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NEW APPROACHES FOR FATALITY AND SERIOUS INJURY PREVENTION

Select Findings from ORCHSE Strategies, LLC

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ORCHSE Strategies, LLC. : Who We Are…

- **The world's premier global family of safety, health, and environmental networks for industry leaders**
  - A unique forum for developing and sharing innovative strategies and effective practices to help members achieve and sustain superior EH&S performance
  - A respected and influential business voice in the development of OSH policies, regulations and programs in the U.S.
  - A growing impact on the development of OSH and environmental policies globally

ORCHSE Networks Members

Senior corporate occupational safety and health and environmental leaders

FROM

120 leading global corporations

IN

More than 20 industry sectors

Participate in one or more of nine different networks, and between meetings engage in task forces, work groups, and extensive benchmarking

The ORCHSE network model is built upon the premise that member value is maximized by capturing best practices and lessons learned across multiple industries

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Lots of Ground To Cover Today…

Part 1. Setting the Table

A. Current Challenges in Preventing Fatalities and Serious Incidents

B. Understanding Core Concepts

Part 2. A New Framework for Integrating FSI Prevention Efforts

- A new way to consider risk
- A six step approach for identifying, prioritizing and addressing situations with high severity potential
- Keys to implementing Human and Organizational Performance Concepts

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Part 3. Practical Application: Examples of Converting Concepts to Practice

ALCOA
Owens Corning
3M
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Issues That We Are Attempting to Address

- How to better identify situations that have a greater likelihood to result in a fatality and/or serious injury
- How to better set priorities for addressing those situations
- Improved hazard mitigation strategies that assist in determining:
  - **The appropriate levels of control**
  - **Number of layers of control**
  - **How can you tell when protection is sufficient?**
- ➢ A way to identify and address company/site/process human and organizational performance (HOP) characteristics that can contribute to fatalities and serious injuries
- How to integrate the new prevention process into ongoing operations and keep it evergreen

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Acknowledgements: We stand on the shoulders of many S&H innovators…

- **Earl Carnes** DOE Thought Leader
- **Todd Conklin** (*Pre-Accident Investigations*)
- **Rob Fisher, Tony Muschara, John Summers** Knowledgeable Consultants
- **Sidney Dekker** (*The Field Guide to Understanding Human Error, 2006*)
- **Atul Gwande** (*The Checklist Manifesto*)
- **Erik Hollnagel, (***Safety I and Safety II***)**
- **Tom Krause** *(Seven Insights Into Safety Leadership)*
- **Nancy Leveson** *(Engineering A Safer World)*
- **Fred Manuele** *(On the Practice of Safety)*
- **Dan Petersen** (*Techniques of Safety Management: A Systems Approach; Safety by Objectives: What Gets Measured Gets Done*)
- **James Reason** (*Human Error; Managing the Risks of Organizational Accidents)*
- **Scott Shappell** *(A Human Error Approach to Aviation Accident Analysis: The Human Factors Analysis and Classification System -HFACS*)

- **ORCHSE Fatality and Serious Injury Prevention Task Force; ORCHSE New View Task Force; ORCHSE Alternative Metrics Task Force**

Note: Our teams have been "cross functional"…

Part 1. Setting the Table

A. Current Challenges in Preventing Fatalities and Serious Incidents

B. Understanding Core Concepts

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Problem Statement…

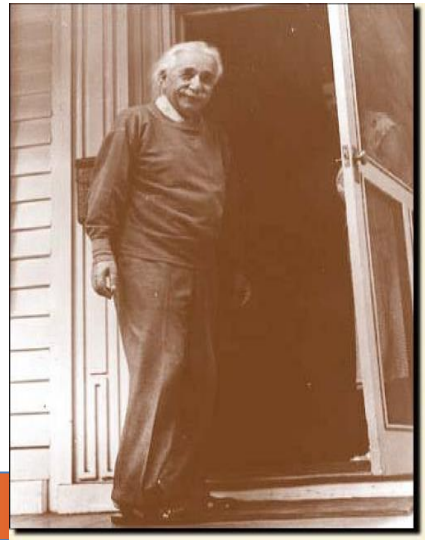
In many industries and companies, OSHA injury and illness rates have dropped dramatically in recent years; fatalities and serious injuries have **not** experienced a similar decline. (BLS recently reported that fatality rates are up.)

- S&H pros are perplexed about continuation of serious cases
- Some companies are experiencing an up-tick in "serious near misses"
- Contractors represent a particular challenge

➢ It is clear that traditional approaches to safety and health are not sufficient for fatality and serious injury prevention

"We can't solve problems by using the same kind used when we created them."

Albert Einstein



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Some Reasons Why FSIs Continue to Occur

- Lack of respect for the hazard
  - Failure to recognize hazard
  - Failure to appreciate the risk (and potential consequences) of hazards that are recognized due to flawed risk assessment
  - Complacency in living with the hazard ("Normalization of Deviation")

- Reliance on workers to be last line of defense with serious hazards;
  - Using low level controls in ***critical*** *steps*
  - Expecting workers to never make a mistake

- *Failure to recognize/address related human and organizational performance (HOP) factors that are error provocative and/or undermine defenses*

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Foundations: FSI Definition

- **Fatality**
- **Life-threatening injury or illness:** one that if not immediately addressed is likely to lead to the death of the affected individual, and will usually require the intervention of internal and/or external emergency response personnel to provide life-sustaining support. Examples include, but are not limited to:
  - Laceration or crushing injuries that result in significant blood loss;
  - Injury involving damage to the brain or spinal cord;
  - Event which requires the application of cardiopulmonary resuscitation or an external defibrillator;
  - Chest or abdominal trauma affecting vital organs.
- **Life-altering injury or illness:** one that results in impairment or loss of use of an internal organ, body function, or body part. Examples include, but are not limited to:
  - Significant head injuries
  - Spinal cord injuries,
  - Paralysis,
  - Amputations
  - Broken or fractured bones

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Food for Thought: Pillars of the S&H Profession that May Be Myths When It Comes to Serious Injury Prevention:

1. The mistaken interpretation ***of the Heinrich Pyramid*** that managing less serious hazards at the bottom will effectively address higher consequence hazards at the top;

2. Collective ***misuse of OSHA data*** as the primary metric for driving and assessing safety performance;

3. *Over-emphasis* on history-based probability estimates when determining ***"likelihood"*** in conducting risk assessments;

4. Failure to effectively argue against the ***mistaken belief that higher level controls are generally cost prohibitive***; and

5. The incorrect ***assumption that most injuries are caused by unsafe acts*** (fueled and reinforced by flawed incident investigations).

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Factors that Contribute to FSIs

Where to Look; Where Not to Look

- The causes are different. *Different sets of circumstances surround severity (*Dan Petersen on serious injuries in 1989…). FSIs tend to occur:
  - **In unusual and non-routine work**
  - **Where upsets occur**
  - **In non-production activities**
  - **Where sources of high energy are present**
  - **During at-plant construction operations**
- *Frequency reduction does not necessarily produce equivalent severity reduction…* (Fred Manuele):

  "…The data require that we adopt a different mindset, and a particularly different focus on preventing events that have serious injury potential."
- *There appears to be no relationship between OSHA injury rates and fatalities (*2007 Rand Study):
  - **The absence of minor injuries is NOT predictive of the absence of future fatalities**
  - **The presence of minor injuries is NOT predictive of the presence of fatalities in the future.**

