Sandia National Laboratories

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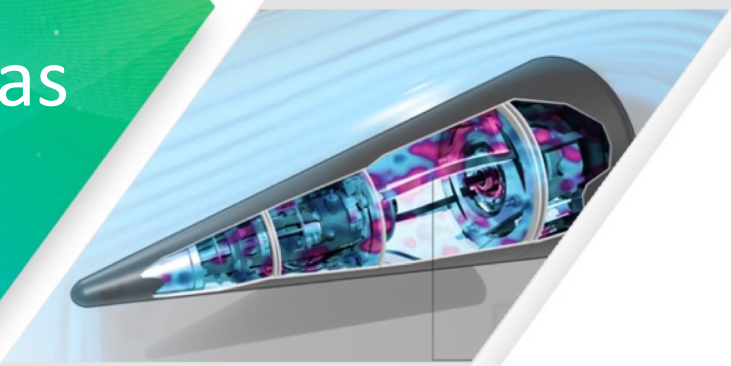
Nuclear Safety Culture Based on Positive Reinforcement and Workers as the Solution



David Epp

Sr Manager, Sandia Nuclear Facilities

October 3, 2024

U.S. DEPARTMENT OF ENERGY | NNSA

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What am I going to talk about?

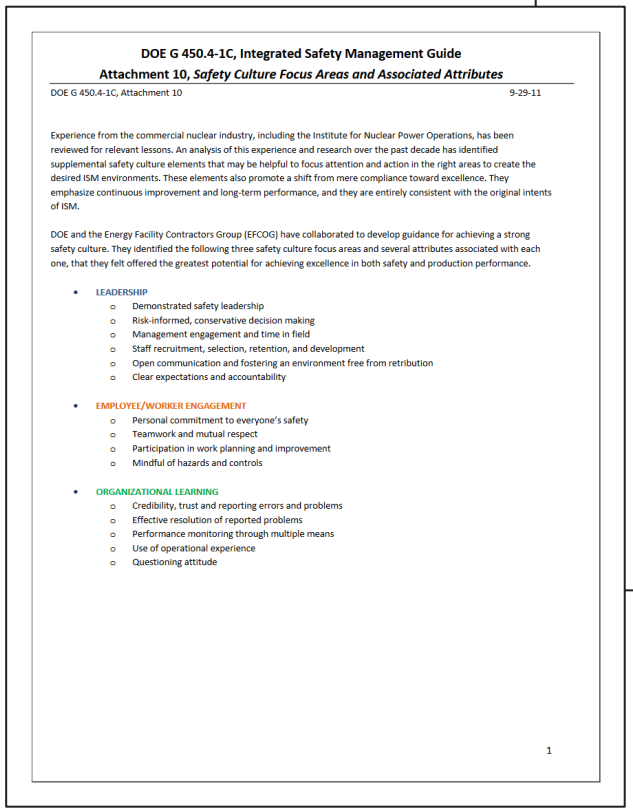
SNL Nuclear Facilities safety culture journey, basically the last 3 years

- Who I am and what nuclear facilities are at Sandia
- Our starting point 3 years ago
- Major shifts in approach
  - What does positive reinforcement look like?
  - How can we leverage the people most familiar with the work?
- Outcomes

Some Assumptions and Things I Won't Talk About

- Formality of operations
- Management oversight
- Management programs
- Regulatory drivers
- Oversight

Basic Assumption: This is where we are starting. There is some culture, formality, and oversight already in place.



