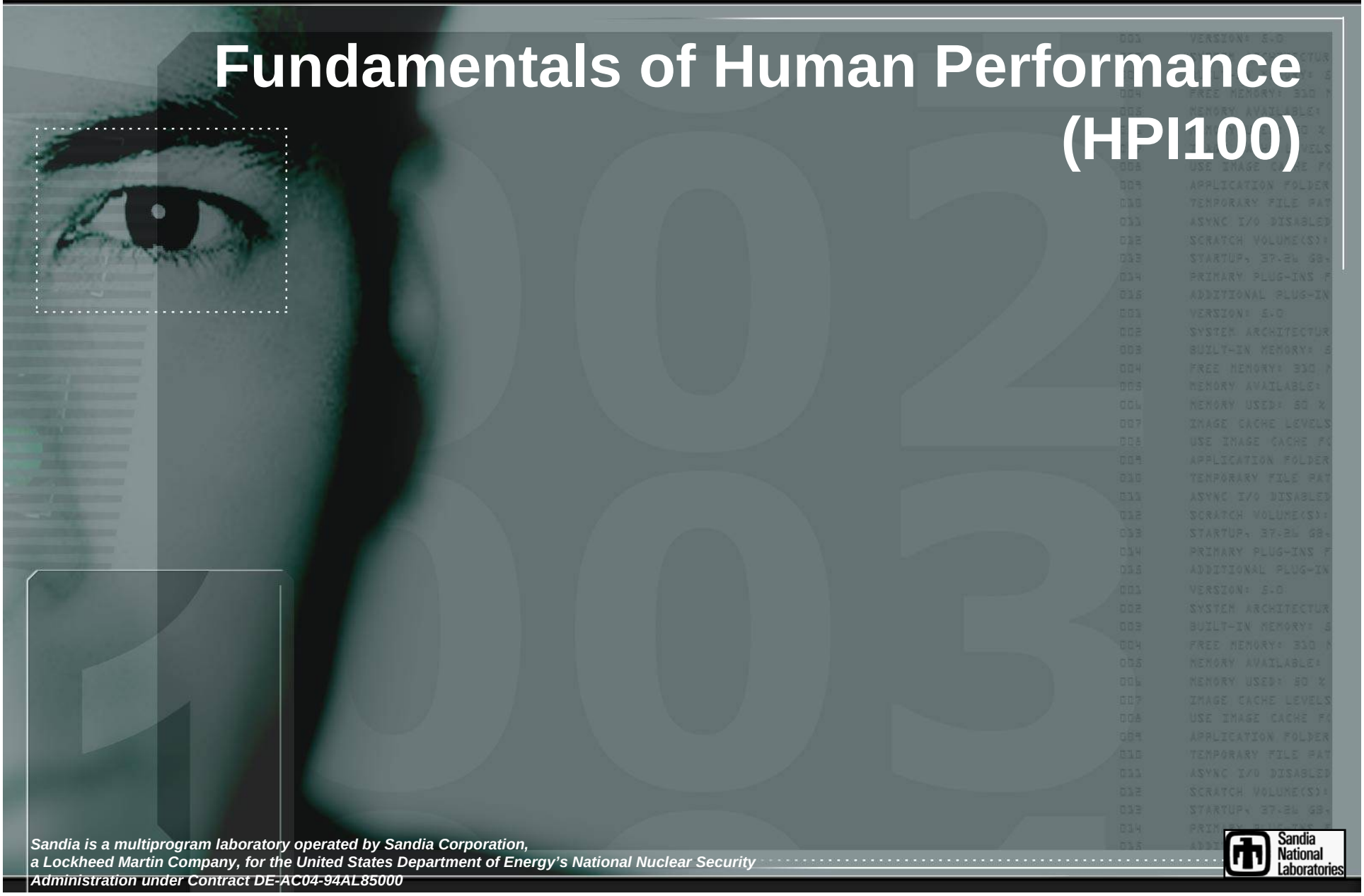
SAND2010-8919P

Fundamentals of Human Performance (HPI100)



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Fundamentals of Human Performance (HPI100)

- Introduction -

The traditional belief is that human performance [the series of behaviors executed to accomplish specific task objectives (or results)] is a worker-focused phenomenon. This belief promotes the notion that failures (or errors) are introduced to the system only through the inherent unreliability of people. "*Once we can rid ourselves of a few bad performers, everything will be fine. There is nothing wrong with the system*."

Human error, however, is caused not only by normal human fallibility, but also by incompatible management and leadership practices and organizational weaknesses in work processes and community values. Experience has shown that weaknesses in organizational processes and cultural values are involved in the *majority* of facility events. Accidents often result from a combination of factors beyond the control of the worker.

> "*To explain failure, do not try to find where people went wrong. Instead, find how people's assessments and actions made sense at the time, given the circumstances that surrounded them*."
>
> - Sidney Dekker
> *The Field Guide to Human Error Investigations*

FACT: People will make mistakes despite their best efforts. Human Performance Improvement is based upon the following principles:

- People are fallible, and even the best people make mistakes.
- Error-likely situations are predictable, manageable, and preventable.
- Individual behavior is influenced by organizational processes and values.
- People achieve high levels of performance largely because of the encouragement and reinforcement received from leaders, peers, and subordinates.
- Events can be avoided through an understanding of the reasons mistakes occur and application of the lessons learned from past events (or errors).

Human error (*unintentional deviation from preferred behavior*) is not a cause of failure, alone, but rather the effect or symptom of deeper trouble in the system. Human error is also not random – it is systematically connected to features of people's tools, the tasks they perform, and the operating environment in which they work. Therefore, behavior and its causes are extremely valuable as the pointers/signals for improvement efforts to anticipate, prevent, catch, or recover from errors.

To improve human performance, as well as the performance of a facility or organization, effort should be made to: 1) reduce the occurrence of errors at all levels of the organization; and 2) enhance the integrity of defenses, barriers, controls, or safeguards discovered to be weak or missing. Reducing errors and managing defenses will lead to no significant events. Eliminating significant events will result in performance improvement of the facility or organization.

$$R_e + M_d \rightarrow \varnothing E$$

> "… *human fallibility is like gravity, weather, and terrain, just another foreseeable hazard. Error is pervasive … What is not pervasive are well-developed skills to detect and contain these errors at their early stages*."
>
> - Weick and Sutcliffe
> *Leading with Resilience in the Face of the Unexpected*

This course is an attempt to improve understanding about human performance and to suggest how to manage it to prevent events triggered by human error.

Common Misunderstandings (Myths) about Human Performance

Myth 1 – If there are no events, there is no human performance problem.
Facts: Trivial human errors occur moment by moment in any facility or operation. The absence of events is more a function of the presence and integrity of defenses, barriers, controls, and safeguards than the errors people make. Therefore, it is erroneous to believe human performance is adequate just because no events have been experienced in the recent past. Reducing the number of errors does influence the frequency of events.

Myth 2 – Training will solve the human performance problem.
Facts: Frequently, training is not the solution to performance problems. Just because people may know what the right thing to do is does not mean they will do it. Also, historically, knowledge deficiencies have constituted only a small fraction of the causes of events. Not only do the knowledge & skills need to be learned, but the values and beliefs deserve focus as well.

Myth 3 – Self-checking means good human performance.
Facts: Self-checking is an attention-management tool to aid an individual in verifying performance at critical points in an activity. Human performance weaknesses exist in many contexts that include not only front-line workers but also supervisors, staff, and managers in the average organization. Not all human activity involves skill such as equipment manipulations. As such, self-checking may add little or no value in certain circumstances. Other types of activities will require rule- and knowledge-based responses. Human performance occurs throughout the facility or operation, and other methods and defenses will be necessary to prevent, catch, and recover from the consequences of error.

Myth 4 – Accountability is all that is necessary.
Facts: Many people unconsciously believe that "bad people make bad errors." However, Human Performance Improvement Principle No. 1 states that "*people are fallible, and even the best people make the worst mistakes*." Accountability is good and necessary for long-term success of any organization. People at every level want to know if they have performed well or not. Strict accountability without consideration of the whole system of defenses diminishes communication.

Myth 5 – Significance determines culpability.
Facts: Administering disciplinary action based entirely on the severity of the event is faulty logic. The severity of an event is a function of weaknesses in defenses, not the error of the individual. Weaknesses in defenses are more a function of the organization and management domains than one person's mistake.

Myth 6 – Reward and reinforcement are the same.
Facts: Rewards are given based upon the results obtained, and occur relatively infrequently. Behavior is how the results were obtained. Behavior is reinforced if explicitly tied to a positive consequence for the person. Reinforcement occurs whenever the behavior occurs. At any given moment, management is getting precisely the performance the organization is tuned to produce. This is because reinforcers are a much stronger influence on behavior than rewards.

Myth 7 – Experience means error-free performance.
Facts: Experienced personnel are not infallible. They do not perform error-free, as much as they are error aware. Because of their experience, they more readily recognize errors (likely made before) and the conditions that lead to error and apply effective strategies to prevent or recover from the error without consequence.

Myth 8 – Errors cause significant events.
Facts: Significance is a function of severity, and severity is a function of the robustness of defenses. Errors generally determine the frequency of events. Errors trigger events. However, several defenses generally must fail in addition to the error to suffer a significant event.

Myth 9 – Errors are bad.
Facts: Error is a normal component of human behavior, and often provides an opportunity to learn. People err frequently, and it's typically error that generates great ideas. Most errors are trivial. The so-called "grievous" errors are the ones that, by chance, trigger negative consequences, generally because the person was working in an error-prone, high-risk situation. Too often people confuse the behavior (error) with the result (event).

FUNDAMENTALS OF HUMAN PERFORMANCE (HPI100)








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Introduction

- Instructors
- Training Facility
  - Restrooms / Exits
  - Lunch Break
  - Phones / Pagers
- Course Logistics
  - 8:00 – 4:30
- Participants

Instructors

Brian Thomson, Project Leader
Phone: 844-2607
E-mail: bcthoms@sandia.gov

Marvin Hadley
Phone: 844-5659
E-mail: mghadle@sandia.gov

Course Goals

1. To **familiarize** Sandia with behaviors that help to align organizational processes and values.
2. To **promote** a structured mental framework that will help people to more readily identify flawed defenses, error-likely situations, and latent organizational weaknesses.
3. To **familiarize** Sandia with proven tools for reducing human error to the lowest possible levels of frequency and severity.

Course Objectives

Participants will be able to….

1. **Improve** individual and organizational performance using a coherent, strategic, and proven approach.
2. **Understand** how implementation of human performance improvement principles enhances productivity, reliability, efficiency, and quality.
3. **Implement** techniques that identify and eliminate error-likely situations, flawed defenses, and latent organizational weaknesses.

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Course Outline

- Introduction
- Lesson 1 Human Performance Basics
- Lesson 2 Reducing Human Error

  - The Role of the Individual -
- Lesson 3 Managing Defenses

  - The Role of the Organization -
- Lesson 4 Leadership & Culture

  - The Role of the Leader –
- Conclusion

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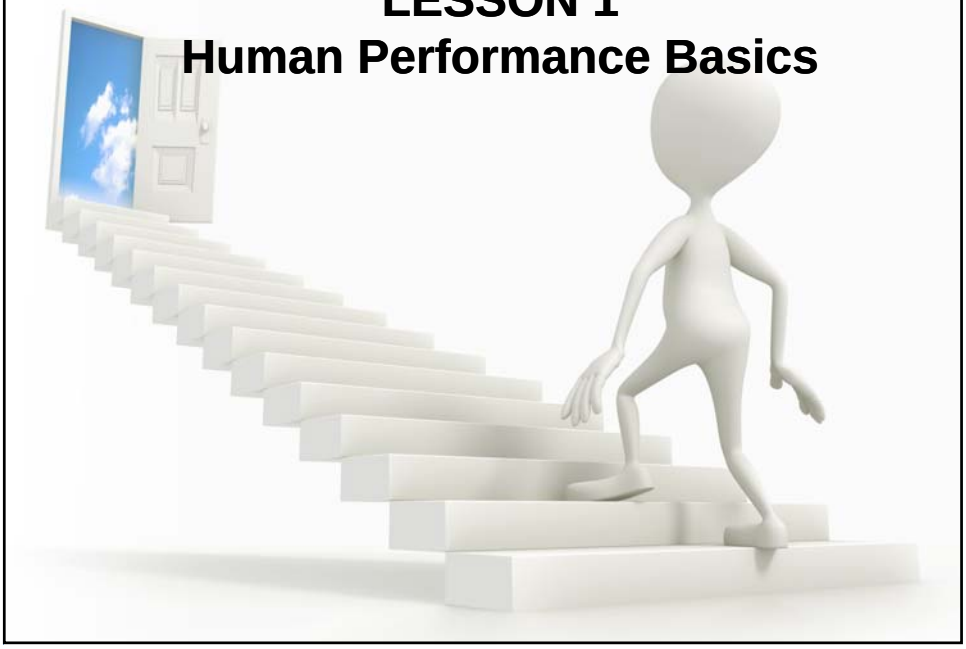
LESSON 1
Human Performance Basics



Lesson 1 Objectives

Participants will be able to….

1. **Identify** the primary factors that lead to unwanted outcomes (events).
2. **Understand** the difference between violations and human error.
3. **Understand** the formula for performance improvement
4. **Identify** the goal of human performance improvement.
5. **State** the five principles of human performance improvement.

1 - 2

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Human Fallibility

"… human fallibility is like gravity, weather, and terrain, just another foreseeable hazard. _____ is pervasive … What is not pervasive are well-developed skills to detect and contain these errors at their early stages."

- ***Weick and Sutcliffe***
Leading with Resilience in the Face of the Unexpected

1 - 3

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To Err is Human

1 - 4

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To _____ is Human

1 - 5

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1 - 6

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Discussion of Kenny Video

- What is your impression of Kenny?
- What error(s) did Kenny make?
- What condition(s) provoked the accident?
- What could be said about defenses?
- What error(s) did the organization make?
- Are there any Kennys in your organization?

