Severe Injury & Fatality Prevention
Working on Solutions

Overview
- Severe Injury & Fatality (SIF) Trends
- Traditional Safety Strategies
- Measuring Safety Performance on Outcomes
- Normalization of Deviations
- The Role of Safety Culture
- Risk Assessments & Near Miss Investigation
- Human Performance Indicators
- Wrap up & Final Discussion

Work Operations/Tasks Associated With Severe Injury & Fatality Risk
- Working from heights
- Driving exposures
- Lockout/Tagout
- Confined spaces
- Machine guarding
- Crane operations
- Trenching and shoring/Excavation
- Bulk quantities of acutely hazardous chemicals
- Any situation involving upset conditions, non-routine work, or a change in plans.

Traditional Safety Efforts and Prevention of Severe Injuries/Fatalities
- Traditional safety efforts have significantly reduced the frequency of workplace injuries.
- Why do they often fall short for predicting and preventing SIF?
- What changes can we make to our safety programs and safety efforts to identify and control SIF exposures?

Traditional Safety Efforts Usually Focus on Outcomes
- Lagging Indicators
  - OSHA incident rate, DART rate
  - OSHA compliance inspections
  - Workers Compensation claims
  - Experience Modification Factor (EMOD)
- Are lagging indicators a good measurement tool for predicting total injuries?
- Are lagging indicators a good measurement tool for predicting SIF?
Safety Incentive Programs or Goals

- Traditional safety incentive programs reward employees for working a specified period of time without reporting an injury.
  - "zero accident" or "days without an accident"
- Safety Incentive Programs
  - Do they decrease accidents?
  - Do they decrease accident reporting including reporting of near misses?
  - Was employee making any effort to be safe or did they just get lucky for a certain period of time?
- Effective incentive programs focus on leading indicators instead of avoiding bad outcomes.

Traditional Safety Efforts
Do We Accept/Reward Risk Taking?

- It Often Depends on the Outcome.
- Poor decisions that result in bad outcomes are generally not accepted.
- Poor decisions that still result in success are often accepted and sometimes rewarded.
- How are good decisions that still result in delays, increased costs, or smaller losses viewed in your organization?

Focusing on Safety Outcomes can lead to a false sense of security

- "All is Well" at our company because we haven’t had the bad outcome yet
- Most Fatalities/SI are low probability
  - “Potential” explosions, falls, crashes don’t make news
  - “It has never happened before” syndrome
- Unsafe behaviors may be ignored or even rewarded based on a good outcome
- A balanced approach identifies critical operations and measures leading and lagging indicators

Near Miss Incidents

- What is the definition of a Near Miss?
- Are near misses a leading or lagging indicator?
- What makes the difference between a near miss and a severe accident?
- Why do we ignore near misses?
  - Frequent near misses can lead to:
    - False sense of security—It’s not going to happen to me
    - Normalization of deviations

Normalization of Deviance

- Getting away with bad behavior
- We get used to it if there is no bad consequence
- Abnormalities without consequence become the “new normal” leading to:
  - Not following procedures all the time
  - Relying on “common sense” of employees
A Shift in Safety Management Theory

- Historically the safety community viewed injury prevention through the paradigm of Heinrich’s Safety Triangle
- There is a fixed ratio between serious and less serious injuries
- All types/severities of injuries have the same underlying causes

Herbert William Heinrich

The Heinrich 300-29-1 Model

- Reducing the frequency rate of minor injuries will lead to corresponding reduction of major injuries
- You must work at the base of the “Triangle” to prevent injuries
- Unsafe acts and unsafe conditions were at the root of all injuries
New Understanding of Serious Injuries and Fatalities

A recent injury pattern has emerged across organizations and industries.
- Recordable and lost time injuries are declining steadily, at the same time serious injuries and fatalities are level or increasing.

A Shift in Safety Management Theory

- Think about how your organization is doing in accident prevention efforts...
- Chances are your organization is performing at a high level when it comes to total number of recordable accidents.
- Have your expensive injury claims decreased in the same manner?