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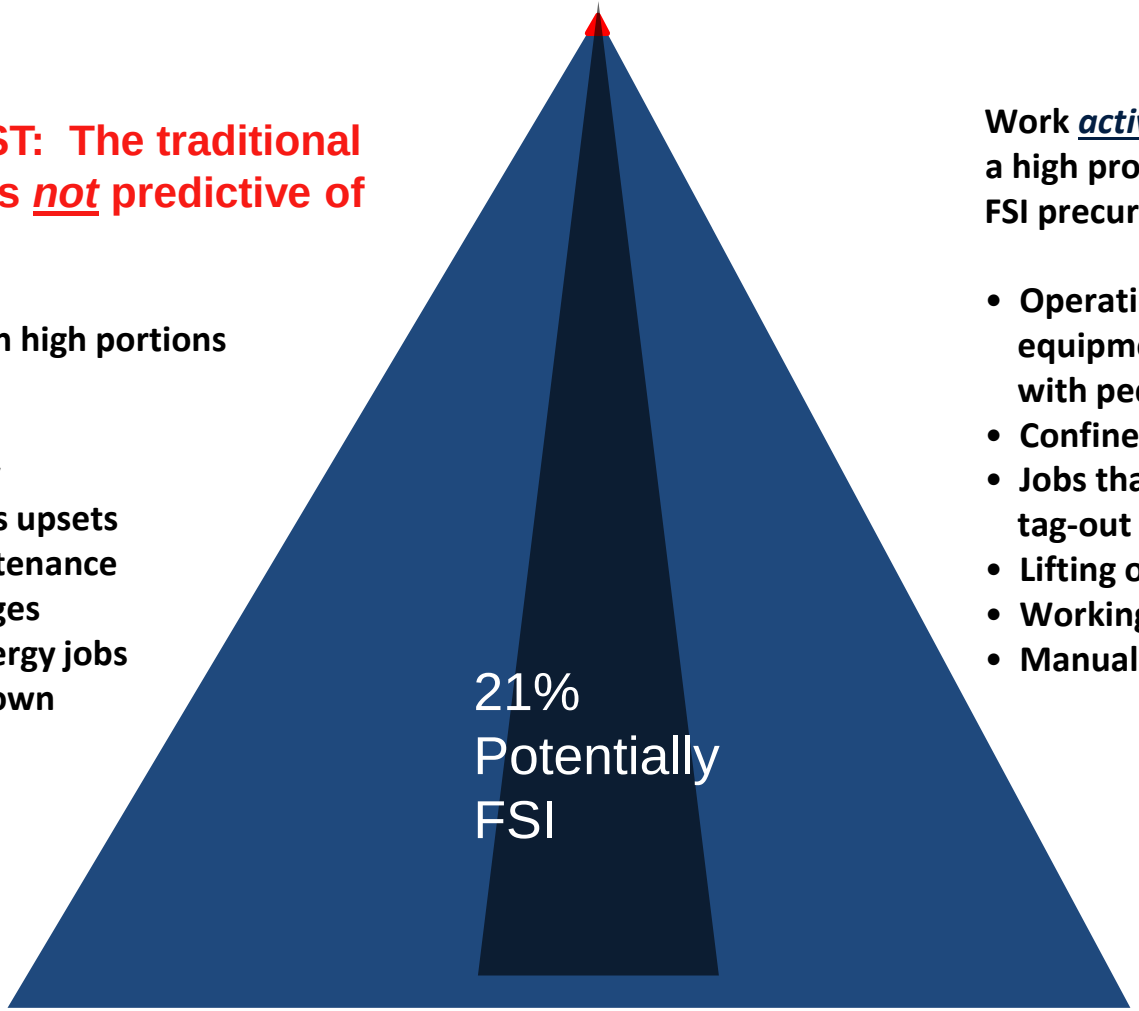
Is the Safety Triangle Accurate *Predictively*?

Tom Krause, BST: The traditional safety triangle is *not* predictive of FSIs

Work *situations* with high portions of FSI precursors:

- **Process instability**
- **Significant process upsets**
- **Unexpected maintenance**
- **Unexpected changes**
- **High potential energy jobs**
- **Emergency shutdown procedures**



Work *activities* that may have a high proportion of FSI precursors:

- **Operation of mobile equipment (and interaction with pedestrians)**
- **Confined space entry**
- **Jobs that require lock-out tag-out**
- **Lifting operations**
- **Working at height**
- **Manual handling**

➢ **"Current measurement systems create a"blind spot" for serious injury prevention"**

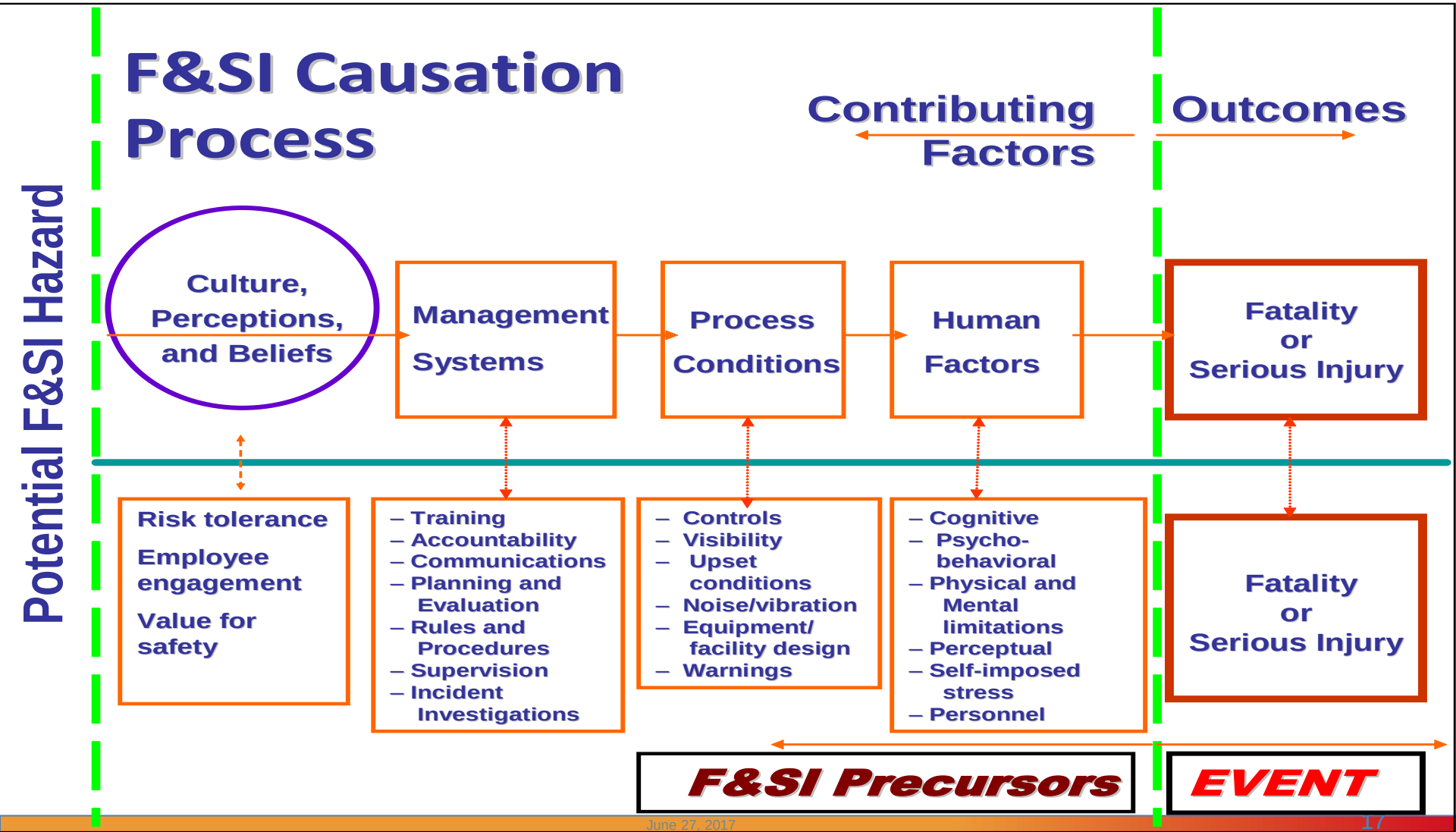
BST study findings

Key Concept

Fatality and Serious Injury Precursor:

A *situation* involving a combination of hazard(s) and underlying human and organizational factors that if left unaddressed can result in a fatal or serious injury. (Context is critically important)

Rationale for Including Human and Organizational Factors that Contribute to FSIs



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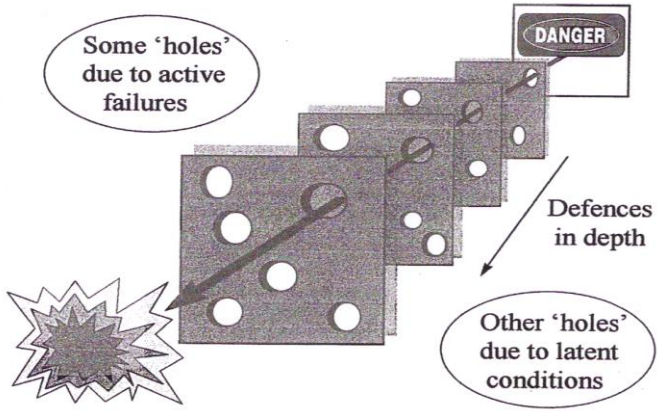
Understanding Human Error