1 - 7

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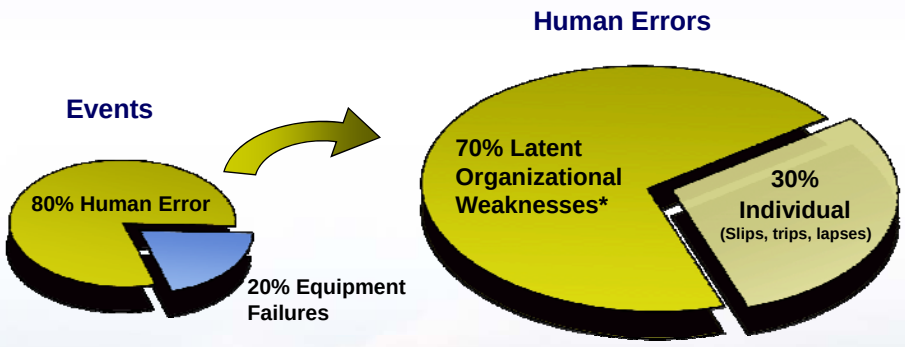
What Cause Events?



* Latent Organizational Weakness = Hidden deficiencies in management control _____, _____ or _____.

1 - 8

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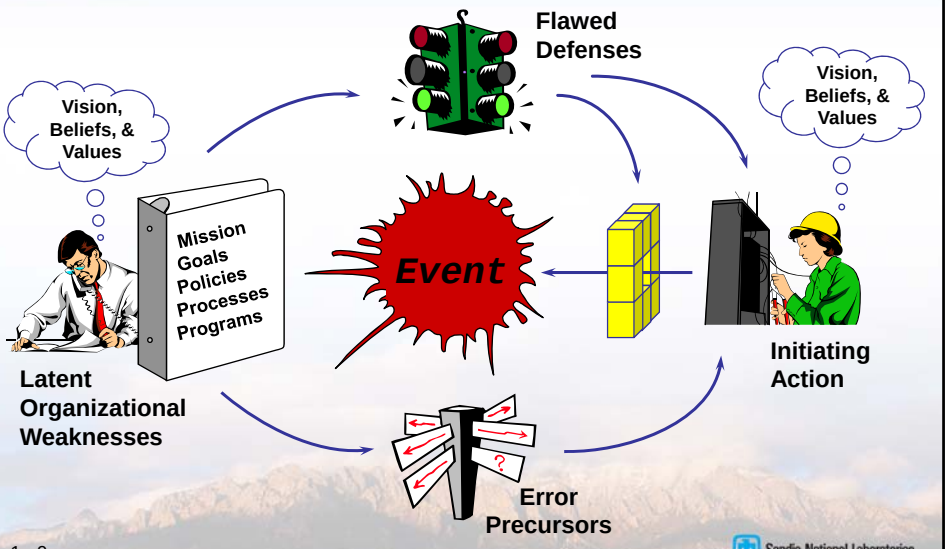
Anatomy of an Event



1 - 9

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"The Past Settles its Accounts…"

"…the ability to deal with a crisis situation is largely dependent on the structures that have been developed before chaos arrives. The event can in some ways be considered as an abrupt and brutal _____: at a moment's notice, everything that was left unprepared becomes a complex problem, and every weakness comes rushing to the forefront."

- Patrick Lagadec and Jocelyn M. Phelps
Preventing Chaos in a Crisis: Strategies for Prevention, Control and Damage Limitation

2 - 10

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Significance of an Event

The significance (or severity) of an event depends upon the consequences suffered, and not on the error that initiates it. The error that triggers a serious accident … and the error that is one of hundreds with no consequences ... can be the same error.

1 - 11

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What is a Violation?

_____acts to deviate from a policy or procedure for personal advantage, usually adopted for fun, comfort, expedience, or convenience.

1 - 12

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What is an Error?

An action that _____departs from an expected behavior.

1 - 13

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Two Kinds of Error

Active Error →

Immediate consequences. Know "who did it."

← ***Latent Error***

Latent consequences. Do not know "who did it."

1 - 14

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Fact About Human Error

A 1999 study estimated that 45,000 – 95,000 people die each year due to human error in medical care!

May 1, 2006

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Human Fallibility

"The single greatest impediment to error prevention in the medical industry is that we _____ people for making mistakes."

- Dr. Lucian Leape,
Professor, Harvard School of Public Health
Testimony before Congress on Health Care Quality Improvement

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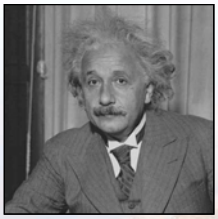
New Approach Needed

"The significant problems we face can not be solved at the same level of thinking we were at when we created them."

- Albert Einstein



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Performance Improvement

$$P = B + R$$

***Performance* = _____ + _____**

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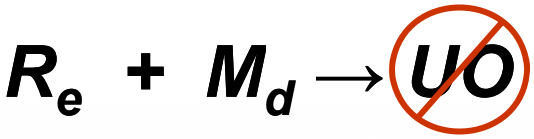
Goal of Human Performance Improvement



Reducing Error + Managing Defenses → Zero Events
(Unwanted Outcomes)

Focusing on error reduction reduces error frequency; focusing on improving defenses reduces error severity.

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Principles of Human Performance

1. People are fallible - even the best people 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 largely because of the encouragement and reinforcement received from leaders, peers, and subordinates.
5. Events can be avoided through an understanding of the reasons mistakes occur and the application of the lessons learned from past events (or errors).

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REVIEW
Lesson 1 Objectives

Participants will be able to….

1. **Identify** the primary factors that lead to unwanted outcomes (events).
2. **Understand** the difference between violations and human error.
3. **Understand** the formula for performance improvement
4. **Identify** the goal of human performance improvement.
5. **State** the five principles of human performance improvement.

1 - 21

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LESSON 2
Reducing Human Error

THE ROLE OF THE INDIVIDUAL

Lesson 2 Objectives

Participants will be able to….

1. **Recognize** the indications and characteristics of at-risk attitudes.
2. **Identify** common error precursors.
3. **Describe** how to predict, manage, and prevent error-likely situations.
4. **Understand** basic human performance tools for reducing human error.

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Human Performance Improvement Principle #1

People are _____, and even the best make mistakes.

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Common Traps of Human Nature

- Stress
- Mental Strain Avoidance
- Inaccurate Mental Models
- Limited Working Memory
- Limited Attention Resources
- Mind-Set
- Difficulty Seeing One's Own Error
- Limited Perspective
- Susceptibility to Emotional / Social Factors
- Motivated Toward Goal Accomplishment
- Fatigue

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At-Risk Attitudes

- **Inaccurate Risk Perspective**: Guided by the heart, not by the head
- **Pride**: "*Don't insult my intelligence*."
- **Heroic**: "*I'll get it done, by hook or by crook*."
- **Invulnerable**: "*That can't happen to me*."
- **Fatalistic**: "*What's the use?*" or "*Que será será*"
- **Bald Tire**: "*I've gone 60K miles without a flat yet*."
- **Summit Fever**: "*We're almost done*."
- **Pollyanna**: "*Nothing bad will happen*."

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At-Risk Behaviors

At-Risk Behaviors: behavioral choices that increase risk where risk is not recognized, or is mistakenly believed to be justified.

Driving a Car:

- …
- …
- …
- …
- …

In the Workplace:

- …
- …
- …
- …
- …

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Human Performance Improvement Principle #2

_____ *situations are predictable, manageable, and preventable.*

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Error-Likely Situation

An error about to happen:

- Typically exists when task-related factors exceed the capabilities of the individual (a mismatch)

Error – likely Situation (also called "*Error Traps*")

Unintentional deviation from preferred behavior

Jobsite conditions

Degree of mismatch due to error precursors

2 - 8

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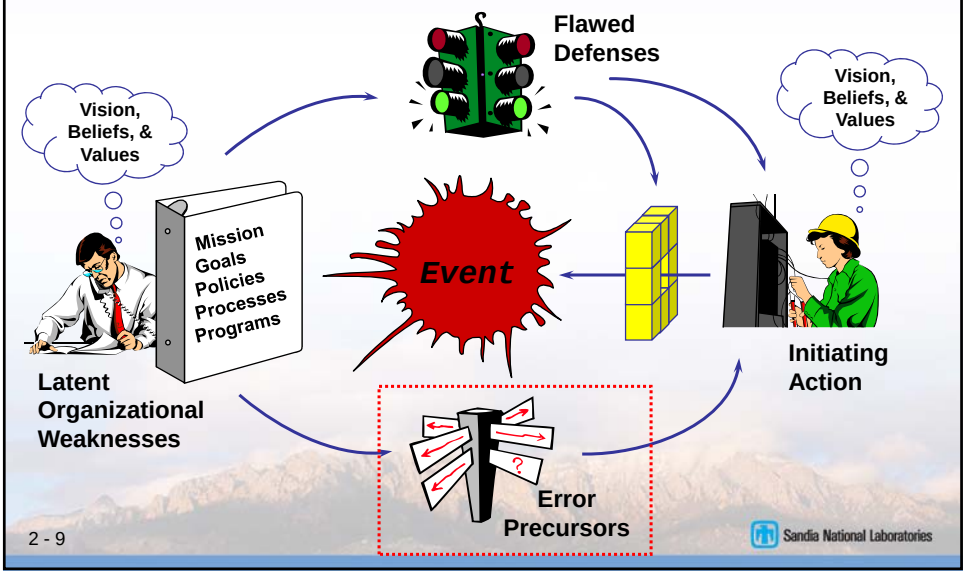
Anatomy of an Event



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Common Error Precursors

(Conditions that Provoke Error)

Task Demands	Individual Capabilities
❑ Time pressure (in a hurry)	❑ Unfamiliarity w/ task / First time evolution
❑ High Workload (high memory requirements)	❑ Lack of knowledge (mental model)
❑ Simultaneous, multiple tasks	❑ New technique not used before
❑ Repetitive actions / Monotony	❑ Imprecise communication habits
❑ Irrecoverable acts	❑ Lack of proficiency / Inexperience
❑ Interpretation requirements	❑ Indistinct problem-solving skills
❑ Unclear goals, roles, & responsibilities	❑ "Unsafe" attitude for critical tasks
❑ Lack of or unclear standards	❑ Illness / Fatigue
Work Environment	**Human Nature**
❑ Distractions / Interruptions	❑ Stress
❑ Changes / Departures from routine	❑ Habit patterns
❑ Confusing displays or controls	❑ Assumptions
❑ Workarounds / OOS instruments	❑ Complacency / Overconfidence
❑ Hidden system response	❑ Mind-set
❑ Unexpected conditions	❑ Inaccurate risk perception
❑ Lack of alternative indication	❑ Mental shortcuts (biases)
❑ Personality conflicts	❑ Limited short-term memory

OOS – out of service

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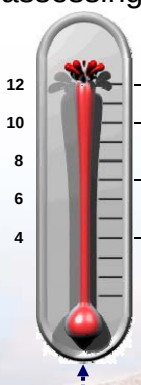
Acquiring Error Wisdom

"***Bucket***" Model for assessing error potential:



Serious Error Risk:
Do NOT go there!

Moderate to Serious Error Risk:
Be very wary

Routine to Moderate Error Risk:
Proceed with caution

Score

\+

\+

\+

Total Score: _____

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Human Performance Improvement Principle #3

Individual _____ is influenced by organizational processes and values.

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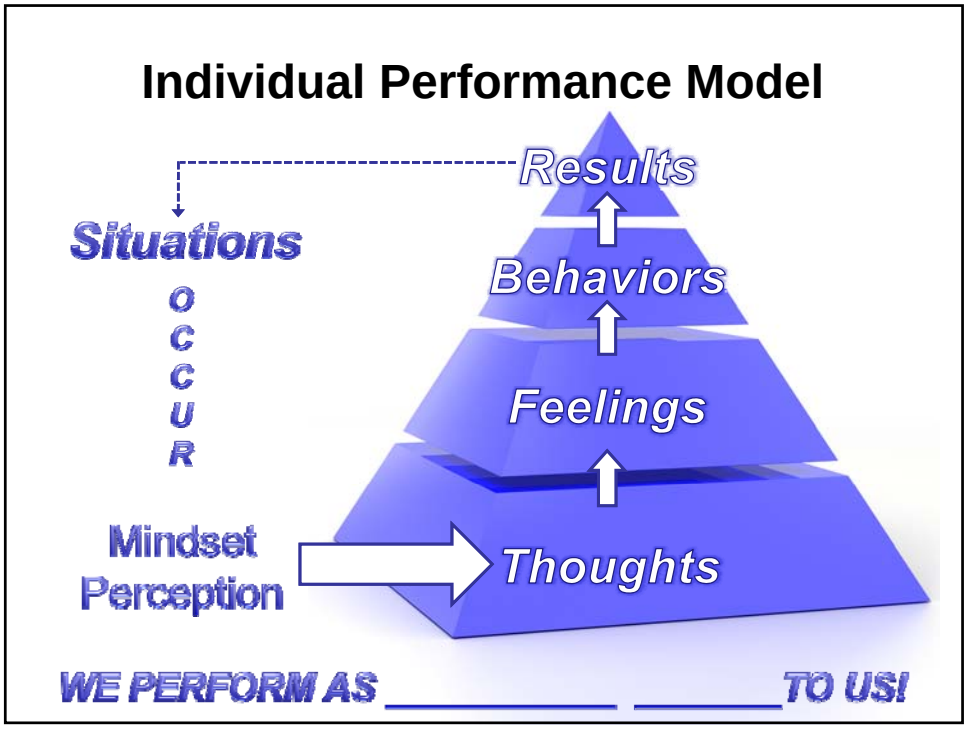
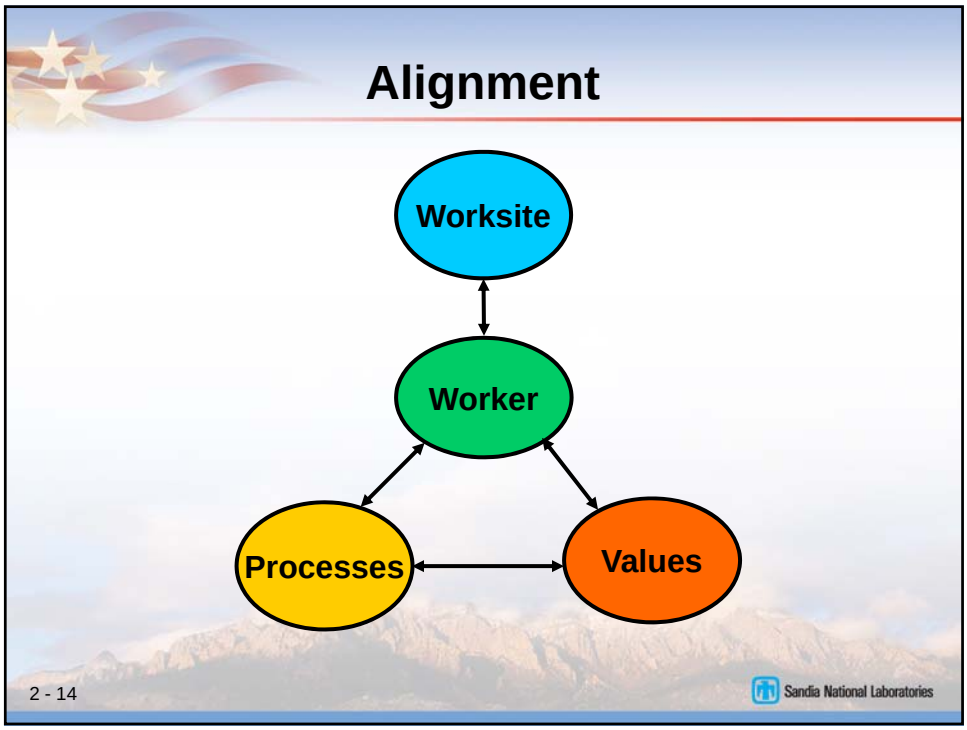

Individual Performance Model
Results
Situations
O
C
C
U
R
Behaviors
Feelings
Mindset
Perception
Thoughts
WE PERFORM AS _____ _____TO US!


