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Well Integrity in the Operate Phase

– past, present and future. The tools of
a crime scene detective

Simon J Sparke



INTERNATIONAL
WELL INTEGRITY LTD



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Jargon Buster.



Acronym	Meaning	Acronym	Meaning
API	American Petroleum Institute	MAASP	Maximum allowable annulus surface pressure
BOEMRE	USA offshore regulator	MoC	Management of change
DCR	Design & Construction Regs (UK)	SCF/min	Standard cubic feet per minute
IOGP	International Oil & Gas Producers	SCSSSV	Surface controlled sub surface safety valve
ISO	International Standards Organisation	WIMS	Well integrity management system
IWCF	International Well Control Forum	GVI	General visual inspection

What is Well Integrity?

The job discipline is very much like modern day forensic science – Crime Scene Investigators

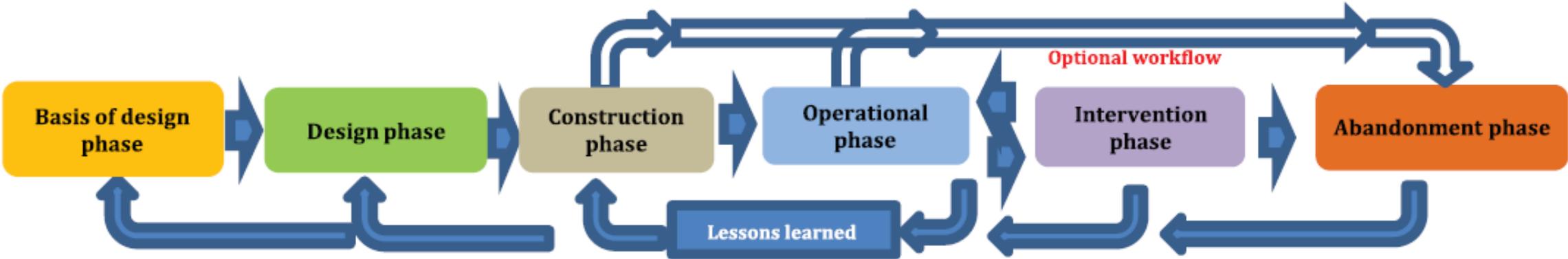


Well Integrity is a lifecycle event



Elements common to all phases		
Well integrity Well integrity management Well integrity policy Risk assessment	Organisational structure Well barriers Performance standards Well barrier verification	Reporting & documentation Management of change Continuous improvement Auditing

Well integrity life cycle phases



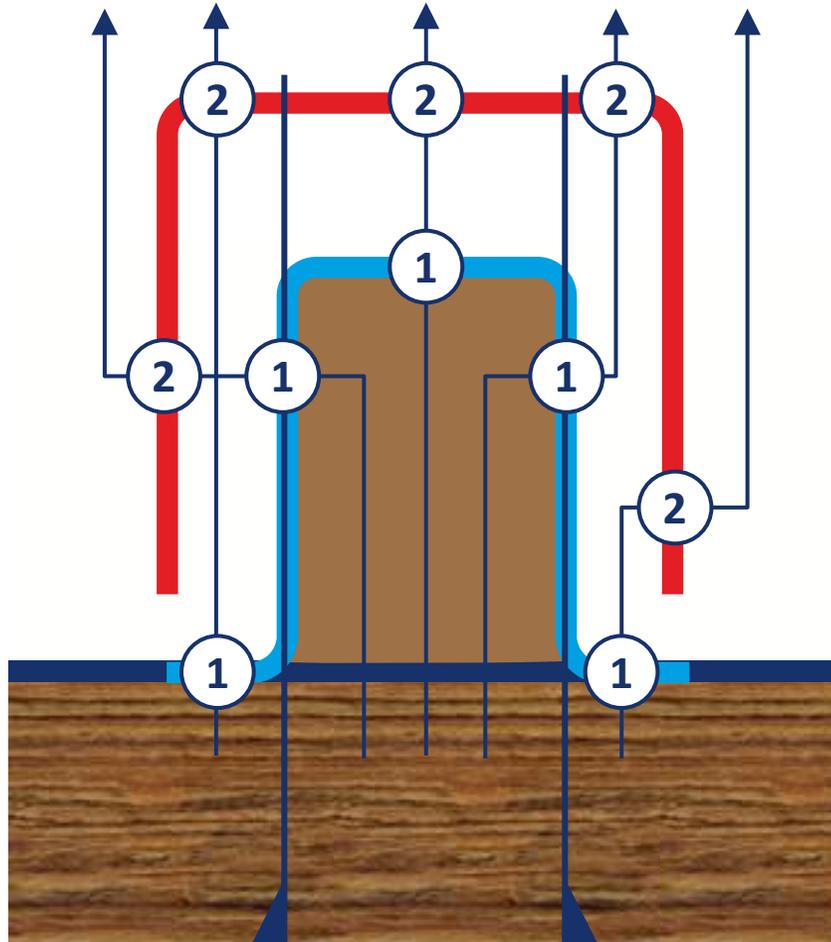
After ISO 16530, 2017

What is a Barrier?

There are four type of barriers, and these consist of the following:

1. **Hardware** barriers (equipment which is designed, installed and verified)
2. **Operational** barriers (monitoring equipment, practices and procedures)
3. **Human** barriers (competencies and training)
4. **Administrative** barriers (assignment of roles, resource provision and procedures)

