Industrial/Occupational Hygiene Management:
Program Development and Implementation

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Introductions

"An expert is one who knows more and more about less and less until he knows absolutely everything about nothing."
—Nicholas Murray Butler

My Background:
- Independent consultant for 15+ years to a wide variety of high-hazard industries
- Global Occupational Hygiene Manager for AbbVie pharmaceutical and LafargeHolcim for 7+ years before recently returning to consulting
- Served on both AIHA and ABIH Boards of Directors
- Current Co-Chair of the Occupational Hygiene Training Association
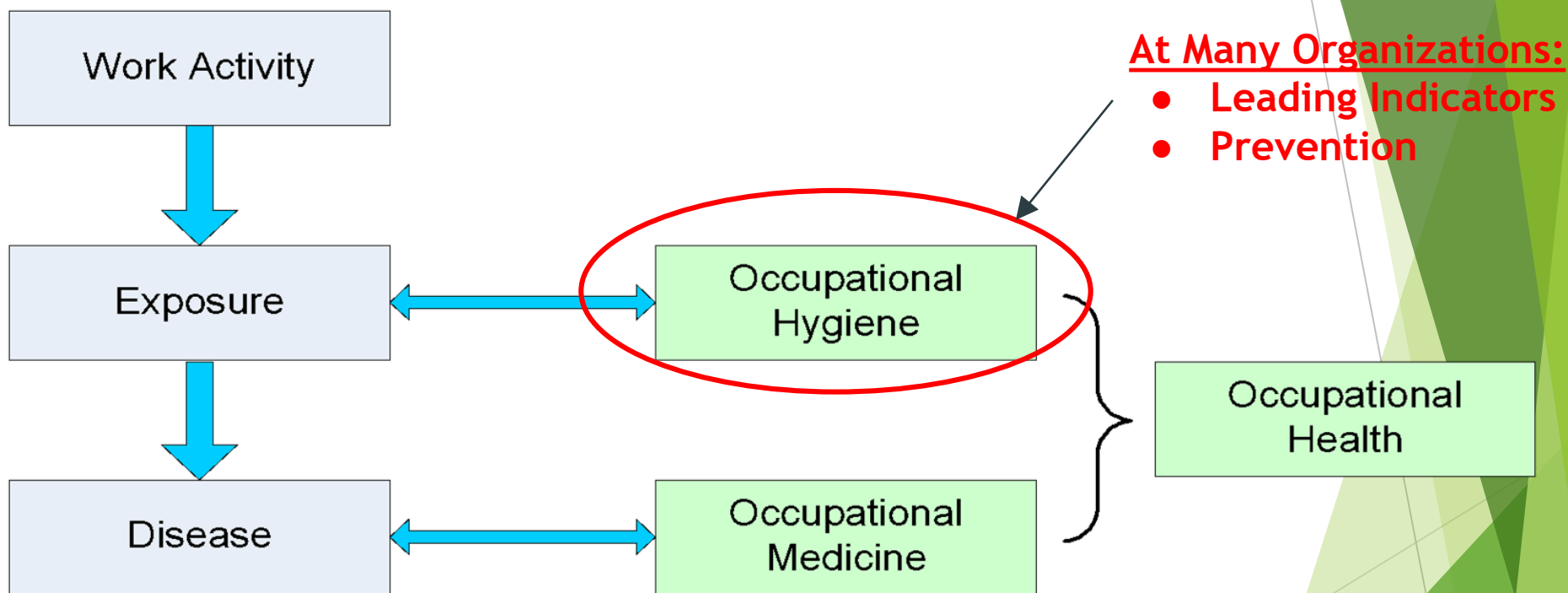
Overview of the Presentation

- Why is Occupational Hygiene(OH) important locally and globally?

- How does OH fit into the larger picture of Health and Safety Management?

- What are the components of an OH Management Cycle?

- How do we pay for the continuous improvement illustrated by KPI's?

- Who should competently play a role in building your OH culture?

- Case Studies and Small Group Exercises

The Importance of Occupational Hygiene

The World Health Organization estimates that globally there are:

- **2,400,000 work-related deaths per year due to chemical exposures!! (Compared to 300,000 safety fatalities per year)**

- 386,000 deaths each year from exposure to airborne particulates in the workplace

- 152,000 deaths per year from carcinogens in the workplace

- 37% of Lower Back Pain is attributed to occupational factors

The Missing Link of Occupational Hygiene

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Work Activity
     │
     ▼
Exposure  ◄──────►  Occupational Hygiene
     │
     ▼
Disease   ◄──────►  Occupational Medicine
                    
                    Occupational Health
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At Many Organizations:
- **Leading Indicators**
- **Prevention**

What is The Remedy?

How Do We Create Health Hazard Prevention and Leading Indicators?

