# Integrating Safety I & Safety II Frameworks with Systems Thinking for Risk Management & Harm Mitigation

Rick Curtis
www.OutdoorEd.com
www.IncidentAnalytix.com

# Introduction

Rick Curtis

Pronouns: he, him, his

Land Acknowledgement

Director, Princeton University Outdoor Action Program

Founder: **www.IncidentAnalytix.com**

Founder: **www.OutdoorEd.com**

Author: **The Backpacker's Field Manual**

# 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 to assess your program by building **Accimaps** and **Preventimaps**

# Terminology

- **Domains/Subdomains** – the industry/work setting where you operate (health care, aviation, outdoors – therapeutic adventure vs college outdoor program)
- **Human Factors/Ergonomics** - the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data, and methods to design in order to optimize human well-being and overall system performance.

# Terminology

- **Complex System** – a system where there a many different components interacting to create the outcome (people, technology, tools, transportation, environment, etc.)
- **Taxonomy** – the practice of classification of things or concepts. Related to the Domain.

# Terminology

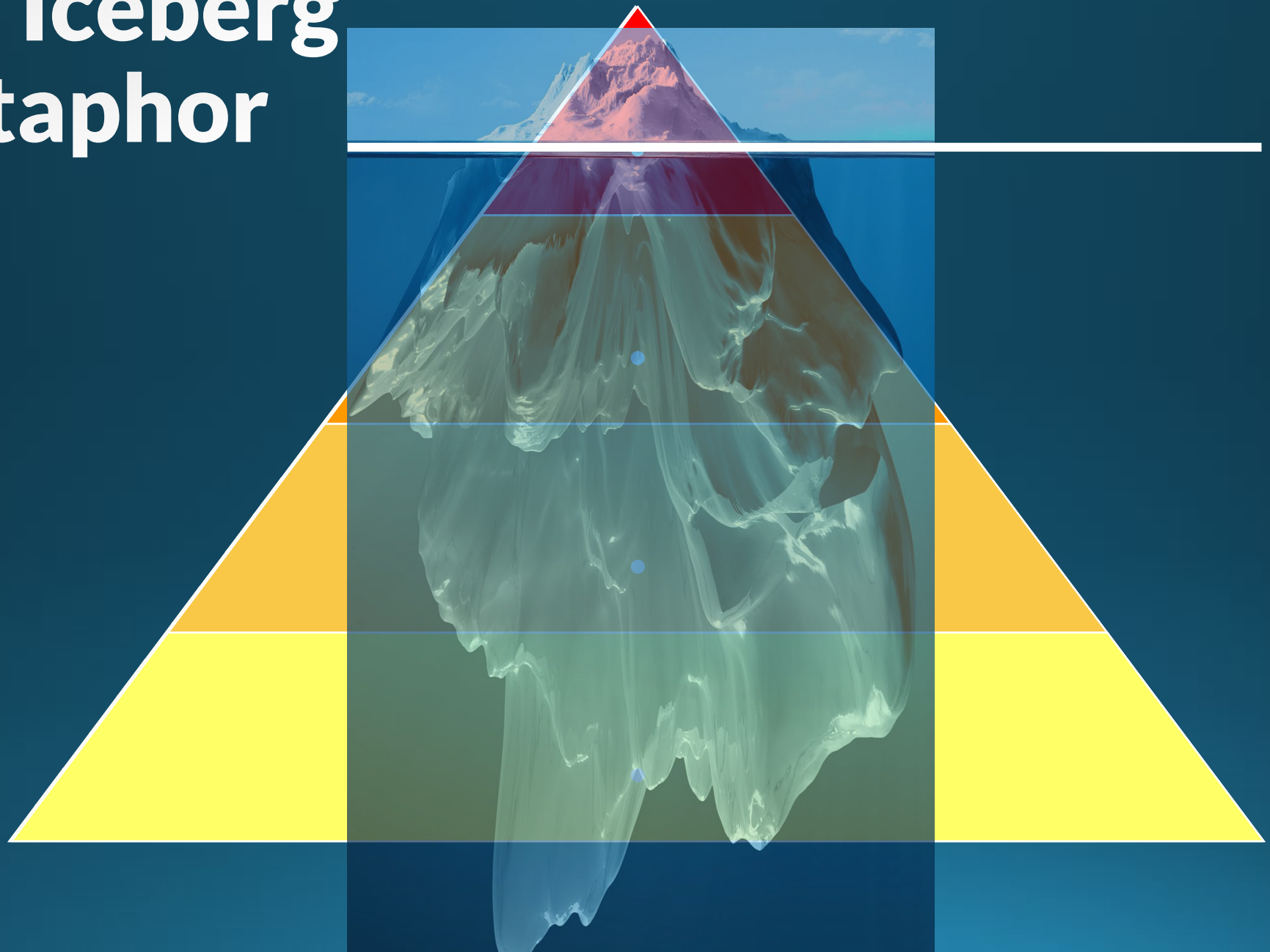
- **Actors** – can be human or non-human. There are multiple actors across the overall system of work

# An Incident is either…

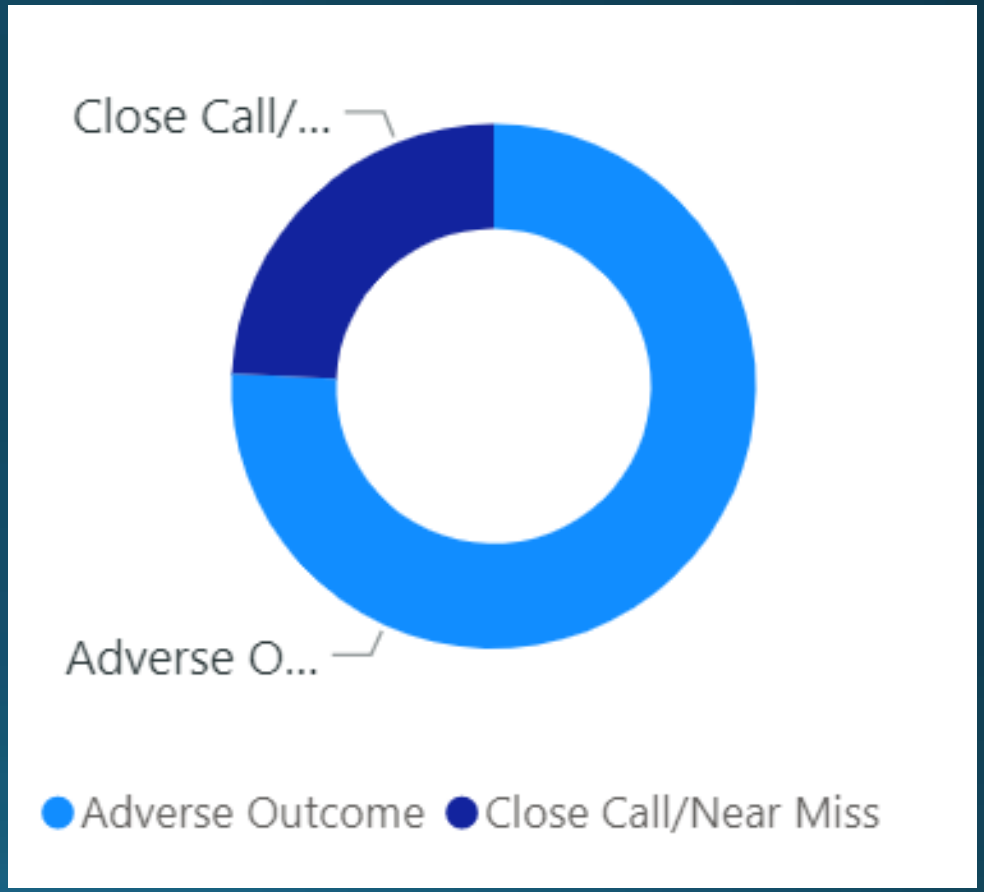
- Adverse Outcome
- Close Call/Near Miss

