HPI 101

HOW WOULD YOU KNOW YOU'RE NOT AS GOOD AS YOU THINK YOU ARE?

CRANE RENTAL ASSOCIATION OF CANADA
JUNE 6, 2014

CRW Consulting Group
Conklin, Rigot and Wagner
Adaptive Solutions for Complex Systems

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

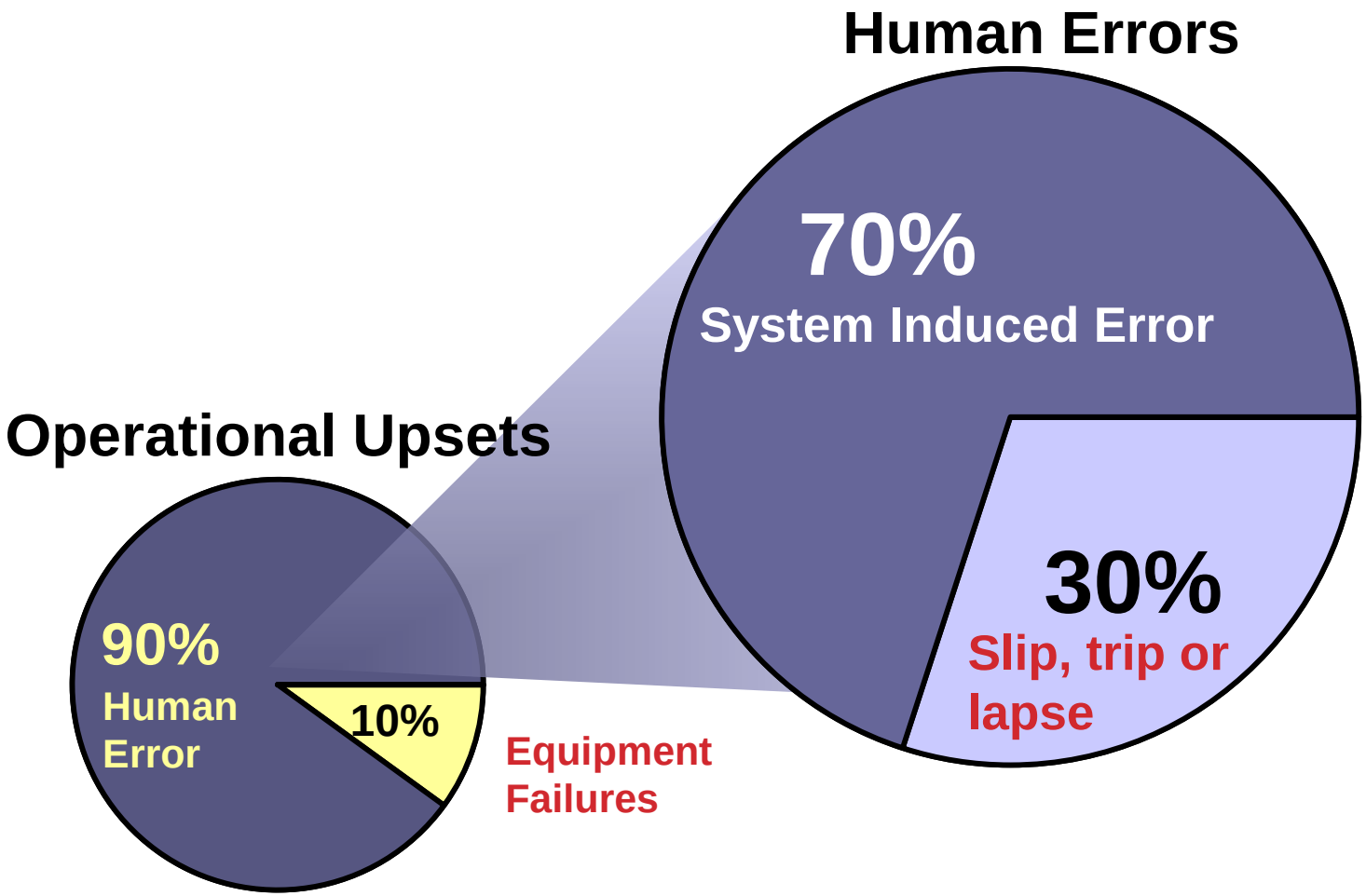
That Has A

Dent In It

AGENDA

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

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 presence of defenses.

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

Or Are They..

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

KENNY VIDEO

HUMAN PERFORMANCE IN A NUTSHELL

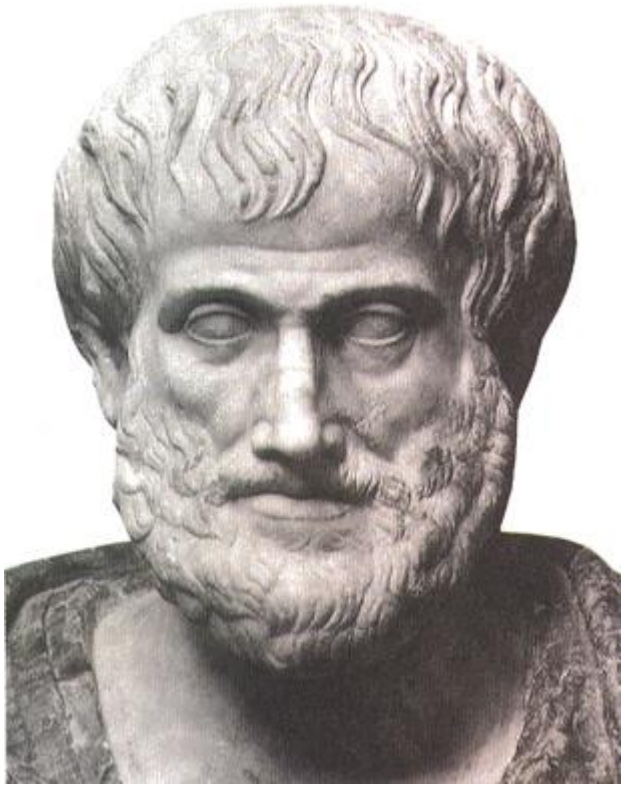
The purpose of Human Performance is to reduce the frequency and severity of events triggered by human error*

*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)

