



Safety Culture in High-Reliability Organizations

Jim McConnell

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Mr. McConnell is the Assistant Deputy Administrator for Nuclear Safety and Operations for NNSA's Defense Programs. He is responsible for safety, infrastructure, operations, and construction projects within NNSA Defense Programs. He is also responsible for the management and oversight of NNSA's eight Site Offices.

As the Director of the Office of Safety within Defense Programs, Mr. McConnell provided direct management support to senior leaders in Defense Programs for all nuclear safety and non-nuclear safety functions and issues. The scope of safety functions included executing the NNSA self-regulatory requirements for nuclear safety and worker safety within Defense Programs.

As the Chief of Defense Nuclear Safety in the National Nuclear Security Administration (NNSA), Mr. McConnell was responsible for the development and implementation of NNSA-wide safety programs. His role was to increase corporate focus on nuclear safety and to coordinate safety issues at the NNSA site offices and headquarters. He reported directly to the NNSA administrator and advised NNSA on its interactions with the DOE, DNFSB, and other federal, state, and local agencies on matters relating to nuclear safety.

Mr. McConnell has spent a majority of his career in the oversight of nuclear safety. Spending 12 years at the DNFSB, he most recently was deputy technical director. In that position, he directed the board's technical staff and provided overall strategic planning to achieve the board's technical safety oversight mission. In this capacity, Mr. McConnell also served on the INPO Advisory Panel for Nuclear Safety Culture. During his tenure at DNFSB, he served as a group leader of the Nuclear Weapons Program, a site representative at the Pantex Plant, program manager for the Y-12 National Security Complex at Oak Ridge and a technical specialist. A former U.S. Navy officer, he served on the USS Houston and was an instructor at the SIC Nuclear Prototype Training Unit in Windsor, Connecticut.

He holds a bachelor's degree in electrical engineering from the U.S. Naval Academy and masters' degrees from the Catholic University of America and George Washington University.



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Learning Objectives

- Compare, contrast and describe organizational culture, safety culture, and safety conscious work environment as they relate to nuclear missions in the Department of Energy.
- Identify, and describe potential signs of a strong or weak safety culture within the organization.
- Given the INPO Safety Culture Principles, apply those principles to organizations and missions in the Department of Energy.

Organizational Culture



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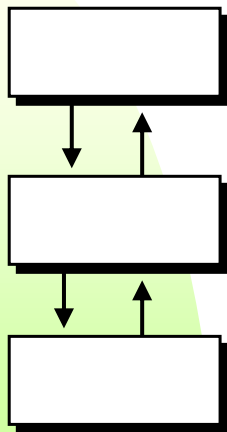


- Culture is the sum total of a group's learning.
- Culture is to the organization what personality and character are to the individual.
- Organizational culture is a combination of subcultures.
 - Hourly workers, salaried personnel
 - Operators, technicians, engineers/designers
 - Union-represented workers and executives

Levels of Organizational Culture



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- VISIBLE ORGANIZATIONAL STRUCTURES & PROCESSES
- (HARD TO DECIPHER)
- STRATEGIES, GOALS, PHILOSOPHIES
- (ESPOUSED JUSTIFICATIONS)
- UNCONSCIOUS, TAKEN FOR GRANTED BELIEFS, PERCEPTIONS, THOUGHTS, & FEELINGS
- ULTIMATE SOURCE OF VALUES & ACTIONS



Why is Culture Important to Safety?

- Normal Accident Theory
- High Reliability Organizations
- Human Performance Improvement
- Behavior-Based Safety
- VPP
- People-Based Safety
- Blah, Blah, Blah, Blah, Blah



Normal Accident Theory

- Postulates that accidents in complex, tightly-coupled, high-technology organizations are inevitable.
- Human Aspects:
 - Practical Drift,
 - Normalization of Deviations
 - Heuristic Traps
- It is easy to forget to fear things that rarely happen.



