

HPI 101

(How would you know you're not
as good as you think you are?)

Presented by: Bill Rigot

SAFE BUILD
ALLIANCE



APRIL 29, 2016



First law of safety

- Never take a
- Sleeping pill
- And a Laxative
- At the same time
- In any order

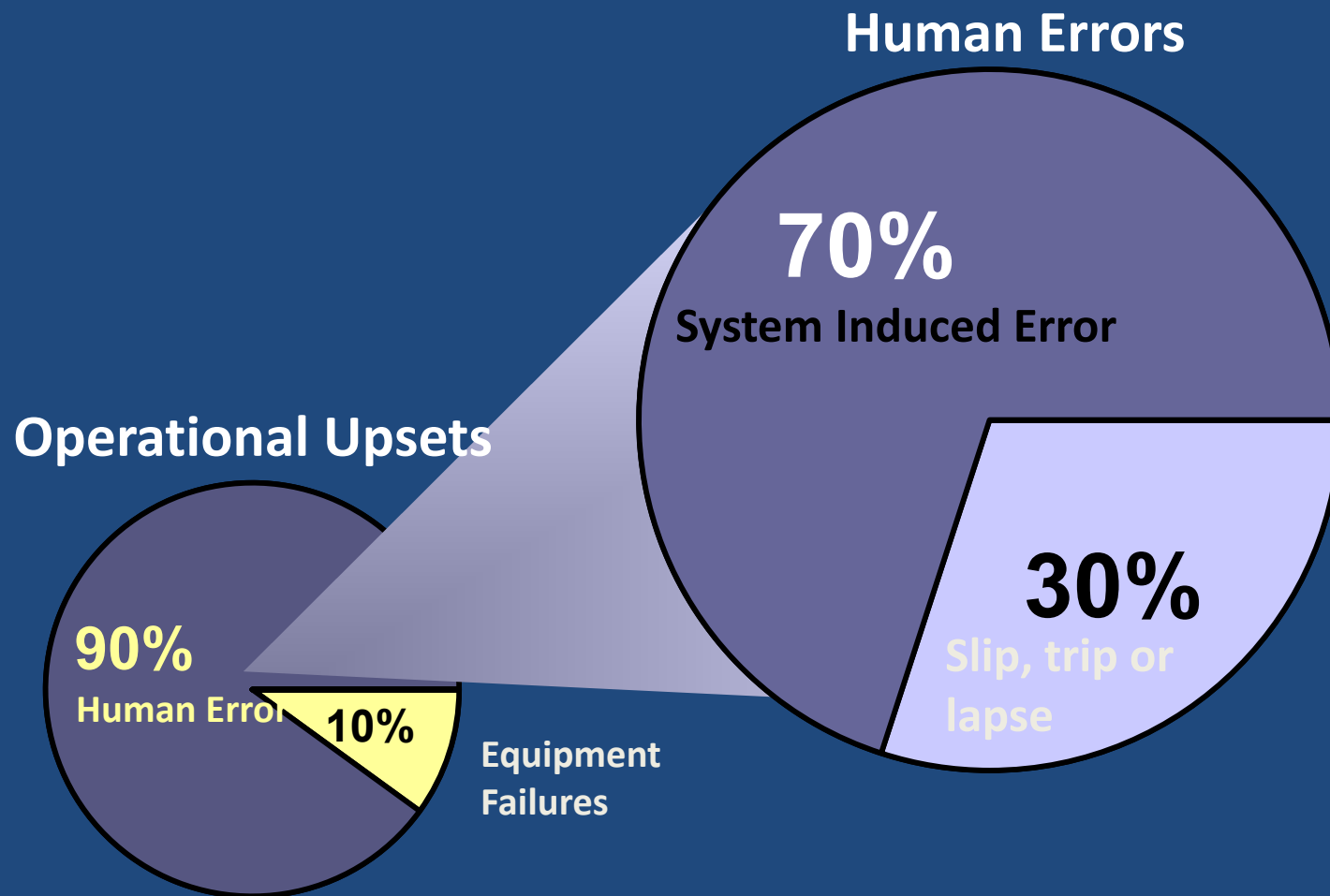
First corollary

- Never Remove A
- Safety Barrier
- That Has A
- Dent In It

Agenda

- Understanding Human Error
- HPI Principles
- Managing Risk
- Complexity of Socio-technical Systems
- High Performing Organizations
- Getting to Foresight

On Human Error...



Origin of Human Error

**Error without
consequence is a
good thing...**

**It shows that our systems
are error-tolerant and that
they are working.**

Safety is not the
absence of
accidents.

Safety is the
capacity of
defenses to fail
gracefully

People Are As Safe
As They Need To Be,
Without Being
Overly Safe...In
Order To Get Their
Job Done.

Or are they?



WHEN GOOD PETS GO BAD

Complete this sentence

Kenny Is:

PRINCIPLES of Human Performance improvement (HPI)*

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

*DOE HDBK-1028-2009

Human Performance Improvement Handbook



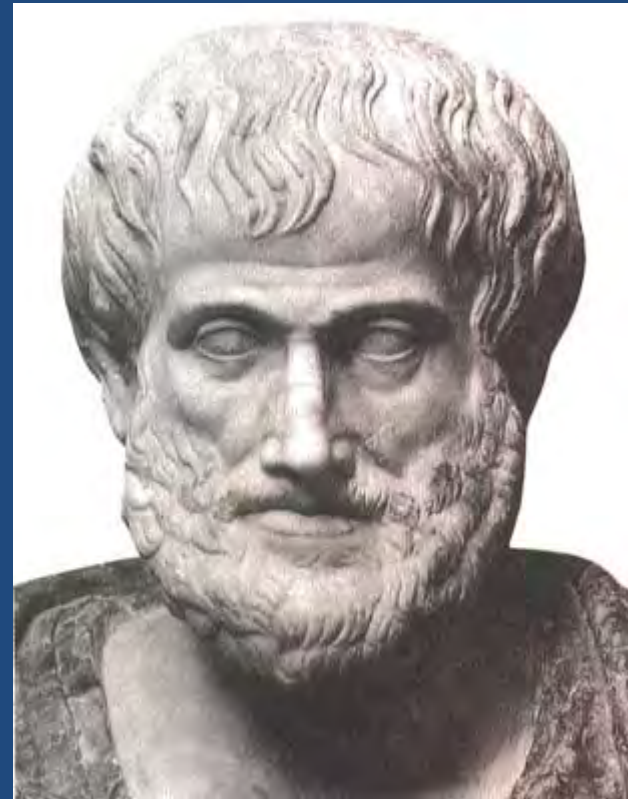
Human Performance In A Nutshell

- The purpose of Human Performance is to reduce the **frequency** and **severity** of events **triggered** by human error*

* DOE HDBK-1028-2009
Human Performance Improvement Handbook

Why Human Performance?