Two Barrier Principle - Operate phase

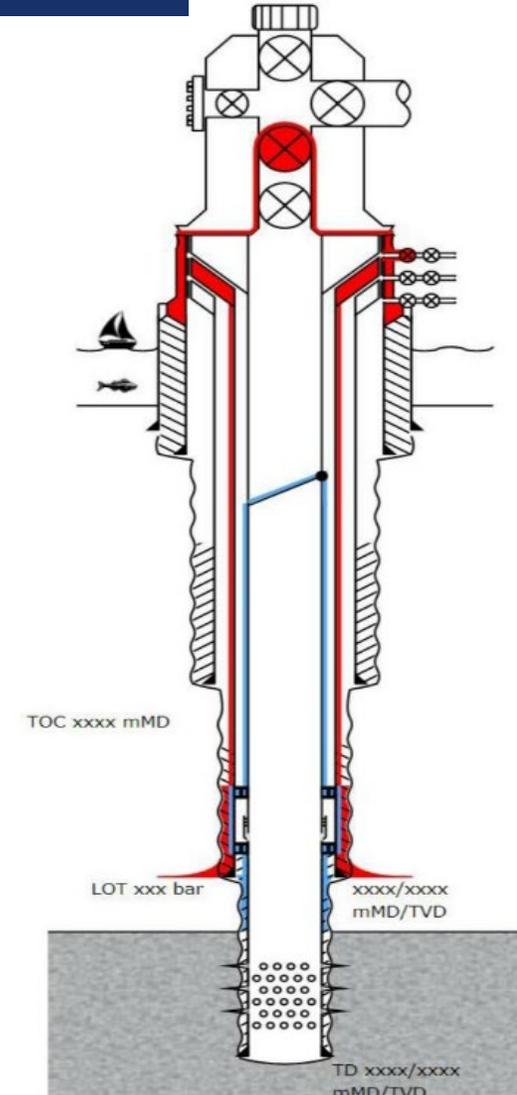
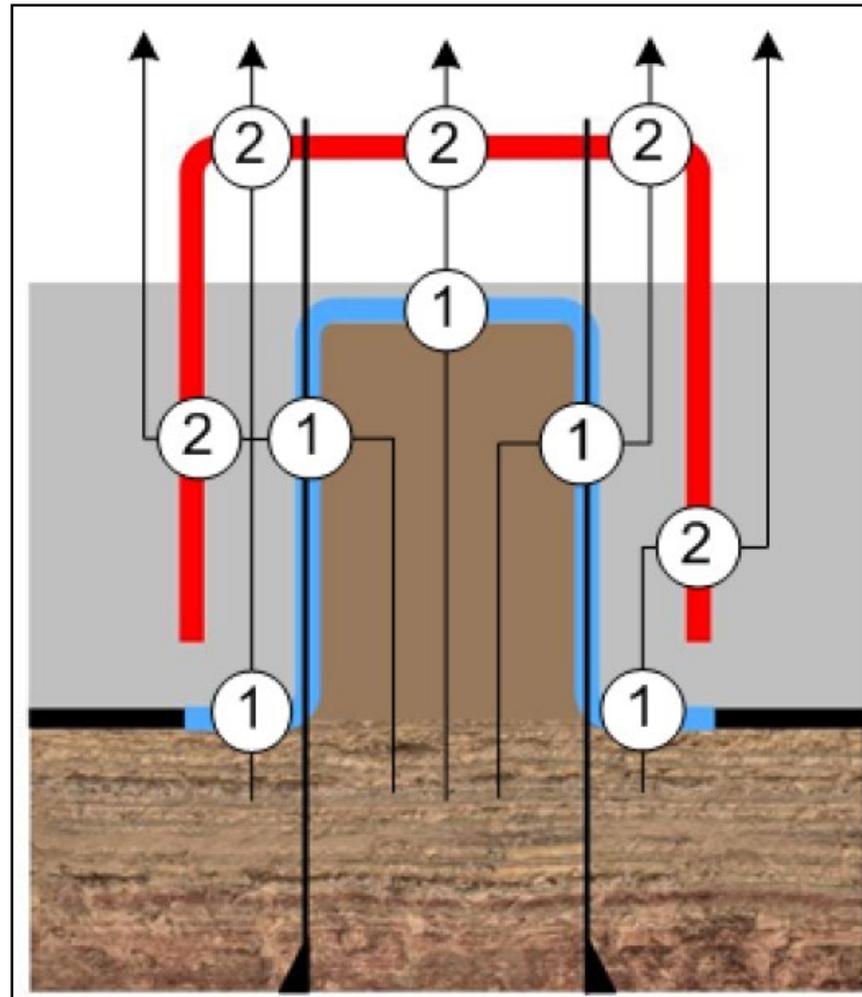


**1, Blue = primary barrier
(always sees the pressure)**
**2, Red = secondary barrier
(last line of defence)**

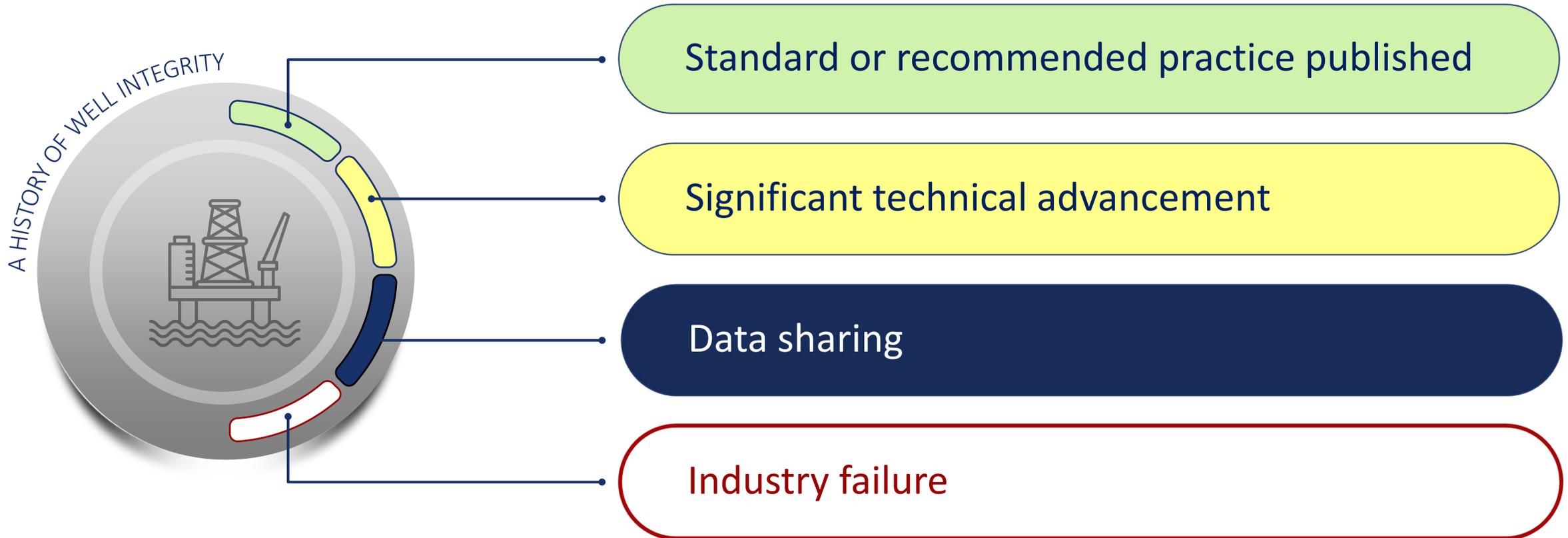
“hat over hat”

Two barrier principle in the Operate Phase

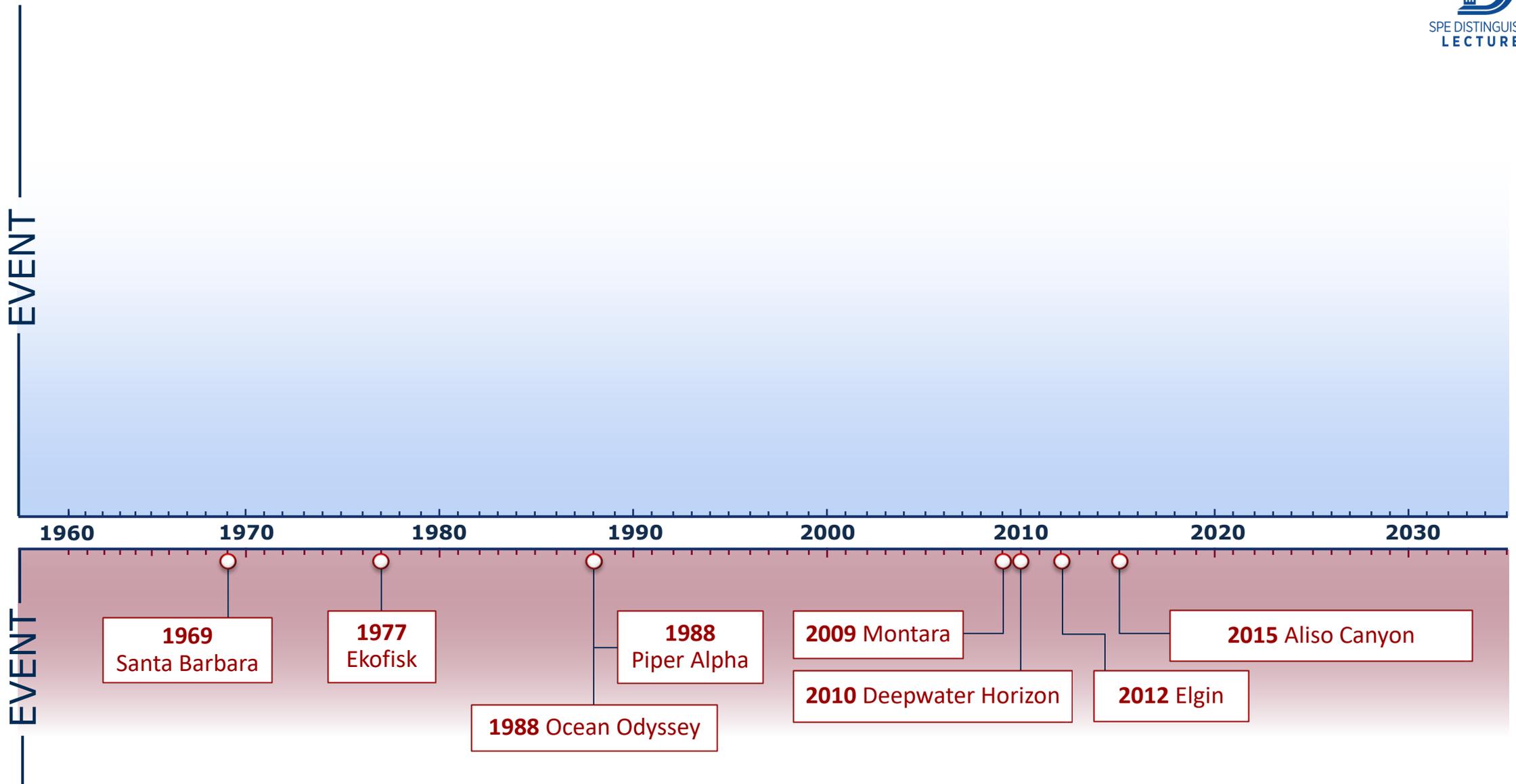
Norsok principle: Hat-over-hat envelope philosophy



