OIL & GAS

PetroHRA – assessing operational barrier elements

Koen van de Merwe

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Some definitions to start with…

Human Reliability Assessment	A structured approach used to identify potential human failure events and to systematically estimate the probability of those events using data, models, or expert judgment.
Human Failure Event	A basic event that represents a failure or unavailability of a component, system, or function that is caused by human inaction, or an inappropriate action.

Barrier definitions

Barrier

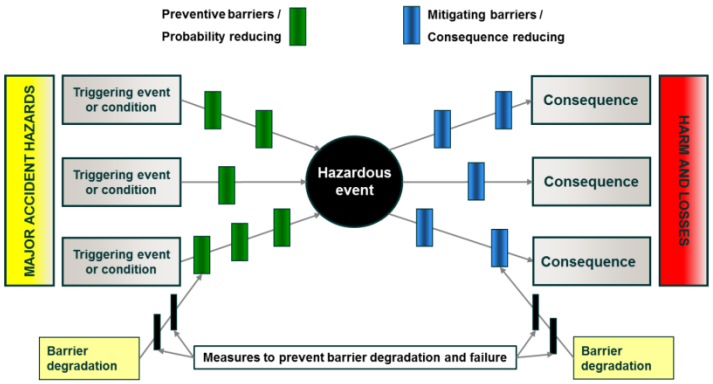
Barriers refer to measures established with an explicit purpose to (1) prevent a hazard from being realized, or (2) to mitigate the effects of a hazardous event.

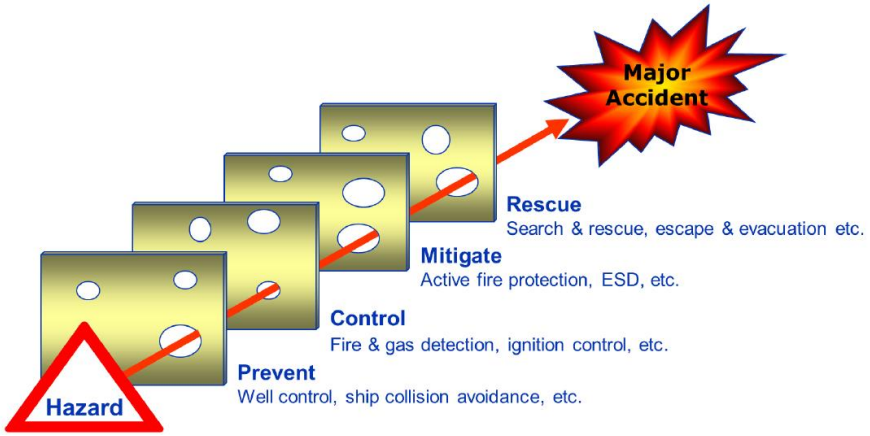
Barrier function

The purpose or role of a barrier.

