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- Barrier definition
- HF's role in barrier management



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PSA BARRIER MEMO - INTRODUCTION



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The barrier concept was introduced in the Norwegian petroleum regulations in 2002

Section 5 on Barriers

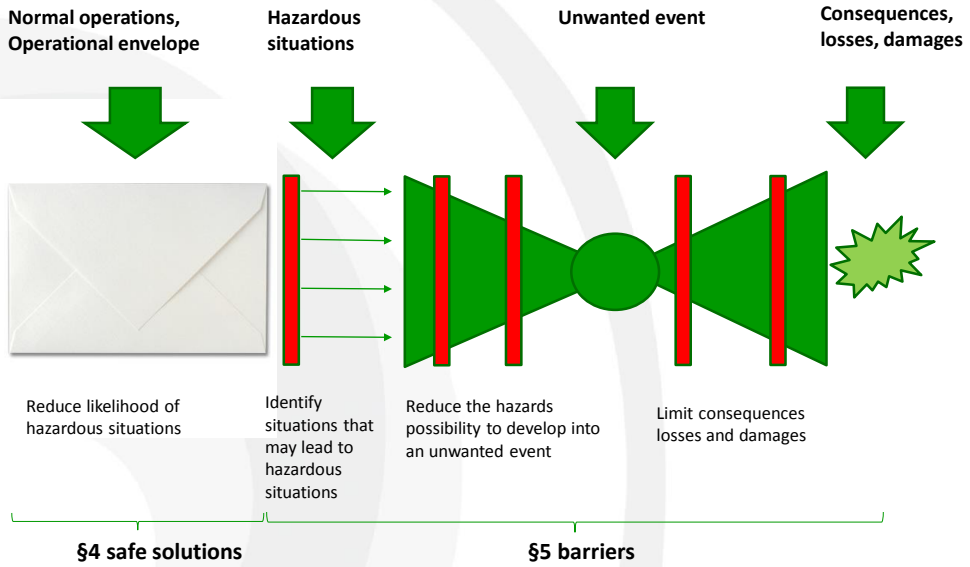
Barriers shall be established that at all times can

- a) identify conditions that can lead to failures, hazard and accident situations,*
- b) reduce the possibility of failures, hazard and accident situations occurring and developing,*
- c) limit possible harm and inconveniences. (...)*

*Personnel shall be aware of what barriers have been established and which function they are intended to fulfil, as well as what performance requirements have been defined in respect of the concrete **technical, operational or organisational barrier elements** necessary for the individual barrier to be effective.*

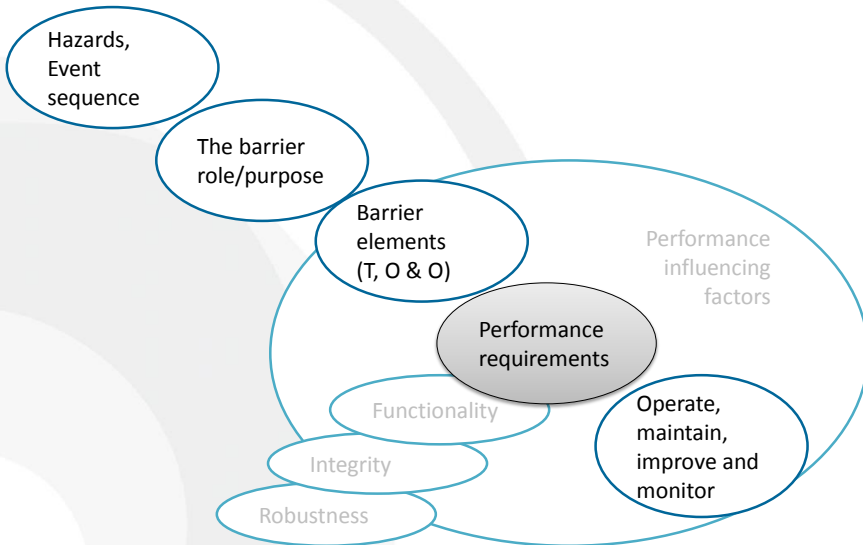


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Context



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Barrier elements

- Most barrier elements will be **purely technical or fully automated** such as damaged stability, fire walls, deluge or ESD valves
- Some will function due to an **interaction between technical, operational and organisational barrier elements**
- Some may function purely based on operational and organisational barrier elements



