

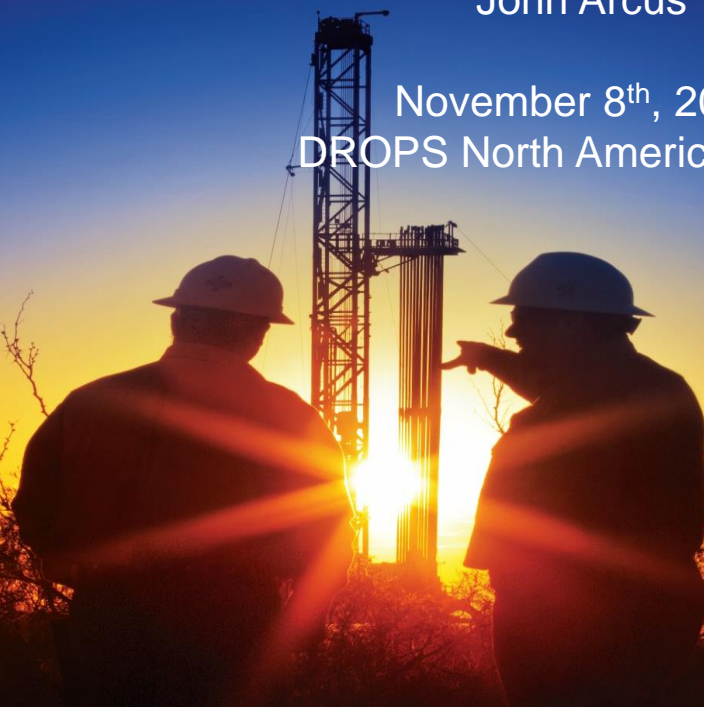


human energy®

DROPS and Bow Ties

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November 8th, 2018
DROPS North America Forum



Gorgon
LNG
facility

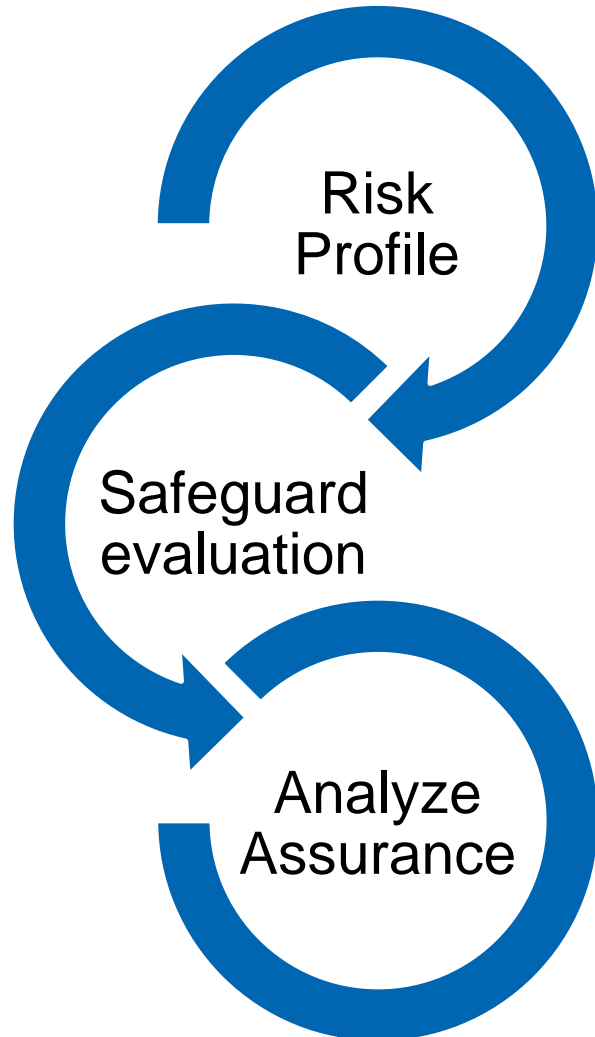
operational excellence risk management

enables effective identification, prioritization, and reduction of risk



Focus on preventing high–consequence incidents and impacts by understanding and mitigating risks and maintaining and assuring safeguards

operational excellence management system



- **Risk profile**
 - Establish risk profile for operations
- **Safeguard Evaluations**
 - Develop Bow Tie models based on identified high risks
 - Assess identified safeguards for completeness and effectiveness (hierarchy of controls, human and hardware)
- **Assurance**
 - Develop assurance activities for each safeguard
 - Test the assurance, how do you KNOW safeguards will function as designed?

safeguards

***Definition:* Safeguards are the hardware and human actions designed to directly prevent or mitigate an incident or impact.**

Common safeguards include facility design elements, mechanical devices, engineered systems, protective equipment and execution of procedures.

