

Hazards29

In association with the Mary Kay O'Connor Process Safety Center

22–24 May 2019, Birmingham, UK

The e-SafetyCase; Electronic or Effortless?

Gareth Ellor – Risktec Solutions Ltd

What is a Safety Case?

The demonstration that something is safe!

That adequate controls are in place to ensure that the major HSSE risks arising from a particular operation, activity, process etc. are both tolerable and reduced
As Low As Reasonably Practicable [ALARP].

*A document
issued to a regulator to
show risks are ALARP to
obtain a license to
operate?*

Safety Cases – you either love'em or hate'em!

Myth

- ✗ Complex and theoretical.
- ✗ A thick, weighty document that no one reads!
- ✗ Something to tick a box and get a stakeholder off your back and then sits on a shelf gathering dust!
- ✗ Symptomatic of a legislative regime.
- ✗ Very expensive!

Reality

- ✓ Proportionate to risk.
- ✓ Fit for purpose, simple, clear and effective. No baggage or precedents! Useful!
- ✓ Provides a central focal point to maintain and improve safety throughout the life-cycle of an asset. A live document!
- ✓ Independent from legislation.
- ✓ Good practice. Shows stakeholders you are managing risk effectively!
- ✓ Effective management of risk proven to reduce overall project costs.



The
e-SafetyCase
OPPORTUNITY
?

What is an e-SafetyCase?

Purpose is identical to a traditional Safety Case;
demonstrate risks are reduced ALARP.

It is how this information is presented that is key difference.



Instead of being a lengthy, complex written document, the e-SafetyCase is highly interactive and intuitive, using clickable links as a means of connecting and navigating the information quickly and easily.



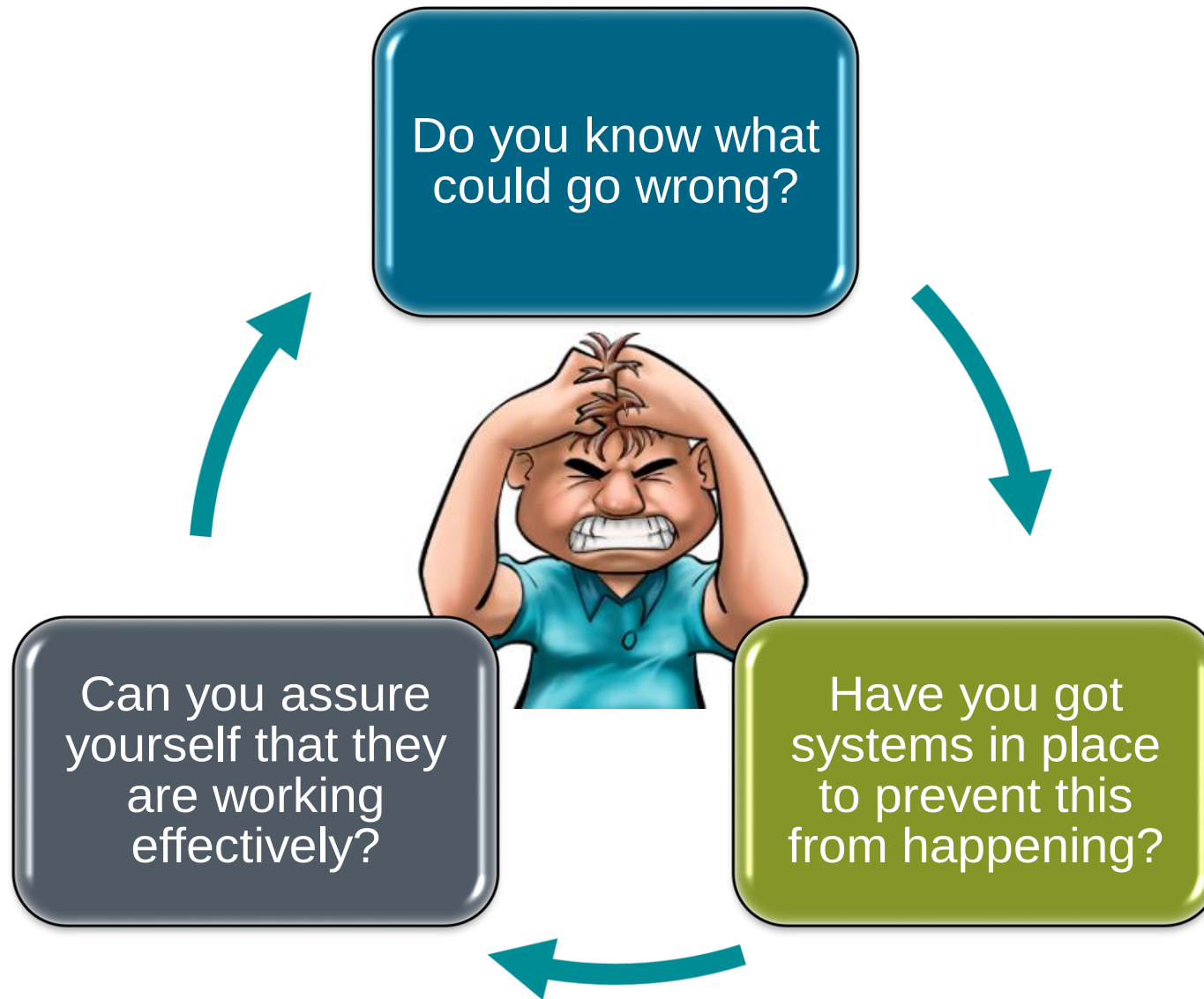
Accessible and helpful to anyone involved
in the safe operation of the facility.



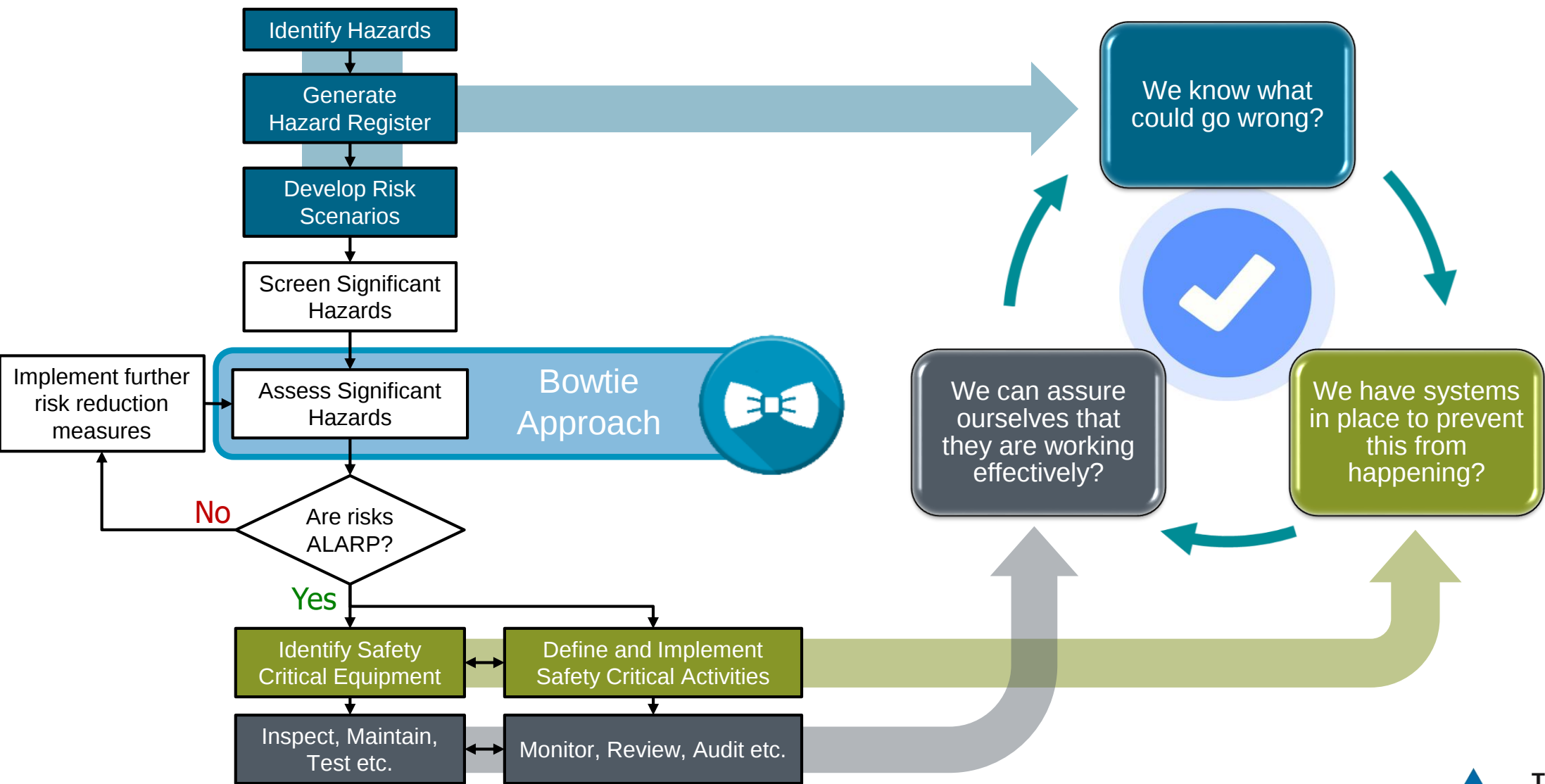
Case Study – Offshore Wind Farm e-SafetyCase