Answer: The Plan-Do-Check-Act Continuous Improvement Process of Occupational Hygiene

Occupational Hygiene Program Cycle
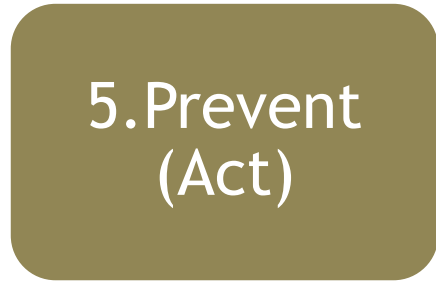
1. Anticipate (Plan)
2. Recognize (Plan)
3. Evaluate (Do)
4. Control (Check)
5. Prevent (Act)

OHSMS Cycle

3.0 Policy Management, Leadership & Employee Participation

7.0 Management Review

Act

Plan

4.0 Planning

6.0 Checking & Corrective Action

Check

Do

5.0 Implementation & Operation
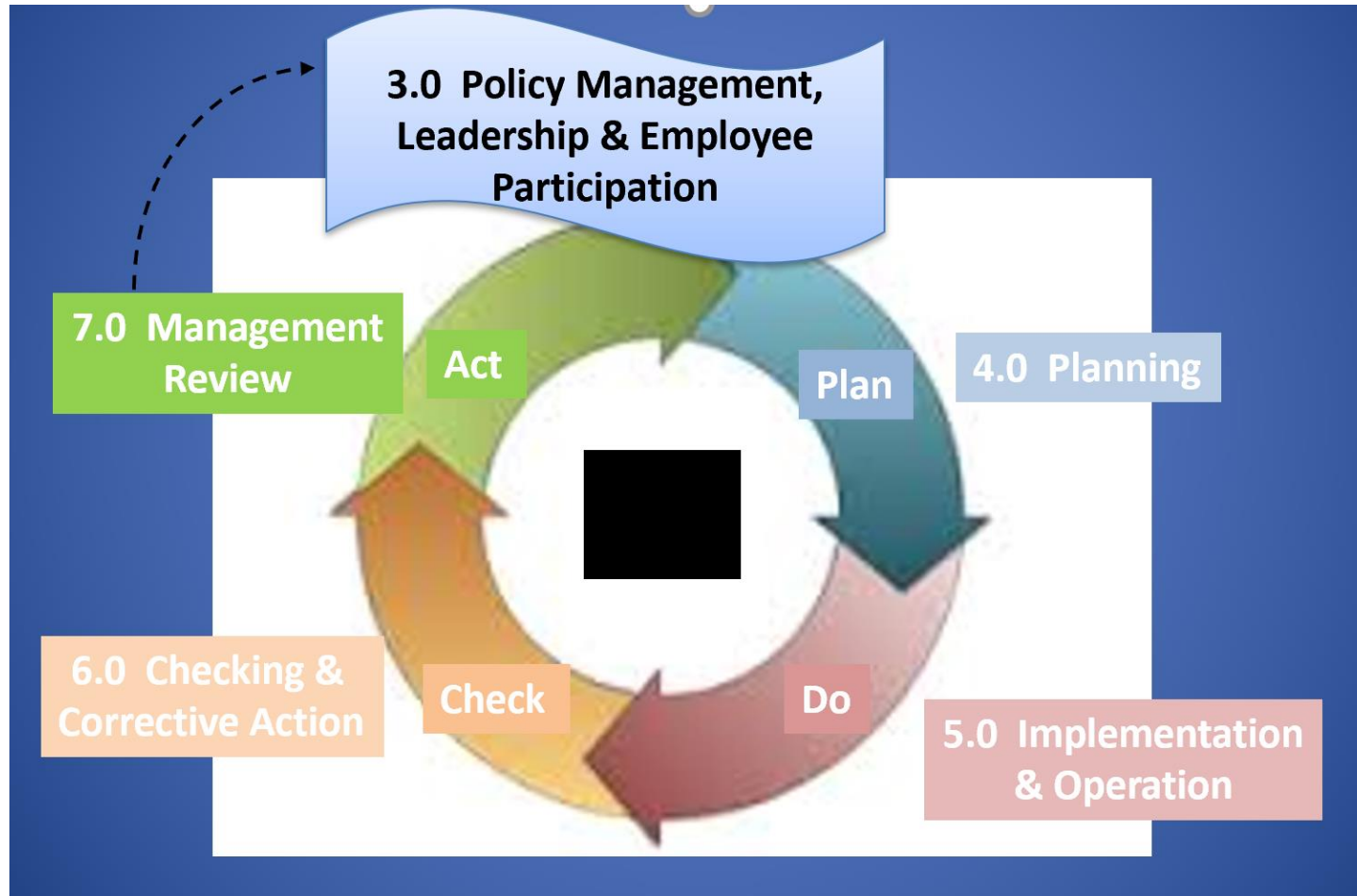
IH/OH Culture Starts at the Top

1. Importance that management places on health and well-being of employees and environmental protection

2. Management's commitment to occupational safety, health, environmental sustainability and product stewardship

3. Emphasis the company places on efficient operations, with a minimum of accidents and losses

4. Intention to integrate loss control into all operations, including compliance with applicable standards

5. Necessity for active leadership, direct participation, and enthusiastic support of the entire organization

Organizational Motivations

- Motivators vary among individuals
- Management theories and approaches
  - Theory X: motivate by external rewards and punishments
  - Theory Y: constructively use the workers self-control and self-direction, motivation is inherent
  - Theory Z: focus on employee well-being and stable employment to foster employee loyalty and support

Goal:

Assist every employee, at every level, to develop a sense of responsibility and desire to continuously improve

- ▶ Reward systems – award and recognize
  - ▶ Individual safety service / heroism
  - ▶ Safety results
  - ▶ Safety program performance
  - ▶ Incentive programs
- ▶ Leadership
  - ▶ Own and share a clear vision
  - ▶ Communicate the benefit of being involved

How Do We Accomplish Each The Goal?