Critical aspects of managing safeguards:
establishing safeguards and **sustaining and assuring safeguards**

simplified bow tie model



simplified bow tie development

visualization of safeguards managing risk

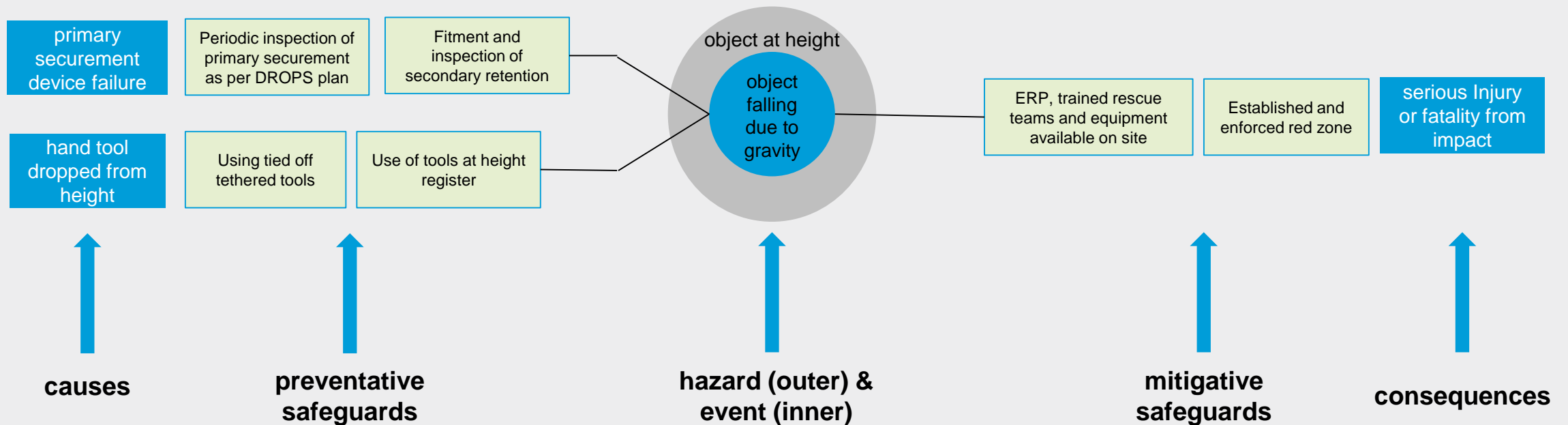