Colour coding explanation



A History of Well Integrity



Spindletop, Texas

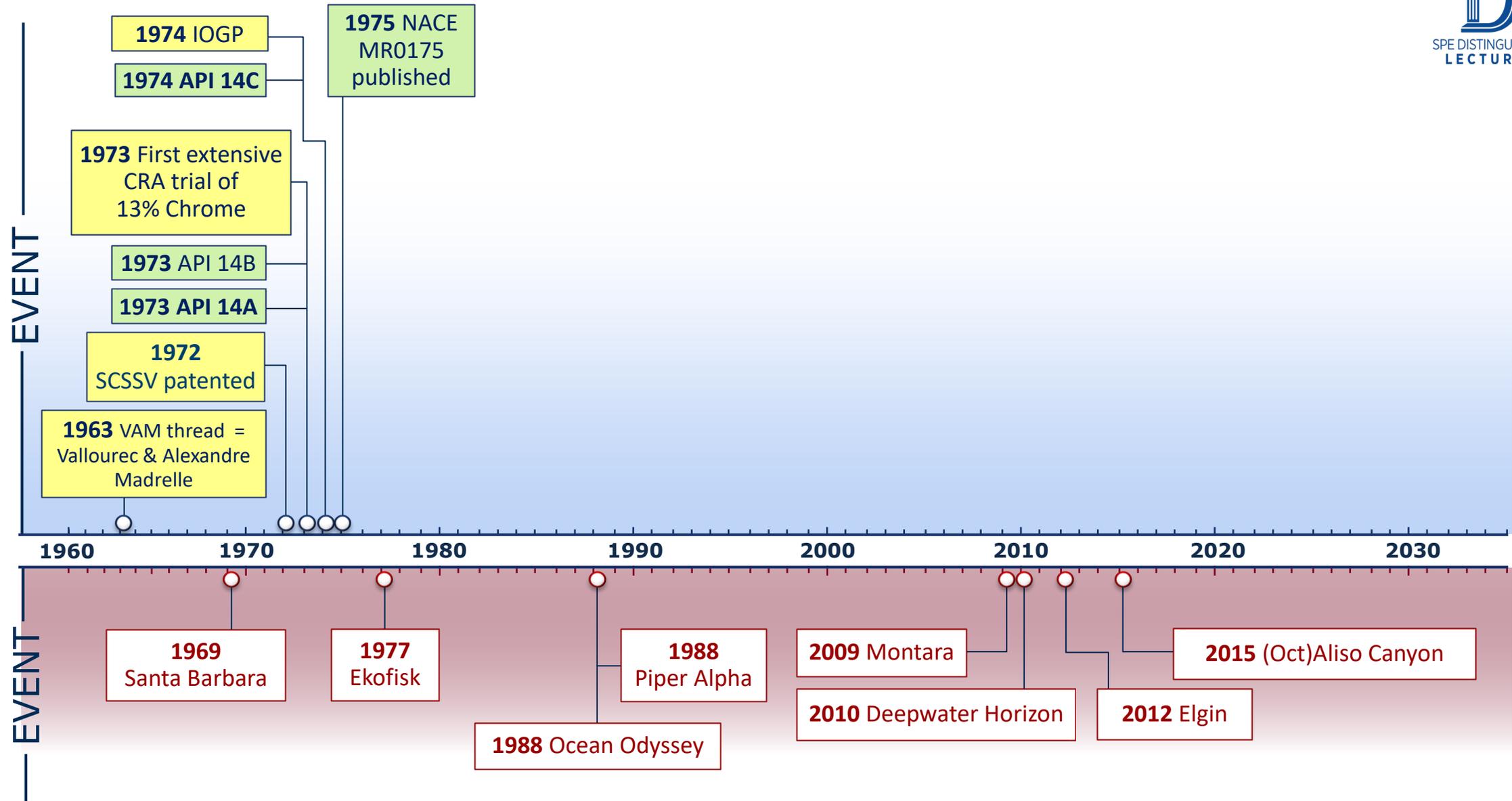
1901



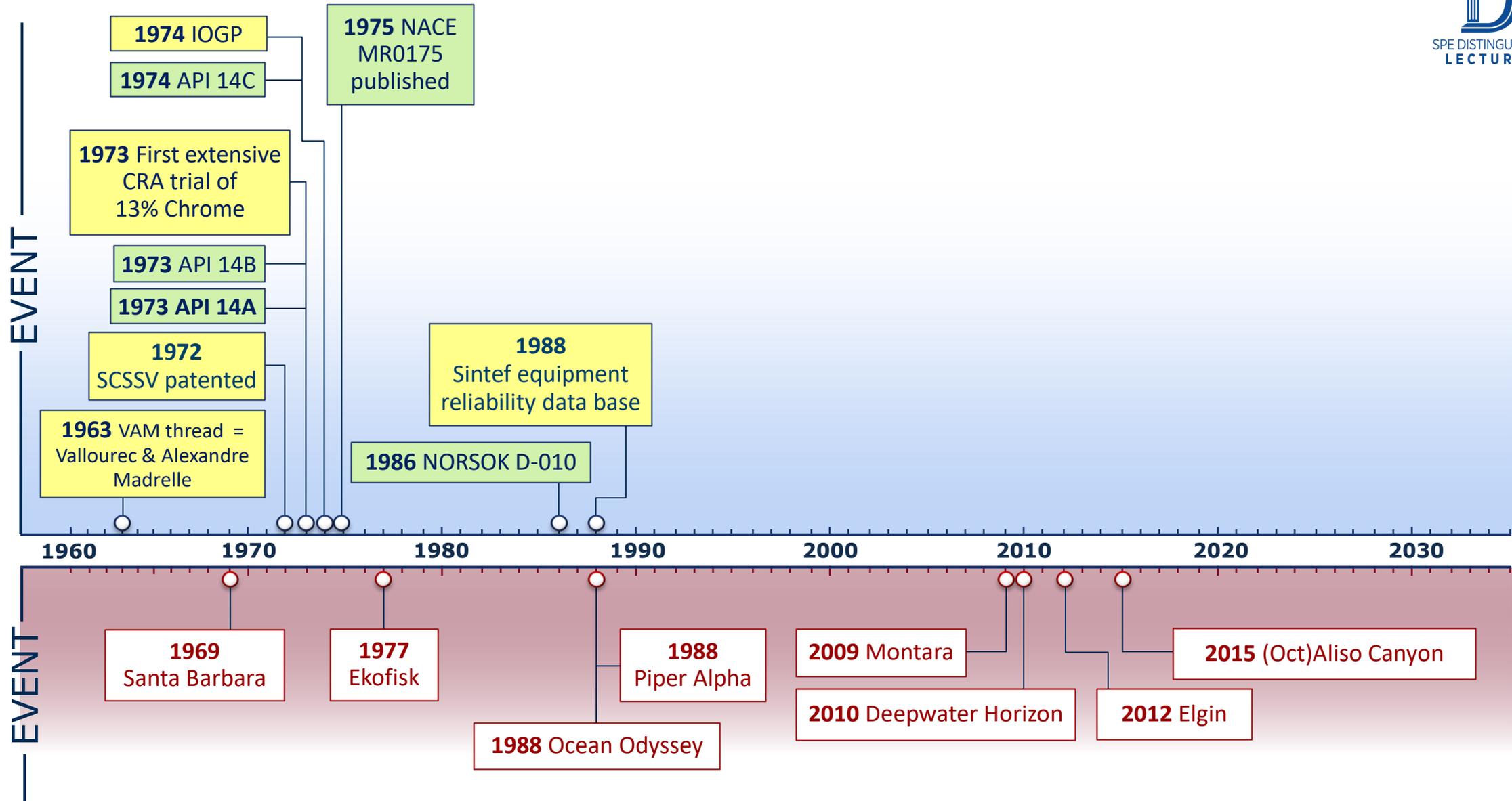
2013



A History of Well Integrity – The past



A History of Well Integrity – The past



Acceptable leak rates

Source of 15 SCF/Min where
does the leak rate come from?

SOUTHWEST RESEARCH INSTITUTE
Post Office Drawer 28510, 6220 Culebra Road
San Antonio, Texas 78228-0510

API 14A SUBSURFACE SAFETY VALVE RESEARCH STUDY-YEAR 4

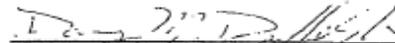
Prepared by
E. B. Bowles, Jr.
P. L. Spencer

SwRI Project No. 04-3245

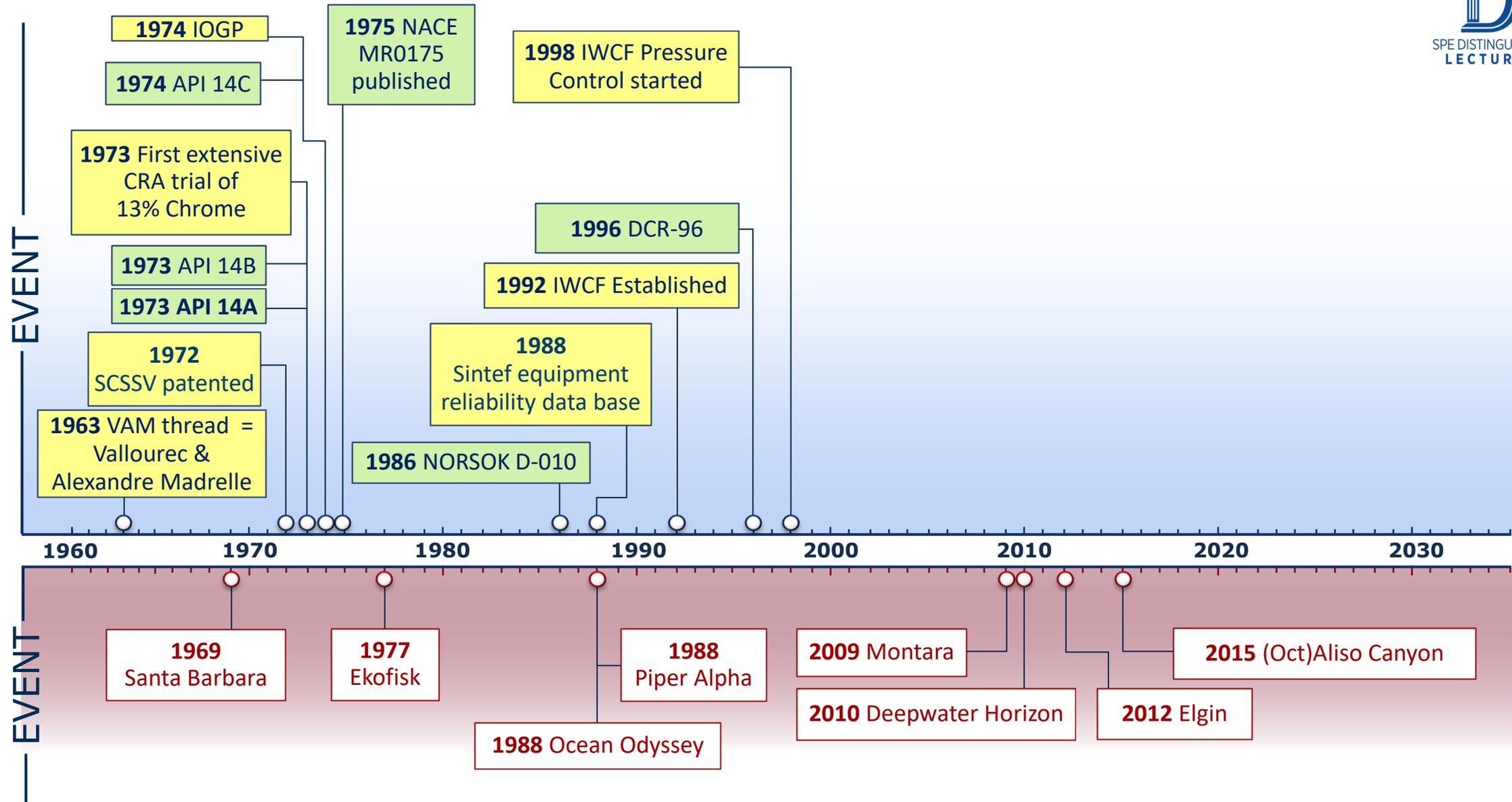
Prepared for
The American Petroleum Institute
Production Department
2535 One Main Place
Dallas, Texas 75202-3904

