Perceiving the problem:

What visual clues lead you to believe there is a problem?

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Topics

- Human Performance
- Error versus Violation
- Acceptable Risk versus Intolerable/UA Risk
- Compliance versus Non-Compliance (unsafe acts)
- Anatomy of an Event
- Critical Steps
- Barriers / Defenses
- Error Likely Situations
- Error Precursors & Error Traps
- Self-Checking & Peer Checking
- Questioning Attitude
- Performance Modes
- SAFER Model
- Prevent Tools: STAR, 3QT, TWIN
- Process Improvement: Cycles and Framework
**What is Human Performance?**

\[ \text{Behavior} + \text{Results} = \text{Performance} \]

<table>
<thead>
<tr>
<th>Good compliant</th>
<th>Actual</th>
<th>Individual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bad</td>
<td>Perceived</td>
<td>Leadership</td>
</tr>
<tr>
<td>Non-compliant</td>
<td>Acceptable</td>
<td>Organization</td>
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<tr>
<td></td>
<td>Unacceptable</td>
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H P techniques are applied to help create a *learning environment*, that is -- a workplace that constantly evaluates incidents and endeavors not to repeat them.
Why a Human Performance Approach?

Human Performance

Incidents  Human Performance

80% Human Performance

20% Equipment Performance

80% Organizational Weaknesses/Errors

20% Individual Weaknesses/Errors
How Human Performance Can Help

Helps change mindsets into a more consistent, methodical mental approach, by:

- Promoting becoming more **Deliberate** in our thoughts and actions
- Focusing a more appropriate level of **Awareness** of the potential consequences, based on better recognition of **RISKs**
- Helps identify error-likely situations
Human Performance Principles

- **Humans are fallible.** People are fallible, and even the best people make mistakes.

- **Error is predictable.** Error-likely situations are predictable, manageable, and preventable.

- **Organization influences behavior.** Individual behavior is influenced by organizational processes and values.

- **Behaviors are reinforced.** People achieve high levels of performance due largely on the encouragement and reinforcement received from leaders, peers, & subordinates.

- **Events are avoidable.** Events can be avoided by understanding the reasons mistakes occur and applying the lessons learned from past events (or errors).
Purpose of Human Performance Focus

To proactively prevent events triggered by human error

Event means an incident with highly undesirable consequences

such as: Texas City refinery explosion, Bopal, Chernobyl
ERROR

An action that \textit{unintentionally} departs from an expected behavior according to some standard

VIOLATION

A \textit{deliberate} deviation from expected behavior
Kinds of Errors

**Active Error:**
Errors that change equipment, system, or plant state triggering immediate undesired consequences;

Error of Commission.

**Latent Error:**
Errors resulting from undetected organization-related weaknesses or equipment flaws that lie dormant (typically by management and staff);

often an Error of Omission that is *failing to act*
Human Error

More flawed defenses & error precursors

Latent organizational weaknesses persist

Management less aware of jobsite conditions

Less communication

Reduced trust

Individual counseled and/or disciplined

More flawed defenses & error precursors

Human Error

**Human Performance Error Reduction Overview**

- Were the actions as intended?
- Evidence of illness or substance use?
- Did the Individual knowingly violate safety requirement?
- Would “others” have made same error?
- Did the Individual have a History of Unsafe Acts?
- Were standards & consequences known/expected?
- Known personal medical condition?
- Were procedures available, workable, intelligible, correct and routinely used?
- Deficiencies in training, selection, or inexperienced?
- Substance abuse without mitigation
- Intentional Act to Cause Harm Not an Error!
- Substance use with mitigation
- Possible Reckless Error or Negligent Violation
- System-enabled Violation
- Possible Negligent Behavior
- System-enabled Error
- Blameless error, corrective training, counseling indicated

**Culpable**

**Gray Area**

**Blameless**
Compliance is a Continuous Fight with Human Nature

- At-risk behaviors are often more comfortable, convenient, and faster than safe behaviors.
- At-risk behaviors are often reinforced by the work culture.
- At-risk behaviors rarely result in negative consequences (eg, injury or reprimand) powerful enough to discourage their performance.
- Unchallenged or ignored, they can become “system enabled” OK to do.
Why Non-Compliant, “Unsafe Acts” Can Easily Occur

Non-Compliance Index = \[(\text{Burden} + \text{Inducement}) \div (\text{Risk} + \text{Peer Check})]\]

Dr. Chiu of PII tells us: “Don’t expect people to endure burdensome situations unless they realize / appreciate the potential RISK & Consequences or peer pressure.”
What to do about PPE Non-Compliance

*Fashion, fit, comfort & performance are key considerations.*

According to a survey conducted at last year’s National Safety Congress, 89 percent of safety professionals polled have observed workers failing to wear PPE when it was necessary.