DOE G 450.4-1C, Integrated Safety Management Guide

Attachment 10, *Safety Culture Focus Areas and Associated Attributes*

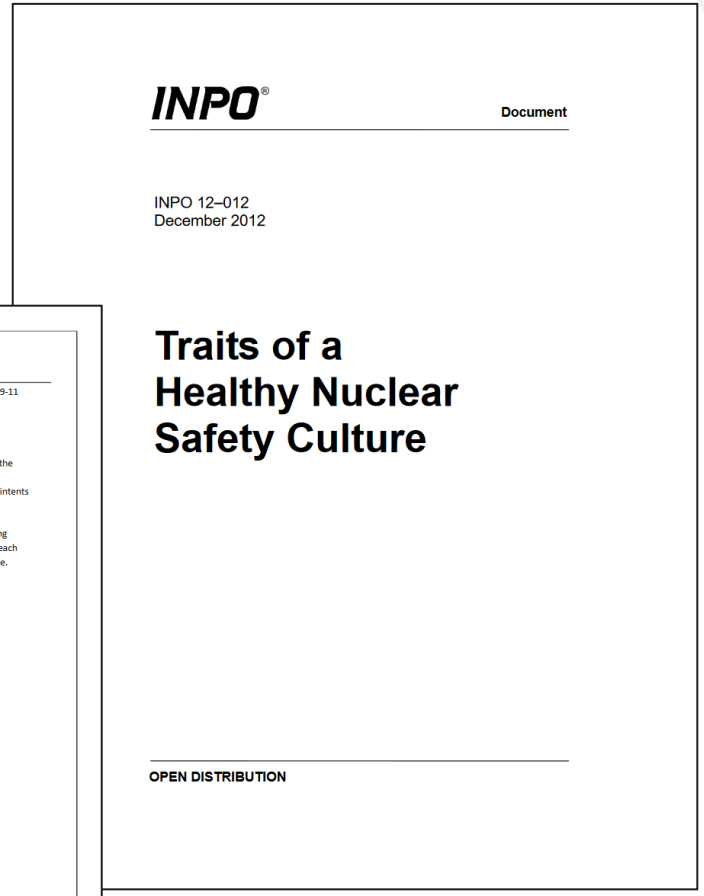
DOE G 450.4-1C, Attachment 10 9-29-11

Experience from the commercial nuclear industry, including the Institute for Nuclear Power Operations, has been reviewed for relevant lessons. An analysis of this experience and research over the past decade has identified supplemental safety culture elements that may be helpful to focus attention and action in the right areas to create the desired ISM environments. These elements also promote a shift from mere compliance toward excellence. They emphasize continuous improvement and long-term performance, and they are entirely consistent with the original intents of ISM.

DOE and the Energy Facility Contractors Group (EFCOG) have collaborated to develop guidance for achieving a strong safety culture. They identified the following three safety culture focus areas and several attributes associated with each one, that they felt offered the greatest potential for achieving excellence in both safety and production performance.

- LEADERSHIP
  - Demonstrated safety leadership
  - Risk-informed, conservative decision making
  - Management engagement and time in field
  - Staff recruitment, selection, retention, and development
  - Open communication and fostering an environment free from retribution
  - Clear expectations and accountability
- EMPLOYEE/WORKER ENGAGEMENT
  - Personal commitment to everyone's safety
  - Teamwork and mutual respect
  - Participation in work planning and improvement
  - Mindful of hazards and controls
- ORGANIZATIONAL LEARNING
  - Credibility, trust and reporting errors and problems
  - Effective resolution of reported problems
  - Performance monitoring through multiple means
  - Use of operational experience
  - Questioning attitude