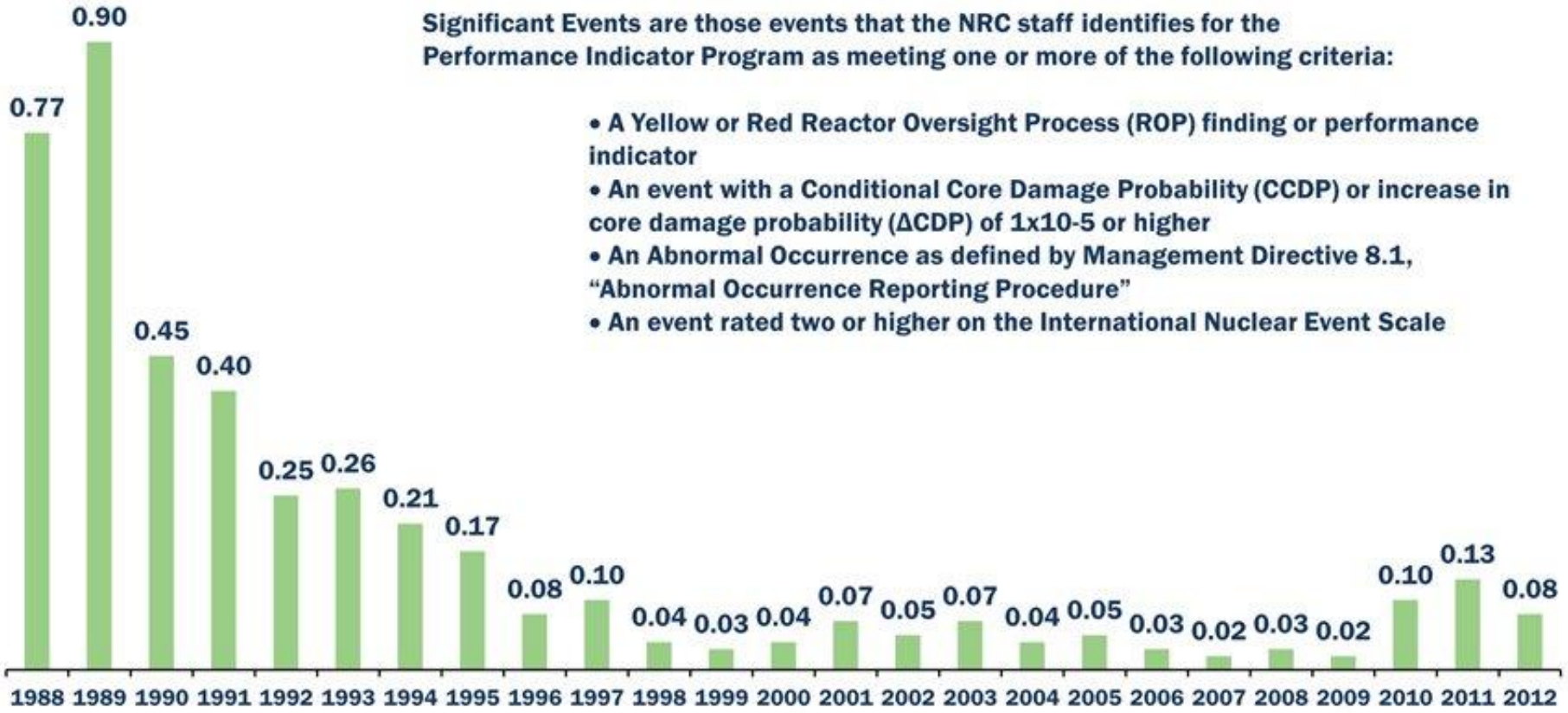
Performance = Behaviors + Results

P = B + R

WIIFM?

Significant Events per Plant

Annual Industry Average, Fiscal Year 1988-2012



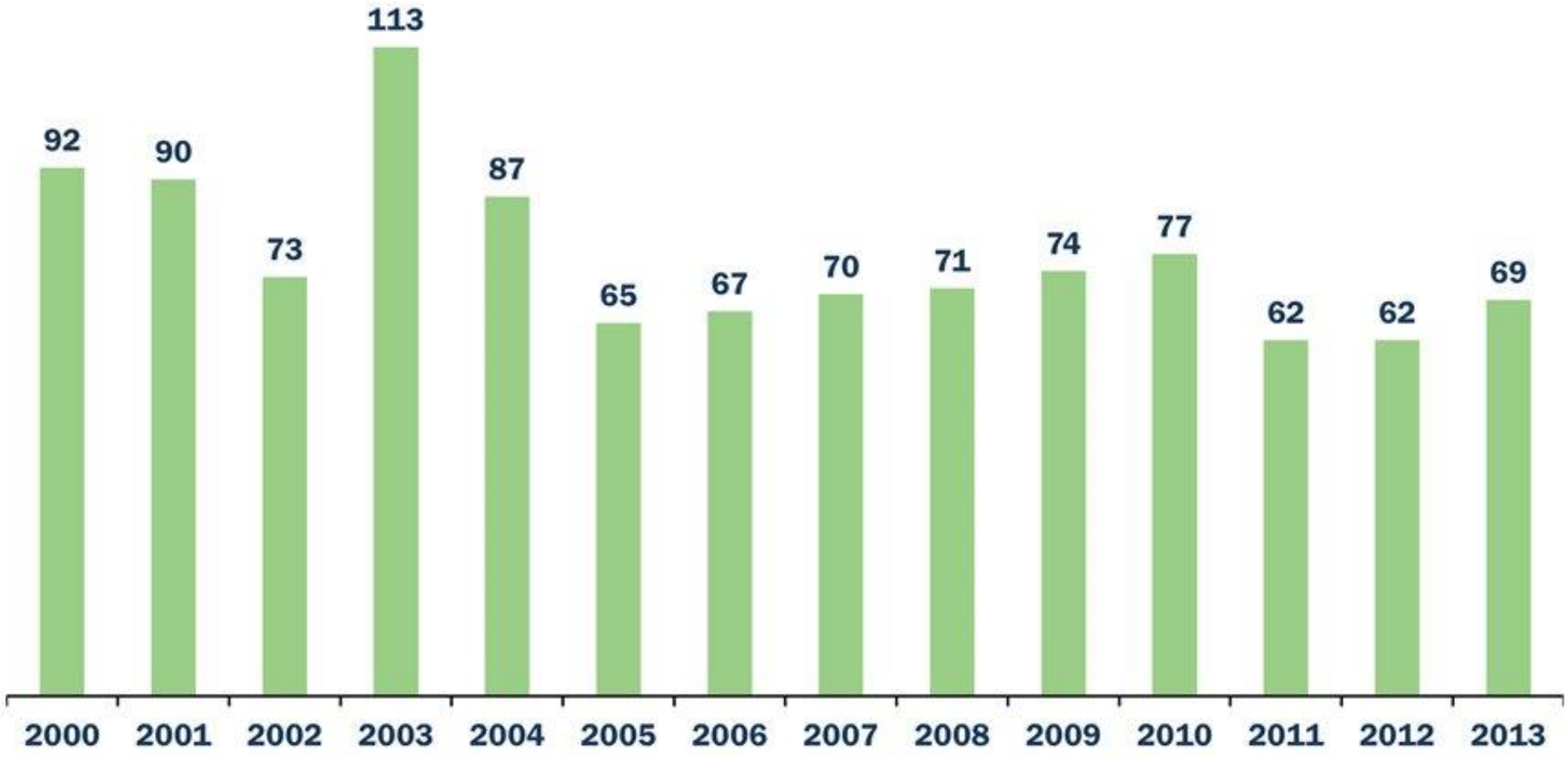
Significant Events are those events that the NRC staff identifies for the Performance Indicator Program as meeting one or more of the following criteria:

