Building a Risk Management Information System (RMIS)

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Introduction

- Rick Curtis
- Pronouns: he, him, his
- Land Acknowledgement – I am in New Jersey, the home of the Lenni Lenape people.
- Director, Princeton University Outdoor Action Program: 39 Years
- Founder: **www.IncidentAnalytix.com**
- Author: **The Backpacker's Field Manual**
- Founder: **www.OutdoorEd.com**

Introductions

- Name
- Preferred pronouns
- Organization
- Program Type (ex. outdoor program, sport association, conservation association, therapeutic adventure, etc.)
- Your role
- A risk management issue for your program (non-COVID)

Learning Objectives

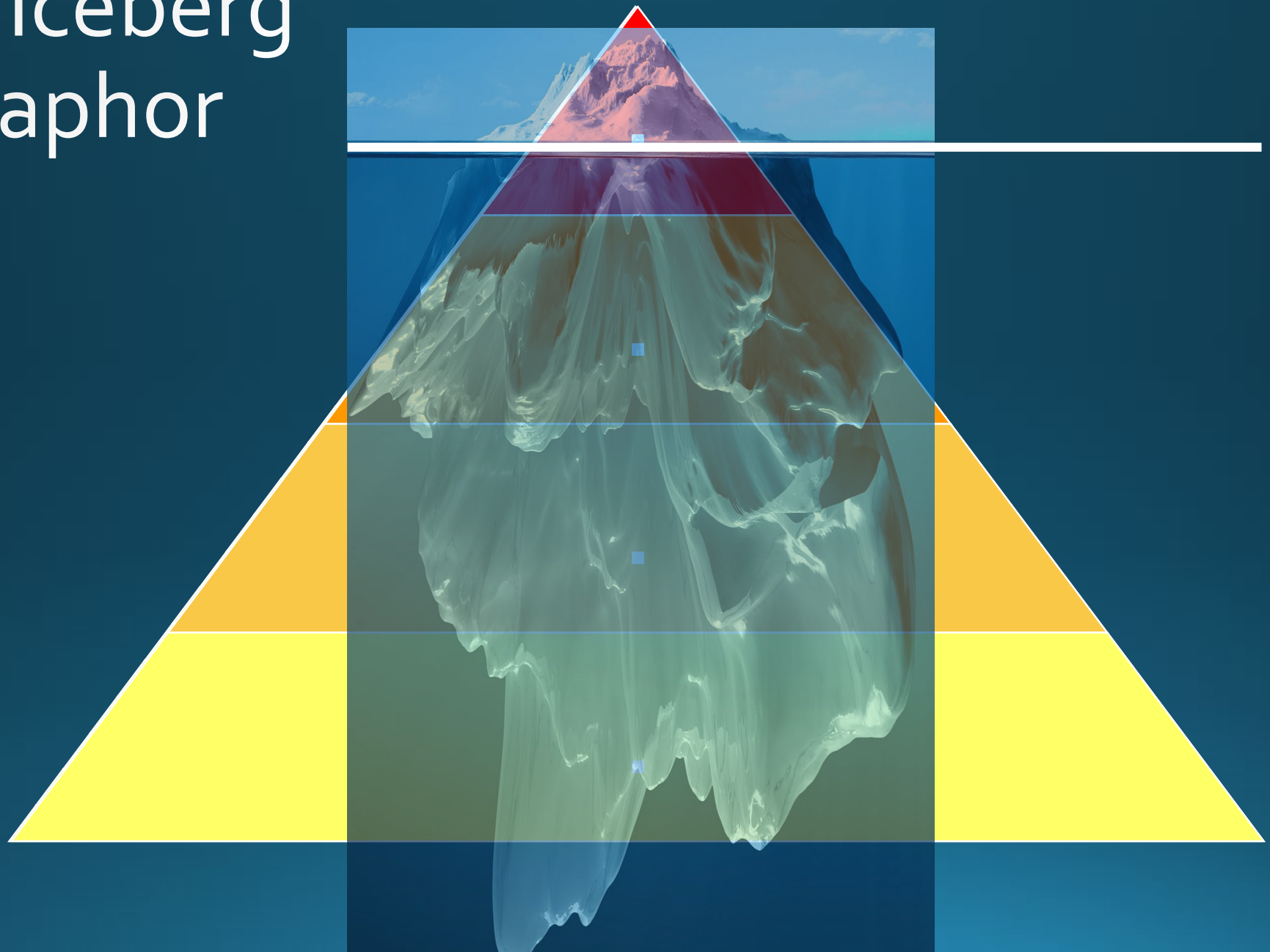
- Learn how the **Safety I** framework and **Safety II** framework are complementary parts of an overall risk management plan
- Understand the **Systems Thinking Approach** to risk management
- Learn how a **Risk Management Information System (RMIS)** can provide rich data for implementing Safety I and Safety II principles
- Learn how to assess your program by building **AcciMaps** and **PreventiMaps**

An Incident is either…

- Adverse Outcome
- Close Call/Near Miss

Accident Pyramid

The Iceberg Metaphor



Risk Level = Probability of Occurrence *
Potential Severity of Outcome

Risk Matrix

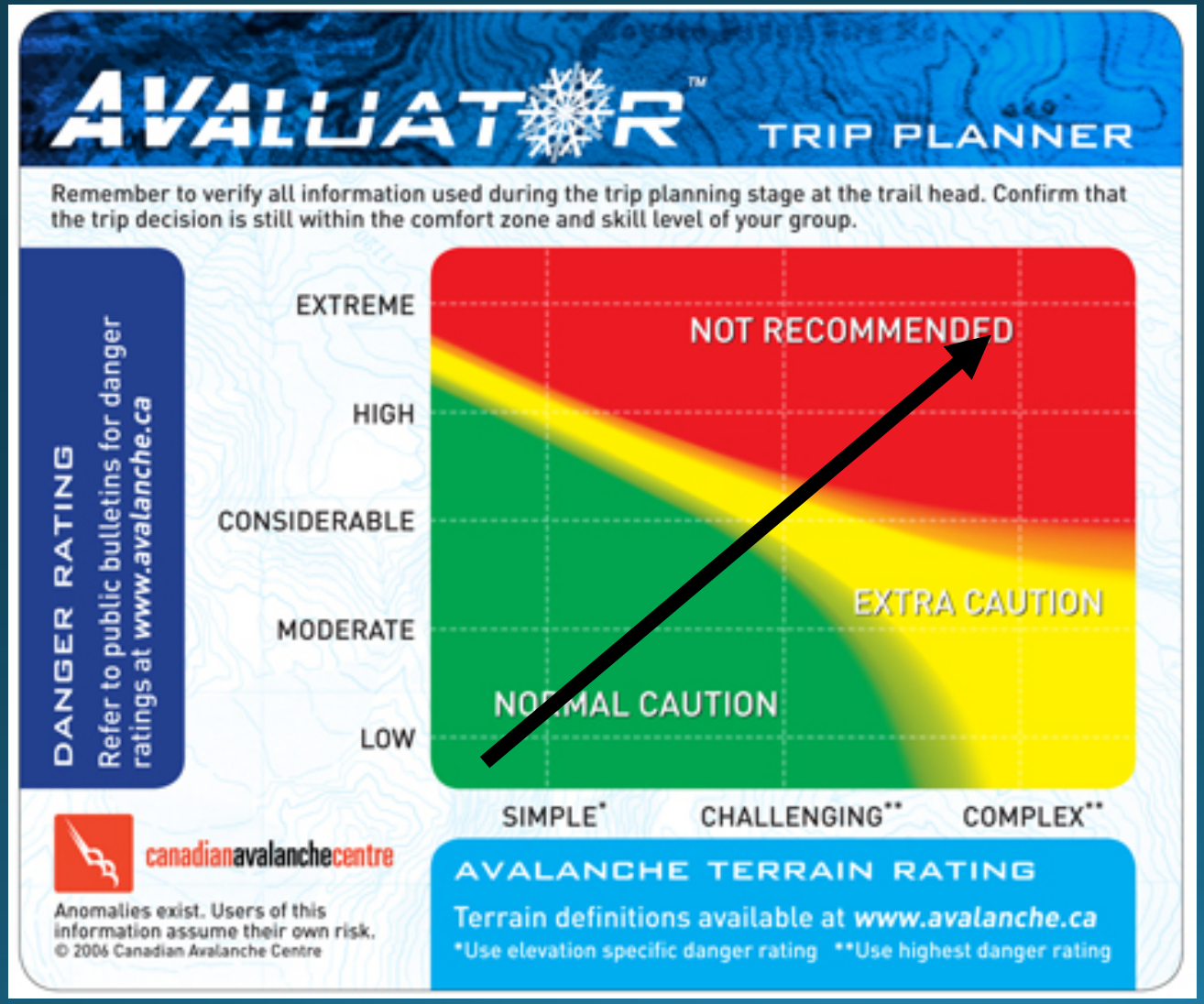
Probability of Occurrence

	Insignificant	Minor	Moderate	Major	Catostrophic
Almost Certain	Lowest Risk	High Risk	Highest Risk	Highest Risk	Highest Risk
Likely	Lowest Risk	Medium Risk	High Risk	Highest Risk	Highest Risk
Possible	Lowest Risk	Low Risk	Medium Risk	High Risk	Highest Risk
Unlikely	Lowest Risk	Low Risk	Medium Risk	Medium Risk	High Risk
Rare	Lowest Risk	Lowest Risk	Low Risk	Low Risk	Medium Risk

Severity of Outcome/Consequences

Based on NASA Risk Matrix

Avaluator Avalanche Risk Level Matrix



How do we approach Risk?

Paradigms

- Safety I
- Safety II

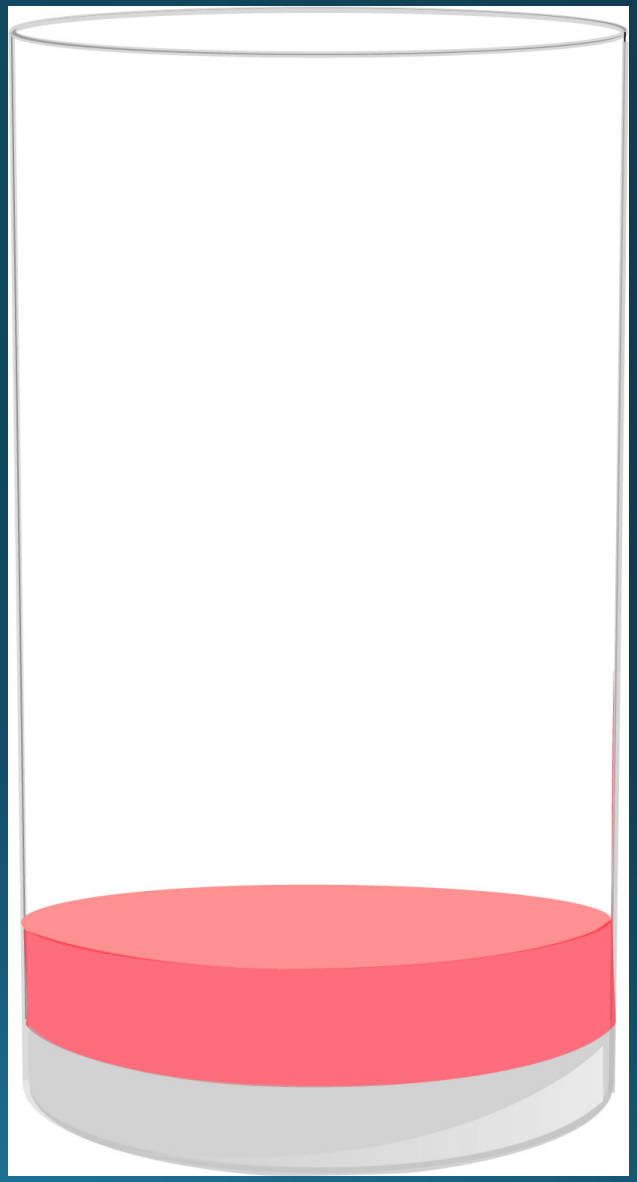
Taxonomies of Causation

- The practice and science of classification of things or concepts

Safety I

What's Going Wrong?

