



# Building a well integrity management culture in PETRONAS

**Azlan Mohamad**  
**Wells, Petronas Carigali**

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# FOCUS AREAS

## DEFINITION

Preserve well integrity throughout wells life cycle and contain reservoir fluids within designed boundaries through Reservoir and Drilling Systems.



## OBJECTIVES

Maintain the hydrocarbon in the reservoir, pipe and in the well.  
Essentially to prevent the release of unintended energy or hydrocarbon throughout the life cycle of a well.



## SCOPE

All well related activites including drilling, completion, well clean up, well testing, workover, intervention, production/injection operations, suspension and abandonment.



**DESIGN &  
ENGINEERING**

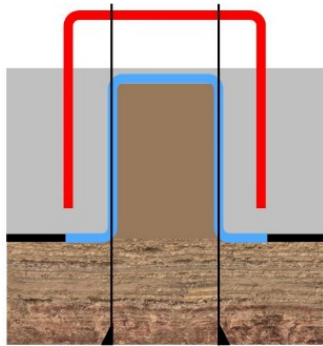
**COMPETENCY  
& CAPABILITIES**

**OPERATIONS**

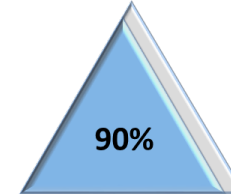
# Well barriers and well integrity

The **safe and well being** of any well is a result of the wells ability to contain pressure and hydrocarbons.

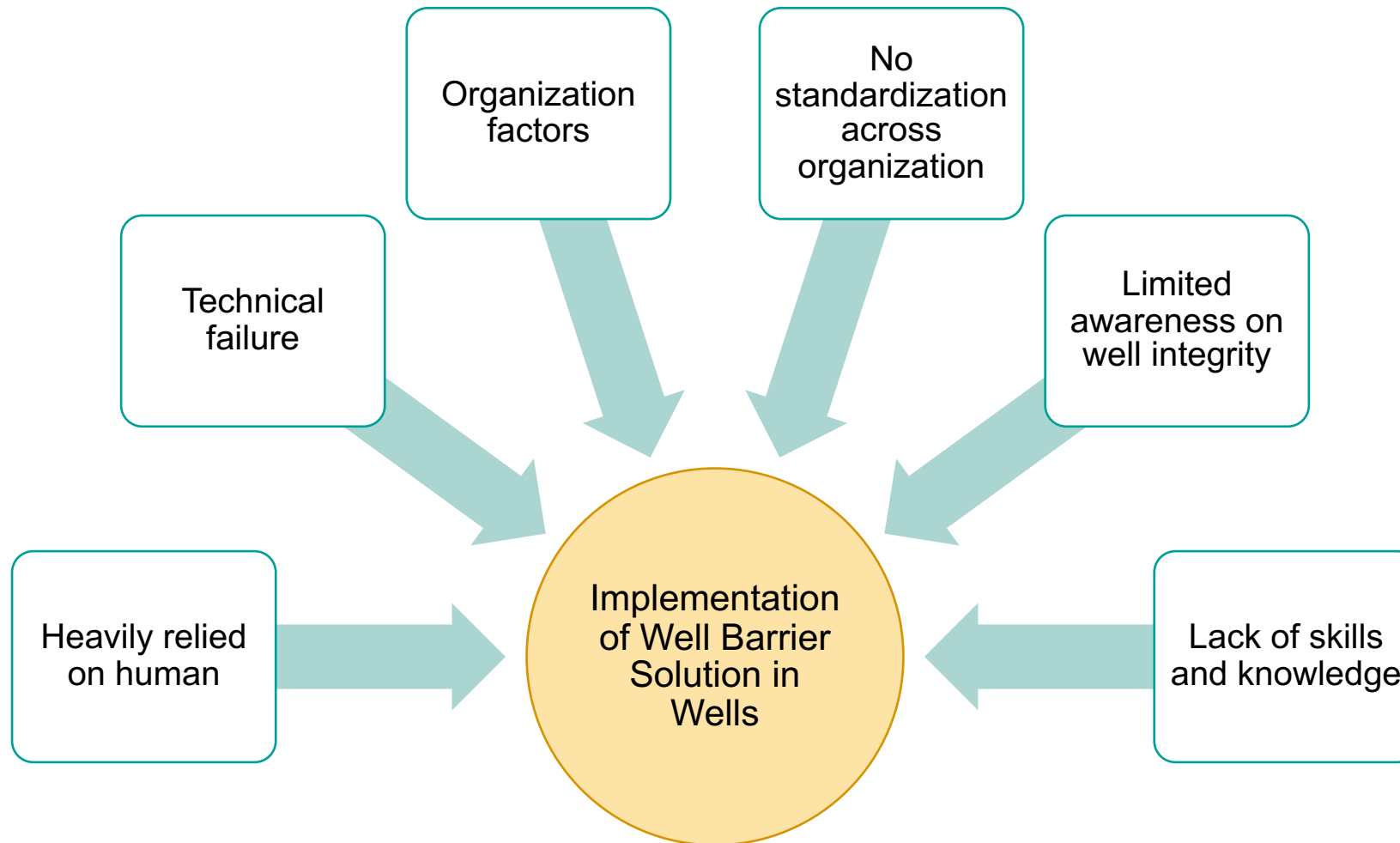
- ❑ For this purpose we apply a **two barrier philosophy** that will allow incidents to happen without escalating into accidents.
  - If two independent barriers are not in place, it is equally important to define available barriers