- **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 (ΔCDP) of 1x10-5 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**

Source: NRC Information Digest, 1988 is the earliest year data is available.
Updated: 10/13

U.S. Nuclear Industry Scram Trend

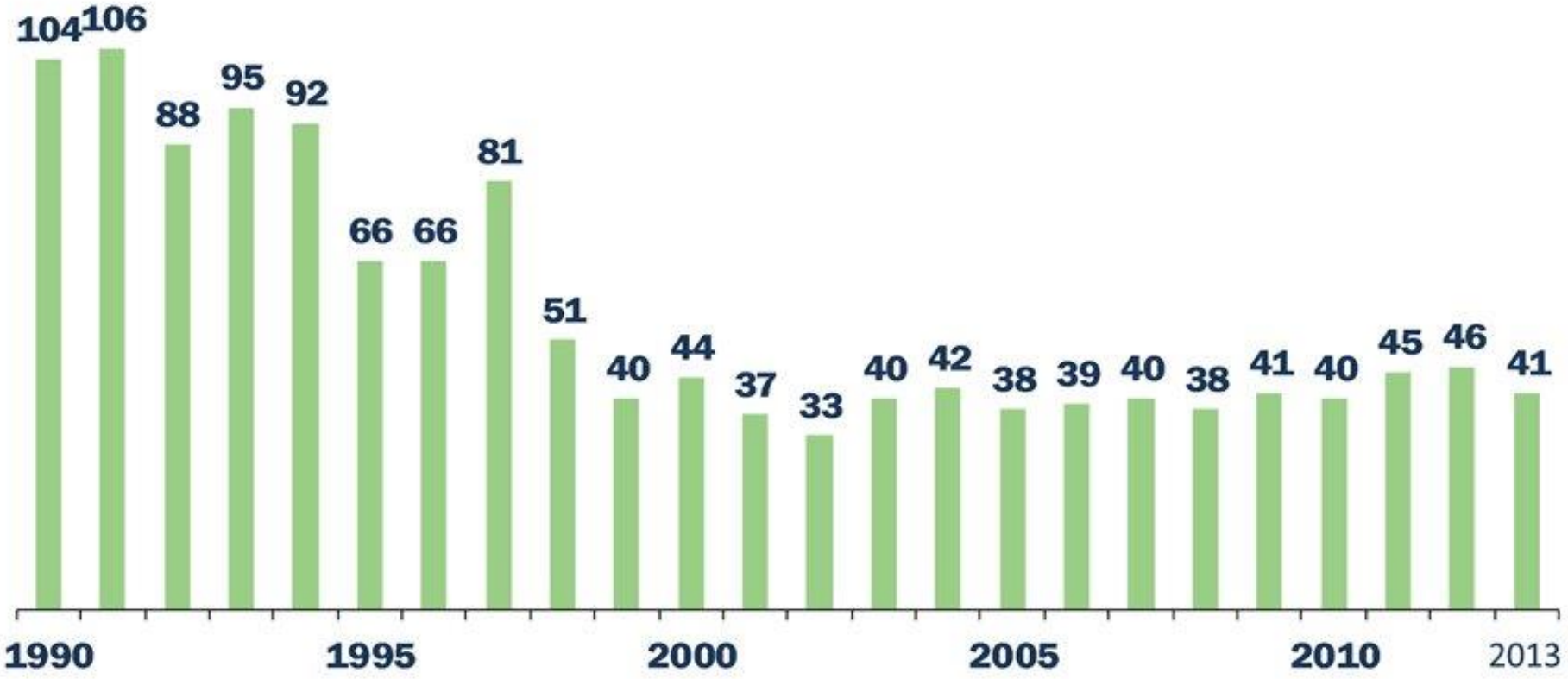
Total Manual and Automatic Scrams



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

U.S. Nuclear Refueling Outage Days

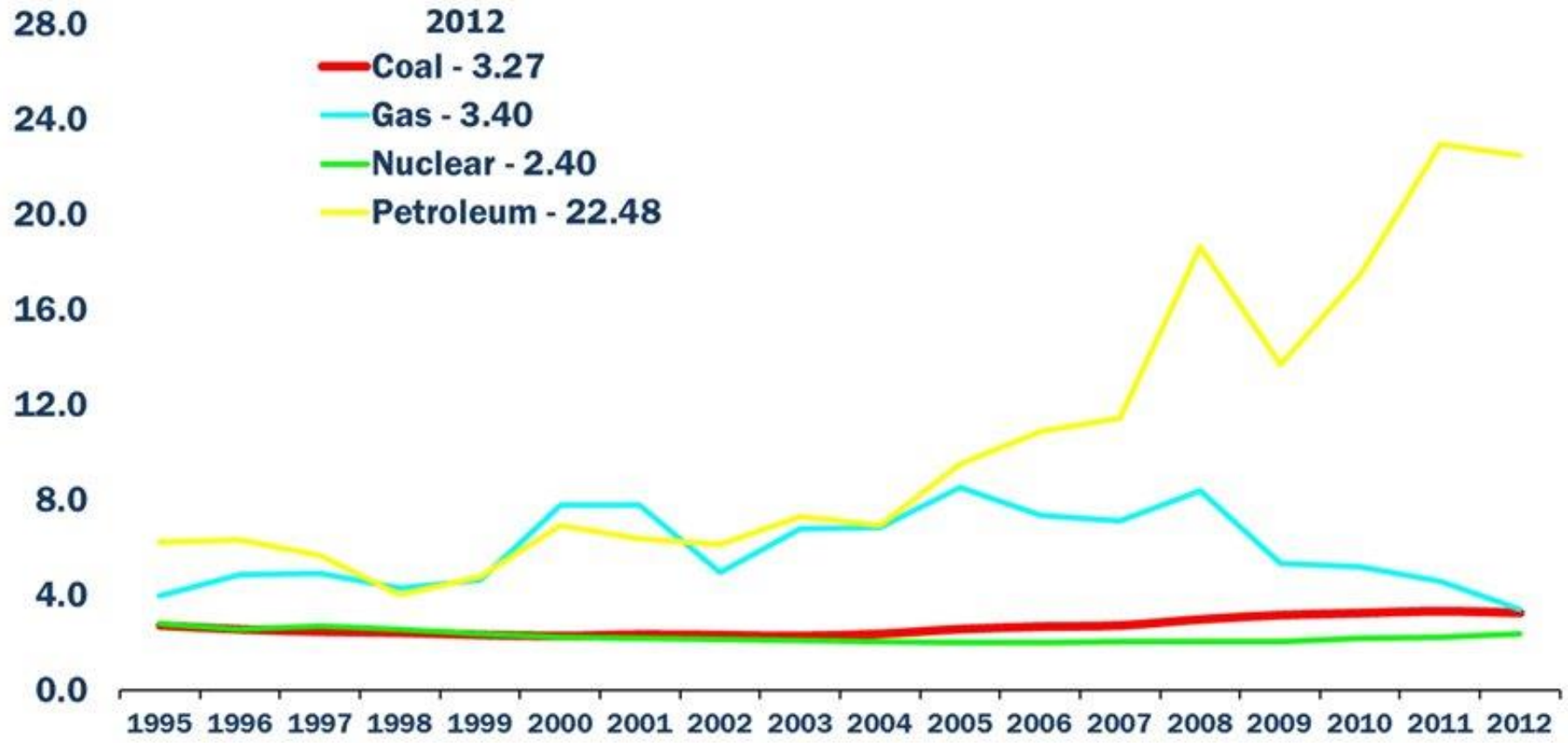
Average



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