# Accident Pyramid

# The Iceberg Metaphor



# How many Near Miss Reports are you getting?



# Important Concepts

## Framework

- Safety I

## Contributing Factors

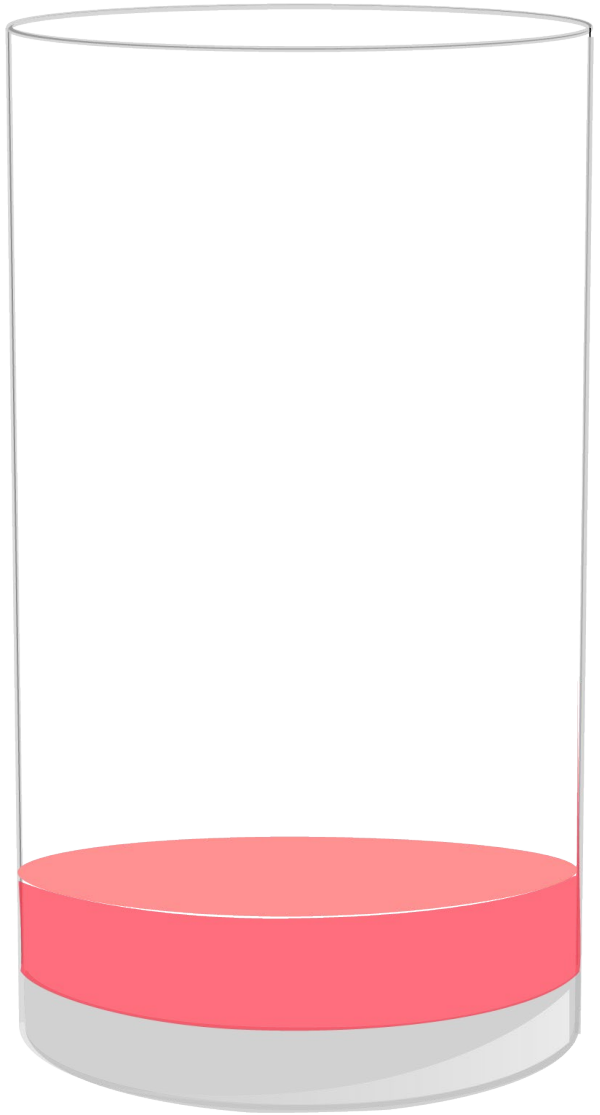
- Taxonomy & Actors

# Safety I

## What's Going Wrong?

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

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



# Causation Taxonomies for Outdoors

# Dynamics of Accidents Model: Hale


**Environmental Hazards**

**Equipment Hazards**

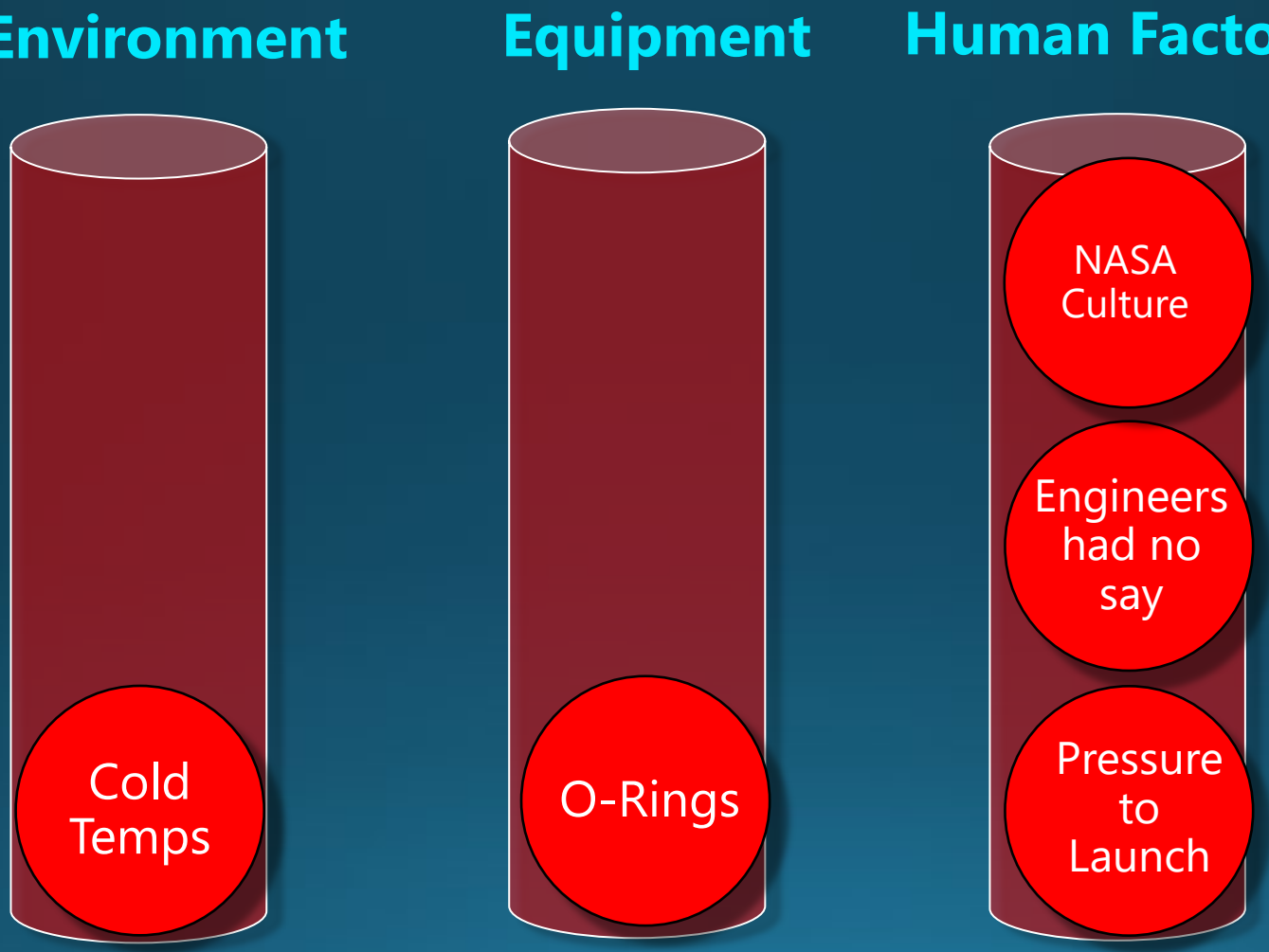
**Human Factor Hazards**

**Accident Potential**

# Challenger Disaster – From Safety I

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

# Contributing Factors – Safety I

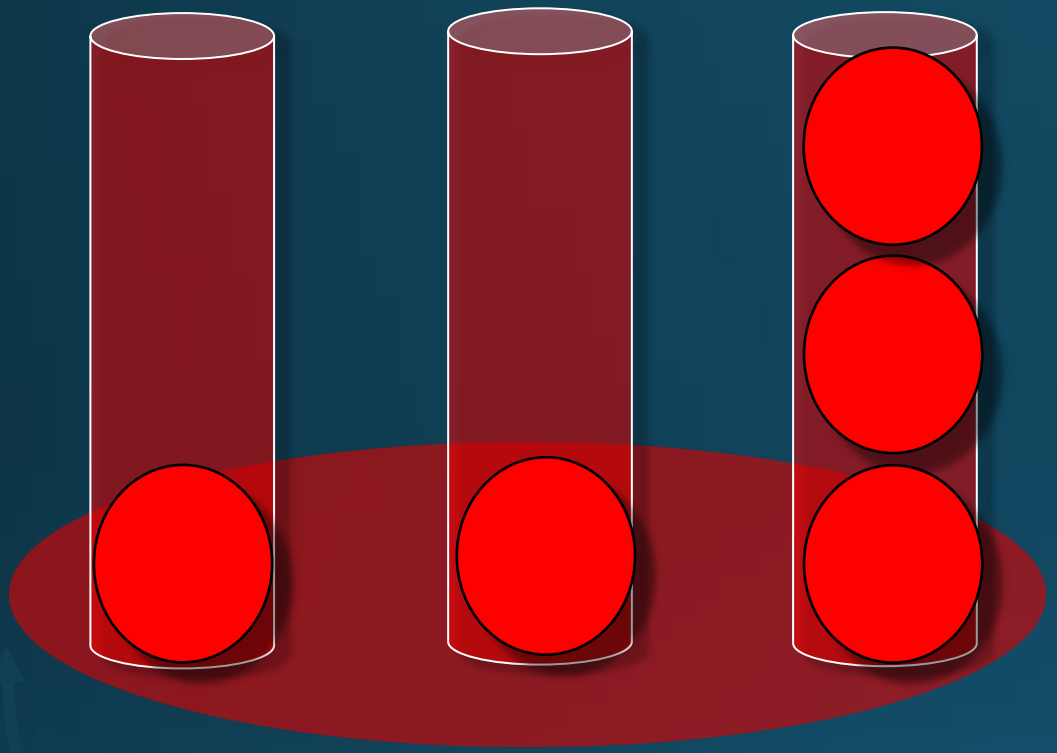


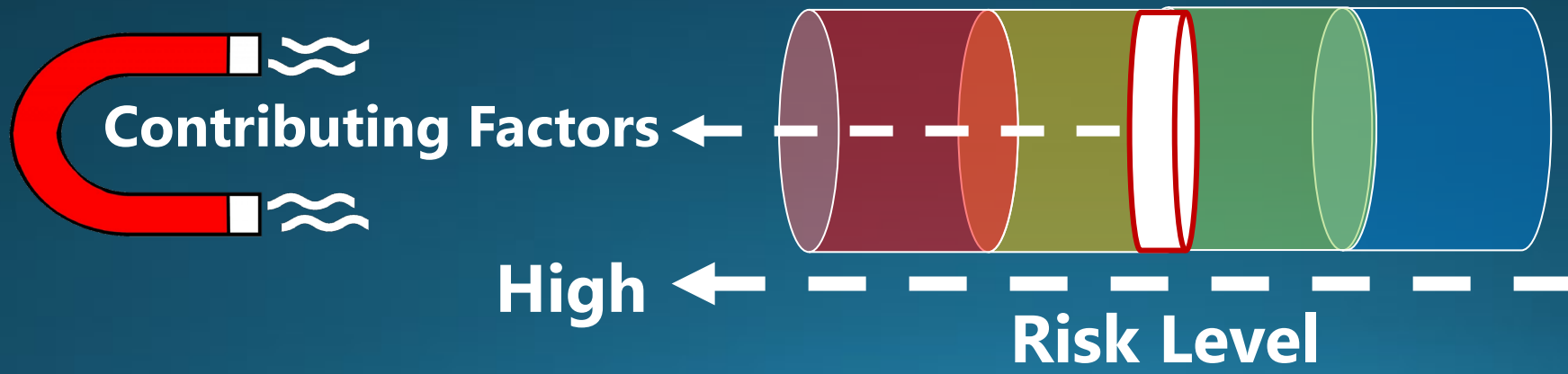
| | Safety I |
|---|---|