- ❑ We believe that 90% (figuratively speaking) of well integrity is about **technical well barrier**

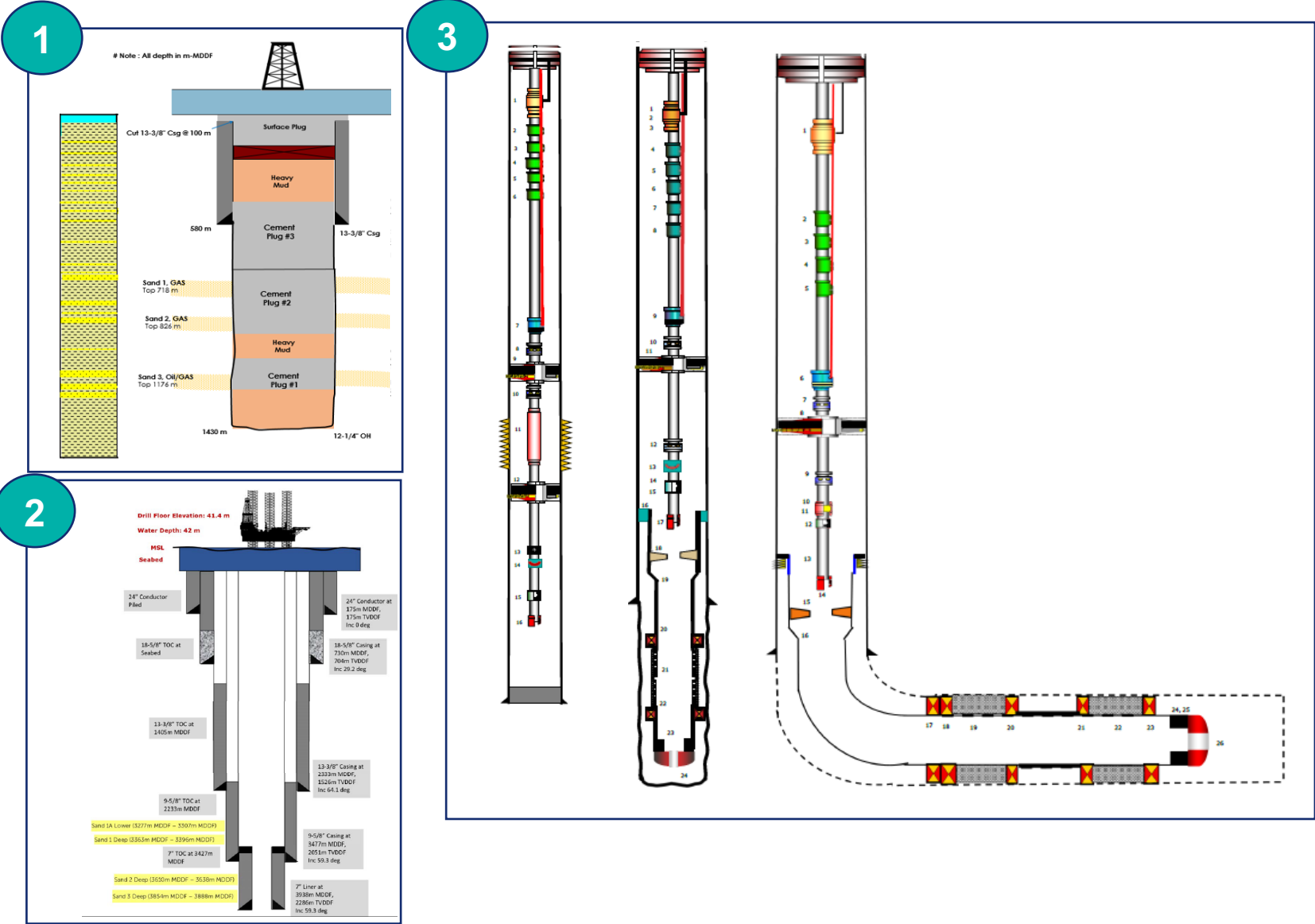


# Pain points



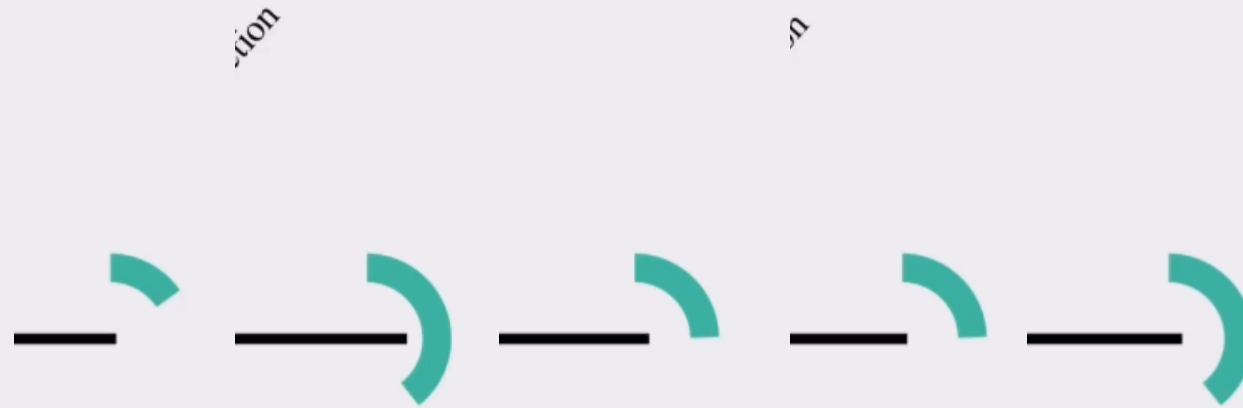