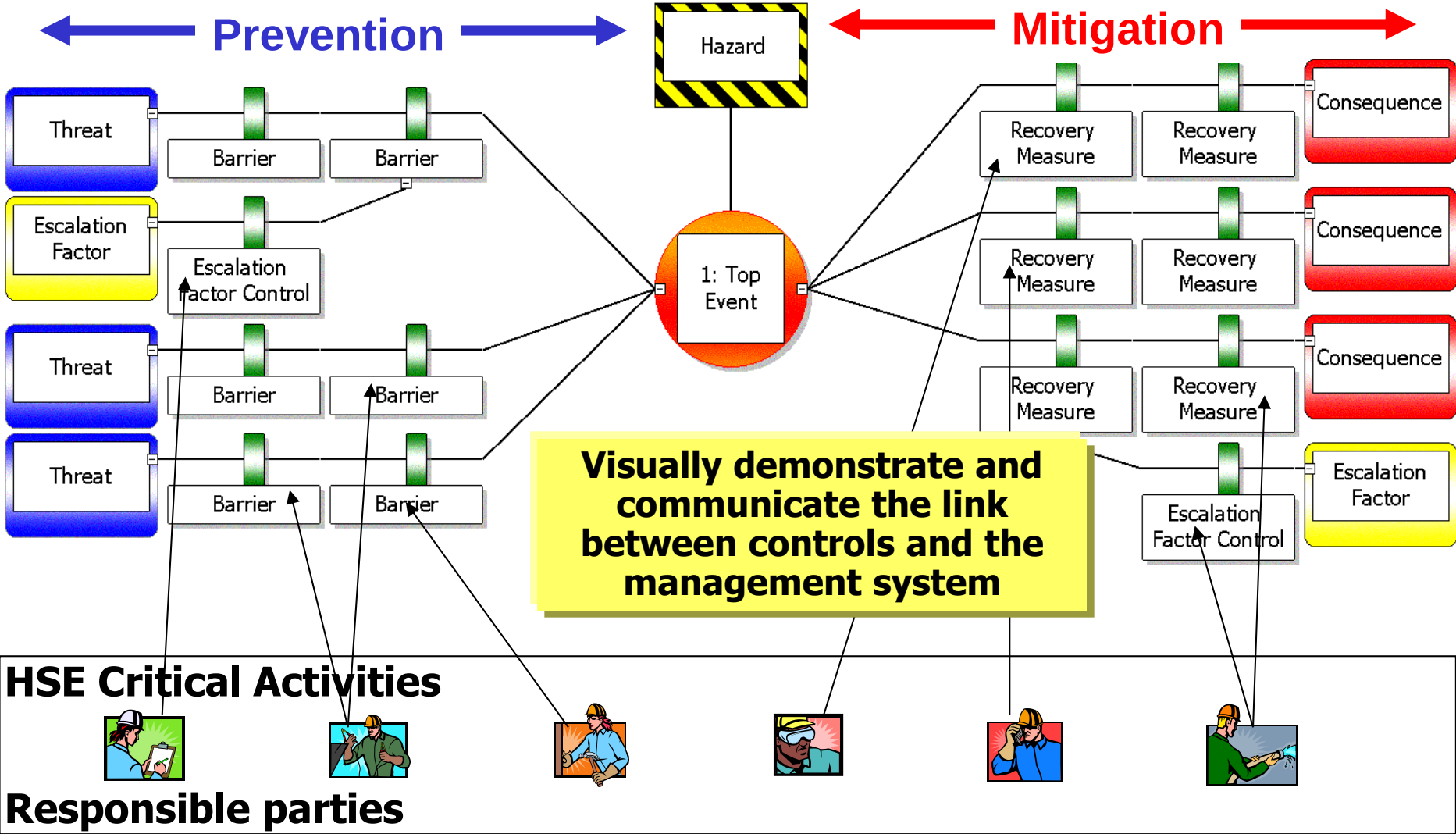
The challenges of effective Risk Management



Risk Management Approach

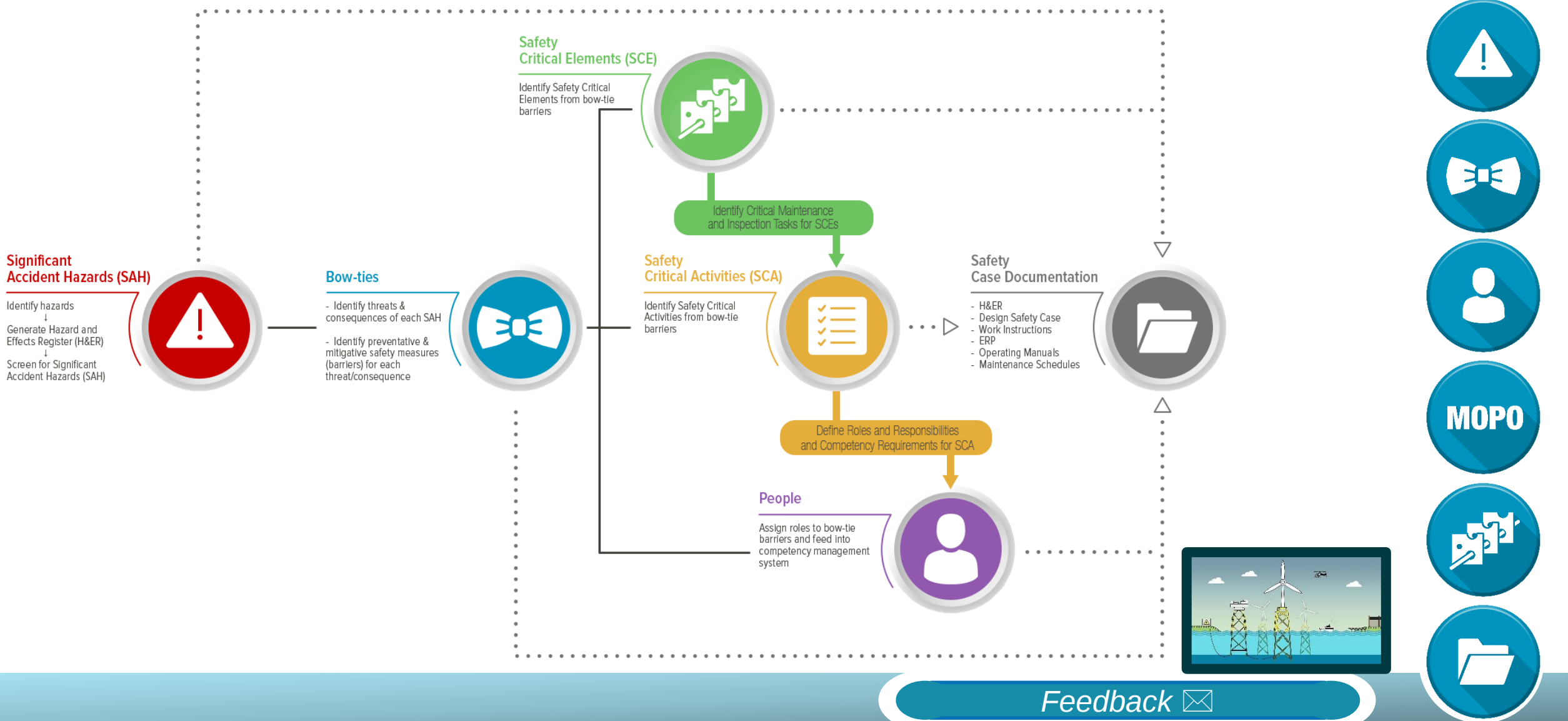


Bowtie Approach



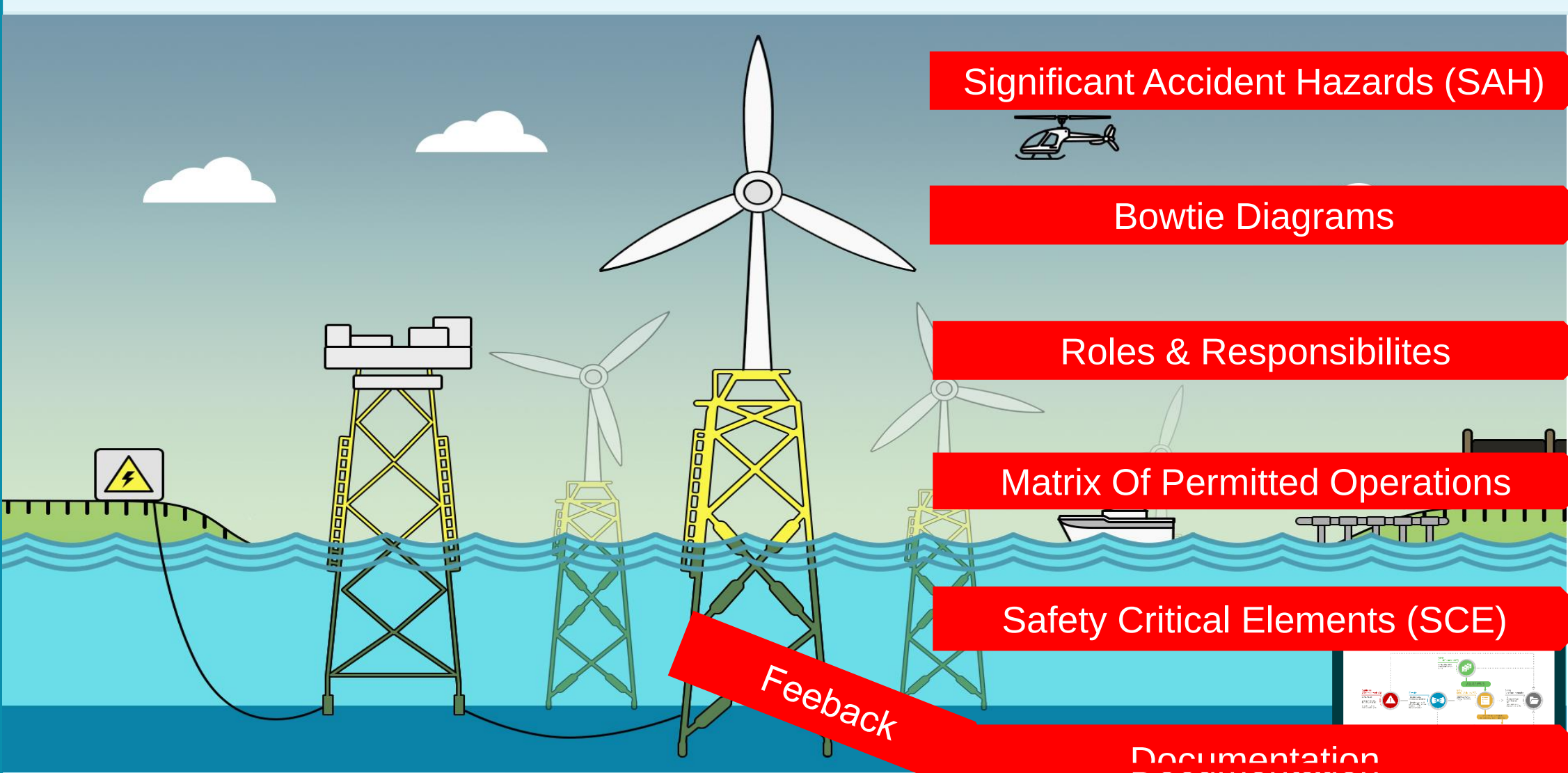


Operations Safety Case





Operations Safety Case



Significant Accident Hazards (SAH)



