Risk Assessment Models Used to Improve Organizational Safety Performance

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Learning Objectives

Participants will be able to:

★ Debunk 5 Common Safety Myths
★ Understand the Principles of Risk Assessment
★ Apply Risk Reduction factors to the Hierarchy of Controls
★ Measure Risk Reduction Efforts
Myth No. 1

★ Reducing injury frequency will also achieve reduction in severity?

![Accident pyramid diagram]

1. FATAL
2. 30 MAJORS (Disabling Injuries)
3. 300 RECORDABLE ACCIDENTS (Off-work, limited work and no lost time)
4. 3000 NEAR MISSES or FIRST AID
5. 30,000 HAZARDS
   Unsafe acts – Unsafe conditions
A reduction of injuries at the bottom, does not always correspond to an equivalent reduction of SIF

21% of OSHA Recordable Cases have the potential to be serious or fatal
Myth No. 2

Unsafe acts are the principle cause of incidents?

Behavior-based safety approach suggests 80% of incidents caused by employee error.

★ In reality employee error is:
★ A symptom, but never the root cause
★ Driven by poorly designed processes and work systems
Myth No. 3

Compliance alone assures FSI prevention?

What we have learned:

★ Compliance assurance is required and necessary with the **ultimate goal** being that of achieving an acceptable level of risk (ALOR)

★ Severity of harm “potential” must be taken into consideration when looking at incident data and assessing workplace exposures.
Myth No. 4

Low level controls have a major impact on reducing severity of harm?

What we have learned:

- Risk avoidance, hazard elimination and substitution impact severity of harm potential. Controls must match the level of risk.
- Low level controls support higher level controls.
- Incident data from risk centric organizations highlight effective level of controls not in place at time of FSI incidents or near miss events.
Myth No. 5

Low injury rate equates to low risk?

🌟 What we have learned:

🌟 Each year highly respected organizations with low injury rates report fatal or serious events.

🌟 Taking a business-as-usual approach or making only minor adjustments to the operational safety and health management system will not advance FSI prevention.
Let’s change the way we practice safety!

Would you like to be able to:

★ Design a facility to use **NO** ladders?
★ Design a process to do **NO** lifting?
★ Design a process so hazardous chemicals are **NOT** handled?
★ Design or purchase safer grinders?
★ Or just change the safety mindset to **eliminate** rather than control serious hazards and risks?
Traditional vs. Risk-Based

Transformative approaches move us towards a risk-based paradigm shift
Risk Assessment – Benefits

★ More than compliance and incident rates
★ Requires effective implementation of proactive measures
★ The new “business of safety”
★ Part of an OSHMS planning process
  - At design or purchase stage
  - Prior to implementation/operation
  - Part of strategic planning
Quick History of Risk Assessment

- **1688**: Lloyds of London house
- **1848**: Cost / Risk Benefit Analysis
- **1993**: Mil Std 882D
- **2000**: ANSI B11 Series
- **2005**: ANSI Z-10 OHSMS
- **2011**: ISO 31000 /10 and ANSI 690.1.2.3
- **2012**: ANSI Z 590.3 Prevention Though Design

**ANSI Z 590.3**: Prevention Though Design

**ANSI B11 Series**: Standard Practice for System Safety

**ANSI Z-10 OHSMS**: Occupational Health and Safety Management Systems

**ISO 31000 /10**: Risk Assessment Techniques

**ANSI Z 590.3**: Prevention Though Design
ANSI/ASSE Z690-2011

- Z690.1 – Vocabulary for Risk Management
- Z690.2-31000 - Risk Management Principles and Guidelines
- Z690.3-31010 – Risk Assessment Techniques
Establishing the Context

Define and document:

- Objectives
- External/internal parameters
- Scope and risk ranking criteria
- Risk acceptability criteria
- Risk assessment process
- Risk management steps
Risk Assessment: Key part of OSH Management System

Continual improvement

Management review
Checking and corrective action
OHS Policy
Planning
Implementation and operation

Risk Assessment
Step 1: Risk Identification

- Identify the hazards
- Numerous tools available
- Varying strengths and limitations
- Select the one which works best
Step 2: Risk Analysis

- Over 30 tools available
- Quantify the risk
- Simple matrices
- Complex models

<table>
<thead>
<tr>
<th>Likelihood Rating</th>
<th>F</th>
<th>IV</th>
<th>III</th>
<th>II</th>
<th>I</th>
<th>I</th>
<th>I</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>IV</td>
<td>III</td>
<td>III</td>
<td>II</td>
<td>I</td>
<td>I</td>
<td>I</td>
</tr>
<tr>
<td>C</td>
<td>V</td>
<td>IV</td>
<td>III</td>
<td>II</td>
<td>I</td>
<td>I</td>
<td>I</td>
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<tr>
<td>B</td>
<td>V</td>
<td>IV</td>
<td>III</td>
<td>III</td>
<td>II</td>
<td>I</td>
<td>I</td>
</tr>
<tr>
<td>A</td>
<td>V</td>
<td>V</td>
<td>IV</td>
<td>III</td>
<td>II</td>
<td>II</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Consequence Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
</tr>
</tbody>
</table>
The Risk Rating determines the necessity for Risk Treatment / Mitigation