U.S. Electricity Production Costs

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



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

NEI NUCLEAR ENERGY INSTITUTE

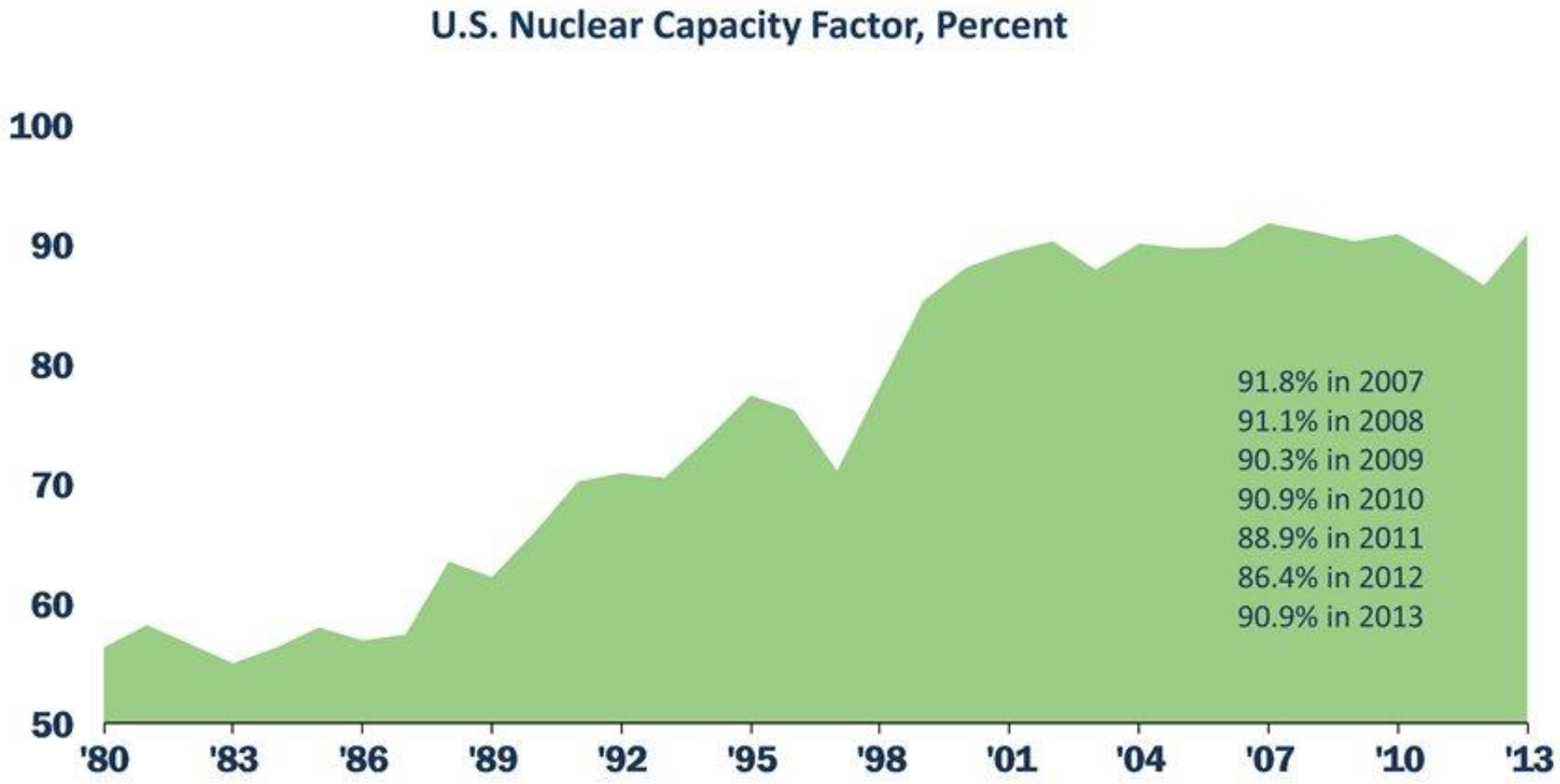
U.S. Capacity Factors by Fuel Type

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

Source: Ventyx Velocity Suite / Energy Information Administration
Updated: 4/14

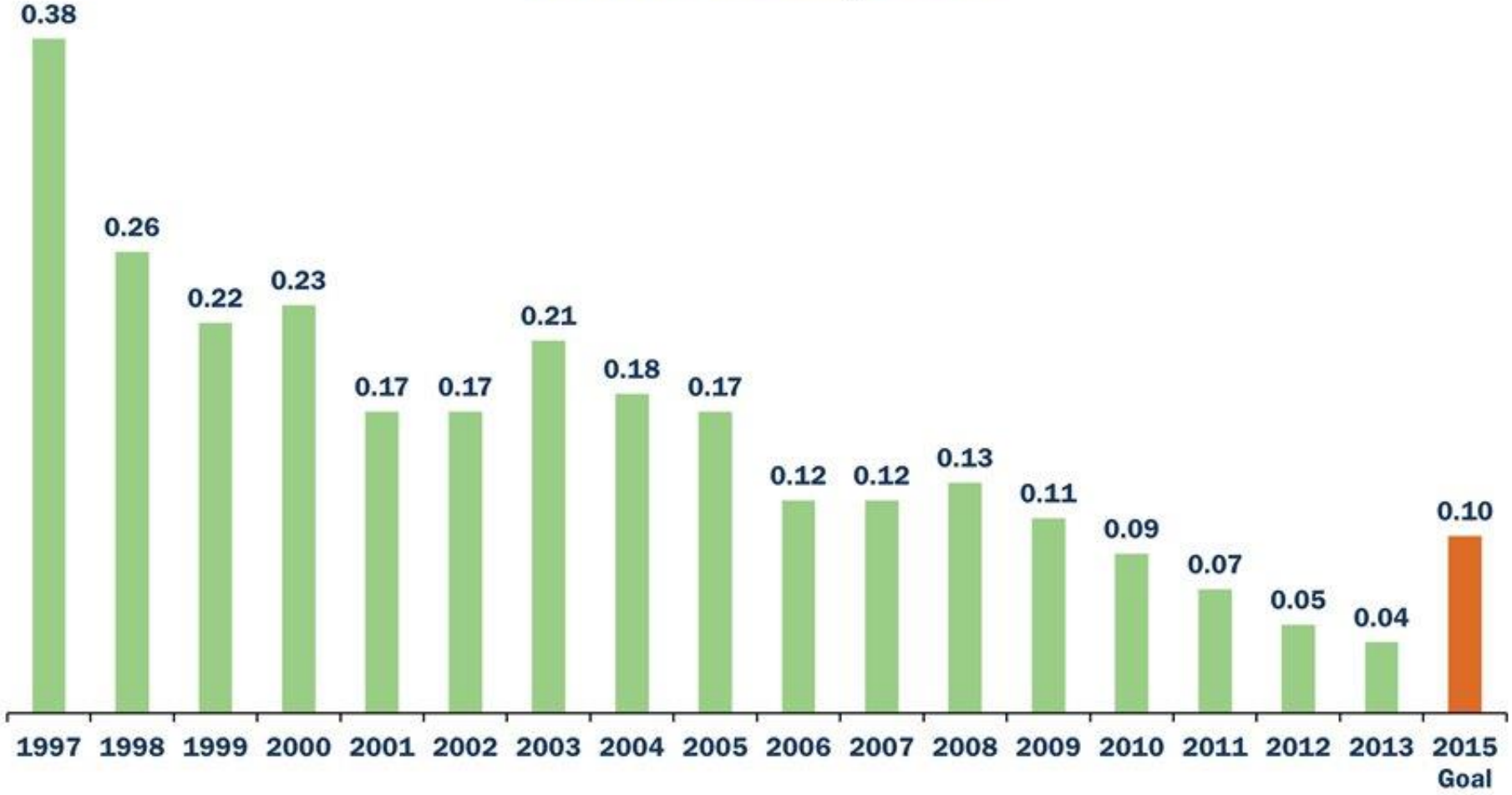
Sustained Reliability and Productivity



Source: Energy Information Administration
Updated: 4/14