March 1991

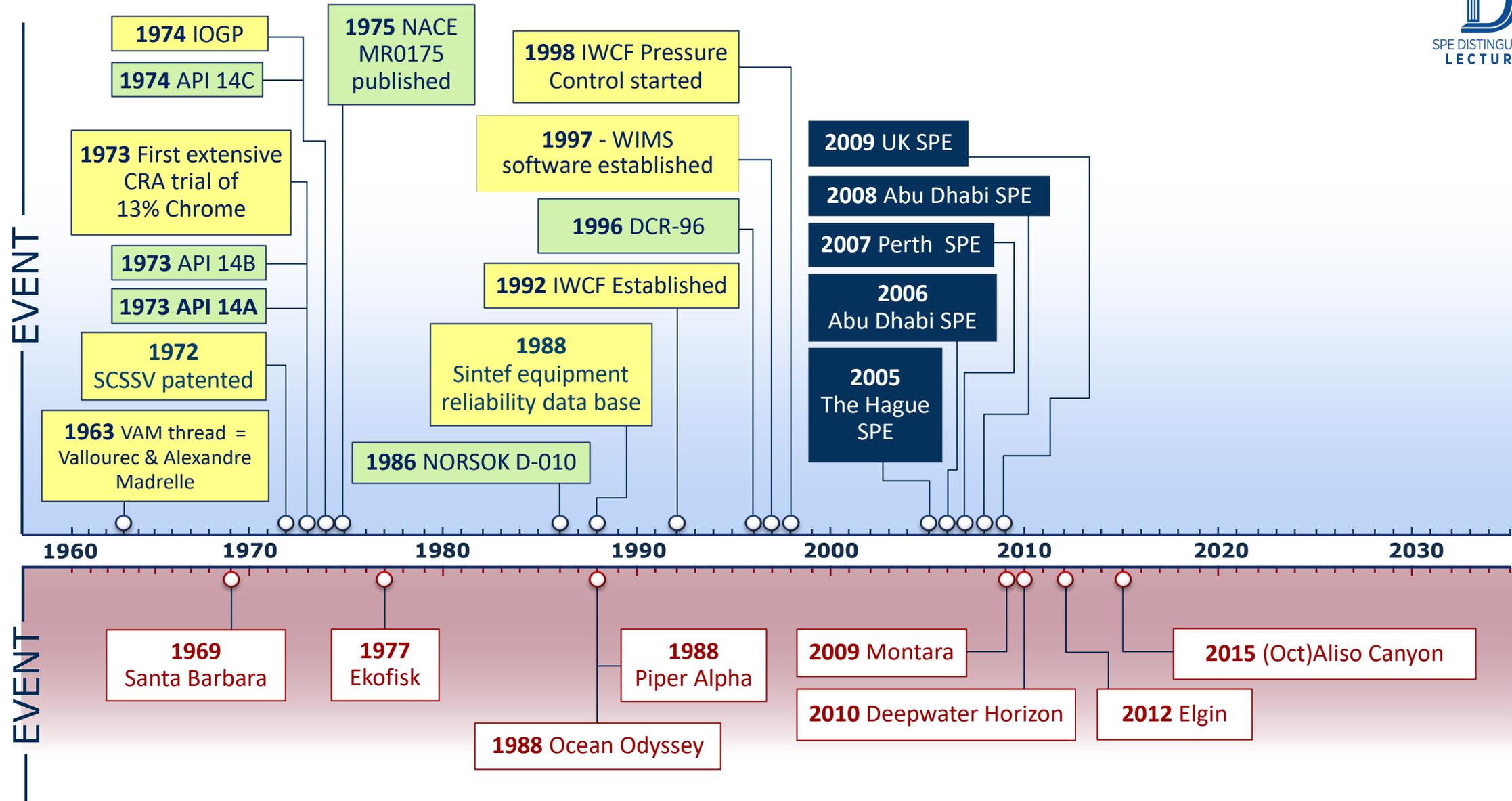
Approved:


Danny M. Deffenbaugh, Director
Fluids Systems Department

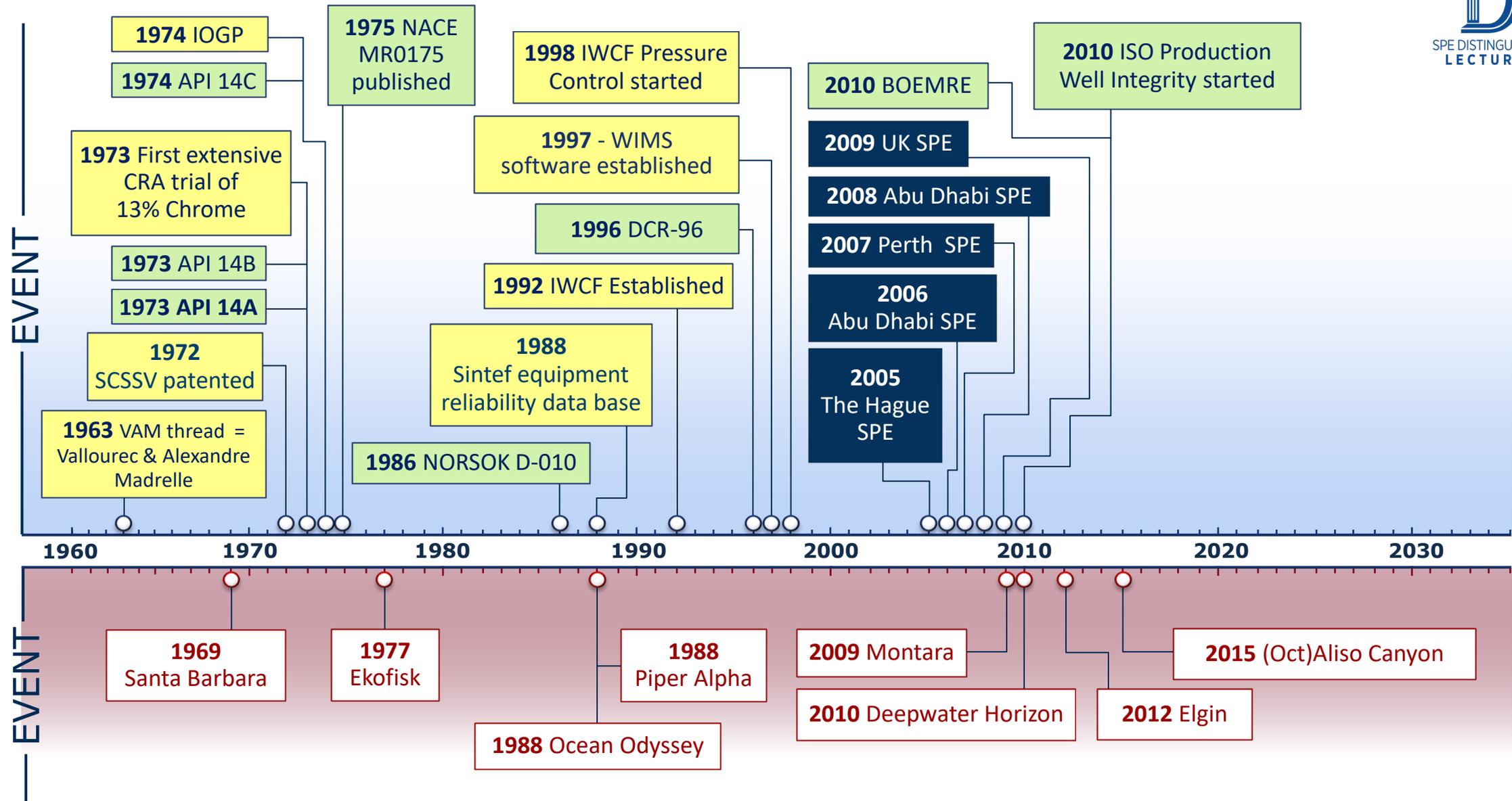
A History of Well Integrity – The past



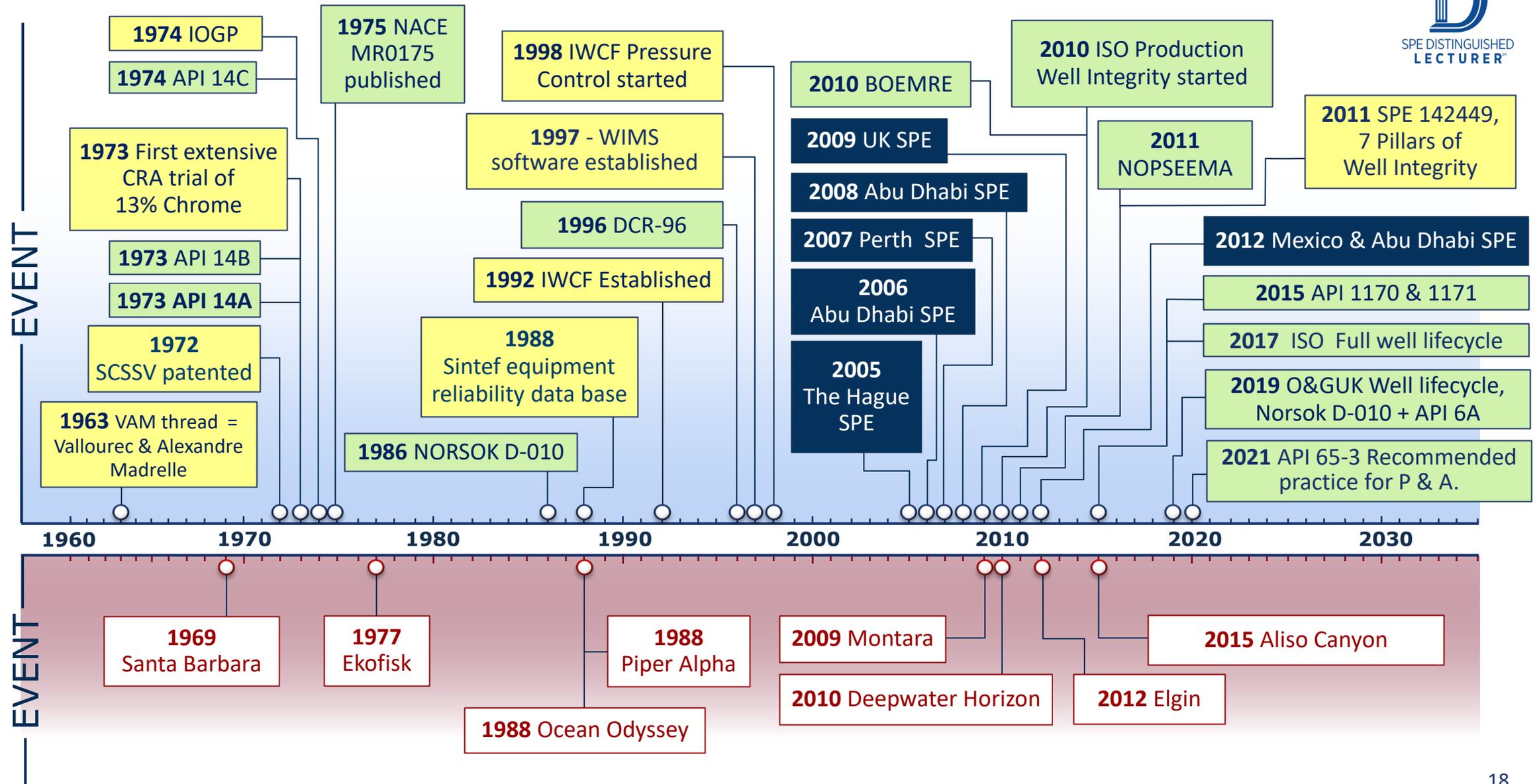
A History of Well Integrity – The past



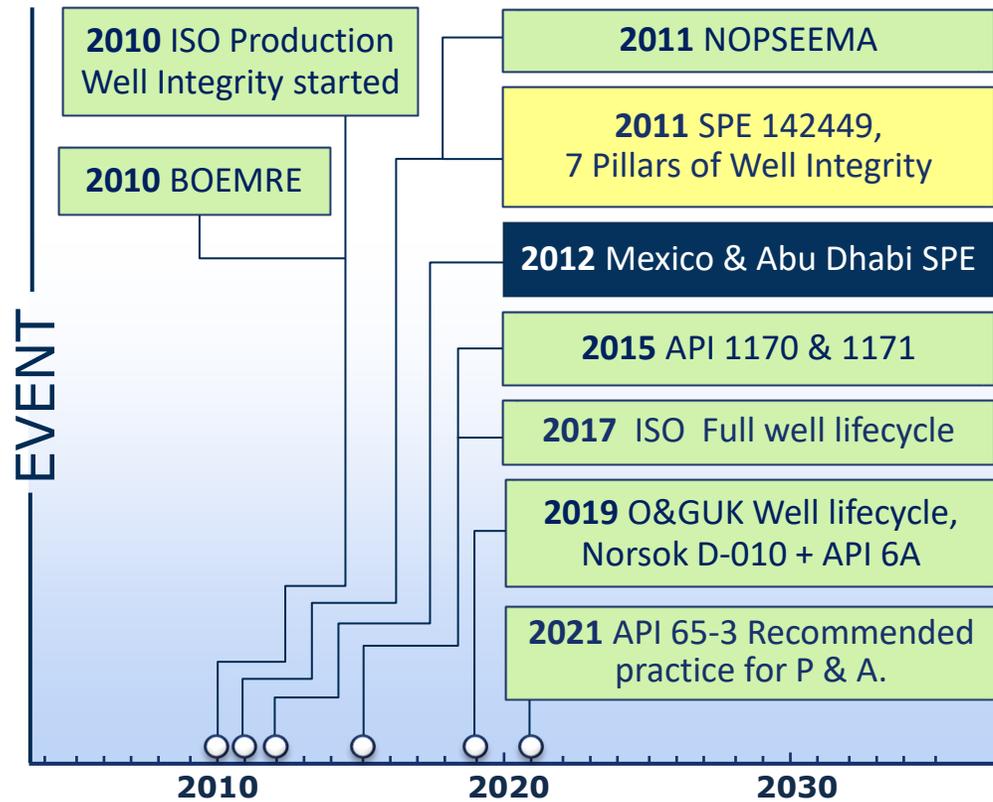
A History of Well Integrity – The past



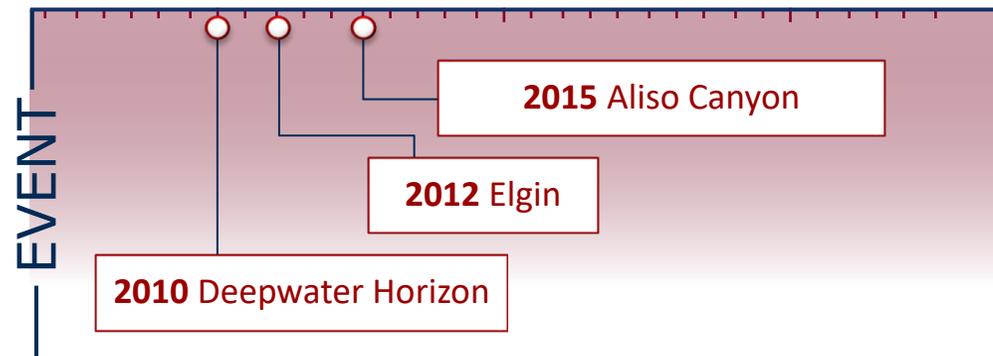
A History of Well Integrity – The present



A History of Well Integrity – The future



- Standards – ISO, O&GUK, Norsok, Nopsema updated periodically
- API recommended practices to be updated
- New regulations to allow for Bismuth, resins ...
- Tougher regulations on ALL emissions
- Geothermal

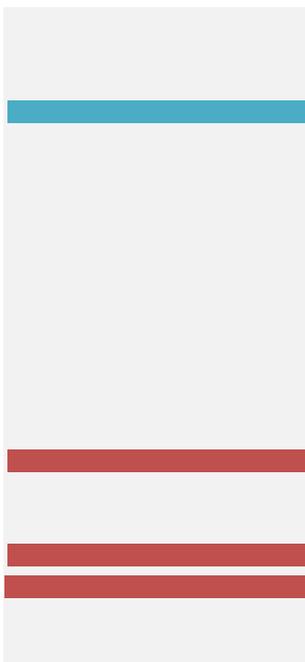


- Re-purposing wells – failure due to age
- Cyber attack
- Co2 sequestration well failure
- Post abandonment leaks
- Knowledge loss due to retirement, cut-backs, oil price etc