A Shift in Safety Management Theory

- Recordable and Lost-Time injuries can be divided into two categories:
  - High
  - Low

New Understanding of Serious Injuries and Fatalities

- New insights that are disturbing to leading organizations:
  1) Not effectively reducing devastating injuries.
  2) New data is in contradiction with Heinrich’s Safety Model

Heinrich claimed that reducing injuries at the bottom of the triangle will result in proportionate reduction at the top. If this claim is true, then recordable injuries and serious and fatal injuries would decline in parallel, which they are not.

Only About 20% of Recordable and Lost-Time Injuries had the potential to be serious

New Prevention Strategy
A Shift in Safety Management Theory

- The underlying causes and correlates for more serious injuries are different from those underlying less serious injuries.
- Serious injuries and fatalities are most frequently associated with basic safety systems.

Lifesaving rules are used to prevent injury associated with high risk activities—not common sense.
- Lifesaving rules are important, but they are the last line of defense. If they fail, the risk of a serious injury is very high.
- Certain high risk situations act as precursors for serious injuries.

Precursor: an unmitigated high risk situation that will eventually result in a serious injury if allowed to continue.

Likely Precursors

1) Vehicles
2) Workplace Violence
3) Gravity
4) Mechanical
5) Electrical
6) Stored Energy
7) Chemical
8) Thermal
9) Radiant Energy
Non-Routine Event

- Series of high-risk, infrequently performed tasks.
- Tasks are tightly coupled, time constrained, and vulnerable to single point failures.
- Non-routine events are a common source of fatalities and severe losses.

A Shift in Safety Management Theory

- The new model says that certain kinds of situations give rise to precursors which are followed by serious and fatal injuries.
- Prevention efforts need to identify and focus in on these critically important precursors.

100% Compliance

- High risk activities should be identified
- Specific policies/procedures addressing severe injuries/fatalities should be developed
- Employees should be trained on/sign off on procedures/policies
- 100% compliance should be required

Written Policy Examples

- Seat Belt Policy
- Cell Phone/Electronics Policy
- Fall Protection
- Lockout/Tagout
- Confined Space
A Shift in Safety Management Theory

• These studies don’t suggest that less attention should be paid to preventing injuries that are more common and less severe.

Safety Management Theory Summary

• Serious injuries and fatalities are increasing in frequency
• Less serious injuries are steadily declining
• The potential for serious injury is present in only 20% of less serious injury
• More serious injuries often have different causes and correlates

Identifying Tasks in Your Workplace That Have SIF Potential

Safety Culture

Studies have shown that a strong safety culture can help to reduce the frequency and severity of workplace, injuries and illnesses.

Unsafe behavior is often rewarding

• Saves time
• Convenience
• Comfort
• Negative consequences unlikely

• To develop a strong safety culture we must overcome these hurdles.

Why are employees unsafe?
Traditional Safety Approach

- Management driven
- Rules and regulations
- Reports violations
- Uses discipline
- Provides little feedback—rarely a “thank you”
- Measures success with trailing indicator rates
- Sees occasional improvement

Leading Indicators

- Audits (PPE, Housekeeping, Guarding, etc.)
- New employee orientation activities and safety training
- Consistency of ongoing employee safety training efforts
- Participation of line supervisors in key safety activities
- Participation of senior managers in key safety activities
- Number of Safety Inspections completed
- Turnaround time on safety related work orders
- Completion of key safety certifications by workers and supervisors
- Risk Assessments/JSA’s Completed
- Safety Observations
- Safety Suggestions
- “Near Misses”

Safety Culture Assessment

Attitudes – Program Elements – Physical Conditions – Behavior

Mean Score Comparison

- Employees
- Supervisor
Establish a Culture Where

• Management and supervisors are committed to safety.
• Employees are encouraged to report dangerous work practices and near misses.
• Immediate action taken to implement safe procedures.
• Employees know to follow safe procedures 100% of the time.