James Reason

- Serious injuries have **multiple causal factors**
- Less than adequate tools, equipment, and processes may be present for many years before they combine with local circumstances and active failures to penetrate the system's layers of defenses

Todd Conklin on Human Error

- Workers don't usually **cause** events
- Workers **trigger** latent conditions that exist in systems, processes, procedures, and expectations that always lie dormant on the job site

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Todd Conklin: Accident Defined = An Unexpected Combination of Normal Variability

- We must strive to understand that accidents don't happen because people gamble and lose.
- Accidents happen because:
  - the person believes that what is about to happen is not possible…
    - They may have performed the task before without consequence
  - or what is about to happen has no connection to what they are doing…
  - or, that the possibility of getting the intended outcome is well worth whatever risk there is

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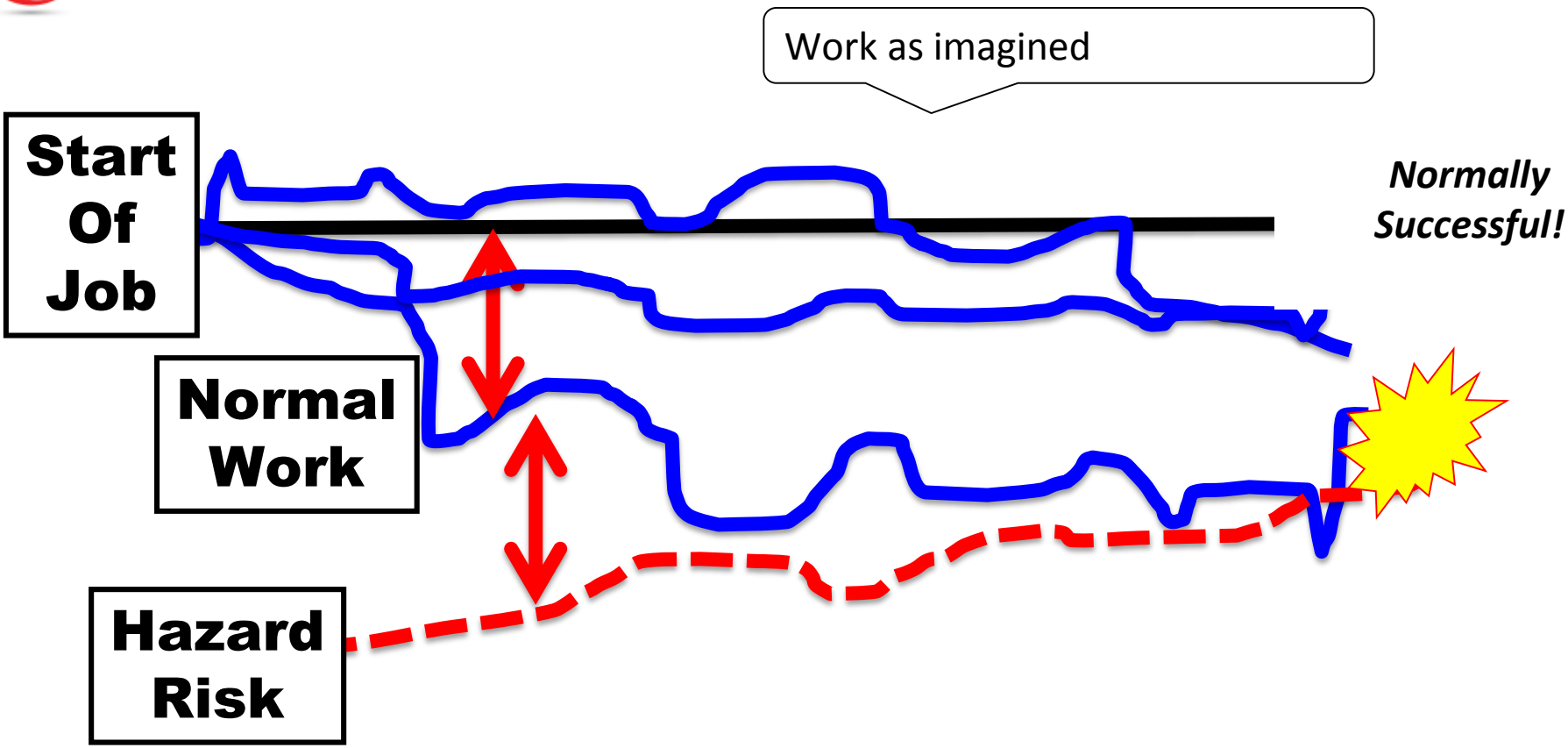

Safety Understood:
How work actually gets done.

Todd Conklin

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Sydney Dekker

- Human error is a symptom of trouble deeper inside a system
- To explain failure find how people's assessments and actions made sense at the time given the circumstances that surrounded them
- Rationality principle -- People generally do reasonable things given their point of view and focus of attention; their knowledge of the situation; their objectives and the objectives of the larger organization in which they work
  - Goals include their objectives and the objectives of the larger organization in which they work
  - Mindset affects their point of view and focus of attention
  - Context includes their knowledge of the situation and the systems and processes in which they work

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Risk Management Strategy – Tony Muschara

1. To minimize the **frequency** of occurrences:
   - Reduce *active errors* at critical process points
   - Reduce *drift* in standards with safe practices
   - Operationally oriented focus
2. To minimize the **severity** of occurrences:
   - Reduce effects of *latent errors* (conditions)
   - Minimize the *accumulation* of latent system weaknesses
   - Organizationally oriented management focus

Chris Hart, NTSB Administrator…

When Things Go Wrong

How It Is Now . . .

You are highly trained

and

If you did as trained, you would not make mistakes

so

You weren't careful enough

so

You should be PUNISHED!

How It Should Be . . .

You are human

and

Humans make mistakes

so

Let's *also* explore why the system allowed, or failed to accommodate, your mistake

and

Let's IMPROVE THE SYSTEM!

Nancy Leveson

A Systems View of Operator Error:

- Operator error is a symptom, not a cause
- All behavior is affected by context (system) in which it occurs
- To do something about operator error, look at system in which people work:
  - Design of equipment
  - Usefulness of procedures
  - Existence of goal conflicts and production pressures

Human error is a <u>symptom</u> of a system that needs to be redesigned

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Principles of Human & Organizational Performance (HOP)

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. Management's response to failure matters

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Five Characteristics of High Reliability Organizations (HRO)

1. **Preoccupation with Failure:** Error reporting is encouraged and lapses are treated as a symptom that something may be wrong with the system.
2. **Reluctance to Simplify:** They know that the world they face is complex, unstable, and unpredictable.
3. **Sensitivity to Operations:** Attentive to the front line where the real work get done, with well developed situational awareness that allows them to make adjustments

Five HRO Characteristics cont.

4. **Commitment to Resilience:** HROs detect, contain, and bounce back.

4. **Deference to Expertise:** People with the most expertise are valued regardless of rank. Many decisions are pushed down in the organization and made on the front line.

HRO Summary

- According to Karl Weick and Kathleen Sutcliffe, high-reliability organizations have:

  1. The capacity to avoid catastrophic events, and

  2. The capacity to minimize their damage if one ultimately does occur.

- Erik Hollnagel provides a similar perspective in Safety One and Safety Two; that we should concentrate less on tracking failure and more on assessing the presence and quality of safety systems.

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HOP and HRO as Key Factors in FSI Prevention

Human and Organizational Performance (HOP) Characteristics – and - Characteristics of High Reliability Organizations (HROs) are really two sides of the same coin

- HOP issues focus on the CONTEXT in which employees must address the hazards associated with their operation
- HRO issues focus on organizational CAPACITY to effectively deal with those hazards

Both have a profound impact on overall risk

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High Reliability Performance Comes From…

- Identifying and assessing risks
- Identifying and understanding points of human interaction with hazards in the process
- Providing high-levels (or multiple layers) of control at critical steps
  - Not expecting people to never make a mistake and relying on them to single handedly control the risk
- Continuously improving by learning from data: precursor events, near misses, etc.