Program Step	Example Tools	Example Resources	Potential Team Members	Timeline Considerations
Anticipate	SDS info R&D info Process info	TOXNET EXPUB	Operations Engineering R&D	As early as possible
Recognize	Qualitative Hazard Assessment	Internal or Purchased Tools	EHS Operations	As early as possible
Evaluate	Exposure Assessment	Internal OH or Consultants	EHS	Depends on Hazard Priority
Control	Hierarchy of Controls	Eng. Control Equipment Manufacturers Training,PPE	Operations Engineering EHS	Depends on Risk Priority
Prevent	Confirming Exposure Assessments	Internal OH or Consultants	EHS Operations Engineering	After Controls Implemented

Pretty Table, But What Tools Should Communicate the Plan?

Focus

1. **<u>Guidelines</u>**

   - Occupational Hygiene Program Guideline

2. **<u>Standards</u>**

   - Chemical Hazards
   - Biohazards
   - Noise
   - Radiation
   - Ergonomics
   - Vibration
   - Thermal Stressors…

Occupational Hygiene Program **Guideline**

▶ Introduction

    ▶ Purpose (What, Where and Why)

    ▶ Scope (Who)

    ▶ Timeline (When)

Occupational Hygiene Program Guideline

▶ Program Expectations

1. Identification of worksites and their hazards

2. Calendar of program tasks and responsible parties

3. Progress tracking process

4. Upper management review and audits of program

Occupational Hygiene Program Guideline

▶ Technical Step #1 – Anticipate and Recognize

  ▶ Gather all sources of information to assess the severity and likelihood of the current and future hazards

- materials used, quantity, physical form
- process equipment and flow
- the likely composition of hazardous substances in 'dust' at different locations of site processes
- Safety Data Sheets of supplied materials or products produced
- vibration amplitude data for equipment
- workplace temperature and humidity data
- previous risk assessments
- past or upcoming process or material changes
- previous OH exposure monitoring data
- internal and/or external occupational hygiene exposure monitoring surveys from comparable processes at other locations
- occupational illness incident reports and medical surveillance program findings

Occupational Hygiene Program Guideline

► Technical Step #2 = Qualitative **and** Quantitative Evaluation

Goal:

Implement a business-specific OH risk assessment process.
Why: Qualitatively target the highest priorities and measure success annually while reducing the need for quantitative annual exposure assessments for every process.
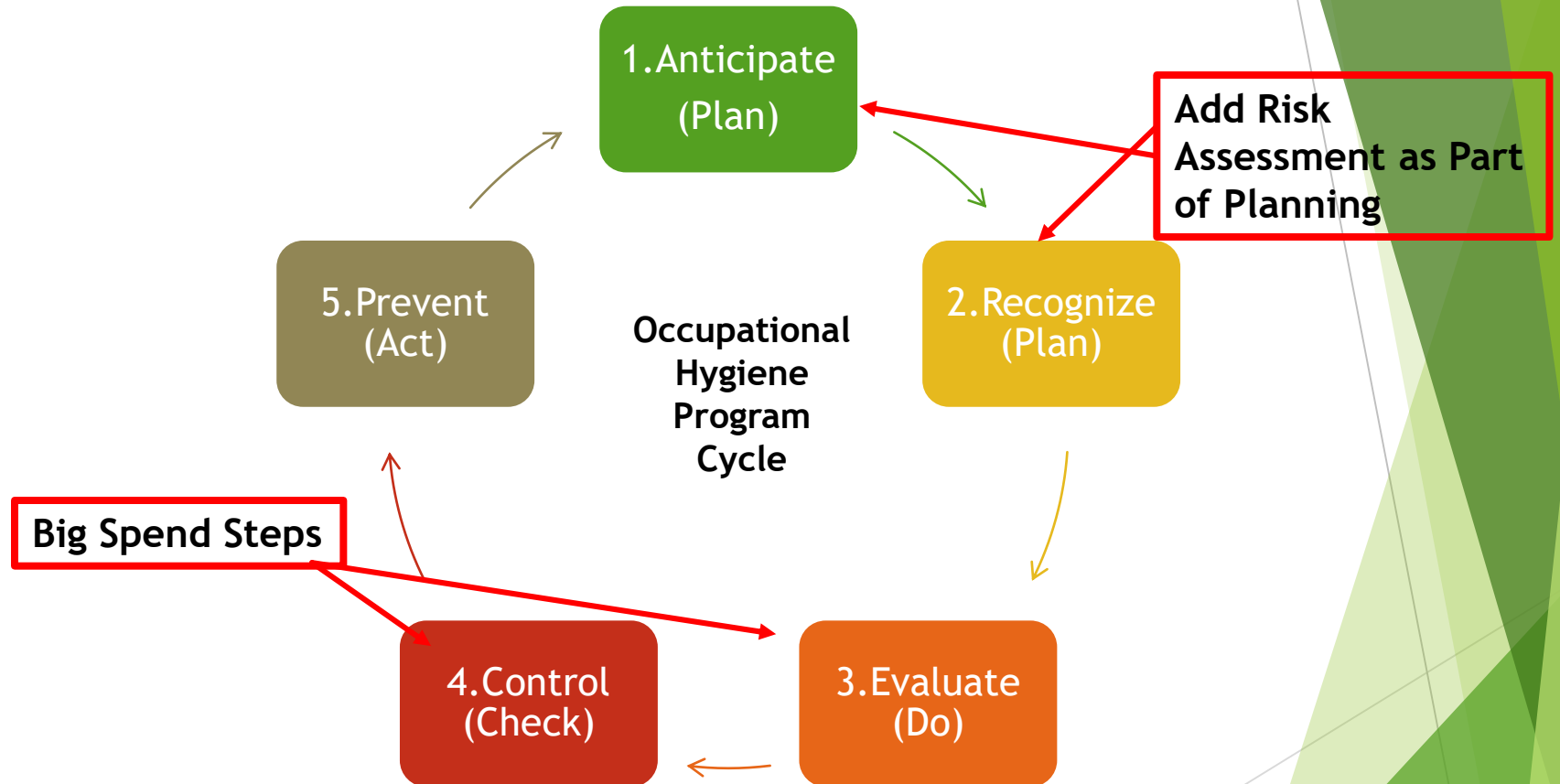
Occupational Hygiene Program Guideline