U.S. Nuclear Industrial Safety Accident Rate

One-Year Industry Values



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

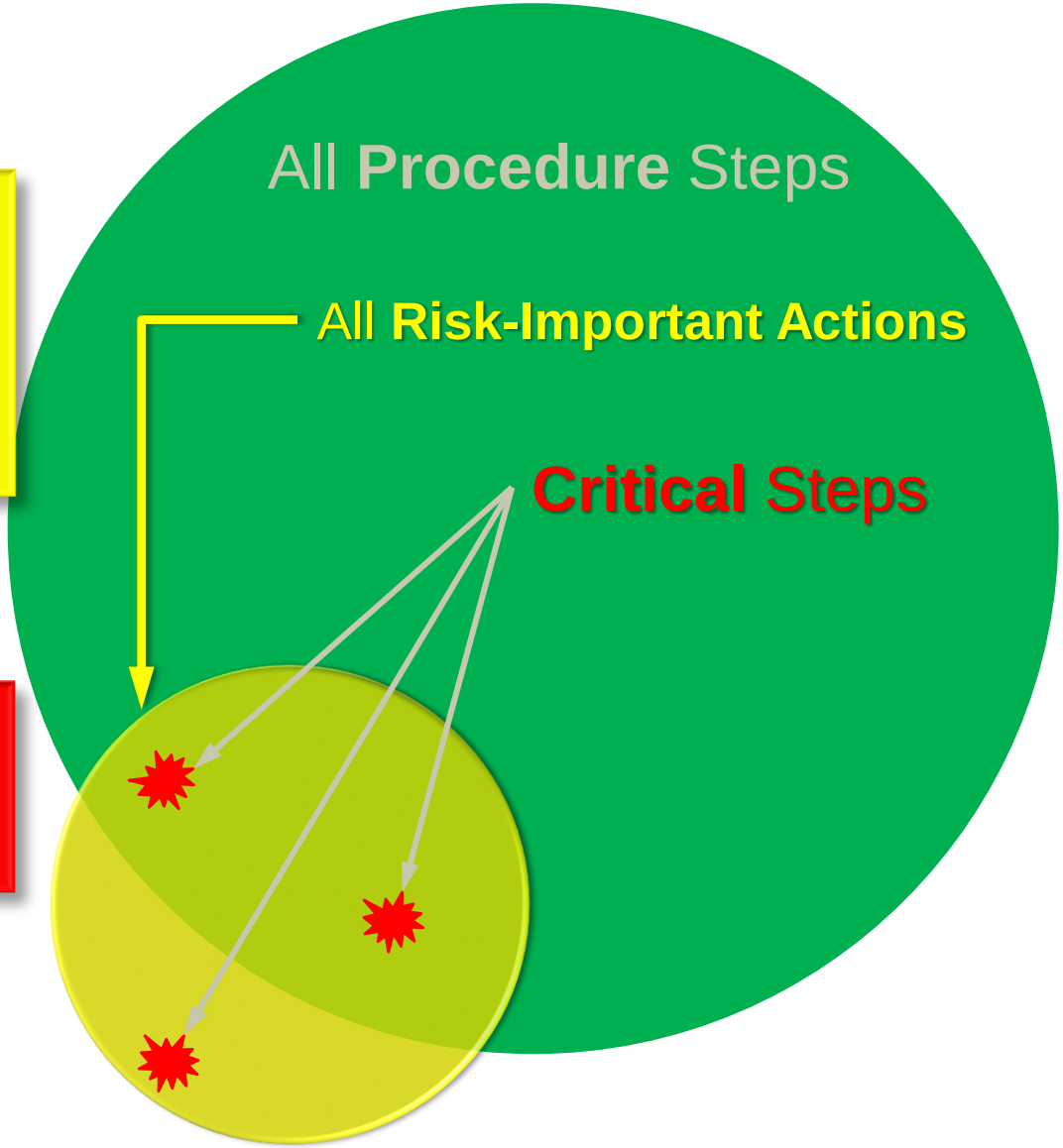
IDENTIFICATION OF CRITICAL TASKS

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.

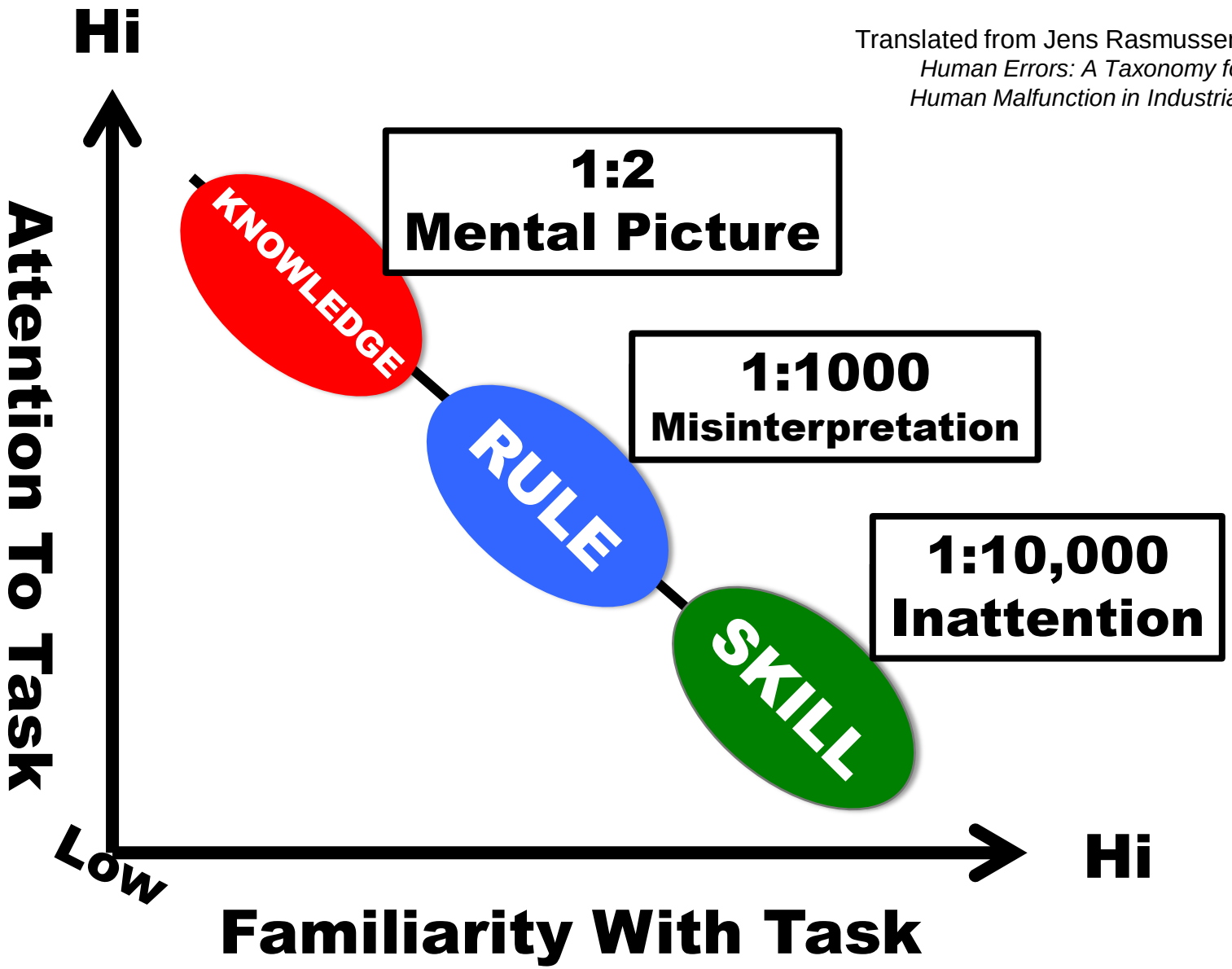
Critical Steps:
actions that *will* trigger *immediate, irreversible harm*



RISK-IMPORTANT ACTIONS AND CRITICAL STEPS

Performance Modes

Translated from Jens Rasmussen
Human Errors: A Taxonomy for Describing Human Malfunction in Industrial Instillations