Part 2. A New Framework for Integrating Prevention Efforts

- A new way to think about risk
- A six step approach for identifying, prioritizing and addressing situations with high severity potential
- Keys to implementing Human and Organizational Performance Concepts

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ORCHSE Proposed New Risk-Based Approach Challenge: How To Tie All This Stuff Together

If current approaches for identifying, evaluating, and managing hazards do not sufficiently protect workers from the most serious hazards, what is needed? What are the specific limitations/gaps in existing approaches and how do we overcome them?

Solution:

A new risk model that creates a separate track for addressing serious hazards:

- Doesn't require discarding what works; can be integrated into ongoing S&H prevention strategies
- Requires that key existing approaches be executed flawlessly at critical steps in your process/task
- Includes some new concepts and new tools

New model emphasizes the need for a heightened sense of awareness and vulnerability in precursor situations.

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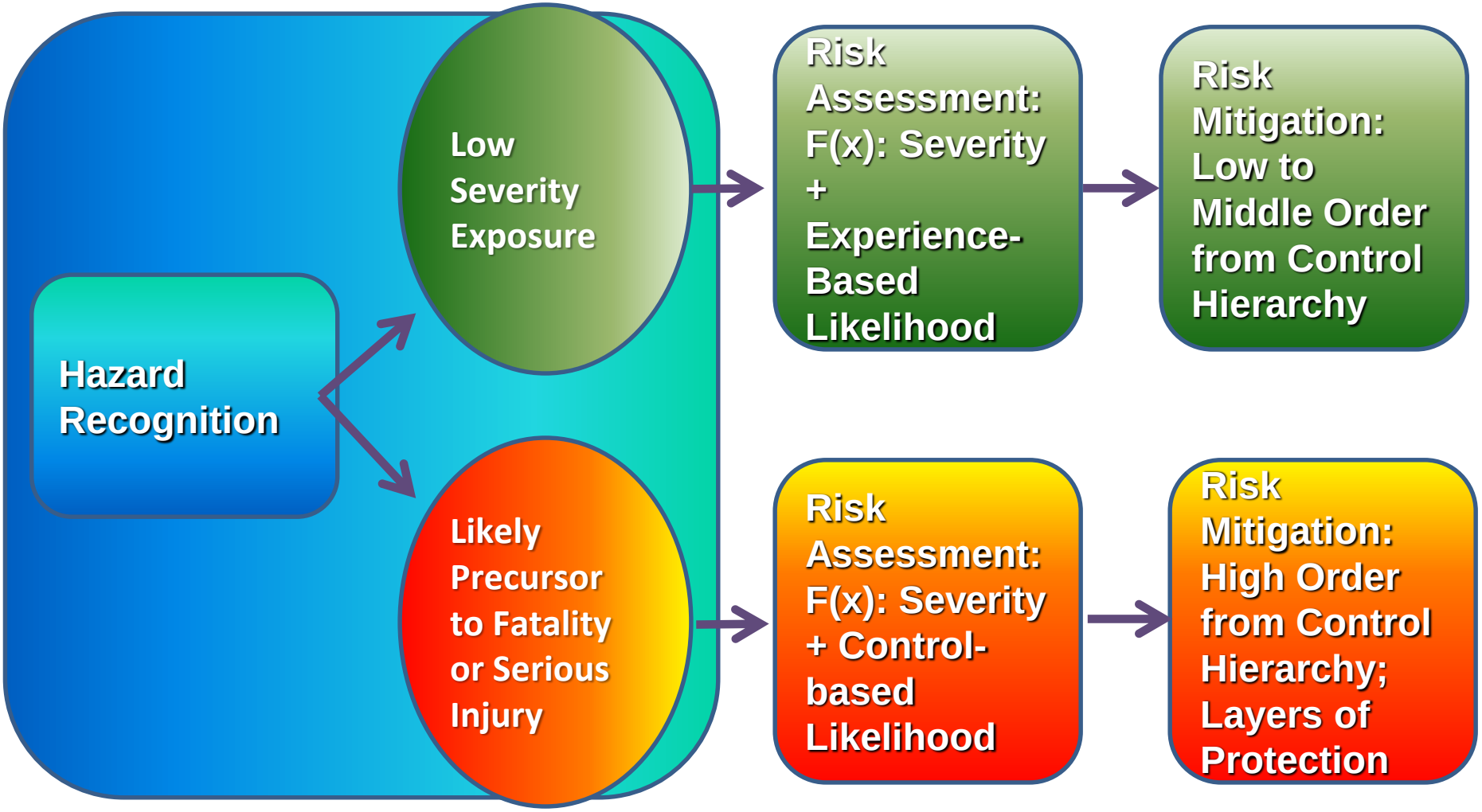
Dual-Path Strategy for Prevention



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Challenge: How do you translate key concepts into practical realities?

Solution: Six Steps Towards a Fatality and Serious Injury-Free Workplace

1. Assess Current Situation and *Set the Stage* for the Technical and Cultural Shift Required to Address Risk with FSI Potential
2. *Conduct Initial Threat Assessment*; Identify the *Most Serious* Situations that Are Potential FSI Precursors
3. Conduct *Risk Assessment* and Refine Priorities for Intervention
4. Ensure Adequate *Control of the Hazard*
5. Address Key *Human* and *Organizational Factors* That Impact Performance
6. Ensure *Infrastructure* (management systems, metrics, etc.) In Place Required to Drive *Continuous Improvement*

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1 Assess Current Situation and Set the Stage for the Technical and Cultural Shift Required to Address Risk with FSI Potential

- Engage leadership to:
  - *Proactively shift focus* ***from "outcomes" to the risks*** that drive them
  - Define *an* ***acceptable level of risk*** for the organization
  - Understand and support ***identifying and addressing serious hazards that are not compatible with that vision/value***
  - Consider establishing ***new levels of competence*** throughout the organization
- Identify and address potential barriers to implementation
  - Management system gaps
  - Ineffective metrics
  - Certain aspects of the culture (e.g. risk tolerance) in which you are operating

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2

Conduct Initial Threat Assessment; Identify the Most Serious Situations That Are FSI Precursors

- Eliminating FSIs requires that situations that are likely FSI precursors be inventoried, assessed and managed
  1. Hazards that could result in serious injury or death
  2. Related human and organizational factors that could activate or intensify the hazard or undermine controls
- The inventory should be constructed on a task basis, populated by "what keeps you up at night":
  1. Observations of current processes
  2. Learnings from past incidents and other data sources
  3. Begin by looking for tasks that include well-known hazards such as exposure to high energy, working at elevation, etc.

➢ Why assess tasks? Because a portion of FSI's are "one offs…not reflected in existing data…

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3

Conduct Risk Assessment and Refine Priorities for Intervention

- Take the "guesswork" out of risk assessment when the consequences of a bad guess may result in tragedy
  1. Evaluate precursor situations based on:
     - The potential severity of the hazard (severity),
     - Degree of control (likelihood),
     - Number workers exposed (magnitude)
  2. Related human and organizational factors that could activate or intensify the hazard or undermine controls and integrate into the risk assessment

➢ Use the resulting Final Risk Assessment to:
- Set priorities for FSI intervention
- Drive continuous improvement on two levels
  - Hazard mitigation
  - Underlying human and organizational factors

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4

Ensure Adequate Hazard Control

- Identify critical steps in the process...tasks where an incident could result in employees being seriously injured or killed (via task based inventory)

- Be proactive to insure operational consistency in these steps, such as promoting the use of checklists for key aspects

- Anticipate mistakes
  - No matter how hard we try, mistakes happen…it is part of the human condition
    - It is risky to expose workers to serious hazards, provide lower level controls, and expect them to never make a mistake

- Mistake proof critical steps whenever possible…shift emphasis to higher level controls and prevention through design. Use multiple levels of control when necessary

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5

Integrate Human and Organizational Performance issues Into The Risk Identification and Abatement Process

- When it comes to assessing incidents there is a basic lack of understanding of the impact on S&H performance (FSIs) by:
  - **Cultural and organizational norms;**
  - **Policies and practices (management system elements);**
  - **Process conditions; and**
  - **Human factors**
- The misunderstanding is often fueled by flawed incident investigations and a culture that frequently focuses on assigning blame and concentrating on the last factor in a chain of events leading up to the case.

➢ Human and organizational performance (HOP) issues need to be incorporated into precursor recognition and assessment strategies.