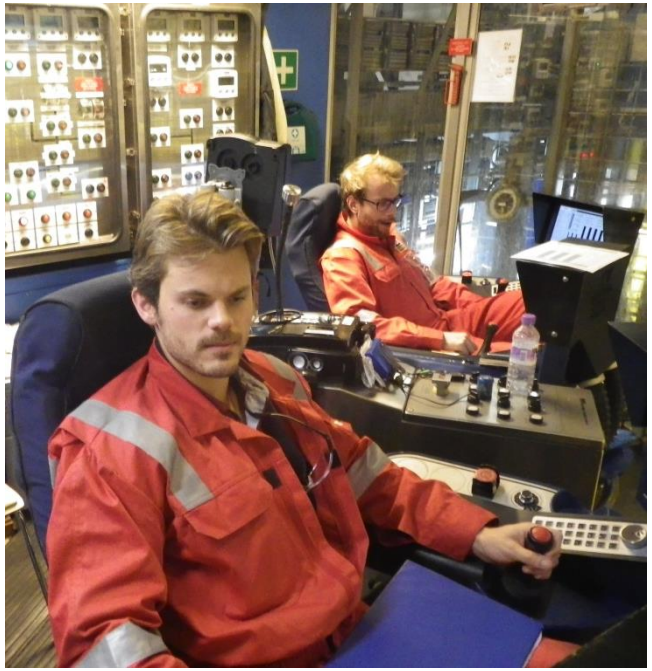
Barrier element

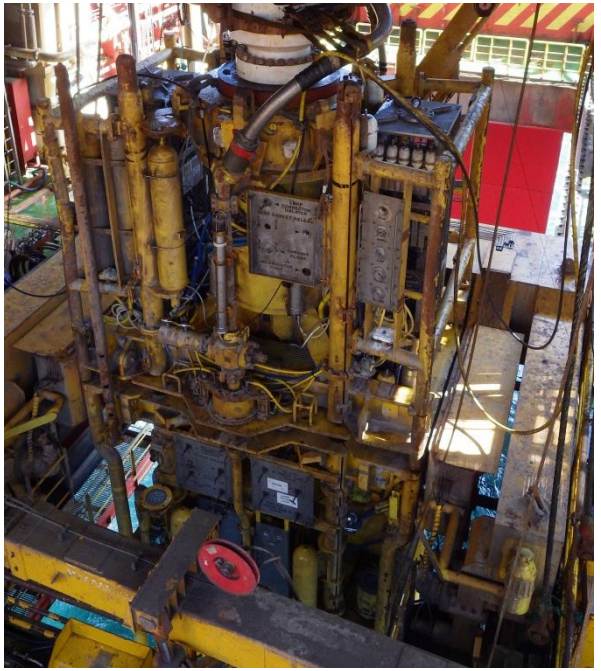
Technical, operational or organisational measures which alone or together realize one or several barrier functions.





Operator tasks as operational barrier elements*



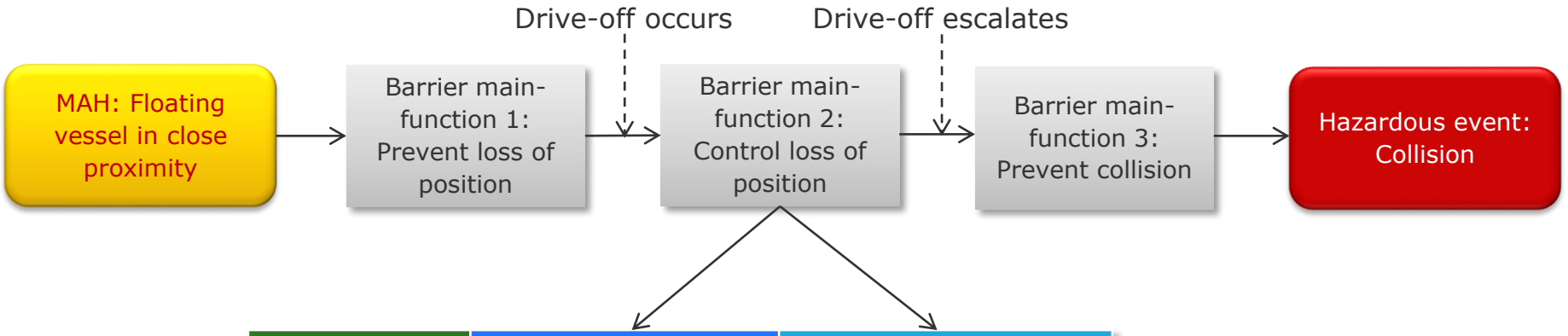


Operational barrier element

A task performed by an operator, or team of operators, which realizes one or several barrier functions.