Qualitative Risk Assessment:

Goal:

Implement a business-specific OH risk assessment process.

Why: Qualitatively target the highest priorities and measure success annually while reducing the need for quantitative annual exposure assessments for every process.

Placement of a Risk Assessment Process?

1.Anticipate (Plan)

2.Recognize (Plan)

3.Evaluate (Do)

4.Control (Check)

5.Prevent (Act)

Occupational Hygiene Program Cycle

Add Risk Assessment as Part of Planning

Big Spend Steps

Q: Why Bother With a Risk Assessment Process?

A: Focused, Efficient, and Effective Evaluation and Control Program

- ▶ Many IH programs prioritize sampling, and therefore may not highlight root causes and other factors behind the numbers

- ▶ Sampling does not always tell the whole story

- ▶ Risk vs. potential loss information needed by management may not be reflected in the outcomes of sampling-focused IH programs

- ▶ Qualitative Assessment completes the risk assessment element of a well-rounded IH program; makes the whole program more effective

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Q: Why Bother With a Risk Assessment Process?

A: Focused, Efficient, and Effective Control Program

- ► Global or National level:
  - ► health management needs clear understanding of root causes of risks in order to guide the control effort
- ► Site level:
  - ► qualitative assessment increases understanding of key factors affecting exposure risk

Occupational Hygiene Program Guideline

▶ **Quantitative** Assessment after qualitative

- It may be necessary to obtain exposure monitoring data for hazards that can be quantified

- Sampling strategy adopted should be appropriate to the hazards and risk ratings <u>determined in the qualitative assessment.</u>

  ▶ Save time and consulting costs

Occupational Hygiene Program Guideline

▶ Critical Exposure Assessment Information:

- OH Exposure Assessment Process
- Occupational Exposure Limits
- Required Format of Reports with Example
- Occupational Hygiene Report Timeline
- OH Proposal Template
- OH Database Template for Sample Results

Occupational Hygiene Program Guideline

Risk Category	Definition
Very High	Greater than Twice (2x) the OEL or Very High Qualitative Risk Rating
High	Greater than the OEL or High Qualitative Risk Rating
Moderate	Greater than the 50% of the OEL or Moderate Qualitative Risk Rating
Low	Less than 50% of the OEL or Low Qualitative Risk Rating

Depending on the risk category, specific actions are needed to reduce the risk of tasks and jobs to a Low level, by applying the hierarchy of controls. All Very High risk jobs and tasks must be addressed immediately. High and Moderate risk jobs and tasks must be prioritized for control action depending on both the seriousness of the risk and the number of workers affected.

Overall Summary of Risk Levels Produce Key Performance Indices (KPI) = An OH Leading Indicator!!

Example:

Silica & Respirable Dust					
Location-Specific Risk Ratings (process locations)			Exposure Monitoring Ratings (general plant areas)		
No. of locations @ Very High		0	No. of areas @ Very High		16
No. of locations @ High		5	No. of areas @ High		0
No. of locations @ Moderate		4	No. of areas @ Moderate		0
No. of locations @ Low		0	No. of areas @ Low		0
Risk KPI		56	Risk KPI		160

Engineering Control Rating -- Dust	
Average Score	53%

Occupational Hygiene Program Guideline

Technical Step #3 – Control the Hazards

- It is important to ensure that recommendations from any assessment are implemented properly.

- Many assessments fail to control exposure because the actions are not implemented.