- Many (perhaps most) FSI precursor situations require hazard management AND corrective actions around HOP

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6

Ensure Infrastructure (Management Systems, Metrics, etc.) Is In Place to Drive Continuous Improvement

- Effectively preventing fatalities and serious injuries requires a shift in some technical aspects of hazard recognition, assessment, and mitigation
- However, cultural and organizational improvements are also critical, and are key to sustaining FSI prevention efforts over the long term
- To sustain and drive continuous improvement, changes need to be made in ongoing management system requirements
- Changes also need to be made in metrics used to measure prevention efforts and evaluate performance
    - Trailing
    - Leading

Part 3. Practical Application: Examples of Companies Converting Concepts to Practice

Owens Corning

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Owens Corning: Define Level of Acceptable Risk

- Engaged leadership to consider and define an acceptable level of risk for the enterprise
- The defined level of risk becomes a benchmark against which to compare existing operations and the need for improvement
- Makes it easier to identify and set priorities; get resources; respond to push back
- Impacts culture by sending a signal to workers that leadership cares about their wellbeing

ALCOA

ALCOA: Pre-job Brief and Risk Assessment

- Work teams identify high risk task of the day
- A high risk task defined:
  - An identifiable function of a job or activity
  - has one or more critical steps *(if omitted or performed incorrectly)*
  - has the potential for single point vulnerability

  – **….that can lead to fatal or life-altering consequences**

ALCOA: Reducing Risk Through Pre-Job Risk Assessment and Task Briefings

- **Trigger** – We recognized that people, programs, and processes, the work environment, organization, and equipment are all part of a system. Flaws in the system impact the performance of the individual and flaws in the individual impact the system.

- **Hazard** – It's not how long somebody has been in the job that's important. What really matters is how many times this person has done this task prior to this time. Simply put, doing something for the first time or so infreqently it is veiwed as a non-routine task increases the risk.

- **Best Practice** – A pre-job/task discussion focused on ensuring each person involved in the task, regardless of their experience, is aware of the critical steps and what could go wrong,the potential hazards and error-likely situations along with the procedures that apply and the layers of protection available to them. Most importantly it t provides a means to agree on clear STOP Work Criteria.

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International Paper

International Paper

It's about...

LIFE

LIFE-CHANGING
INJURY AND
FATALITY
ELIMINATION

INTERNATIONAL PAPER

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LIFE Incident Definition/Criteria

What is a LIFE Incident?

An injury that results in 14 or more calendar days away from work AND involves:

- Organ Damage
- Concussion or Other Brain Trauma
- Bone Fracture
- Crushing Injury
- Degloving of the Hand, Finger, or other Extremity*
- Serious 2nd or 3rd Degree Burn**

*Degloving is an injury to an extremity – finger, hand, arm, leg, or foot – in which the soft tissue is peeled off down to the bone.

**A serious burn covering 10% or more of the body, or results in diminished function or significant scarring.

OR

A Fatality or Amputation (regardless of lost workdays)

"Life-Changing" Injuries and Fatalities

It's about... LIFE

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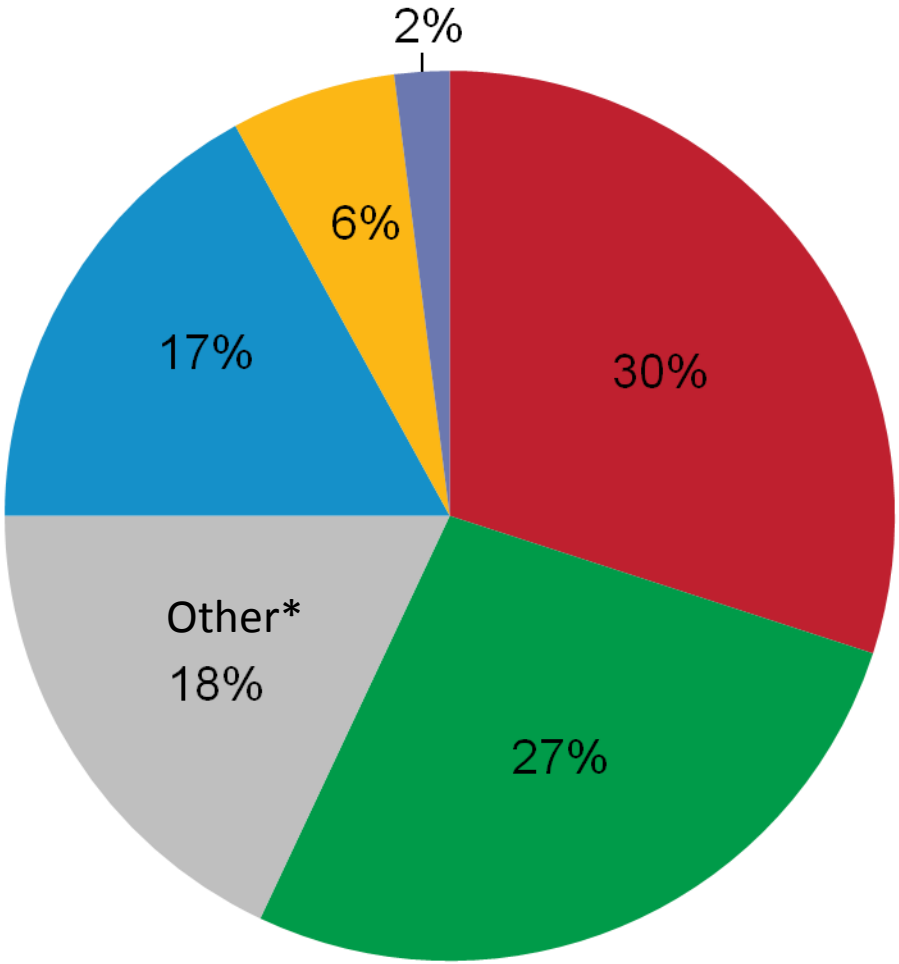
LIFE Incident Analysis 2007-2010
Led to 5 Focus Areas



- Machine Safeguarding
- Falls
- Motorized Equipment
- Harmful Substances or Environments
- Driver Safety

***Other – primarily acute trauma due to material handling**

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LIFE Strategy

Communicate Effectively	Engage Stakeholders	Make Safety a Core Value
Learn From Past Mistakes	Benchmark Best Practices	Project Teams & Data Driven
Improve Training & Education	Change the way we measure safety performance	Be Global

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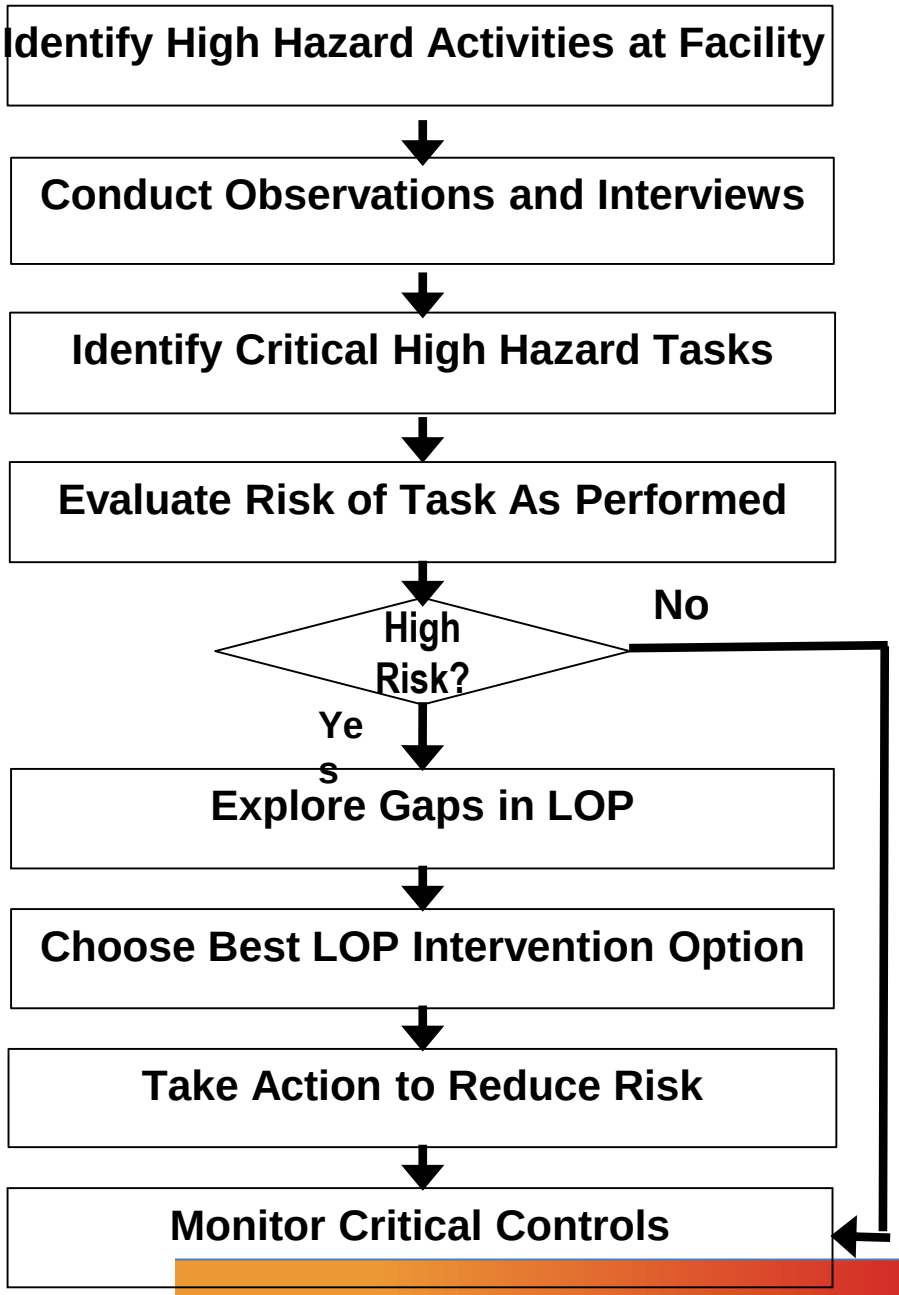
The Approach



