Concepts and figures used in this presentation were adapted from the classic work of John Mulhausen and Joseph Damiano: *A Strategy for Assessing and Managing Occupational Exposures*. 2nd Edition, 1998, AIHA Press, Fairfax
Managing Medical Surveillance

Your Assumption:
uncontrolled, unacceptable exposure
Exposure Assessment

- Education & Training
- Hazard Communication
- Exposure Monitoring
- Administrative Controls
- Work Practice Controls
- Personal Protective Equip.
- Engineering Controls
- Radiation Safety
- Epidemiology
- Hearing Conservation
- Medical Surveillance
- Hazardous Material Mgt.
Assessing Occupational Exposure

Good risk assessment ⇒ Good risk management

Establish needs and priorities for health hazard control

Demonstrate regulatory compliance
An Exposure Assessment Strategy

- **Start**
  - Basic Characterization
    - Exposure Assessment
      - Exposure is Acceptable
        - Reassess Exposure
      - Exposure is Uncertain
        - Prioritize Further Information Gathering
      - Exposure is Unacceptable
        - Exposure Control & Reassessment
An Exposure Assessment Strategy

1. Start
2. Basic Characterization
3. Exposure Assessment
4. Further Information Gathering (FIG)
5. Health Hazard Control
6. Reassessment
7. Communication & Documentation
Basic Characterization

- **Workplace Agents**
  - Health effects associated with excessive exposure
  - OEL

- **Workforce**
  - Organization; assignment of tasks

- **Sources of Exposure**
  - Processes, operations, tasks, work practices
  - Existing controls
Data Organization and Storage

Thanks Ray Fiorillo

David P. Bleicher, CIH
Industrial Hygiene & Environmental Health Science
Protecting Worker Health

DOI Exposure Assessment
& Medical Surveillance
Exposure Assessment

Define Exposure Profile

Compare:

Exposure Profile \( \rightarrow \) OEL

Categorized Exposure

Acceptable
Uncertain
Unacceptable
What’s the Problem?

Goal:

Assess exposure and occupational health risks of all workers to all agents on all days

- Accurately and efficiently
- So that all workers are protected

Thousands of workers

Exposures Vary
Similar Exposure Group (SEG)

A group of workers having:
- same general exposure profile
  - Similarity & frequency of tasks
  - Similarity of materials and processes
  - Similarity in how tasks are performed

Assignment is dynamic & flexible

A tool for stratification & allocation of limited resources
SEG Classification

Process-Job Classification-Agent
Task-Agent
Process-Agent
Work Teams
Non-repetitive Tasks
Two Perspectives on SEGs

1. EA conducted at facility
   Assign workers to SEGs for health risk management

2. SEG Catalogue
   As a tool for Basic Characterization
Exposure Profile

An estimate of an exposure & its variability
plus uncertainty

Quantitative:
mean, standard deviation
statistical confidence limits

Qualitative:
knowledge, experience, professional judgment
Define the Exposure Profile

Exposure Rating: a useful tool...

<table>
<thead>
<tr>
<th>Rating</th>
<th>Exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>&gt;OEL 95th %tile &gt; OEL</td>
</tr>
<tr>
<td>3</td>
<td>50-100 %OEL 95th %tile between 0.5 &amp; 1.0 of OEL</td>
</tr>
<tr>
<td>2</td>
<td>10-50 % OEL 95th %tile between 0.1 &amp; 0.5 of OEL</td>
</tr>
<tr>
<td>1</td>
<td>&lt; OEL 95th %tile &lt; 0.1 of OEL</td>
</tr>
</tbody>
</table>
Basis of Exposure Rating

Monitoring data
- Personal
- Screening measurements

Surrogate data
- Exposure data from another agent
- Exposure data from another operation

Predictive modeling
Predictive Modeling

“All models are false but some are useful.”
Box & Draper 1987

Examples:
Saturation vapor models
Well mixed room
Far-Near field models
Select an OEL

PELs, TLVs, RELs

In absence of an OEL?

setting OELs for carcinogens
non-carcinogens NOELs

FDA uncertainty factors…

Consultation with a toxicologist.

Performance-based exposure control limits.
Hold that thought…
…we’ll talk about that tool later.

For now we will use the OEL.
Judging Exposure

- DOI Exposure Assessment & Medical Surveillance
- Judging Exposure
- Exposure Level
Performance-Based Exposure Control Limits

Bruce Naumann, et.al. 1996

Performance-based Control Limits for Pharmaceutical Active Ingredients
Exposure Control & Management

- Exposure is Acceptable: No Action
  Define routine Monitoring Program

- Exposure is Uncertain: Prioritize List for
  Further Information Gathering

- Exposure is Unacceptable: Prioritize List for Control & Reassessment

David P. Bleicher, CIH
Industrial Hygiene & Environmental Health Science
Protecting Worker Health

DOI Exposure Assessment
& Medical Surveillance
Critical Exposures

Potential worker exposure may result in significant risk
Medical Surveillance Action