# Conventional arrangement

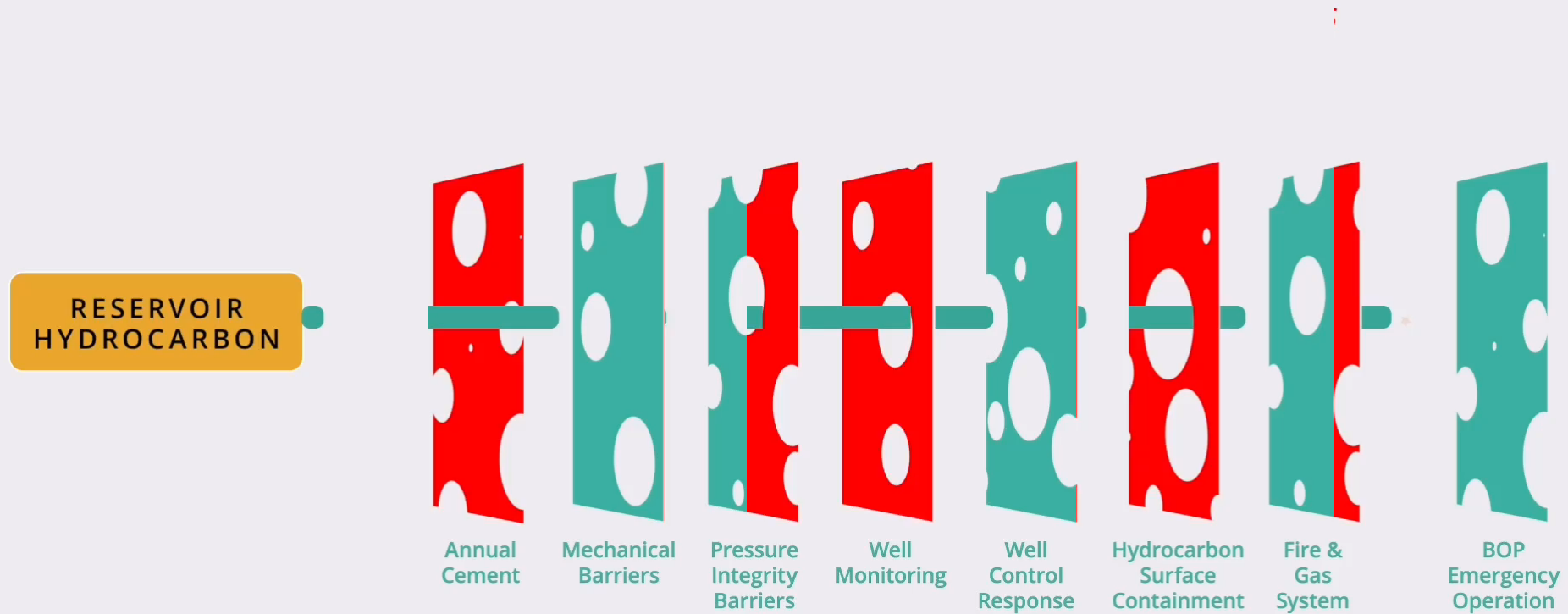


# Well barriers in the well life cycle

Preserve well integrity throughout wells life cycle and contain reservoir fluid within designed boundaries