This is the third consecutive year the survey revealed a high rate of PPE non-compliance, with 87 percent in 2007 and 85 percent in 2006.

- Discomfort was found to be the chief cause of non-compliance.
- *2nd was workers’ opinion that their PPE was not necessary for the task.*
- *3rd was complaints PPE was too hot, fit poorly, or was unattractive.*
At-Risk Behavior is the result, not why the action was taken (root cause)

Causal Factors may involve:

- Poor Communication
- LTA Pre-Job Briefing
- Time Pressure (self-induced)
- Peer Pressure
- Bad habits / habit intrusion
- Lack of Accountability
- Inadequate Training
- Confusing written guidance
- Poor memory
- Lack of co-worker engagement (didn’t speak-up or have a questioning attitude)
Anatomy of an Event

- Vision, Beliefs, & Values
- Latent Organizational Weaknesses
- Mission Goals Policies Processes Programs
- Flawed Barriers/Defenses
- Error Precursors
- Initiating Action
- Event

DAV, AEP Ohio Human Performance Error Reduction Overview 16
Initiating Action

An action or behavior by an individual, either correct or in error, that results in an event.

This includes **active errors** that have immediate, observable, undesirable outcomes.
A Critical Step is defined as:

A task action that, if done incorrectly or not at all, would result in an unrecoverable condition that prevents successful job completion.

As such, not all steps are equally important . . .

Critical steps include things like:
− Actions aimed at changing the state of the electrical system or components
− Steps that are irrecoverable or actions that cannot be reversed
− Steps where the outcome of an error is intolerable for personnel safety or public safety or the safety & reliability of our distribution & transmission systems
Defects with defensive measures that, under the right circumstances, may **fail to protect** equipment or people against hazards, and **fail to prevent** the occurrence of active errors, violations, or **at-risk** behaviors.
Human Performance Process Issues
that can become *Latent Organizational Weaknesses*

- Training
- Procedures
- Goals & Priorities
- Task Structure
- Roles & Responsibilities
- Values & Norms
- Planning & Scheduling
Strategic Perspective on Human Performance

Reducing error and Managing defenses leads to ZERO Events

$R_e + M_d \rightarrow \emptyset E$
Error-Like Situations

- Conditions that increase potential for errors from slips, mistakes, or oversights

- Error-likely situations have 3 components:
  1. The individual
  2. The presence of error precursors
  3. An action needs to be taken
TWIN ANALYSIS of Error-Like Situations

Error-likely Situation

Task Demands

Human Nature

Work Environment

Individual Capabilities

Event

An error about to happen due to Error Precursors

Error Precursors

Event Precursors

Work Precursors

Environment Precursors

Human Nature Precursors

Task Demands Precursors

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# TWIN Error Precursors, by grouping

<table>
<thead>
<tr>
<th>Task Demands</th>
<th>Individual Capabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time pressure (in a hurry)</td>
<td>Unfamiliarity w/ task / First time</td>
</tr>
<tr>
<td>High Workload (memory requirements)</td>
<td>Lack of knowledge (mental model)</td>
</tr>
<tr>
<td>Simultaneous, multiple tasks</td>
<td>New technique not used before</td>
</tr>
<tr>
<td>Repetitive actions, monotonous</td>
<td>Imprecise communication habits</td>
</tr>
<tr>
<td>Irreversible acts</td>
<td>Lack of proficiency / Inexperience</td>
</tr>
<tr>
<td>Interpretation requirements</td>
<td>Indistinct problem-solving skills</td>
</tr>
<tr>
<td>Unclear goals, roles, &amp; responsibilities</td>
<td>“Hazardous” attitude for critical task</td>
</tr>
<tr>
<td>Lack of or unclear standards</td>
<td>Illness / Fatigue</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Work Environment</th>
<th>Human Nature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distractions / Interruptions</td>
<td>Stress (limits attention)</td>
</tr>
<tr>
<td>Changes / Departures from routine</td>
<td>Habit patterns</td>
</tr>
<tr>
<td>Confusing displays or controls</td>
<td>Assumptions (inaccurate mental picture)</td>
</tr>
<tr>
<td>Workarounds / OOS instruments</td>
<td>Complacency / Overconfidence</td>
</tr>
<tr>
<td>Hidden system response</td>
<td>Mindset (&quot;tuned&quot; to see)</td>
</tr>
<tr>
<td>Unexpected equipment conditions</td>
<td>Inaccurate risk perception (Pollyanna)</td>
</tr>
<tr>
<td>Lack of alternative indication</td>
<td>Mental shortcuts (biases)</td>
</tr>
<tr>
<td>Personality conflicts</td>
<td>Limited short-term memory</td>
</tr>
</tbody>
</table>
Top Error Traps to Avoid