| **Definition of Safety** | As few things as possible go wrong |
| **Safety Management Principle** | Reactive, respond when something happens or is categorized as unacceptable risk |
| **View of Human Factors** | Humans are predominantly seen as a liability or hazard. They are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

# Safety I


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

# Contributing Factors





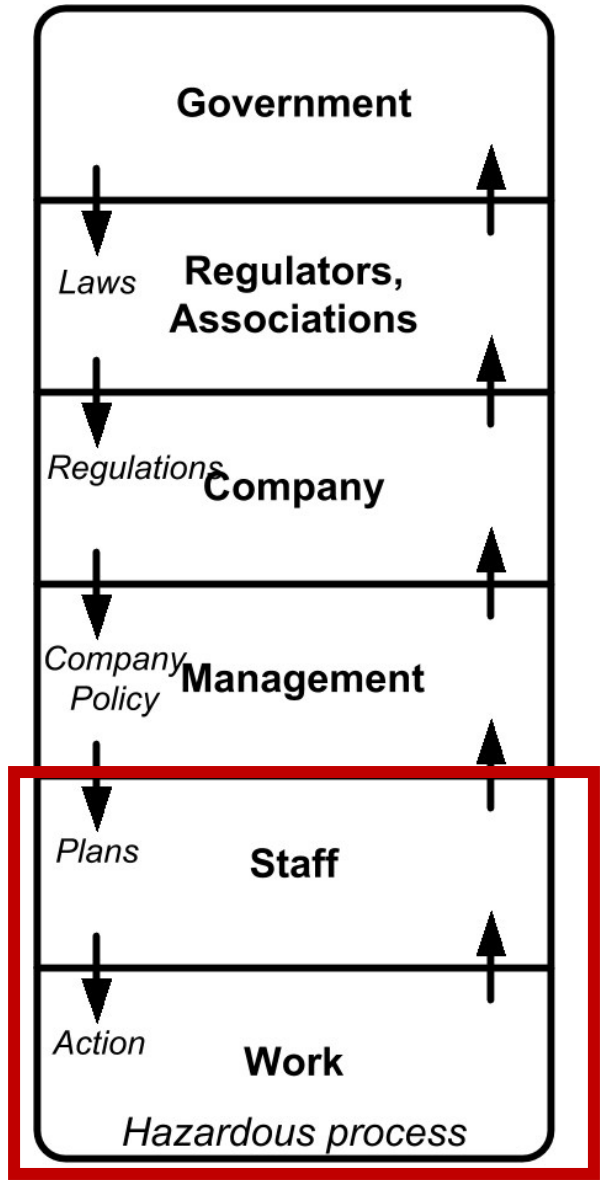
# Systems Thinking

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

# Systems Thinking

Risk Management in a Dynamic Society
Jens Rasmussen, Safety Science, 1997

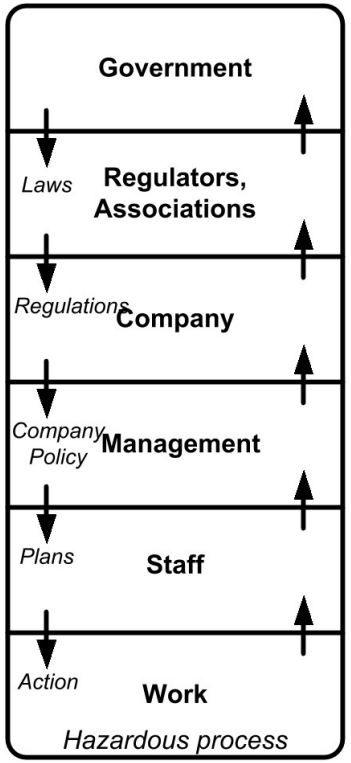
- A Safety I approach
- Expanded into the Safety II framework



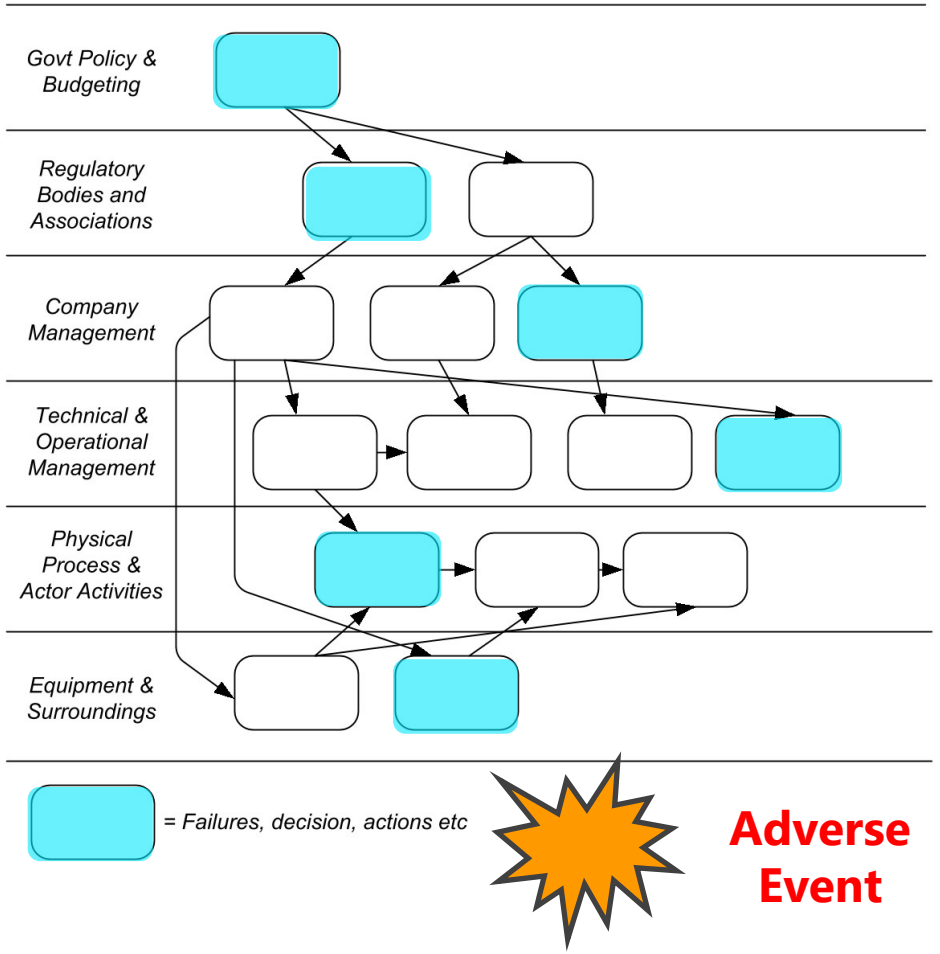
# Accimaps

- Map of a Sociotechnical system
- Root Cause Analysis approach is 'deprecated'