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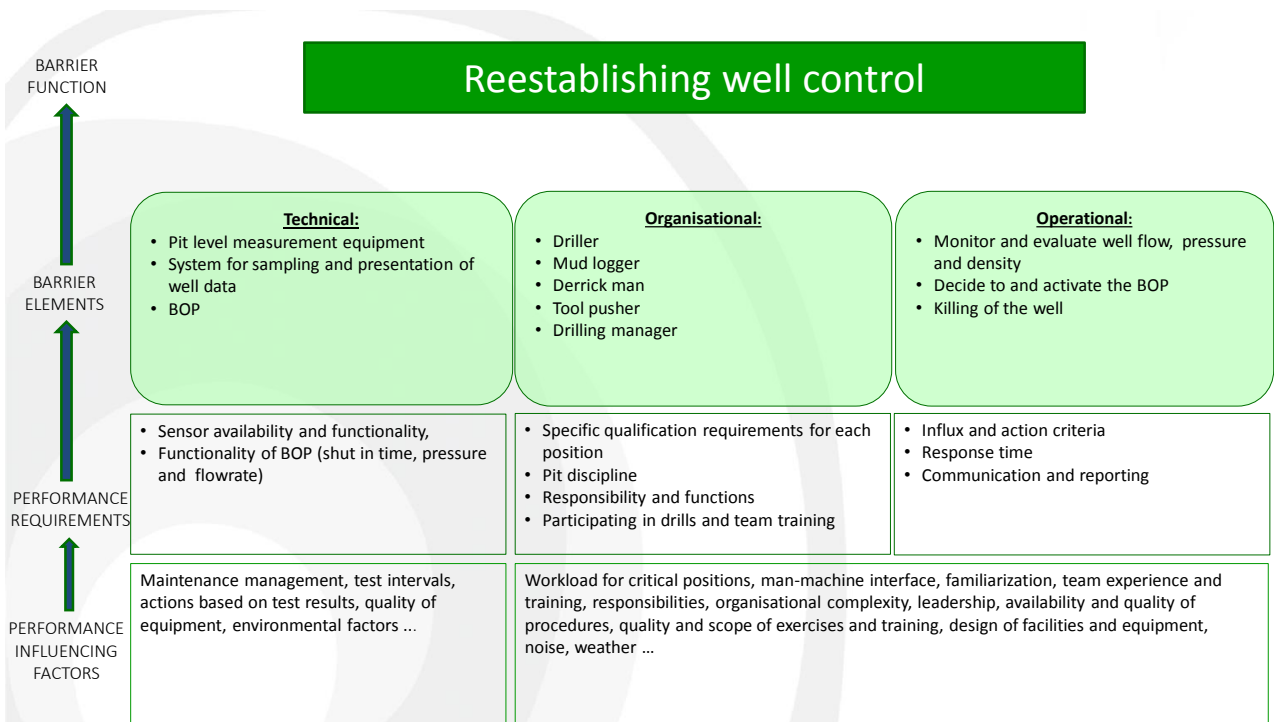
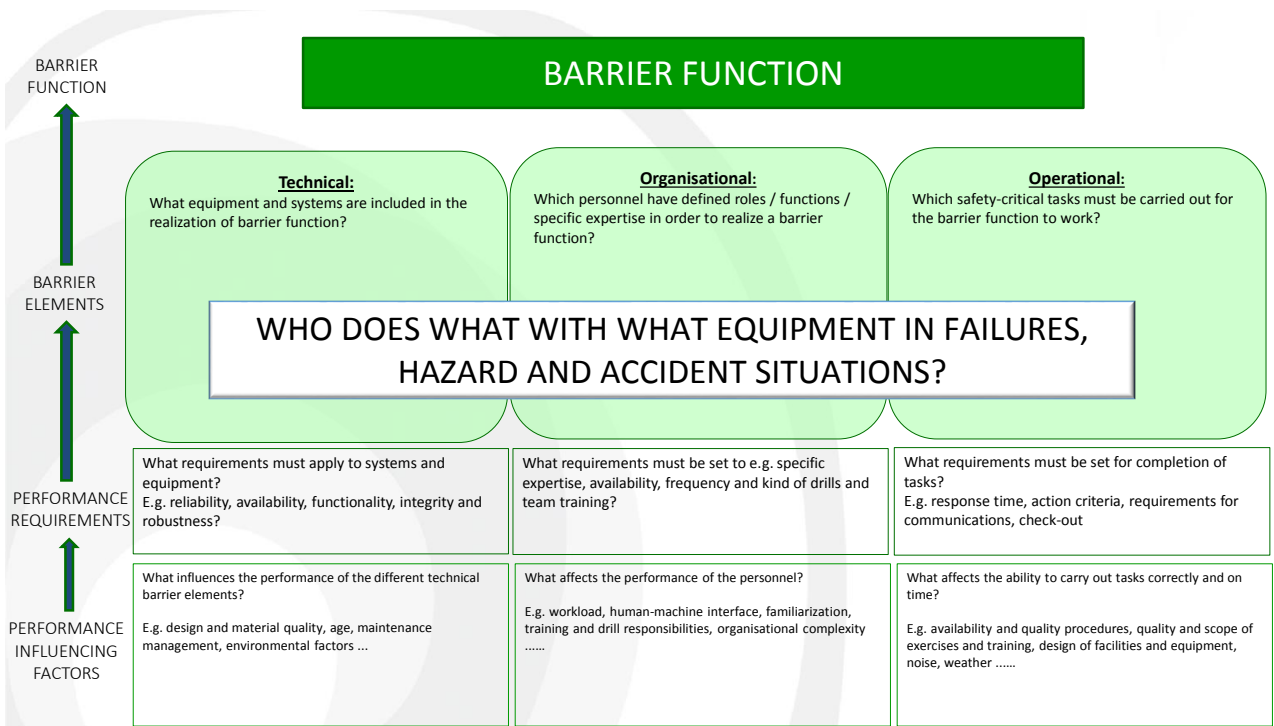
Barrier element definitions