<table>
<thead>
<tr>
<th>Risk Rating</th>
<th>Definition</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>High (H)</td>
<td>Operation not permissible</td>
<td>Stop the job, Continuous Oversight, Defense in Depth or layers of protection.</td>
</tr>
<tr>
<td>Serious (S)</td>
<td>High Priority Remedial Action</td>
<td>Controls such as elimination, isolation, substitution and barriers are preferable. Defense in Depth and layers of protection.</td>
</tr>
<tr>
<td>Medium (M)</td>
<td>Take Remedial action at appropriate time</td>
<td>Utilize Hierarchy of Controls. If controls are limited to administrative or PPE, add defense in depth or layers of protection.</td>
</tr>
<tr>
<td>Low (L)</td>
<td>Risk Acceptable, Remedial action discretionary</td>
<td>May be able to rely on administrate and PPE controls.</td>
</tr>
</tbody>
</table>
Step 3: Risk Evaluation

- Evaluate controls to determine if the risk is acceptable
- Consider additional controls for unacceptable risks
- Create data to make decisions and monitor future actions
Defense in Depth
Layers of Protection and Hierarchy of Controls

- The circles represent holes or potential failures in a control. As you can see, some controls are more effective than others.
- With multiple layers of protection, what is the chance of each layer failing at the same time?
- The more severe the potential hazard, the more layers of protection you may need.
- Risk assessment is more than a one-time assessment!!!
## Risk Evaluation

- **Substitution ↓ Severity**
- **Others ONLY ↓ Likelihood**

- **Concepts based on ANSI B11.0**
- **Determine Residual RRN**

### Controls / Protective Measure / Risk Mitigation Reduction Factor

<table>
<thead>
<tr>
<th>Factor</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avoidance / Elimination</td>
<td>100% - Severity = 0</td>
</tr>
<tr>
<td>Substitution</td>
<td>90% reduction in Severity = substitution with no hazard</td>
</tr>
<tr>
<td></td>
<td>80% Reduction in Severity = substitution with something that</td>
</tr>
<tr>
<td></td>
<td>still has some hazards. Automation.</td>
</tr>
<tr>
<td>Engineering / Isolation Controls</td>
<td>Likelihood Only</td>
</tr>
<tr>
<td></td>
<td>70% = Isolation. Interlocks on Barrier Controls.</td>
</tr>
<tr>
<td></td>
<td>60% = Engineering control redundancy or multiple</td>
</tr>
<tr>
<td></td>
<td>engineering controls</td>
</tr>
<tr>
<td></td>
<td>50% = single engineering control</td>
</tr>
<tr>
<td></td>
<td>40% = engineering controls that require admin intervention to</td>
</tr>
<tr>
<td></td>
<td>initiate</td>
</tr>
<tr>
<td>Warnings and Administrative Controls</td>
<td>Likelihood Only</td>
</tr>
<tr>
<td></td>
<td>30% = Training, plus signs plus inspections/observations</td>
</tr>
<tr>
<td></td>
<td>20% = Training, plus warnings, signs, etc.</td>
</tr>
<tr>
<td>Personal Protective Equipment</td>
<td>Likelihood Only</td>
</tr>
<tr>
<td></td>
<td>10%</td>
</tr>
</tbody>
</table>

- Preferred
- Only if Low Severity
Risk Reduction

Let’s look at risk reductions based on the hierarchy of controls!

<table>
<thead>
<tr>
<th>Activity (Hazard/Scenario)</th>
<th>Initial Risk</th>
<th>Residual Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walking over a step carrying hazardous chemicals</td>
<td>S (4)</td>
<td>Medium 20</td>
</tr>
<tr>
<td></td>
<td>L (5)</td>
<td>Installing a ramp Engineering @ 50% Medium 12</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Now Add these additional Mitigations or Treatments</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemicals containers with a lid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>People wearing safety clothing and face ware</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Training</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engineering @ 60%, Admin @ 20%, PPE @ 10%</td>
<td></td>
<td>Medium 8.6</td>
</tr>
</tbody>
</table>
Risk Treatment

Document how treatment options will be implemented:
- Proposed actions
- Priority order
- Assign responsibilities
- Available resources
- Timelines
- Performance measures
- Reporting and monitoring
Communication

- External/internal stakeholders
- All stages of the process.
- Controls communicated to those performing the tasks:
  - Training and conformance testing
  - Observation and feedback
  - Coaching
Consultation

- Stakeholders interests
- All risks identified
- Variety of expertise
- Different views considered when defining risk criteria/evaluating risks
- Secures endorsement for treatment plan
Monitoring

During all aspects of the process to:

- Ensure controls are effective
- Obtain process improvement information
- Produce “lessons learned”
- Detect changes/revise treatments
- Identify emerging risks
Review

- Ongoing review of leading metrics including:
  - Monitoring results
  - Treatment plan results
  - Risk reductions
- All are recorded and externally and internally reported
Sample Scorecard / Dashboard

Establishing Department and Site-Specific

★ Objectives and
★ Accountabilities

To Facilitate

★ Ownership
★ Continuous improvement.