RISK MANAGEMENT

Identifying, Assessing, Prioritizing & Reducing Risk

Risk Defined:

• Risk = Severity X Probability
• Risk = Severity X Probability X Exposure

Three Key Concepts

1. Incidents are the result of uncontrolled or inadequately controlled risk
2. Risk can and must be managed
3. To effectively impact incidents we must manage our risks
Hazard Evaluation - Setting Parameters

- Sample company risk parameters for a hazard

<table>
<thead>
<tr>
<th>Likelihood/Probability</th>
<th>Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Almost Certain (4)</td>
<td>Major Event (4)</td>
</tr>
<tr>
<td>Could Happen (3)</td>
<td>Severe (3)</td>
</tr>
<tr>
<td>Unlikely (2)</td>
<td>Moderate (2)</td>
</tr>
<tr>
<td>Extremely Unlikely (1)</td>
<td>Minimal (1)</td>
</tr>
</tbody>
</table>

- Note:
  - “Severe” is a likely disabling injury
  - “Major Event”- fatality or several disabling injuries

Using a Risk Assessment Matrix

<table>
<thead>
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</tbody>
</table>

- **Class C Hazard**: Continue with task after completion of required actions.
- **Class B Hazard**: Stop! Inform supervisor. Develop and implement controls.
- **Class A Hazard**: Stop! Inform supervisor. Complete a Job Hazard Analysis.

Near Miss Tracking

- Benefit
  - Why not ignore?
  - What can be learned?
  - When should we investigate?
  - What was the potential for hurt?
  - Track SIF as closely as injury rate

Human Performance: A New Way of Thinking

Systems thinking is about relationships...

Not about breaking down the event into its individual parts.

Purpose of Human Performance

To proactively prevent "Unwanted Outcomes" triggered by human error.

Reducing Errors should not be the primary focus. It should be reducing the consequences of errors!
A Simple Model

Performance outcome $Y$ is a function of factors $X$.

$Y = f(x)$

THE CHALLENGE; IDENTIFYING WHAT FACTORS AFFECT PEOPLE PERFORMANCE

WHY A HUMAN PERFORMANCE IMPROVEMENT APPROACH?

INDUSTRY EVENT CAUSES DUE TO HUMAN PERFORMANCE

5 Principles
1. People are fallible, and even the best make mistakes.
2. Error-likely situations are predictable, manageable, and preventable.
3. Individual behavior is influenced by organizational processes and values.
4. People achieve high levels of performance based largely on the encouragement and reinforcement received from leaders, peers, and subordinates.
5. Events can be avoided by understanding the reasons mistakes occur and applying the lessons learned from past events.
Exercise

How many times does the uppercase or lowercase letter "F" appear in the following sentence?

Finished Files are the Result of Years of Scientific Study Combined With the Experience of Many Years.

“Mistakes arise directly from the way the mind handles information, not through stupidity or carelessness.” – Edward de Bono PhD

ERROR PRECURSORS
SHORT LIST

Task Overloads

- Time pressure on a hurry
- High Workload / memory requirements
- Knowledge / Complex tasks
- Repetitive actions / monotony
- Interpretation requirements
- Unknown Problem-solving skills

Individual Capabilities

- Uncontrollable / stubborn
- Stupidity / Carelessness
- Uninformed / Inadequate training
- Inaccuracy / Inadequate training
- Inadequate system response
- Schizophrenia / mental illness
- Inadequate equipment condition
- Inadequate risk perception / (Pollyanna)
- Lack of elimination indication
- Mental illness / sickness
- Personality conflicts
- Lapsed short-term memory

Work Environment / Human Nature

- Pressure / Interruptions
- Stress / Mental attention
- Changes / Variations from routine
- Unforeseen / Unexpected
- Controlling
- Uncontrollable / Inadequate training
- Inadequate / Inadequate training
- Inadequate / Inadequate training
- Inadequate / Inadequate training
- Inadequate / Inadequate training

Source: http://www.larkin.biz/
**Performance Modes—Attending Problems**

- Inaccurate Mental Picture
- Misinterpretation
- Skill-Based Action
- Inattention


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**Questioning Attitude Meter**

- Healthy Unreadiness/Wariness
- Uncertain Trusting
- Too Centrally Fixated
- What Could Go Wrong?
- What Am I Going to Do To Make It Safe?