We are safe is there is as little as possible of this



Safety I

	Safety I
Definition of Safety	As few things as possible go wrong
Safety Management Principle	Reactive, respond when something happens or is categorized as unacceptable risk
View of Human Factors	Humans are predominantly seen as a liability or hazard. They are a problem to be fixed.
Accident Investigation	Accidents are cause by failures and malfunctions. The purpose of an investigation is to identify the causes.

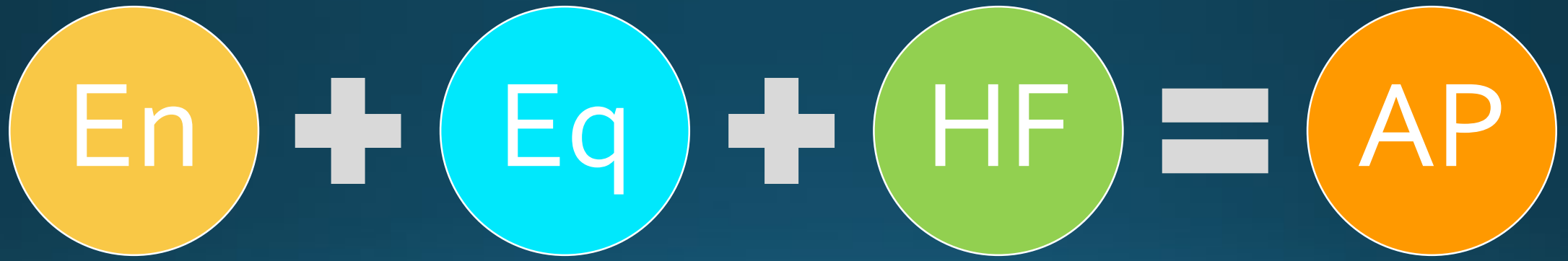
1. Hollnagel, E. Hearns, R., Braithwaite, J. - EUROCONTROL (2013). *From Safety-I to Safety-II (A White Paper)*. Brussels.

Causation Taxonomies

- Potential Causes of Accidents in Outdoor Pursuits
  - Meyer (1979) revised by Williamson (1984 – 2013)
- Dynamics of Accidents Model
  - Hale (1982)
- Risk Management in a Dynamic Society
  - Rasmussen (1997)
- Risk Assessment & Safety Management Model (RASM)
  - Curtis (2000)
- Causation in Led Outdoor Activities
  - Salmon et al (2014)

Taxonomy: Dynamics of Accidents Model

Safety I Only



Environmental Hazards

Equipment Hazards

Human Factor Hazards

Accident Potential

Taxonomy: Causes of Accidents in Outdoor Pursuits
Safety I Only

Unsafe Conditions

- Falling objects
- Inadequate Area Security
- Weather
- Equipment/Clothing
- Physical/Psychological Profile of Participants and/or Staff

Unsafe Acts

- Inadequate Protection
- Inadequate Instruction
- Inadequate Supervision
- Unsafe Speed (fast/slow)
- Unauthorized/Improper Procedure

Errors in Judgment

- Desire to please others
- Trying to adhere to a Schedule
- Misperception
- New or Unexpected Situation (includes fear/panic)
- Miscommunication
- Disregarding Instincts

Taxonomy: Causation in Led Outdoor Activities Safety I & Safety II

- Activity Leader
- Activity Participants
- Other People in Activity Group
- Activity Group
- Other People in Activity Environment
- Supervisor/Field Managers
- Higher-Level Management
- Local Area Government
- Schools/Contracting Organizations
- Parents/Guardians
- Regulatory Bodies and Professional Associations
- State and Federal Government

Taxonomy: Risk Assessment & Safety Management Safety I & Safety II

Safety I

- Equipment Factor Hazards
- Environmental Factor Hazards
- Human Factor Hazards

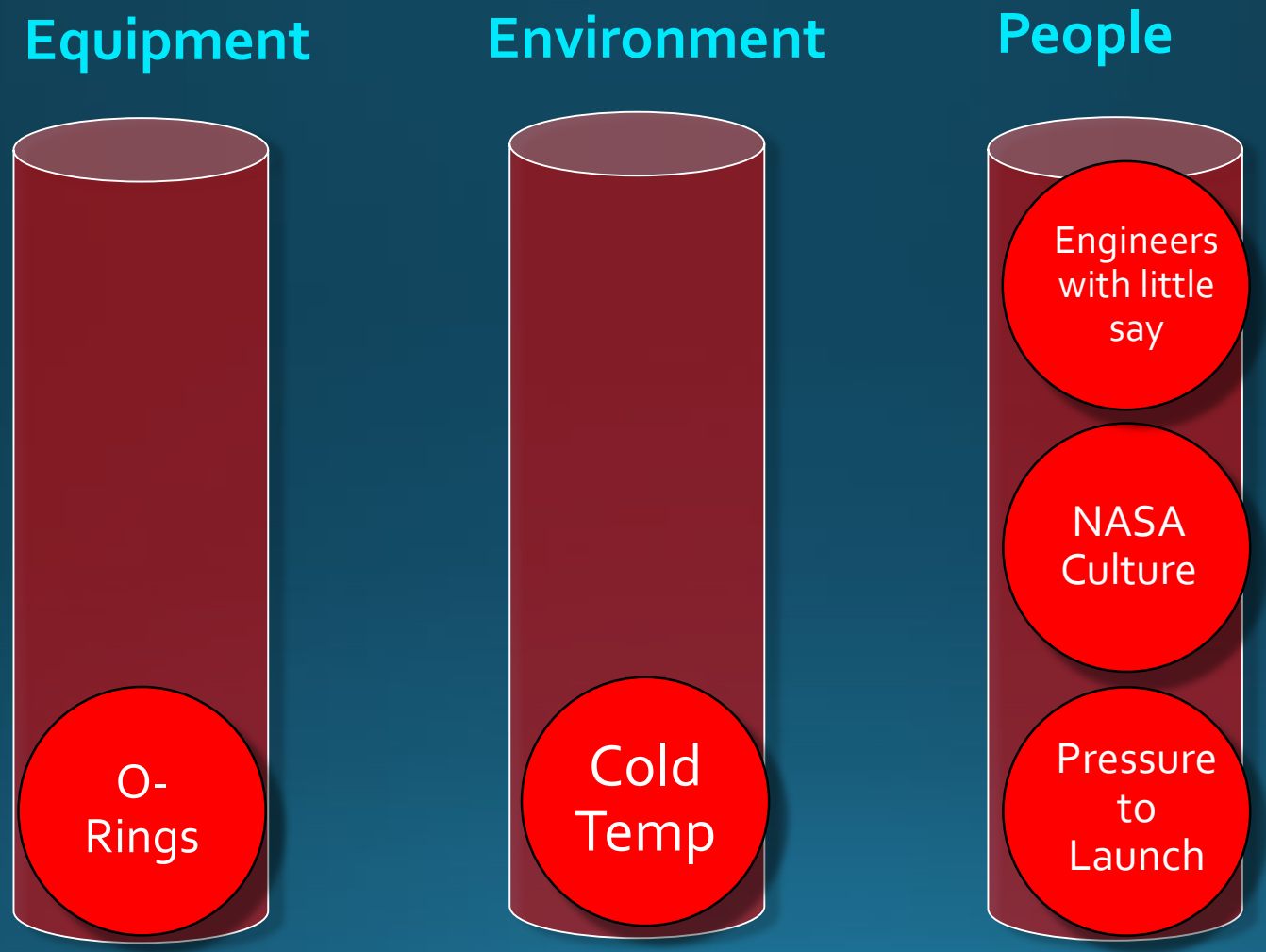
Safety II

- Equipment Safety Factors
- Environmental Safety Factors
- Human Safety Factors

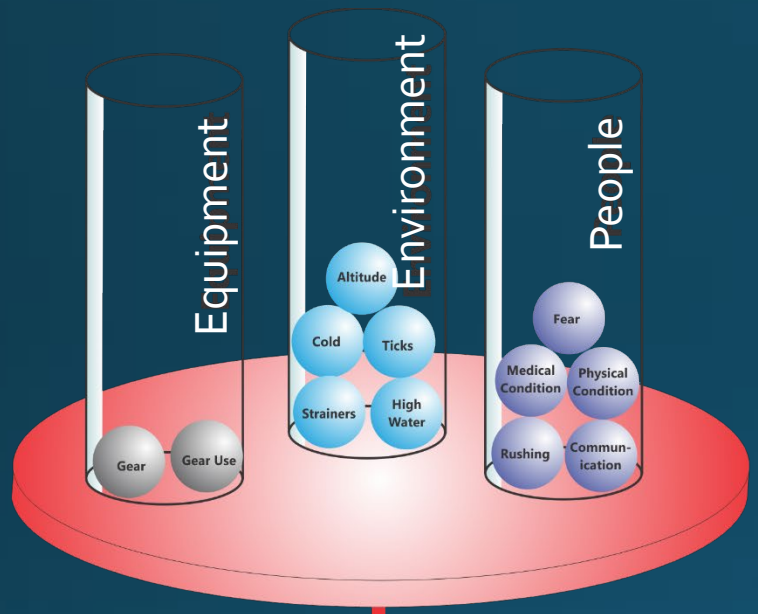
Challenger Disaster – From Safety I

- January 28, 1986
- Challenger breaks apart 73 seconds after liftoff
- All seven astronauts killed

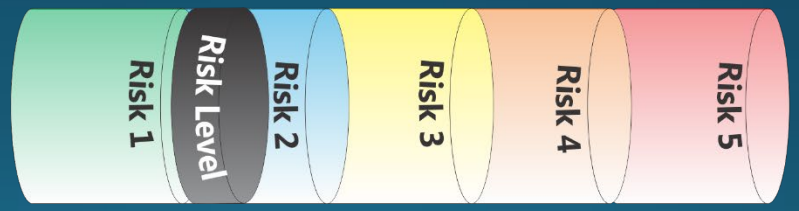
Challenger Hazard Factors – Safety I



Risk Assessment & Safety Management Model (RASM) ©



Hazard Factors



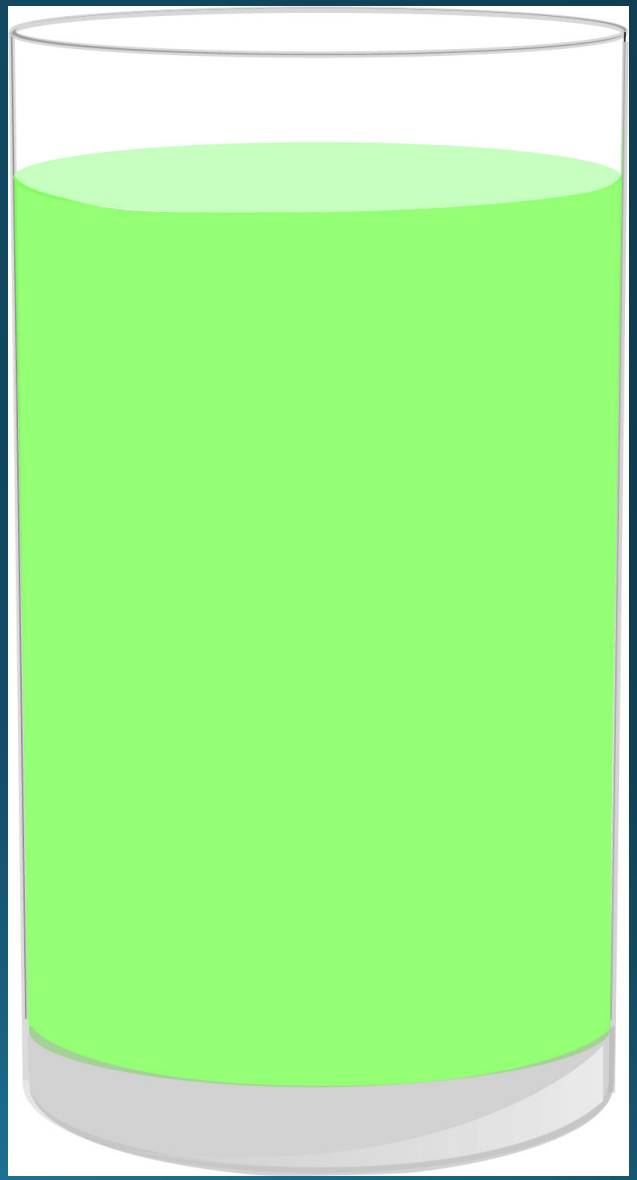
Low ← - - - - - - - - - - - - - - - → High