Practical Drift

Scott Snook, “*Friendly Fire*” (Two US F-15 fights shot down 2 US Black Hawk helicopters)

- Organizations establish rules for high-consequence, high-stress situations
- Procedures are sometime seen as burdensome during “normal” operations so personnel develop informal processes that are simpler and more efficient (i.e., “practical”)
- These informal processes can fail when personnel do not recognize that the situation calls for more rigorous process direction



Normalization of Deviation

Diane Vaughn, “*The Challenger Launch Decision: Risky Technology, Culture, and Deviance at NASA*”
(Brittle o-rings lead to explosion)

- Small deviations from specifications, requirements, or expectations can be accepted
- Each deviation becomes the base-line against which the next deviation is evaluated
- Over time this iterative process can lead to the acceptance of conditions that are far different than the original requirements
- The way safety questions are posed matters



Heuristic Traps

Belief that our behavior is correct to the extent that we have done something before

Belief that a behavior is correct to the extent that others are engaged in it

Belief that a behavior is correct to the extent that it is consistent with a prior commitment

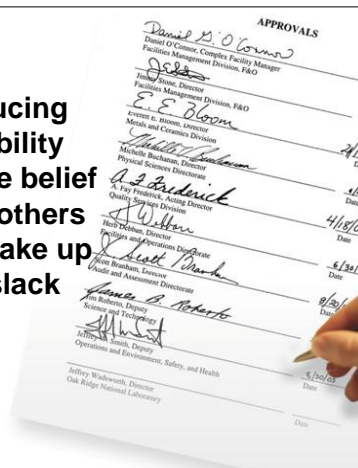
Distorting the value of opportunities that we perceive as limited and competing with others to obtain them



Heuristic Traps (continued)

More engines on a jet may make trans-oceanic flights less safe, not more safe

Reducing reliability in the belief that others will take up the slack





Lessons Learned from the Space Shuttle Columbia Accident

- Well-intentioned people and high-risk organizations can become desensitized to deviations from standards.
- Past successes may be the first step toward future failure.
- Organizations, like people, must always be learning, especially from past mistakes.
- Poor organizational structure can be just as dangerous to a system as technical, logistical, or operational factors.
- Leadership training and system safety training are wise investments in an organization's current and future health.



Lessons Learned from the Space Shuttle Columbia Accident (cont.)

- Leaders must ensure external influences do not result in unsound program decisions.
- Leaders must demand minority opinions and healthy pessimism.
- Stick to the basics.
- High-reliability organization safety programs cannot remain silent or on the sidelines – must be visible, critical, empowered, and fully engaged.
- Safety efforts must focus on preventing versus solving mishaps.

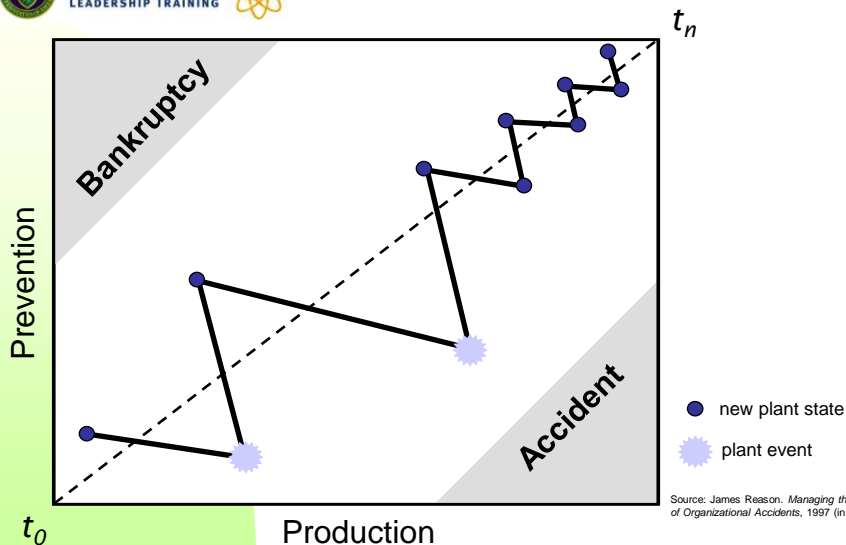


High-Reliability Organization Theory

- Characterized by placing a high cultural value on safety, effective use of redundancy, flexible and decentralized operational decision making, and a continuous learning and questioning attitude
- Elements
 - extraordinary technical competence
 - flexible decision-making processes
 - sustained high technical performance
 - processes that reward the discovery and reporting of errors
 - equal value placed on reliable production and operational safety
 - a sustaining institutional culture



Competing Resources



What is Safety Culture?