Alignment
Worksite
Worker
Processes
Values
2 - 14
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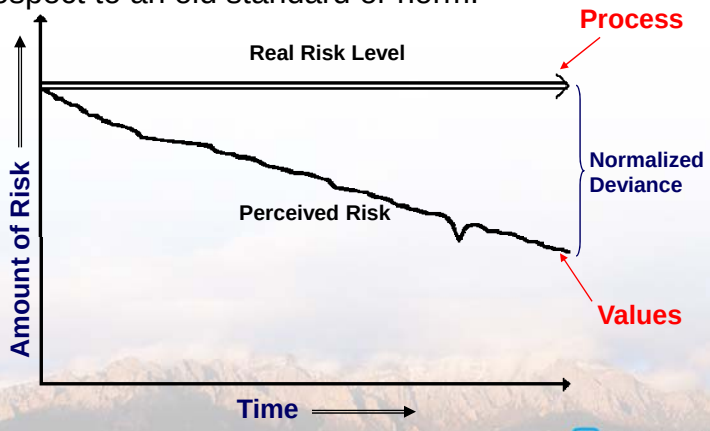
Normalized Deviance

Focusing on one moment in time, you see negligence with respect to an old standard or norm.



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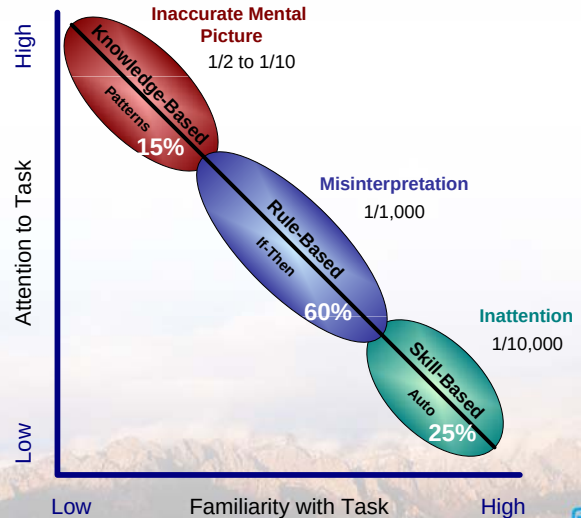
Consider Performance Modes



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Fundamental Human Performance Tools

- Task Preview
- Job-Site Review
- Questioning Attitude
- Stop (& collaborate) when unsure

SITUATIONAL AWARENESS

- Self-Checking
- Procedure Use and Adherence
- Effective Communication

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Conditional Human Performance Tools

- Pre-job Briefing
- Peer-Checking
- Concurrent Verification
- Independent Verification
- Flagging
- Placekeeping
- Turnover
- Post-job Review

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Team Errors

- ***Halo Effect***: Blind trust in the competence of specific individuals
- ***Pilot / Co-pilot***: Subordinate reluctant to challenge opinions, decisions, or actions of senior person
- ***Free Riding***: One takes the lead while others tag along without actively scrutinizing the work.

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Team Errors (Cont.)

- ***Groupthink***: Reluctance to share contradictory information for the sake of maintaining harmony
- ***Risky Shift***: Tendency to gamble with decisions more as a group than if each member was making the decision individually – accountability is diffused (also called "*herd mentality*")

It takes a _____ error to have an event.

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REVIEW
Lesson 2 Objectives

Participants will be able to….

1. **Recognize** the indications and characteristics of at-risk attitudes.
2. **Identify** common error precursors.
3. **Describe** how to predict, manage, and prevent error-likely situations.
4. **Understand** basic human performance tools for reducing human error.

2 - 21

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LESSON 3
Managing Defenses

Lesson 3 Objectives

Participants will be able to….

1. **Understand** how individual behavior is influenced by organizational processes and values.
2. **Describe** the functions, categories, and dependability of defenses.
3. **Understand** basic human performance tools for finding organizational weaknesses.
4. **Describe** the value of error tolerant systems.

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Human Fallibility

"Events are not so much the result of error-prone workers as they are the outcome of error-prone tasks and error-prone work environments, which are controlled by _____."

\- ***James Reason***
Managing the Risks of Organizational Accidents

3 - 3

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Who is the Organization?

A group of individuals (managers, supervisors, staff) with a shared purpose (mission) and means (processes) to efficiently apply resources toward the safe and reliable (values) design, construction, operation, and maintenance of the physical facility.

3 - 4

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Human Performance and the Organization

"No matter how efficiently {plant} equipment functions; how good the training, supervision, and procedures are; and how well the best worker, engineer, or manager perform his or her duties, people cannot perform better than _____supporting them."

- ***Maurino, Reason, Johnston, and Lee,***
Beyond Aviation Human Factors, 1995.

3 - 5

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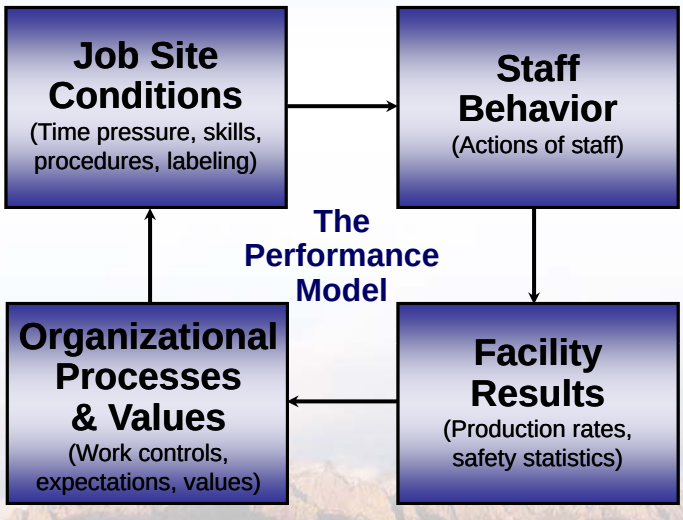
Influence of the Organization



3 - 6

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Latent Organizational Weaknesses / Conditions

Undetected deficiencies in processes or values, or equipment flaws that create workplace conditions that provoke error ("error precursors") or degrade the integrity of defenses ("flawed defenses").

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Function of the Organization

Provide Structure

- Establish Mission & Goals
- Develop Business Plans
- Establish Budget Priorities
- Select & Train Personnel
- Develop & Implement Policies & Procedures
- Develop & Implement Programs
- Establish Work Processes
- Define Roles & Relationships

Promote Values

- Priorities
- Measures & Controls
- Rewards & Sanctions
- Reactions to Incidents
- Reinforcement
- Coaching
- Teamwork

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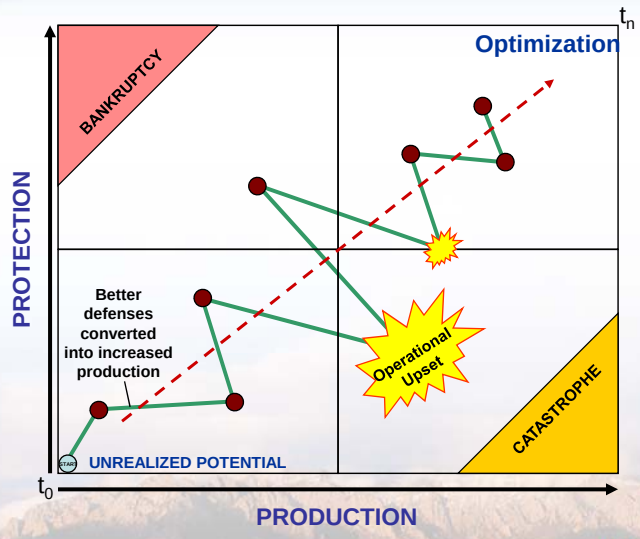
Competing Priorities?



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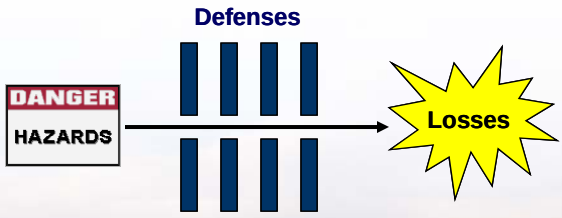
Organizational Accidents

All **organizational accidents** entail the breaching of the barriers and safeguards that separate damaging and injurious hazards from vulnerable people or assets … collectively termed "***losses***."



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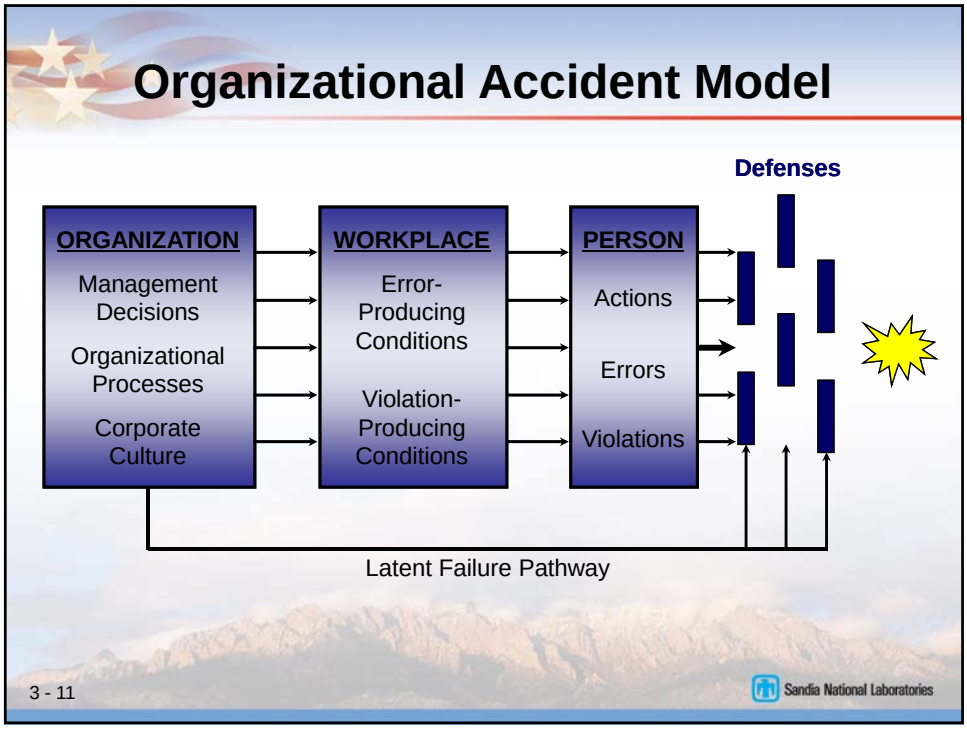
Organizational Accident Model
Defenses
ORGANIZATION
Management Decisions
Organizational Processes
Corporate Culture
WORKPLACE
Error-Producing Conditions
Violation-Producing Conditions
PERSON
Actions
Errors
Violations
Latent Failure Pathway
3 - 11
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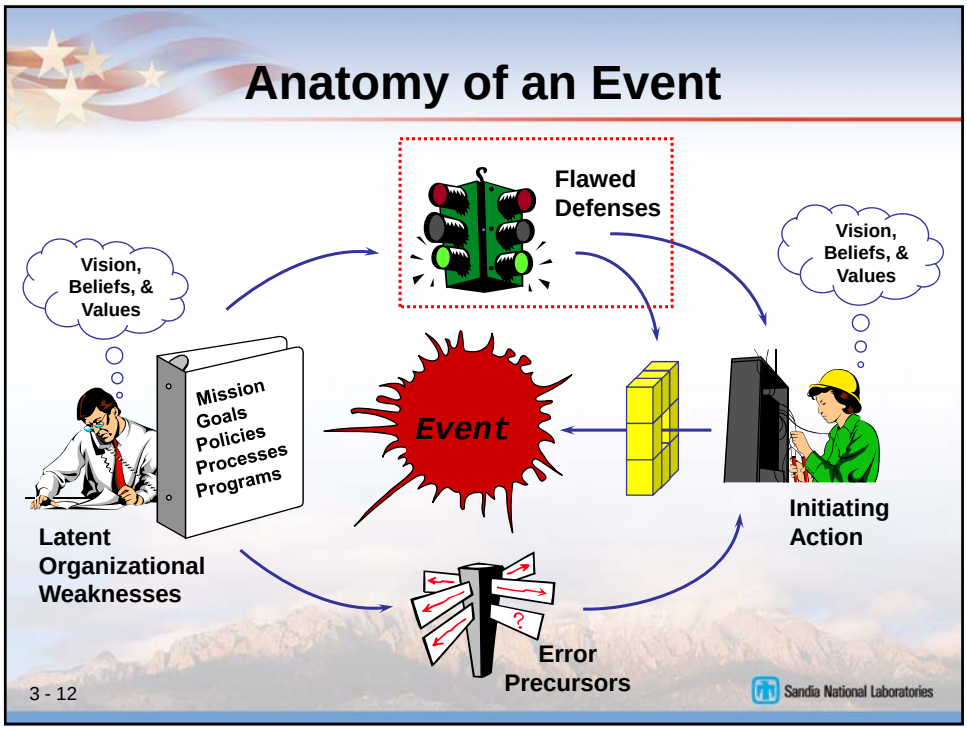
Anatomy of an Event
Flawed Defenses
Vision, Beliefs, & Values
Vision, Beliefs, & Values
Mission
Goals
Policies
Processes
Programs
Event
Latent Organizational Weaknesses
Initiating Action
Error Precursors
3 - 12
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Functions of Defenses

$R_e + M_d \rightarrow \not{UO}$

- ***Create Awareness*** and ***Understanding*** of hazards
- Give clear ***Guidance*** on how to operate safely
- ***Detect*** & ***Warn*** of imminent danger
- ***Protect*** against error / harm and potential losses
- ***Restore*** facility to a safe condition
- ***Contain/Mitigate*** the effects of errors and hazards
- Provide the means of ***Escape*** and ***Rescue*** should containment fail

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Categories of Defenses

- _____ Controls
- _____ Controls
- _____ Controls
- _____ Controls

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Defense-in-Depth

"… assume that mistakes will happen, and have in place procedures {e.g., barriers, practices, etc.} that will catch and correct them before they snowball."