Bowtie Diagrams

Roles & Responsibilities

Matrix Of Permitted Operations

Safety Critical Elements (SCE)

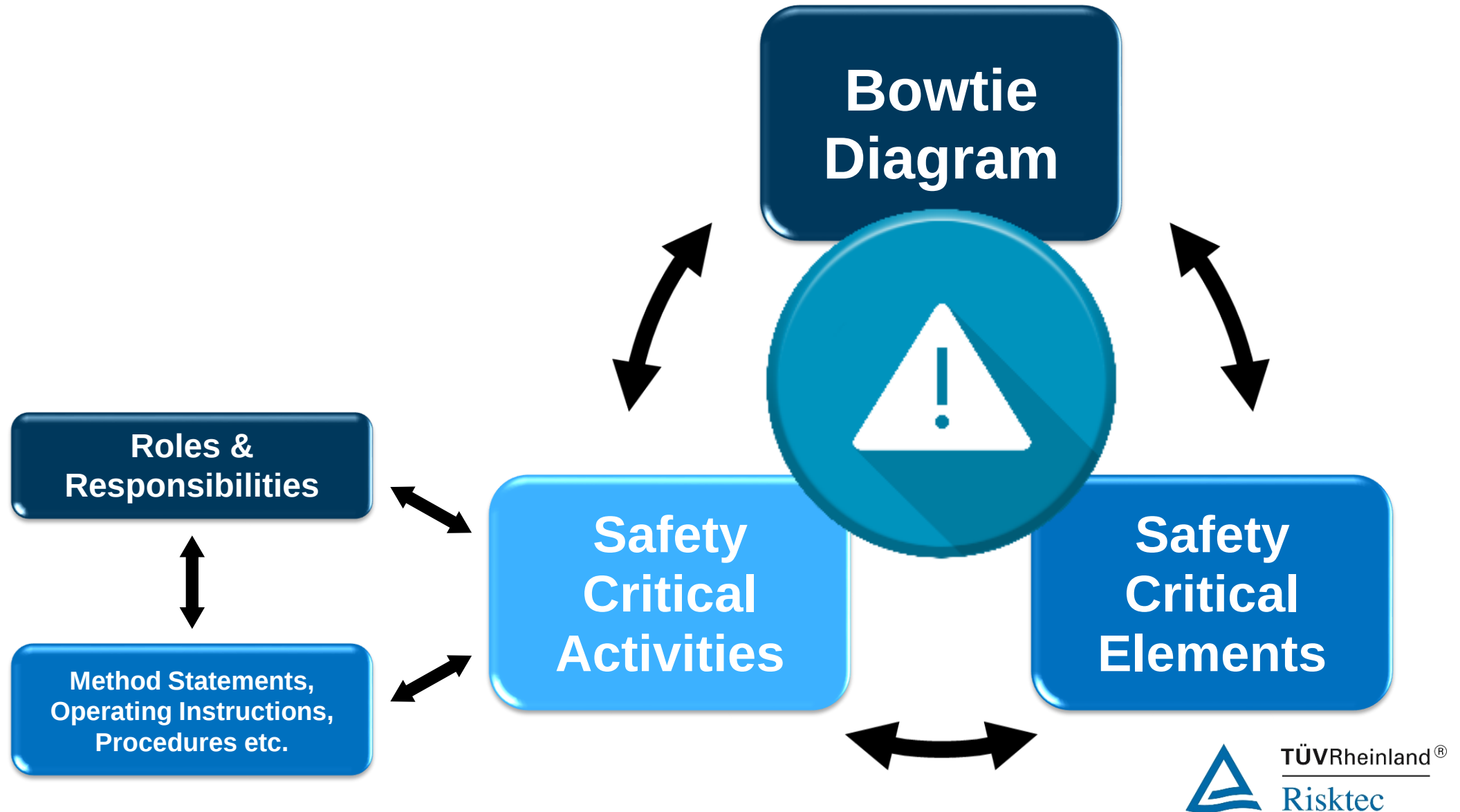
Feedback

Documentation

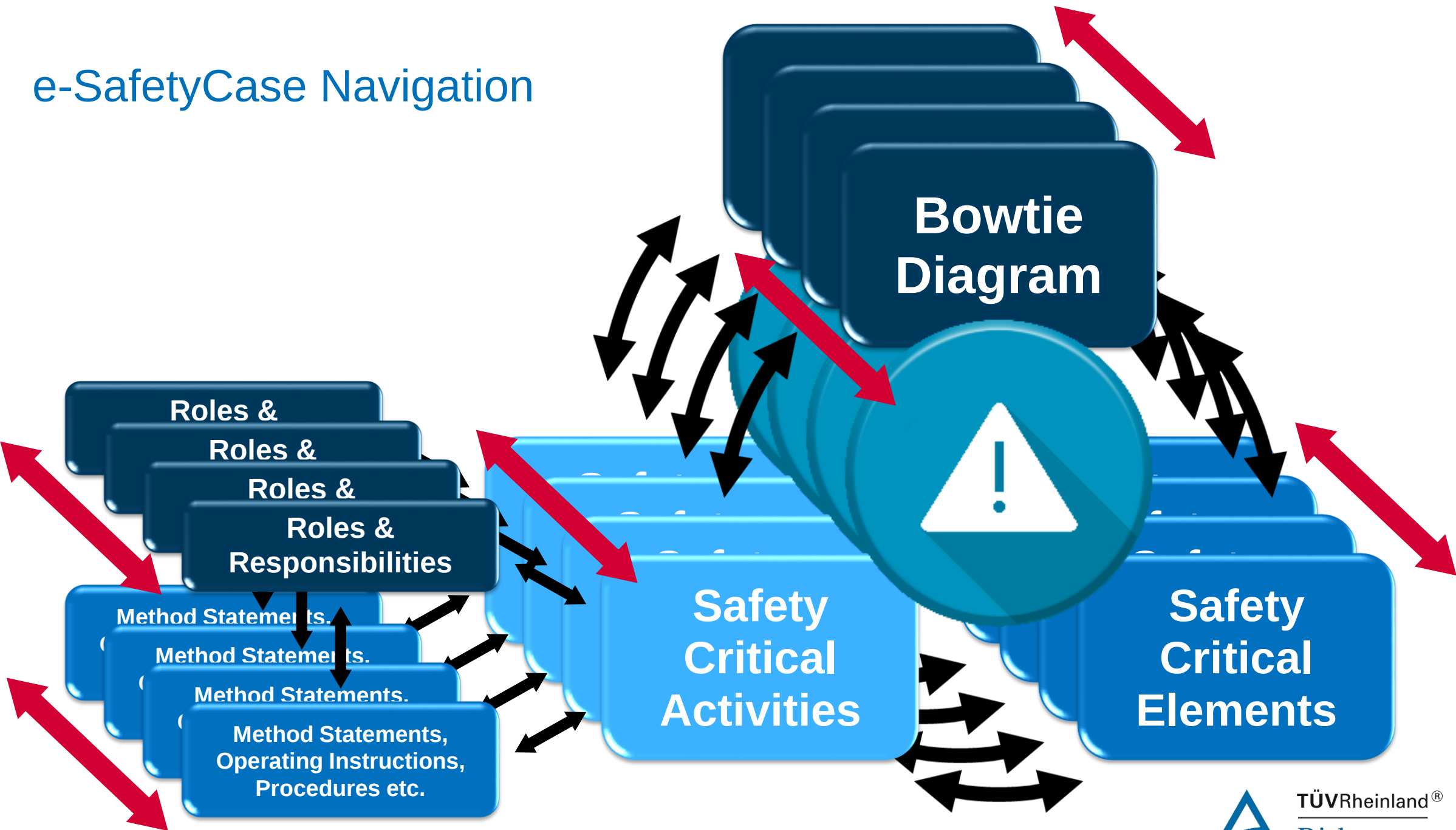
Feedback



e-SafetyCase Navigation

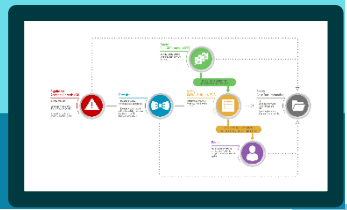
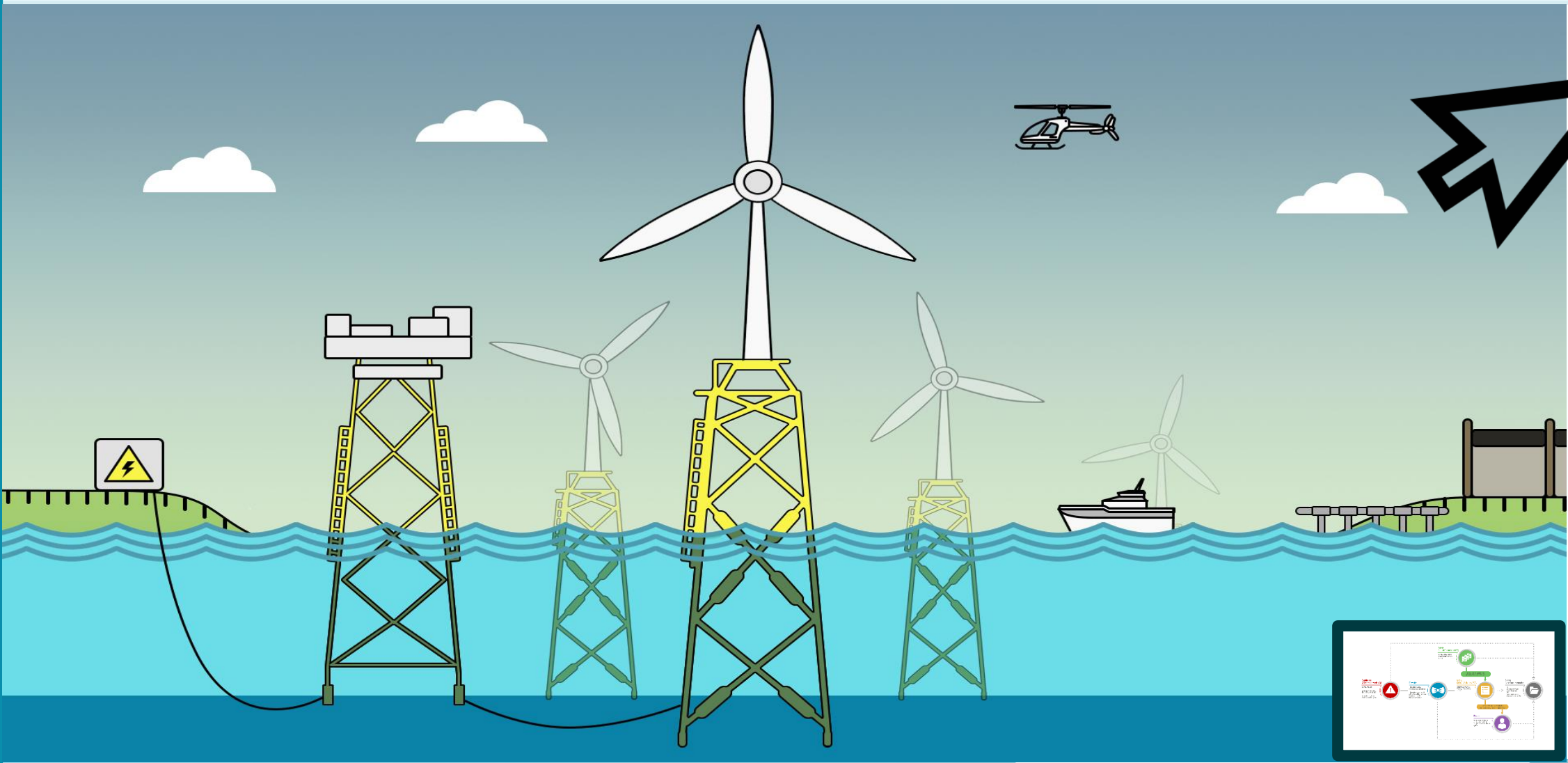