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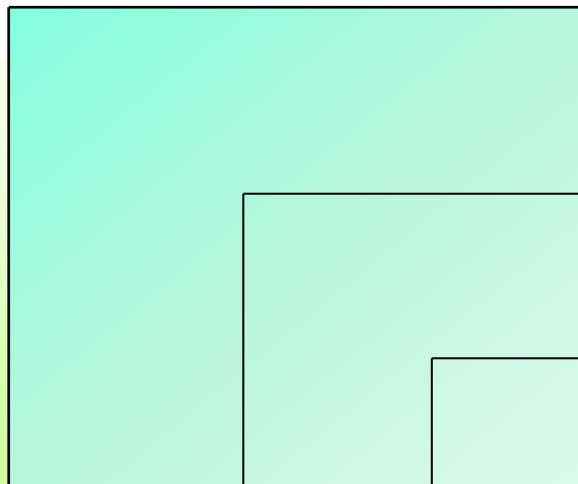


- **Safety Culture:** An organization's values and behaviors – modeled by its leaders and internalized by its members – that serve to make nuclear safety the overriding priority (INPO).
- **Leaders affect**, but do not completely define, culture or safety culture.

Conceptual Diagram



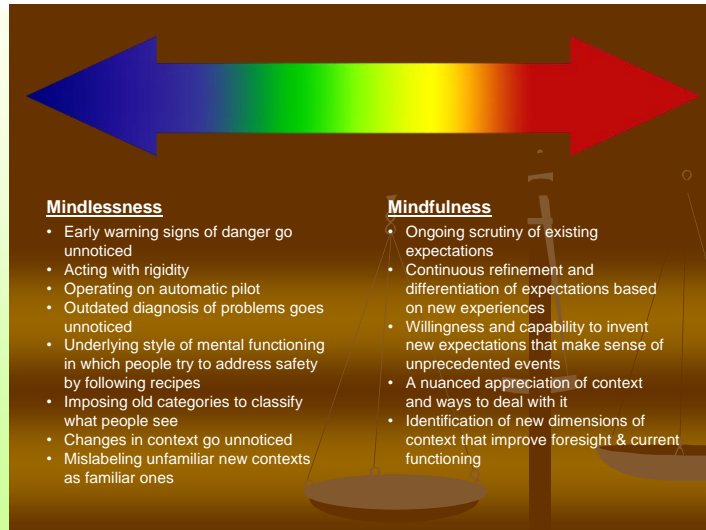
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Safety Culture Continuum



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Stages of Safety Culture Development



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- **Pathological**
 - “Who cares as long as we don’t get caught.”
- **Reactive**
 - “Safety is important . . . we do a lot of training every time we have an accident.”
- **Calculative**
 - “We have systems in place to manage all hazards.”
- **Proactive**
 - “We work hard on problems we find.”
- **Generative**
 - “We know that achieving safety is difficult. We keep brainstorming new ways in which the system can fail and have contingencies in place to deal with them.”

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Why People Don't Behave The Way We Want Them To