- “We are what we repeatedly do. Excellence, then, is not an act but a habit.”
 - Aristotle (384 BC – 322 BC)
- “Practice doesn’t make perfect; practice makes permanent.”
 - Choir Director (2010)



Performance = Behaviors + Results

$$P = B + R$$

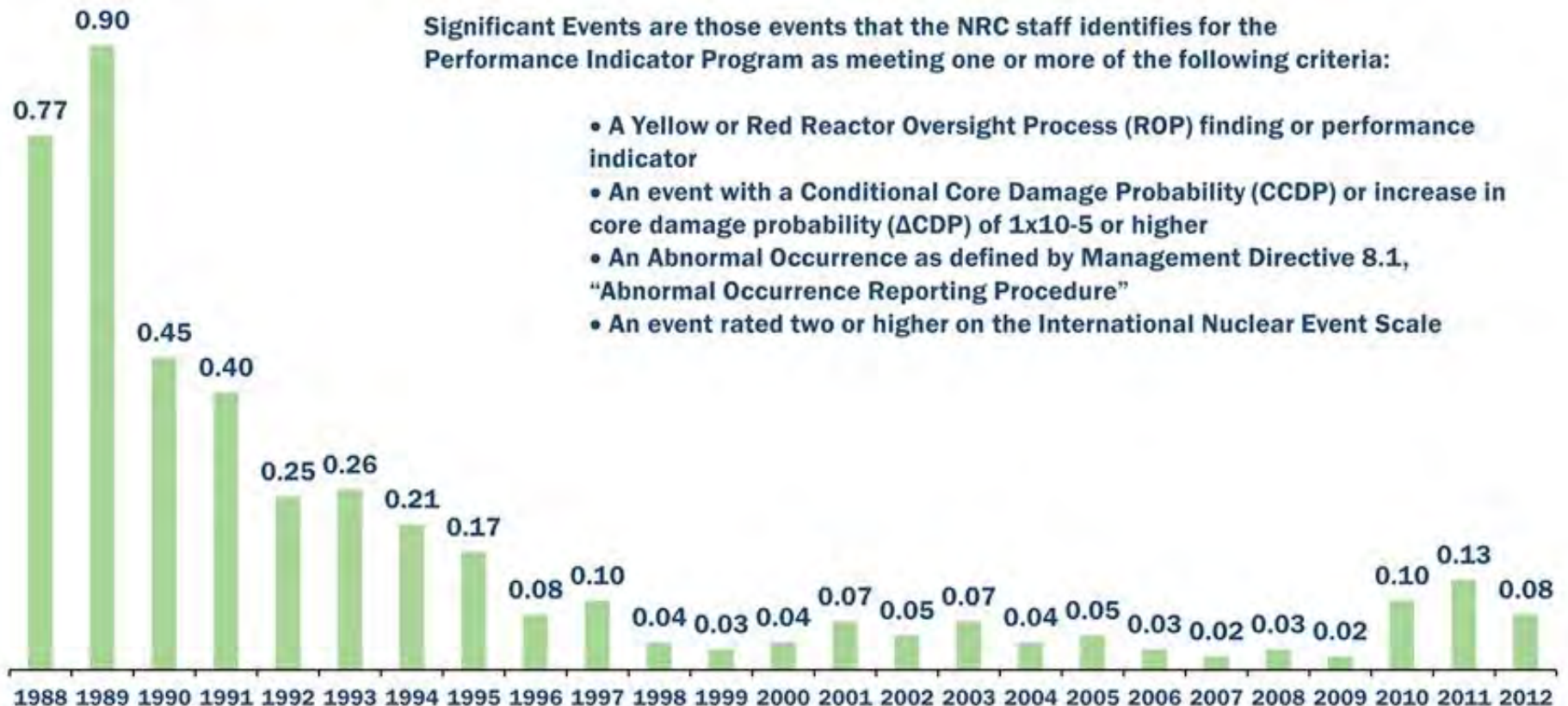
WIIFM?