- Vincent Czaplyski,
Boeing 727 Check Airman

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Defense-In-Depth

Active Error

Facility & Equipment Design

Verbal & Written Communication and Procedures

Work Practices

Personnel Training

Protective Equipment

Diverse and Redundant

Operational Upset

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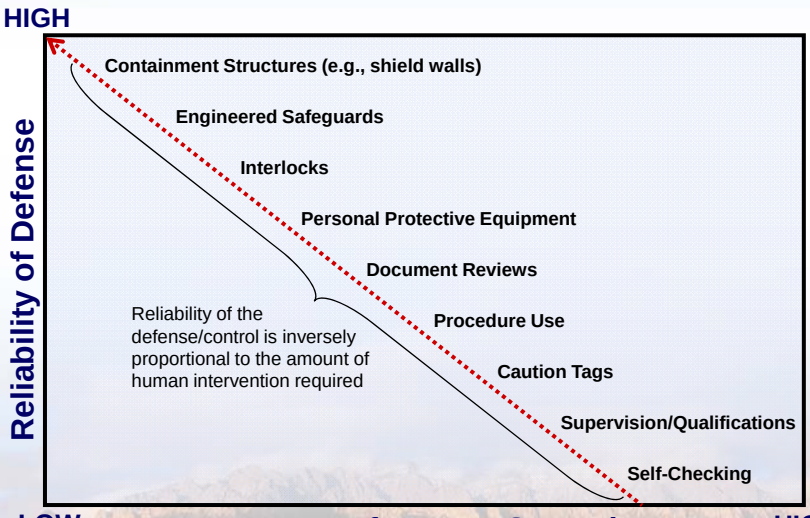
Dependability of Defenses



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Dependability of Defenses (Cont.)

WARNING: Defense-in-depth can be a two-edged sword.

- Redundant defenses improve safety margins but also increase _____.
- Flaws, traps, flawed defenses, and safety hazards can become more difficult to detect.
  - Latent conditions allowed to persist

Weakness in defenses may not be detected and repaired … because the people involved often forget to be afraid.

3 - 18

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Tools for Finding Latent Organizational Weaknesses

- Observations
- Self-Assessments
- Benchmarking
- Post-Job Critiques
- Key Performance Indicators
- Surveys & Questionnaires

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Value Prevention of Errors

Understanding human fallibility encourages a proactive perspective toward work:

- It is easy to err, and a person may not even know it
- Workers should possess a keen - and healthy - sense of _____ toward any activity
  - prompts the mindset: "*expect success but anticipate failure*"
  - fosters ***intolerance for error traps / precursors***

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The Value of Error Tolerance

***Error Tolerance**:*

- Design processes, tasks, equipment, etc., such that the inevitable human error will not result in an _____

Error without consequence shows that our systems are error-tolerant and that they are working.

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REVIEW Lesson 3 Objectives

Participants will be able to….

1. **Understand** how individual behavior is influenced by organizational processes and values.
2. **Describe** the functions, categories, and dependability of defenses.
3. **Understand** basic human performance tools for finding organizational weaknesses.
4. **Describe** the value of error tolerant systems.

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LESSON 4
Leadership and Culture

Lesson 4 Objectives

Participants will be able to….

1. **Understand** how encouragement and reinforcement affects individual performance.
2. **Describe** the elements of a culture of mindfulness.
3. **Discuss** the value of lessons learned.

Leader Defined

Any individual who takes personal responsibility for their performance and the organization's performance.

- Attempts to influence the improvement of organizational processes and values.
- Influences others through relationships characterized by respect, honesty, and fairness.

4 - 3

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Human Performance Improvement Principle #4

People achieve high levels of performance largely because of the _____ and _____ received from leaders, peers and subordinates.

4 - 4

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Open Communication

Managers:

"Ask for what you need to hear, not for what you want to hear."

Subordinates:

"Tell your boss what they need to hear, not what you think they want to hear."

-- Roger Boisjoly –
Former Chief Engineer, Morton-Thiokol, Inc.

Facilitate Open Communication (Cont.)

"With every problem, someone somewhere sees it coming. But those people tend to be low rank, invisible, unauthorized, reluctant to speak up, and many not even know they know something that is consequential."

- Weick & Sutcliffe
Managing the Unexpected

Elements of a Culture of Mindfulness

A culture that creates and sustains intelligent wariness. To be mindful is to "see more clearly, not to think harder and longer.

Consists of:

1. A _____ culture
2. A _____ culture
3. A _____ culture
4. A _____ culture

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A Reporting Culture

Basis of reporting = valid feedback on local and organizational factors promoting errors and incidents is far more important than assigning blame to individuals.

The Challenge:

- **Natural disinclination to confess** – *"Me?"*
- **Suspicion** – *"It will count against us!"*
- **Skepticism** – *"Management won't act!"*
- **Takes time and effort** – *"Not worth it!"*

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A Learning Culture

Facilitates the learning of all its members and consciously transforms itself and its context

- Possess a strong desire to find and fix flaws
- Quickly learn from mistakes
- Aggressively respond to problems
- Appreciate the impact of their actions on others
- Foster inquiry and open dialogue

"Learning disabilities are tragic in children, but fatal in organizations."

Peter Senge, Organizational Theorist

6 - 9

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A Flexible Culture

Flexibility is one of the defining properties of High Reliability Organizations (HROs).

- Characterized by a constant concern – an intelligent awareness – a proactive mental framework
- Promoted by:
  - Face-to-face communication
  - Divergent work groups
  - A highly trained staff
  - A balanced work control system

4 - 10

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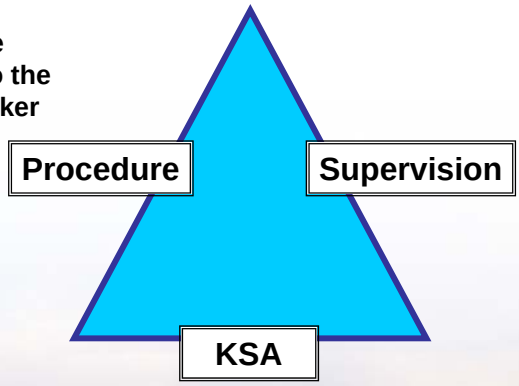
A Balanced Work Control System

Procedure appropriate to the task and worker



Knowledge, skill, and ability of the worker

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A Just Culture

Atmosphere of trust in which people are encouraged, even rewarded, for providing essential information – but in which they are also clear about where the line is drawn between acceptable and unacceptable behavior.

Zero tolerance for **reckless behavior**

balanced by:

Widespread confidence that the vast majority of **unintended unsafe acts** will go unpunished.

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Human Performance Improvement Principle #5

Events can be avoided through an understanding of the reasons mistakes occur and the application of the _____ from past events (or errors).

4 - 13

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REVIEW
Lesson 4 Objectives

Participants will be able to….

1. **Understand** how encouragement and reinforcement affects individual performance.
2. **Describe** the elements of a culture of mindfulness.
3. **Discuss** the value of lessons learned.

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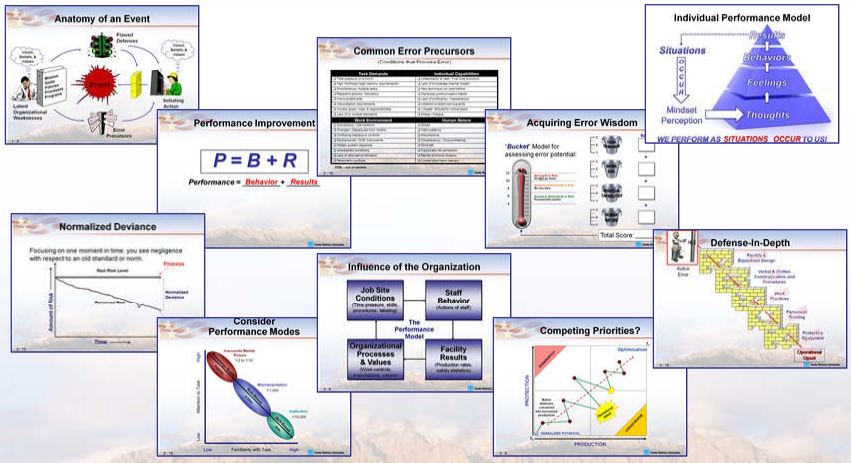
HPI100
Conclusion



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Course Goals

1. To **familiarize** Sandia with behaviors that help to align organizational processes and values.
2. To **promote** a structured mental framework that will help people to more readily identify flawed defenses, error-likely situations, and latent organizational weaknesses.
3. To **familiarize** Sandia with proven tools for reducing human error to the lowest possible levels of frequency and severity.

I - 2

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Course Objectives

Participants will be able to….

1. **Improve** individual and organizational performance using a coherent, strategic, and proven approach.
2. **Understand** how implementation of human performance improvement principles enhances productivity, reliability, efficiency, and quality.
3. **Implement** techniques that identify and eliminate error-likely situations, flawed defenses, and latent organizational weaknesses.

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Principles of Human Performance

1. People are fallible - even the best people 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 largely because of the encouragement and reinforcement received from leaders, peers, and subordinates.
5. Events can be avoided through an understanding of the reasons mistakes occur and the application of the lessons learned from past events (or errors).

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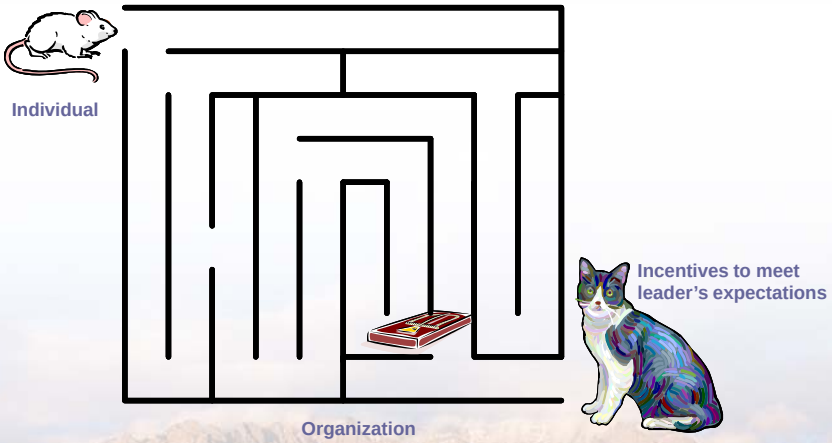
How to Improve Human Performance



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- *The Field Guide to Understanding Human Error*, Sidney Dekker
- *Managing the Unexpected*, Karl Weick & Kathleen Sutcliffe
- *Viral Change*, Leandro Herrero
- *Managing the Risks of Organizational Accidents*, James Reason
- *Organizational Culture and Leadership, Edgar Schein*
- *The Human Contribution, James Reason*
- *Human Performance Fundamentals – Course Reference*, Institute of Nuclear Power Operations (INPO)
- *Human Performance Improvement Handbook (Draft Standard)*, U.S. Dept. of Energy
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- *Bringing Out the Best in People, Aubrey Daniels*

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- *The Atomic Chef, Steven Casey*
- *Set Phasers on Stun, Steven Casey*
- *The Fifth Discipline,* Peter Senge
- *Crucial Conversations,* VitalSmarts™
- *Crucial Confrontations,* VitalSmarts™
- *Influencer,* VitalSmarts™
- *The Black Swan,* Nassim Nicholas Taleb
- *A Field Guide to Good Decisions*, Bennett and Gibson
- *Good to Great*, Jim Collins
- *Built to Last*, Jim Collins
- *The ETTO Principle,* Erik Hollnagel
- *Barriers and Accident Prevention*, Erik Hollnagel

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HPI200 Course References (cont.)

- *The Oz Principle,* Connors, Smith, and Hickman
- *Journey to the Emerald City,* Connors, Smith, and Hickman
- *Just Listen*, Mark Goulston
- *The Seven Habits of Highly Effective People*, Stephen R. Covey
- *The Speed of Trust*, Stephen R. Covey
- *The 8th Habit*, Stephen R. Covey
- *The Checklist Manifesto*, Atul Gawande
- *Risky Work Environments, Owen, Beguin, and Wackers*
- *Chasing the Rabbit, Stephen J. Spear*

Sandia National Laboratories

Fundamental Human Performance Improvement Tool

Task Preview

What it is:

Task Preview is a structured means by which to consider the elements and constraints of a task from a human performance perspective prior to beginning the task. It involves consideration of risks involved in performing the task, and offers the worker an opportunity to consider the 'whole job' and the effects (or potential effects) upon the surroundings or other work in progress of performing a specific task.