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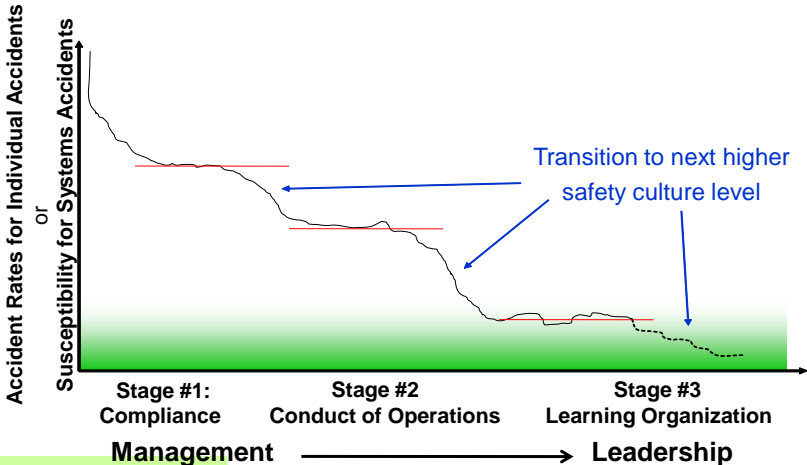


- They don't know they should.
- They don't know how.
- They can't.
- They don't want to.

Improvements in Safety for Each Stage of Safety Culture Maturity



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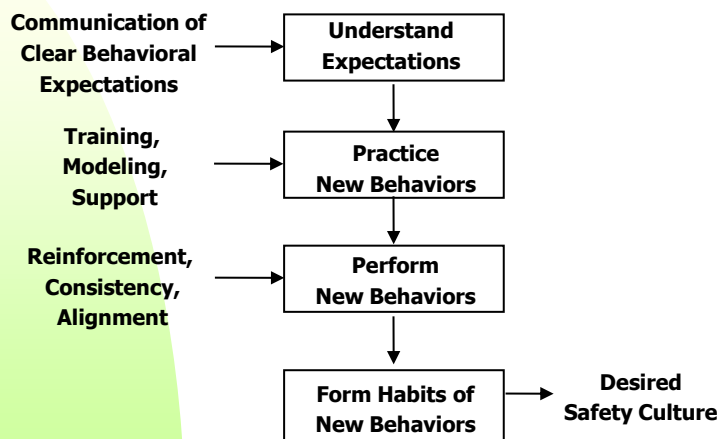


How Do We Change Safety Culture?

“Managers don’t have power to create new culture – they only have power to coerce behavior.”



Process for Changing Behaviors to Change Culture



HPI, BBS, VPP, and Other 3-Letter Acronym Safety Programs



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- HPI, Human Performance Improvement (or Technology):
 - A structured approach to improving the performance of systems with a significant human component by analyzing important performance gaps, planning for future improvements in human performance, designing and developing effective and ethically justifiable interventions, implementing the interventions, and evaluating results
 - » Adapted from *ASTD Models for Human Performance Improvement, Second Edition William J. Rothwell, ed.*
- BBS, Behavior-Based Safety:
 - An observation and feedback process that helps employees identify unsafe behaviors and choose a safe behaviors
- VPP, Voluntary Protection Program:
 - VPP sets performance-based criteria for a managed safety and health system, invites sites to apply, and then assesses applicants against these criteria. Verification includes an application review and a rigorous onsite evaluation by a team of safety and health experts

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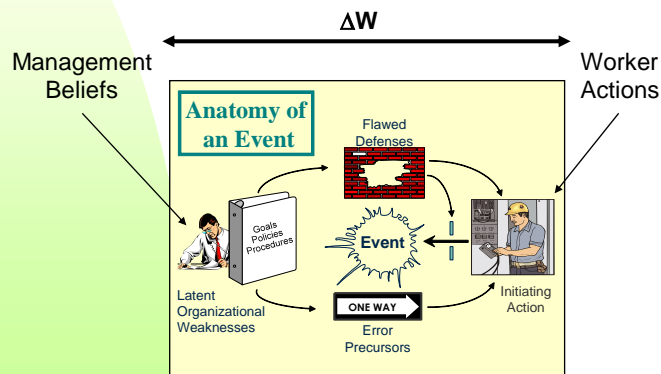


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ΔW

ΔW The difference between how management imagines work is being performed and how work is actually performed in the field



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ΔW The difference between how management imagines work being performed and how work is actually performed in the field

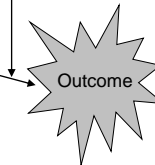
Management
Expectation

Work proceeds on the established path

Expected
Outcome

Worker
Actions

- Different conditions
- Unclear procedures
- Time pressures
- Etc



ΔW

Outcome



Safety Culture Break-Out Session

Identify 3 – 5 specific indicators that would indicate a potential weak safety culture and describe how they would specifically address the issues within the DOE environment. (You have 45 minutes.)