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**Challenger...**

- Liquid hydrogen tank explodes, ruptures liquid oxygen tank
- Resulting massive explosion destroys the shuttle

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**The Legacy of Challenger**

- The Rogers Commission, which investigated the incident, determined:
  - The SRB joint failed when jet flames burned through both o-rings in the joint
  - NASA had long known about recurrent damage to o-rings
  - Increasing levels of o-ring damage had been tolerated over time
  - Based upon the rationale that "nothing bad has happened yet"

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**O-Ring Problems**

- As early as 1971 and 1977 engineers said O-Ring design was flawed but was accepted in 1980 as flight worthy anyway
- Evidence of O-Ring problems showed up in the 2nd shuttle flight
- NASA waived their own procedures 6 times and flew knowing the risk, before the loss of the shuttle and crew in 1986
NASA Shuttle Losses and the “Normalization of Deviance”

• Term was coined by Dr. Diana Vaughn, a sociologist, in her book *The Challenger Launch Decision*
• “the gradual process through which unacceptable practice or standards become acceptable”
• There are crucial lessons for the practice of Safety in all organizations in her Book and in the Columbia Accident Investigation Board (CAIB) report

Recall our earlier discussions of the perceptions of near misses and the need to capture that data in your organization, as well as act on it

Is it OK in your organization to say “I don’t feel good about doing this”?

Are there work activities in your organization today that you believe are not best practice but are tolerated?

Analysis using damage prediction software “Cater” was conducted – personnel were inexperienced in its use and erroneously concluded that damage was unlikely

British Petroleum- String of Disasters

2005, 15 killed 180 injured (23 more killed in Accidents in prior 30 years)

2006, 480 barrels spilled

2007, 11 dead, 17 injured, 4.9M barrels spilled

Are there work activities in your organization today that you believe are not best practice but are tolerated?
A Tale of Two Companies: British Petroleum vs Exxon

• The US government report issued in September 2011 stated that, although the events leading to the sinking of Deepwater Horizon were set into motion by the failure to prevent a well blowout, the investigation revealed numerous systems deficiencies.
• The loss of life and the subsequent pollution of the Gulf of Mexico were the result of poor risk management, last-minute changes to plans, failure to observe and respond to critical indicators, inadequate well control response, and insufficient emergency bridge response training by companies and individuals responsible for drilling at the Macondo well and for the operation of the drilling platform.

(35,050 ft deep well in 5,100 ft of water)

Exxon

After the 1989 Exxon Valdez disaster the company vowed “never again”.

“That accident was the low point in ExxonMobile’s history. But it was also a turning point” (Rex Tillerson, Chairman)

Exxon BlackbeardWest Gulf Well (2005)

- Ultradeep like Macondo (32,000 feet) but in shallower water (70ft below sea level)
- Exxon’s Drillers encountered similar problems as BP did at Macondo
- Exxon’s risk management assessment called for abandoning the job on the Driller’s recommendation
- Chairman of the Board Rex Tillerson approved walking away from the $187,000,000 investment

Oil & Gas Industry Initially Critical of Exxon Decision, But...

“Exxon’s ‘lack of guts’ looks a lot more like justified conservatism and prudence, and a prescient awareness that safety, caution and catastrophic risk avoidance would be key themes as oil companies were forced to push the envelope in search of new oil...the fact is that Valdez pushed Exxon to the highest safety standards in the industry.”
- Deutsche Bank, July 2010

Conclusions

• Most major catastrophes follow some variation of these patterns even if on a smaller scale
• In 2013, 37 Utahans were killed in work related fatalities
• “Any man’s death diminishes me, because I am involved in mankind, and therefore never send to know for whom the bell tolls; It tolls for thee.” — John Donne “No Man is an Island”

Thank You!