Step 1: Define the hazard and the event

Step 2: List possible causes that will lead to the event

Step 3: List possible consequences from the event

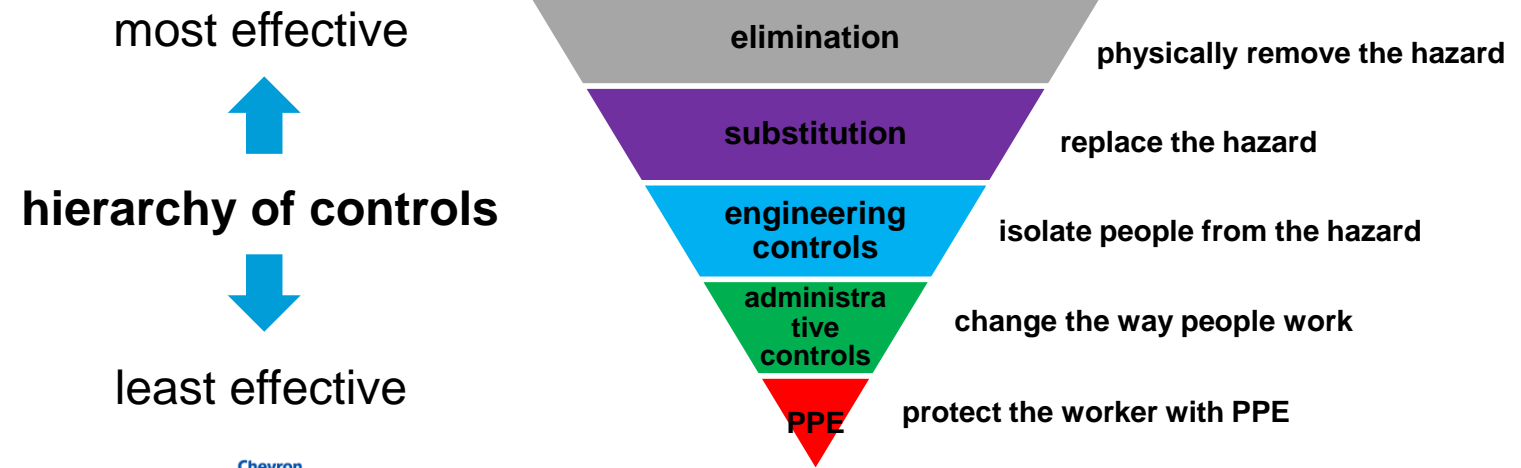
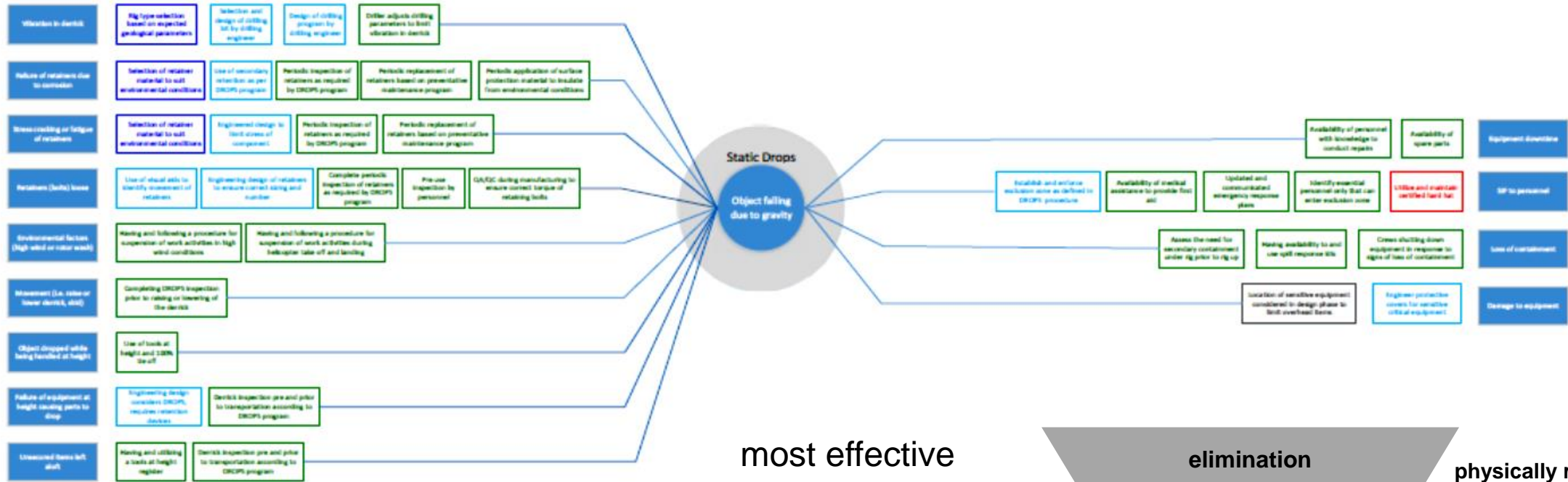
Step 4: List safeguards that will prevent the event