through Reservoir and Drilling Systems across the full Well lifecycle.

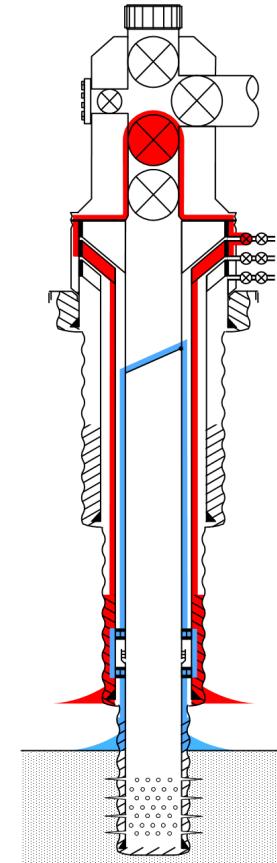


# Understanding the well activity risk



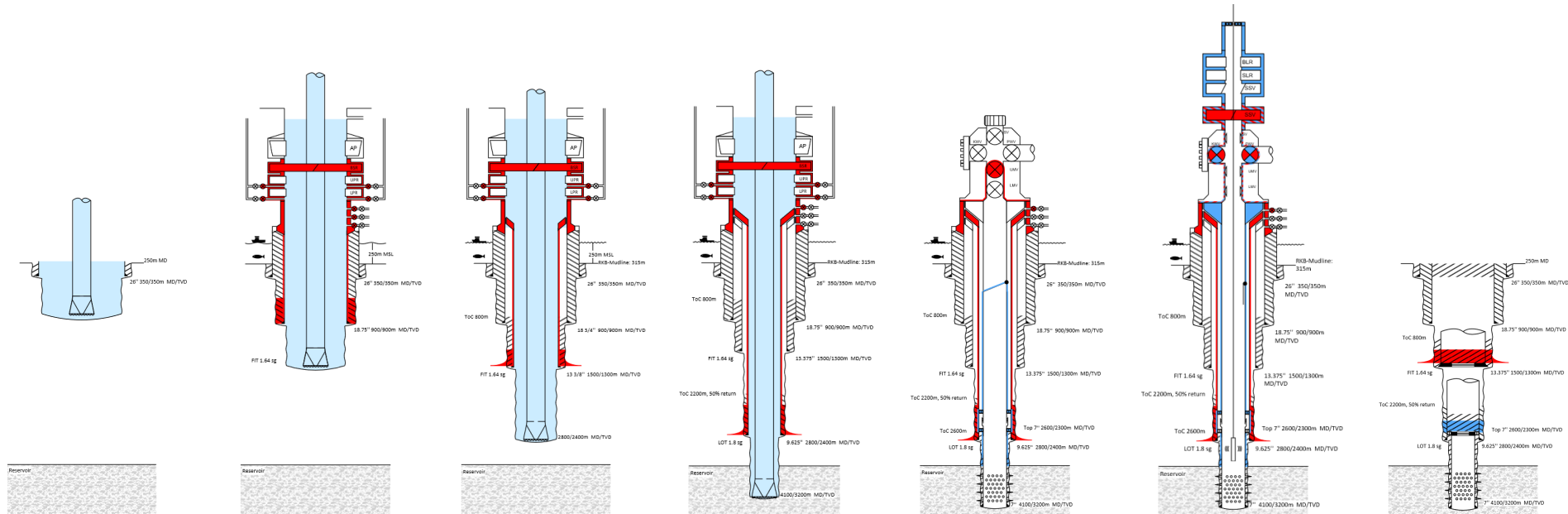
# How we adopt?