1



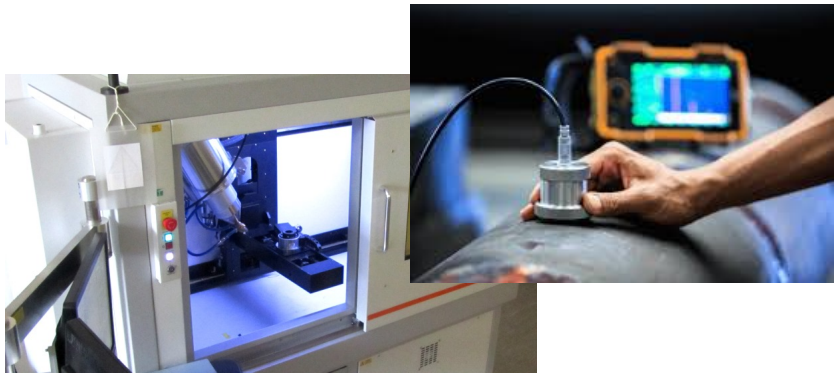
INPO® Document

INPO 12–012
December 2012

Traits of a Healthy Nuclear Safety Culture

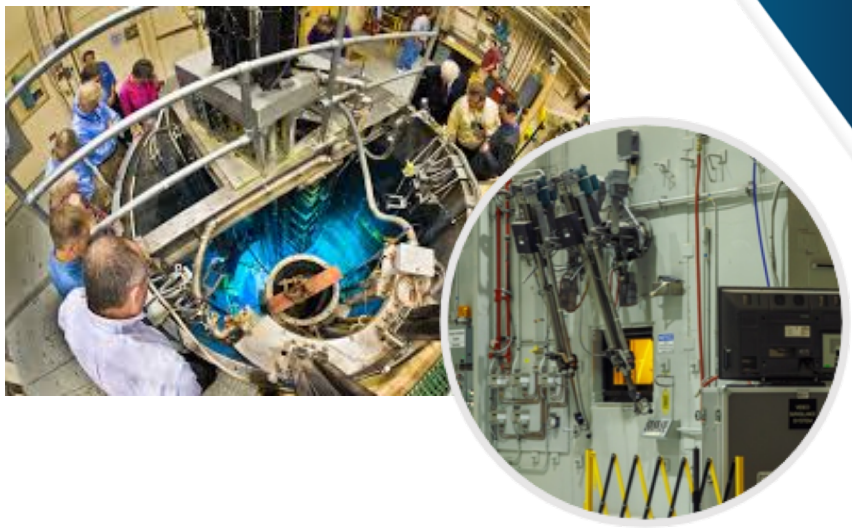
OPEN DISTRIBUTION

My background is environmental testing facility management



Industrial Radiography and NDE

Direct field acoustic



Nuclear radiation environments

Vibration and modal testing

Large mechanical environments

Therma vacuum

My own previous experience with two paths

Security Response

- Has it been contained?
- What happened?
- How can we prevent it in the future?
- Reporting responsibilities

Safety Response

- Did anyone get hurt?
- Who made a mistake?
- Why did they make a mistake?
- Reporting responsibilities

Sandia Nuclear Facilities

DAVID EPP
Senior Manager, 1380

MISSION FOCUS

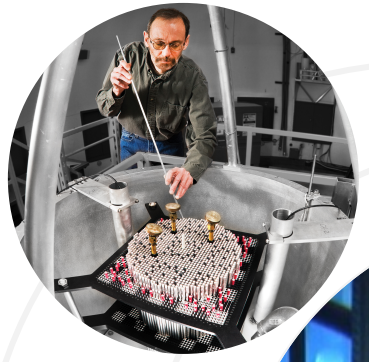
- Survivability in hostile neutron radiation environments
- Aging and survivability in long term gamma radiation environments
- Nuclear Criticality Safety for Sandia

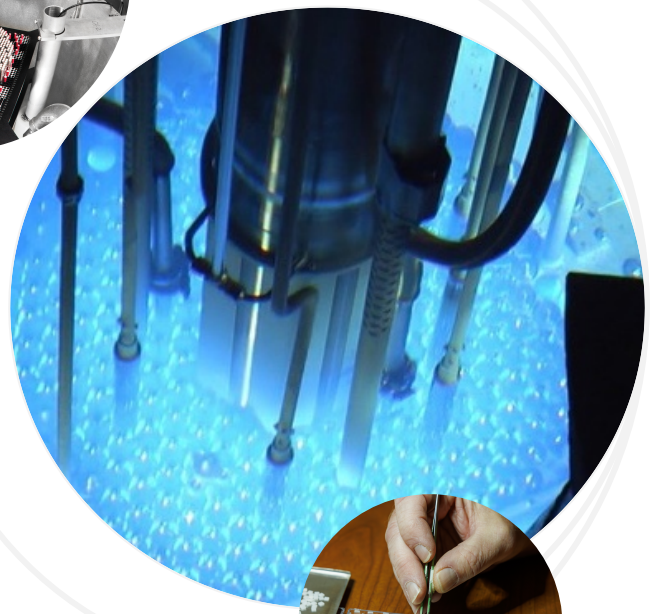
CAPABILITIES

- Nuclear Facilities – two reactors (ACRR, SPR/CX) and hot cells (AHCF)
- Radiation Facilities – irradiation (GIF, LDRIF) and metrology (RML)
- Nuclear safety basis, quality, engineering, and operations

KEY KNOWLEDGE

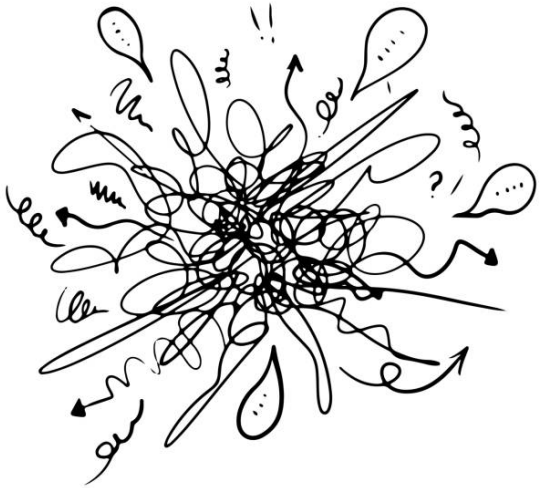
- Highest hazard category at Sandia
- Regulated by DOE (not NRC)
- Oversight from SFO and DNFSB
- 65 people in organization: Ops, Safety Basis, Quality, Engineering, R&D





Where were we 3 years ago?