Step 5: List safeguards that will mitigate the consequence



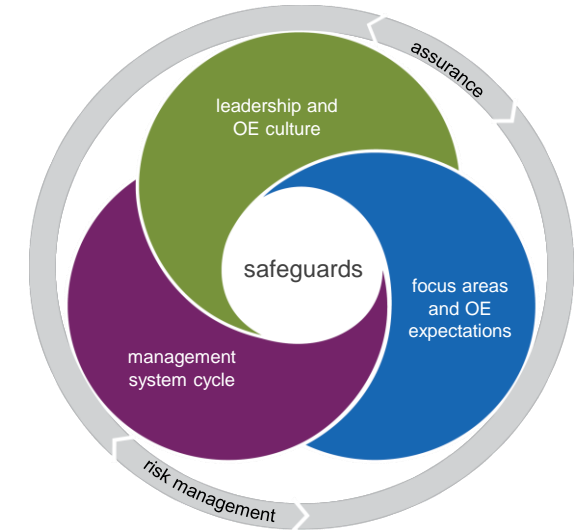
completed bow tie

Static Dropped Object



assurance

- Assurance process verifies that safeguards are functioning as intended
- To sustain effective safeguards, we must analyze and act on safeguard performance data, identified through assurance activities, such as inspection, testing and audits



adding verification of safeguards

Safeguard	Assurance	Verification
Periodic inspection of primary securement as per DROPS plan	Complete Level 1 inspection as per DROPS Plan table 2.0. Test primary securement per requirement. Identify action items.	Verify Level 1 inspection completed as per DROPS Plan table 2.0. Verify all actions closed.
Fitment and inspection of secondary retention	Complete Level 1 inspection as per DROPS Plan table 2.0. Visually inspect secondary retention devices are in place and in good condition	Verify Level 1 inspection completed as per DROPS Plan table 2.0. Verify all actions closed.
Using tied off tethered tools	Refer DROPS Plan section 4.8 Tools at Height. Inspect tools at height and tethers, discuss with crews to confirm use of tethered tools at height.	Verify Tools at Height availability on location. Discuss use with crews.
Use of tools at height register	Refer DROPS Plan section 6.3 Tools at Height Register. Complete tools at height register for all items taken aloft and returned.	Review Tools at Height register for completeness. Discuss with crews
ERP, rescue teams and equipment available on site	1. Updated ERP available on site. 2. Rescue teams training completed. 3. Availability of medical equipment 4. Conduct rescue with medical response drills	1. Review ERP. 2. Confirm rescue teams are knowledgeable on rescue techniques. 3. Confirm availability of medical equipment 4. Confirm rescue team has conducted rescue/medical drills
Established and enforced red zone	Refer DROPS Plan section 9.2 Exclusion zones. Visually confirm Red zone established on rig floor, markings are in good condition. Entry conditions are established and known by crew. Discuss with crews.	Review DROPS Plan section 9.2 and verify zone on rig floor is in compliance. Discuss enforcement with crews.



safeguard health

verification of safeguards

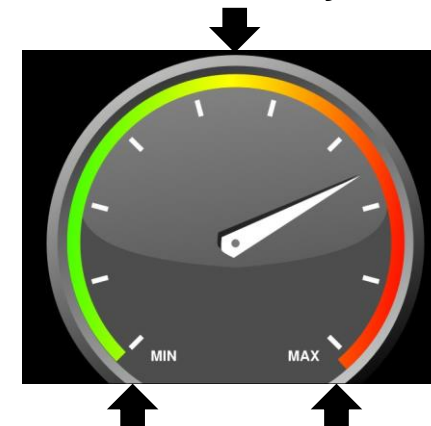
Safeguard visualization chart (with traffic lights)

Facility A Risk Profile				Prevention										Mitigation													
#	Scenario	Consequence Category	Risk Profile RR	Design	Flame Arrestor	Flow Restriction	Mechanical Device-Prevention	Safety Instrumented System-Prevention	Pressure Safety Device	Process Control and Alarm	Asset Integrity	Collision/Impact Prevention	Lifting Equipment	Weather and Natural Events Protection	Human	Other-Prevention	Containment	Overflow	Passive Fire Protection	Safety Instrumented Systems-Recovery	Mechanical Device-Mitigation	Active Fire Protection	Ignition Control	Emergency Management	Human	Other-Mitigation	
1	Potential large release of oil from pipeline 1 to City X, resulting in potential personnel and public impact	PH&S	1	4																							
2	Potential large release of ammonia from storage area, resulting in potential personnel and public impact	PH&S	1	5																							
3	Potential large release of flammable gas from Area 1, resulting in potential personnel impact	WH&S	2	4																							
4	Potential large release of H2S from Area 2, resulting in potential personnel impact	WH&S	2	5																							
5	Potential large release of LPG from storage area, resulting in potential personnel impact	WH&S	2	6																							

safeguard meter

Measure of safeguard functionality and status of verifications (established through assurance)