- PETRONAS is moving **beyond** just **standardizing drawing** for visualizing wells into **leveraging** the power of illustration tool into its **risk assessment process**.
- **Simplified** well barrier diagrams for each well lifecycle are **used as visual aid** during discussion.
- Then **discussion revolving around well integrity** takes place as part of risk assessment process.
- The discussion should **show the potential failure modes** depending on the design and type of service for the well to aid the **discussion on potential problems**.
- The well diagrams and list of potential failure modes should be prepopulated and sent to team members prior to meeting to **aid the discussion**.
- **Determining the consequence** of a failure mode assumes all other well barriers remain intact.
- Wellbarrier **schematics assist** for performing **well integrity risk assessment** and **completion of required risk register** for each well phase.
- The **risk assessment** then performed or reviewed and made specific at each well lifecycle phase as **part of the handover process**.
- The illustrations are then **used during execution** phase in **verifying well barrier status** and then **recorded in barrier verification reports** upon completion including abandoned and suspended wells.



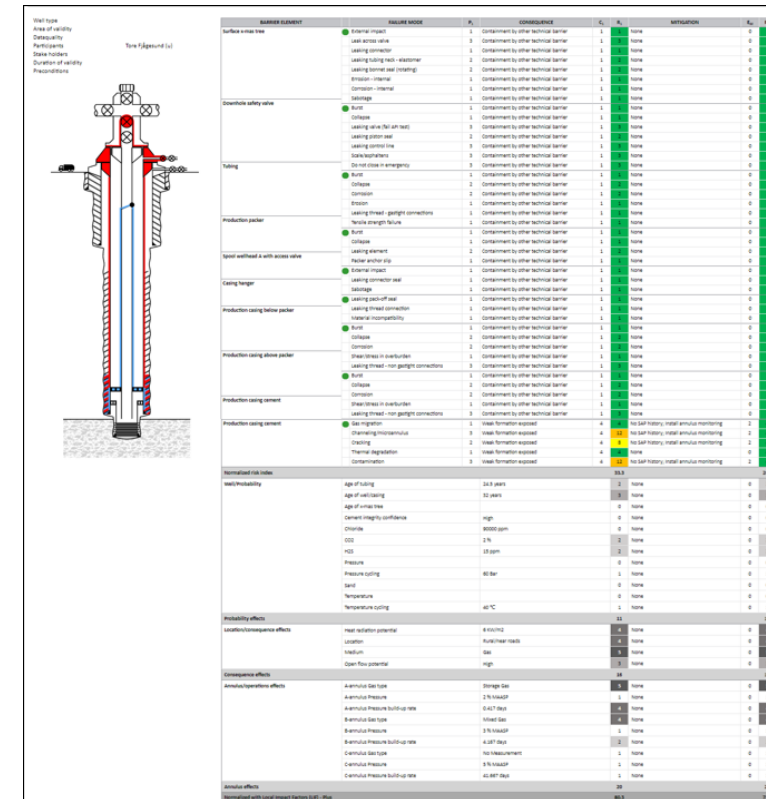
# Sequence diagrams

Sequence diagrams are useful to see the **progression of the well activity** and how the barrier definition changes as you are progressing the work throughout the well life cycle