Causal analysis experience



Frustrated and demoralized

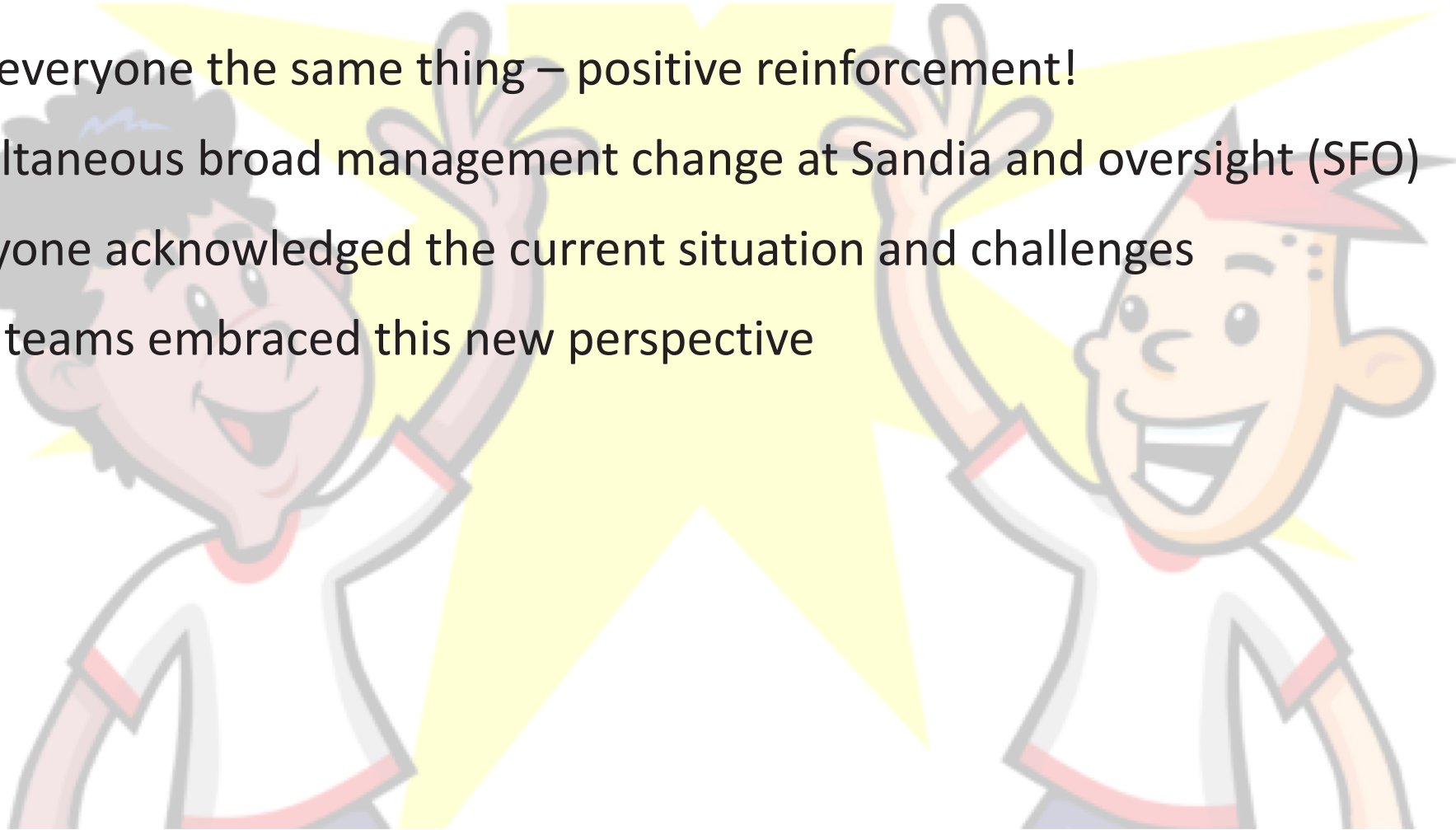
Who made a mistake and why?