e-SafetyCase Navigation





Operations Safety Case





Significant Accident Hazards (SAH)



Control of Hazardous Energy	SAH-01 Electrical Hazards		SAH-02 Fire Hazards	
			Non-electrical	Electrical
	SAH-06 Hydraulic and Mechanical Systems - Uncontrolled Movement		SAH-07 Hydraulic Systems – Pressure Hazards	
Structural Integrity	SAH-12 Explosion Hazards		SAH-10 Suspended Loads	
	SAH-11 Loss of Structural Integrity			
Occupational Risks	SAH-04 Personnel Transfer		SAH-05 Personnel at Height	
	SAH-08 Vessel Transport		SAH-09 Helicopter Transport	
Emergency Response				

Significant Accident Hazards (SAH)

A Significant Accident Hazard (SAH) is defined as a hazard having the potential to lead to major injuries and/or fatalities. The SAHs for this windfarm were defined during a hazard screening process in the design phase of the project.

This section of the safety case allows you to navigate through the SAH pages.

Click [here](#) to open a companion document that describes the process for development of the SAH during the design stages and through to the O&M Phase. This companion document includes:

- A description of the hazard and effects register;
- A description of the process for hazard screening and identification of SAH carried out during the development of the design safety case;
- The process for management of SAH including hazard analyses and bow-tie analysis carried out during the design stages and then operationalised for the Operations Safety Case.

SAH-04 Personnel Transfer Hazards

SAH-04 Personnel Transfer Hazard Summary

The boatlanding [PC003] forms the primary means of access to each WTG and OTM, with heli-hoisting an alternative means of access at the heli-hoisting deck.

Threats which may cause a loss of control during personnel transfer could be vessel movement, human error, poor visibility or extreme weather.

Consequences of such an event could be personnel injury or fatality.

These threats and consequences are presented diagrammatically on the bow-tie diagram on the right (click on image). See [here](#) for bow-tie methodology description and [here](#) for link to full bow-tie.

Safety Critical Elements and Safety Critical Activities

The two buttons on the right provide information on the Safety Critical Elements (SCEs) and Safety Critical Activities (SCAs) associated with SAH-04. These were identified during the bow-tie development process and appear on the relevant preventative and mitigative safety barriers in the bow-ties.

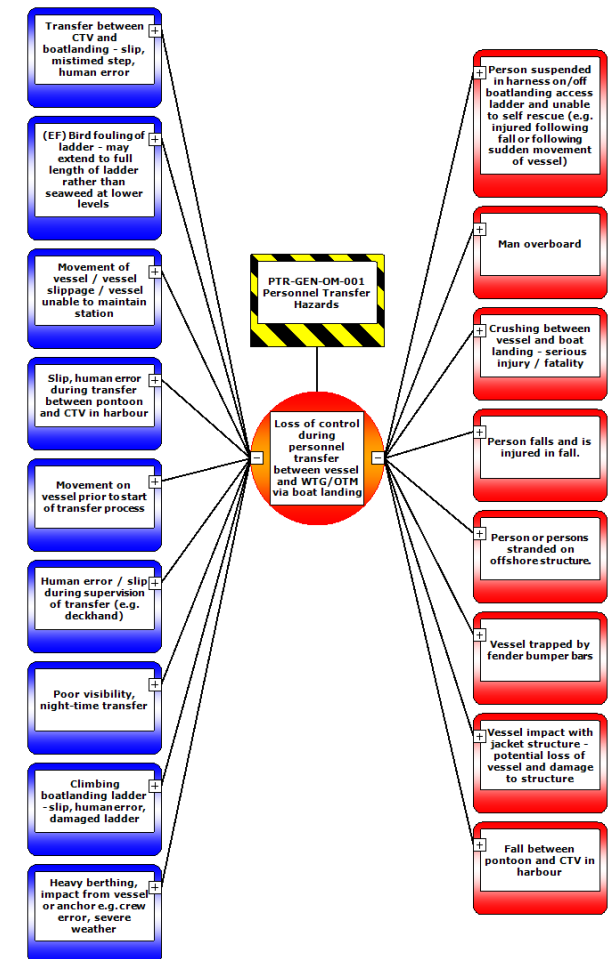
Training: Personnel Transfer



SAH-04 Personnel Transfer Hazards SCEs

SAH-04 Personnel Transfer Activities

Bow-tie Threats and Consequences





SAH-04 Personnel Transfer Hazards Activities



SAH-04 Personnel Transfer Activities

Activity Reference	Activity Title
SAFETY CRITICAL ACTIVITIES	
SCA-02	Marine Coordination
SCA-03	Provision of suitable offshore PPE and enforcement of PPE regime
SCA-10	Vessel Emergency Response
SCE ASSURANCE TASKS	
SCE-SI002	WTG Sub-Structure
SCE-PC001	CTV
SCE-PC003	Boatlanding
SCE-LS001	Fall Arrest Systems
SAFETY IMPORTANT ACTIVITIES	
SIA-01	Competency Management
SIA-02	Safety culture and leadership
SIA-03	Vessel housekeeping
SIA-06	Management of change procedures

The high level activities presented in the table on the left were identified from the bow-ties and support the safety barriers in place against loss of control during personnel transfer.

Click on an activity reference to see details of that activity and to view the sub-tasks for those activities.

See [here](#) for Safety Critical Activities (SCA) description and links to all SCAs.

See [here](#) for Safety Important Activities (SIA) description and links to all SCAs.

For details of specific Safety Assurance Tasks, see corresponding Safety Critical Element.



SCA-03 Provision of suitable offshore PPE and enforcement of PPE regime



SCA-03 Provision of suitable offshore PPE and enforcement of PPE regime					
Activity Ref.	Description of Activity	Responsibility	Bow-tie	Document	Verification
SCA-03.01	Put on immersion suit in suitable areas and ensure that it is worn while transferring	<u>/ SS Technician</u>			
SCA-03.02	Ensure that policy and practice is implemented such that personnel do not climb if FAS is out of service	<u>CTV Skipper</u>			
SCA-03.03	Ensure personnel using rope access equipment which has been certified and is inspected regularly	<u>OPS MGR</u>			
SCA-03.04	Carry out buddy check of PPE when changing over from access/climbing PPE to working PPE in the WTG. Check must be carried out prior to resuming working at height	<u>/ SS Technician</u>			
SCA-03.05	Ensure that personnel wear safety harness attached to SRL FAS, and appropriate PPE including survival suit, life jacket and hard hat at all times when transferring	<u>/ SS Technician</u>		<u>PTR-GEN-OM-001</u>	
SCA-03.06	Ensure that personnel work in restraint if covers are removed and fall hazards exist	<u>OPS MGR and SS OPS MGR</u>			
SCA-03.07	Maintenance and inspection of PPE to ensure it is in good condition	<u>OPS MGR and SS OPS MGR</u>			
SCA-03.08	Personnel to carry life jacket and immersion suit up to nacelle from T-piece on arrival at site	<u>/ SS Technician</u>		<u>EER-GEN-GN-001</u>	
SCA-03.09	Ensure footwear in good condition and free from oil / grease contamination	<u>/ SS Technician</u>		<u>HGT-WTG-OM-001</u>	
SCA-03.10	Ensure all personnel with access to WTG tower are equipped with PPE including full body harness, and work positioning belts and lanyards, which can be used to enable the climber to rest at any point on the ladder.	<u>SS OPS MGR</u>		<u>HGT-WTG-OM-001</u>	
SCA-03.11	Ensure provision of lifejacket providing at least 275 N of buoyancy	<u>OPS MGR and SS OPS MGR</u>			
SCA-03.12	Ensure provision of immersion suit and policy for wearing immersion suit is developed and enforced	<u>OPS MGR and SS OPS MGR</u>			
SCA-03.13	Ensure that personnel wear lifevests with reflective tape, whistles, and personal locator beacon (when working outside or during an emergency)	<u>OPS MGR and SS OPS MGR</u>		<u>EER-GEN-GN-001</u>	



Service Technician (Tech)

Service Technician (Tech)

SAFETY CRITICAL ACTIVITIES	
Activity Ref.	Activity Title
SCA-01	Personnel Transfer Procedure
SCA-03	Provision of suitable offshore PPE and enforcement of PPE regime
SCA-04	Work on WTG SSOW
SCA-05	Rope Access Work SSoW
SCA-06	Work inside Blade SSOW
SCA-07	Permit to Work system
SCA-08	Management of WTG / OTM Inventory
SCA-13	Work on OTM SSoW
SCA-14	Safe System of Work for Lifting Operations
SCA-15	Safe System of Work for Electrical Work
SCA-16	Helicopter Operations SSOW
SCA-17	Safe System of Work for Use of Hydraulic Tools (Owned)

SCE ASSURANCE TASKS	
Activity Ref.	Activity Title
SCE-SI003	WTG Structure
SCE-PC004	Nacelle Heli-hoist Deck
SCE-PC007	WTG Tower Lift
SCE-PC011	Blade (Internal)
SCE-HC001	Hydraulic System
SCE-HC002	WTG Transformers
SCE-HC004	Service Lifting Equipment
SCE-HC012	LV Supply System
SCE-HC014	Electrical Cabinets / Containers
SCE-DS004	Fire/smoke Detection Systems
SCE-PS003	Lightning Protection System
SCE-SD001	WTG Shutdown
SCE-ER001	Escape & Evacuation Routes
SCE-LS001	Fall Arrest Systems

SAFETY IMPORTANT ACTIVITIES	
Activity Ref.	Activity Title
SIA-04	WTG housekeeping

Insert high level role description



This section allows you to navigate through the different responsibilities identified from the bow-ties associated with the role of Service Technician.