Regulation triggered Medical Surveillance

Critical Exposures
Medical Surveillance Action

What is OMSEP?
Further Information Gathering

Prioritization

Control actions priority list
FIG priority list

Don’t forget regulation-triggered actions.
# Health Effects Rating

<table>
<thead>
<tr>
<th>Rating</th>
<th>Health Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Life-threatening or disabling injury or illness</td>
</tr>
<tr>
<td>3</td>
<td>Irreversible health effects of concern</td>
</tr>
<tr>
<td>2</td>
<td>Severe, reversible health effects of concern</td>
</tr>
<tr>
<td>1</td>
<td>Reversible health effects of concern</td>
</tr>
<tr>
<td>0</td>
<td>Reversible effects of little concern</td>
</tr>
</tbody>
</table>
## Health Risk Rating

<table>
<thead>
<tr>
<th>Health Effects Rating</th>
<th>Exposure Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>4 8 12 16</td>
</tr>
<tr>
<td>3</td>
<td>3 6 9 12</td>
</tr>
<tr>
<td>2</td>
<td>2 4 6 8</td>
</tr>
<tr>
<td>1</td>
<td>1 2 3 4</td>
</tr>
</tbody>
</table>

1 2 3 4

---

David P. Bleicher, CIH  
*Industrial Hygiene & Environmental Health Science*  
*Protecting Worker Health*  

DOI Exposure Assessment  
& Medical Surveillance
## Uncertainty Rating

<table>
<thead>
<tr>
<th>Rating</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Highly Uncertain: Significant information absent on exposure profile or health effects</td>
</tr>
<tr>
<td>1</td>
<td>Uncertain: Adequate information available for judgment, but FIG warranted to verify exposure</td>
</tr>
<tr>
<td>0</td>
<td>Certain: Agent’s exposure profile and health effects well understood</td>
</tr>
</tbody>
</table>
## Priority

<table>
<thead>
<tr>
<th>Health Risk Rating</th>
<th>16</th>
<th>12</th>
<th>9</th>
<th>8</th>
<th>6</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>12</td>
<td>9</td>
<td>8</td>
<td>6</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Uncertainty Rating</td>
<td>36</td>
<td>24</td>
<td>18</td>
<td>16</td>
<td>12</td>
<td>8</td>
<td>6</td>
<td>4</td>
<td>2</td>
</tr>
</tbody>
</table>

David P. Bleicher, CIH

*Industrial Hygiene & Environmental Health Science*

*Protecting Worker Health*
DOI Exposure Assessment & Medical Surveillance

David P. Bleicher, CIH
Industrial Hygiene & Environmental Health Science
Protecting Worker Health

Priority and Action

<table>
<thead>
<tr>
<th>Uncertainty Rating</th>
<th>Health Risk Rating</th>
<th>Action Needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>Control Needed</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>Information Gathering Needed</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>Information Gathering Needed</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>Information Gathering Needed</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>Information Gathering Needed</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>Information Gathering Needed</td>
</tr>
<tr>
<td>8</td>
<td>8</td>
<td>Information Gathering Needed</td>
</tr>
<tr>
<td>9</td>
<td>9</td>
<td>Control &amp; Information Gathering Needed</td>
</tr>
<tr>
<td>12</td>
<td>12</td>
<td>Control &amp; Information Gathering Needed</td>
</tr>
<tr>
<td>16</td>
<td>16</td>
<td>Control &amp; Information Gathering Needed</td>
</tr>
<tr>
<td>36</td>
<td>36</td>
<td>Control &amp; Information Gathering Needed</td>
</tr>
</tbody>
</table>

Control Needed
No Action Needed
Information Gathering Needed
Priority and Action

Uncertainty Rating

Health Risk Rating

Control Needed

Information Gathering Needed

No Action Needed

Control & Information Gathering Needed

Increasing Control Priority

Increasing FIG Priority

David P. Bleicher, CIH
Industrial Hygiene & Environmental Health Science
Protecting Worker Health

DOI Exposure Assessment & Medical Surveillance
Exposure to Biological Agents

Risk Factors
- Pathogenicity
- Route of transmission
- Agent stability, concentration
- Host susceptibility

Availability of prophylaxis
## NIH: Classification of Human Etiologic Agents

### Qualitative Risk Groups for Biological Agents

<table>
<thead>
<tr>
<th>RG1</th>
<th>No disease in healthy adults</th>
</tr>
</thead>
<tbody>
<tr>
<td>RG2</td>
<td>Disease, but rarely serious; prevention &amp; therapy available</td>
</tr>
<tr>
<td>RG3</td>
<td>Serious, lethal disease; prevention &amp; therapy may be available</td>
</tr>
<tr>
<td>RG4</td>
<td>Serious, lethal disease; prevention &amp; therapy not available</td>
</tr>
</tbody>
</table>
Dermal Exposure Assessment

Screening incidental contact
Routine contact
Immersion of hands

DA = (S) (Q) (FQ) (ABS) (WF)
Assessing Occupational Exposures & Managing Medical Surveillance

U.S. Department of Interior
Industrial Hygiene Working Group
November 18, 2009

David P. Bleicher, CIH
Industrial Hygiene & Environmental Health Science
Protecting Worker Health

DOI Exposure Assessment & Medical Surveillance