- Time Pressure (often, self-imposed)
- Distractions / Interruptions
- High Work Load / Multiple Tasks
- Overconfidence / Complacency
- Imprecise Communications / Rule Changes
- First Working Day After Days Off
- ½ Hour After Wake-up or Meal
- Peer Pressure
- Physical Environment
- Mental Stress - Fitness for Duty
Human Performance Tools for the **Individual**
To Combat Error Traps (in addition to 3QT)

- Self Checking…. STAR….  
- Peer Checking  
- Knowledge / Training  
- Procedure Use and Adherence  
- Questioning Attitude  
- Place-Keeping  
- Flagging (i.e., marking correct item to assure focus, or masking)  
- Effective Communication with Repeat Backs  
- Task Preview, Pre-Job Briefing, Post-job Review/Critique  
- Turnovers with good Pre-Job Briefs
HP Tool: Self - Checking

- Is a tool that helps you focus on **Critical Steps** by raising the level of individual **awareness**
- Creates **deliberate** thought prior to the performance of a **Critical Step**
- Creates an understanding of the expected outcome
- Means to verify results
- Is performed in addition to a thorough job briefing
Detect and Correct to Prevent an Error Resulting in an Injury Event
Anatomy of an Event

Initiating Action

Task Demands

Work Environment

Individual Capabilities

Human Nature

Error

Too often, PPE is the only or last barrier to prevent injury
DaveV’s Caution: High Energy Level Collapses Disaster Pyramid into an Express Escalator to a possible Fatality

The Three Question Technique (3QT)

[ Questions to ask before you start work ]

1. What are the **critical steps** of the work activity?

2. How can I make a **mistake**?

3. What **bad things** can happen?

X. What **barriers** or defenses are in place?...........
   (administrative controls, safety equipment, PPE)

These can and should always be covered in a pre-job brief.
Self-Checking Using the S-T-A-R Method

**Stop** -- Pause to focus your attention.

**Think** -- Understand what is being done, plan your actions, consider expected results, and decide what to do if expected results do not occur.

**Act** -- Carry-out the work activity, as planned.

**Review** -- Verify that results occur as expected. If unexpected, take action as planned.
Human Performance Improvement Cycle

**Work Preparation**

- **HP Tools**
  - Operating Experience
  - TWIN Analysis
  - 3 Question Technique
  - Trained & Competent
  - Job Hazard Analysis

**Pre-Job**

- **HP Tools**
  - Pre-job brief
  - Operating Experience
  - 3 Question Technique
  - TWIN Analysis

**Post-Job**

- **HP Tools**
  - Work Package Quality
  - Corrective Action
  - Modify Equipment or Labeling
  - Enhance or Revise Training
  - Revise or Correct Procedure
  - Revamp or Clarify Work Practices
  - Post Job Review / Critique

**Field Work**

- **HP Tools**
  - STAR/Time Out
  - 3 QT, 3 Question Technique
  - Peer Check
  - Technical Support
  - 3 Way Communication
  - Procedure Use
  - Verbalize
The First Two HP Review Questions:

1. How capable was the employee of doing this task?

2. Did we assign an employee who was properly prepared to succeed?
Performance Modes

Most Common Errors

- Inattention
- Misinterpretation
- Poor Mental Model

Skill-based (Familiar)
- 1 in 10,000

Rule-based (Stored Rules)
- 1 in 1,000

Knowledge-based (Unfamiliar)
- 1 in 2
Quantifying Error Modes and %’s

Skill-based Errors:
~ 90% of daily activities are Skill-based
~ 25% of all errors are Skill-based