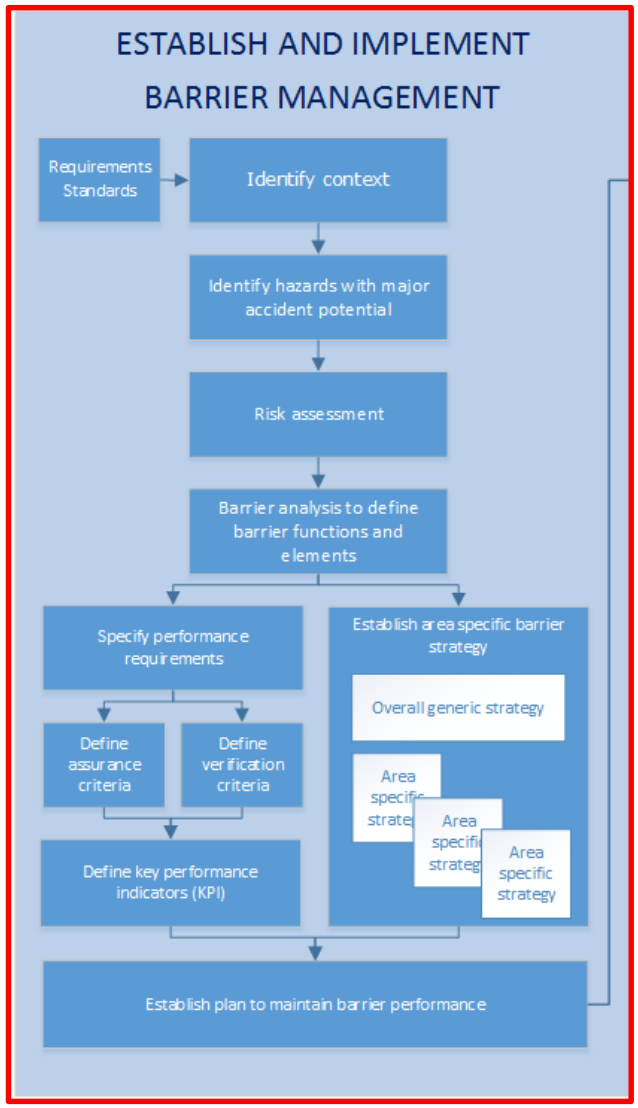
*Good practices – Barrier management in operation for the rig industry (2014)

A Dynamic Positioning example



Barrier sub-functions	Operational barrier elements	Technical barrier elements
2.1 Detect loss of position	Detect alarms from DP system	Reference systems
	Check absolute position	Gangway sensors
	Etc.	Etc.
2.2 Diagnose situation	Check current parameters	Weather sensors
	Check thruster parameters	Thruster azimuth & load
	Etc.	Etc.
Etc.	Etc.	Etc.

Analysing reliability of human performance



	Example
Requirements	DP rig on NCS
HAZID	Collision due to drive-off
BowTie	Operator intervention
Task requirements	Intervene within X seconds
How reliable?	Time required by operator
	Time available to intervene
PSF analysis	Training, system support, procedures, stress mgmt, …

↓

- Reduce human error
- Improve performance
- Improve reliability
- Reduce uncertainty