- Incorporate the OH Assessment and Control Plan/Recommendations into the site OH Improvement Plan based upon risk ratings from qualitative and quantitative assessments

Selection and Implementation of Controls

- Communicate the Risk

  Internal
  - Exposure data
  - Product development and stewardship
  - Training information
  - Risk assessments

  External
  - Product communications (e.g., Safety Data Sheets)
  - Public announcements and the media

- Communicate the <u>Hierarchy</u> of Controls
  - Engineering
  - Administrative
  - Personal Protective Equipment

Risk Communication-Perceptions

- ▶ Voluntary risks are accepted more readily than those imposed.

- ▶ Risk under individual control are accepted more readily than those under government control.

- ▶ Risks that seem fair are more acceptable.

- ▶ Trustworthiness of sources matters.

- ▶ Risks that seem ethically objectionable will seem more risky than those that do not.

- ▶ Natural risks seem more acceptable than artificial risks.

- ▶ Exotic risks seem more risky than familiar risks.

- ▶ Risks that are associated with other memorable events are considered more risky.

Risk Communication Tips

- Distill out the main messages to avoid overwhelming the audience – support as needed with data and details
- Panel of subject matter professionals helps
- Understandable language that is not condescending
  - Respond directly to questions
  - Be definitive, not unequivocal
- Put concerns in perspective
  - Severity
  - Potential for long-term consequences
  - Limits of uncertainty
- Avoid characterizing symptoms as psychological – allay concerns about symptoms with studies when feasible
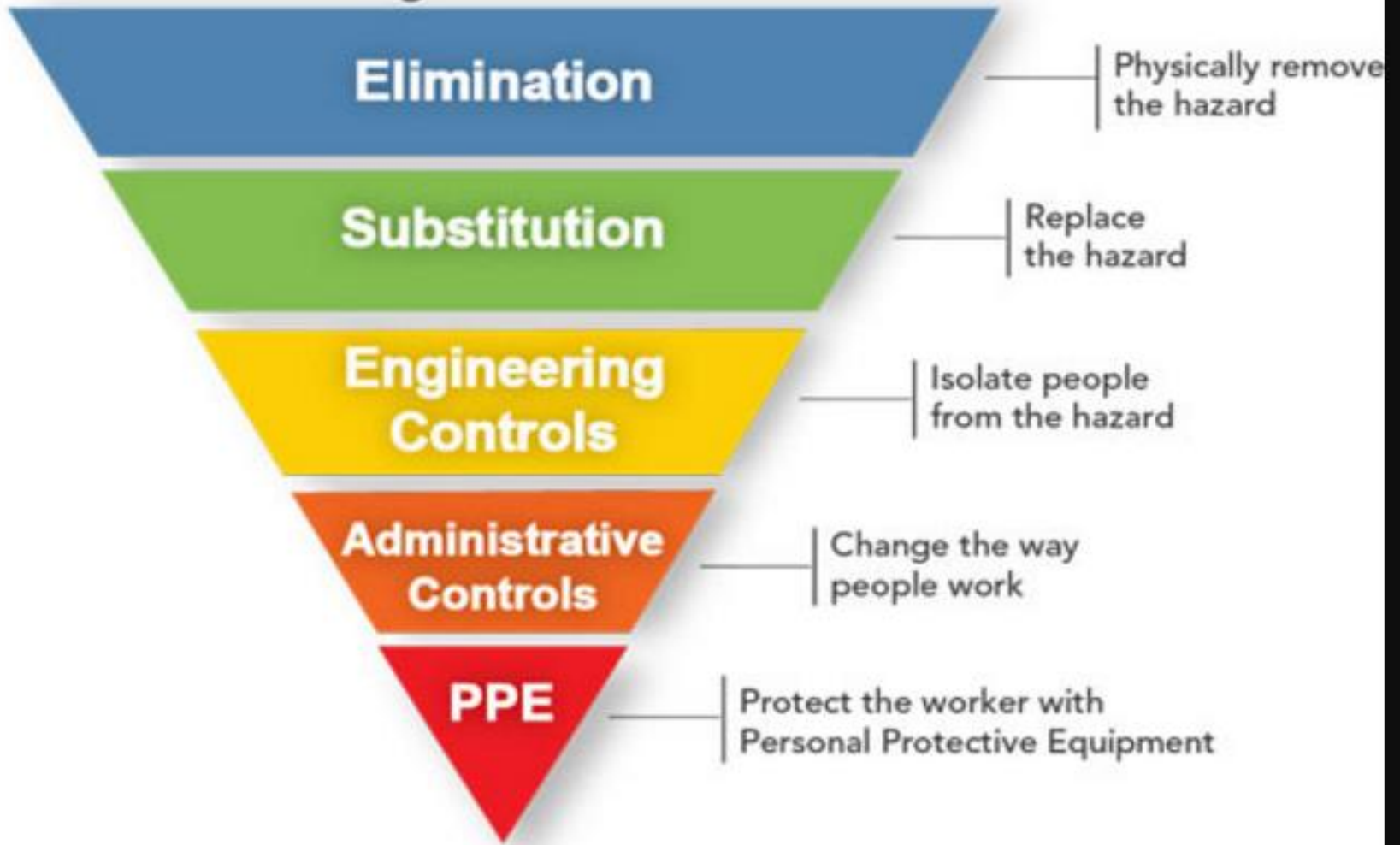
The Reason PPE is Considered Last Resort...