## Taxonomy




## Contributing Factors/Actors



6 students and a teacher drown in a canyoning accident in April 2008

# Mangatepopo Tragedy - NZ

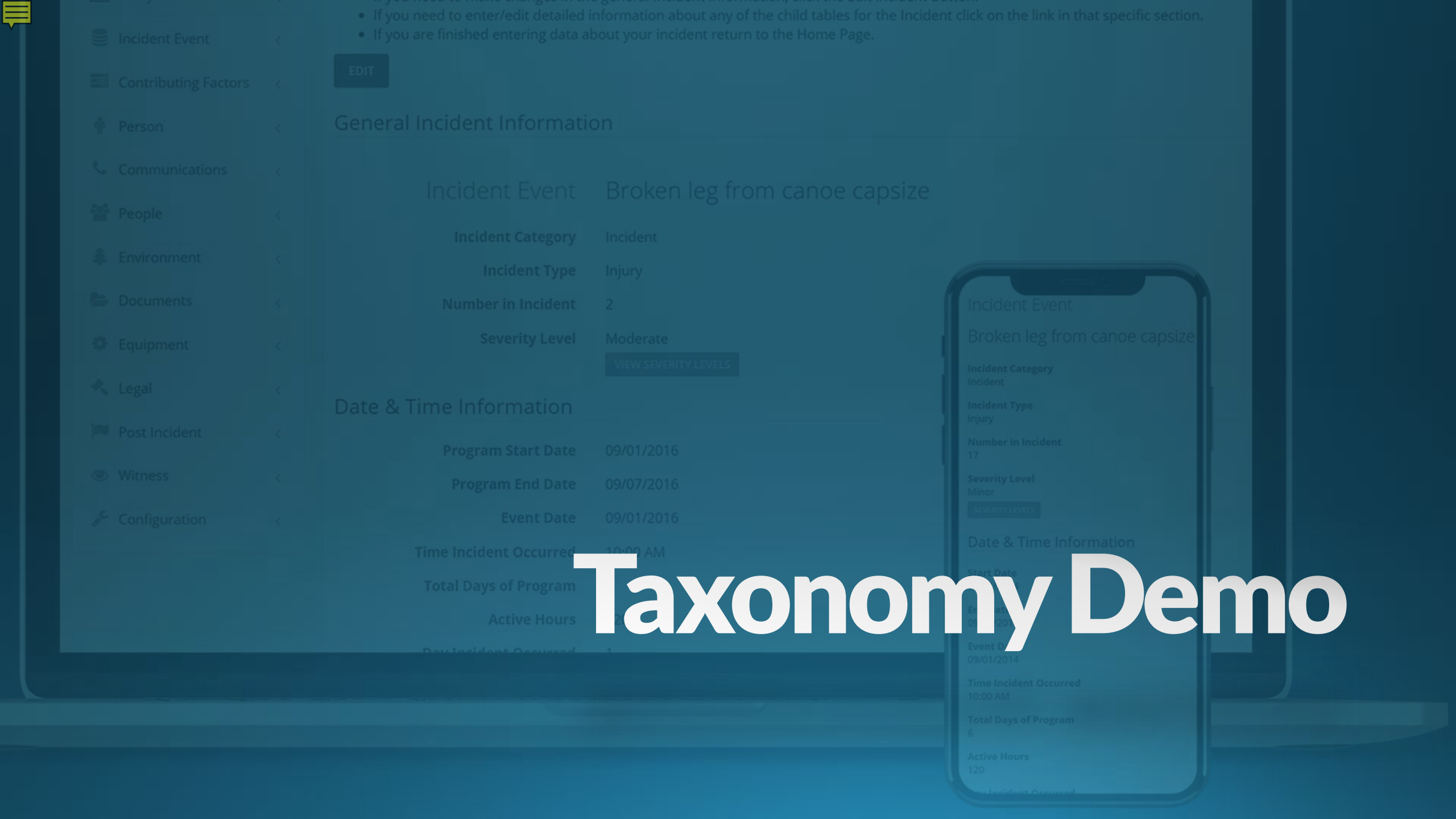
# Building an Accimap

| Taxonomy | Outcomes | Causal Factors | Relationships | Analysis |
| --- | --- | --- | --- | --- |
| Determine a Taxonomy | Identify the outcome(s) | Identify Causal Factors | Identify and Relationships between Factors | Formulate Recommendations based on Scope |

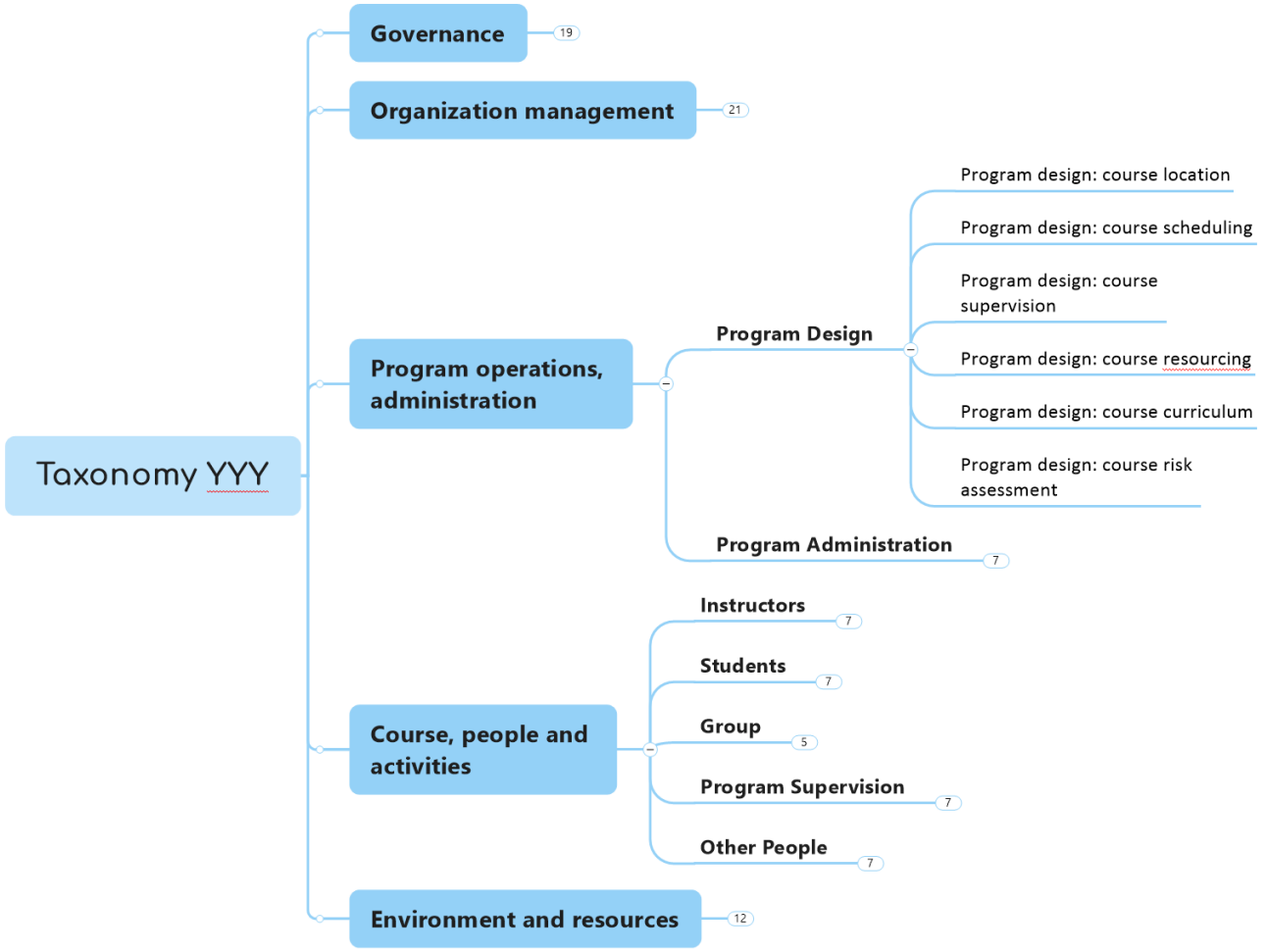
# Causation in Led Outdoor Activities[1]

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

1 Understanding accident causation in led outdoor activities: development of an accident analysis framework Salmon, et al


Incident Event
Contributing Factors
Person
Communications
People
Environment
Documents
Equipment
Legal
Post Incident
Witness
Configuration
If you need to enter/edit detailed information about any of the child tables for the Incident click on the link in that specific section.
If you are finished entering data about your incident return to the Home Page.
EDIT
General Incident Information
Incident Event
Broken leg from canoe capsize
Incident Category
Incident
Incident Type
Injury
Number in Incident
2
Severity Level
Moderate
VIEW SEVERITY LEVELS
Date & Time Information
Program Start Date
09/01/2016
Program End Date
09/07/2016
Event Date
09/01/2016
Time Incident Occurred
10:00 AM
Total Days of Program
Active Hours
Incident Event
Broken leg from canoe capsize
Incident Category
Incident
Incident Type
Injury
Number in Incident
17
Severity Level
Minor
Date & Time Information
09/01/2014
Time Incident Occurred
10:00 AM
Total Days of Program
6
Active Hours
120
Taxonomy Demo