PetroHRA

The Research Council of Norway

Statoil

DNV·GL

NTNU – Trondheim
Norwegian University of Science and Technology

Idaho National Laboratory

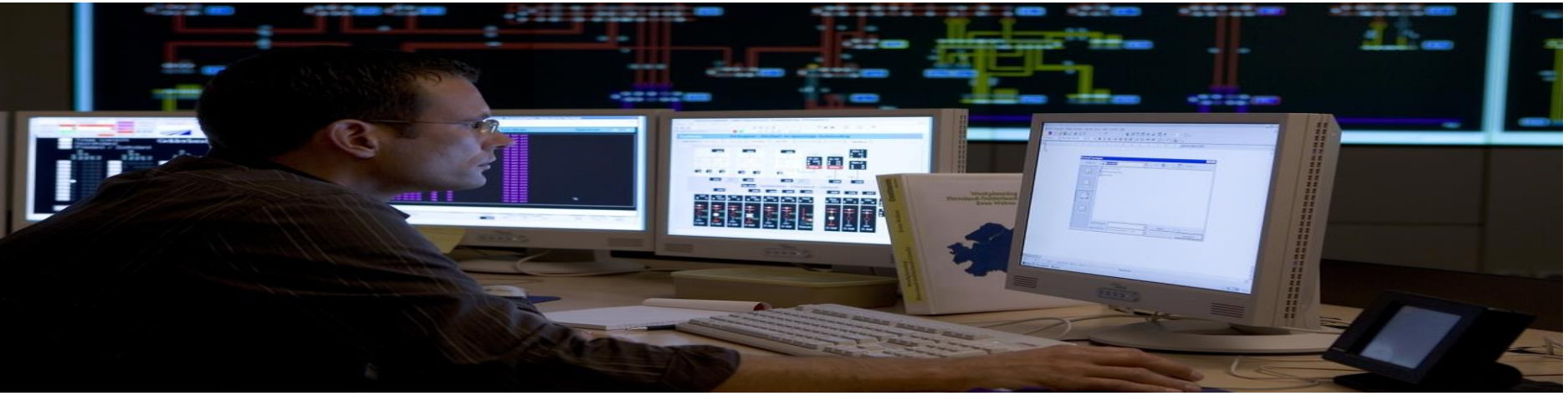
SINTEF

PetroHRA

Objective	To test, evaluate and adjust HRA to accident scenarios in the petroleum industry, improving the decision basis for managing risk in design and operations.
Schedule	2012 - 2016
Deliverable	Validated HRA method for the petroleum industry
Activities	Adapting PSFs to the petroleum context Establishing task and error libraries Established guidance on qualitative data collection Expert group quantification **Apply guideline to case studies for testing** **Develop and deliver final PetroHRA guideline**

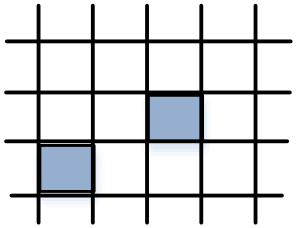
HRA results

Quantitative	Estimate *likelihood* of human error
Qualitative	Understand *why* tasks are prone to error - Error mechanisms - Performance Shaping Factors - Dependency

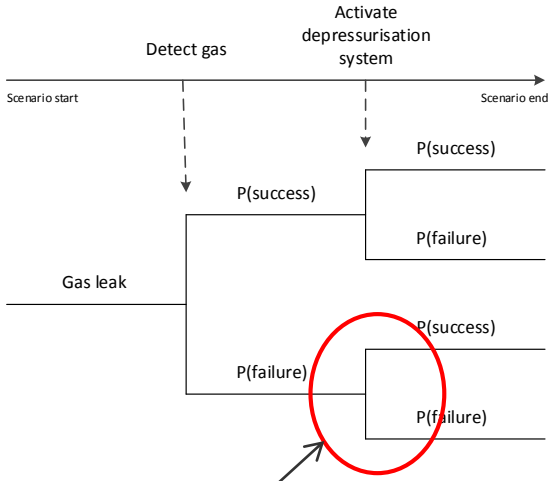


HRA method

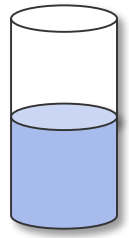
Scenarios / HAZID



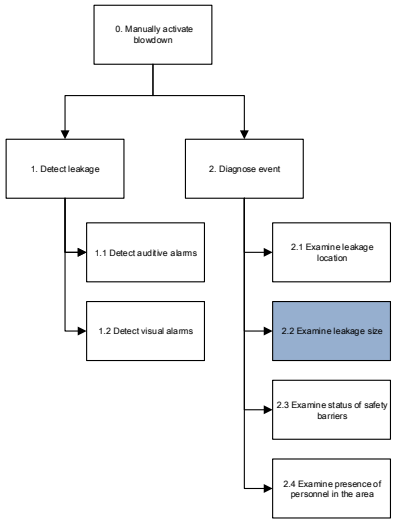
Build event tree



Risk level

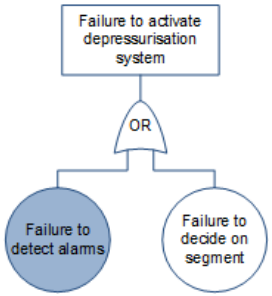


Create Task Analysis



Identify potential errors

Model errors (in Fault Tree)