Significant Events per Plant

Annual Industry Average, Fiscal Year 1988-2012

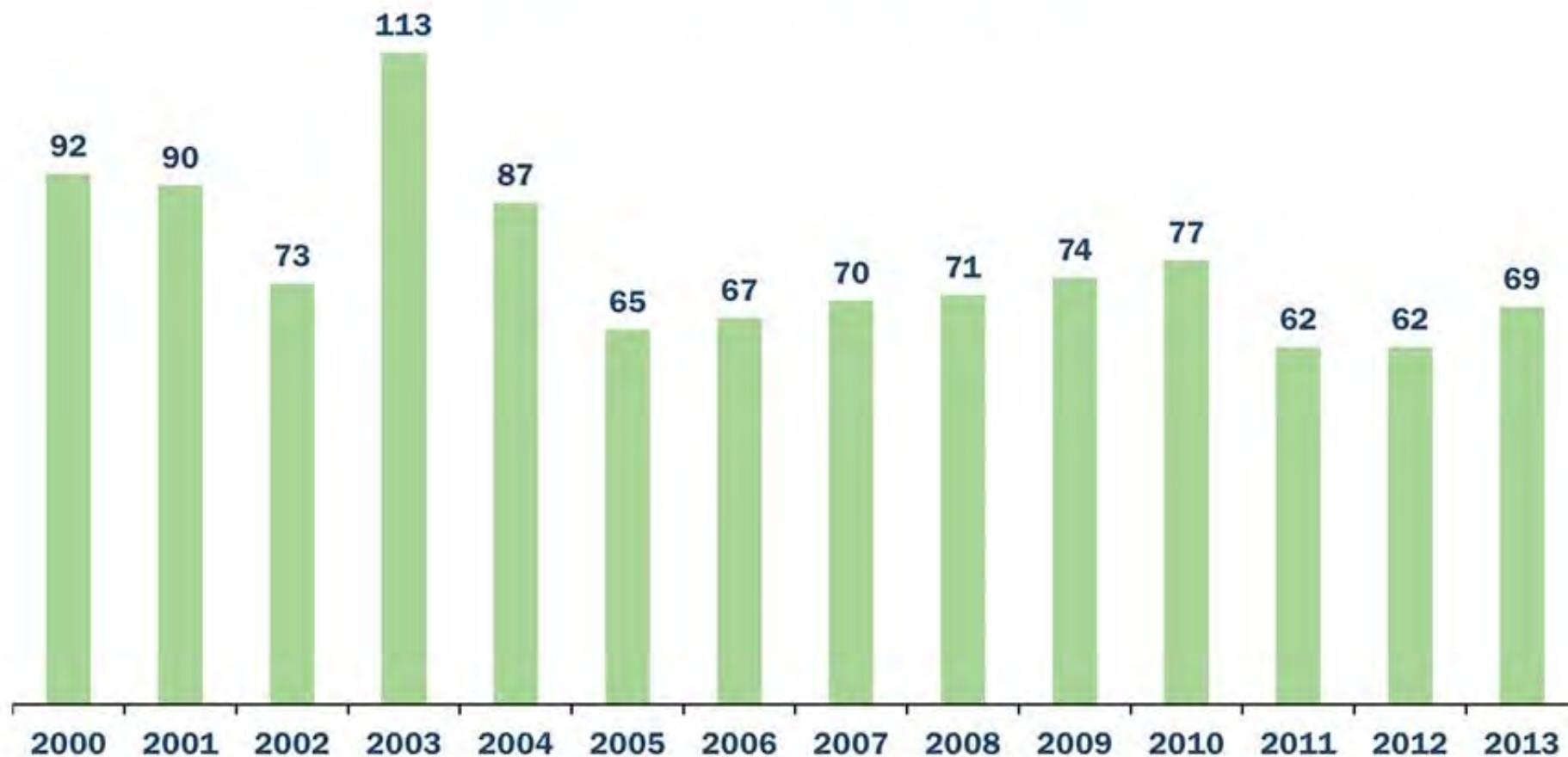
Significant Events are those events that the NRC staff identifies for the Performance Indicator Program as meeting one or more of the following criteria:

- A Yellow or Red Reactor Oversight Process (ROP) finding or performance indicator
- An event with a Conditional Core Damage Probability (CCDP) or increase in core damage probability (Δ CCDP) of 1×10^{-5} or higher
- An Abnormal Occurrence as defined by Management Directive 8.1, "Abnormal Occurrence Reporting Procedure"
- An event rated two or higher on the International Nuclear Event Scale