# Sample Taxonomy with Actors



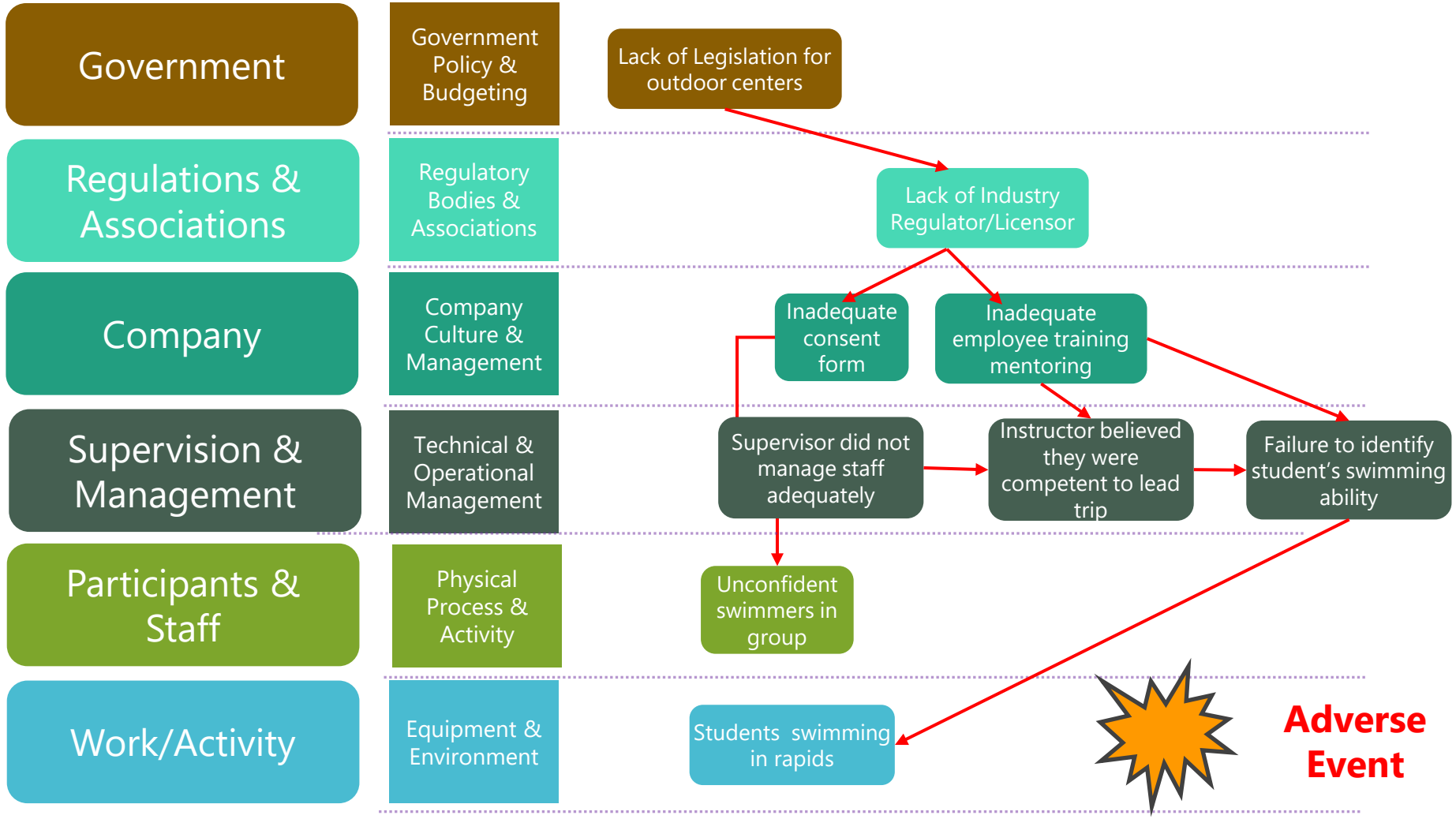
# Build an Accimap

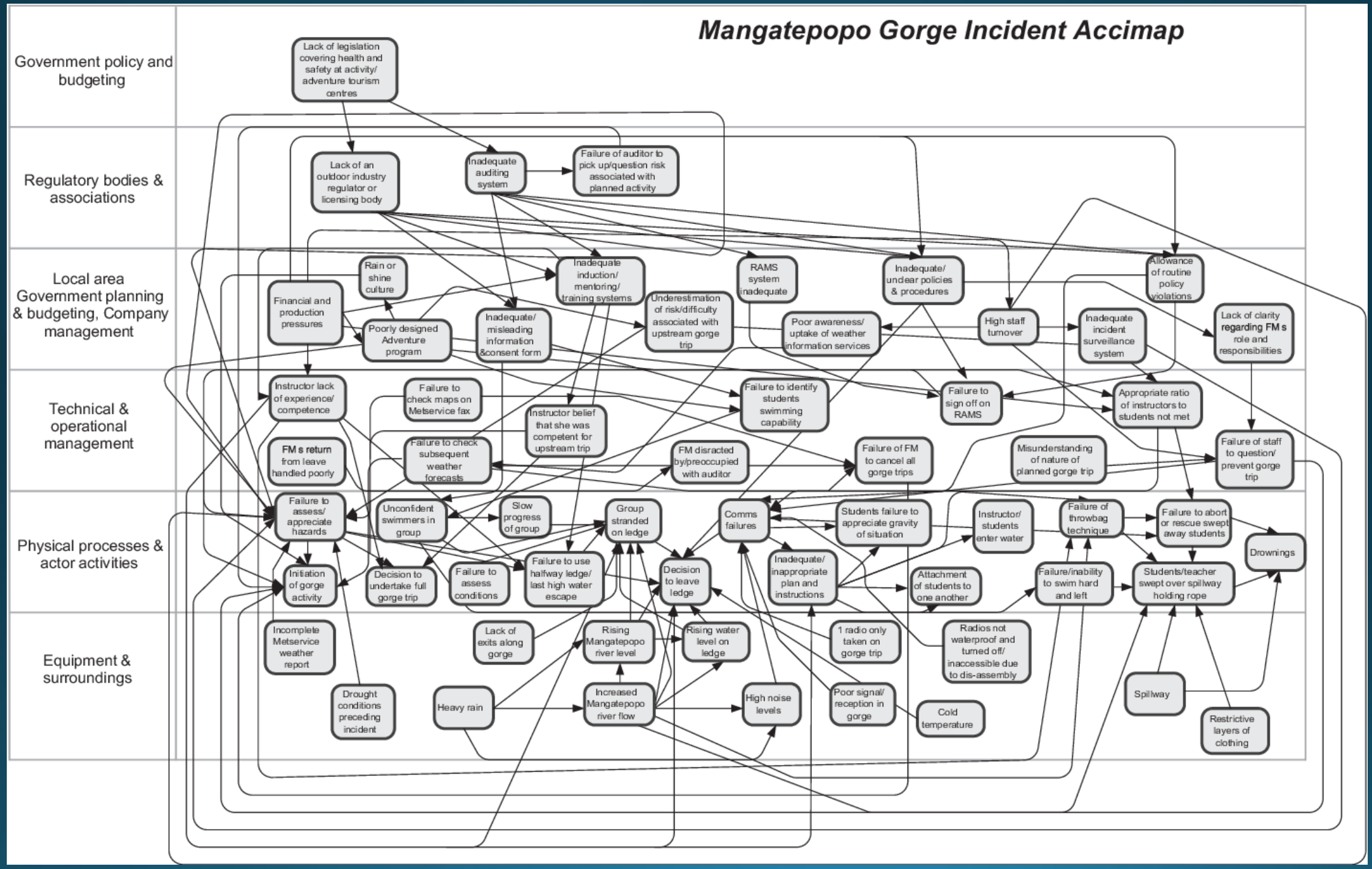
- Download the AcciMap Template
- Enter Contributing Factors at the appropriate Taxonomy Level
- Identify Relationships