- *Technical barrier elements* means equipment and systems which constitute a part of realising a barrier function
What equipment (shall be used)?
- *Operational barrier elements* means actions and activities the personnel have to perform to constitute a part of realising a barrier function
What shall be done?
- *Organisational barrier elements* means personnel with defined roles or functions and specific competence which constitute a part of realising a barrier function
Who is doing it?

WHO DOES WHAT WITH WHAT EQUIPMENT IN FAILURES, HAZARD AND ACCIDENT SITUATIONS?



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PSA's barrier requirements – simplified and summarized

- First priority is to select technical, operational and organisational solutions that reduce the likelihood for failure, hazard and accident situations to occur
- In addition effective barriers shall be established to identify failures, hazard and accident situations and limit the development of these into accidents
- The barrier functions are often handled by technical barrier elements only, but in a significant numbers of barrier functions the technical barrier elements have to be activated or handled by personnel



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PSA's barrier requirements – simplified and summarized – cont'd

- The personnel and the actions they have to perform to ensure that a barrier function effectively are carried out must be identified. In other words the organisational and operational barrier elements must be identified
- It is imperative to have good answers to the question: **“WHO DOES WHAT WITH WHAT EQUIPMENT IN FAILURES, HAZARD AND ACCIDENT SITUATIONS?”**



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PSA's barrier requirements – simplified and summarized – cont'd

- Necessary performance requirements have to be defined for the concrete operational and organisational barrier elements as well as for the technical elements
- Factors that can significantly influence the performance of the technical, operational or organisational barrier elements shall be identified and handled adequately
- The personnel must know and understand their own role in the barrier functions, **training and drills are essential**



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BARRIER DEFINITION – IT'S A JUNGLE



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Interpretational costs

Different interpretations of the concept “Barrier”

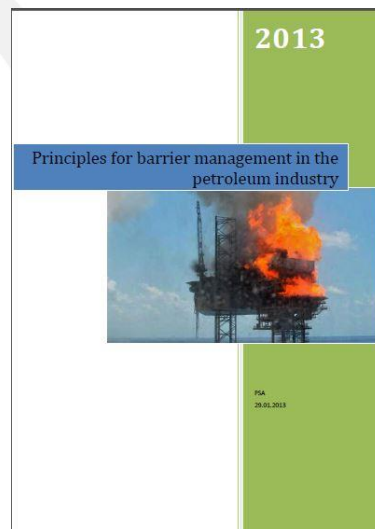
- The term barrier is used in “everyday speech”
- Different technical standards use different interpretations
- Different disciplines interpret the concept differently
- Different companies use different approaches
- Accident investigations methods use the term “barrier” as any measures that could have stopped the course of events in hindsight
- *J. Reason* reserves “barriers” to physical measures
- *W. Haddon* reserves “barriers” as something that should separate energy sources and vulnerable targets by physical measures or in time or space



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The PSA's guidelines related to barriers

- Differences between the players' understanding of the regulatory requirements
- A need to make the requirements related to barrier more easily accessible
- The document does not form a part of the formal petroleum regulations
- 2012 -2013 -2016

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Definitions must be chosen by the industry and used consistently

- As a regulator we have made our choices when it comes to definitions of the barrier concept
- The concept has some similarities with Haddon's strategies and Reasons hard defences
- However - the regulations are goal oriented and functional - the goal is risk reduction - not that everyone use our terms and definitions