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Core List Of Higher Hazard Activities

- *Working Around Mechanical Hazards Where Guarding Is Critical*
- *Handling Toxic / Reactive / Corrosive / Flammable Materials*
- *Mobile Equipment / Vehicle Operations*
- *Loading / Unloading Bulk Materials (High Volume Liquids or Solids)*
- Working on Energized Systems or Under Lockout / Tagout
- Confined Space Entry or Trench / Pit Excavation
- Pipe / Line Opening Operations
- Working At Heights
- Mechanical Lifting Operations
- Use Of Open Flame
- "Red Flag" Situations

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"Red Flag" Situations

- In unusual and non-routine work
- Where upsets occur
- In non-production activities
- During on-site construction activities
- Where sources of high energy are present

- Pressure
- Radiation
- Thermal
- Chemical
- Mechanical
- Electric al
- Gravity
- Mass / Inertia
- Biological
- Noise
- Body Mechanics

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Risk Assessment and Prioritization (RAP) Tool

Choose Most Appropriate Factor For Each Column			
Probability Of Control What is the likelihood of existing controls not working as intended?	**Frequency Of Exposure** How often or how long does personnel exposure to the hazard occur?	**Consequence Severity** If a control does not work as intended, what is the most likely consequence ?	**Risk Level Score** P x F x C
0.5 - Highly Effective	1.0 - Very rare	1 - Near Miss	0 to 11 (Level I Risk)
1.0 - Effective	1.5 - Rare	3 - Minor	12 to 80 (Level II Risk)
2.0 - Somewhat Effective	2 - Unusual	7 - Moderate	81 to 160 (Level III Risk)
4.0 - Somewhat Ineffective	3 - Occasional	15 - Serious	161 to 600 (Level IV Risk)
6.0 - Ineffective	4 - Daily	40 - Severe	601 to 1600 (Level V Risk)
8.0 - Highly Ineffective	6 - Repetitive	100 - Catastrophic	1601 to 4800 (Level VI Risk)
<select>	<select>	<select>	0
<select>	<select>	<select>	0
<select>	<select>	<select>	0

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According to 3M, In Assessing Controls, Consider…

- Are the right controls in place?
- Are there enough controls of sufficient strength?
- Are the controls reliable?
- Do the controls operate independently?
- How prone are the controls to human error?
- How are the most important hazard controls monitored for reliability?

General Electric

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GE HOP Journey

APPROACH

- Operating philosophy, NOT a new program
- Risk-based
- Focus on culture more than work control
- Flexible for Businesses deployment
- Not just EHS

METHOD

- Education
- Broad stakeholder involvement
- Integration into processes
- Initial focus on key tools/methods
- Standard terminology

- Experiment, Learn & Share
  - HOP Leaders in business who collaborate
  - Pilot sites
  - 10 Questions
  - SOD Matrix
  - Learning Teams

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Heat Map

Totals

- 4 Recordables
- 5 First Aids
- 165 Near Misses
- Concern Reports

High Risk Operations and Top Operational Hazards

Frequency (Low → High)

Housekeeping 2 Tubing/Piping Issues 9	Assembly / Disassembly Operations 2	Hand & Power Tool 1 12	Driver Safety 7	Crane Operations (Lifting & Rigging) 28 Release of Energy Sources 17
Chemical Management 1 3	Slips/Trips/Fall 1 1 5 Walking Working Surfaces 1 1 6	PPE 4	Working at Heights 9 Scaffolding 1 4	
Compressed Gas Usage 1 Boroscope / Inspections 2	Tooling (Customer Supplied and Tool Center) 1 1 5 Start-Up/Shut Down 3	Material Handing 4 Hot Work 6	GE Contractor Work 3	
Temperature Extremes Testing 3	Forklift/Lift Operations 2 Waste Mgmt	Industrial Hygiene Ergonomics, Noise Hex Chrome, Asbestos	Environmental Spills 5	Confined Space 2 Electrical Safety / High Voltage Work 2
Office Work 1	Loading/Unloading	Installation Site Work	Customer Contractor Work 5	Security

Low ← **Potential Consequence (without barriers or mitigants)** → High

- Gray = routine operation/activity
- Blue = non-routine operation/activity
- Striped = Customer control

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Strength of Defenses Matrix

Type / Purpose	Engineered Defenses	Admin Defenses	Management Oversight Defenses	Personal Protective Equipment	Cultural Defenses
Eliminate (substitute)	Ex: eliminate need for permit confined space entry, substitute les hazardous material, task redesign to eliminate hazard	Ex: SRA with Critical Steps. No single error vulnerability critical steps	Ex: Supervisor verify daily checklist inspection to confirm critical controls operating correctly		Ex: effective employee EXPECTATION to stop unsafe work; consistent management style reinforcing H&S
Prevent	Ex: machine guard, lo exhaust ventilation, o interlock	imum wo	Ex: Permit to Work before proceed with high risk task		Ex: Chronic unease and questioning attitude emphasized by leadership and employees
Catch	Ex: process over-pressure or high temperature sensors with emergency shutdown procedures	Ex: peer check at critical step	Ex: supervisor approval prior to high risk task	Ex: Faceshield for splash tection, cut resistant	Ex: stop when unsure
Detect	Ex: continuous air monitor to hazardous gas	Ex: pre-job checklist inspection	Ex: supervisor audits t verify use of establishe procedures. Add to supervisor scorecard.		Ex: active use of Concern Reports
Mitigate	Ex: blast barriers, noise baffles	Ex: training on response to unexpected conditions, CSE emergency rescue arrangement	Ex: supervisory verification that only necessary and qualified personnel allowed where HRO to be performed	Ex: Vibration attenuation gloves	Ex: Value system, priorities

Stronger

Weaker

Adapted from Muschara Error Management Consulting LLC

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Organizational Learning
Todd Conklin's Learning Teams

Old View

- Starts with employee
- Focuses on "why" event occurred
- Looks for a "root cause"
- Tries to fix the employee
- A "crime & punishment" approach
- Makes employees feel guilty and wrong

HOP View

- Starts with the process, work towards the event
- Tells the story of "how" the event occurred
- Identifies "latent conditions"
- Fixes the process by building better defenses
- A holistic "diagnose & treat" approach
- Makes our organization better.