U.S. Nuclear Industry Scram Trend

Total Manual and Automatic Scrams



NEI

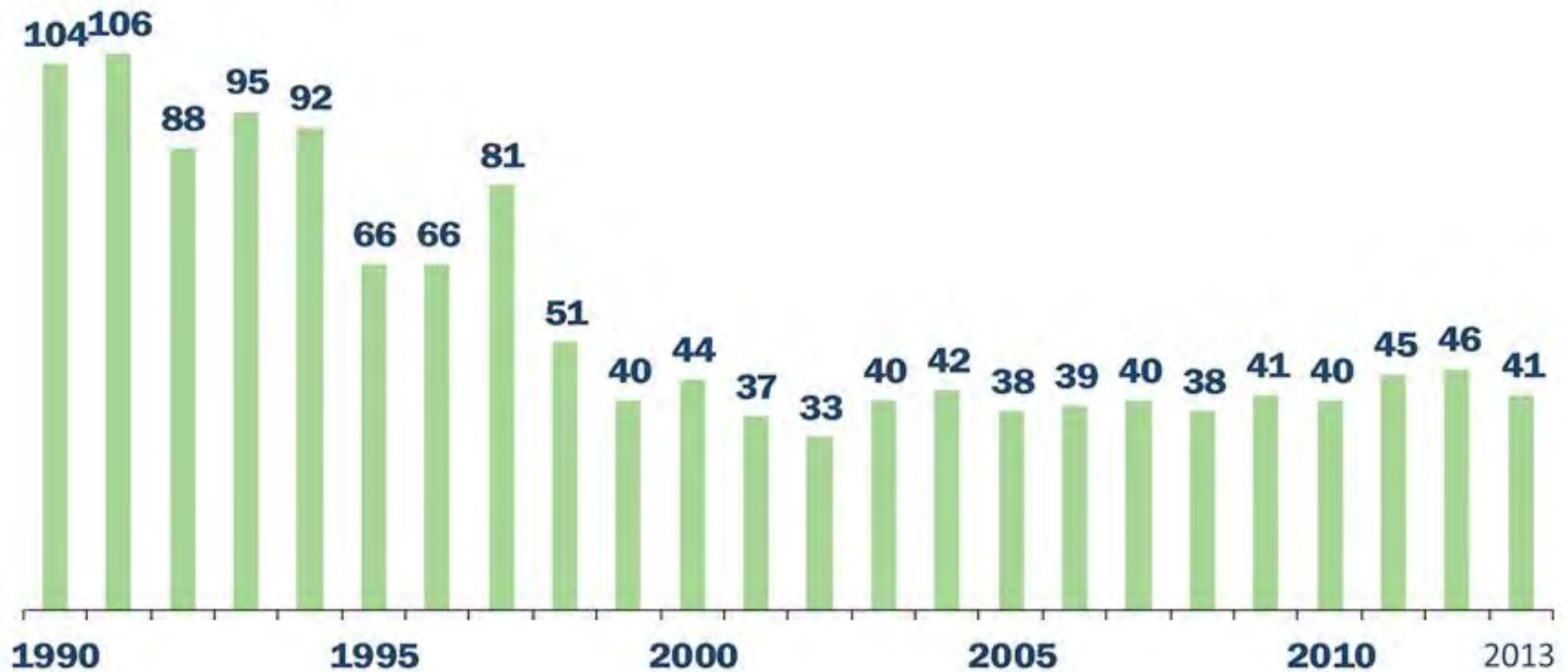
NUCLEAR ENERGY INSTITUTE

Source: World Association of Nuclear Operators
Updated: 4/14

nuclear, clean air energy

U.S. Nuclear Refueling Outage Days

Average



NEI

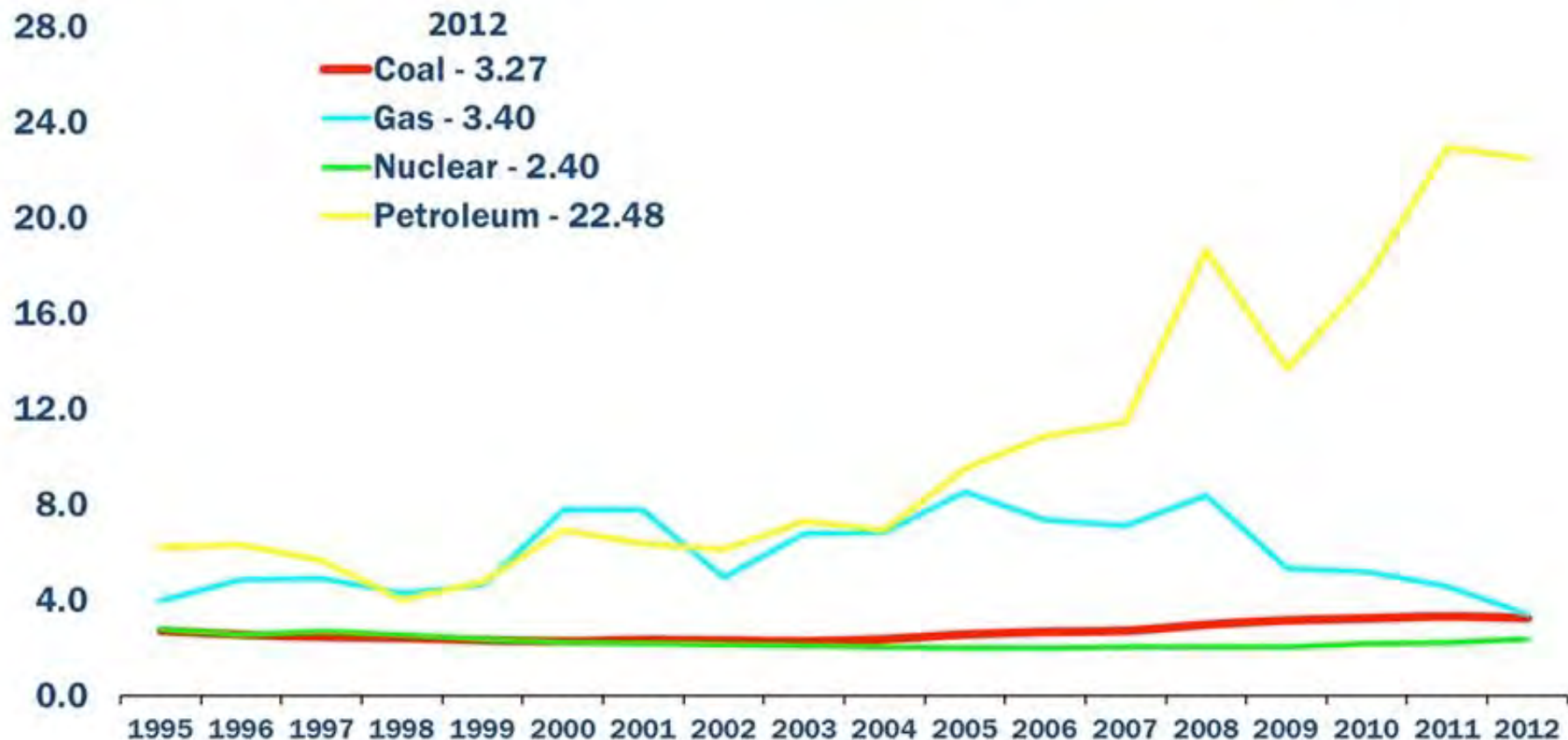
NUCLEAR ENERGY INSTITUTE

Source: 1990-98 EUCG, 1999-2013 Ventyx Velocity Suite / Nuclear Regulatory Commission
Updated: 4/14

nuclear, clean & energy

U.S. Electricity Production Costs

1995-2012, *In 2012 cents per kilowatt-hour*



NEI

NUCLEAR ENERGY INSTITUTE

Production Costs = Operations and Maintenance Costs + Fuel Costs. Production costs do not include indirect costs and are based on FERC Form 1 filings submitted by regulated utilities. Production costs are modeled for utilities that are not regulated.

Source: Ventyx Velocity Suite

Updated: 5/13

U.S. Capacity Factors by Fuel Type

2013

Fuel Type	Average Capacity Factors (%)
Nuclear	90.9
Geothermal	67.2
Biomass	67.1
Coal (Steam Turbine)	58.9
Gas (Combined Cycle)	50.3
Hydro	40.5
Wind	32.3
Solar	24.4
Oil (Steam Turbine)	13.1
Gas (Steam Turbine)	11.9