Regulator relationship

We are going to use positive reinforcement!

First major driver for change…

- Told everyone the same thing – positive reinforcement!
- Simultaneous broad management change at Sandia and oversight (SFO)
- Everyone acknowledged the current situation and challenges
- New teams embraced this new perspective



MIT Statistics about reporting from airline industry

- Airlines that seem to be less safe won't kill you
- There is an inverse relationship between reporting, honesty, discussions about what could go wrong and things actually going wrong. -Sidney Dekker

How do we encourage MORE participation and reporting?

Table 1
Correlation of Major U.S. Jet Air Carrier[1] Nonfatal Accident/Incident Rates and Passenger-mortality Risk, Jan. 1, 1990–March 31, 1996

Type of Nonfatal Event	Correlation[2]
Incidents Only	–0.10
Incidents and Accidents[3]	–0.21
Accidents Only	–0.29
Serious Accidents Only[4]	–0.34

[1] The U.S. Federal Aviation Administration defines "major air carrier" as an air carrier certified under U.S. Federal Aviation Regulations Part 121 or Part 127 and with annual operating revenues greater than US$1 billion.

[2] Values shown are the coefficients of correlation between the accident/incident rate per 100,000 departures and the mortality risk per randomly chosen nonstop flight (i.e., the Q-statistic).

[3] The U.S. National Transportation Safety Board (NTSB) in 1996 defined "accident" as "an event involving serious injury, loss of life or substantial aircraft damage."

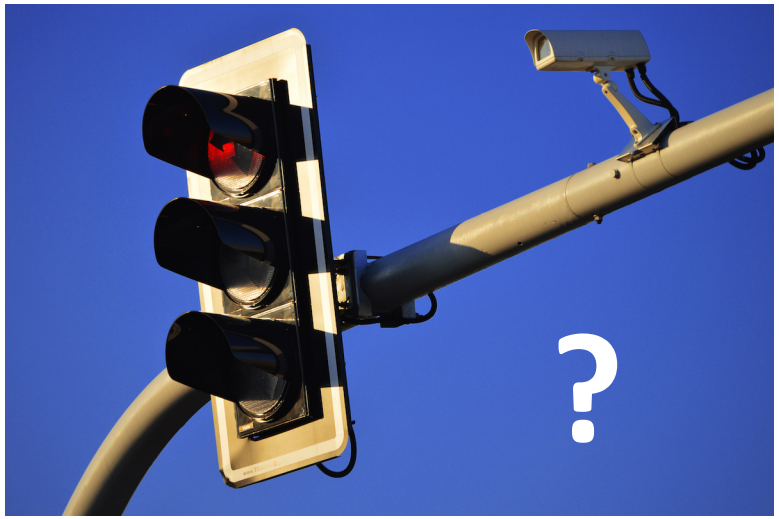
[4] NTSB in 1996 said that accidents in the "serious accident" category "exclude turbulence[-related accidents and] other minor accidents in flight, and gate or ramp accidents."

Sources: Arnold Barnett and Alexander Wang

Table 1 shows correlations of nonfatal accidents/incidents per 100,000 departures for individual major carriers with their passenger-mortality risks, as measured by Q-statistics.