Integrate overall error probability in QRA event tree

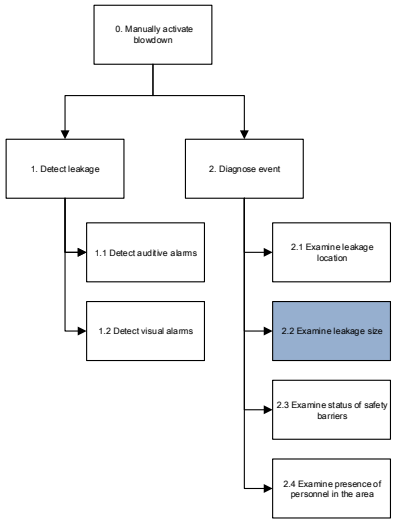
Integrate error probabilities in model

Assess Performance Shaping Factors & quantify human error

Multiplier	PSF
10	HMI
5	Procedures
...	...
HEP = .15	

HRA method

Task identification	Identify which tasks form the operational barrier element
Task analysis	Identify performance requirements for the tasks
Error identification	Understand how the task may fail



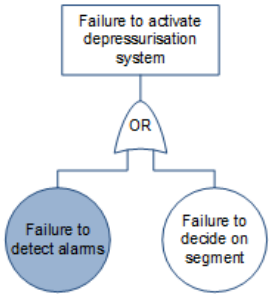
HRA method

Error modelling

Identify interactions between failures

Identify potential errors

Model errors (in Fault Tree)



Integrate error probabilities in model

Assess Performance Shaping Factors & quantify human error

Multiplier	PSF
10	HMI
5	Procedures
...	...
HEP = .15	

HRA method

PSF assessment	Identify factors influencing performance
Error reduction	Set performance requirements to PSFs

Create Task Analysis

Identify potential errors

Model errors (in Fault Tree)

Integrate error probabilities in model

Assess Performance Shaping Factors & quantify human error

Multiplier	PSF
10	HMI
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...	...
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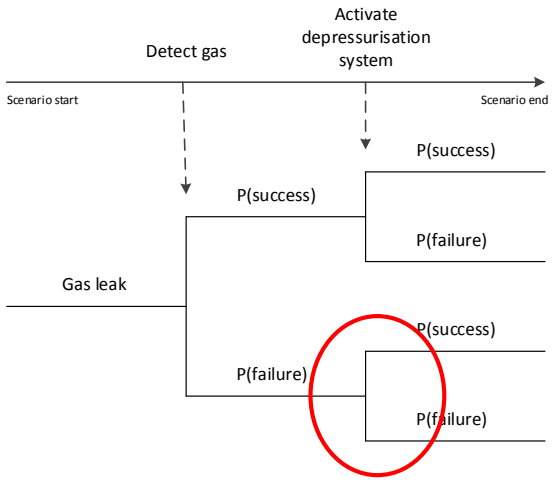
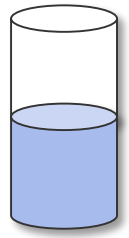
HRA method