Safety Through Accountability and Recognition
Valid Risk Assessment

Each Department (8) identified
- Key Supervisors
- Key committee personnel
- Subject Matter Experts (SMEs) and
- Safety department liaisons

Completed their Risk Assessment

Validation = SMEs and Safety Department Concurrence
ID Risk Reduction Targets

Each department selected from among their higher residual risks at least

- Two (2) tasks to be reduced

A Green score meant objectives and targets were identified

- If not, it showed up as Yellow
- And the ↑ indicated a change from the previous reporting period.
Business Level Concurrence

Department Management was expected to

- Concur with these targets
- Communicate this to their entire department and
- Monitor completion as part of their regular management meetings.
Target (Objective) Status - % Complete

Based on two (2) risk reduction targets, there may be a number of action plans

- Closure is tracked
- 100% is green
- No progress is red
- Change from previous reporting is also monitored by the ↑
Critical Control Validation Rate

Critical Controls were based on
- High Initial Risk or
- Catastrophic Residual Severity

Departments identified 3-5 critical controls to add to their inspection checklist
- this could include knowledge testing, and
- Observations as well as conditions

% conformance target initially was 95%

As conformance matured, different controls were added to the inspection checklist.
**Department Scorecard**

Quarterly Organizational Risk Reduction Scorecard

<table>
<thead>
<tr>
<th>Organization</th>
<th>Validate Site Level Risk Assess</th>
<th>ID Risk Reduction Targets</th>
<th>Business Concurrence on Target</th>
<th>Target (Objective) Status % Complete</th>
<th>Critical Control Verification Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>100%</td>
<td>3</td>
<td>y</td>
<td>100%</td>
<td>N/A</td>
</tr>
<tr>
<td>B</td>
<td>100%</td>
<td>2</td>
<td>↑</td>
<td>50%</td>
<td>97%</td>
</tr>
<tr>
<td>C</td>
<td>100%</td>
<td>0</td>
<td>N</td>
<td>N/A</td>
<td>97%</td>
</tr>
<tr>
<td>S</td>
<td>100%</td>
<td>1</td>
<td></td>
<td>0%</td>
<td>N/A</td>
</tr>
<tr>
<td>E</td>
<td>100%</td>
<td>2</td>
<td>↑</td>
<td>50%</td>
<td>N/A</td>
</tr>
<tr>
<td>F</td>
<td>100%</td>
<td>3</td>
<td>↑</td>
<td>67%</td>
<td>95%</td>
</tr>
<tr>
<td>G</td>
<td>100%</td>
<td>1</td>
<td></td>
<td>100%</td>
<td>88%</td>
</tr>
<tr>
<td>H</td>
<td>100%</td>
<td>2</td>
<td>↑</td>
<td>50%</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
<td><strong>3</strong></td>
<td><strong>88%</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**

- Insert an arrow (up or down or horizontal) indicating the direction of change (if any) since the last quarter.

Targets = Goals, Objectives and action plans
Ultimate Goal!

Ongoing Risk Reduction and Continuous Improvement

Paradigm Shift

★ Providing a Safe and Healthful Workplace!
Resources

http://www.oshrisk.org/

External Sources

For more Risk Assessment resources, view these additional publications and websites.

- Articles, Journals, etc.
- Books
- Websites

Videos

The ASSE Risk Assessment Institute developed this series of videos to help OSH practitioners develop competencies in the area of OSH risk assessment and management for immediate practical use in the workplace.

Use these videos to learn more about or refresh your knowledge on OSH risk assessment and management.

Risk Assessment

Introduction to Risk Assessment

Risk Assessment is the skill set of the future for OSH professionals. Learn how risk assessment is part of (and feeds into) risk management and how to explain key risk assessment terms and processes. Learn what it takes to take a leading role in your organization’s risk assessment process.
Health, Safety and Environmental

References

- **Department of Energy**
- **OHSAS 18000**
- **ANSI Z 10**
- **OSHA Program Management Guidelines**
- **OSHA TED 8.4 (VPP)**
- **OSHA’s Management Systems eTools**
- **ANSI Risk Assessment ANSI B11.0-2000**
- **Balanced Scorecard (Kaplan and Norton)**
  - [http://www.valuebasedmanagement.net/methods_balancedscorecard.html](http://www.valuebasedmanagement.net/methods_balancedscorecard.html)