What's Wrong In this Picture?

Occupational Hygiene Program Guideline
Technical Step #4 – Prevent the Recurrence of the Hazards

Examples:

- Repeating a qualitative risk assessment after improvements have been implemented to verify risk reduction e.g. ergonomic risk control measures, dust control improvements.
- Additional quantitative exposure monitoring after implementing exposure control improvements e.g. installation of noise silencers or acoustic enclosures or enclosure of dust generating processes.
- Respirator fit testing to ensure the respiratory protective equipment is providing the required protection.
- Preventive maintenance checks of a water spray dust suppression system or local exhaust ventilation system.
- Microbiological testing water systems at risk of Legionella for presence of the bacteria and other indicators of water treatment effectiveness.
- Observation of welding tasks using a smoke tubes to qualitatively evaluate the capture of fume by local exhaust ventilation equipment.

Example of a Site Occupational Hygiene Assessment and Control Plan

Process Steps	Action	Outcome	Responsible Parties	Timeline
1.Anticipation and Recognition of Hazards	Define and understand the process, worker tasks, materials and products to anticipate and recognize the hazards that result from both direct process emissions and work task emissions. Define and understand with process maps, SDS's, standard operating procedures, bulk analysis of materials, past OH studies and research.	Plan the qualitative and quantitative evaluation with the recognition information by focusing the effort and resources and avoiding redundant effort.		
2.Qualitative Evaluation	Plan and complete an OH qualitative risk assessment for all tasks with risk assessment tool(s). In risk assessment consider ALL exposure routes: inhalation, skin contact and ingestion.	Assess risk of exposure by all routes at all relevant steps in process – step by step assessment. Evaluate and document existing control measures in use: engineering, administrative and PPE		
3.Quantitative Evaluation	Design and complete a quantitative (measured) OH exposure assessment for all very high, high and moderate tasks to evaluate the hazards.	Determine the priorities for control implementation. Develop sampling plan for personal samples from workers to assess all relevant SEGs and work tasks.		
4.Control Selection and Implementation	Review qualitative and quantitative exposure monitoring results for very high, high and moderate risk tasks and operations. Determine if there is a need for additional control measures. Where appropriate, implement additional engineering, administrative controls, with PPE as a last resort, into the site IH improvement process.	Determine the cost, timeline and commitment for controlled, safe and healthy handling of the material and products.		
5.Evaluation of Controls Prevention of Future Hazards	Confirm the effectiveness of all implemented controls by conducting quantitative OH exposure assessment on newly controlled processes and those processes that have been changed. Document the progress into the qualitative risk assessment process as part of Key Performance Indices and as a leading health indicator.	Determine the on-going effectiveness of the controls and to prevent future exposures.		

Elements of An Auditing Process

▶ Standards: set of procedures, practices, rules, policies, guidelines, and expectations

▶ Protocols: documented procedures for collecting objective data

▶ Auditors

  ▶ Competent, experienced evaluator

  ▶ Independence

▶ Management support

  ▶ Resources (time, $, charter, etc.)

  ▶ Communication of importance

  ▶ Consequences for non-conformance

Management of Key Documentation

- ▶ What information
- ▶ When reviewed and duration of retention
- ▶ Who has access
- ▶ Where stored and level of accessibility

Example Key Documentation

- Exposure data
- Workers Comp and Medical Records
- Safety Data Sheets
- Regulatory compliance documents
- Training records
- Product development and testing records
- Evidence of product hazard analysis, risk assessments, and due diligence
- Incident investigation records

Paying for Continuous Improvement

▶ Expense vs. Capital Budgets

▶ Gathering cost data

▶ Net Present Values

▶ Payback period comparisons

Making Decisions Using Present Value

▶ *Is the project a good investment?*

  ▶ Net Present Value (NPV) = $PV_{Benefit} - PV_{Cost}$

  ▶ If NPV is positive, then good investment.

▶ *Which alternative investment should I choose?*

  ▶ Compare NPV_A vs. NPV_B vs. NPV_C... etc.

  ▶ "Cost – Benefit Analysis"

    ▶ Ratio of PV_{Cost} to $PV_{Benefit}$, or vice versa

    ▶ Project A costs $1 for each $3 returned, while Project B costs $1 for each $3.50 returned, therefore choose B

    ▶ a.k.a. "Benefit/Cost Ratio", where $PV_{Benefit} / PV_{Cost}$

Simple Payback Method

How long will it take to realize a return on investment?

▶ Method often ignores the time value of money

▶ Method assumes "all things being equal", i.e., no major changes

▶ Initial project cost / Annual benefit cost = Payback period in years

Example: Noise reduction program

▶ Initial cost of sound enclosures = $800,000

▶ Annual cost of hearing conservation program = $500 / employee x 500 employees (Enclosures would eliminate this need.)

▶ Annual cost of hearing loss claims = $10,000

▶ Payback period calculation w/o including reduced claims

$800,000 / $250,000/yr = 3.2 years

▶ Payback period calculation w/ reduced claims

$800,000 / $260,000/yr = 3.08 years, or about 1 month better payoff.