In place but is not verified to fully meet defined criteria



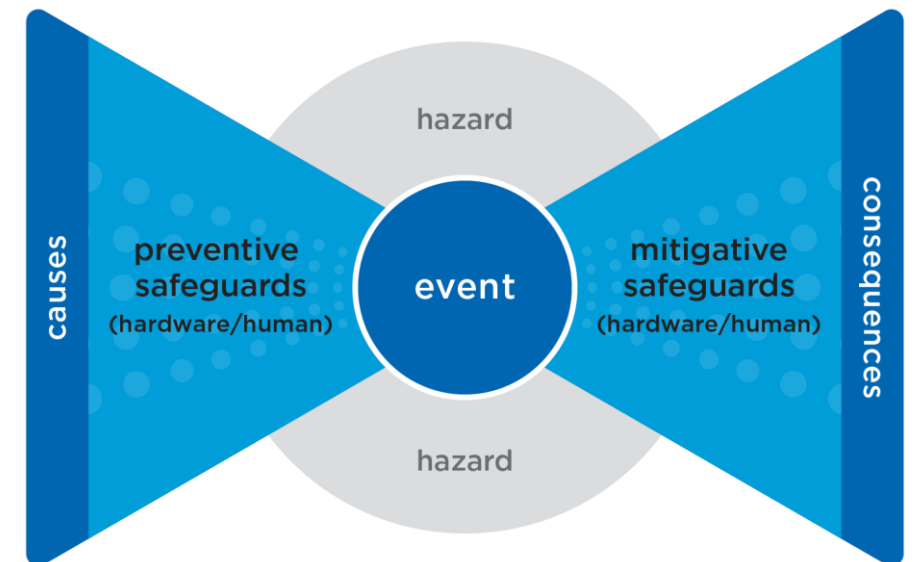
In place and verified to meet defined criteria