Risk Level

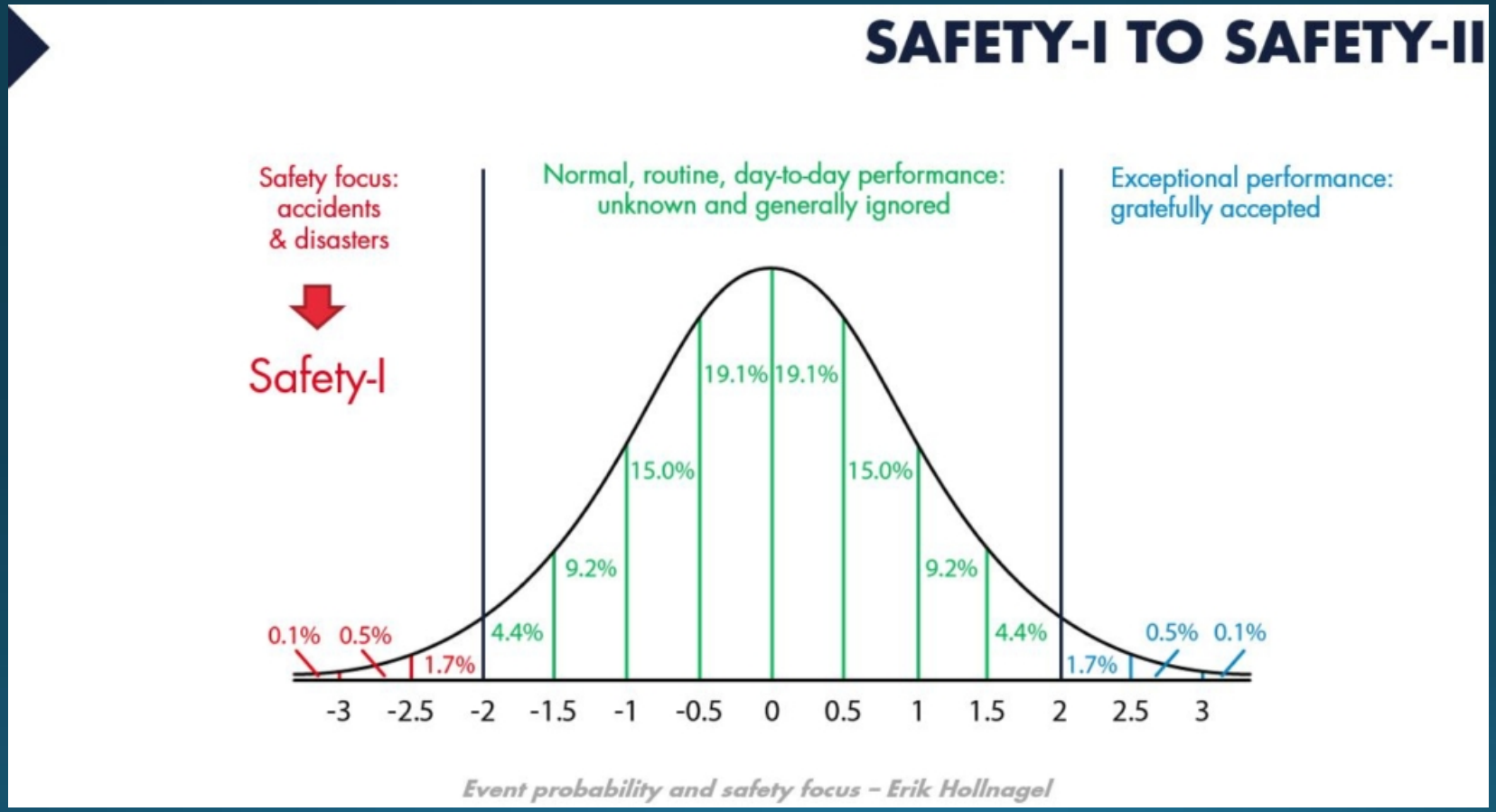
Safety II

What's Going Well?

We are safe is there is as much as possible of this



Safety I & Safety II



Safety II

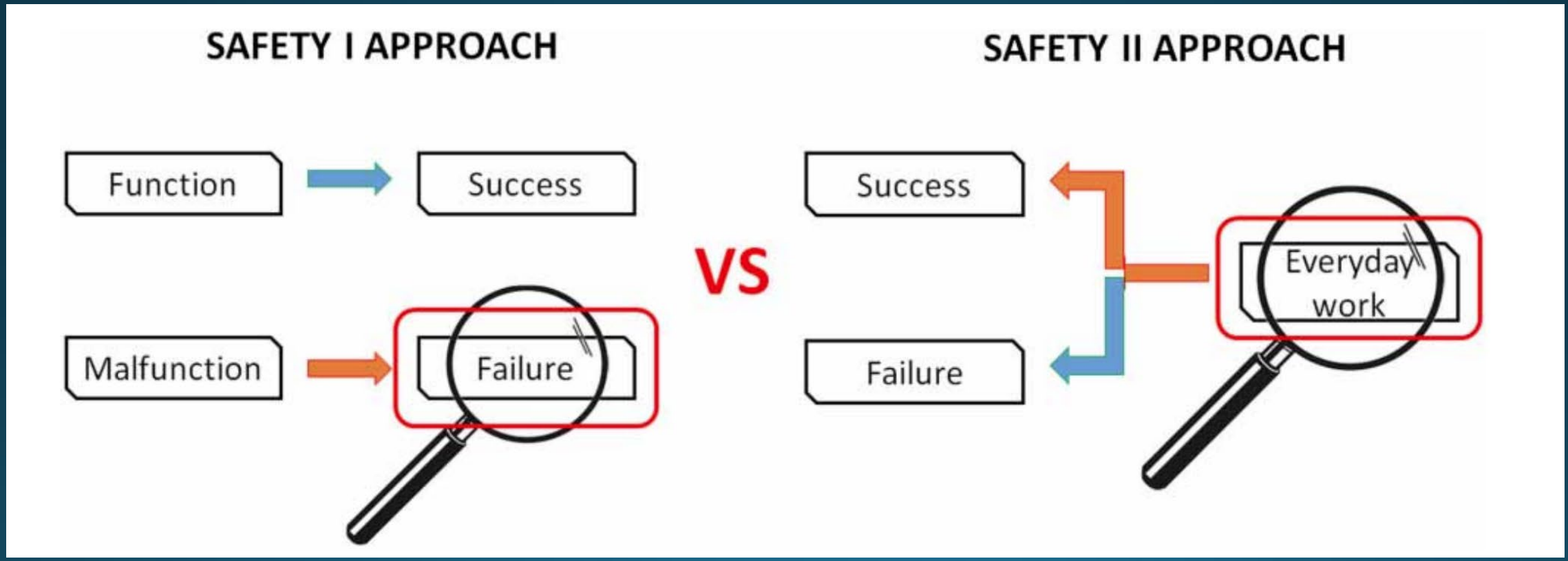
	Safety II
Definition of Safety	As many things as possible go right
Safety Management Principle	Proactive, continuously try to anticipate developments and events
View of Human Factors	Humans are seen as a resource necessary for system flexibility and resilience. They provide flexible solutions to many problems.
Accident Investigation	Things basically happened in the same way regardless of outcome (positive or negative). The purpose of an investigation is to understand how things usually go right as a basis for explaining how things occasionally go wrong.

1 Hollnagel, E. Hearns, R., Braithwaite, J. - EUROCONTROL (2013). *From Safety-I to Safety-II (A White Paper)*. Brussels.