Task Preview is a tool that highly skilled workers often use as a routine aspect of how they do their work, without recognizing it as a specific "tool." Many would consider conducting such a preview before beginning work purely as "common sense."

Others may consider that different aspects of the technique are 'covered' by various elements of the work process. For example, the mindset might be that the consideration of external conditions and ramifications of performing a given task was covered during the planning/scheduling process. While this might be true, having the task performer review such considerations as part of their individual Task Preview adds another barrier to human error. The more barriers we have, the less likely it is for mistakes to occur.

While the depth and rigor may vary based upon the work at hand, ***Task Preview*** is a fundamental tool for error prevention, and should be used prior to the conduct of every task by every worker.

Why to use it:

- To mentally and physically prepare to perform the task correctly
- To enhance awareness of all aspects of the job
- To consider how actions to be taken may impact safety and production
- To minimize the potential for making mistakes

When to use it:

- Before beginning any task
- Prior to a scheduled Pre-Job Brief
- Just prior to any step that might be considered "critical"
- Following extended delays in task performance (lunch, breaks, etc.)

How to use it:

- Review procedures, charts and work packages to identify:
  - Scope of work
  - Task sequence
  - Critical steps

- Ask, “What is the worst that could happen?”
- Consider controls, contingencies, and past experience
- Identify appropriate error prevention tools
- A great technique for ensuring a thorough Task Preview is to use the following memory aid **“S-A-F-E-R”**:
  - **Summarize** ‘critical’ / key steps
  - **Anticipate** error-likely situations and the precursors to those situations
  - **Foresee** the possible, probable and worst-case consequences of possible errors occurring during each of the ‘critical’ / key steps
  - **Evaluate** the controls or ‘defenses’ available for each ‘critical’ / key step to (1) prevent, (2) catch, (3) recover from, and (4) minimize the consequences of errors
  - **Review** related previous experience and lessons learned relevant to the task and associated steps

Fundamental Human Performance Improvement Tool

Job Site Review

What it is:

A ***Jobsite Review*** is an evaluation of a work area or work site by the individuals who will be performing work before work is commenced. It is conducted to assess system/equipment condition, to identify key components and critical indicators, to evaluate any workplace hazards, and to familiarize workers with locations and nomenclature relative to procedures / work packages.

An awareness of all aspects of the jobsite is important not only for efficient task performance, but for personnel and equipment safety as well. Taking the time necessary to become familiar with jobsite conditions helps to establish focused mental engagement and promotes a *Questioning Attitude* on behalf of those about to do the work.

The jobsite conditions / work environment may change during the course of job performance. As such, a periodic evaluation of jobsite hazards / potential hazards, as well as changes in external conditions that might affect performance of the task itself is a fundamental aspect of preventing error.

Why to use it:

- To become aware of work environment
- To identify changing or off-normal conditions
- To identify any potential safety or performance hazards
- To minimize the potential for making mistakes

When to use it:

- All the time

How to use it:

- Explore the work area and ***ASK QUESTIONS*** regarding…
  - Potential safety hazards
  - Potential problems and error traps (or error-likely situations)
  - Available tools and equipment
- Verify proper equipment, proper system, proper component
- Identify appropriate error prevention tools
- Ensure others are aware of any potential hazards

Fundamental Human Performance Improvement Tool

Questioning Attitude

What it is:

Questioning Attitude is simply an attitude of 'being sure'. It is a cautious and thoughtful approach, exercised before, during and after taking an action. It is a process of fully understanding, considering pertinent 'what ifs', and resolving any question in your mind before moving forward. A critical aspect of *Questioning Attitude* is both the advocacy of specific issues and the raising of concerns.

Questioning Attitude is a tool that keeps the mind engaged. Mental engagement is critical to preventing errors. Through this mental engagement, asking appropriate questions (and getting resolution) roots out potential pitfalls caused by Latent Organizational Weaknesses, and overcomes the negative effects of most human error traps.

Questioning Attitude greatly minimizes the potential for making mistakes. It also identifies waste and non-value added activities, and can create much more efficient methods and processes.

Why to use it:

- To challenge pre-conceptions and assumptions
- To stimulate healthy thought regarding processes and procedure steps
- To consider actions and assumptions from differing perspectives
- To identify waste and non-value-added activities
- To minimize the potential for making mistakes

When to use it:

- At ***all*** times

How to use it:

- Be aware when things "don't seem right" and pursue an answer as to why
- **STOP WHEN UNSURE!**
- Consider the "what ifs" ***prior*** to taking any action or making any decision
- Be deliberate in constructively questioning the thoughts/assumptions of others
- Offer challenging questions in a spirit of helpfulness and caring
- Be open and receptive to being questioned by others
- Appoint a "devil's advocate" in decision-making processes
- ***NEVER ASSUME ANYTHING***

Fundamental Human Performance Improvement Tool

STOP When Unsure

What it is:

Stop When Unsure is a defined behavior that is executed whenever a worker finds himself/herself in a state of confusion or uncertainty when performing a task. It is designed to halt actions and acquire resolution prior to proceeding.

When a worker is in a state of confusion or uncertainty and they proceed with the task, they enter into the Knowledge-based performance mode. Error likeliness is greatly increased in this mode (often to a 1-out-of-2 chance of making a mistake). This is where "Murphy's Law" oftentimes comes into play.

By providing a defined tool for the worker to use when he or she recognizes their state of confusion or uncertainty, performance is returned to the Rule-based mode. The potential for error is thus greatly reduced, and resolution is acquired prior to proceeding.

In many cases, resolution to uncertainty or confusion may simply be the elimination of the confusion or uncertainty by those more knowledgeable with the task.

Why:

- To eliminate confusion or uncertainty
- To get clarification ***BEFORE*** proceeding
- To provide for a brief stoppage of work when necessary
- To minimize the potential for making mistakes

When:

- When uncertainty or doubt exists during task performance
- If outside conditions assumed by work instructions
- When feeling distrustful of another individual
- When unexpected conditions/results occur
- When something expected does not happen

How:

- *Whenever you're unsure or things "just don't seem right"…*
  - **STOP!**
  - Place whatever you're working on in a safe condition (as appropriate)
  - Notify your supervisor
  - Resolve the issue / get the procedure fixed ***BEFORE*** proceeding

- **Watch out for …**
  - Thinking a task is “simple” or “routine”
  - Believing that nothing bad can happen
  - Discounting questions/concerns of those less experienced
  - Not asking for help

Fundamental Human Performance Improvement Tool

Self-Checking

What it is:

It is a natural tendency for the human brain to 'wander'; for attention to be scattered and not necessarily fully focused on a task at hand. On top of this, we are confronted regularly with human error traps (distractions and interruptions, time pressure, mental stress, environmental factors, etc.) that can further draw our attention from where it should be.

One of the two most powerful human performance improvement tools, ***Self-Checking*** is a defined technique whereby you (as an individual performing a task) can ensure that you do the right thing to the right thing. It provides for conscious and deliberate thought prior to performing an action, when taking the action, and for ensuring that the desired response was achieved when the action was taken.

Self-Checking brings you into focus and fully engages your conscious mind in the task at hand. When taking an action, ***Self-Checking*** is the last barrier between you and a mistake.

Why to use it:

- To ensure that you do the right thing to the right thing ***BEFORE*** you take action
- To consider the indications and results you desire
- To verify that the desired indications/results were received
- To ensure that what you expected to happen is what actually happened
- To minimize the potential for making mistakes

When to use it:

- ***BEFORE*** and ***DURING*** performance of any activity where mis-performance could cause bad things to happen

How to use it:

- **Stop**
- **Think**
- **Act**
- **Review**

- *Before taking action* …
  - ***STOP*** … take a moment to think about what you're going to do
  - Eliminate current or potential distractions
  - ***THINK*** through your desired response/ indications / outcome

- *During your action* …
  - READ the direction(s) to perform the action
  - VERIFY the appropriate component, instrument, etc.
  - Take the ***ACT***ion
- *After your action* …
  - ***REVIEW*** what happened
  - VERIFY the desired indication/response/outcome
  - If the action/outcome is not as expected, take action as previously anticipated/determined

General Rules and Insights

1. The *Self-Check* technique is intended to be a continuous sequence. If interruptions occur during the sequence (such as someone asking you a question, etc.), start over.
2. When conducting physical actions (such as manipulating equipment, performing work on a patient, etc.), each element of S-T-A-R can be verbalized and overtly demonstrated. Doing so improves the formality and focus with which the tool is applied, infuses a level of professionalism and precision into your actions, and can greatly enhance the effectiveness of the tool.
3. For non-physical actions, use of S-T-A-R is more of a mental exercise; however, its usefulness should be recognized, irrespective of the task at hand. Again…this is one of the most powerful tools that exists for preventing mistakes.

Fundamental Human Performance Improvement Tool

Procedure Use

What it is:

Procedure Use involves adherence to the governing documents of an organization, activity, or task. Such documents can include formal procedures, policies, work packages/instructions, job sheets, etc.

Guiding documents have typically been thought through by individuals with experience in the given activity (and hopefully tested and revised over time), and should therefore guide you through a process in an appropriate sequence with minimum potential for error. Following accurate guiding documents ensures that right actions are performed in the right sequence.

A well-designed document averts potential human error traps, and lays out a sequence of events that is most efficient and effective for everything and everyone involved. Experience has shown not following such documents to be a large contributor to human error and has resulted in numerous consequential events.

Why to use it:

- To ensure that the right actions are performed in the right sequence
- To minimize the potential for making mistakes

When to use it:

- ***AT ALL TIMES*** when procedure, policy, work package, job instruction, or check sheet, requirements exist
- When, in the judgment of a worker, a work document should exist but does not. In such cases, ASK QUESTIONS. STOP the process and get clarification from supervision prior to proceeding with the task.

How to use it:

- Ensure that you are ***QUALIFIED*** to complete the task
- Verify procedures are current ***BEFORE*** use
- Unless otherwise directed, perform all steps ***in the order written***
- Use ***THINKING*** compliance. ***DO NOT interpret***
- *What if you're unsure or the procedure just "doesn't seem right"?*
  - **STOP!**
  - Place whatever you're working on in a safe condition (as appropriate)
  - Notify your supervisor
  - Resolve the issue / get the procedure fixed ***BEFORE*** proceeding

Fundamental Human Performance Improvement Tool

Effective Communication

What it is:

The goal of ***Effective Communication*** is mutual understanding between two or more people (e.g., sender to receiver), *especially communication involving technical information related to facility operation or personnel safety*. Effective communication is likely the most important defense in the prevention of errors and events. The verbal exchange of information, especially face-to-face, is the most frequent form of communication, an important team behavior. However, verbal communication possesses a greater risk of misunderstanding compared to written forms of communication. Misunderstandings are most likely to occur when the individuals involved have different understandings, or mental models, of the current work situation or use terms that are potentially confusing. Therefore, confirmation of verbal exchanges of operational information between persons must occur to promote understanding and reliability of the communication.

Effective Communication will improve the accuracy of any communication irrespective of the significance of the consequences should miscommunication occur. Experience has shown that members of organizations who regularly use this tool during the conduct of work (routine or otherwise) make fewer mistakes and work with a higher level of accuracy.

Regular use of *Effective Communications* also makes it a natural means of communicating when abnormal/emergency conditions occur (thereby greatly reducing the potential for error to occur).

Why to use it:

- To provide for the accurate, concise, clear, and mistake-free transfer of information
- To ensure that the message intended is the message received
- To minimize the potential for making mistakes

When to use it:

- ***All the time***
- *FORMAL Communication Tools (three-part communication and use of phonetics) are used when…*
  - Communicating an important condition or parameter
  - Operating or testing critical equipment
  - Communicating instructions from a formal work document
  - Directing the activities of other workers
  - Directed by specific organizational guidance

How to use it:

- *Three-Part Communication includes…*
  - *Send the Message* [The sender provides clear and concise direction/information]
  - *Acknowledgement* [The receiver repeats back the message to the sender. If the message is direction, it is repeated back verbatim; if information, the message may be paraphrased.]
  - *Confirmation of Acknowledgement* [The sender confirms that the receiver understands the correct message by affirming the acknowledgement.]
- The Phonetic Alphabet is used when verbally communicating ALL alpha- or alpha-numeric designations
  - Use of the phonetic alphabet eliminates the potential for error caused by misheard letter designators. There are many letters that sound same (such as "B," "C," "D," "E," "G," etc.). This can be especially true in noisy environments and in the presence of human error traps (such as time pressure or mental stress).
  - When using the phonetic alphabet, it is a simple matter of saying a commonly accepted word in the place of a letter. For example, "34A," would be spoken as, "34alpha". The standard phonetic terms are provided in the table below.

PHONETIC ALPHABET			
A - Alpha	H - Hotel	O - Oscar	V - Victor
B - Bravo	I - India	P - Papa	W - Whiskey
C - Charlie	J - Juliette	Q - Quebec	X - X-ray
D -Delta	K - Kilo	R - Romeo	Y - Yankee
E - Echo	L - Lima	S - Sierra	Z - Zulu
F - Foxtrot	M - Mike	T - Tango	
G - Golf	N - November	U - Uniform	

- "Phonetic Numbering" is used when verbally communicating numbers that sound the same.
  - Phonetic Numerals are used for the same purpose as the phonetic alphabet- to prevent miscommunication of numbers. The good news here is that there are no terms to memorize (as in the phonetic alphabet). This is merely a different way to pronounce numbers that sound similar (for example, "16" and "60").
  - Since "16" ("sixteen") sounds very similar to "60" ("sixty"), we pronounce "16" as "one-six" and "60" as "six-zero." This is the same for "14" and "40"…"15" and "50", etc. A few other examples are provided below:

    "130" = "*one-three-zero*"

    "1,600" = "*one-six-hundred*"

    "17,000" = "*one-seven-thousand*"

Conditional Human Performance Improvement Tool

Pre-Job Brief

What it is:

Pre-Job Briefs (referred to as "tailboards" in some organizations) are discussions of an activity before the activity is performed. The discussion includes ALL persons involved in the activity. While the level of detail and formality of a ***Pre-Job Brief*** may vary depending upon the complexity / potential consequences of the activity, it provides a discreet opportunity for everyone involved to get onto the 'same page.'