Scenarios / HAZID

Build event tree



Risk level



Create Task Analysis

Error quantification

Identify absolute and relative contribution to risk

Identify potential errors

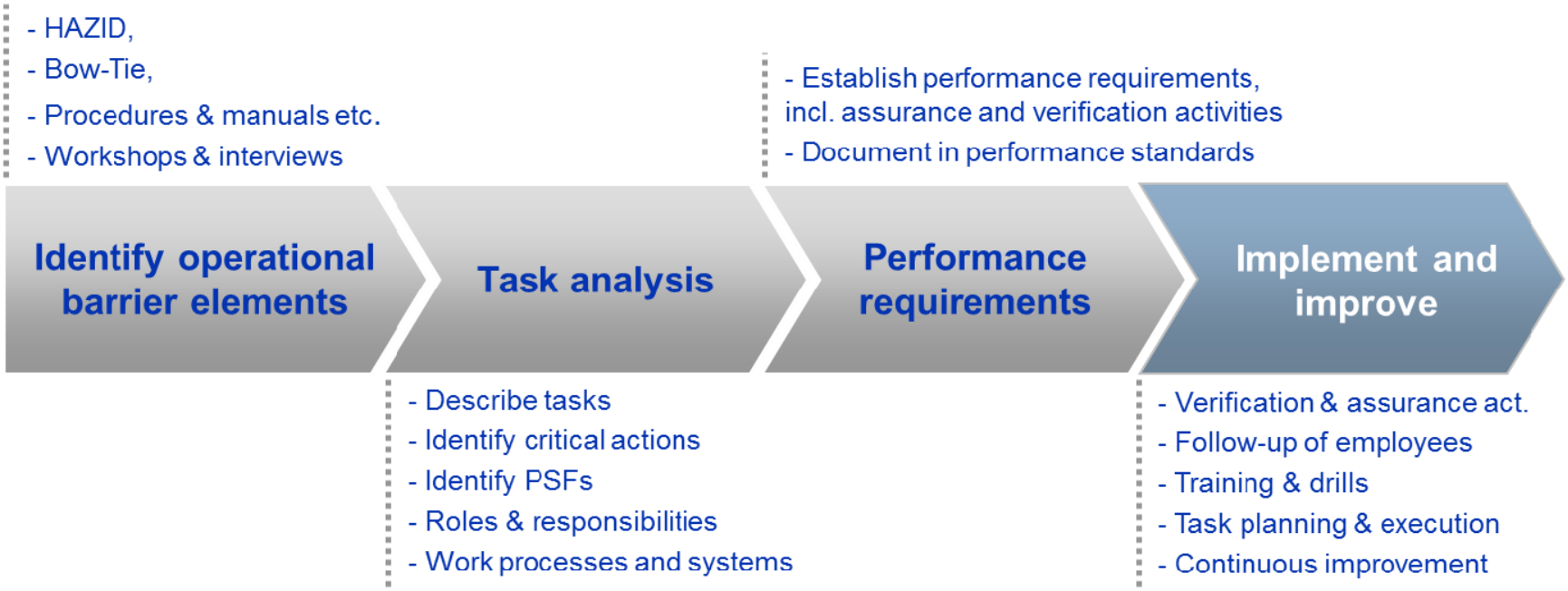
Model errors (in Fault Tree)