The tables on the left provides a summary list of high level activities, these include;

- Safety Critical Activities – *activities which are critical to ensuring safety and continued integrity of design*
- SCE Assurance Tasks – *these tasks assure the Safety Critical Elements continue to function as intended*
- Safety Important Activities - *are not safety critical but are responsible for supporting safety critical activities*

For each high level activity there are sub-tasks. Open [this document](#) to see all sub-tasks for which the Service Technician is responsible.

The ‘activity reference’ links in the tables to the left navigate to detailed activity pages which also provide links to bow-ties where they appear and documentation which support the activities and tasks.



People (Roles & Responsibilities)

- + Site Operations Manager (OPS MGR)
- + Service Operations Manager (Serv OPS MGR)
- + Marine Controller (MCO)
- + Electrical Switching Supervisor (ESS)
- + Control Room Shift Supervisor/Emergency Controller (CRSS/EC)
- + Maintenance Technician (MT)
- + Service Technician (S Tech)
- + Control Room Operator (CRO)
- + Service Manager (SERV MGR) / Technical Support (STS)
- +
 - Service Asset Engineers (SAE)
 - Emergency Command Team (ECT) / Duty Officer (DO)
 - Boat Leaders (BL)

People (Roles and Responsibilities)

This section of the safety case allows you to navigate through the different roles and responsibilities identified from the bow-ties produced for the O&M Phase of the Offshore Windfarm.

The People pages of this safety case contain information regarding the following:

- Activities that each role is responsible for implementing;
 - Safety Critical Activities (SCA) – *activities which are critical to ensuring safety and continued integrity of design*
 - SCE Assurance Tasks (SCE) – *these tasks assure the Safety Critical Elements continue to function as intended*
 - Safety Important Activities (SIA) - *are not safety critical but are responsible for supporting safety critical activities*
- Links to the bow-ties from where the roles and responsibilities were identified;
- Competency requirements for each role.

The roles and responsibilities for third party personnel can be found using the button below.

Third Party Roles and Responsibilities

Benefits of an e-SafetyCase

- Accessible
- Engaging
- Intuitive
- Useful
- Relevant
- Used
- Up-to-date



Summary of benefits of an e-SafetyCase

1. Provides an accessible, engaging and intuitive basis of safety which proactively drives and encourages safe operations.
2. Naturally evolves hand-in-hand with the facility as routine business.
3. Provides a seamless link between hazards and the actions people need to take to ensure risk is reduced ALARP.

.....brings Safety Case to life!



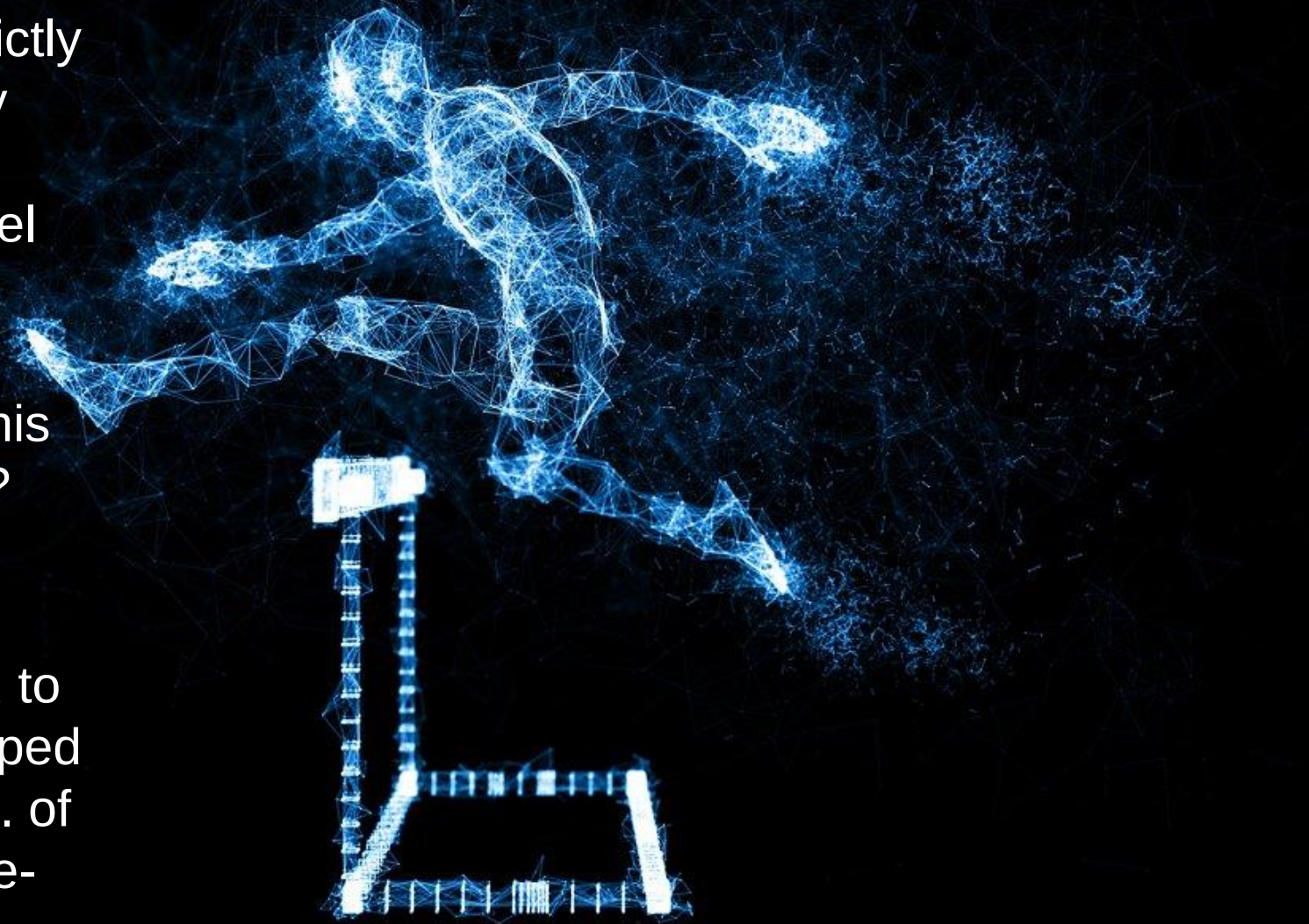
So why aren't all Safety Cases electronic?



Cost
Maintenance

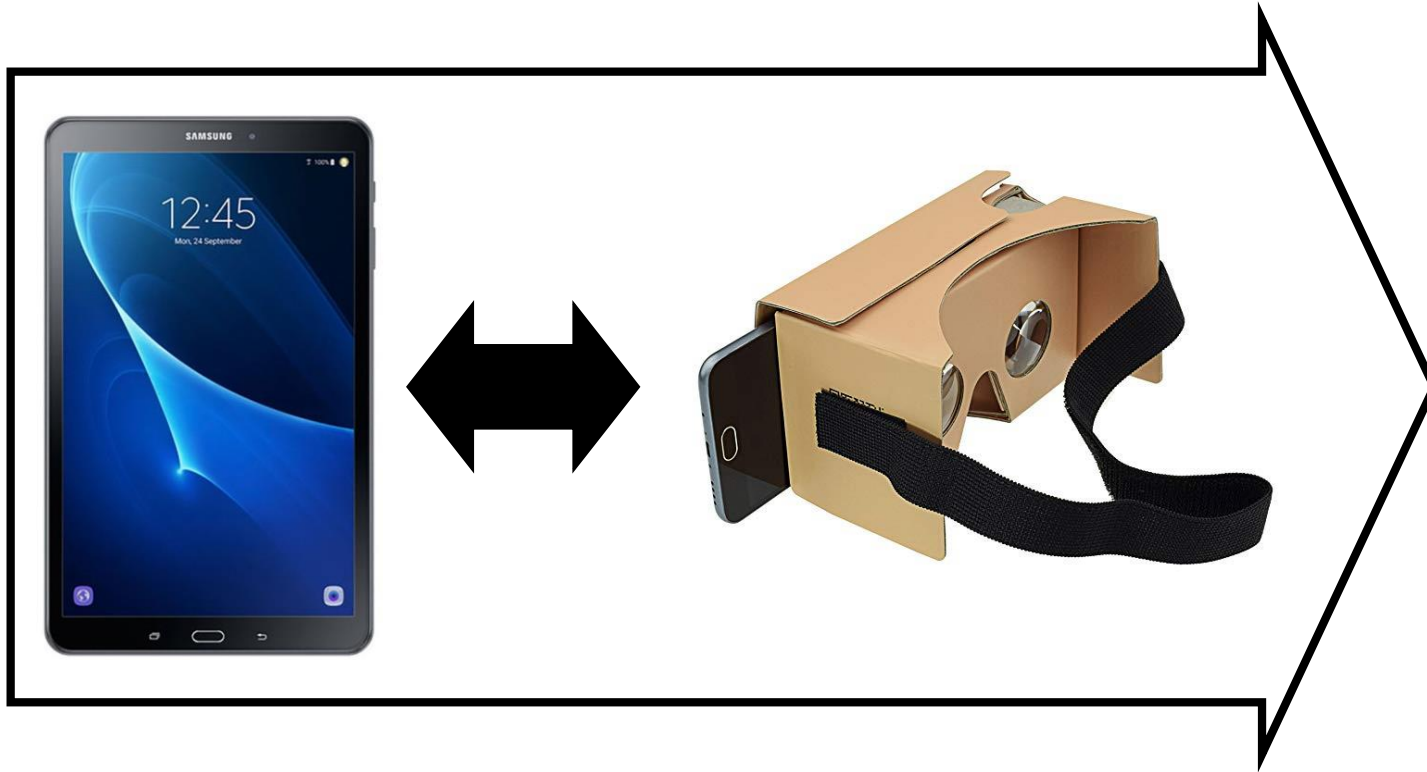
Challenges

1. A regulatory Safety Case is a strictly controlled document and for very good reason. How can an e-SafetyCase deliver the same level of control?
2. A Safety Case includes highly sensitive information. How can this be kept secure in a virtual world?
3. Regulated industries expect a traditional paper-based Safety Case. This is what they are used to and they will invariably have shaped the format, structure, content etc. of these. Will regulators accept an e-SafetyCase?