# Read Case Study

# Building Accimap & Discussion

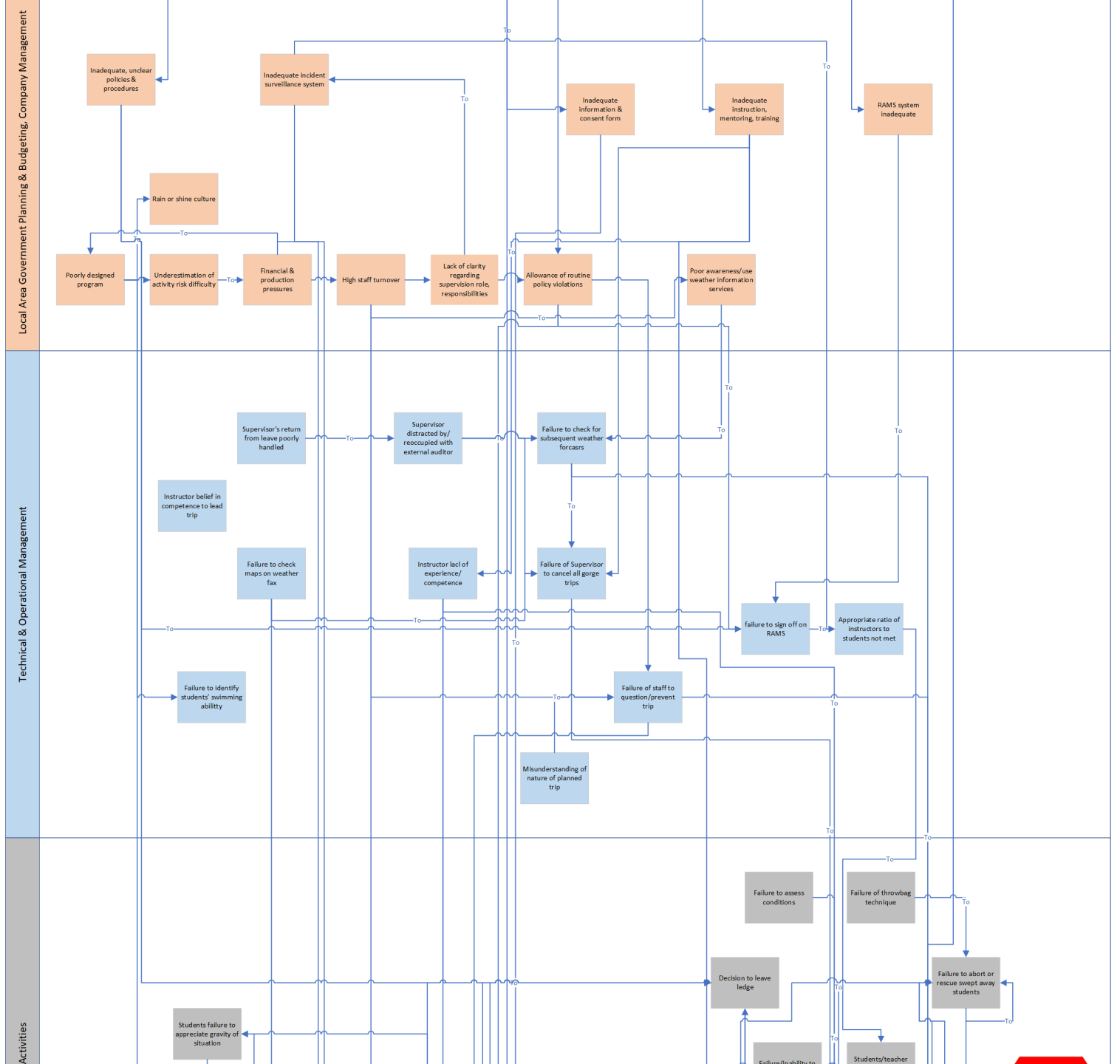
# Mangatepopo River Accident, NZ from Salmon et al




Mangatepopo Gorge Incident Accimap
Government policy and budgeting
Regulatory bodies & associations
Local area Government planning & budgeting, Company management
Technical & operational management
Physical processes & actor activities
Equipment & surroundings
Lack of legislation covering health and safety at activity/ adventure tourism centres
Lack of an outdoor industry regulator or licensing body
Inadequate auditing system
Failure of auditor to pick up/question risk associated with planned activity
Rain or shine culture
Financial and production pressures
Poorly designed Adventure program
Inadequate induction/ mentoring/ training systems
Inadequate/ misleading information &consent form
Underestimation of risk/difficulty associated with upstream gorge trip
RAMS system inadequate
Poor awareness/ uptake of weather information services
Inadequate/ unclear policies & procedures
High staff turnover
Allowance of routine policy violations
Inadequate incident surveillance system
Lack of clarity regarding FM s role and responsibilities
Instructor lack of experience/ competence
Failure to check maps on Metservice fax
Instructor belief that she was competent for upstream trip
Failure to identify students swimming capability
Failure to sign off on RAMS
Appropriate ratio of instructors to students not met
FM s return from leave handled poorly
Failure to check subsequent weather forecasts
FM disracted by/preoccupied with auditor
Failure of FM to cancel all gorge trips
Misunderstanding of nature of planned gorge trip
Failure of staff to question/ prevent gorge trip
Failure to assess/ appreciate hazards
Unconfident swimmers in group
Slow progress of group
Group stranded on ledge
Comms failures
Students failure to appreciate gravity of situation
Instructor/ students enter water
Failure of throwbag technique
Failure to abort or rescue swept away students
Drownings
Initiation of gorge activity
Decision to undertake full gorge trip
Failure to assess conditions
Failure to use halfway ledge/ last high water escape
Decision to leave ledge
Inadequate/ inappropriate plan and instructions
Attachment of students to one another
Failure/inability to swim hard and left
Students/teacher swept over spillway holding rope
Incomplete Metservice weather report
Lack of exits along gorge
Rising Mangatepopo river level
Rising water level on ledge
1 radio only taken on gorge trip
Radios not waterproof and turned off/ inaccessible due to dis-assembly
Drought conditions preceding incident
Heavy rain
Increased Mangatepopo river flow
High noise levels
Poor signal/ reception in gorge
Cold temperature
Spillway
Restrictive layers of clothing

# Generated Accimap

- Autogenerated Accimap from an Excel spreadsheet




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

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

# Safety II

## What's Going Right?

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

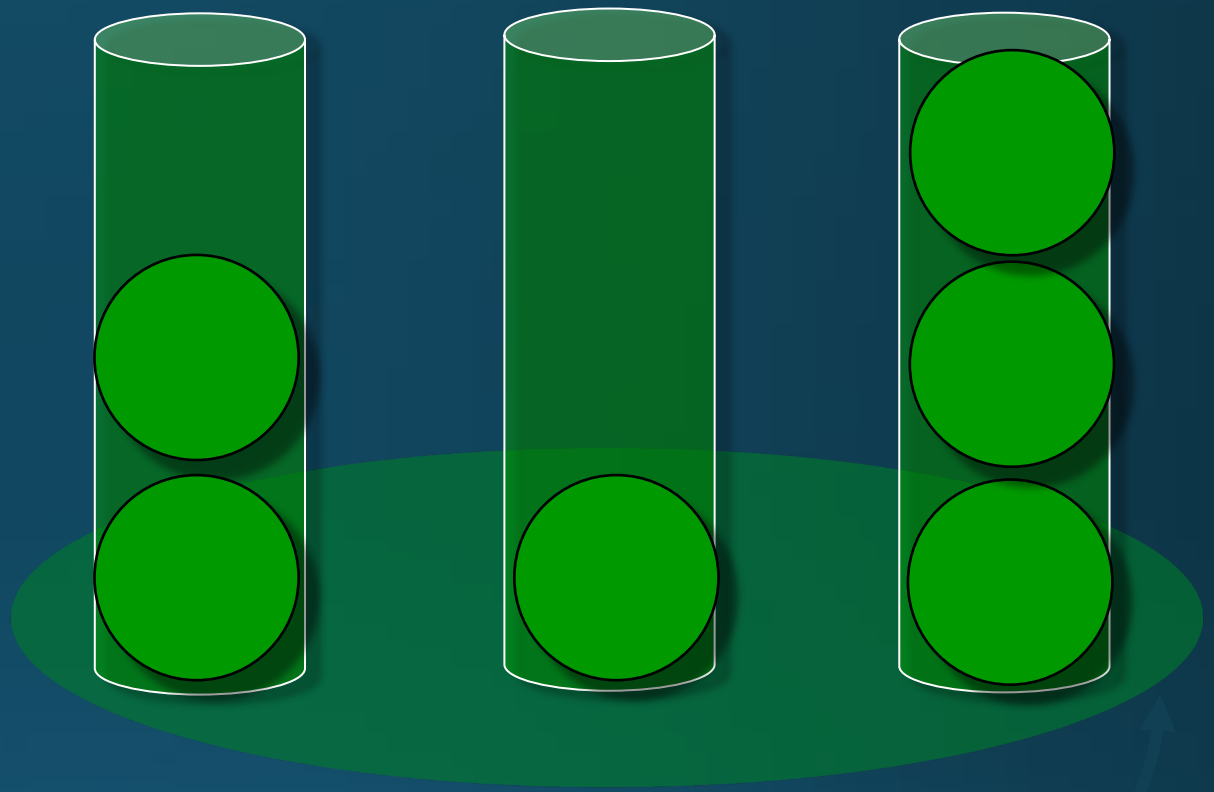
"Trying to understand safety by only looking at incidents is like trying to understand successful marriages by only looking at divorces."
- Marit de Vos 2018