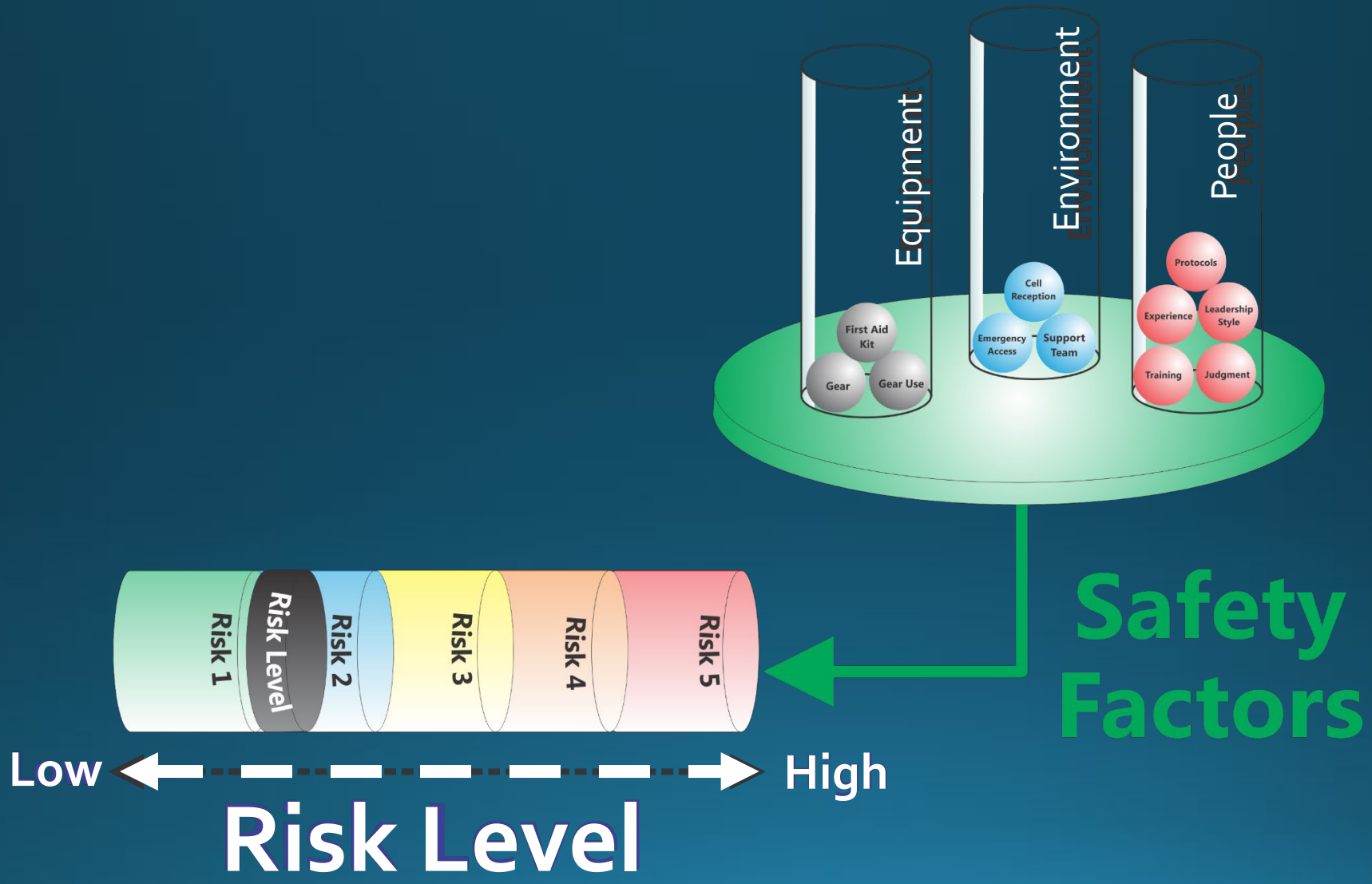
Safety II

https://www.youtube.com/watch?v=gauR843rRNk

Safety I vs Safety II

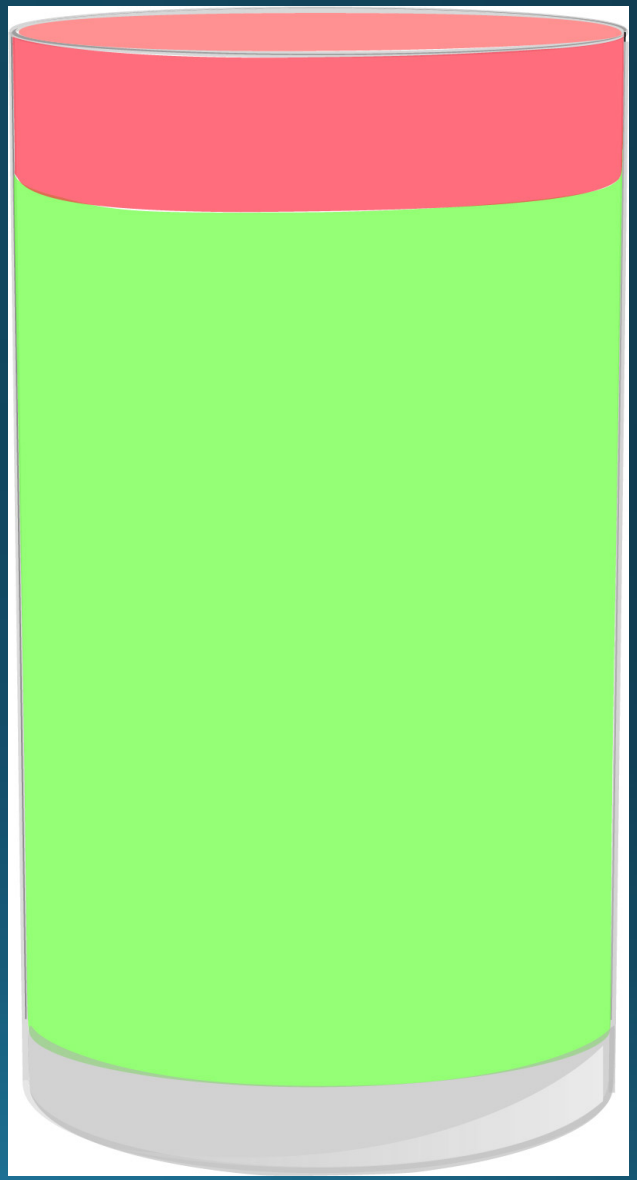


Risk Assessment & Safety Management



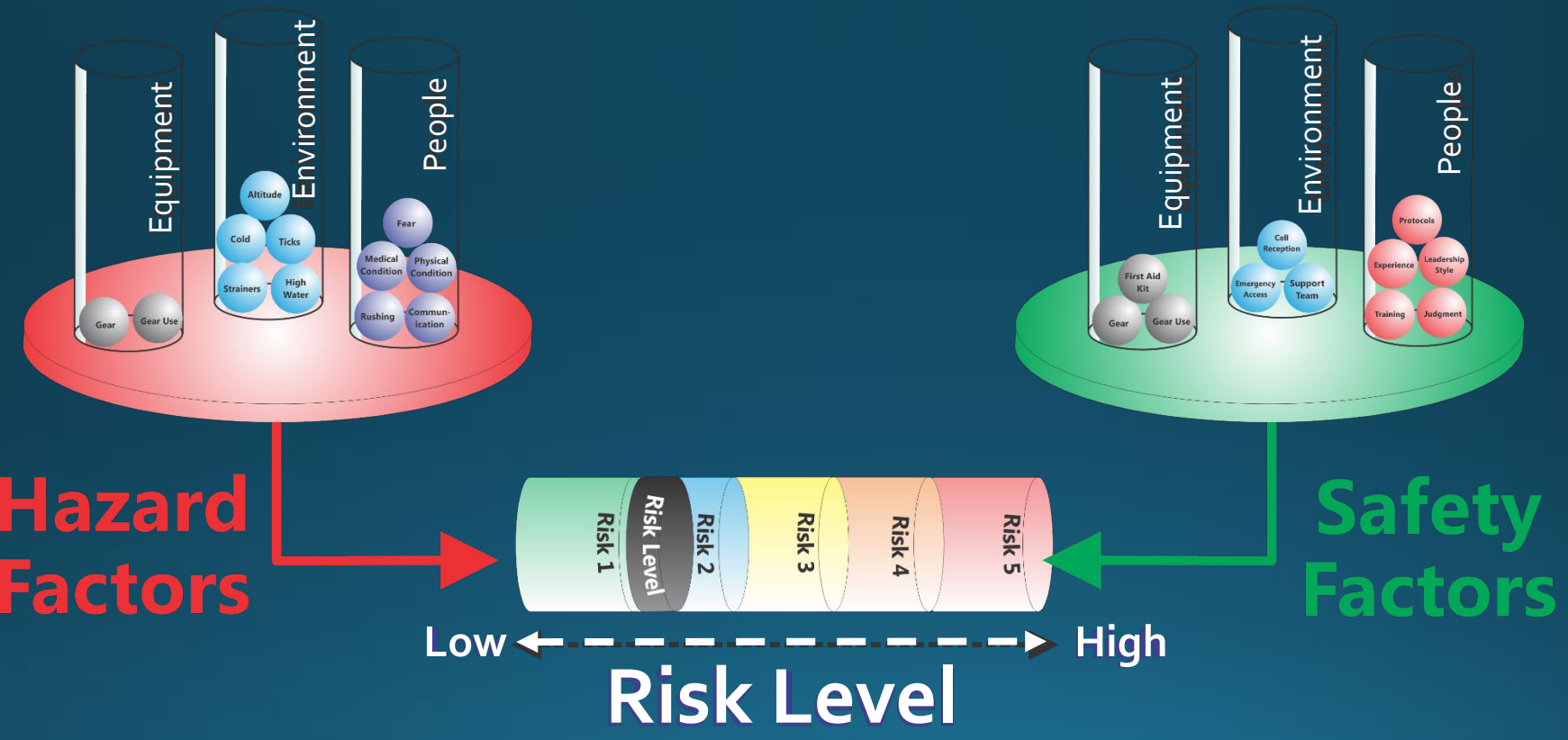
Safety I & Safety II

Covering the entire spectrum



RASM – Safety I & Safety II

The model can use different Taxonomies



Safety I vs Safety II

	Safety I	Safety II
Definition of Safety	As few things as possible go wrong	As many things as possible go right
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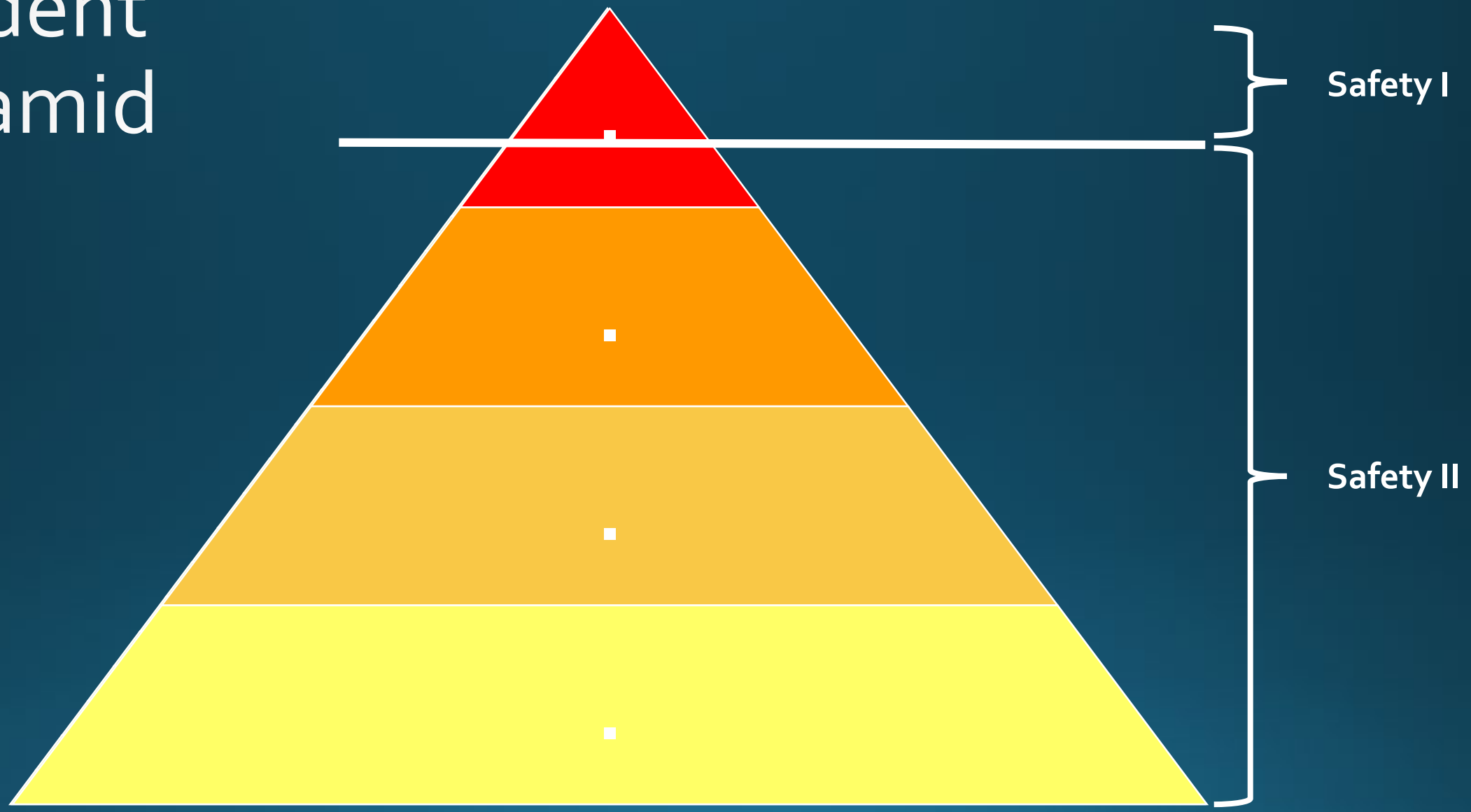
Incident Pyramid



When do to use Safety I vs Safety II?