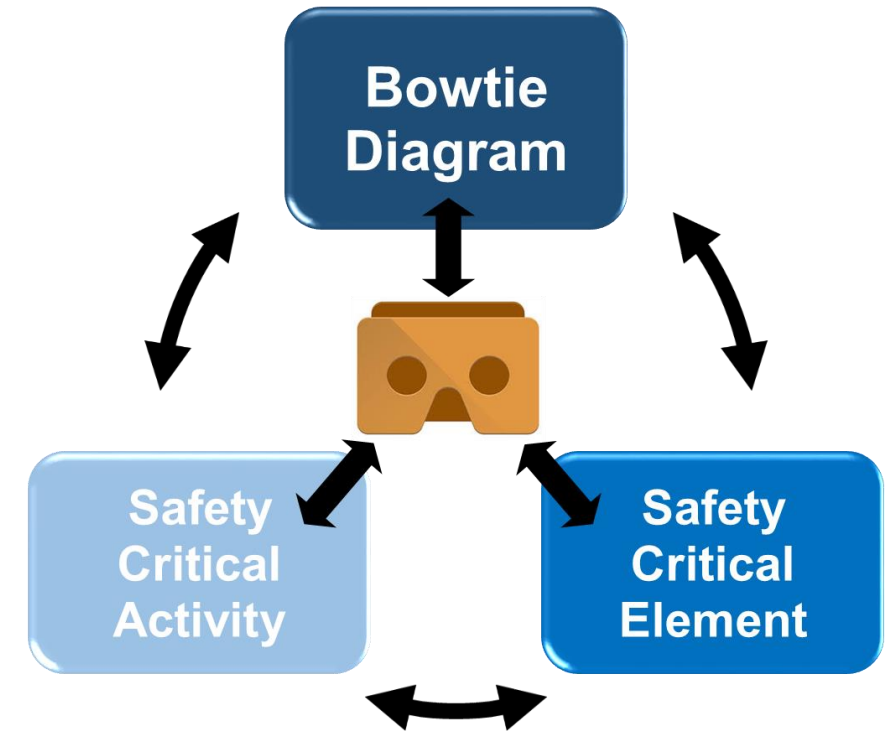


Future Developments – blending VR with e-SafetyCase

Hardware

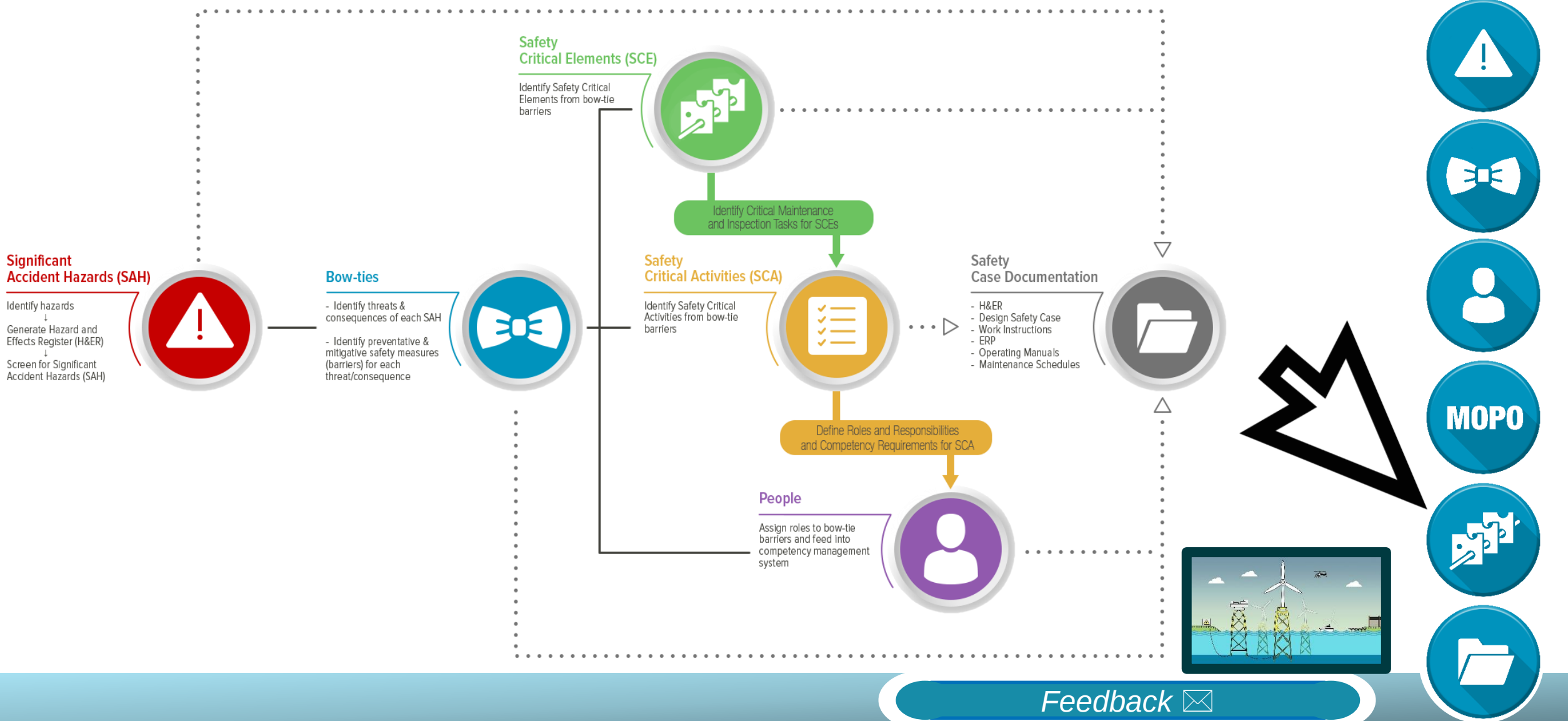


Functionality



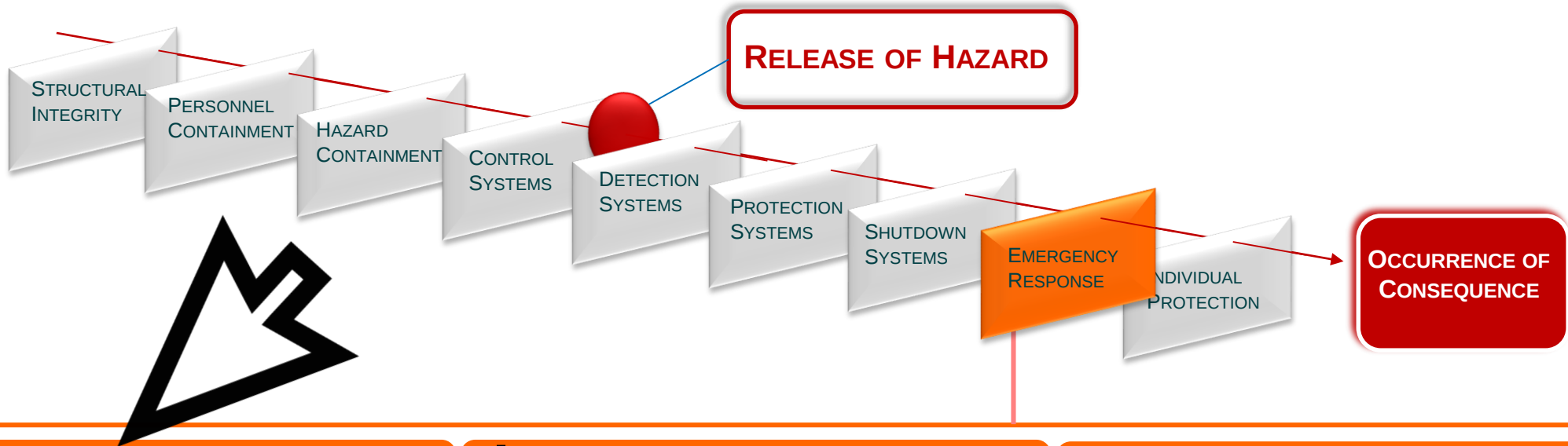


Operations Safety Case





Emergency Response Safety Critical Elements (SCEs)



- + ER001: Escape & Evacuation Routes
- + ER002: Fire Fighting Equipment
- + ER003: Support Vessel
- + ER004: Support Helicopter

- + ER005: Emergency Power System
- + ER006: Communication System (Emergency)
- + ER007: Emergency Evacuation Equipment
- + ER008: Temporary refuge/Primary Muster Areas

- + ER009: Emergency Escape/ Lighting
- + ER010: Local Alarms
- + ER011: First Aid Equipment



ER001 Escape & Evacuation Routes

ER001 Escape & Evacuation Routes

Goal: To enable people to safely evacuate during an emergency.

Safe, direct and unobstructed exits, access, and escape routes are provided from all normally manned areas of the structures to muster areas and embarkation or evacuation points.