Pre-Job Briefs provide the opportunity for everyone involved to fully understand the tasks and potential consequences of the activity. It provides an opportunity for everyone to ask questions, to fully comprehend their individual roles, to identify how their actions will coordinate with those of the others involved, and to understand how their actions will affect the overall activity.

Pre-Job Briefs also provide an opportunity to consider what could possibly go wrong during the performance of the activity, and to agree on pre-determined contingencies should things not go as planned.

Experience has clearly shown that effective ***Pre-Job Briefs*** significantly reduce the likelihood of errors caused by confusion, lack of clearly defined lines of responsibility, inappropriate assumptions made during performance of a task, failure to learn from previous experience, and failure to identify and eliminate potential traps.

Effective ***Pre-Job Briefs*** minimize the potential for making mistakes.

Why to use it:

- To inform all involved workers of the intended work scope
- To define individuals' roles in the execution and support of the job
- To anticipate challenge areas and identify, in advance, expected responses
- To discuss past challenges and successes in performing the work here and elsewhere in the industry
- To minimize the potential for making mistakes

When to use it:

- *Before commencement of any work that…*
  - is complex
  - is being done for the first time
  - has any potential for significant consequences should something go wrong

How to use it:

The more complex or potentially significant the job or consequences of an error, the more extensive the Pre-job Brief:

- Is attended by ALL personnel involved in attending the work
- Is conducted as close to the time of implementation as practical
- **S**ummarize critical steps
- **A**nticipate error-likely situations
- **F**oresee consequences
- **E**valuate defenses
- **R**eview related past experience
- Use an appropriate checklist to facilitate the brief
- Provide all attendees with open opportunity to ASK QUESTIONS

General Rules and Insights

Pre-Job Briefs should be scheduled as near to the actual beginning of the activity as possible. Significant time delays between the brief and commencement of work will result in loss of retention on the behalf of those involved. Furthermore, the greater the time between *Pre-Job Brief* and performance of the activity, the greater the potential for changes in external or peripheral conditions that might affect the activity itself.

Emergency situations requiring immediate actions obviously do not require *Pre-Job Briefs* before taking action; however, a *Pre-Job Brief* should be conducted as soon as the situation allows thereby ensuring that everyone involved is on the same page.

Conditional Human Performance Improvement Tool

Peer Checking

What it is:

Peer Checking is the verification by a second person (a **peer**) that the *actions* of an individual performing an activity are correct. When possible (such as in the manipulation of equipment or in the performance of a procedure that is not time critical), Peer Checking takes place before the **performer** takes the action, ensuring that the action about to be taken is correct. This type of *Peer Check* is referred to as an "online *Peer Check*".

There are many types of tasks where the term ***Peer Checking*** is used synonymously with 'second check' or 'second verification'. In such cases, the action has already been taken, followed by a check of the work by a second individual. Good examples of this type of Peer Check (referred to as an "offline Peer Check") include checking of a calculation performed by an Engineer, or checking the wording of a document prior to release/publication.

In its purest sense, ***Peer Checking*** is nothing more than backing someone up. It is a well-known fact that human beings make mistakes. It is an equally known fact that teams are consistently more successful than lone individuals. ***Peer Checking*** simply builds upon the success of teamwork and provides a "team of two" to ensure that important activities are performed without error.

Why to use it:

- To provide an in-process second check of intended actions ***BEFORE*** the actions are taken
- To allow us to learn from one another
- To minimize the potential for making mistakes

When to use it:

- When the action to be taken is not immediately reversible
- When performing manipulations/steps/actions that, if performed in error, could result in significant consequences

How to use it:

- Request a *Peer Check* when conditions are appropriate
- Use ***Effective Communications***
- *Performer*: ***Prior*** to taking the intended action…
  - Consult the proper controlling document(s)
  - Indicate the specific action to be taken, and…
  - Verbalize the action(s) (including simulating the intended action)
    - Example: ***"I am going to open switch alpha-zero-six [A-06]"***
- *Peer Checker*: ***Prior*** to operation…
  - Carefully observe the stated and simulated actions

  - Seek clarification if uncertain of the performer's intent
  - Provide response to the performer once satisfied that the actions to be taken are correct
  - If it appears that an incorrect action is about to be taken, say, "STOP" to the performer and seek clarification
- The Performer ***THEN*** performs the specified action with engagement as required from the peer

General Rules and Insights

Experience has proven that once *Peer Checking* becomes part of a culture, overall teamwork improves and error rates drop. *Peer Checking* helps to break down many of the barriers to effective personnel interaction. Once this occurs, it becomes second nature for all levels of the organization to proactively challenge one another. This creates a very healthy work environment that is strongly biased toward and mutually supportive of error-free performance.

Peer Checking helps the members of your organization to learn from one another by promoting the exchange of knowledge, skill and experience.

Ultimately, your entire organization should share a common set of goals - to safely and efficiently fulfill the vision and mission of the organization. Keep this in mind when initial resistance to *Peer Checking* is encountered.

Conditional Human Performance Improvement Tool

Peer Coaching

What it is:

Peer Coaching is the act of one worker observing the actions/behaviors of another, and sharing insights through feedback that serve to positively recognize and reinforce positive behaviors and/or provide corrective / helpful insights when behaviors either do not meet expectations or when performance can be improved, made more efficient, etc.

Peer Coaching capitalizes upon the concept of, "*No one of us is as smart as all of us*." By achieving the cultural ideal that, "Everyone's a Coach," an organization taps into the wealth of knowledge and insight existing within the members of the organization, and does so in an information-sharing manner through which everyone benefits.

Why to use it:

- To transfer knowledge, awareness and insight
- To positively influence behaviors
- To reinforce standards, expectations, and use of the Tools
- To elevate overall organizational performance
- To minimize the potential for making mistakes

When to use it:

- *Peer Coaching is appropriate…*
  - Whenever the opportunity presents itself
  - When behaviors differ from expectations
  - When knowledge and insight can be shared to promote more effective task performance

How to use it:

- Demonstrate a positive and caring attitude
- Focus on facts
- Share personal experience and insight
- Provide timely feedback on behaviors
- Use ***POSITIVE*** reinforcement

General Rules and Insights

- Anyone engaging in *Peer Coaching* should do so because they care. They care about the success of the individuals being coached; they care about the success of the team.
- It is important to remember that *Peer Coaching* is also to be used for positive reinforcement (not simply for correction).
- The more timely the coaching, the more likely that it will succeed. Be prompt. Be clear. Be positive.

Conditional Human Performance Improvement Tool

Concurrent Verification

What it is:

Concurrent Verification consists of a series of actions - by two individuals working together at the *same time and place* - to separately confirm the **condition** (or configuration) of a component/equipment before, during, and after an action (e.g., a critical step).

Why to use it:

- To ensure that the requirements of the task (i.e., equipment condition) have been completed in conformance with associated standards and procedures
- To maintain positive control of alterations of important equipment

When to use it:

- When the consequences of an error would result in possibly irreversible harm, damage, or negative consequences
- When independent verification (verification separated by time) is not viable or advisable

How to use it:

- Prior to execution, the *performer and verifier* mutually agree on the action to take, referencing the guiding document separately, and the equipment condition to achieve
- The *performer* self-checks the correct component
- The *verifier* separately self-checks the correct component
- The *performer and the verifier* agree on the correct component, and the final condition to be achieved
- The *verifier* observes the *performer* before and during task execution
- By one or more of the following methods, the *performer and the verifier* separately confirm that the final condition and the expected response are correct:
  - hands-on check (preferred)
  - system response
- The *performer and verifier* sign or initial the guiding document or checklist to record the verification

IMPORTANT NOTE: Because Concurrent Verification requires both individuals to work together, side by side, true *independence* cannot be achieved. However, each person attempts to be as objective and unbiased as possible during each step of the process.

Conditional Human Performance Improvement Tool

Independent Verification

What it is:

Independent Verification is a series of actions by two individuals working independently to confirm the condition of a component after the original act that placed it in that condition. It involves a second check of action(s) taken after the fact by an individual maintaining both physical and mental disengagement from the individual who performed the action(s). It is predominantly used when specifically required by procedure, regulatory requirements, or management directive.

Why to use it:

- To ensure that the requirements of the task have been completed in conformance with associated standards and procedures

When to use it:

- *Following task performance where a second independent verification is appropriate (such as)…*
  - Placement of protective/caution tagging
  - Verification of calculations
  - Restoration of equipment to service following maintenance
  - Installation and removal of temporary modifications such as jumpers, hoses, etc.

How to use it:

- The verifier and performer should be separated by time, space, and thought
- Verification occurs AFTER task completion
- Verifier must not be influenced by visual or audible cues from the performer
- Verifier and performer should not collaborate on actions taken

General Rules and Insights

Separation of time, distance, and thought are important to achieve true independence of verification.

Conditional Human Performance Improvement Tool

Flagging

What it is:

Flagging involves the distinct marking, in some capacity, of specified components in such a manner that visually helps worker(s) identify and return to them during the performance of a task or evolution.

Equipment arrangements, less than optimum labeling, and human factors elements such as similar looking components in close proximity increase the potential for human error when tasks are being performed. ***Flagging*** provides positive visual cues to help ensure that workers access the correct components and/or stay away from incorrect components.

Why to use it:

- To help ensure work is done on correct components
- To pre-designate components
- To identify off-normal component conditions
- To shield components from inadvertent manipulation

When to use it:

- When handling a component multiple times near similar-looking equipment
- While working on multiple trains in close proximity
- During work near 'trip sensitive' or risk-important equipment
- When the off-normal condition of a component is not physically obvious
- When some of a series of components are to be manipulated multiple times

How to use it:

- ***Identify*** the component to be flagged using Self-Checking
- ***Flag*** the designated component using an approved method
- ***Perform*** the task / manipulations
- ***Remove*** the flagging once the job is complete

General Rules and Insights

- Appropriate *Flagging* should be identified during *Task Preview*, and should be discussed during the *Pre-Job Brief* (as well as during the walk-down prior to commencement of work).
- The flagging devices are to be installed prior to commencement of work, left in place during performance of the task, and removed following task completion.
- Flagging devices must be for a specific job.
- Flagging devices must not interfere with the job at hand, and must not obscure indications

Conditional Human Performance Improvement Tool

Placekeeping

What it is:

Most tasks involve a proper order of performance. Oftentimes, it is critical to perform steps in order; however, even when order of performance is not critical, it is always important to ensure that all steps are properly completed.

Placekeeping is process for keeping positive track of steps completed / being worked on when following a work document (procedure, job instruction, drawings, etc.) while performing a task. It involves physically marking the work document as steps are commenced and completed.

Procedures and other types of work packages often involve many steps, some of which branch to other steps and involve multiple decision points. ***Placekeeping*** provides a means by which to methodically and efficiently navigate such documents. Use of this tool prevents skipping, inadvertently duplicating, or only partially completing steps within a procedure or job instruction.

When a procedure / work document is being directly followed to complete a task, the process typically involves referencing the document, taking the action, and referring back to the document. ***Placekeeping*** provides positive control of steps completed as the worker's attention shifts from document, to taking action, back to document, etc.

Why to use it:

- To prevent skipping, duplicating, or only partially completing work steps
- To provide a structured process between reading a procedure step and taking the associated action
- To minimize the potential for making mistakes

When to use it:

- Whenever job instructions are being directly referred to while performing a task

How to use it:

- Normally perform on only one step or sub-step at a time
- When initial/sign-off blocks are provided, complete only AFTER associated action has been taken
- Use the "Circle and Slash" Method…
  - Circle the step number that is to be performed
  - Read and understand the entire step
  - Perform the step as written
  - Once the step is complete, slash through the circled step number

Example:

3.1 Open and short test device TD1 (fingers B, C, E, F, H and I) to isolate current path from ammeter AM/12F

3.2 Verify no current flows through ammeter circuit

3.3 Make removals according to write-ups, wiring prints, schematics and panel prints

- Sometimes a step cannot be completed prior to starting additional step(s) (e.g., continuous action or contingency steps). In such cases, the circle will continue to indicate that such a step has been begun, but has not yet been completed.
- When a series of steps must be repeated (e.g., until specific acceptance criteria has been met), the individual performing the task should establish a scheme of *Placekeeping* that provides for positive control of each sequence through the series of steps. It is important to do so, because in such situations there is an increased likelihood of missing a step. One such method might be to establish a column of marks for each sequence through the steps. For example:

3.2 If fan rotation is out of balance, balance fan blades (repeat steps 3.2.1 – 3.2.3 as needed)

3.2.1 Place fan to OFF

3.2.2 Once fan stops rotating, attach / position balance slider

3.2.3 Place fan to ON, check for balance

3.2.4 Once fan is balanced, affix balance weight and remove slider

In this example, fan rotation was out of balance, therefore Step 3.2 is performed.

  - The number 3.2 is circled, indicating that the step is in progress
  - Steps 3.2.1 through 3.2.3 have been repeated twice, resulting in the achievement of fan balance
  - Step 3.2.4 is now in progress to affix the balance weight. Once this is completed, a slash will be placed through 3.2.4
  - Once all sub-steps (3.2.1 through 3.2.4) are finally completed, a slash will be placed through 3.2 to indicate completion of the entire step.
- When a step is written as a conditional step (as in the example above, where Step 3.2 states, “If fan rotation is out of balance…”) and is not required, mark such steps “N/A”.
- When it is known in advance that certain steps will not be required, such steps should be marked “N/A” in advance of commencing task performance. This will help to eliminate confusion during task performance. It may also be appropriate for the discipline supervisor to -review steps marked as “N/A” prior to commencement of work.

Conditional Human Performance Improvement Tool

Turnover

What it is:

Turnover is the transfer of job, task, or condition information from one shift or individual to another shift or individual.