## What's next for us? FMECA risk assessment

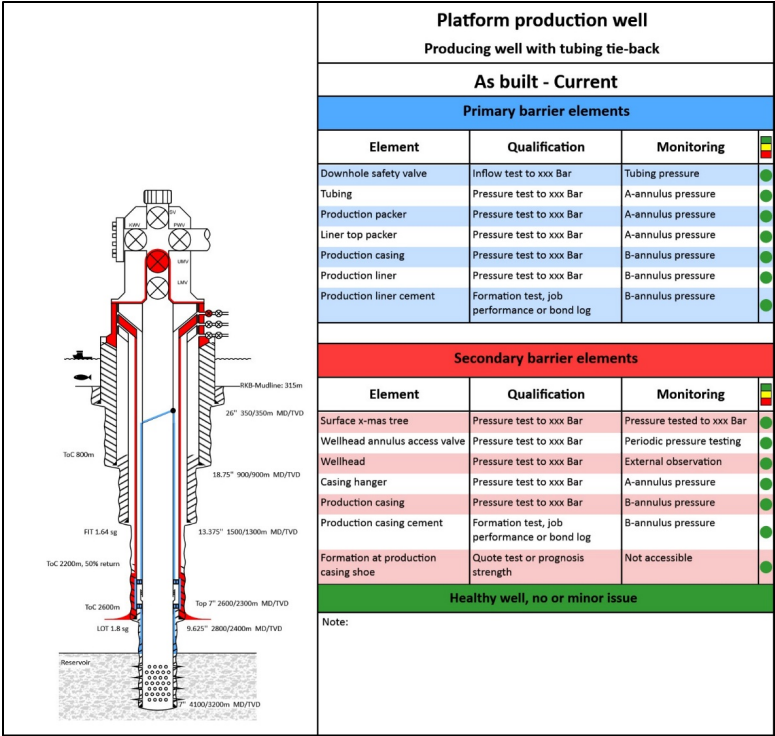
- The **definition of the applicable well barrier elements** in the well provide an ideal starting point for risk assessment
- **Environmental conditions** are taken into consideration
- The **failure mode** of each component is assessed through a hardcoded model
- The **consequence** is evaluated and a risk **calculated**
- Upon which **compensating measure** may be applied



# Well Control Barrier Management Benefits

By having the Well Barrier Management Software in Wells, it will address most if not all the current issues/concern where the following benefits are expected:

- Strengthen the risk prevention** on Well Control incident (i.e., left-hand side of Bow Tie Model).
- Ensure **consistency** and **standardization** in operations (i.e., managing the well barrier—doing thing the same ways, lesson learnt application and ability to explain the varying results).
- Better understanding** of the interaction between operational, organizational and technical elements in the barriers. Strengthen understanding of the relationship between risk and barrier management.
- Enhance well planning process** with the well barrier illustration tools that provide better visualization and understanding of the 2 well barrier philosophy.
- Expedite** Wells Engineers **learning curve** for well integrity management. Having a database would assist and **educate new engineers**, ensure **consistent application** and capture **lesson learnt**.
- Improve quality** of data illustration and information on managing well control barrier. In addition, **save time** using “easy to use” tool. Able to communicate in a consistent and professional manner.



# Change Management outcome: successful uptake factors

**Essential** to make Well Barrier Schematics for all well activities

**Easy to use** software

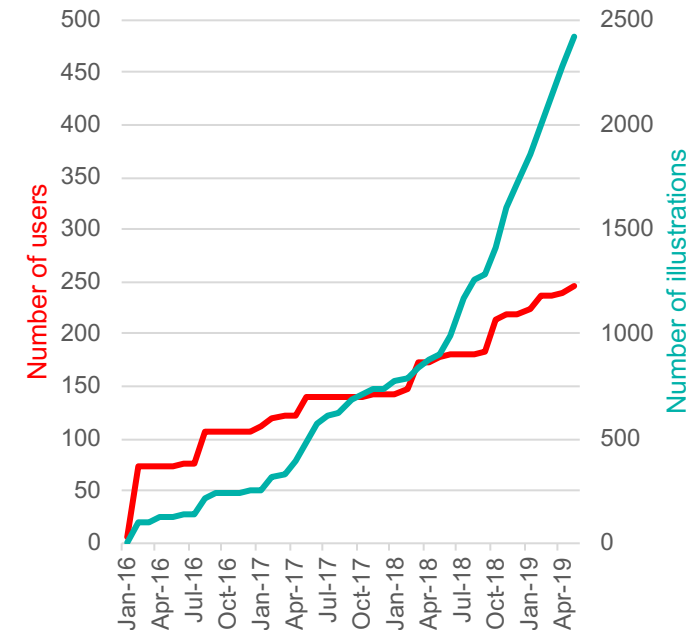
Entered into a working relationship with Wellbarrier in 2015

**Central ownership** to software application and instructing the organization

- “We have this software tool and you get to use it”