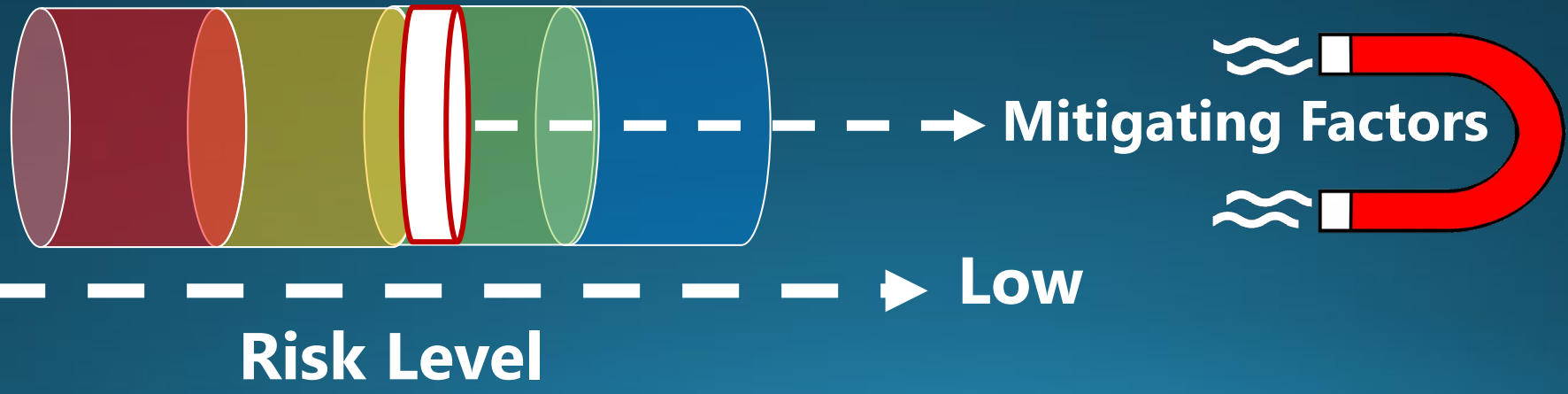
| | Safety II |
|---|---|
| **Definition of Safety** | As many things as possible go right |
| **Safety Management Principle** | Proactive, continuously try to anticipate developments and events |
| **View of Human Factors** | Humans are seen as a resource necessary for system flexibility and resilience. 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. |

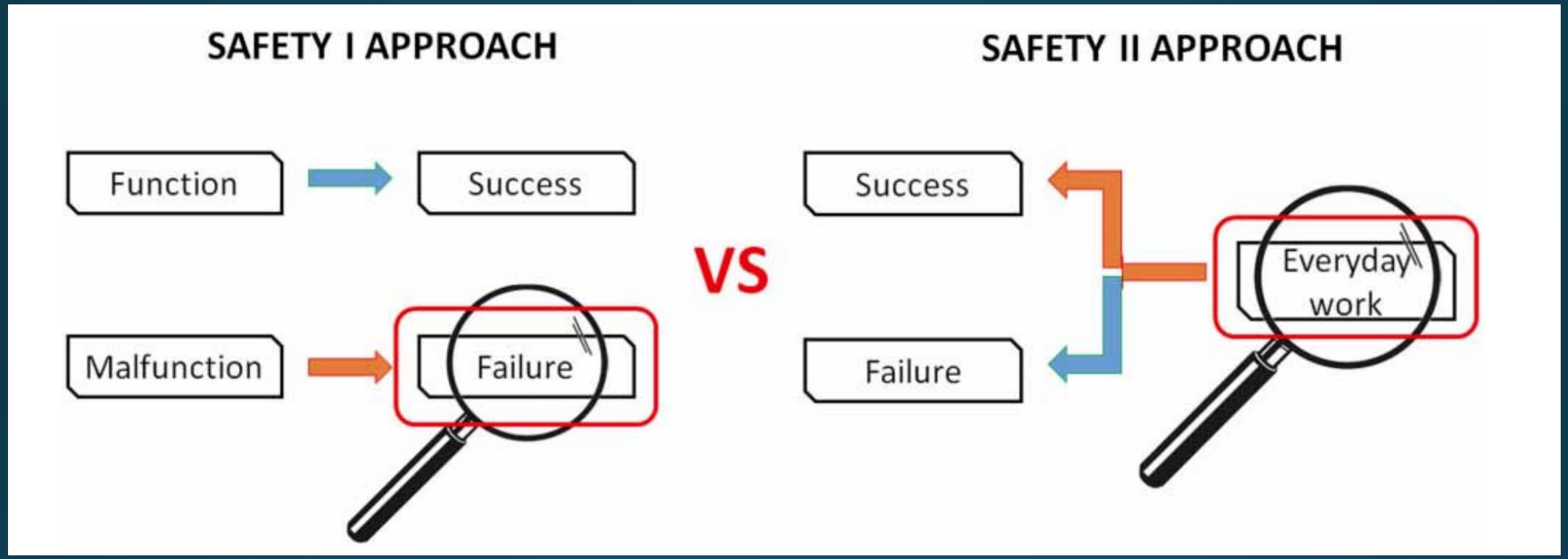
# Safety II


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

# Mitigating Factors








# Safety I vs Safety II

# Safety I & Safety II

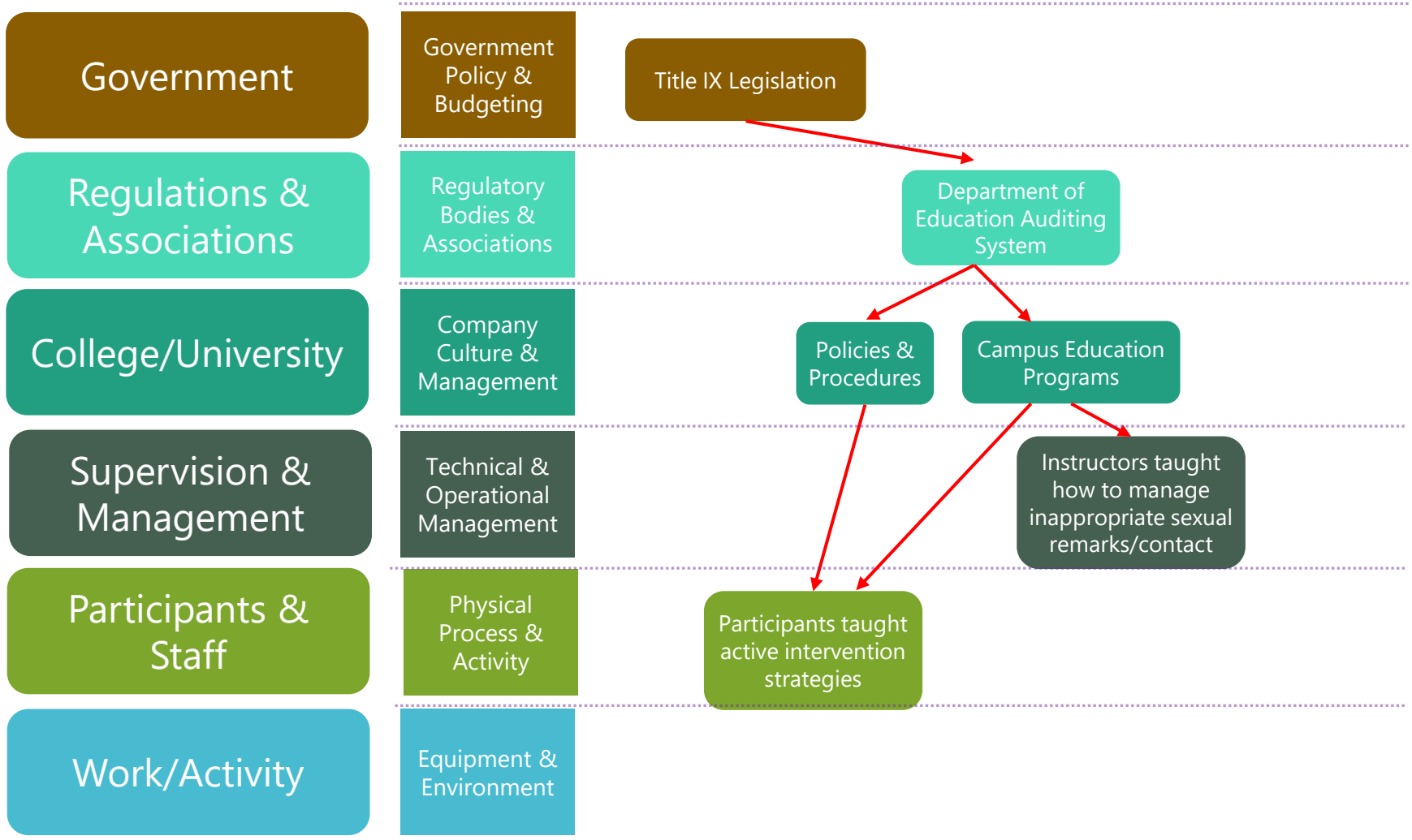
- It is not Safety I **or** Safety II
- It is Safety I **and** Safety II

# Safety II Preventimaps

- **Safety I** = **Accimaps**
  Contributing Factor Analysis of “What went wrong?”