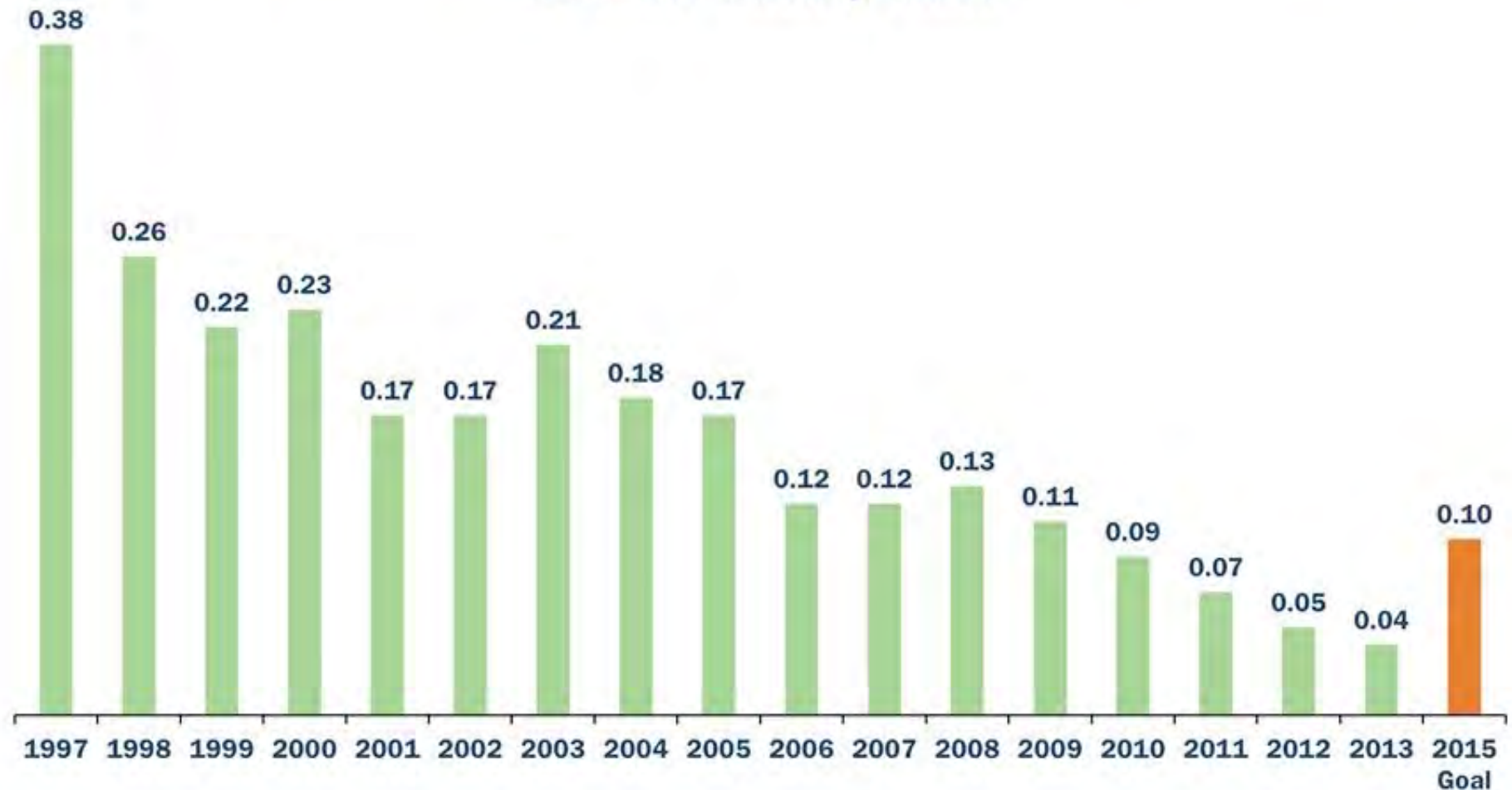
Sustained Reliability and Productivity

U.S. Nuclear Capacity Factor, Percent



U.S. Nuclear Industrial Safety Accident Rate

One-Year Industry Values



NEI

NUCLEAR ENERGY INSTITUTE

ISAR = Number of accidents resulting in lost work, restricted work, or fatalities per 200,000 worker hours.

Note: Starting in 2008, data includes supplemental personnel.

Source: World Association of Nuclear Operators

Updated: 4/14

Human Performance

“To understand failure...we must first understand our reaction to failure.”

“People do not operate in a vacuum, where they can decide and act all-powerfully. To err or not to err is not a choice. Instead, people’s work is subject to and constrained by multiple factors.”

— Sidney Dekker

Worker's Don't Cause Failures.

Worker's Trigger Latent Conditions That Lie Dormant In Organizations Waiting for This Specific Moment In Time.

Failure Defined...

“Accidents are the unexpected combination of normal performance variability”

Eric Hollnagel

Accidents Happen Because:

- What is about to happen is simply not possible.
- What is about to happen has no perceived connection to what is currently happening.
- The possibility of getting the intended outcome is well worth whatever risk there is.

**Accidents Don't Happen Because Workers
Gamble and Lose...**

How We See Events

Old View

- Human error is a cause of accidents
- To explain failure, investigations must seek failures of parts of systems
- These investigations must find inaccurate assessments and bad decisions

New View

- Human error is a symptom of trouble deeper inside a system
- To explain failure, do not try to find out where people went wrong
- Instead, find out how peoples' actions and assessments made sense at the time given the circumstances that surrounded them.

Risk

“The problem with the future is that more bad things can happen than will happen.”