A quick review of Geology

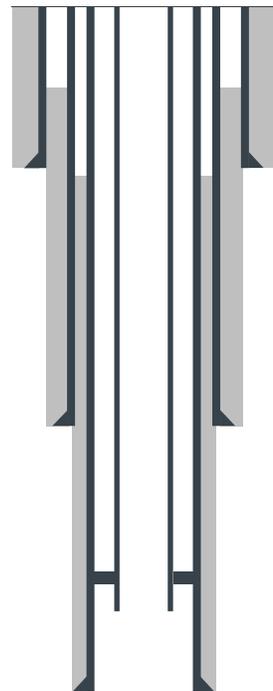


The world as
nature created



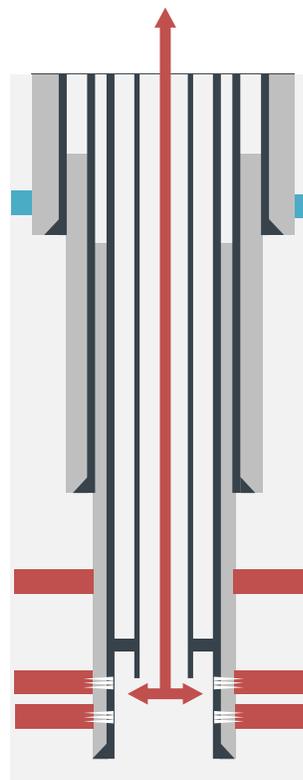
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The world Big
Oil designed

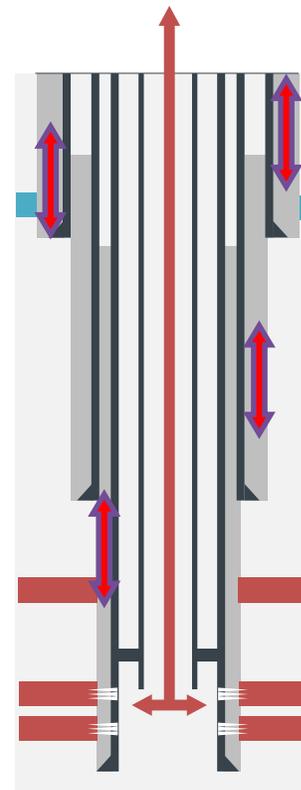


=

The world Big
Oil constructed



The world as Big
Oil had to manage



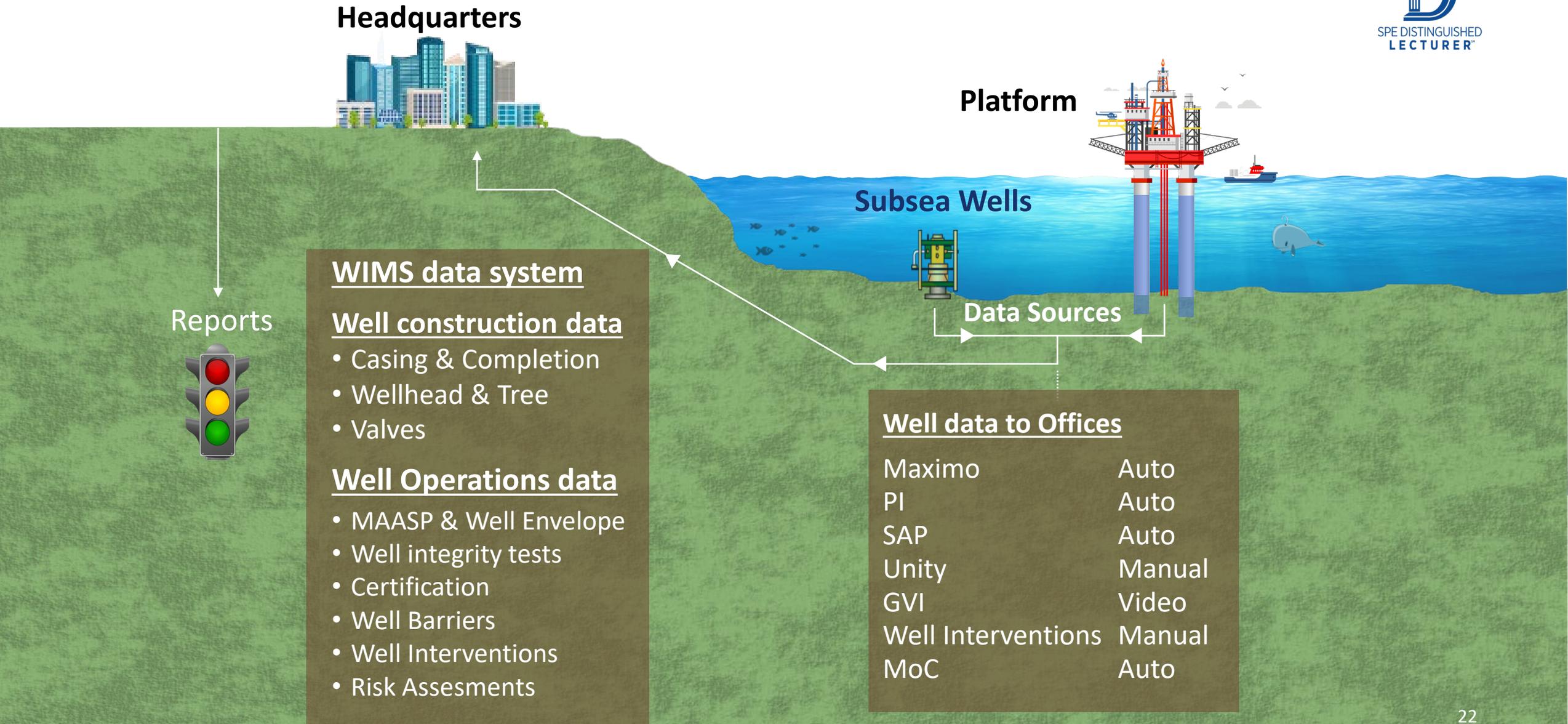
Well Integrity Management Systems (WIMS) – what is the range?