- **Safety II** = **Preventimaps**
  Mitigating Factor Analysis of “What went right?”

# PreventiMap: Title IX Implementation on Campus



# Scope Assessment

# Determining Scope

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

# In Scope Prioritization

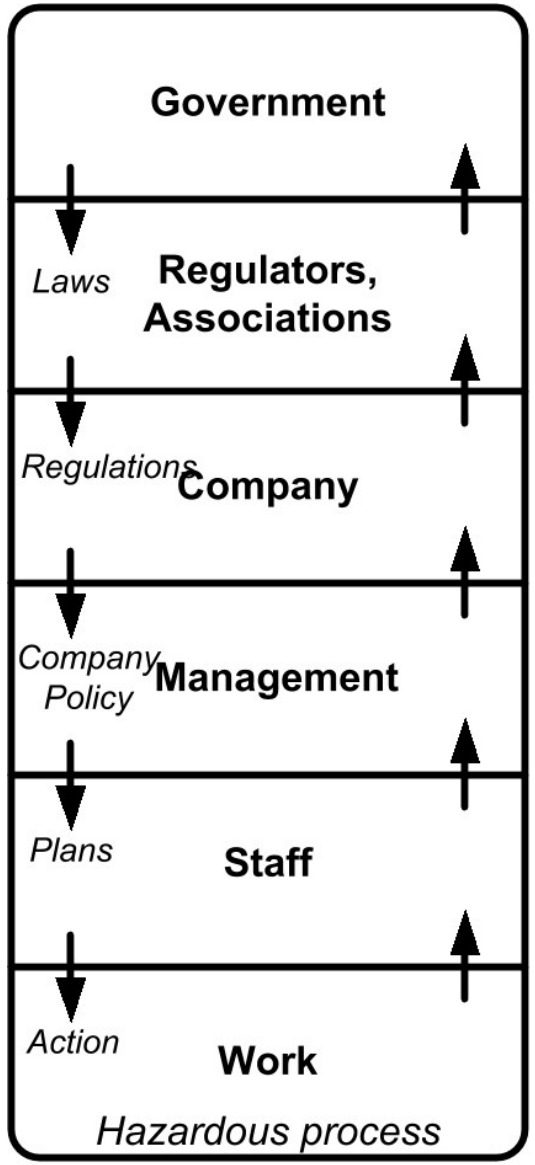
- Risk Mitigation Impact (RMI)
  - What will get you the greatest impact with the least amount of resources?
  - What is the single most important factor to address that would have a significant impact regardless of resources?
  - If it is resource intense, how will you make the case for getting those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

# Questions for your program

- Does your program have a robust incident reporting culture?
- Does your staff know how to recognize an incident versus a close call, and do they have the proper tools to report what they observe?
- Do you have the tools to transform collected data into actionable insights to ensure and promote youth safety?
- Does information flow up and down through the system?

# Incident Data Collection

- Systems Thinking approaches require that you collect incident and near miss data in order to assess your
- Bidirectional Data Flow is essential
- Risk Management Information System (RMIS) like IncidentAnalytix



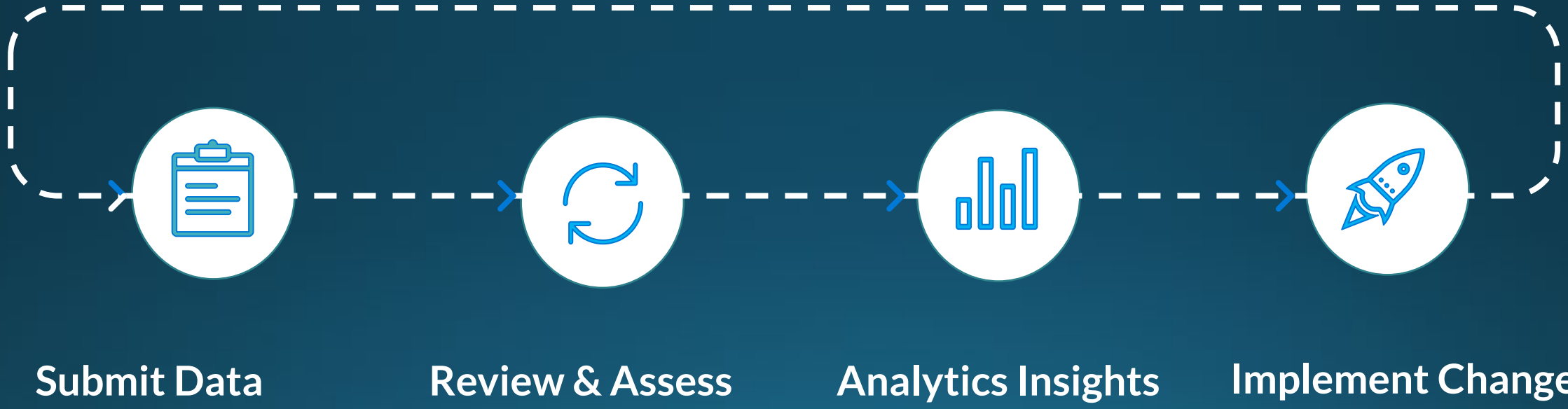
# Meta-analysis of Accimap Causal Factors

| Taxonomy | Contributory Factors | Percent |
|---|---|---|
| **Equipment, Environment & Surroundings** | Physical & Natural Environment Factors | **32.6%** |
| **Equipment, Environment & Surroundings** | Equipment, Technology & Resources | **30.8%** |
| **Equipment, Environment & Surroundings** | Weather & Climate | 15.1% |
| **Physical processes & Actor Activities** | Judgement & Decision Making | **20.2%** |
| **Physical processes & Actor Activities** | Compliance with Procedures, Violations & Unsafe Acts | **20%** |
| **Physical processes & Actor Activities** | Qualification, Experience & Competence | 15% |

# 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** |

# Risk Management Information Systems



# What Data to Track?

- Start with an assessment of past incidents:
  - What are most common?
  - What are the most severe?
- What else could happen?
  - What incidents are commonly associated with that activity, population, etc. (even if it hasn't happened to you)
  - What has never happened that you need to be prepared for?
- What data will provide insight?

# Diversity & Inclusion Risks

- **Physical Safety** is only one dimension on the Risk Management spectrum
- **Psychological/Emotional Safety** is equally important and Hazards can be equally life threatening
  - Teens committing suicide after bullying
  - LGBTQIA+ individuals being assaulted or killed
- 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

# Implementing Safety Culture Change

- Responsibility runs up and down the entire organization
- Moves away from ‘Blame Culture’
- Individuals need to be held accountable, but only for those things that they have control over
- Encourages incident and close call reporting
- More Data means deeper understanding

# Key Concepts

- Safety I
- Taxonomy of Causation
- Systems Thinking
- Building Accimaps
- Safety II
- Building Preventimaps
- Scope
  - Identifying In Scope vs Out of Scope
  - Determining RMI for In Scope
- Collecting Incident and Close Call Data

# Incident Data Collection

- 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

# Videos & Articles

- 1.5.5 Safety I vs Safety II - https://www.youtube.com/watch?v=WM0LVv9NrhM
- 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=oMtLS0FNDZs
- 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=j8N0PZx5YwM
- FAA Safety Management Systems (SMS) Fundamentals: Safety Risk Management Component: https://www.youtube.com/watch?v=b6dwxQ3oEAE
- 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

# Final Thoughts

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

Data is safety.

# Resources

www.IncidentAnalytix.com/blog

staff@IncidentAnalytix.com

www.OutdoorEd.com