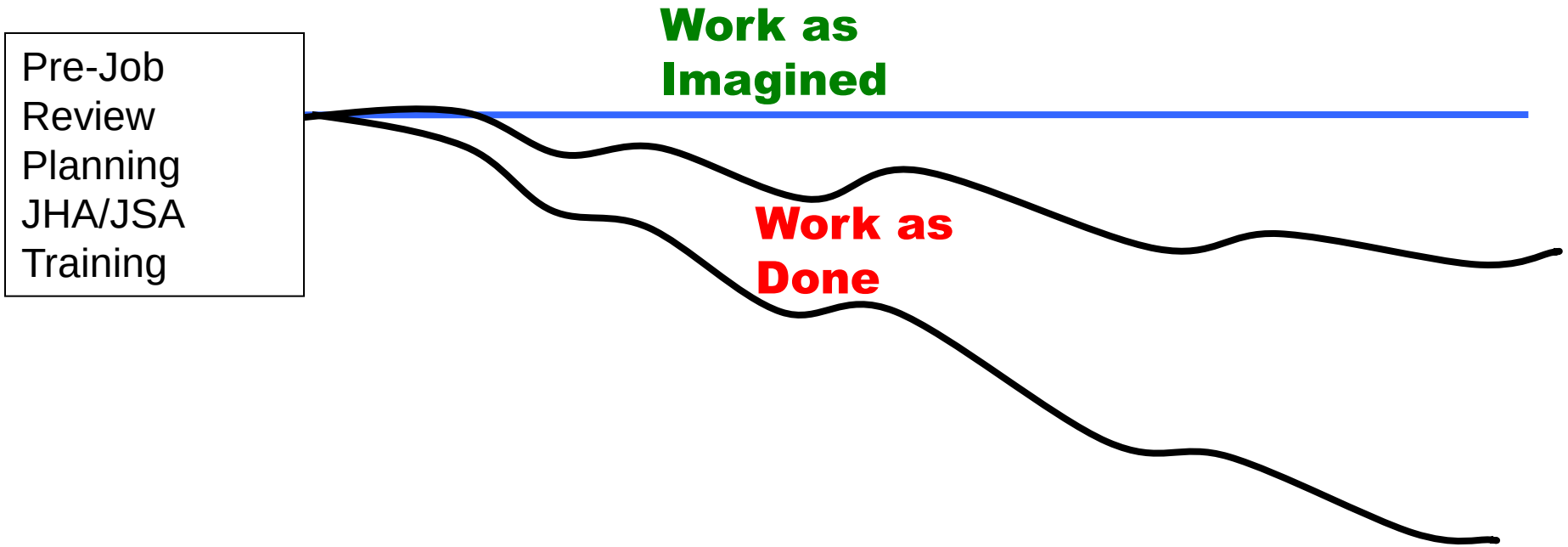
Clearly Safe to do Work

The Grey Area: Uncertain interpretation of Safe work

Clearly **Not** Safe to do Work

PEOPLE DISCOVER SAFETY…

HOW DID THIS HAPPEN?