Each break-out group will return and brief their results to the full group.



INPO Safety Culture Principles

- Developed by an industry advisory group
- Describe basic principles rather than prescribing a specific program or implementing methods
- Attributes help clarify the intent of the principles



INPO Safety Culture Principle 1

Everyone is personally responsible for nuclear safety.

Responsibility and authority for nuclear safety are well defined and clearly understood. Reporting relationships, positional authority, staffing, and financial resources support nuclear safety responsibilities. Corporate policies emphasize the overriding importance of nuclear safety.

1



INPO Safety Culture Principle 2

Leaders demonstrate commitment to safety.

Executive and senior managers are the leading advocates of nuclear safety and demonstrate their commitment both in word and action. The nuclear safety message is communicated frequently and consistently, occasionally as a stand-alone theme. Leaders throughout the nuclear organization set an example for safety.

2



INPO Safety Culture Principle 3

Trust permeates the organization.

A high level of trust is established in the organization, fostered, in part, through timely and accurate communication. There is a free flow of information in which issues are raised and addressed. Employees are informed of steps taken in response to their concerns.

3



INPO Safety Culture Principle 4

Decision-making reflects safety first.

Personnel are systematic and rigorous in making decisions that support safe, reliable plant operation. Operators are vested with the authority and understand the expectation, when faced with unexpected or uncertain conditions, to place the plant in a safe condition. Senior leaders support and reinforce conservative decisions.

4



INPO Safety Culture Principle 5

Nuclear technology is recognized as special and unique.

The special characteristics of nuclear technology are taken into account in all decisions and actions. Reactivity control, continuity of core cooling, and integrity of fission product barriers are valued as essential, distinguishing attributes of the nuclear station work environment.

5



INPO Safety Culture Principle 6

A questioning attitude is cultivated.

Individuals demonstrate a questioning attitude by challenging assumptions, investigating anomalies, and considering potential adverse consequences of planned actions. This attitude is shaped by an understanding that accidents often result from a series of decisions and actions that reflect flaws in the shared assumptions, values, and beliefs of the organization. All employees are watchful for conditions or activities that can have an undesirable effect on plant safety.

6



INPO Safety Culture Principle 7

Organizational learning is embraced.

Operating experience is highly valued, and the capacity to learn from experience is well developed. Training, self-assessments, corrective actions, and benchmarking are used to stimulate learning and improve performance.

7



INPO Safety Culture Principle 8

Nuclear safety undergoes constant examination.

Oversight is used to strengthen safety and improve performance. Nuclear safety is kept under constant scrutiny through a variety of monitoring techniques, some of which provide an independent “fresh look.”

8



INPO Safety Culture Principles

1. Everyone is personally responsible for nuclear safety.
2. Leaders demonstrate commitment to safety.
3. Trust permeates the organization.
4. Decision-making reflects safety first.
5. Nuclear technology is recognized as special and unique.
6. A questioning attitude is cultivated.
7. Organizational learning is embraced.
8. Nuclear safety undergoes constant examination.



INPO Safety Culture Trouble Signs

Finger Pointing Instead of Teamwork

- Individuals who question current practices or provide alternative points of view are not considered team players.
- The initial management reaction to a plant event is to “find the guilty.”
- “Good catches” are not celebrated and publicized.
- There are “clay layers” in the organization where downward and/or upward communication stops.
- Workers exhibit symptoms of “malicious compliance.”
- Workers are reluctant to speak candidly from fear of retribution or criticism.
- Unresolved conflicts among groups or individuals are prevalent.
- Minority opinions are not encouraged or are stifled.