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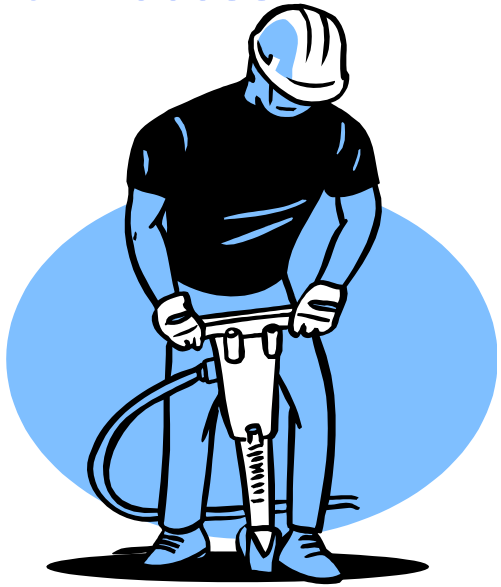
Drilling Down on Two Key Steps

3 **Conduct Risk Assessment and Refine Priorities for Intervention**

5 **Integrate Human and Organizational Performance issues Into The Risk Identification and Abatement Process**



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Conduct Risk Assessment and Refine Priorities for Intervention

- Take the "guesswork" out of risk assessment when the consequences of a bad guess may result in tragedy
- Evaluate precursor situations based on:
  1. The hazard
     - The potential severity of the hazard (severity),
     - Degree of control (likelihood),
     - Number workers exposed (magnitude)
  2. Related human and organizational factors that could activate or intensify the hazard or undermine controls and integrate into the risk assessment

➢ Use the resulting Final Risk Assessment to:
- Set priorities for FSI intervention
- Drive continuous improvement on two levels
  - Hazard mitigation
  - Underlying human and organizational factors

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Integrate Human and Organizational Performance issues Into The Risk Identification and Abatement Process

- When it comes to assessing incidents there is a basic lack of understanding of the impact on S&H performance (FSIs) by:
  - **Cultural and organizational norms;**
  - **Policies and practices (management system elements);**
  - **Process conditions; and**
  - **Human factors**
- The misunderstanding is often fueled by flawed incident investigations and a culture that frequently focuses on assigning blame and concentrating on the last factor in a chain of events leading up to the case.

➢ Human and organizational performance (HOP) issues need to be incorporated into precursor recognition and assessment strategies.

- Many (perhaps most) FSI precursor situations require hazard management AND corrective actions around HOP

Problem with Experience-Based Probability

- Traditional risk assessment is based on judgment about the severity of the hazard and the likelihood of occurrence (probability).
- Probability assessments are usually based on past experience, of which luck is a component, and OSHA data, which are not predictive of fatalities and serious injuries.
- Probability (an educated guess in some circumstances) is sometimes given the same weight as known information about the severity of the hazard in risk assessment matrices
- Accurate knowledge about probability is difficult to obtain; judgment is often subjective
- Failure to judge probability accurately can lead to serious consequences

Alternative Risk Assessment Approach for FSI Prevention – Consider:

1. The severity of the hazard
2. Degree of control
   a) The *degree of control* is linked to probability (high degree of control = low probability)
   b) It is easier to evaluate
   c) It is more compelling; high-rated hazards with low degree of control should be identified for higher priority
   d) It is <u>actionable</u>; employers can do something about it
3. Actual exposure
   a) Number of workers exposed
   b) Frequency (and duration) of exposure

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Precursor Inventory: A New Approach to Compiling and Evaluating Data

- Eliminating fatalities and serious injuries requires that situations that are likely precursors to serious cases be inventoried, assessed and managed.

- The inventory should be constructed on a task-by-task basis, populated by:
  1. Observations of current processes
  2. Learnings from past incidents and other data sources
  3. Plans for future operations

- A task-based approach is recommended
  - Covers potential "one offs"
  - Facilitates analysis of controls.
  - Multiple hazards are evaluated for each task – and points are assigned to allow for comparison and facilitate priority setting.
- Fully understanding precursor situations requires more than recognizing hazards; it includes awareness of the underlying organizational factors that could activate or intensify the hazard or undermine needed controls.

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Creating a Task-Based Precursor Inventory…

Step One: Begin by identifying tasks that involve exposure types with known serious injury potential

- **Electrical energy**
- **Mechanical energy (machinery and equipment)**
- **Pressurized vessels of all types (cylinders, tanks, pipes, etc.)**
- **Falls from Elevations**
- **Falls on same level**
- **Explosion and fire potential (chemical energy)**
- **Crushing hazards (heavy objects—caught in, under or between)**
- **Engulfment hazards**
- **Suspended loads**
- **Confined spaces, inert energy, or other suffocation hazards**
- **Highly toxic chemicals**
- **Extreme heat or cold**
- **Radiation**
- **Motor vehicles**
- **Workplace violence**

Severity/Control Risk Matrix

Control Ranking → / Severity/Effects Ranking ↓	No Hazard	Control Highly Effective	Control Generally Effective	Control Somewhat Effective	Control Somewhat Ineffective	Control Generally Ineffective	Complete Lack of controls
		Cannot Be Affected by Worker Actions *	Can Be Defeated by Worker Actions **	Somewhat Dependent on Employee Actions ***	Highly Dependent on Employee Actions °	Very Highly Dependent on Employee Actions °°	
Very High = Catastrophic	10	7	6	4	3	2	1
High = Serious/ Irreversible	10	8	7	6	4	3	2
Medium = Serious/ Reversible	10	9	8	7	5	4	3
Very Low = Moderate/ Reversible	10	9	9	8	7	6	4
None = Insignificant/No Effect	10	10	10	10	10	10	10

The point values assigned to each color block in the matrix indicate the relative priority, on a 1-10 scale, for taking action to mitigate the hazard.

Control Ranking Descriptions

***Control Highly Effective**: Effectiveness Cannot Be Affected by Worker Actions = Hazard Isolated from Employee Contact, Engineering Control such as Closed-loop Systems

****Control Generally Effective**: Effectiveness Can Be Influenced by Worker Actions = Engineering Control such as Interlocked or Immovable Barrier Guard; Local Exhaust Ventilation.

*** **Control Somewhat Effective**: Effectiveness Dependent on Employee Actions = Personal Protective Equipment such as Worker is fully enclosed in high-performing gear (like Level A Hazmat Protection with SCBA, Fire Suit, etc.), Safe Work Practices, Skill-based procedures and checklists, Cardinal Rules, Engineering Controls such as Movable Barrier Guards, General Exhaust Ventilation, Administrative Controls

° **Control Somewhat Ineffective:** Effectiveness Highly Dependent on Employee Actions = Personal Protective Equipment such as High-performing gear like heavy electrical-work gloves, air-supplied respirators, lanyards

°° **Control Generally Ineffective**: Effectiveness Very Highly Dependent on Employee Actions = Knowledge-based Rules and Standard Operating Procedures, Personal Protective Equipment such as Ordinary PPE, safety glasses, face shields, Respirators with APF < 25

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Application: Case Study Example

The event: Two workers on scissors lift doing a "non-live" installation of wiring for fans that would later be connected, energized and inspected by a licensed electrician. As they ran conduit across the ceiling they approached a partially exposed 480 volt electrical bus bar in a bus enclosure missing an end cap.

The victim attempted to use a voltmeter to test the current. The voltmeter crossed two phases of the bus bar and exploded, setting fire to the victim's clothing and causing burns to over 35% of his body. His co-worker managed to lower the lift, but his clothes caught on fire too. Both men passed out. The worker holding the voltmeter died 14 days later.

Background: The plant where the incident occurred was purchased by the company 18 months prior to the incident. It employed 170 permanent employees and 200 – 300 temporary employees, who worked during a four-month long busy season.
Most were from the Dominican Republic.

There was little formal training and no safety training other than what the employees learned on the job.

The victim was a 19 year old Hispanic male, originally hired as a laborer-helper, in the process of being trained to work as a mechanic's assistant. The employee had not had any training on electrical safety, and was not trained to test circuits.