Safety I – Simple Systems

- Systems are Decomposable – we can break things down into specific components and look for points of failure in each component
- Functionality is Bimodal – it either works or it is broken

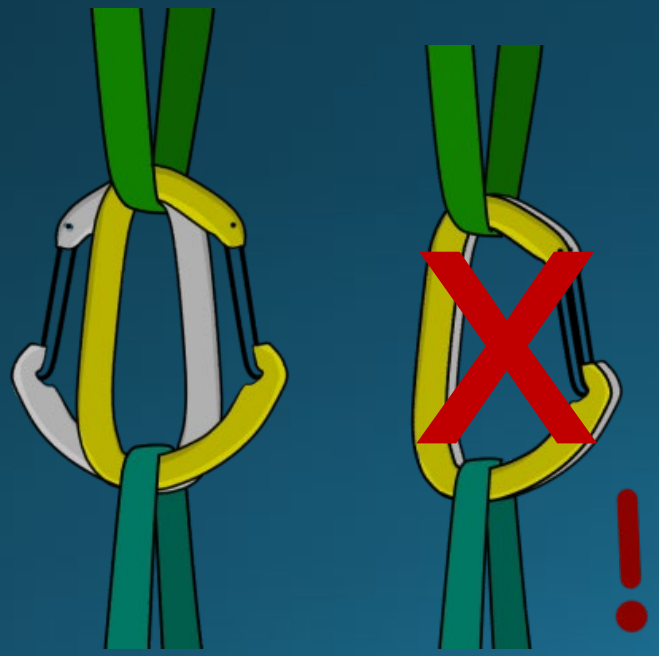
Safety II – Complex Systems

- System success is based on relationships across many components, not just the components themselves
- Functionality is not simply bimodal

When do to use Safety I vs Safety II?

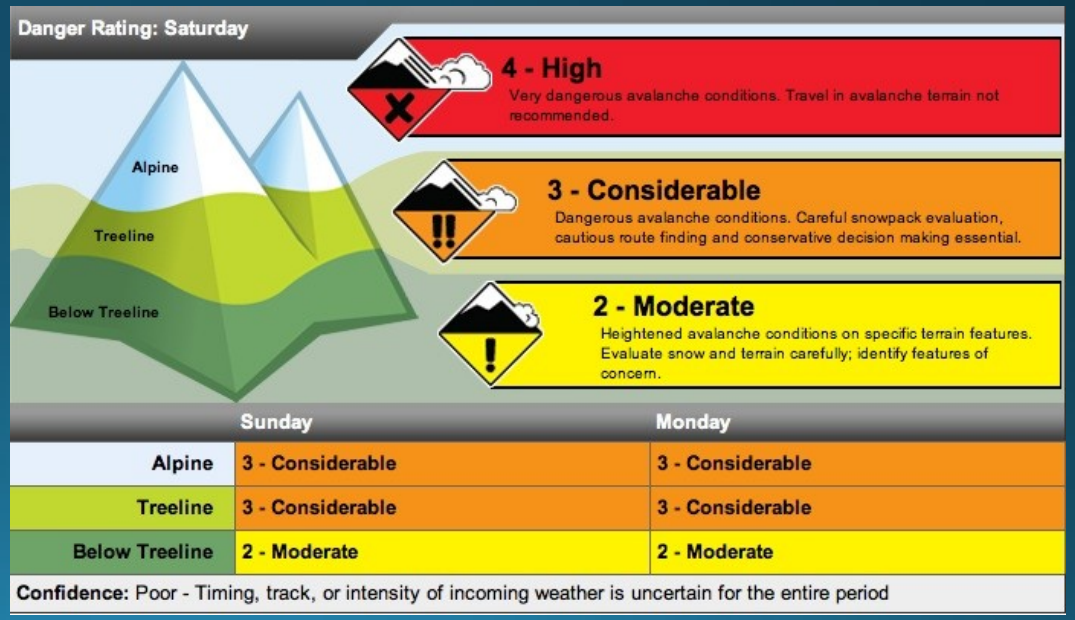
Safety I – Simple Systems

- Carabiners set as Opposite and Opposed – Simple, Bimodal



Safety II – Complex Systems

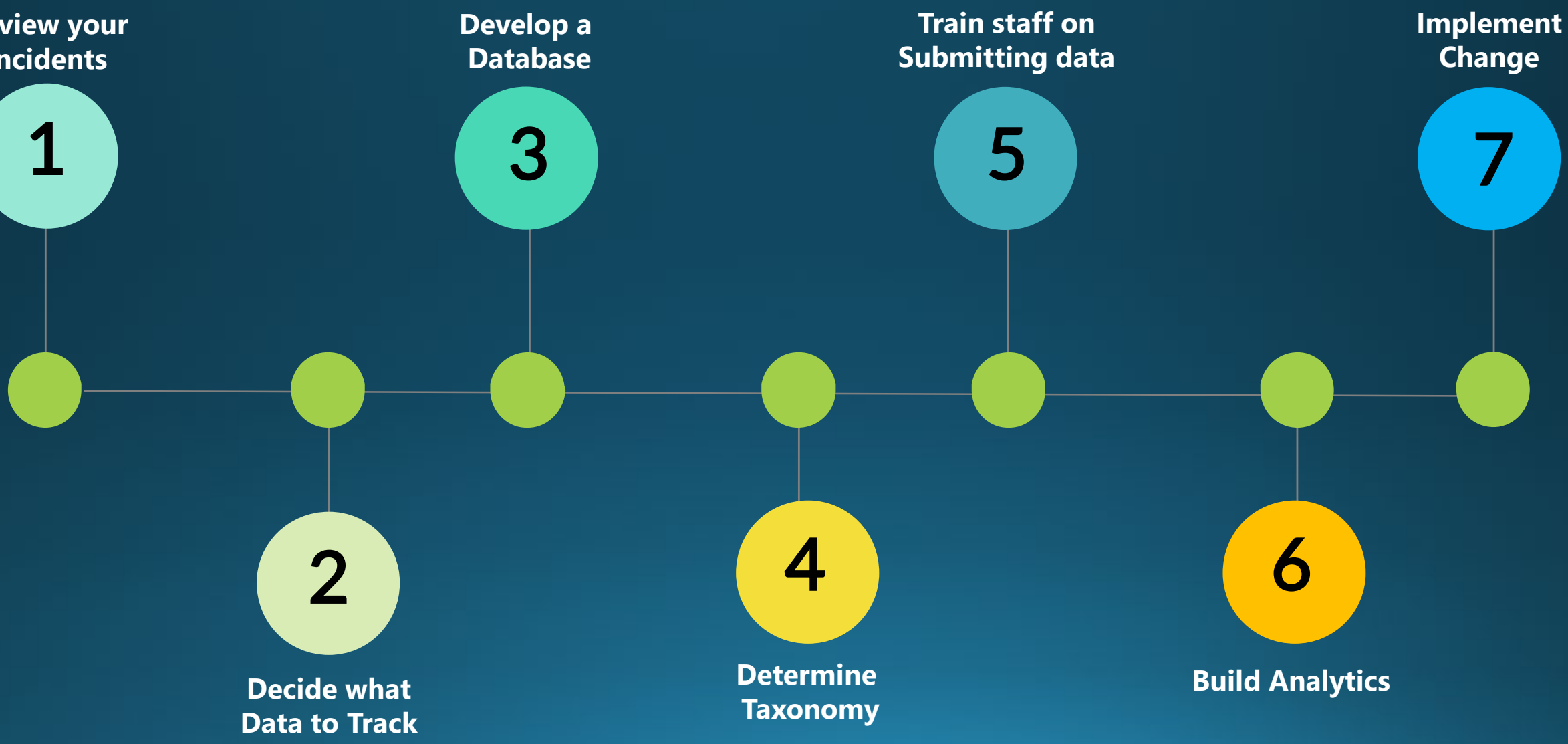
- Making decisions about avalanche danger with many variables & low data confidence



What is a Risk Management Information System?

Database System for collecting and analyzing Incident and Close Call Data that allows you to apply Safety I & Safety II principles of causal analysis to inform your risk management process.

Developing an RMIS



What Data to Track?

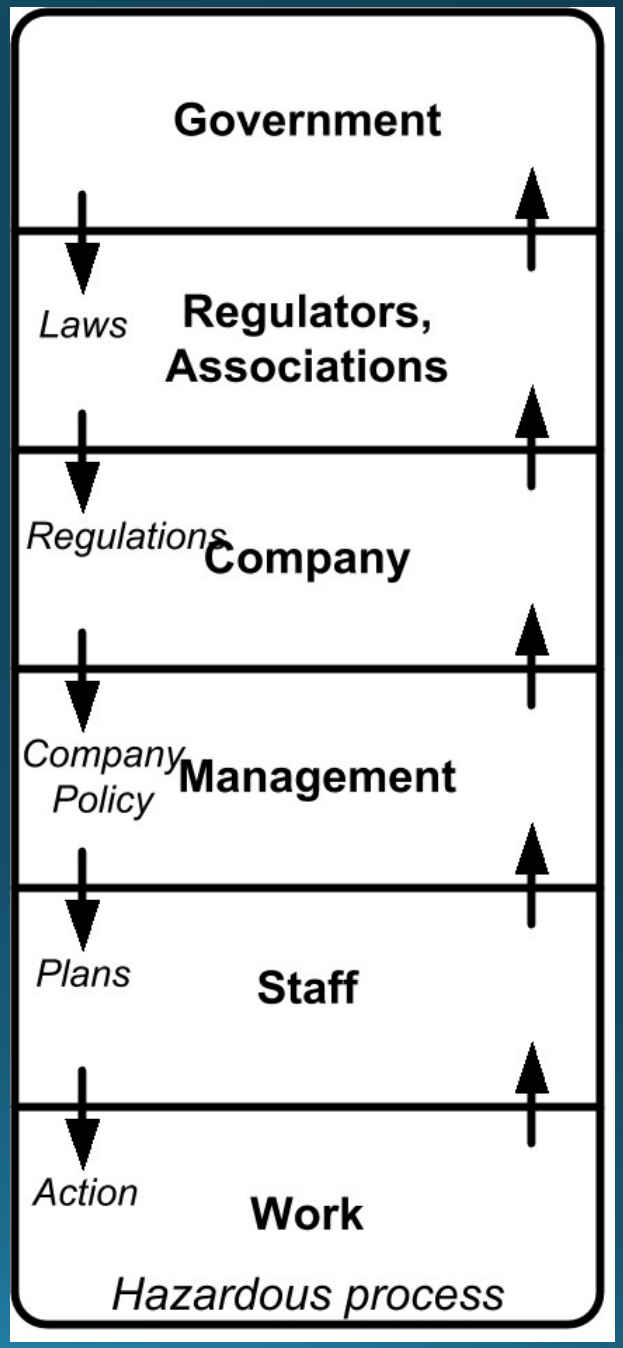
- Start with an assessment of past incidents
  - What are most common?
  - What are the most severe?
  - What incidents are commonly associated with that activity, population, etc. (even if it hasn't happened to you)
  - What has never happened (or you never heard about it) but you need to prepare for?