Not in place, or does not meet defined criteria

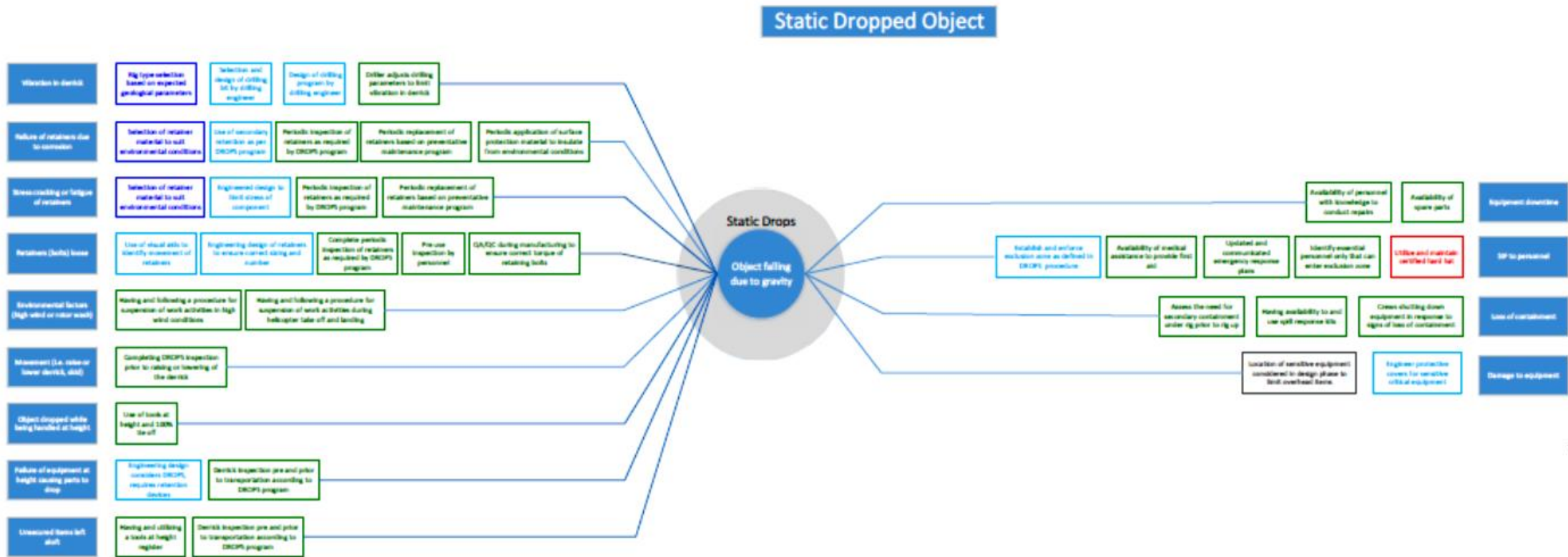
uses of bow tie models

- Fit for purpose, can be scaled to suit depending upon event used
- Can be developed in the field through facilitated learning team workshops
- Crews can visualize how and where the safeguards work
- Found the bow ties to be a good reference during job planning
- Tool for assurance teams to understand what safeguards should be in place and how to verify them
- Post investigation QA tool