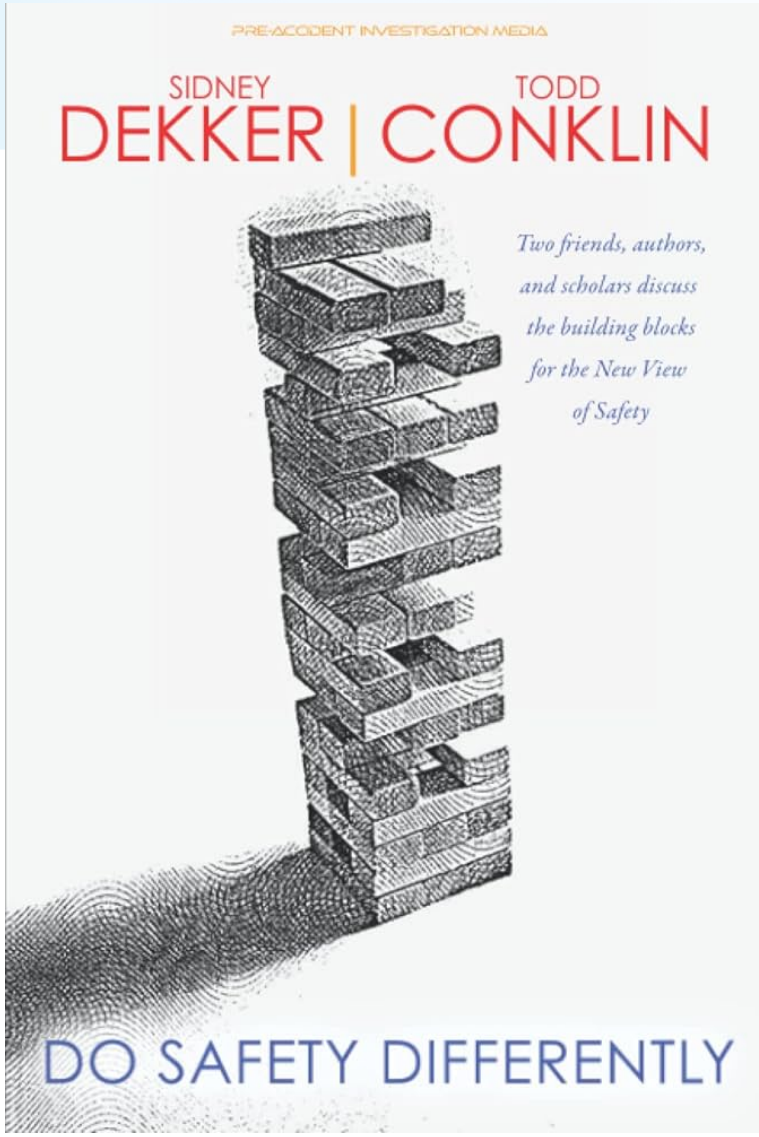
All the correlation coefficients shown in Table 1 are negative, which means that carriers with higher rates of nonfatal accidents/incidents had lower mortality risks. Furthermore, the correlations shown become increasingly negative as the events become more severe — from –0.10 for incidents only to –0.34 for serious accidents only.[15]

What does positive reinforcement look like?



Todd Conklin and HOP (or Safety II, or New Safety)

Second major driver for change…



Workers are the solution, not the problem!