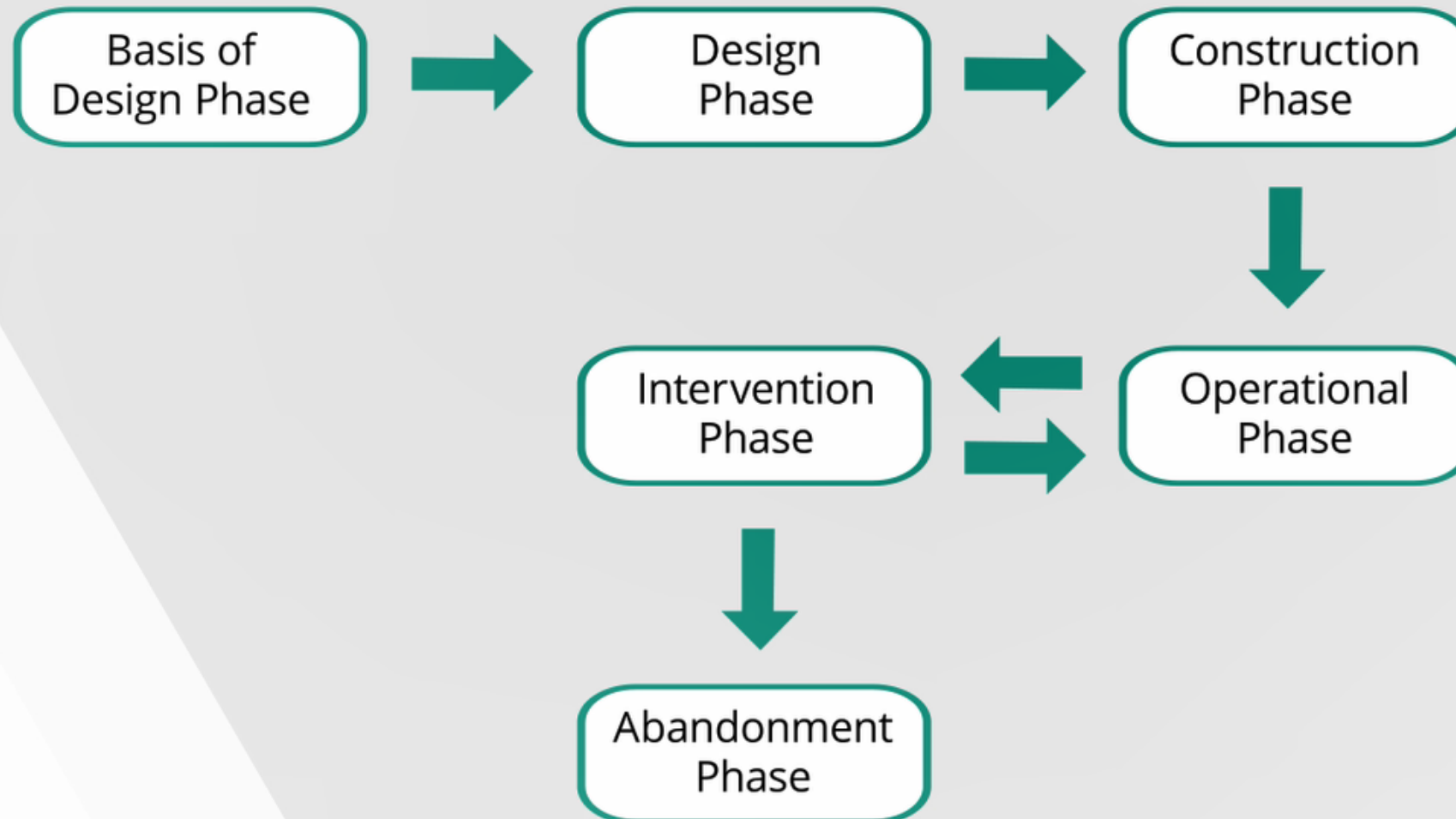
Well Engineering appointed a person who is responsible for the usage and uptake of the application

- **Appointed “product champion”**

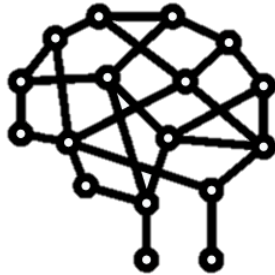




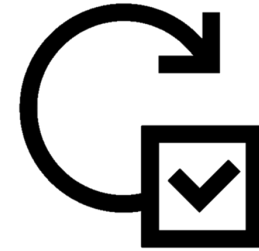
# WELL INTEGRITY LIFE CYCLE PHASES



# Where we want to be?



Intelligent type



Auto update status



Real Time Data Link

**Thank you for your passion!**