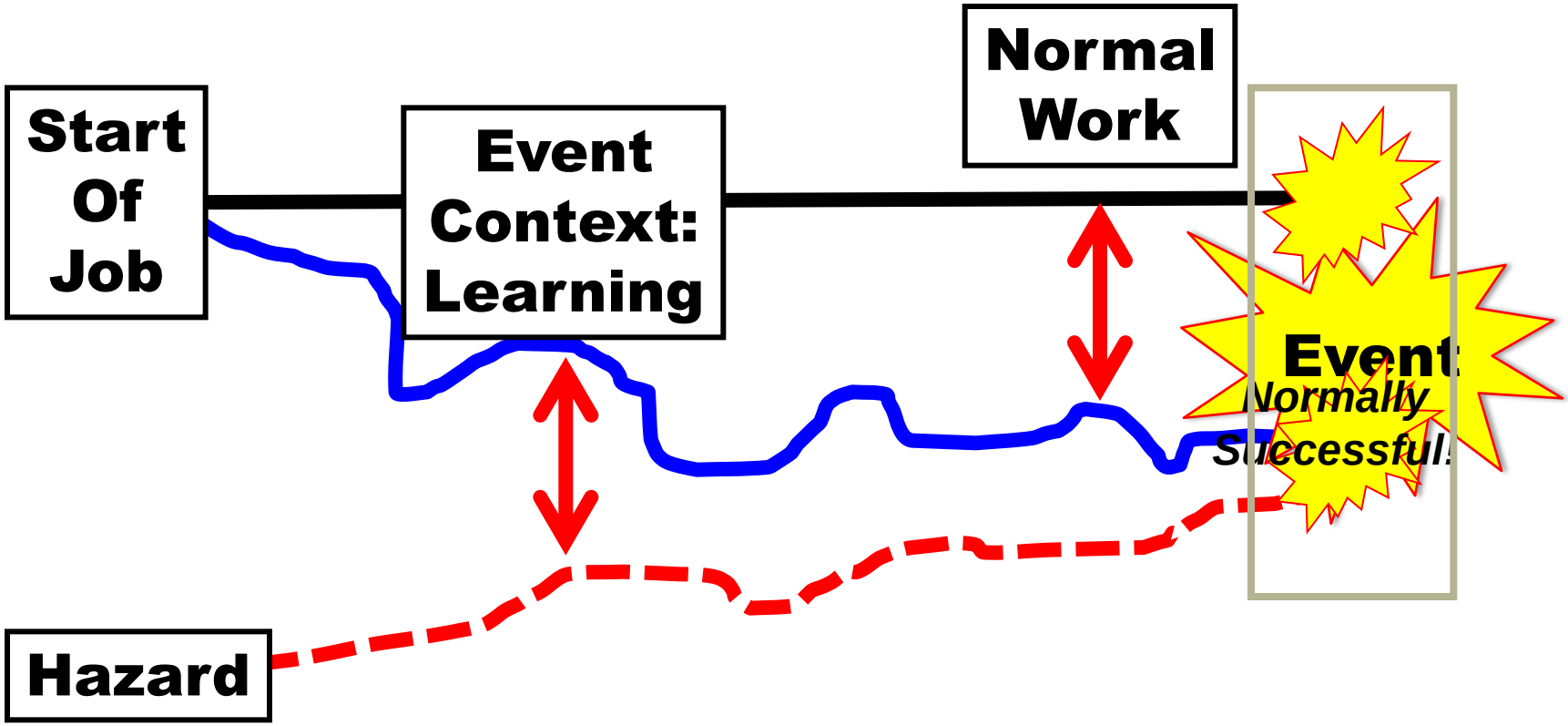


THE TRADITIONAL SAFETY EMPHASIS ON PRE-WORK AND PLANNING

TWO VIEWS OF FAILURE

Newtonian

Complex-Adaptive



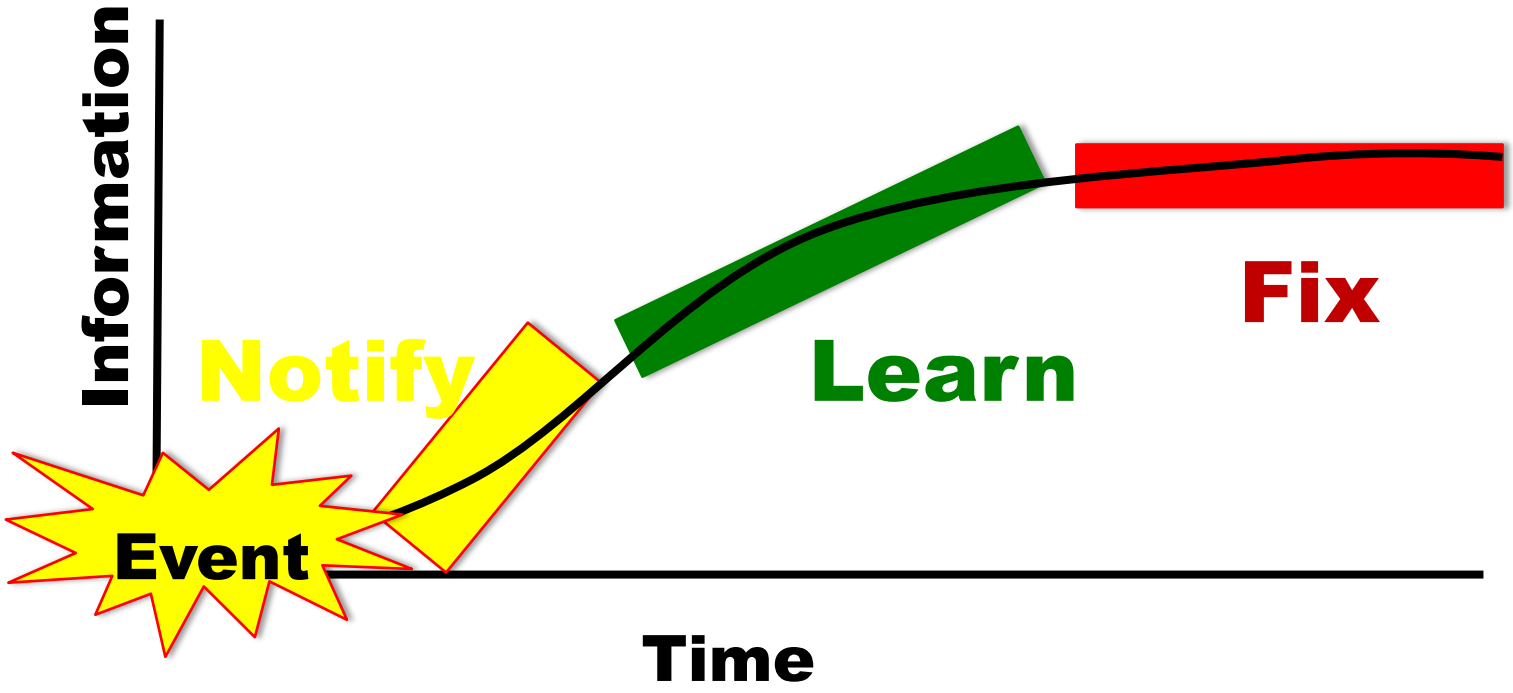
Safety Understood:

Drift and Accumulation

The Pressure To Know...

What You Ask For Is What You Get