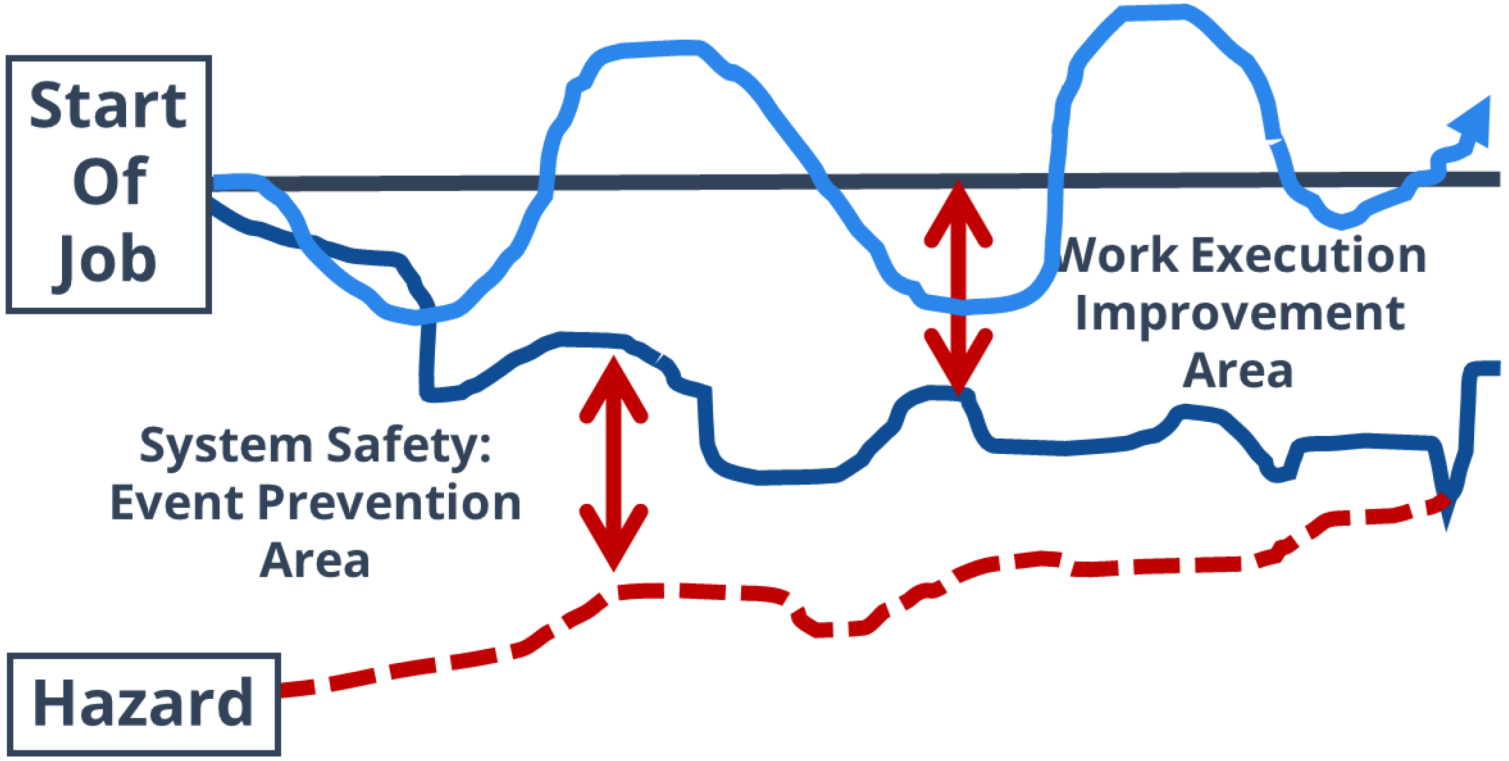
- Who knows how work is actually performed?
- Learning from work as performed is significantly more valuable than learning from work as planned
- Blaming and shaming does not improve the system, learning does
- … *anything* that puts downward pressure in your organization on honesty, disclosure, openness, and learning is bad for your business. You're going to ask for trouble. – Sidney Dekker

Learning Teams

- Small group of people who were present/close to the topic or event, minimize everyone else.
- Understand: **What** *happened? What are the facts? What do we need to understand?*
- Provide: "Soak Time" – take a breather..
- Learn: **How** *can we make the system more resilient next time? What systems/controls can we improvement?*

The Practice of Learning Teams: Learning and improving safety, quality, and operational excellence. Sutton, B., McCarthy, G., Robinson, B., (2020)
Los Alamos National Laboratory. *(2022-07-12) Learning Teams Facilitator Orientation. Utrain:54959.* Petrowski, M. & Trujilo, S.

Resilience to mistakes



Safety is not the absence of events, it is the presence of capacity.

Ref: Conklin HOP Fundamentals

Can we measure success?

- Feedback and individual interviews
  - Morale is significantly higher on operations teams
  - Growing confidence in operations teams that they are listened to
  - Interface with oversight has shifted to transparent collaboration
  - Growing confidence that management will react positively and optimistically
- Safety culture survey
  - 2019, 2021, 2023
  - Highlights: management commitment to safety, personnel feel safe, management is approachable
  - Opportunities: Learning teams tools, reinforce that safety goes beyond facilities

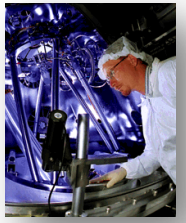
Larger Sandia Safety Culture evolution

Sandia National Laboratories' journey leverages an intentionally structured effort to develop a ***robust safety culture core***, which is necessary to:

- improve the *effectiveness of leadership*;
- significantly increase *employee/worker engagement*;
- promote continuous *organizational learning*; and
- enable organizational resiliency.

Focus: Go beyond academic understanding and deliberately develop the skills necessary to achieve and maintain an effective safety culture.





To summarize what we have learned…

- We are going to use positive reinforcement!
- Workers are the solution, not the problem
- Use Learning Teams
- Build resilience with continuous improvement

- We are still on a journey though…

Acknowledgements

I borrowed and took inspiration liberally for this presentation

- Billy Martin
- Benjamin Cook
- Brian Thompson
- Todd Conklin
- Sandia Nuclear Facility Safety Culture Team and Safety Champions
- Sandia corporate ES&H organizations
- …