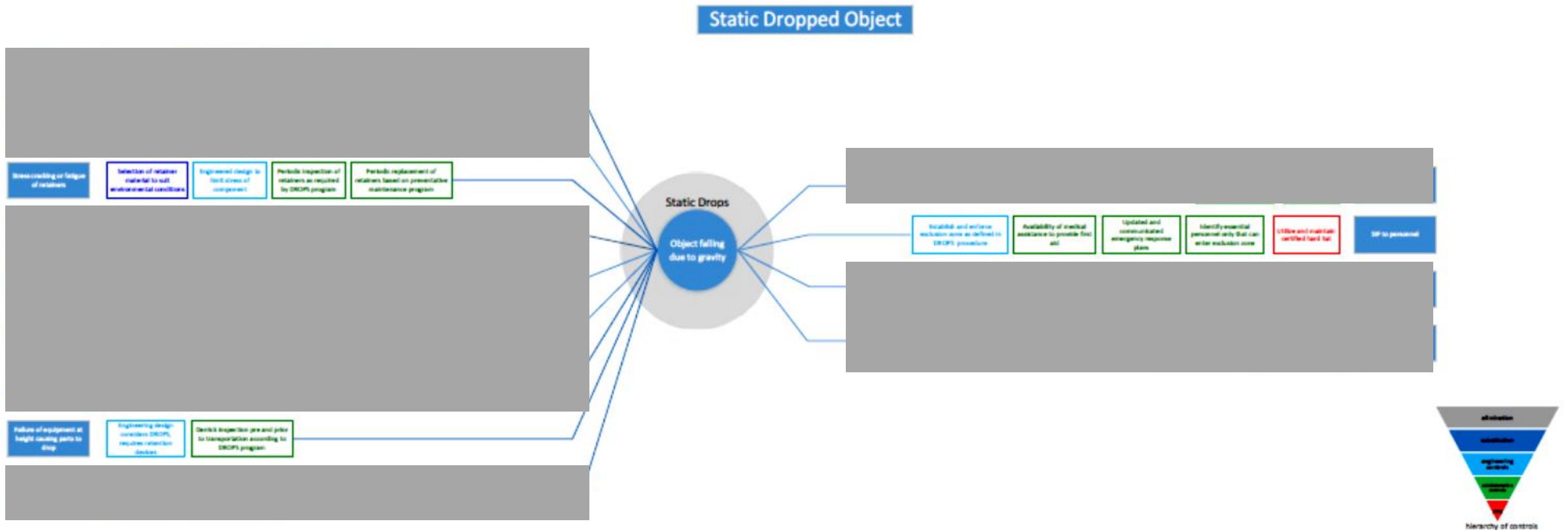
simplified bow tie model



evaluate how tie based on investigation or learning teams findings

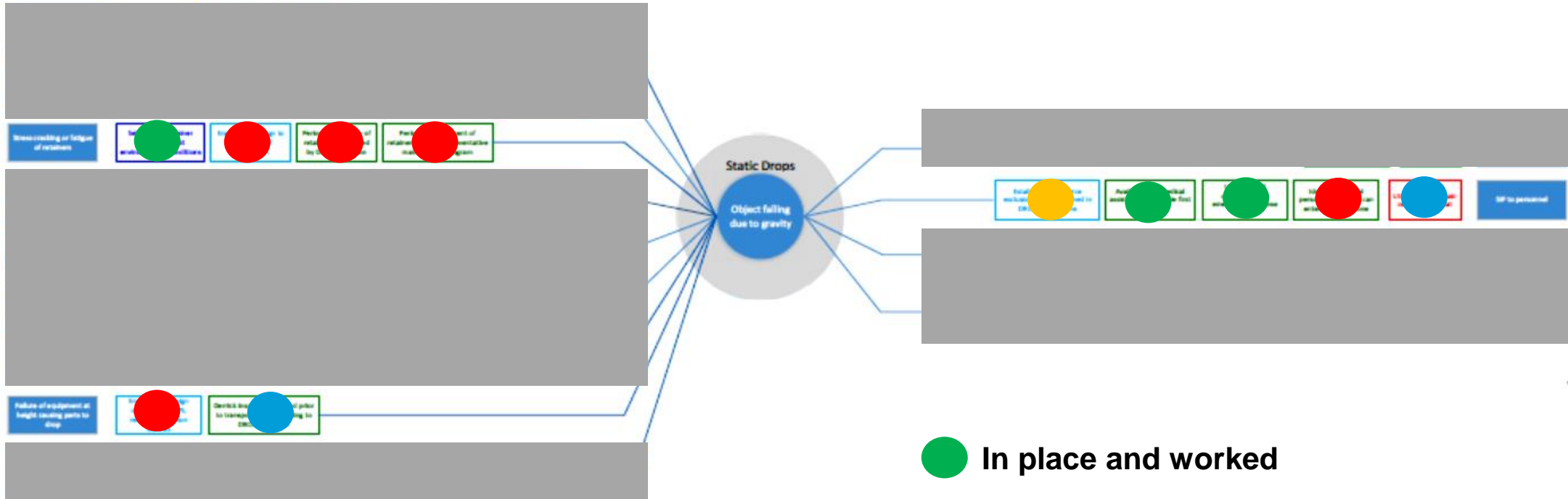


remove causes and consequences not involved in the event



identify safeguards that worked and did not work

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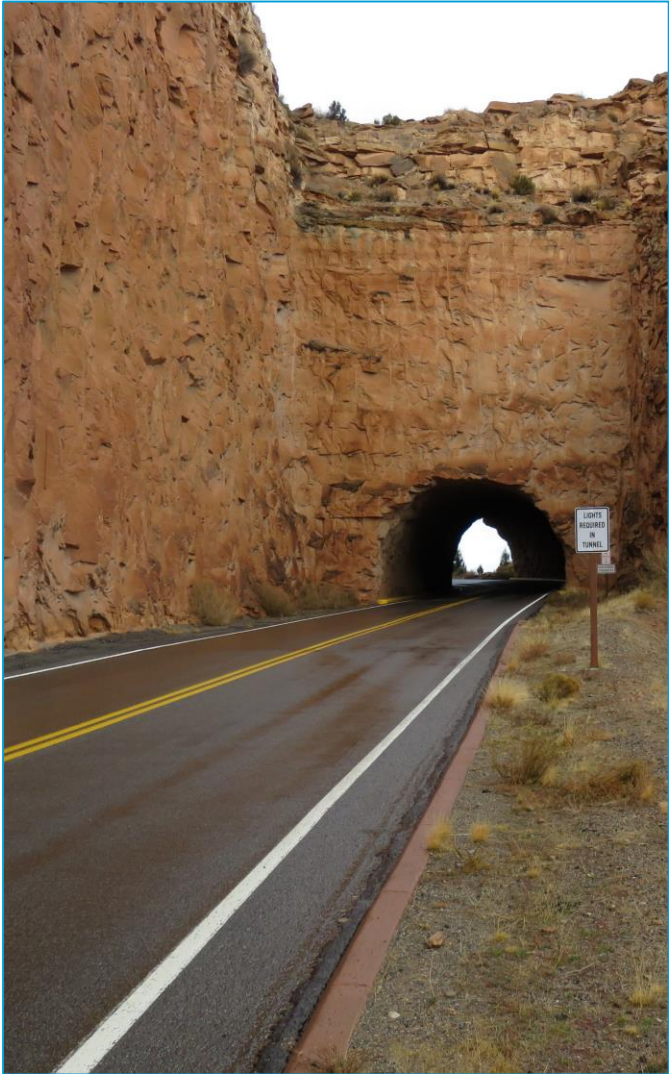