Integrate error probabilities in model

Assess Performance Shaping Factors & quantify human error

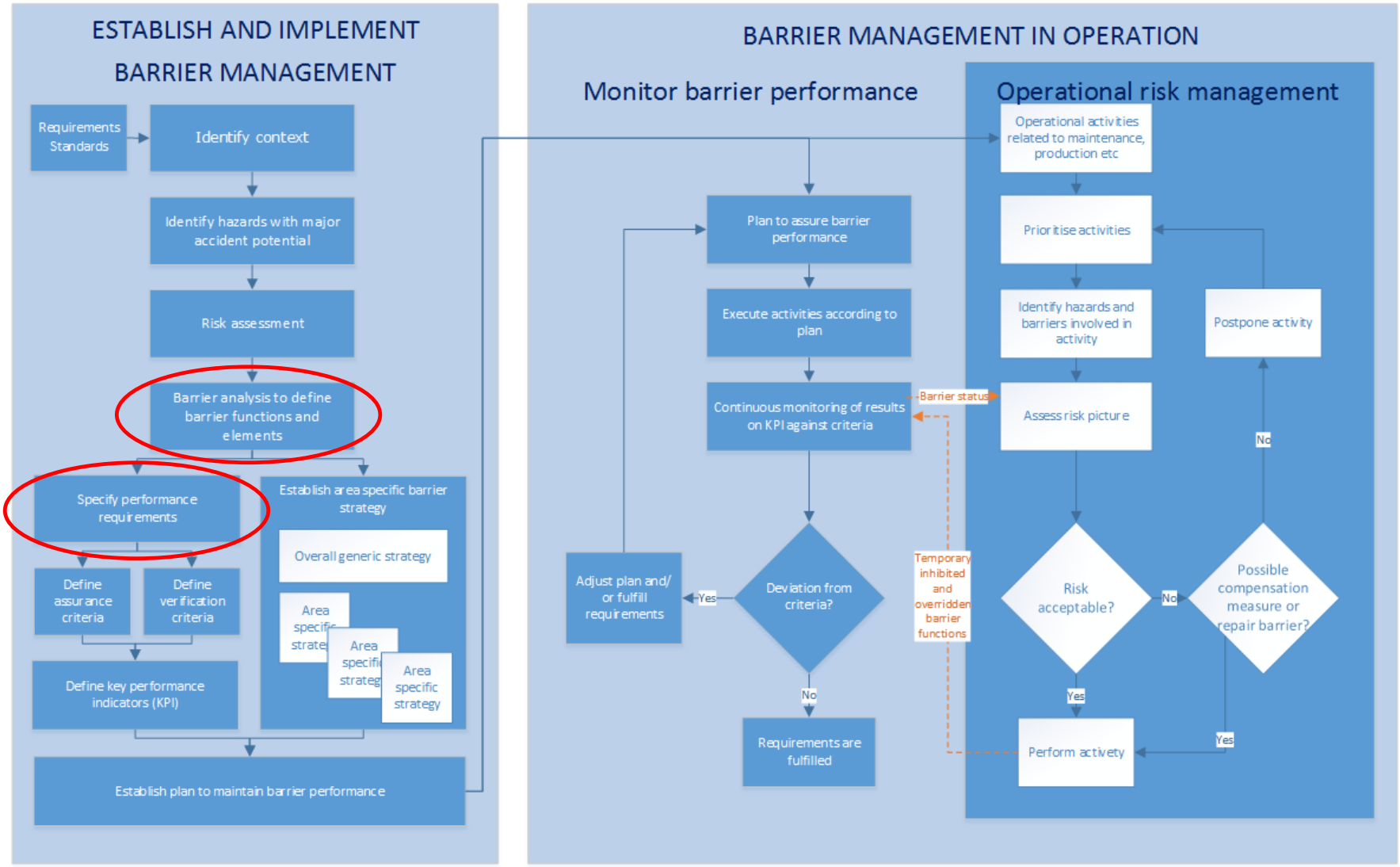
Multiplier	PSF
10	HMI
5	Procedures
...	...
HEP = .15	

Identify – analyse – establish – follow up



Note that this process is part of an overall barrier analysis

Analysing reliability of human performance



Conclusion

Barrier analysis

Structured approach analysing human contribution to major accident risk

Risk reduction through focus on factors (PSFs) influencing human error

Solid basis for writing procedures, competence development, and improvements of technology

Gives personnel involved a thorough review of their practices and systems

Methodological

Consists of a suite of well-established (HF) methods

- Task analysis
- Error identification analysis
- Event tree/Fault tree
- SPAR-H

Builds on well-proven approaches from nuclear, with long history of use and research

Can be applied fully or partially to a wide range of technologies and operations

Systematic approach to identifying performance requirements for operational barrier elements

Thank you!

Koen van de Merwe
Koen.van.de.merwe@dnvgl.com
+47 93 06 3660

www.dnvgl.com

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