Who Does What:

IMPROVING INTERNAL OH COMPENTENCY

OH Lead Competencies

Role	Professional and Technical Competencies	Business Management Competencies
OH Country Lead	• Understand methods for sampling, analysis, testing and control of the working environment • Able to document and report findings and observations using reports and an OH database • Follows complex procedures and gets reliable results • Knowledge of current LH and local regulatory requirements • Understands roles of related professionals (eg. occupational health, safety, environmental, OH consultants) • Recognizes issues that need to be referred and seeks advice when appropriate • Appropriate IT skills and robust science and mathematics abilities • Ability to design and provide basic occupational hygiene training and coaching to Units	• Interpersonal skills and ability to establish confidence and trust of Unit personnel and influence good occupational hygiene practices and performance • Ability to advise Units on the selection and implementation of exposure control measures • Oversee the content and progress with implementation of Unit Occupational Hygiene Assessment and Control Plans • Coordinate occupational hygiene program development in the Country

OH Competencies for HS Managers

Role	Professional and Technical Competencies	Business Management Competencies
Unit H&S Manager	• Understands basic occupational hygiene principles • Able to complete qualitative risk assessment process • Recognizes and aware of issues relevant to own workplace • Familiar with relevant local regulations and resources to facilitate evaluation and control of hazards	• Ability to facilitate the engineering, administrative and PPE control implementation processes • Able to act as advocate and focal point • Recognizes own limitations and knows where to go for help • Knows and understands all local health and safety rules and procedures

OH Competencies for Medical Services and Managers

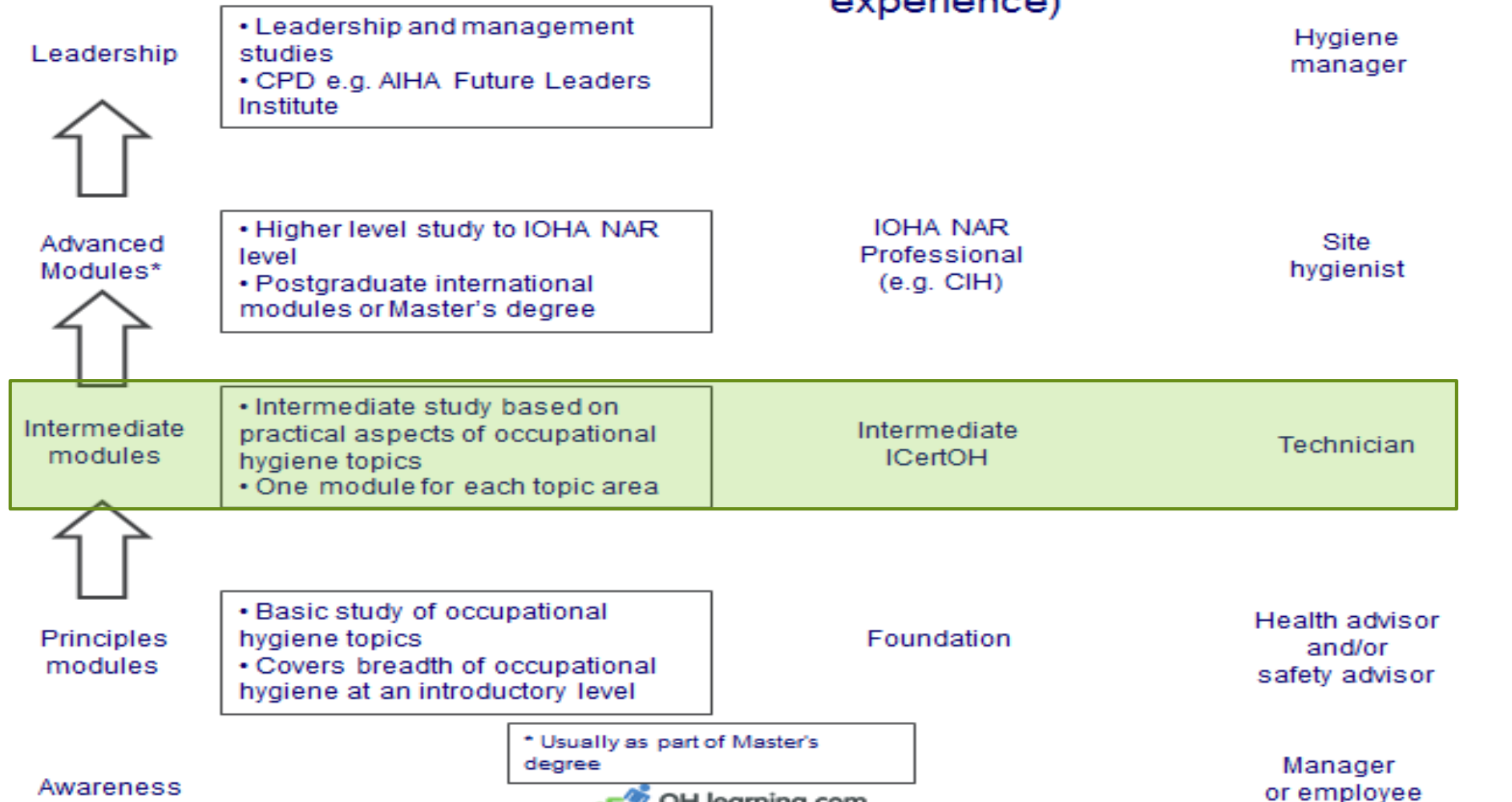| Role	Professional and Technical Competencies	Business Management Competencies
Occupational Health Service Provider	• Foundation understanding of occupational hygiene principles and practice • Ability to conduct and contribute to qualitative risk assessments of health risks • Able to interpret quantitative exposure monitoring data and survey conclusions • Analysis of medical surveillance, biological monitoring and exposure monitoring data to advise Unit on the prioritization of control actions	• Able to collaborate effectively with Unit team H&S advisers, external occupational hygiene consultants and management to provide risk-targeted occupational health advice • Escalate suspected health incident cases to Unit personnel to ensure appropriate workplace case investigation of health risks
Managers, Engineers and Operators	• Awareness of occupational hygiene hazards and relevance to their job • Aim to protect themselves and others	• Visibility of business benefits • Know where to go for help