RMIS Data


Adverse Outcome
Close Call/Near Miss
INCIDENT
People
20
Factors
2
Conditions
5
Equipment
3
Communication
2
Documents
2
Legal
3
Post Event
3

Systems Thinking

- Risk Management in a Dynamic Society, Safety Science, 1997, Jens Rasmussen
  - Safety I + Safety II



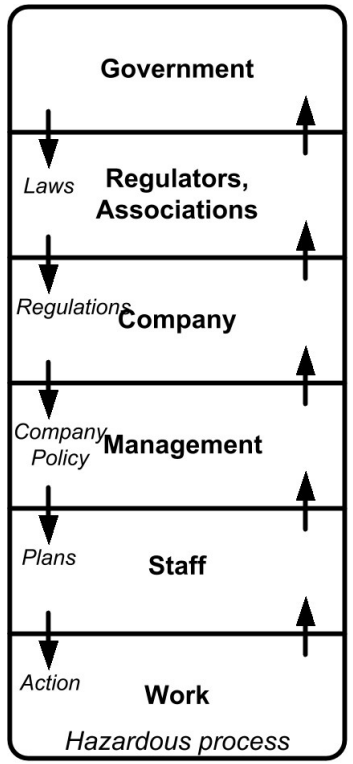
Systems Thinking[1]

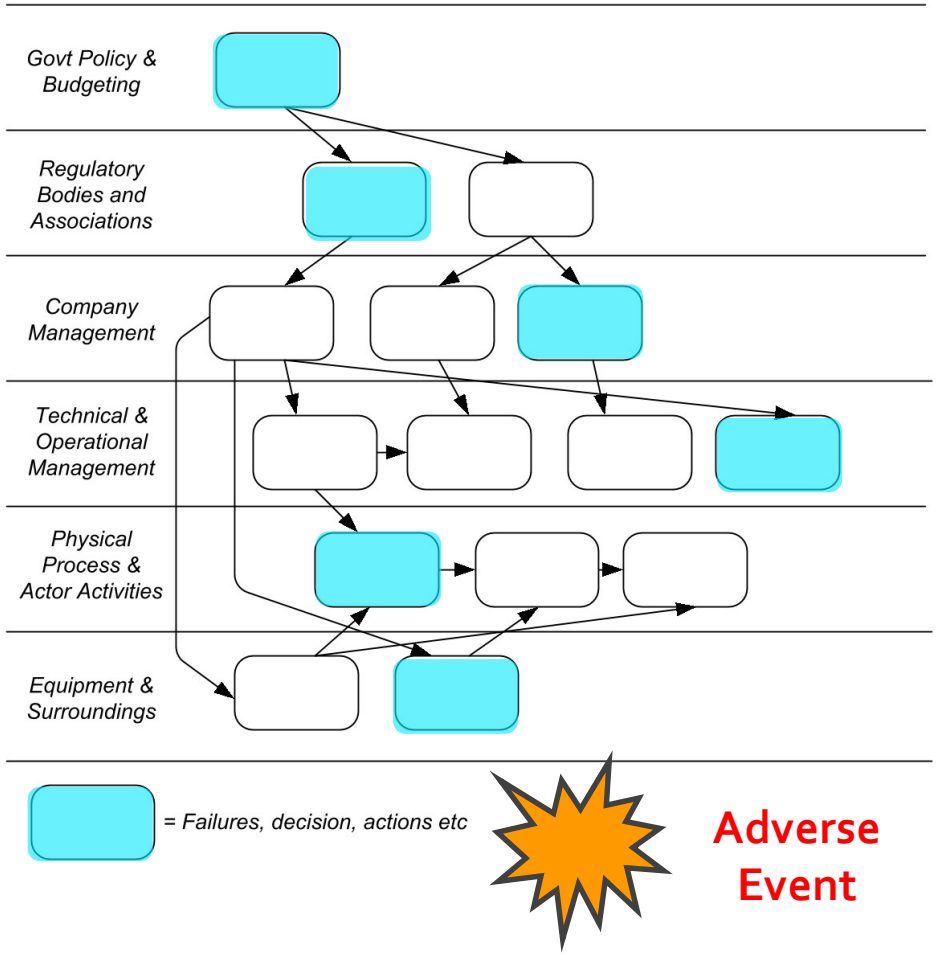
- "Behavior and safety is impacted by the decisions and actions of everyone in the system, not just frontline workers alone."
- "Near misses and adverse events are caused by multiple, interacting, contributing factors, not just a single bad decision or action."
- "Effective countermeasures focus on systemic changes rather than individuals."

1. UPLOADS Project, https://uploadsproject.org

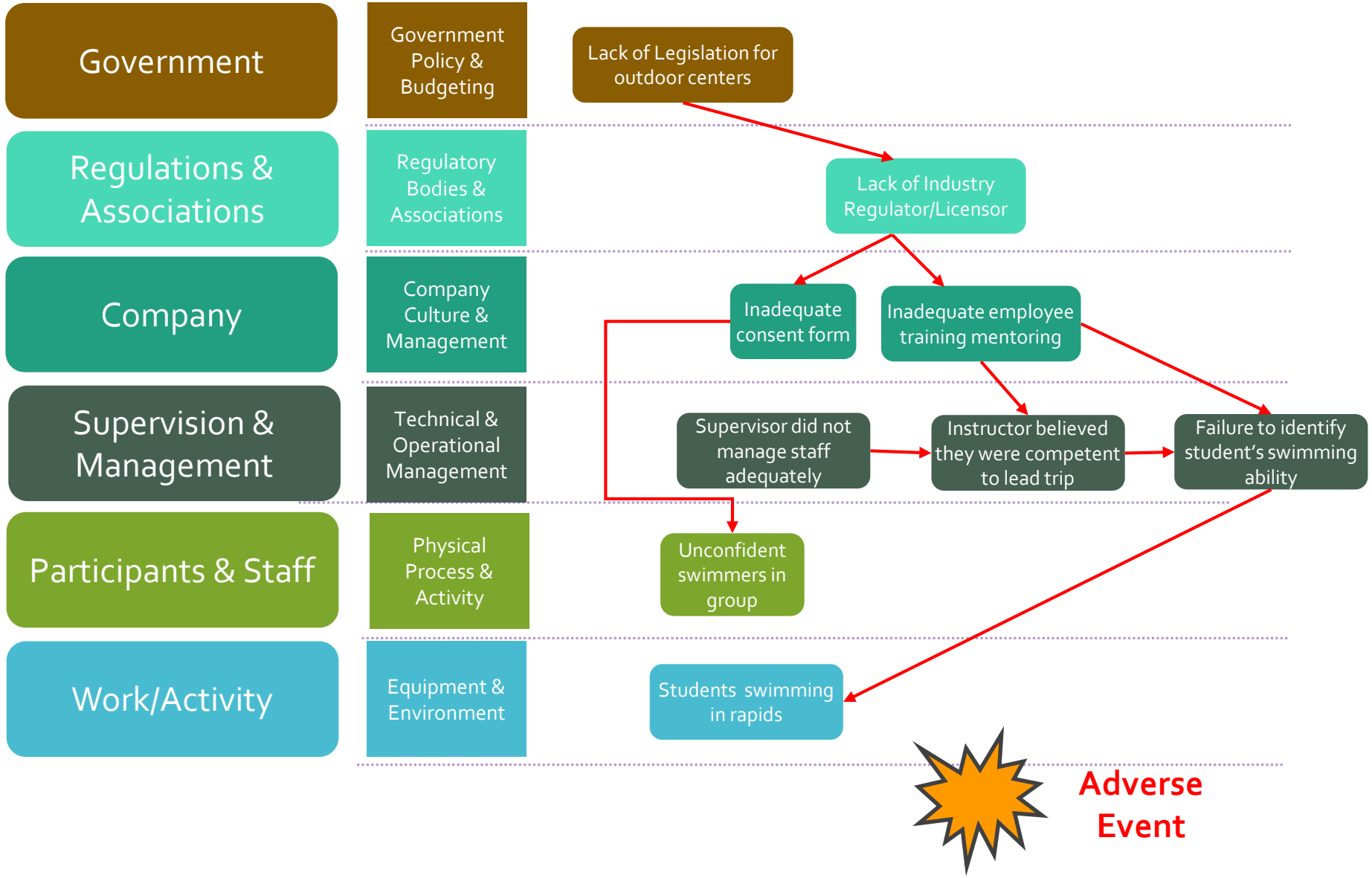
AcciMaps

- Map of a Sociotechnical system
- Negative Outcome is at bottom
- Higher Levels show factors contributing directly or indirectly to the negative outcome





Mangatepopo River Accident, NZ from Salmon et al



Building an AcciMap

1. Create a blank AcciMap with the Taxonomy headings on the left sidebar in hierarchical order
2. Identify the outcome(s) and enter at the bottom
3. Identify Causal Factors on a sticky note
   - Items which are
4. Enter the Causal Factors at each Taxonomy Level
5. Identify and Relationships between Factors
   - Had A not occurred, B would (probably) not have occurred
     - AND
   - B is a direct result of A (no other factor in between, otherwise link A to C and C to B)
6. Check causal logic
7. Formulate Safety Recommendations
   - What is In Scope?
   - What is Out of Scope

Build an AcciMap from your Incident (15 min)

- Download the AcciMap Template
  - GOOGLE DRIVE LINK
- Enter Contributing Factors at the appropriate Taxonomy Level
  - You may have a Systems Approach list of things, you may have things at the 'sharp end', either is fine for this exercise
- Draw Relationships

Causation in Led Outdoor Activities Taxonomy

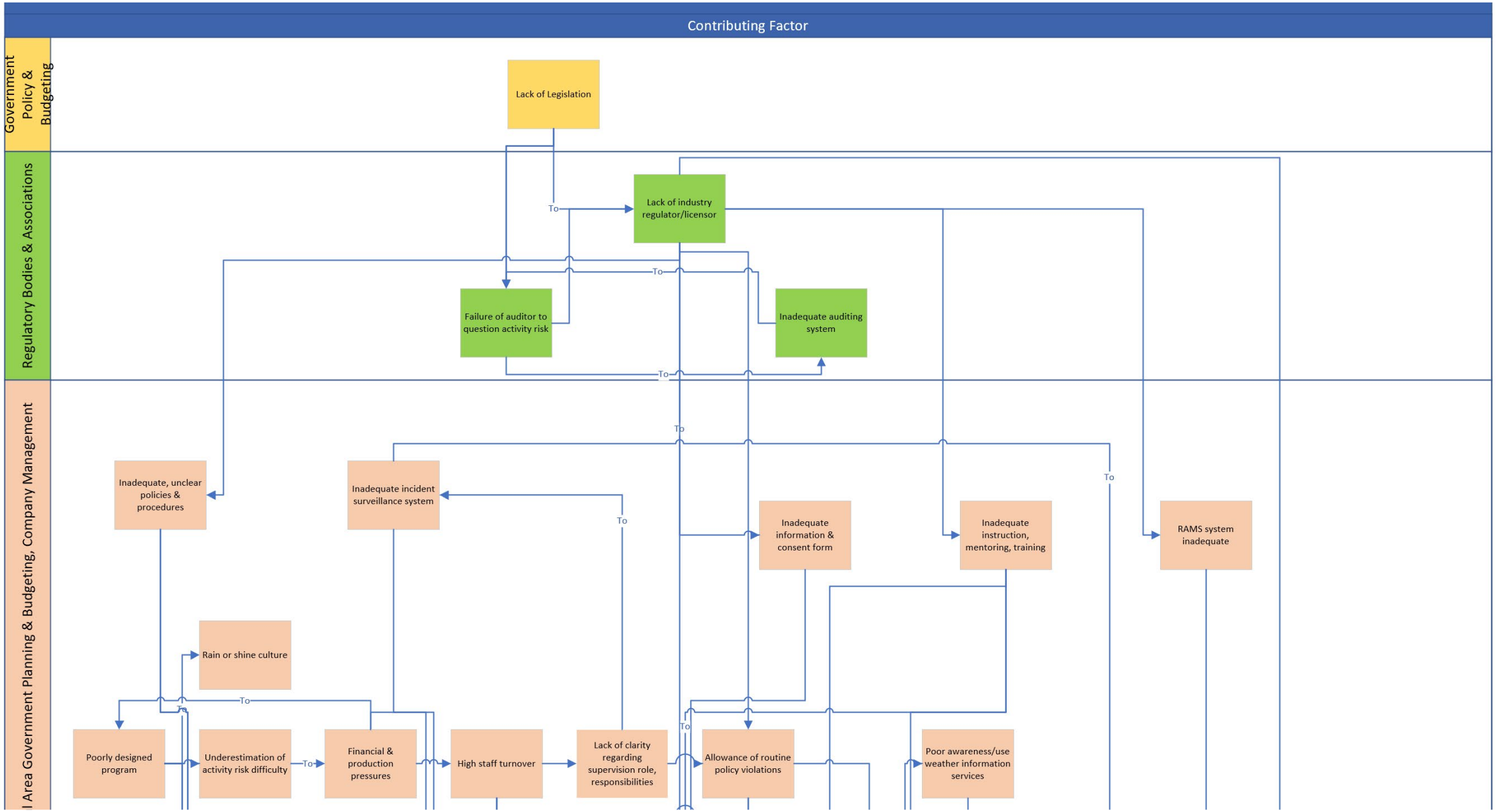
- Government Departments
- Regulatory Bodies & Associations
- Local area government, parents and schools, Organization management, planning & budgeting
- Supervisory and management decisions & actions
- Decisions & actions of leaders, participants, and other actors at scene
- Equipment, environment and meteorological conditions