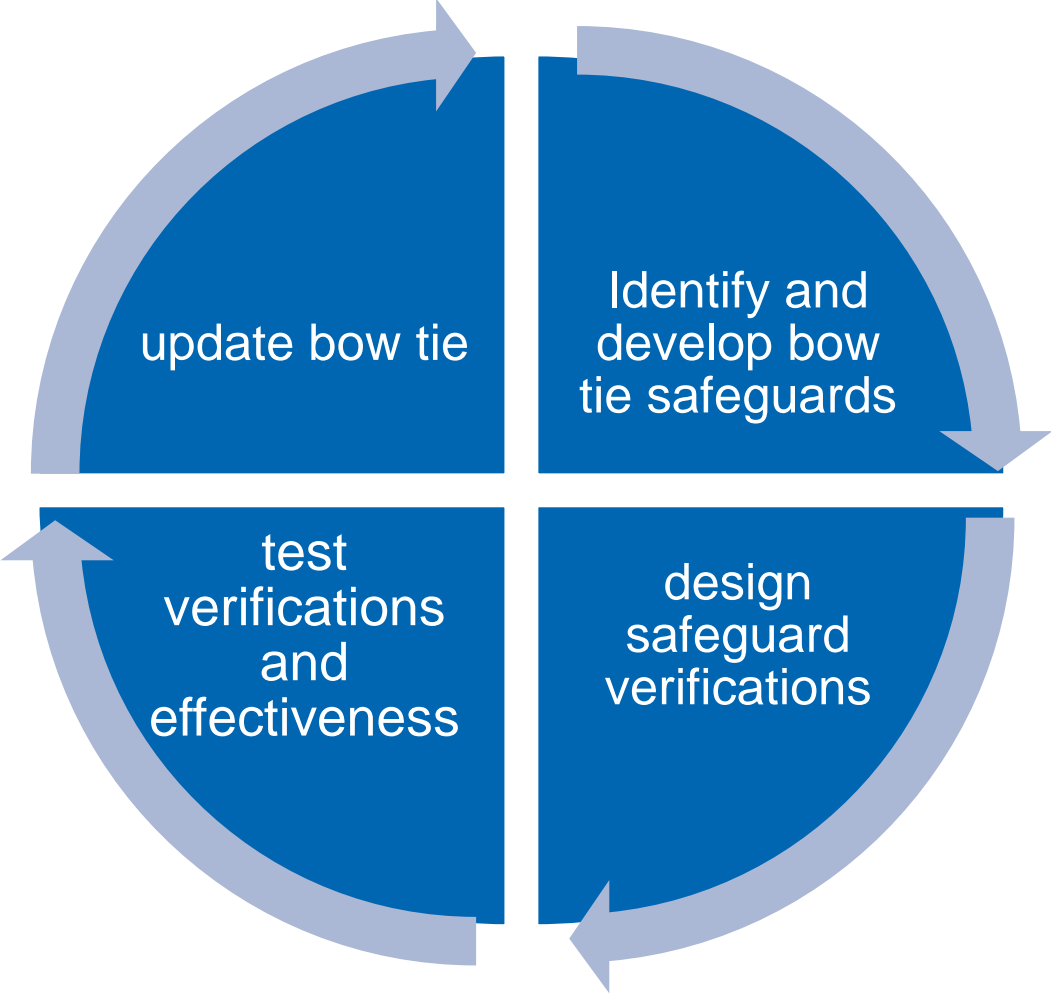


*Add any missing safeguards identified during the Root Cause Analysis (RCA)

- In place and worked
- In place but did not work fully
- Not in place, or did not work
- Not relevant for this event



the journey and continuous improvement



thank you