OH Competencies for Consultants

Role	Professional and Technical Competencies	Business Management Competencies
OH Consultant (professional level)	• Comprehensive knowledge and practice of occupational hygiene • Understands, assesses and manages risks to health • Able to design and manage an occupational hygiene program for a large and complex business. • Analyses and solves problems • Interprets complex data • Clear recognition and understanding of priorities • Initiates and leads occupational hygiene projects • Professionally active • Continually develops own professional skills • Involvement with emerging issues and national legislation	• Shows leadership abilities • Able to influence business managers • Empathy for personal and business impacts • Awareness of business imperatives • Adheres to professional code of ethics • Effective communicator of technical and sensitive information • Teacher, mentor and champion • Interacts with regulators, employees, managers and public • Objective and factual report writing and data presentation • Managing a budget • Managing people • Knowledge of organization & key business processes

OHTA – Occupational Hygiene Training Assn.

•A not-for-profit organisation run by volunteers

•Dedicated to improving protection of people worldwide from the risks of the working environment

•Formed to promote better standards in industrial/occupational hygiene training practices

•Manages the global training and qualifications framework in industrial/occupational hygiene

•Provides free access to educational materials through its website (www.OHlearning.com)

Scheme for Growing OH Competency

OHTA Training levels		Certification (qualification + practice + experience)	Typical Role
Leadership	• Leadership and management studies • CPD e.g. AIHA Future Leaders Institute		Hygiene manager
Advanced Modules*	• Higher level study to IOHA NAR level • Postgraduate international modules or Master's degree	IOHA NAR Professional (e.g. CIH)	Site hygienist
Intermediate modules	• Intermediate study based on practical aspects of occupational hygiene topics • One module for each topic area	Intermediate ICertOH	Technician
Principles modules	• Basic study of occupational hygiene topics • Covers breadth of occupational hygiene at an introductory level	Foundation	Health advisor and/or safety advisor
Awareness	* Usually as part of Master's degree		Manager or employee

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OHTA Intermediate modules

Module Topics

- Measurement of Hazardous Substanc[es]
- Thermal Environme[nt]
- Noise
- Asbestos
- Control
- Ergonomics
- Hazards of Chemicals

- ▶ 5-day taught modules designed to meet needs of industry

- ▶ Interactive teaching methods with questions and workshops

- ▶ Practical "hands-on" exercises

- ▶ International syllabus based on good hygiene practice

- ▶ Innovative student assessment
  - ▶ part of the learning process
  - ▶ "open book" test of understanding

Case Studies and Small Group Exercises

Please form Groups of 3-4

Case Study #1

- ZED, Inc. has welding operations and send at least 3 of the total 7 welders to the local occupational health provider for combinations of headache, fever, chills, muscle aches, thirst, nausea, vomiting, chest soreness, fatigue, gastrointestinal pain, weakness, and tiredness on a quarterly basis.

- What IH program components are missing at ZED, Inc.?

- Who is responsible for each component?

Case Study #2

- Bubblewrap, Inc. has established manufacturing operations with 5 years of IH data clearly illustrating that potential exposures to airborne contaminates are under control. Upper management refuses to support the removal of respiratory protection.

- What are the steps to remedy this situation so that workers are not required to wear unnecessary PPE?

Case Study #3

- Renegade, Inc. is a manufacturing start-up. After hiring an EHS consultant to review their overall facility, they received recommendations to further evaluate their paint booth process. They currently only use N-95 respirators for their worker's protection.

- What should they do first, second, third,… to ensure their worker's are protected?

Case Study #4

- BIG, Inc. has 5+ years of thorough industrial hygiene data, held at their local sites, that clearly profile worker exposures to dust, hexavalent chromium and noise.

- What benefits are there to gathering and evaluating this data in aggregate at the corporate level?

Case Study #5

- Global, Inc. has operations spanning 25 countries. At least 15 of the 25 countries have no internal IH resources and sparse, qualified consulting resources.

- What options does Global have for implementing the IH management cycle at their operations?

- How can you communicate the options to upper management for financial support?

Questions and Discussion

Where are your program gaps?