-Plato

Identification of Critical Tasks

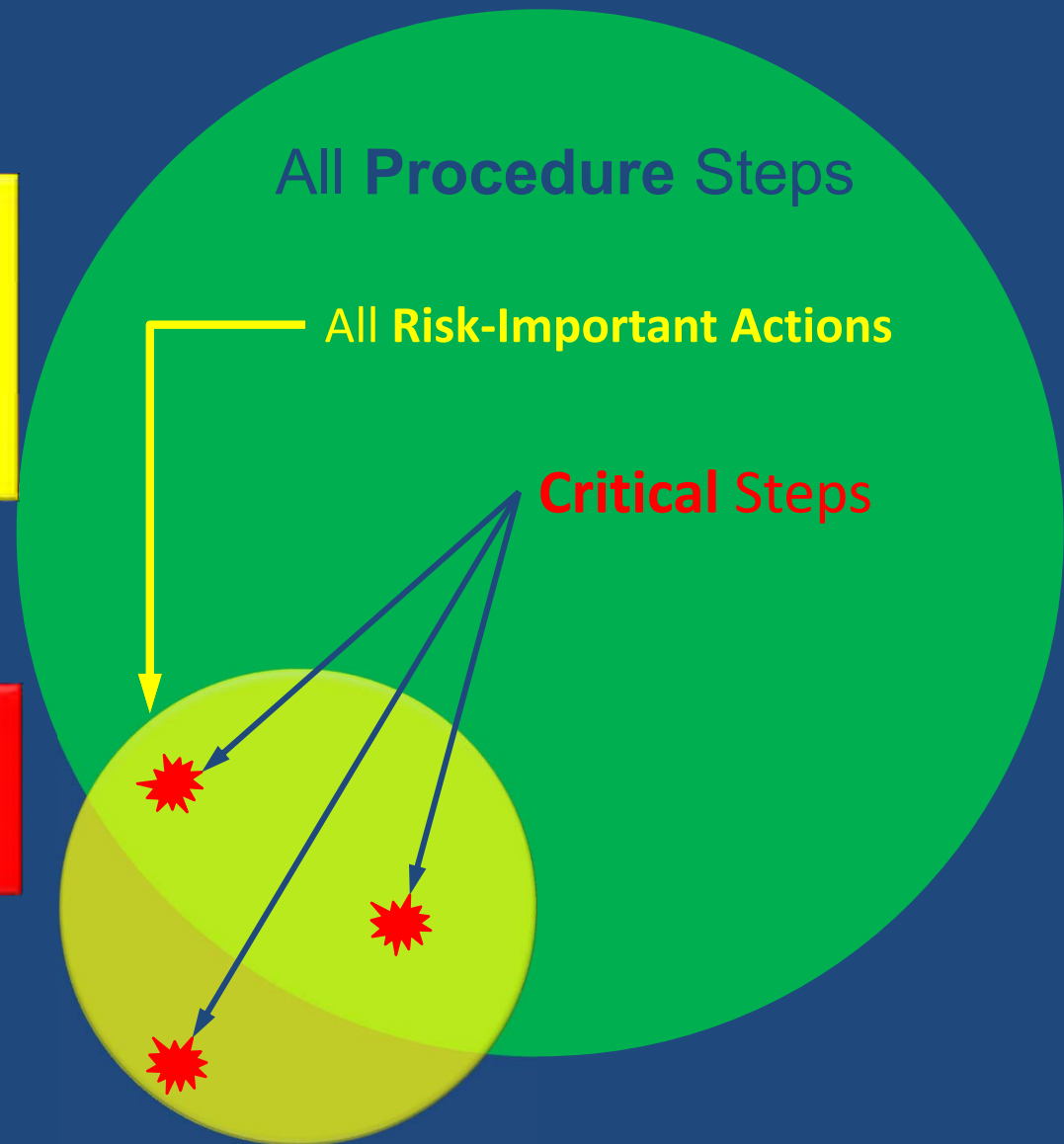
- If you try to fix everything you will go broke and crazy.
- You must pinpoint the critical areas of your processes and duties to identify places which have the greatest risk and greatest value to the stability and reliability of your work.

Risk-Important Steps:

procedure steps or actions that expose products, services, or assets to the potential for or actual harm.

Critical Steps:

actions that *will* trigger immediate, irreversible harm

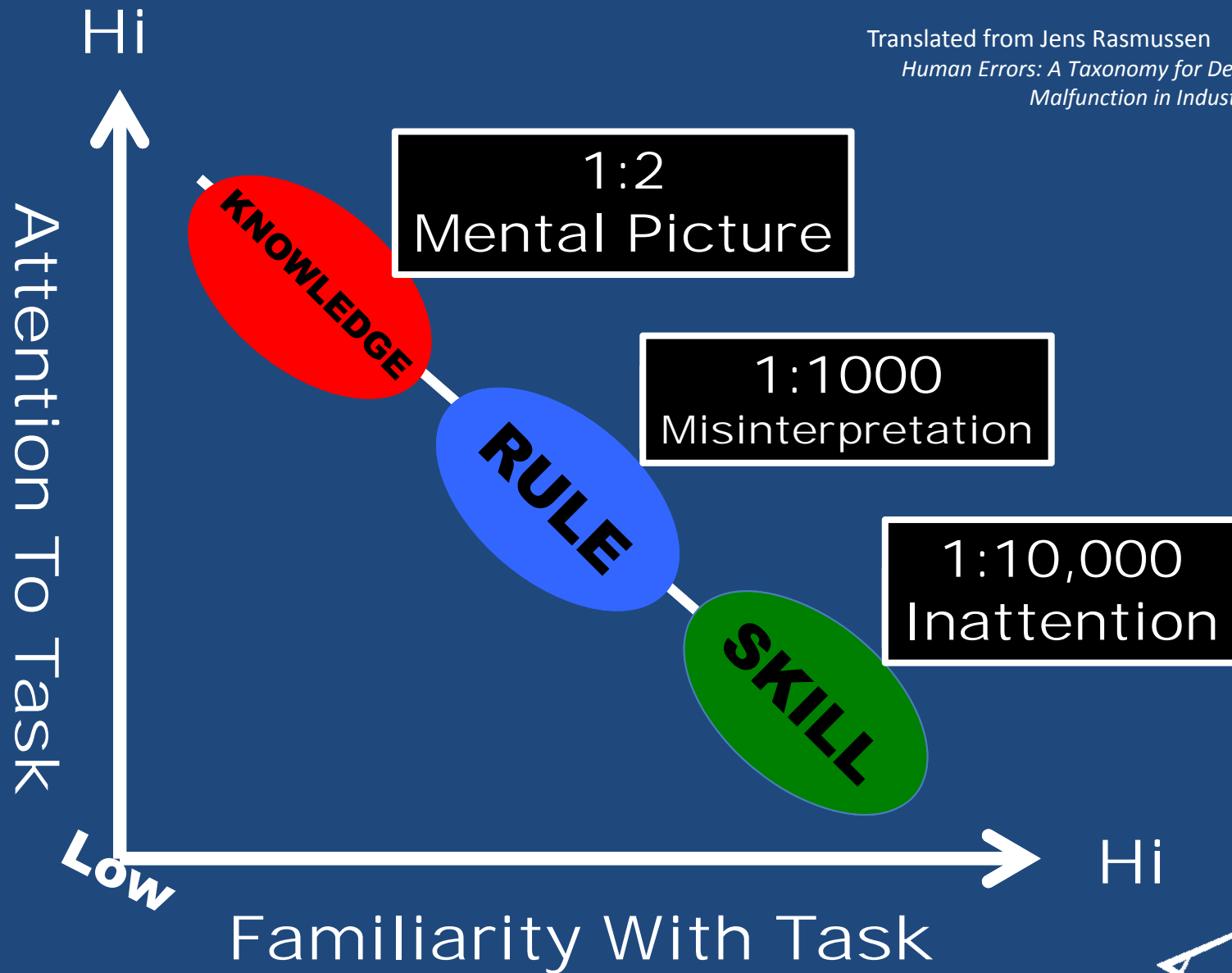


Risk-Important Actions and Critical Steps

Performance Modes

Translated from Jens Rasmussen

*Human Errors: A Taxonomy for Describing Human
Malfunction in Industrial Installations*



Clearly Safe
to do Work

The Grey Area:
Uncertain
interpretation
of Safe work

Clearly **Not** Safe
to do Work

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People Discover Safety...

How did this happen?



How did this happen?



How did this happen?



How did this happen?