For a variety of reasons, job, task, or condition information is required to be transferred from one individual to another. When this occurs, it is critically important that adequate and accurate information is transferred to provide for continuity between jobs, shifts, and positions. It also ensures that proper judgment and decision-making capability will exist on behalf of the recipient after the transfer occurs.

Communications between individuals is a likely point for errors to either occur or be set up to occur. Proper use of the ***Turnover*** tool provides for the accurate, concise and clear transfer of information, thereby eliminating the potential for communication error during the turnover / handoff process.

Why to use it:

- To ensure continuity between jobs, shifts, and positions
- To ensure accurate and adequate transfer of information and awareness when transferring responsibilities
- To minimize the potential for making mistakes

When to use it:

- Prior to the handoff of responsibilities from one person to another or one discipline to another
- Prior to the formal transfer of responsibilities between work groups / departments
- Prior to shift changes

How to use it:

- Take the time to do it right- follow existing procedural guidance where it exists
- THINK - "*If I were taking this over, what would I want to know*?"
- Over-communicate- ***DON'T ASSUME ANYTHING***
- ***WRITE IT DOWN***
- Use ***Effective Communications*** when speaking
- ***ASK QUESTIONS*** to ensure that information given equals understanding achieved

General Rules and Insights

A very effective way to promote/ensure consistent and effective *Turnovers* is to use a department / discipline-specific checklist. Such an aid can ensure that all appropriate parameters are covered, and if so designed can provide the necessary written information which can be tendered along with the verbal *Turnover*.

Whenever possible, conduct *Turnovers* face-to-face using supporting written documentation (records, charts, logs, *Turnover* check sheets, etc.).

Conditional Human Performance Improvement Tool

Post-Job Review

What it is:

A ***Post-Job Review*** is a review after completion of a task, by the individual(s) completing the task, to identify specifically what went well (and not so well) during task performance. The objective of the exercise is to capture lessons learned that can be capitalized upon during the subsequent performance of the same or similar task.

Some organizations, particularly those with numerous repetitive tasks (such as preventive maintenance), have developed easily accessible databases within which to capture the Post-Job Review information. This information is then used down the road when preparing work packages, and when conducting *Task Previews* and *Pre-Job Briefs*.

A ***Post-Job Review*** need not be a formal drawn out process, and may only take a few moments for the individuals involved in a task to get together and document any knowledge gained during the task performance.

Why to use it:

- To discuss what went well (and not so well) during performance of a job
- To capture lessons learned
- To positively influence future performance

When to use it:

- When completing any work during which complications occurred
- Upon completion of a non-routine or strategically important task
- When any recurring/routine task goes better (or worse) than normal
- Whenever anything of significance is discovered during task performance

How to use it:

- Include a Post-Job Review as part of the work package for appropriate tasks/projects
- Provide time for Post-Job Review
- Identify what worked well and areas for improvement
- Document results of the Review

Human Performance Improvement Glossary

A

Accountability - The expectation that an individual or an organization is answerable for results; to explain its actions, or be subject to the consequences judged appropriate by others; the degree to which individuals accept responsibility for the consequences of their actions, including the rewards or sanctions.

Acting - Physical human action (know how) to change the state of a component using controls, tools, and computers; includes verbal statements to inform or direct others.

Action - Externally observable, physical behavior (bodily movements or speech). (See also *behavior.*)

Active Error - Action (behavior) that changes equipment, system, or plant state triggering immediate undesired consequences

Administrative Control - Direction that informs people about what to do, when to do it, where to do it, and how well to do it, and are usually documented in various written policies, programs, and plans

Alignment - The extent to which the values, processes, management, and existing factors within an organization influence human performance in a complementary and non-contradictory way; facilitating organizational processes and values to support desired safe behavior

Anatomy of an Incident - A cause-and-effect illustration of the active and latent origins (linkages) of incidents initiated by human action

Anxiety-Avoidance - a new technique is discovered for reducing collective anxiety and it is repeated over and over again regardless of effectiveness.

Assumption - A condition taken for granted or accepted as true without verification of the facts. (See also *belief*, *mental model* and *unsafe attitudes.*)

At-Risk Practice - A behavior or habit that increases the chance for error during an action, usually adopted for expedience, comfort, or convenience

Attitude - An unobservable state of mind, or feeling, toward an object or subject

B

Bald Tire - A belief that past performance is justification for not changing (improving) existing practices or conditions

Barrier - Anything that keeps operations or processes within safe limits, or protects a system or person from a hazard. (See also *controls* and *defense.*)

Behavior - The mental and physical efforts to perform a task; observable (movement, speech) and non-observable (thought, decisions, emotional response, and so forth) activity by an individual— Generally, we treat observable behavior as measurable and controllable.

Behavior Engineering Model - An organized structure for identifying potential environmental and individual factors that impact performance at the job site, and for analyzing the organizational contributors to those factors

Belief - Acceptance of and conviction in the truth, existence, or validity of something, including assumptions about what will be successful

Benchmarking - A process of comparing products, processes, and practices against the best in class, the toughest competitors or those companies recognized as industry leaders; discovering innovative thinking or approaches

C

Challenge - When a mismatch is reduced by addressing the relevant error precursors, the risk for error is minimized, but a chance for error remains because of human nature.

Change Management - A methodical planning process to establish the direction of change, align people and resources, and implement the selected modifications throughout an organization, large or small

Checking - the act of confirming the *actions* of a performer are correct, without error

Coaching - The process of facilitating changes in behavior of another person through direct interaction, feedback, collaboration, and positive relationships. (See also *feedback.*)

Cognitive (cognition) - Descriptive of mental activity related to sensing and thinking phases of information processing; perception, awareness, problem-solving, decision-making, and judgment

Complacency - Self-satisfaction accompanied by unawareness of actual dangers, hazards, or deficiencies; being unconcerned in a hazardous environment

Conservative Decision-Making - Reaching conclusions by placing greater value on safety then the production goals of the organization—decisions demonstrate recognition and avoidance of activities that unnecessarily reduce safety margins

Continuous Improvement - Small, incremental changes initiated by team members

Controls - Devices, methods, or practices that make an activity or process go safely, effectively, efficiently, predictably, and according to high standards to protect key assets from human error—usually taking an engineered, administrative, cultural, or oversight form. (See also *defenses*, *barrier*, and *positive control.*)

Critical Activity/Task – an engineering activity, an evolution, or a task that is *vital* to nuclear safety, industrial safety, environmental protection, regulatory compliance, or plant/system performance – This typically involves one or more critical attributes, such that undetected errors with these activities/tasks will result in intolerable consequences to the plant or to personnel. (*Vital* means the engineering product can have a direct, and possibly immediate, adverse impact either during installation or testing or upon implementation of the product in question.)

Critical Attributes – risk-related aspects of engineering activities that could directly affect the following:

- reduction in safety margins
- alignment of physical configuration and design requirements
- operability/functionality of risk-important systems and equipment, especially critical components (such as Maintenance Rule equipment)
- protection against single-point failure vulnerabilities
- control of human error by the user at critical steps of related activities
- protection of the environment
- prevention of regulatory concern
- adequacy of installation and constructability
- control of security, generation, and economic risks
- past success instead of failure used as a basis for design

Critical Step – a procedural step or series of steps, or an action that, if performed improperly, will cause irreversible harm to plant equipment or people, or that will significantly affect facility operation. An action that if performed improperly has an immediate negative consequence that cannot be reversed or undone.

Culpability – the amount of blameworthiness that an individual's behavior merits based on the nature of the deviation from expected behavior, the outcomes of the deviation, and the responsibility and authority of that individual, in the context of the situation in which the behavior occurred.

Culture - An organization's system of commonly held values and beliefs that influence the attitudes, choices and behaviors of the individuals of the organization. (See also *safety culture.*)

Cultural Control - Leadership practices that teach (consciously and unconsciously) their organizations how to perceive, think, feel, and behave

D

Defect – an undesired result of an error committed earlier in the engineering process, which becomes embedded in either the physical plant or design bases documentation

Defense - Means or measures taken to prevent or catch human error, to protect people, plant, or property against the results of human error, and to mitigate the consequences of an error. (See also *barrier* and *controls.*)

Defense-in-Depth - The set of redundant and diverse defenses, barriers, controls, and safeguards to protect personnel and equipment from human error, such that a failure with one defense would be compensated for by another defensive mechanism to prevent or mitigate undesirable consequences.

Dependency - The increased likelihood of human error due to the person's unsafe reliance on or relationship with other seemingly independent defense mechanisms. (See also *team error.*)

E

Engineered Controls - Those physical items (hardware, software, and equipment) in the working environment designed to modify behavior and choices, or limit the consequences of undesired actions or situations. These controls may be active (requires action/change of state) or passive (defense requires no action).

Engineering Assumption – a hypothesis, theory, supposition, or premise that is **accepted** as true without supporting documentation; design criteria accepted as true or conservative in order to bound inputs—(Alternatively, an *unverified assumption* is an assumption that has not or cannot be validated or trusted as correct without additional data or testing.)

Engineering Judgment – the process of applying technical knowledge, experience, and professional intuition to make sound decisions; a decision that would meet the standard of acceptance when compared to a rigorous and analytical evaluation

Error – human decisions or actions that unintentionally depart from an unexpected behavior or some standard

Error-Likely Situation – a work situation in which there is greater opportunity for error when a specified action or task is performed, because error precursors are present

Error Mode - Error modes are the prevalent ways people make mistakes, not the only way, for the particular performance mode. Error modes are generalities that aid in anticipating and managing error-likely situations aggravated by inattention, misinterpretation, and inaccurate mental models.

Error precursors – task-related conditions for a specific activity or task that provoke human error and increase the chance of a technical error or an adverse consequence; otherwise referred to as “risk factors.” Examples are time pressure, first-time activity, lack of knowledge or experience, and interruptions.

Error of Commission - An error that involves performance of an action other than the expected action

Error of Omission - Failure to take an expected action.

Expectations - Established, explicit descriptions of acceptable organizational outcomes, business goals, process performance, safety performance, or individual behavior (specific, objective, and doable)

F

Factor - An existing condition that positively or adversely influences behavior. (See also *organizational factors.*)

Fallibility - A fundamental, internal characteristic of human nature to be imprecise or inconsistent.

Fatalistic - A defeatist belief that all events are predetermined and inevitable, and nothing can be done to avert fate;

Feedback - Information about past or present behavior, and results that is intended to improve individual and organization performance.

Flawed Defenses - Defects with engineered, administrative, cultural, or oversight controls that, under the right circumstances, fail to:

- Protect plant equipment or people against hazards
- Prevent the occurrence of active errors
- Mitigate the consequences of error

(See also *anatomy of an incident* and *defense-in-depth.*)

Function Allocation - The distribution of actions (functions) among human or machine elements of a system to achieve a particular outcome

Fundamental Attribution Error - the tendency to over estimate the internal and underestimate the external factors when explaining behavior of others

G

Gap Analysis - The process of comparison of actual results or behavior with desired results or behavior, followed by an exploration of why the gap exists

Gut Feeling - It is common to be aware of something without being conscious of it. The subconscious level of attention continually receives information from the immediate environment. A “gut feeling” that something is not right is a signal that the subconscious has detected something that is inconsistent with the present situation, goals, or intent.

H

Heroic - An exaggerated sense of courage and boldness

High-Reliability Organizations - Successful organizations involving complex technologies requiring specialist knowledge and specialized management that can be characterized as follows:

- maintain high levels of operational safety and reliability if it is to be allowed to continue performing its mission
- maintain high levels of productivity to meet expectations and requirements
- manage production activities in real time, while maintaining prevention capabilities
- cannot easily make tradeoffs between production capacity and safety
- reluctant to learn by trial-and-error for fear that the first failure will be the last trial
- judged to have “failed” if it does not perform at high levels

Hindsight bias is the inclination to see incidents that have occurred as more predictable than they in fact were before they took place

Human Error A phrase that generally means the slips, lapses, and mistakes of humankind

Human Factors - The study of how human beings function within various work environments as they interact with equipment in the performance of various roles and tasks (at the human-machine interface): ergonomics, human engineering , training, and human resources

Human-Machine Interface The point of contact or interaction between the human and the machine.

Human Nature - The innate characteristics of being human; generic human limitations or capabilities that may incline individuals to err or succeed under certain conditions as they interact with their physical and social environments.

Human Performance - A series of behaviors executed to accomplish specific results
(HP = B + R)

Human Reliability - The probability of successful performance of human activities, whether for a specific act or in general

I

Incident - An undesirable change in the state of structures, systems, or components or human/organizational conditions (health, behavior, controls) that exceed established significance criteria.

Independent – *freedom of thought* between a performer and a verifier, created by separating the actions of each individual by physical distance and time, such that audible or visual cues of the performer are not detectable by the verifier before and during the work activity

Independent Verification - The act of checking, after the fact, the condition of a component or document free of another person’s actions related to establishing the condition for the purpose of catching an error; physically separate in time and thought from the act of the first individual.

Individual - An employee in any position in the organization; that is, worker, supervisor, staff, manager, and executive

Individual Capabilities - Unique mental, physical, and emotional abilities of a particular person that fail to match the demands of the specific task

Infrequently Performed Task - Activity rarely performed although covered by existing normal or abnormal procedures.

Initiating Action - A human action, either correct, in error, or a violation; that results in an incident. (See also *Anatomy of an Incident.*)

Intolerance - A strong personal bias against the existence of certain conditions that could provoke error.

Invulnerability. A sense of immunity to error, failure, or injury.

Irreversible – actions and related results that cannot be returned to original conditions by reversing the initiating actions

J

Job - A combination of tasks and duties that define a particular position within the organization usually related to the functions required to achieve the organization's mission, such as Facility Manager or Maintenance Technician.

Job Site - The physical location where people touch and alter the facility.

Job-Site Conditions - The unique factors associated with a specific task and a particular individual; factors embedded in the immediate work environment that influences the behavior of the individual during work. (See also *error precursors* and *organizational factors.*)

Just Culture - Atmosphere of trust in which people are encouraged, even rewarded, for providing essential information – but in which they are also clear about where the line is drawn between acceptable and unacceptable behavior.