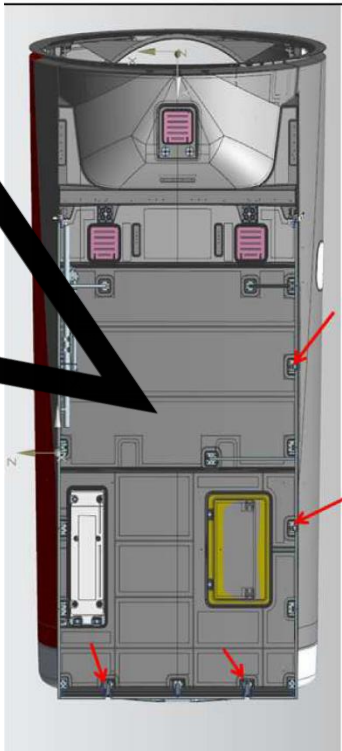
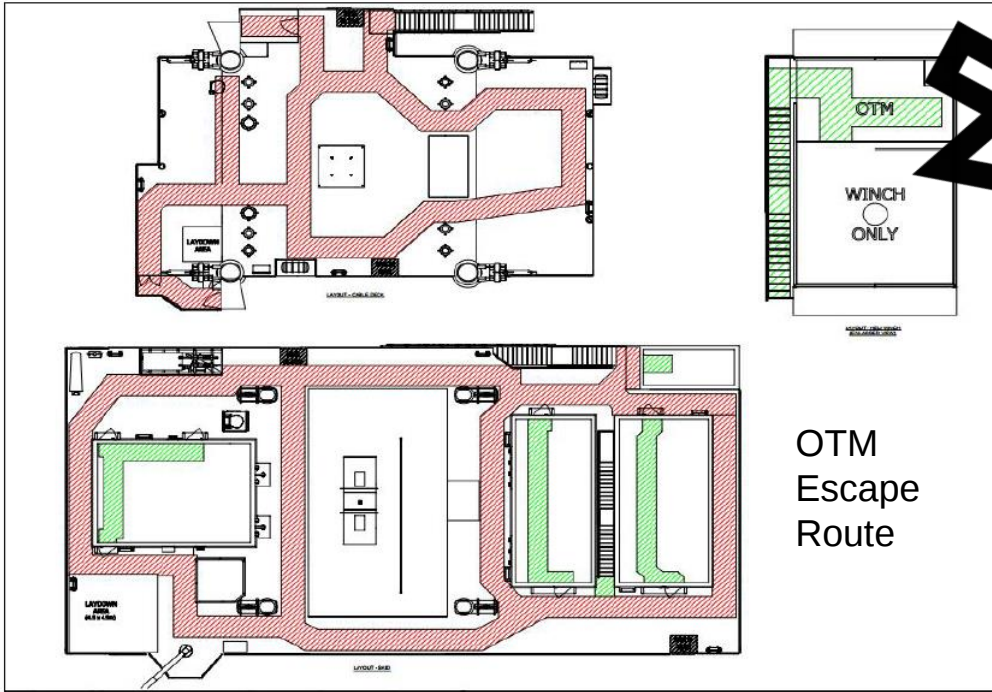
In the event of an emergency, personnel may escape the WTG via the primary escape route which is down the tower and boatlanding for evacuation by CTV. If the primary route is impaired, a secondary means of evacuation is through the nacelle onto the to be winched by helicopter or to escape over the deck railing via a milan descender.

On the OTM there are two boatlandings for evacuation by CTV or an alternative means is available on the roof of the control container for evacuation by helicopter. The OTMs are equipped with one stairway between the skid and cable decks, as part of the primary escape route. A ladder between the skid and cable decks is also provided as a means of secondary escape.

All escape doors from rooms on the installation are designed to open in the direction of escape and shall not block the external escape routes.

Corresponding SAH	
SAH	SAH Title
SAH-01	Electrical Hazards
SAH-02	Fire Hazards
SAH-03	Structural Integrity
ER	Emergency Response

SCE ASSURANCE TASKS		
Activity Reference	Activity Title	Responsible
SCE-ER001.01	Technicians will inspect tower prior to descending to confirm whether tower is impaired	Service Technician



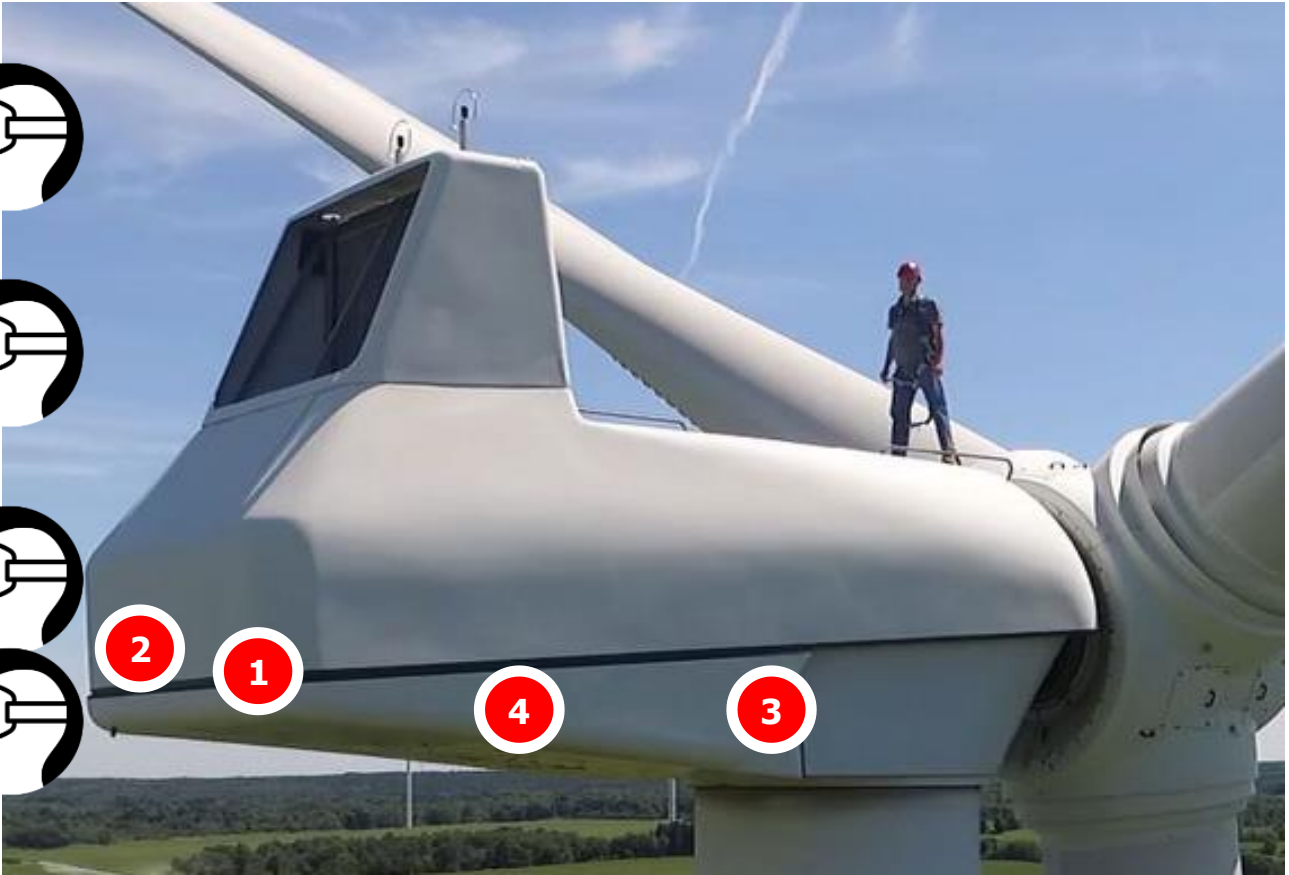
Nacelle Helihoist Deck Assembly Area and anchor points