From Translating Systems Thinking Into Practice: A Guide to Developing Incident Reporting Systems

Building & Discussion

Creating AcciMaps - Excel

Contributing Factor Taxonomy	Contributing Factor	Relates To
Government Policy & Budgeting	Lack of Legislation	B1,B2,B3
Regulatory Bodies & Associations	Lack of industry regulator/licensor	C4,C5,C7,C9,C12,E1
Regulatory Bodies & Associations	Inadequate auditing system	B3
Regulatory Bodies & Associations	Failure of auditor to question activity risk	E2
Local Area Government Planning & Budgeting, Company Management	Financial & production pressures	C3,C10
Local Area Government Planning & Budgeting, Company Management	Rain or shine culture	
Local Area Government Planning & Budgeting, Company Management	Poorly designed program	C2,C6,D7,E1
Local Area Government Planning & Budgeting, Company Management	Inadequate information & consent form	E3
Local Area Government Planning & Budgeting, Company Management	Inadequate instruction, mentoring, training	D1,D8,E7
Local Area Government Planning & Budgeting, Company Management	Underestimation of activity risk difficulty	E1
Technical & Operational Management	Instructor lacl of experience/competence	E8,E9,E16
Technical & Operational Management	Supervisor's return from leave poorly handled	D6
Technical & Operational Management	Failure to check maps on weather fax	D8,E1
Technical & Operational Management	Failure to check for subsequent weather forcasrs	D8,E2
Technical & Operational Management	Instructor belief in competence to lead trip	
Technical & Operational Management	Failure of staff to question/prevent trip	E2,E10
Physical Processes & Actor Activities	Failure to assess/appreciate hazards	E2,E4,E8,E9
Physical Processes & Actor Activities	initiation of trip activity	
Physical Processes & Actor Activities	Unconfident swimmers in group	E6,E8,E13
Physical Processes & Actor Activities	Decision to undertake full gorge trip	
Physical Processes & Actor Activities	Failure to assess conditions	E8
Physical Processes & Actor Activities	Slow progress of group	E8
Physical Processes & Actor Activities	Failure to user halfway ledge/last high water escape	E8
Physical Processes & Actor Activities	Group stranded on ledge	
Physical Processes & Actor Activities	Decision to leave ledge	
Physical Processes & Actor Activities	Communication device failures	E9,E11,E12
Physical Processes & Actor Activities	Inadequate /inappropriate plan & instructions	E12,E13,E14


Contributing Factor
Government Policy & Budgeting
Regulatory Bodies & Associations
Area Government Planning & Budgeting, Company Management
Lack of Legislation
Lack of industry regulator/licensor
Failure of auditor to question activity risk
Inadequate auditing system
Inadequate, unclear policies & procedures
Inadequate incident surveillance system
Inadequate information & consent form
Inadequate instruction, mentoring, training
RAMS system inadequate
Rain or shine culture
Poorly designed program
Underestimation of activity risk difficulty
Financial & production pressures
High staff turnover
Lack of clarity regarding supervision role, responsibilities
Allowance of routine policy violations
Poor awareness/use weather information services
To

Determining Scope

- Based on the Taxonomy you selected for your analysis, determine what things are:
  - In Scope
  - Out of Scope

In Scope Prioritization

- Risk Mitigation Impact (RMI)
  - What will get you the greatest impact with the least amount of resources?
  - What is the single most important factor to address that would have a significant impact regardless of resources?
  - If it is resource intense, how will you make the case for getting those resources?
  - Who are your stakeholders to help you?

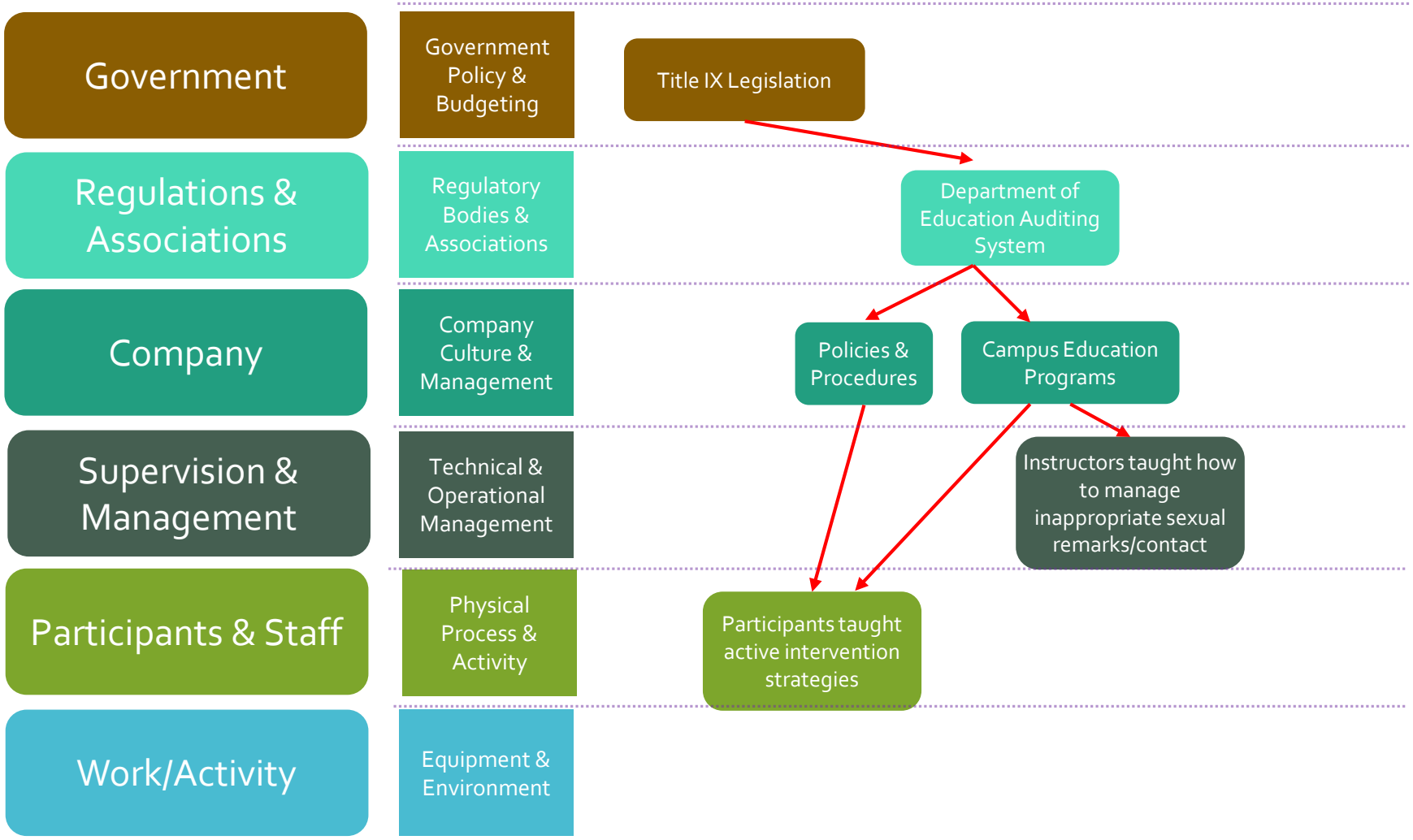
Safety II = PreventiMaps

- Safety I = AcciMaps (hazard analysis)
  "What went wrong?"

then

- Safety II = PreventiMaps (mitigation analysis)
  "What went right?"

Title IX Implementation on Campus



Meta-analysis of AcciMap Causal Factors

Taxonomy	Contributory Factors	Percent	
Equipment, Environment & Surroundings	Physical & Natural Environment Factors	32.6%	In Scope
Equipment, Environment & Surroundings	Equipment, Technology & Resources	30.8%	In Scope
Equipment, Environment & Surroundings	Weather & Climate	15.1%	Out of Scope (in the field)
Physical processes & Actor Activities	Judgement & Decision Making	20.2%	In Scope
Physical processes & Actor Activities	Compliance with Procedures, Violations & Unsafe Acts	20%	In Scope
Physical processes & Actor Activities	Qualification, Experience & Competence	15%	In Scope

Meta Analysis of AcciMap Causal Factors

Taxonomy	Contributory Factors	Percent	
Equipment, Environment & Surroundings	Physical & Natural Environment Factors	32.6%	May be In Scope or Out of Scope
Equipment, Environment & Surroundings	Equipment, Technology & Resources	30.8%	In Scope
Equipment, Environment & Surroundings	Weather & Climate	15.1%	Out of Scope (in the field)
Physical processes & Actor Activities	Judgement & Decision Making	20.2%	In Scope
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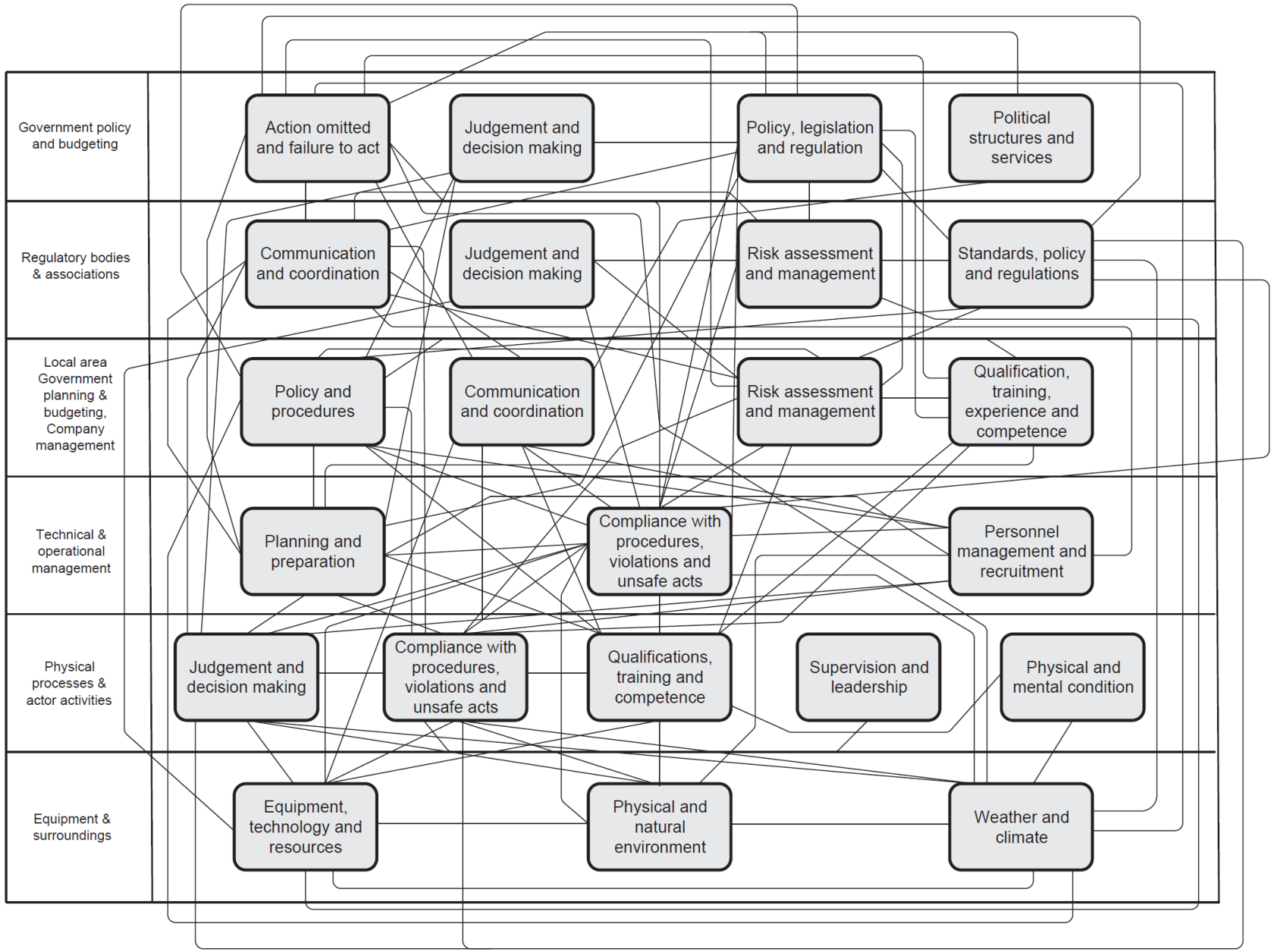