K

Knowledge & Skill - The understanding, recall of facts, and abilities a person possesses with respect to a particular job position or for a specific task

Knowledge-based Performance - Behavior in response to a totally unfamiliar situation (no skill, rule or pattern recognizable to the individual); a classic problem solving situation that relies on personal understanding and knowledge of the system, the system's present state, and the scientific principles and fundamental theory related to the system

Knowledge Worker - An individual who primarily develops and uses knowledge or information. (e.g. scientist, engineer, manager, procedure writer)

L

Lagging Indicator - A parameter or measure, changes in which provide information about previous human performance as reflected in incidents, observations, problem reports, and similar occurrences

Lapse An error due to a failure of memory or recall. (See also *slip* and *mistake.*)

Latent Condition - An undetected situation or circumstance created by past latent errors that are embedded in the organization or production system lying dormant for periods of time doing no apparent harm. (See also *latent organizational condition*)

Latent Error - Errors (typically committed by knowledge workers) resulting in undetected organizational conditions or equipment flaws that lay dormant and may be hidden from view until revealed later by an incident, near miss, testing, or self-assessment.

Latent Organizational Condition or Weakness - Undetected deficiencies in organizational processes, equipment, or values that create job-site conditions that either provoke error or degrade the integrity of defenses.

Leader – Any individual who takes personal responsibility for his or her performance and the plant's performance and attempts to positively influence the processes and values of the organization. Managers and supervisors are in positions of responsibility but may or may not exhibit leadership behaviors. Workers, although not in positions of responsibility, can be very influential leaders. The influence of leaders is earned from subordinates, peers, and superiors. Those who follow define the leader.

Leadership - The behavior (actions) of individuals to influence the behaviors, values, and beliefs of others.

Leadership Practices - Techniques, methods, or behaviors used by leaders to guide, align, motivate, and inspire individuals relative to the organization's vision.

Learned Helplessness - a condition in which people learn that attempts to change their situation are fruitless so they give up trying.

Learning Culture - An organization that possesses the willingness and competence to draw the right conclusions from its information system, and the will to implement major reforms when their need is indicated.

Lesson Learned – A good work practice, innovative approach, or negative experience shared to promote positive information or prevent recurrence of negative incidents

M

Management (manager) - That group of people given the positional responsibility and accountability for the performance of the organization

Management Practices - Techniques, methods, or behaviors used by managers to set goals, plan, organize, monitor, assess, and control relative to the organization's mission. (See also *practices.*)

Mental Model - Structured organization of knowledge a person has about how something works (usually in terms of generalizations, assumptions, pictures, or key words); a mental picture of the underlying way in which a system functions, helping to describe causes, effects, and interdependencies of key inputs, factors, activities, and outcomes

Mission - The ultimate accomplishment for which the organization exists and which requires programs of action

Mistake - Errors committed because the intent of the act was incorrect for the work situation, typically defined by the condition of the physical plant; incorrect decision or interpretation. (See also *error* and compare with *slip.*)

Mistake-proofing - is the use of process or design features to prevent errors or the negative impact of errors. Mistakeproofing is also known as poka-yoke (pronounced pokayokay), Japanese slang for "avoiding inadvertent errors."

Model - A representation of the underlying way in which a system functions; helps describe causes, effects, and interdependencies of key inputs, factors, activities, and outcomes

Motives - The personal (internal) goals, needs, interests, or purposes that tend to stimulate an individual to action.

N

Near Miss - Any occurrence that could have resulted in undesirable consequences but did not; ranging from minor breaches in defenses to incidents in which all the available safeguards were defeated, but no actual losses were sustained

Norm - A behavior or trait observed as typical for a group of people.

O

Operating Experience – Information that relates to the methods in which work is planned and conducted and an organization's missions are performed. Operating experience provides the basis for knowledge and understanding that fosters development of lessons learned and improvement of operational performance.

Organization - A group of individuals with a shared mission, set of processes, and values to apply resources and to direct people's behavior toward safe and reliable operation

Organizational Factors - 1) Task-specific sense: an existing job-site condition that influences behavior and is the result of an organizational process, culture, and other environmental factors 2) General sense: the aggregate of all management and leadership practices, processes, values, culture, corporate structures, technology, resources, and controls that affect behavior of individuals at the *job site*

Organizational Processes and Values - A phrase that attempts to encompass all factors associated with the organization, management, and leadership of a nuclear facility that ultimately direct, aid, guide, or influence workers at the job site

Oversight Control - Methods to monitor, identify, and close gaps in performance

P

Peer-Checking - Objective monitoring by a qualified individual of another individual conducting a portion of a task for the purpose of verifying proper selection of devices about to be operated

Performance - Any activity that has some effect on the environment; the accomplishment of work. (See also *human performance.*)

Performance Gap - The difference between desired performance and actual performance, whether in terms of results or behavior

Performance Improvement - A systematic process of identifying and analyzing gaps in human performance, followed by developing and implementing interventions or corrective actions to close the gaps

Performance Indicators - Parameters measured to reflect the critical success factors of an organization. A Leading Indicator is a measure of results or outcomes. A Lagging Indicator is a measure of system conditions or behaviors which provide a forecast of future performance. (also known as "metrics")

Performance Mode - One of three modes a person uses to process information related to one's level of familiarity and attention given to a specific activity. People will likely use multiple modes to complete a task. (See also *Skill-based*, *Rule-based*, and K*nowledge-based performance.*)

Performance Model - A systems perspective of the context of individual human performance, showing how plant results and individual behavior are interrelated with organizational processes and values through job-site conditions

Performance Monitoring - Review and comparison of performance against expectations and standards using problem reporting, feedback, reinforcement, coaching, observation data, incident data, trend data, and so on. (See also *performance indicator*, *performance gap*, and *gap analysis.*)

Performance Problem - A discrepancy in performance with respect to expectations or operating experience, or an opportunity to improve performance created by changes in technology, procedures, or expectations. (See also *performance gap.*)

Physical Plant - Systems, structures, and components of the facility

Plant Results - The outcomes of the organization in terms of production, incidents, personnel safety, external assessments, configuration, and so on

Pollyanna. People tend to presume that all is normal and perfect in their immediate surroundings. Humans seek order in their environment, not disorder, to fill in gaps in perception and to see wholes instead of portions. Consequently, people unconsciously believe that everything will go as planned. This is particularly true when people perform ‘routine’ activities, unconsciously thinking nothing will go wrong.

Population Stereotype - The way members of a group of people expect things to behave; for example, in the U.S., up, right (direction), or red implies on or energized.

Positive Control - Active measure(s) to ensure that what is intended to happen is what happens, and that is all that happens

Practices - Behaviors usually associated with a role that can be applied to a variety of goals in a variety of settings. (See also *work practices*.)

Prejob Briefing - A discussion among people involved in a task to understand the scope (big picture), limits and precautions, task sequences, and roles and responsibilities for the job to be performed (includes clarification of not only desired accomplishments, but also of what to avoid) (see task preview)

Prevention Behaviors - Behaviors or practices oriented toward the prevention of errors or incidents. (See also *production behaviors.*)

Pride - An excessively high opinion of one's ability; arrogance. Being self-focused, pride tends to blind us to the value of what others can provide, hindering teamwork.
Principles - A set of underlying truths that can be used to guide both individual performance and the management of human performance

Proactive - Preemptive measures to prevent incidents or avoid error by identifying and eliminating organizational and job-site contributors to performance problems before they occur; preventing the next incident.

Proactive Mental Framework - A structured methodology for thinking that helps individuals identify critical steps, error-likely situations, potential consequences, and defenses before a specific task is conducted so that appropriate actions can be taken to prevent error or an incident (see also task preview)

Procedure Adherence The expectation that approved written guidance is followed as written and as intended; the behavior of following procedures as written

Process - A series of actions organized to produce a product or service; tangible structures established to direct the behavior of individuals in a predictable, repeatable fashion as they perform various tasks

Production Behaviors - Behaviors oriented toward creating the organization's product from the resources provided. (corollary to *prevention behaviors.*)

Q

Questioning Attitude An attitude that encourages a person's foresight to precede his or her action such that planning, judgment, and decision-making are appropriate for the situation

R

Reactive - Taking corrective action in response to an incident or *error*.

Readiness - An individual's mental, physical, and emotional preparedness to perform a job as planned

Reinforcement - The positive consequences one receives when a specific behavior occurs that increases the probability the behavior will occur again

Rigor - Completeness and accuracy in a behavior or process; cautiously accurate, meticulous, exhibiting strict precision during the performance of an action

Root Cause - A cause that, if corrected, will prevent recurrence of an incident

Rule-Based Performance - Behavior based on selection of a defined path forward derived from one's recognition of the situation; follows an IF (symptom X), THEN (action Y) logic.

S

Safety Culture - An organization's values and behaviors—modeled by its leaders and internalized by its members—that serve to make safety the overriding priority. (See also *values* and *culture.*)

Self-Assessment - Formal or informal processes of identifying one's own opportunities for improvement by comparing present practices and results with desired goals, policies, expectations, and standards. (See also *benchmarking* and *performance monitoring.*)

Self-Checking - An attention-management technique an individual can use to help identify changes in an activity and to ensure the correct component is selected for manipulation; verifies attention is focused on appropriate component and prompts the individual to think about the intended action and its expected outcome before performance

Sensing. Visual, audible, and other means to perceive information in one's immediate vicinity (displays, signals, spoken word, or cues from the immediate environment). Recognition of information is critical to error-free performance.

Shared Attention Resources - A pool of mental resources that enables the mind to attend to information while performing one or more tasks (such as driving a car and talking on a cellular telephone at the same time). How much attention is required to perform satisfactorily defines the mental workload for an individual, as some tasks require more attention than others. Knowledge, skill, and experience with a task decrease the demand for attention.

Shortcut - An action, perceived as more efficient by an individual, that is intended to accomplish the intent of actions rather than the specific actions directed by procedure, policy, expectation, or training. (See also *violation.*)

Situation Awareness - The accuracy of a person's current knowledge and understanding of actual conditions compared to expected conditions at a given time

Skill-Based Performance - Behavior associated with highly practiced actions in a familiar situation executed from memory without significant conscious thought.

Skill of the Craft - The knowledge, skills, and abilities possessed by individuals as a result of training or experience. Activities related to certain aspects of a task or job that an individual knows without needing written instructions

Slip - A physical action different than intended. (See also *error*, *lapse*, and compare with *mistake.*)

Standdown - A period of time devoted by an organization toward the education, training, and sensitization of personnel on issues associated with performance improvement.

Stress - Stress is the body's mental and physical response to a perceived threat(s) in the environment. The important word is perceived; the perception one has about his or her ability to cope with the threat. Stress increases as familiarity with a situation decreases.

Summit Fever. The zeal to finish the closer one gets to a goal. Nearness to goal accomplishment can cause individuals to disregard or not see conditions or factors important to safety;

Supervisor - That member of first-line management who directs and monitors the performance of individual contributors (front-line workers) in the conduct of assigned work activities

System - A network of elements that function together to produce repeatable outcomes; the managed transformation of inputs (resources) into outputs (results) supported with monitoring and feedback

Systems Thinking - Consideration of the multiple, diverse, and interrelated variables and their patterns that come to bear on a worker at the job site; knowledge of the interdependencies of processes and leadership dynamics on performance—the organizational nature of human performance. (See also *Performance Model.*)

T

Task - An activity with a distinct start and stop made up of a series of actions of one or more people; sometimes a discrete action

Task Demands - Specific mental, physical, and team requirements that may either exceed the capabilities or challenge the limitations of human nature of the individual assigned to perform the task. (See also *error precursor.*)

Task Preview A structured thought process using information about the planned task and assigned individual to help anticipate critical steps, error-likely situations, potential consequences, flawed defenses, and contingencies before a task is performed (see also prejob briefing)

Team Error - A breakdown of one or more members of a work group that allows other members of the same group to err due to either a mistaken perception of another's abilities or a lack of accountability within the individual's group

Technical Rigor – completeness and accuracy in both the process and the delivered product; cautiously accurate and meticulous; exhibiting strict precision during the performance of action

Thinking - Mental activities involving decisions on what to do with information. This stage of information processing involves interaction between one's working memory and long-term memory (capabilities, knowledge, experiences, opinions, attitudes).

U

Uncertainty - a presence of doubt, confusion, or questions about a work situation

Uneasiness - An attitude of apprehension and wariness regarding the capacity to err when performing specific human actions on plant components

Unsafe Attitudes - Unhealthy beliefs and assumptions about workplace hazards that blind people to the precursors to human error, personal injury, or physical damage to equipment

V

Values - The central principles held in high esteem by the members of the organization around which decisions are made and actions occur, such as reactor safety. (See also *culture* and *safety culture.*)

Verification - the act of confirming that the *condition* of a component, or other product of human performance, conforms to the condition required by a guiding document

Violation - A deliberate, intentional act to evade a known policy or procedure requirement for personal advantage usually adopted for comfort, expedience, or convenience. (See also *shortcut.*)

Vision - A picture of the key aspects of an organization’s future that is both desirable and feasible—to be the kind of organization people would aspire to—that guide employees' choices without explicit direction, but understandable enough to encourage initiative.

Vulnerability - Susceptibility to external conditions that either aggravate or exceed the limitations of human nature, enhancing the potential to err; also the weakness, incapacity, or difficulty to avoid or resist error in the presence of error precursors. (See also *error precursor.*)

W

Wariness An attitude involving a keen awareness of one’s limitations and vulnerability because of human fallibility; encourages people to be sensitive to flawed defenses and job-site conditions that could provoke error (also known as uneasiness)

Work Environment - General influences of the work place, organizational, and cultural conditions that affect individual behavior at the job site. (See also *error precursors.*)

Work Execution - Those activities related to the preparation for, performance of, and feedback on planned work activities

Worker - An individual who performs physical work on equipment, having direct contact (touching) with equipment, and is capable of altering its condition. (Compare with *knowledge worker.*)

Work Practices - Methods an individual uses to perform a task correctly, safely, and efficiently including equipment/material use, procedure use, and error detection and prevention. (See also *practices.*)