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Background for increased supervision on organisational and operational barrier elements

- Investigations show that the human contribution in barrier functions has not been adequately addressed
- Increased our attention on operational and organisational barrier elements
- Many questions about the definition of operational and organisational barrier element
- PSA first updated the publication "Principles for barrier management in the petroleum industry" in 2013 with definitions of operational and organisational barrier elements
- Definitions of operational and organisational barrier elements included in the guidelines of § 5 on Barriers 1.1.2016



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Examples

- The function of most barrier elements will be purely technical or fully automated such as fire walls, deluge or ESD valves
- Some will be automated - but will need human back up (manual release or other actions) if automation fails
- In some barrier functions safety critical actions must be performed by personnel - in interaction with equipment - to make them function in failures, hazard and accident situations
 - «Detect drive off of semi sub» and «Re-establish position of installation (in case of drive off)»
 - «Detect loss of stability» and «Re-establish stability of installation»
 - «Detect loss of well control» and «Re-establish well control»



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PSA aim for

- Better understanding of interdependence between technical, operational and organisational barrier elements
- Improved communication with the industry about what can be achieved by means of a more holistic barrier management
- Important to listen to companies' own experiences and solutions on barrier management
- Ensuring an appropriate monitoring and auditing based on regulatory requirements for barrier elements - that ensures risk reduction

Based on work internally in the PSA, and the acquisition of knowledge from the companies, we will update the "Barrier memo" in 2016 www.ptil.no



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HF'S ROLE IN BARRIER MANAGEMENT



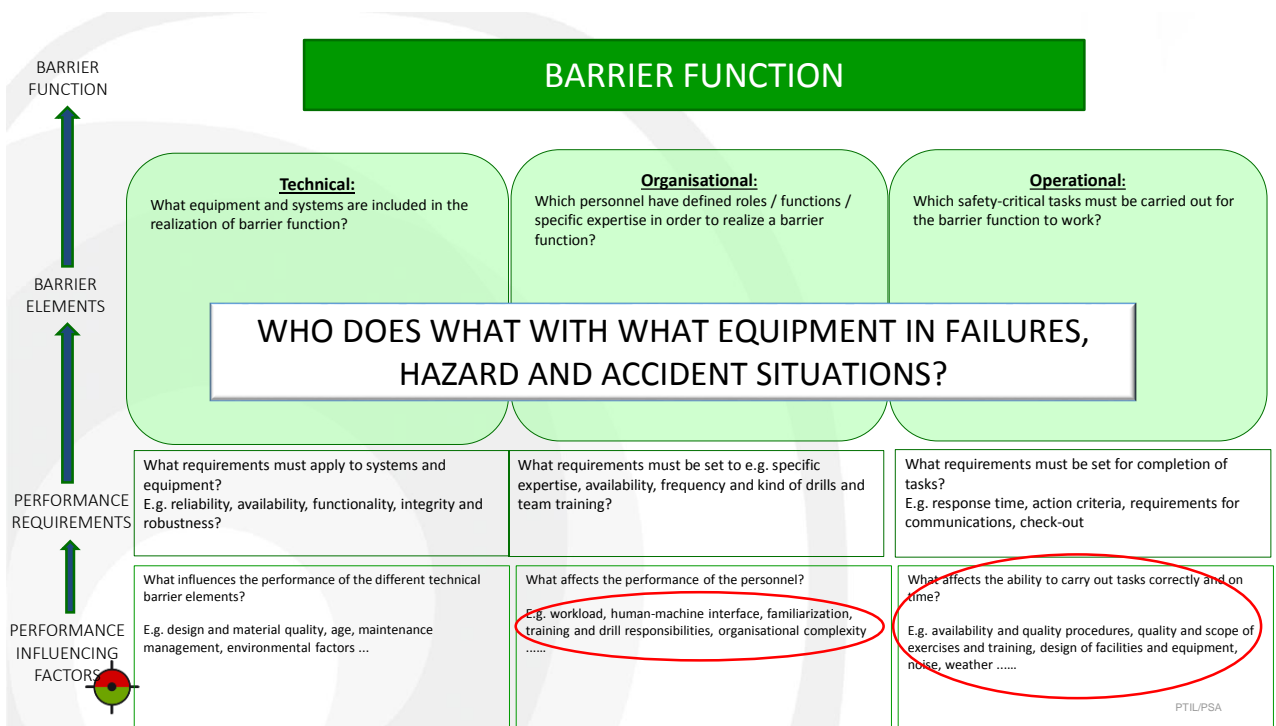
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Implication of the barrier definition