Government policy and budgeting
Regulatory bodies & associations
Local area Government planning & budgeting, Company management
Technical & operational management
Physical processes & actor activities
Equipment & surroundings
Action omitted and failure to act
Judgement and decision making
Policy, legislation and regulation
Political structures and services
Communication and coordination
Judgement and decision making
Risk assessment and management
Standards, policy and regulations
Policy and procedures
Communication and coordination
Risk assessment and management
Qualification, training, experience and competence
Planning and preparation
Compliance with procedures, violations and unsafe acts
Personnel management and recruitment
Judgement and decision making
Compliance with procedures, violations and unsafe acts
Qualifications, training and competence
Supervision and leadership
Physical and mental condition
Equipment, technology and resources
Physical and natural environment
Weather and climate

Top 3 Contributory Factors/Taxonomy Level

Government Policy & Budgeting	Policy, legislation & regulation	Action omitted, failure to act	**Judgment & decision making**
Regulatory Bodies & Associations	Standards, policy & regulation	Communication & coordination	**Judgment & decision making**
Local Area Government planning & Budgeting, Company Management	Risk assessment & management	**Qualification, experience, training & competence**	Policy & procedures
Technical & Operational Management	Planning & preparation	**Compliance violations & unsafe acts**	Personnel management & recruitment
Physical Processes & Actor Activities	**Judgment & decision making**	**Compliance violations & unsafe acts**	**Qualification, experience, training & competence**
Equipment & Surroundings	Physical & natural environment	Equipment, technology & resources	Weather & climate

Implementing Culture Change – Safety I & Safety II

Diversity & Inclusion Risks

- **Physical Safety** is only one dimension on the Risk Management spectrum
- **Emotional Safety** is equally important and Hazards can be equally life threatening
  - Teens committing suicide after bullying
  - LGBTQ individuals being harassed
- Talk to your staff about where there are Emotional/Interpersonal Hazards, Assess the Risk Level, and establish the necessary guidelines, structures, protocols, culture to manage the risk

Concept Review

- Safety I
- Safety II
- Taxonomy of Causation
- Systems Thinking
- Collecting Incident and Close Call Data
- Building AcciMaps
  - Identifying In Scope vs Out of Scope
  - Determining RMI for In Scope
- Building PreventiMaps
- Implementing Data Driven Organizational Change

Take Aways

- Develop your Incident Data Management Plan
  1. Review your Incidents
  2. Decide What to Track
  3. Develop a Database
  4. Determine Taxonomy
  5. Train your Staff in collecting/submitting data
  6. Build your Analytics
  7. Implement Program Changes based on actionable data

Key Resources

- Risk Management in a Dynamic Society: A modeling problem – Jens Rasmussen (1997) - https://orbit.dtu.dk/ws/files/158016663/SAFESCI.pdf
- From Safety-I to Safety-II: A White Paper – Hollnagel E; Wears RL; Braithwaite J. (2015) - https://www.england.nhs.uk/signuptosafety/wp-content/uploads/sites/16/2015/10/safety-1-safety-2-whte-papr.pdf
- Translating Systems Thinking Into Practice: A Guide to Developing Incident Reporting Systems – Goode, Salmon, Lenne, Finch – Available at Amazon Books
- https://www.IncidentAnalytix.com
- Contact: Rick Curtis – staff@incidentanalytix.com

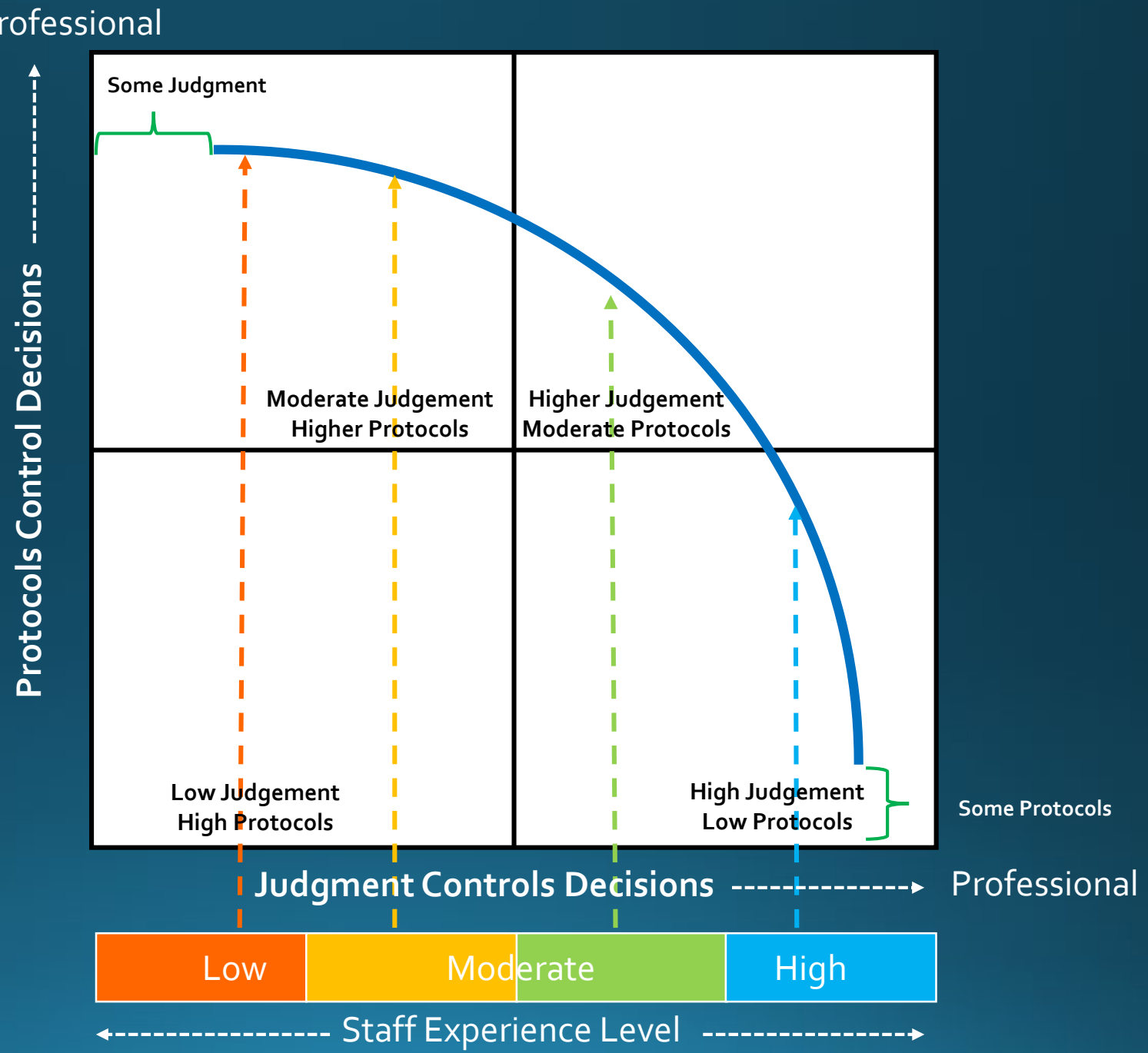
Videos & Articles

- 1.5.5 Safety I vs Safety II - https://www.youtube.com/watch?v=WMoLVv9NrhM
- Doing Safety Differently – Sydney Dekker: https://www.youtube.com/watch?v=6gREMV6j2A4
- Safety II & Safety II – Erik Hoffnagel: https://vimeo.com/channels/1366431/89492241
- Perceiving what cannot be seen" - the practical side of Safety - II - Erik Hollnagel: https://vimeo.com/159498494
- A story of Safety II – Jeffrey Braithwaite: https://www.youtube.com/watch?v=gauR843rRNk
- Safety Differently | The Movie: https://www.youtube.com/watch?v=moh4QN4IAPg
- Sidney Dekker — Safety Differently Lecture: https://www.youtube.com/watch?v=oMtLSoFNDZs
- Sidney Dekker — Just Culture short course 1: https://www.youtube.com/watch?v=PVWjgqDANWA
- The New View of Safety with Todd Conklin: https://www.youtube.com/watch?v=IoYUQlWiRgc
- Dr. Todd Conklin speech "Risk Analysis is Fixed in Time - But Hazards Ebb and Flow: https://www.youtube.com/watch?v=X211fU39808

Videos & Articles

- Guidelines for AcciMap Analysis: https://openresearch-repository.anu.edu.au/bitstream/1885/20987/2/01_Branford_Guidelines_for_ACCIMAP_2009.pdf
- Webinar: An Introduction to "New Safety" (HOP, Safety II, and Safety Differently): https://www.youtube.com/watch?v=zqZVGaFIhyw
- FAA Safety Management Systems (SMS) Fundamentals: Policy: https://www.youtube.com/watch?v=j8NoPZx5YwM
- FAA Safety Management Systems (SMS) Fundamentals: Safety Risk Management Component: https://www.youtube.com/watch?v=b6dwxQ30EAE
- Mangatepopo canyoning tragedy a decade on: 'I know they would be loving every minute of life': https://www.nzherald.co.nz/nz/news/article.cfm?c_id=1&objectid=12032068
- In a Flash TV Movie: https://www.tvnz.co.nz/shows/in-a-flash/episodes/s1-e1
- BBC NASA Challenger Disaster: https://www.youtube.com/watch?v=reM5fTo-6PI
- Challenger Disaster Governmental Report: https://www.govinfo.gov/content/pkg/GPO-CRPT-99hrpt1016/pdf/GPO-CRPT-99hrpt1016.pdf
- A Review of Accident Modelling Approaches for Complex Critical Sociotechnical Systems: https://www.semanticscholar.org/paper/A-Review-of-Accident-Modelling-Approaches-for-Qureshi/c3a597212068c27be45d84dec76e86baabd4cf90

Protocols/Rules vs Judgment/Experience



Final Thoughts

The biggest mistake
about a mistake
is not learning from it.

Resources

www.OutdoorEd.com

www.IncidentAnalytix.com