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Risk Priority Ranking Example: Initial Risk Assessment Based on Severity of Hazard and Controls in Place

Control Ranking → / **Severity/Effects Ranking ↓**	**No Hazard**	**Control Highly Effective**	**Control Generally Effective**	**Control Somewhat Effective**	**Control Somewhat Ineffective**	**Control Generally Ineffective**	**Complete Lack of controls**
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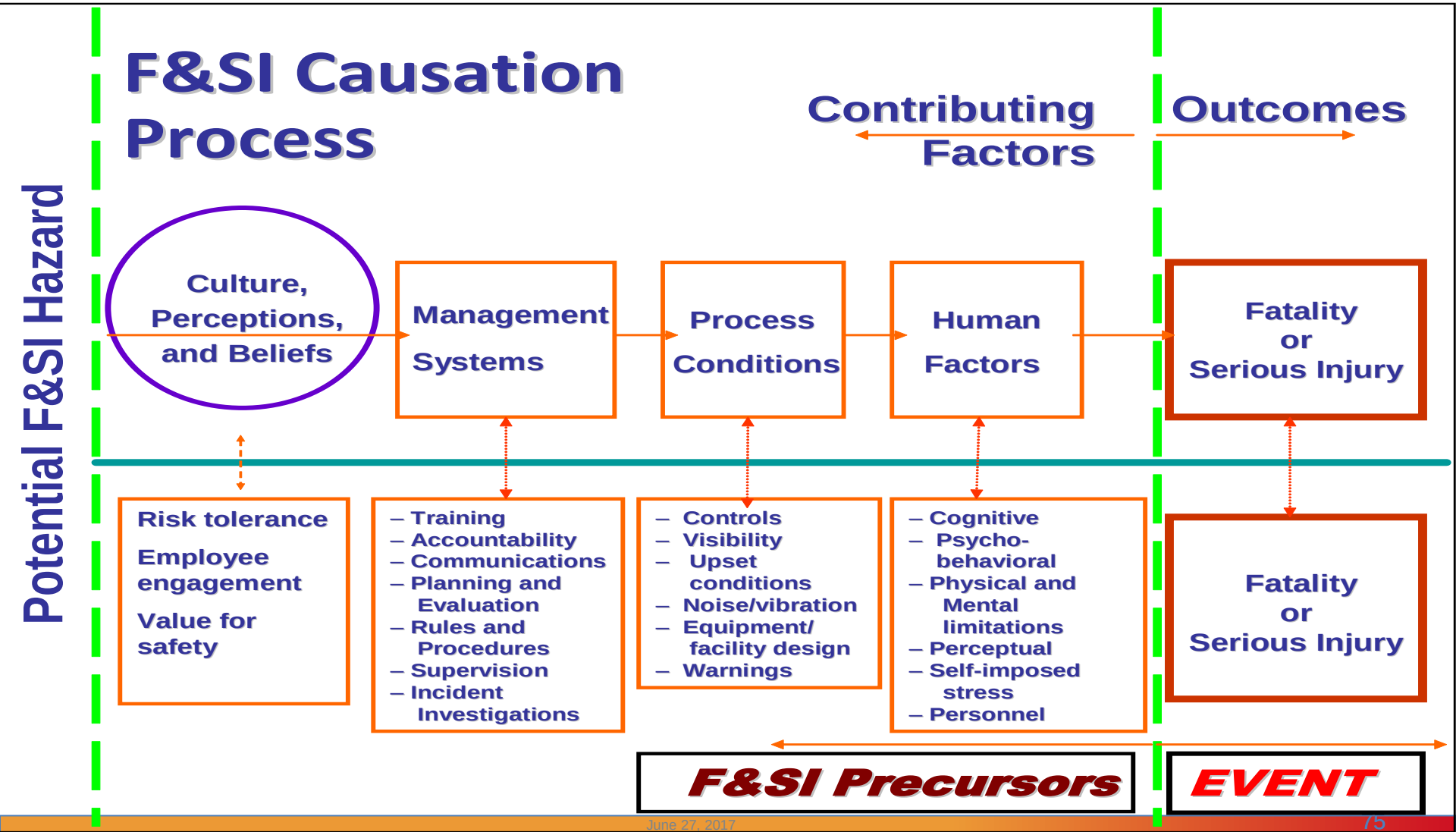
Step Two: Consider underlying systems and processes that could be error provocative and/or undermine controls (HOP issues) .

1. Cultural/ Organizational (attitudes and values)
2. Management Systems (policies and practices)
3. Process Conditions
4. Human Factors

Rationale for Including Human and Organizational Factors that Contribute to FSIs



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Examples of Cultural/ Organizational Issues (attitudes and values)

Cultural/Organizational Checklist	
	Value for safety not demonstrated by senior management
	Alcohol and drug abuse found in the workplace
	Employees do not receive support for safety decisions
	High risk tolerance
	Inadequate financial resources for safety
	Low employee engagement personnel resources not adequate for safety
	Production has higher priority/value than safety
	Safe behavior is not recognized by supervisors/mangers
	Supervisors do not receive support for safety decisions
	Personnel resources not adequate for safety

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Examples of Management Systems Issues (policies and practices)

Management Systems Checklist	
	Checklists not in use
	Cross-monitoring not in use
	Goals and objectives for safety performance have not been established
	Infrequent inspections
	Low management accountability
	Poor communication
	Poor follow-up on identified corrective actions
	Poor risk recognition training
	Potential for miscommunication
	Pre-task briefing not in use
	Pre-task planning/risk assessment not in use
	Procedures/work instructions not adequate
	Standard terminology not in use
	Work-in-progress re-planning not in use

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Examples of Process Condition Issues (work environment and flow)

Process Conditions Checklist	
	Emergency shutdown
	Inadequate design
	Inadequate maintenance
	Inadequate warning mechanisms
	Noise/vibration
	Poor visibility or lighting
	Prior changes not communicated
	Production pressure
	Significant process upsets
	Unexpected maintenance
	Unexpected process changes
	Unexpected repair
	Confusing Controls/switches
	Use of personal protective equipment creates awkward job
	Work/task resources inadequate

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Examples of Human Factors Issues (fitness for the job and task)

Human Factors Issues Checklist	
	Lack of skills/education for task/job
	Circadian rhythm issues
	Cognitive over-saturation
	Dehydration
	Distraction
	Drug use/self medication
	Incompatible work space
	Physical ability not matched to job/task requirements
	Physical or mental fatigue likely
	Physical task oversaturation
	Pre-existing injury or illness condition
	Time pressure
	Poor visual adaptation possible

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Application: Case Study Example Revisited

The event: Two workers on scissors lift doing a "non-live" installation of wiring for fans that would later be connected, energized and inspected by a licensed electrician. As they ran conduit across the ceiling they approached a partially exposed 480 volt electrical bus bar in a bus enclosure missing an end cap.

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Differences in Risk ID and Assessment Approach

Experience Based: **Not on radar screen since no prior history of similar experience**

Hazard-Based: Significant priority since employees working at elevation, and exposed to high energy with low level controls

Hazard-Based, with Human Factors and Organizational Deficiencies: Task gains higher priority attention since workers exposed to hazards impacted by organizational factors that could contribute to injury/death.

Organizational factors that could apply to this case:

1. **Cultural/ Organizational**
   - Value for safety not demonstrated by Senior leadership
   - Organizational risk tolerance
   - Low employee engagement
2. **Management Systems**
   - Poor risk recognition training
   - Inadequate procedures
   - Pre-task planning/risk recognition not in use
3. **Process Conditions**
   - Work-in-progress planning not in use
   - Unexpected process change
   - Prior changes not communicated
   - Work task resources inadequate
   - Inadequate maintenance
4. **Other Factors**
   - Lack of skills/education for task/job

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Result = Adjusted Risk Priority Ranking to Reflect HOP Issues

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The point values assigned to each color block in the matrix indicate the relative priority, on a 1-10 scale, for taking action to mitigate the hazard.

A Few Concluding Thoughts

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Feel Like You've Been Drinking from a Fire Hose?!!

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A Few Key Points Worth Remembering

1. Just managing routine safety and OSHA recordables can leave your company vulnerable to fatalities and serious injuries.

2. Effectively managing the most serious hazards requires rethinking some fundamental S&H concepts that may be barriers to serious injury prevention. Those include how we do risk assessments.

3. Take steps to identify FSI precursor situations -- potentially serious hazards imbedded in your processes and associated human and/or organizational factors that could undermine controls.

The precursor identification and assessment approach should be task based. Why? Because many FSIs are "one offs" that may not be reflected in prior site/enterprise experience. Also analyzing tasks facilitates matching hazards to controls.

A Few Key Points Worth Remembering

4. Reconsider your approach to risk assessment; don't rely on an educated guess (experienced- based risk assessment) in situations that could result in serious injury or death; substitute degree of control for OSHA rate experience.

5. Understand that HOP issues (culture, management systems, process conditions and human factors) can significantly impact the risk, and develop a means to integrate HOP into your risk assessment process.

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QUESTIONS?

More information? Contact:

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THANK YOU FOR YOUR CONTINUED COMMITMENT TO WORKER SAFETY AND HEALTH