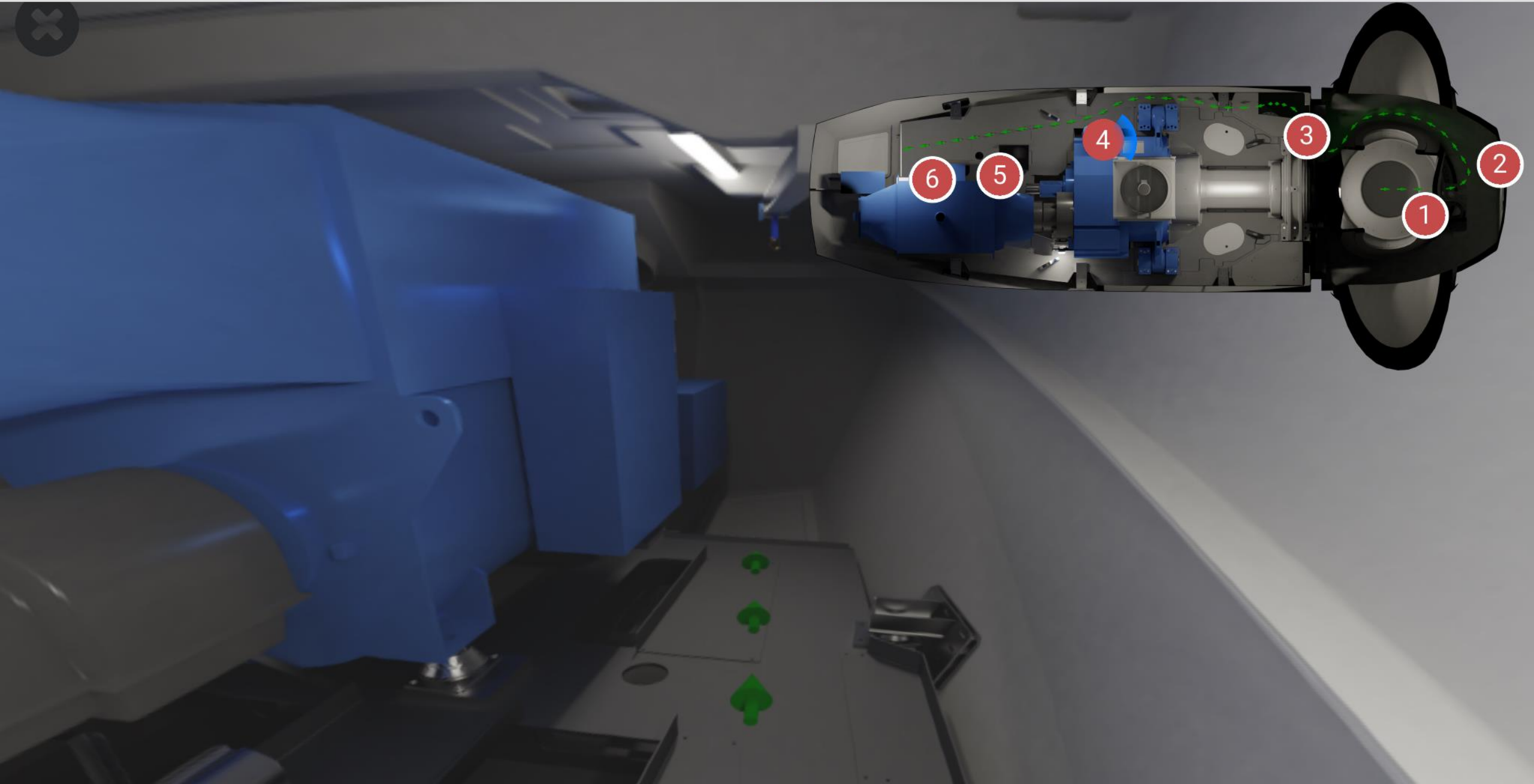
ER001 Escape & Evacuation Routes

ER001 Escape & Evacuation Routes – Wind Turbine

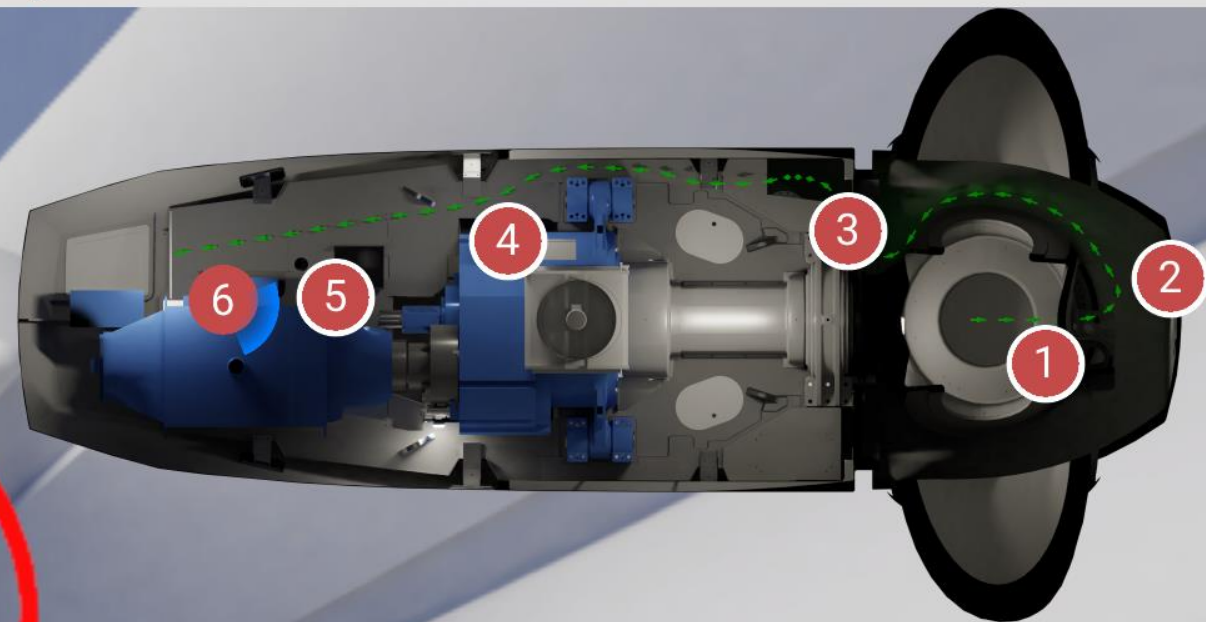
Loc	Time	Visibility	Comment
1	0	100%	The fire is identified, and you start to realise there is a need to evacuate
2	10	80%	You make your way forward in the nacelle and see that visibility is decreasing, and that Evacuation Route 1 is not useable
3	60	40%	You start to locate the descent device and get ready to set it up
4	90	30%	You have the device fitted and open the hatch ready to evacuate



Risktec eSafety Case



Risktec eSafety Case





ER007 Emergency Evacuation Equipment

ER007 Emergency Evacuation Equipment

Goal: To enable people to safely evacuate during a major incident.

The WTGs are fitted with an emergency evacuation equipment store (far right bottom) in the nacelle comprising six immersion suits and three Milan descenders.

The OTM has two (2) throwover liferafts (far right top) to be used via descent frame and DONUT devices (8 no.) (near right bottom). The DONUT safety devices enable each person to safely escape by means of controlled descent. The device may be attached to a handrail or other load bearing structure but the specialist descent frame should be the primary method. The DONUT provides the user a guaranteed entry to the safety of the life raft. In addition, a DONUT Safeland Rescue Unit has been provided to ensure that injured persons can be lowered by stretcher to a CTV. The OTM also has a Milan hub (near right top) to allow winching of a stretcher to a vessel below.

The table below indicates which SAH(s) are linked to ER007.

Corresponding SAH	
SAH	SAH Title
SAH-02	Fire Hazards
SAH-03	Structural Integrity
SAH-08	Vessel Transport
SAH-09	Helicopter Transport
ER	Emergency Response

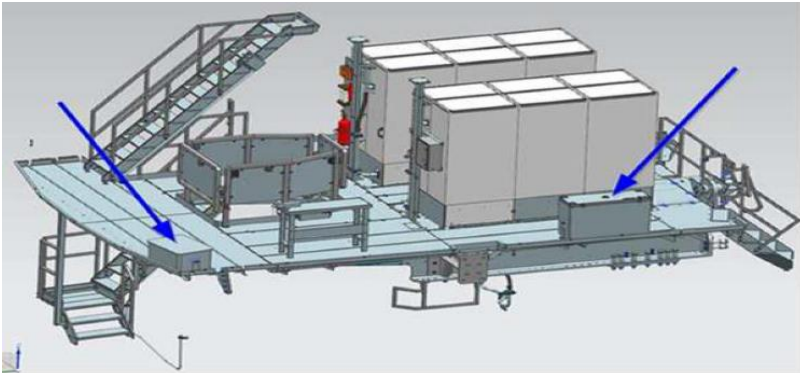
SCE ASSURANCE TASKS		
Activity Reference	Activity Title	Responsible
SCE-ER007.01	Develop operational procedure to inspect and manage lifesaving equipment (liferafts on OTM)	Operations Manager

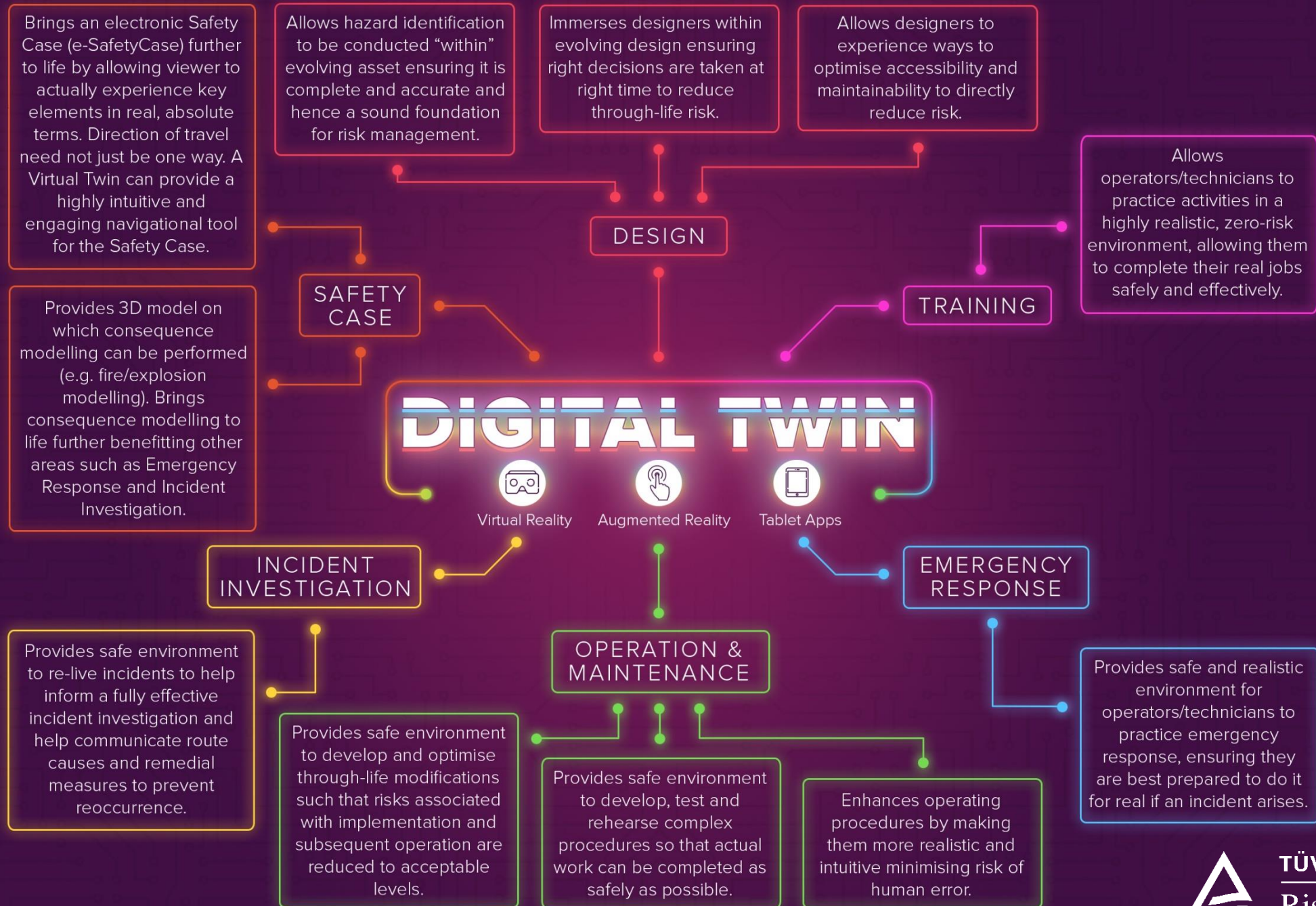


- Suitably stored next to the life raft.
- 4 normal at each liferaft within a suitable container Personal Rescue Device using simplified abseiling principles.
1 No. capable of lowering a stretcher - Safeland
- Offers the means of escape from very high structures in hostile environments and ever-changing conditions.
- Compact and unrestricting, the device is ISO 9002 approved and has certification from all major international regulatory authorities, providing the operator with complete confidence.



- ① Harness
- ② Containment Bag
- ③ Descender Unit
- ④ High Strength Tape
- ⑤ Wire Strap
- ⑥ Liferaft Strap
- ⑦ Quick Release Mechanism





Conclusions

- An e-SafetyCase is no more onerous to produce and maintain than a conventional Safety Case - it's just different!
- Could be so useful and effective it will naturally evolve hand-in-hand with the facility as routine business.
- Provides an accessible, engaging and intuitive basis of safety which proactively drives and encourages safe operations.
- Can be blended with technological innovations such as Virtual Reality to further bring it to life.



Thank you

Have a safe and secure day!

Gareth Ellor – Director Renewables & Innovation
gareth.ellor@risktec.tuv.com
risktec.tuv.com

