Biomechanics (Forces) -- Work-Related Musculoskeletal Disorders (WRMSDs / MSDs)
- Physiological

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Biological Agents

Microoganisms

Arthropods

Plants

Vertebrates

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Routes of Entry

Inhalation
- Gases
- Particulates: Size is important
  - Solids: dusts and fumes
  - Liquids: mists

Skin Absorption (or barrier failure)

Ingestion

Injection

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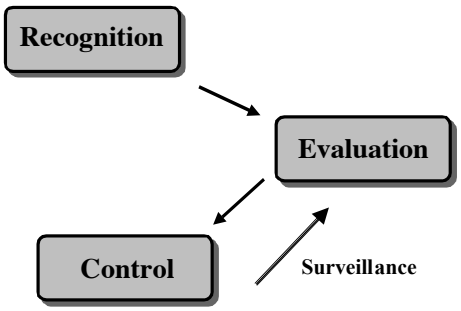
Basic Steps



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Evaluation Topics

Review of Agents and Routes of Entry

Assessment Methods
- Preliminary
- Sampling

Evaluation Criteria
- Standards: Statutory and Good Practice
- Threshold and Action Levels

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Preliminary Assessment

Know the Process
- Steps and Equipment
- Agents associated with each step

Consult Medical Records
- OSHA Logs
- Workers Compensation Cases
- First Aid Records
- Biological Monitoring Results

Walk-through Survey

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Case Study

What agents are present?
- Chemical
  - particulates
  - gases
- Physical and Ergonomic
- Biological

What would you expect from the medical records?

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Decision

Standards of Professional Practice
- Statute: OSHA PELs
- NIOSH Criteria Documents (RELs)
- ACGIH Guidelines (TLVs)
- Industry standards, guidelines, etc.
- Open literature

Generically, Occupational Exposure Limit (OEL)

Exposures: Levels and Patterns
- Average over a day (TWA)
- Peak exposure (STEL and Ceiling)

OEL and Action Levels

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Biological Monitoring

Dose versus Exposure

Biological monitoring integrates all routes of entry and can account for individual response.

Measures -- Biological Exposure Indices (BEI)
- Blood
- Urine
- Breath
- Hair
- Nails
- Feces

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Sampling for Lead

Personal Monitoring -- Breathing Zone
- Sample over the shift
- Sample multiple workers and jobs

Area Monitoring -- Confirmation and Alerts
- Map levels for different work zones
- Task Analysis
- TWA (time-weighted average)

Medical Monitoring -- Blood Levels

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Action Levels

When does management implement a program to control a hazard?

Answer: Usually at 50% of the OEL.

Some standards will dictate an action level, such as the Lead Standard at 30 $\mu g/m^3$ and the Noise Standard at 85 dBA.

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Control

Principles of Occupational Health and Safety
- Anticipation and Recognition
- Evaluation
- Control: Interventions against Hazards
- Programmatic Approach

Interventions
- General Controls
- Specific Controls

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Controls Preceded by Evaluation

Recognition
- What agents/hazards are present
- Industry experience

Evaluation
- Sources
- Actual or potential levels of hazards
  - normal operations
  - maintenance / emergency
- Routes of entry

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General Controls

General controls are implemented for those workers who may be exposed to the particular hazards.

Not Discretionary

Types
- Training
- Hygiene Practices
- Medical Surveillance

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Training

Training is the mechanism used to inform workers of the hazards in the workplace and the means to control them.

Goals
- Understand hazards
- Know where and when hazards occur
- Know the control methods

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Training Notes

Training
- Annual
  - general meetings
  - workplace / tail gate meetings
- Appropriate refreshers

Content (sometimes standard driven)
- Nature and effects of the hazards
- Likely conditions and places of exposure
- Control methods

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Hygiene Practices

Hygiene practices are those actions taken by individuals that will reduce the risk of exposure to the hazards present in the workplace.

Implications
- Knowledge
- Minimal Barriers to Practices
- Individual Responsibility

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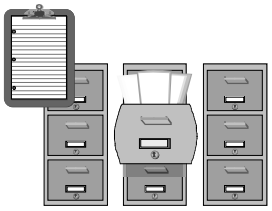
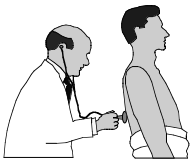
Medical Surveillance

Site-Wide

Individuals





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Specific Controls

Specific controls are selected and implemented based on the manifestation of the hazards and local constraints.

Specific controls are the primary methods to control hazards.

Priority
- Engineering Controls
- Administrative Controls
- Personal Protection

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Engineering Controls

Engineering controls attempt to remove or isolate the hazard from the work environment.

Implication: The risks of injury and illness are reduced or eliminated.

Point of Application
- Source
- Path of Travel

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Types of Engineering Controls

Changing the Process
- New plant or facility
- Changing tools and methods

Substitution of Materials

Isolation (shields, barriers, etc.)
- Equipment
- Person

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Types of ECs (cont)

Ventilation
- Local exhaust ventilation
- General dilution ventilation

Status
- Permanent
- Temporary

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Administrative Controls

Administrative controls manage the risk of hazard exposure by controlling the way the work is performed.

Implication: The hazards are still present but the risks are reduced by reducing the opportunity for exposure.

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Types of Administrative Controls

Limiting the number of people exposed

Limiting the exposure time

Area monitoring / Personal monitoring

Procedures and work practices

Housekeeping

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Personal Protection

Personal protection is a hazard barrier that is worn or used by an individual and that protects only the individual.

Implications
- Burden of use and impairment is borne by the individual
- Barrier failure means there is no other protection

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Types of Personal Protection

Inhalation: Respiratory Protection (respirators)

Skin Absorption
- Clothing
- Creams, etc.

Ingestion: Face shield, mouth covers, etc.

Injection: Shields, etc.

Protection from noise, thermal, mechanical and electrical hazards

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Stages of Controls

Below the Action Limit
- Monitoring

Above the Action Limit and Below Occupational Exposure Limit (OEL)
- General Controls plus Monitoring

Above the Occupational Exposure Limit (OEL)
- Specific Controls plus General Controls and Monitoring

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Leaded Steel Manufacturing

Who are the exposed workers and when?

What controls might be considered?
- general controls
- engineering controls
- administrative controls
- personal protection

How would you judge the success of the controls?

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Program Approach

Who is responsible for health and safety?

Line versus Staff Functions

Continual Evaluation of Workplace and Controls

Coordination among Activities

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