INPO Safety Culture Trouble Signs

Assumptions Rather than Verification

- People tend to jump to the obvious conclusions and explanations rather than exploring plausible alternatives.
- Management decisions seem to be made without a thorough understanding of the facts or without staff input.
- Individuals don't seem to recognize things can – and sometimes do – go wrong, and they don't anticipate the worst possible outcomes.
- PRA information and insights are not used as an input to manage safety margins.
- Problems are “pencil-whipped” away by engineering analyses.
- The design basis is not maintained – drawings, calculations, safety analyses are out of date and/or not easily retrievable.
- Managers and supervisors are not in the plant personally looking at equipment problems.



INPO Safety Culture Trouble Signs

Unfounded Optimism vs. Facing Facts

- The “burden of proof” for resolving important safety questions is inverted (i.e., when a safety question is identified, rather than requiring the organization to prove safety margins remain adequate, management forces individuals to prove the problem creates undue risk).
- Changes in employee concern program metrics go unnoticed or are not investigated for possible degradations in the culture.
- Workers have a perception that managers only want to hear positive reports.
- The organization is not actively searching for safety culture “blind spots.”



INPO Safety Culture Trouble Signs

Unfounded Optimism vs. Facing Facts (cont.)

- Input from independent sources is not valued.
- People live with problems.
- Outside auditors are not allowed to see unvarnished performance because activities are “managed” in their presence.



INPO Safety Culture Trouble Signs

Satisfaction with Status Quo instead of Challenging Goals

- The organization seems overconfident and isn't striving for continuous improvement – the numbers look good and the plant is living off past successes.
- Standards are set by outside influences rather than the site.
- Through isolation or complacency, the organization does not understand what levels of performance are realistically achievable.
- Workers and managers tolerate longstanding equipment problems, process deficiencies, and human errors.
- The importance of some issues is not recognized and some are not treated as “significant emotional events” to help communicate the need for change and internalize lessons learned.



INPO Safety Culture Trouble Signs

Mixed Signals instead of Consistent Safety Message

- Nuclear safety is not very visible – it is assumed.
- Schedule adherence is valued more than taking the time to do the right thing.
- Executives seem only to recognize/reward actions that kept the plant on line or contributed to quick resumption of operations.
- Managers and workers don't make suggestions that cost money because of perceived budget constraints.
- Workers (including non-station personnel) are unsure if they will be rewarded or criticized for stopping an activity in the face of uncertainty.
- Procedures are not consistently used – they are considered guidelines only.



INPO Safety Culture Trouble Signs

Mixed Signals instead of Consistent Safety Message (cont.)

- Operations shift managers aren't viewed as key members of the station management team.
- When evaluating problems, managers appear interested only in satisfying "requirements."
- People don't intervene and correct coworkers when they observe rules not being followed or standards not being met.



INPO Safety Culture Trouble Signs

"Flavor of the Month" as opposed to Well-Managed Change

- The pace of change is excessive, creating a sense of confusion.
- People are busy doing unimportant things or meeting arbitrary due dates.
- Work hours are poorly managed, and overtime is high.
- Management and bargaining units have longstanding unhealthy relationships.
- Managers overly focus on the near-term, with crisis management being the rule.



INPO Safety Culture Trouble Signs

“Flavor of the Month” as opposed to Well-Managed Change (cont.)

- Site managers aren't adept at withstanding overemphasis from corporate management on reducing costs, cutting resources, and shortening schedules.
- Personnel are not informed of the basis for important decisions that impact them.
- Managers are changed too frequently.



INPO Safety Culture Trouble Signs

Lack of Trust Equipment Will Perform

- Equipment performance problems continually distract the organization.
- Operators lack confidence in the reliability of equipment.
- Workers don't strive to maximize equipment availability.
- Maintenance backlogs are high.
- Unplanned entries into technical specification limiting conditions of operation are viewed as normal.

Ensuring a Strong Safety Culture – High Reliability



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- Unlock the power of differing opinions
 - Is someone assigned the task of challenging group assumptions and decisions?
 - Ask, “Why is this safe?” not “Why is this unsafe?”
- Celebrate people who raise well-intentioned objections
 - Even (especially?) if they are later proven wrong
- Choose to learn from minor events to avoid major events
- Manage and model behavior to change fundamentals