PHOTO: AGENCE FRANCE PRESSE / GETTY IMAGES

Pre-Job
Review
Planning
JHA/JSA
Training

Work as Imagined

Work as Done

The Traditional Safety Emphasis on Pre-Work and Planning

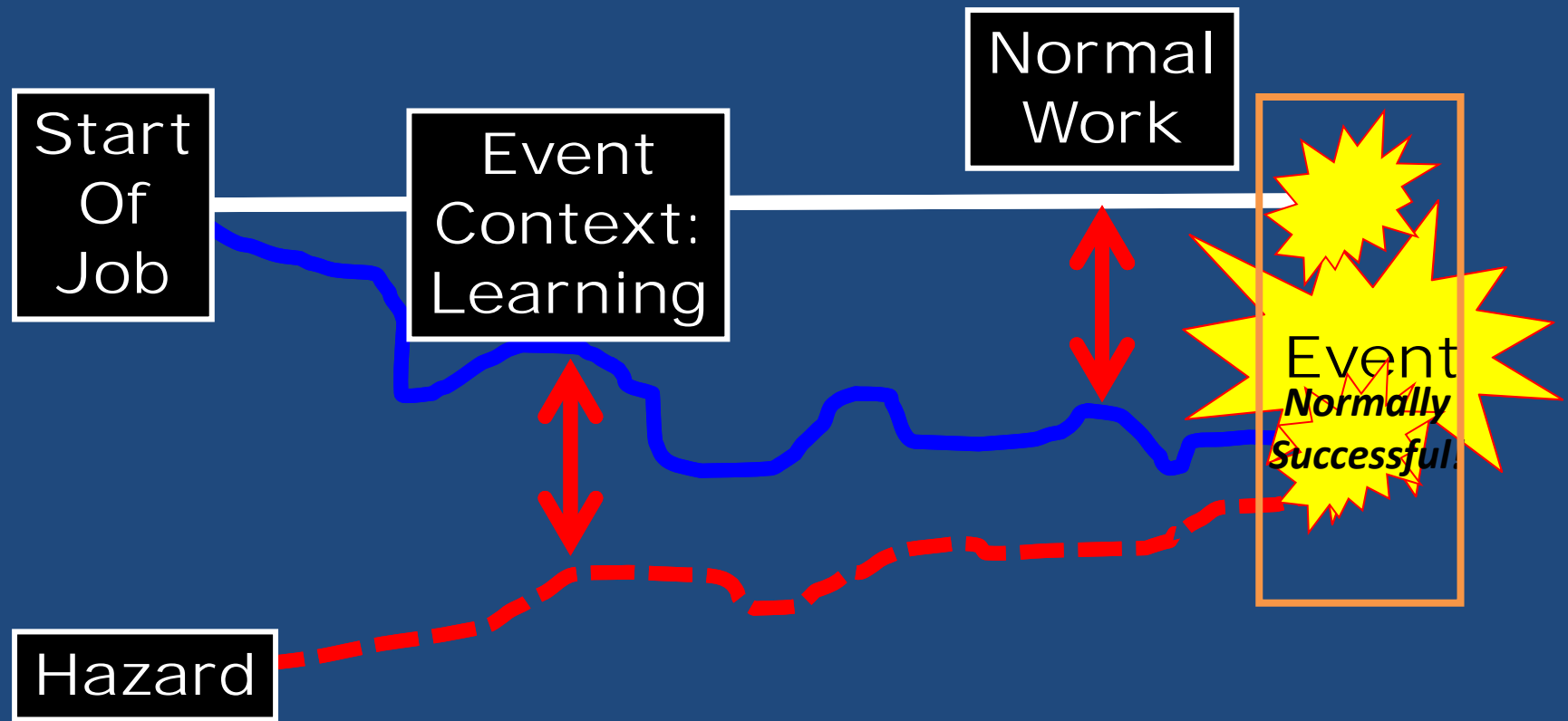
Two Views of Failure

Newtonian



Complex-Adaptive



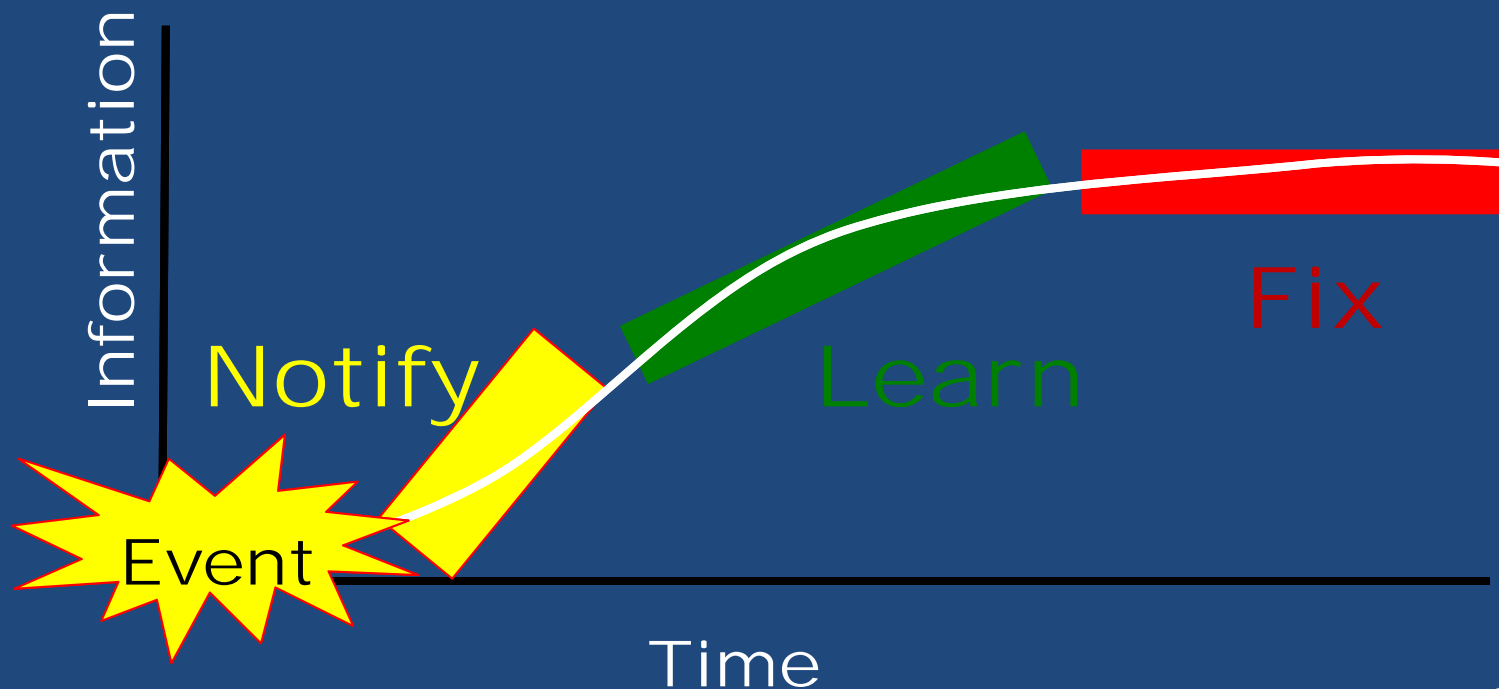


Safety Understood: Drift and Accumulation

The Pressure To Know...

What You Ask For
Is What You Get

Outweighs The Pressure To Learn



Safety Defined

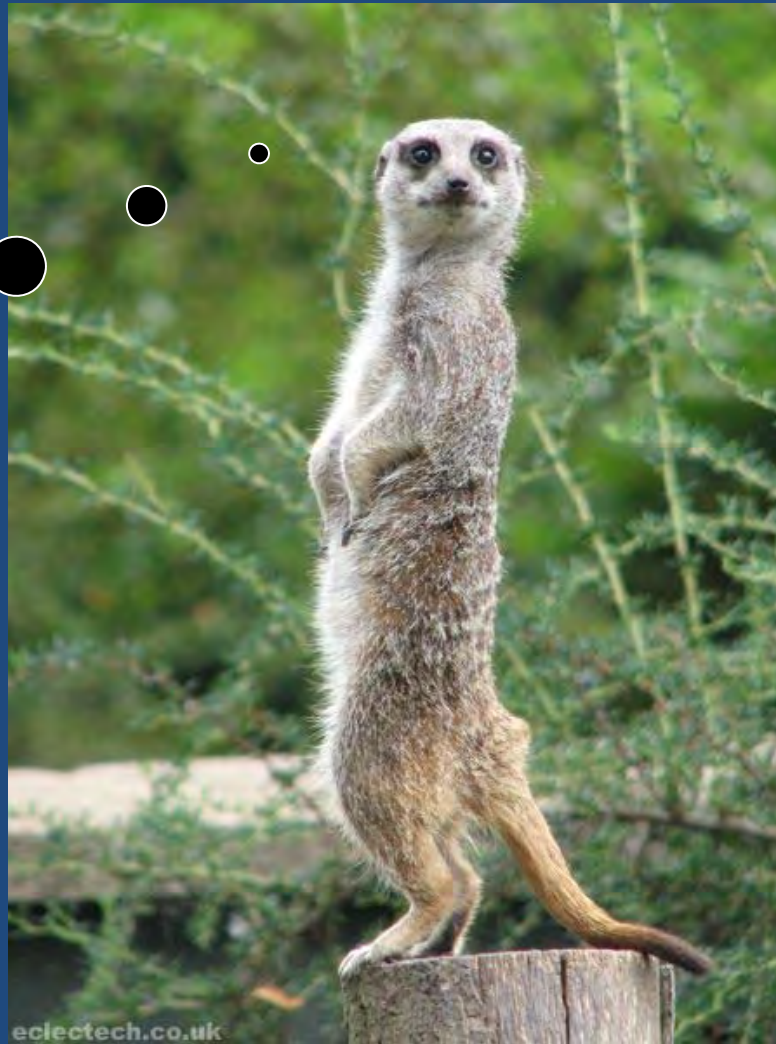
- Safety is not the absence of events...
- Safety is the capacity of systems to fail gracefully

Immediate Steps

Successful organizations seem to do four things very well:

- Constantly predicting the next failure
- Consistently reducing operational complication
- Respond with urgency to pre-cursor data
- Respond to events with deliberation

Questions?



eclectech.co.uk

For More Information

- ITI HPI and Accident Investigation Classes
 - September 6-8
 - Houston, TX
 - December 6-8
 - Houston, TX
- Bill Rigot
 - bill@iti.com
 - 706-627-7590

View the ITI Human Performance Improvement
full course details @ iti.com/hpi