Outweighs The Pressure To Learn...



SAFETY DEFINED

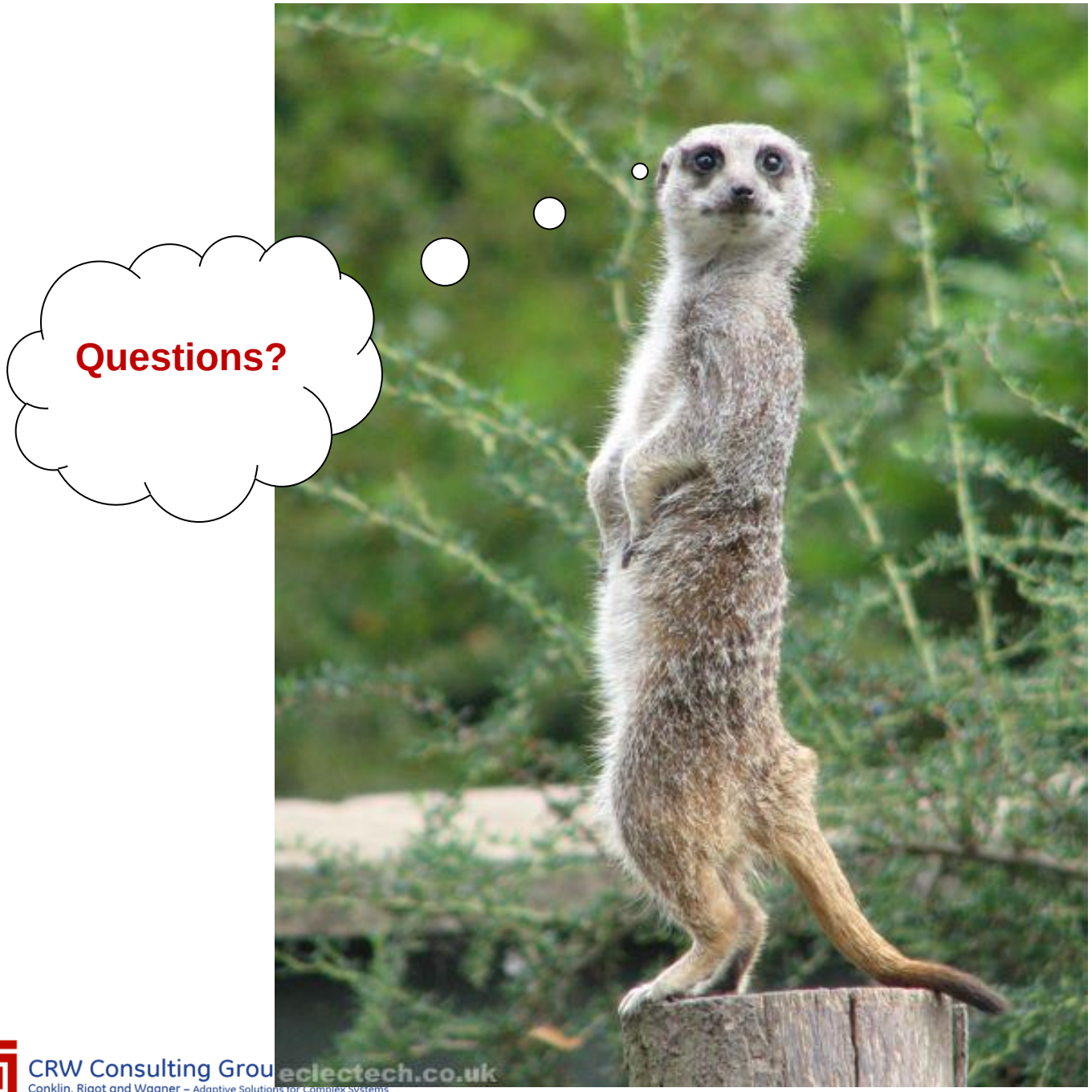
Safety is not the absence of events…

Safety is the presence of defenses.

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?

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ADAPTIVE SOLUTIONS FOR COMPLEX SYSTEMS