- Due to choice of definitions - will important safety issues and risk reducing activities be lost on the way?
 - Maintenance
 - Human Factors Engineering
 - Organisational Factors



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Scenario based team training and drills

- Training and drills are important performance influencing factors – empowering people to perform their duties
- Frequency of trainings and drills at different scenarios can be relevant performance requirements
- Evaluation of training and drills can be important for verification of whether the performance requirements are fulfilled, and form the basis for implementing risk reducing measures



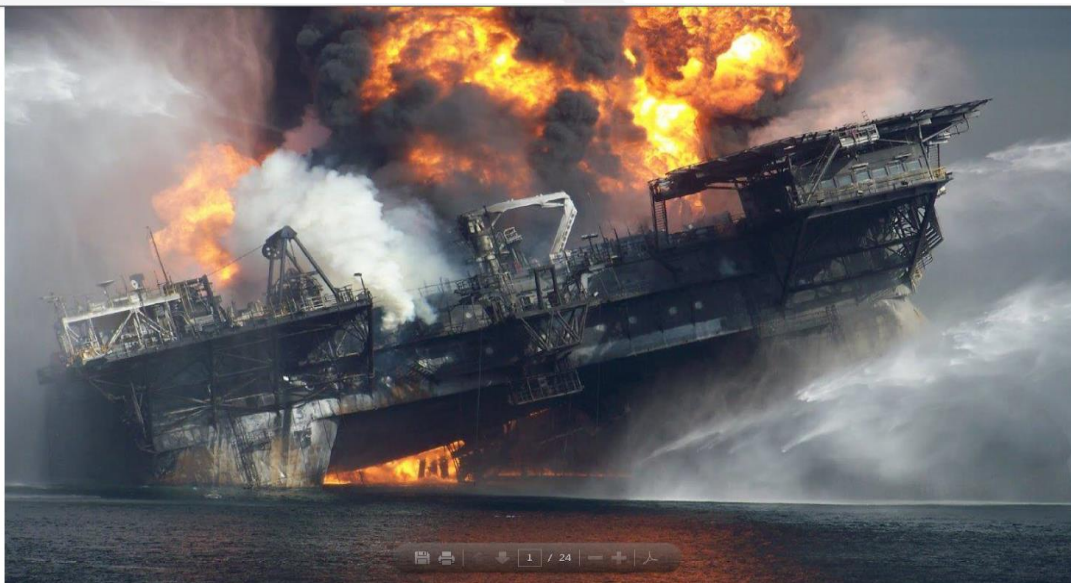
Understanding of human strengths and limitations is imperative in barrier management

- HF-competence is as important in securing a safe solution as before - and in addition competence on HF becomes vital in barrier management
- Contributing in identifying necessary technical, operational and organisational barrier elements (e.g. by performing task analysis, function analysis)
- In securing human centred design reducing risk of human errors (using acknowledged HF methods)
- In operations – assessing whether performance requirements are met (e.g. HRA analysis)
- In operations – securing continuous improvement in barrier management by assessing and monitoring performance influencing factors



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Six years since Macondo



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U.S. Chemical Safety Board's investigation report after Macondo, published April 2016

<http://www.csb.gov/the-us-chemical-safety-boards-investigation-into-the-macondo-disaster-finds-offshore-risk-management-and-regulatory-oversight-still-inadequate-in-gulf-of-mexico/> Volume 3.

To reduce risk of major accidents the report puts emphasis on :

- The need for barrier management that includes a better understanding of the interplay of technical, operational and organisational barrier elements
- U.S. Chemical Safety Board underline the need for human factors expertise
"The need for a proactive process for assessing human factors for major accident prevention".



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We will ask the industry

- Are personnel empowered to perform their tasks in potential major accident events?
- Specific performance requirements for equipment, personnel and tasks?
- Competence requirements for personnel involved in the realization of barrier functions?
- Specific requirements for team exercises and drills?
- Verification of operational and organizational barrier elements performance?
- Monitoring performance of barrier elements over time?
- Identification, assessment and handling of relevant performance influencing factors?



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Summary

- PSA Barrier memo – introduction
 - **WHO DOES WHAT WITH WHAT EQUIPMENT IN FAILURES, HAZARD AND ACCIDENT SITUATIONS?**
- Barrier definition
 - A wide range of definitions exists – PSA have chosen one
 - **The key is risk reduction...**
- HF's role in barrier management
 - HF-competence is as important in securing a safe solution as before - and in addition competence on HF becomes vital in barrier management



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