Rule-Based Errors:
* Occur during conscious decision making process
  • ~ 60 % of all errors are rule-based

Lack of Knowledge-based Errors:
* Characterized as stressful situations
  ~ 15 % of all errors are knowledge-based
Pre-Job & Pre-Task, use the **S-A-F-E-R** Model:

- **S**ummarize critical steps
- **A**nticipate error-likely situations
- **F**oresee consequences
- **E**valuate barriers / defenses
- **R**eview operating experience
Critical Steps

• Steps in the job completion process that if performed incorrectly or not at all would impact safety, productivity, quality, and/or reliability

• Steps that create a point of no return
  – What is going to happen – is going to happen
  – **Not all steps are critical**
  – Are actions in which the level of risk to both safety & reliability is increased
  – Have consequences that are irrecoverable & intolerable
  – Their safe execution depend mainly on the Individual
Anticipate Error Traps

- Review the job-site conditions using the *TWIN Error Precursors list*

- To ensure that you don’t repeat the most typical problems, also review the “Top Error Traps to Avoid”

- Identify errors that could occur *during* the performance of a critical step

- Identify areas where confusion is likely or critical steps can be *easily missed*
Foresee Potential Consequences

• If a mistake does occur at a critical step,
  – What is the worst that can happen?
  – What is likely to occur?

• Consider the production goals that would not be achieved -- however, safety and prevention are more important than schedule

• Intolerance for error-likely situations should prevail -- if the potential outcomes of an error are judged as too severe, the task should not proceed as presently planned
Evaluate Barriers / Defenses

Consider what **control measures and PPE and special safety equipment** are needed, in response to the following three questions:

- **What are the Hazards?**
- **What are the Risks?**
- **What do we need to do to minimize the risks to adequately protect personnel and the public?**

If you don’t ensure the defenses needed are in place, then you may be creating “**Unacceptable Risk.**”
A Sequential Checklist of Barriers/Defenses to Minimize Errors that will Prevent Events

- Trained & Qualified workers assigned
- Personnel are fit-for duty
- Critical Steps (from JSA/JHA) are known and discussed in
- Meaningful Pre-Job Brief conducted (SAFER Model)
- Roles & Responsibilities understood by each and all
- Peer Checker assigned (safety person, attendant, qualified observer)
- Supervisor/Leader field visits – Observations for Coaching
- Communications will use repeat backs and confirmations during critical steps
- Workers wear PPE to protect themselves from unanticipated as well as recognized hazards
- Everyone is willing to exhibit a Questioning Attitude; Stop When Unsure (Situational Awareness); Speak-Up and Listen-Up
**Sequence to Error Reduction Framework**

**PLAN**
- Job-Site Conditions
  - Task Demands
  - Work Environment
  - Individual Capabilities
  - Human Nature

**PREPARE**
- Organizational Processes & Values

**PERFORM**
- SAFER Dialogue
  - Summarize Critical Steps
  - Anticipate Error Traps
  - Foresee Potential Consequences
  - Evaluate Defenses
  - Review Experience

**LEARN**
- Pre-job Briefing
  - A Dialogue

**STAR**
- Worker Behavior
  - Stop
  - Review
  - Think
  - Act

**PURSUE EXCELLENCE**
- Look Critically, Engage to Improve, Avoid Recurrence, Report Honestly, and Nurture Learning in Others

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Human Performance Error Reduction Overview
Employees are willing to report “honest mistakes” because we all can learn from them.

Be fair and consistent when it comes to disciplinary action for safety / health violations.
Conclusion, Extras and Q & A

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Extra Resource Material:

September 09 Wind Storm
(Hurricane Ike in Ohio)
Safe Restoration Package of 16 PowerPoint slides....

Some Error Reduction Techniques to Help Assure Personnel Safety during Storm Restoration Sept. 08

- Error Precursors
- Top Error Traps
- Work S-A-F-E
- Error Preventing Tools for Safe Work
  - 3 Question Technique
  - For Individuals
  - For Leaders
  - STAR
  - Questioning Attitude 1
Main Error Prevention Tools

- Self-checking
- Peer-checking
- 3-way Comm.s
- Questioning Attitude
- Pre-job briefing
- 3 Question Technique
- STAR
- Procedure Use & Adherence