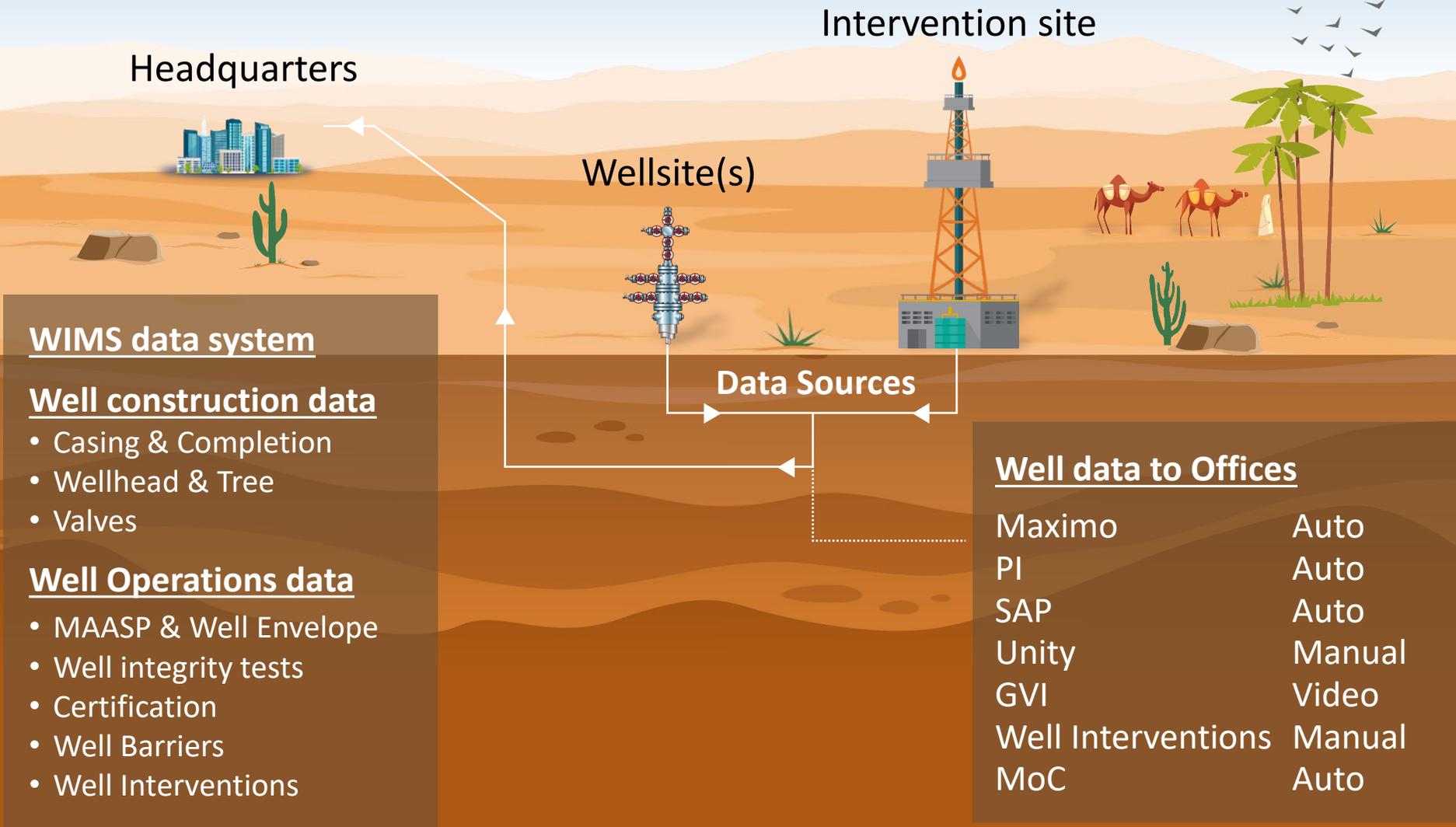
To the Production wing valve or associated flange

From the mule shoe/perforations

Well Data Management – Ideal System



Well Data Management - Ideal System



WIMS data system

Well construction data

- Casing & Completion
- Wellhead & Tree
- Valves

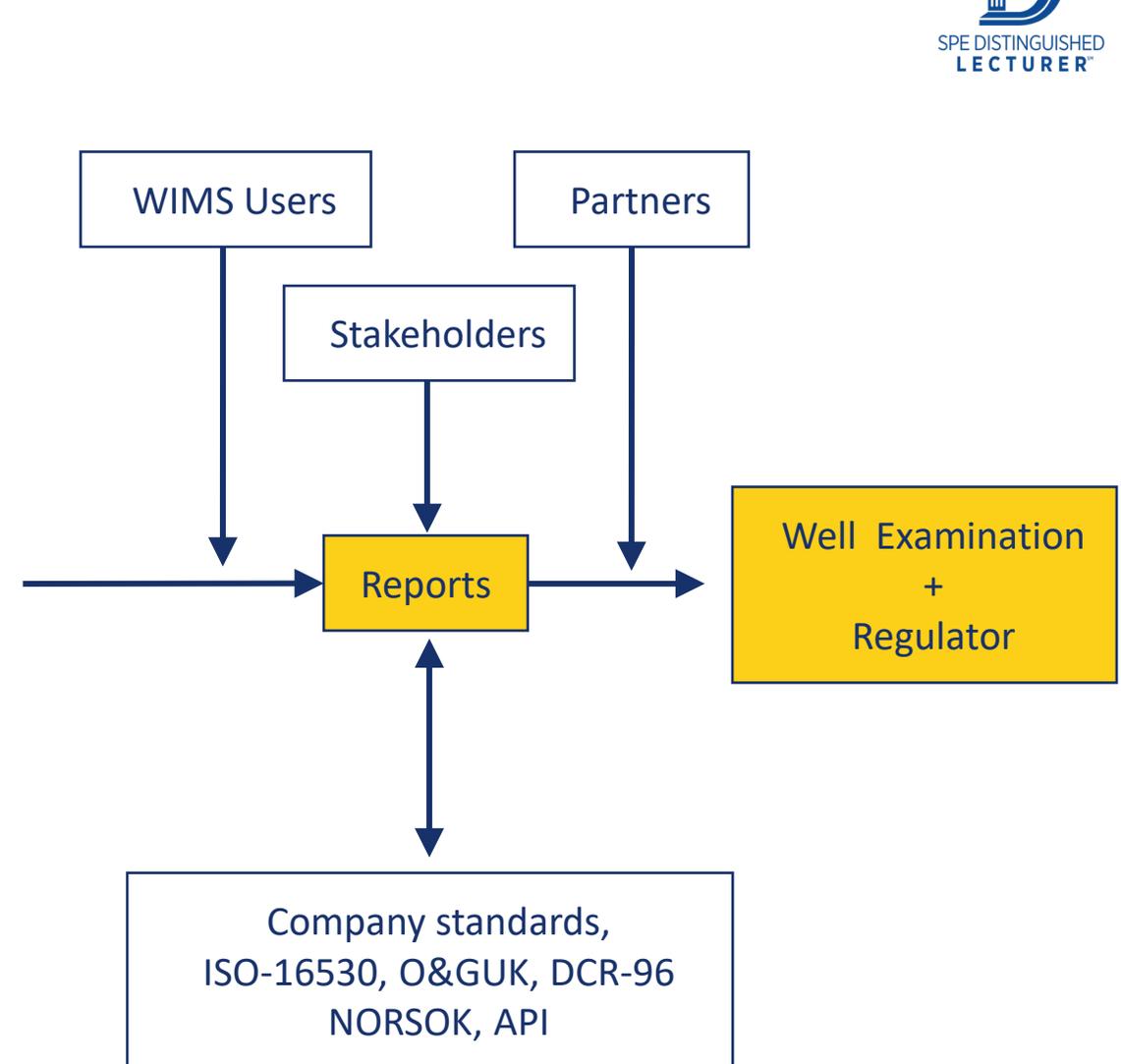
Well Operations data

- MAASP & Well Envelope
- Well integrity tests
- Certification
- Well Barriers
- Well Interventions

Well data to Offices

Maximo	Auto
PI	Auto
SAP	Auto
Unity	Manual
GVI	Video
Well Interventions	Manual
MoC	Auto

Typical Data Path



Three Key Features to the WIMS



- Legislative – what do I have to do
- Responsibilities – how will I do it
 - Well examination scheme
 - Wells register
 - Well integrity policy
 - Well handover process
- Data management – how do I collect/present my data, and provide status report(s)

Example Regulatory Documents



INTERNATIONAL STANDARD

ISO 16530-1

First edition 2017-03

Petroleum and natural gas industries — Well integrity — Part 1: Life cycle governance

Pétrole et industries du gaz naturel — Intégrité du puits — Partie 1: Gouvernance du cycle de vie

Oil & Gas UK



Guidelines for the Abandonment of Wells

Issue 5
July 2015

OIL & GAS UK

Well Life Cycle Integrity

Guidelines

Issue 4
March 2019

NORSOK D-010:2021

Published: 2021-01-11
Language: English

Well integrity in drilling and well operations

Brønnintegritet i boring og brønnoperasjoner

national-Well Integrity 2021-06-02

Oil and Gas and Sulphur Operations on the Outer Continental Shelf-Oil and Gas Production Safety Systems

A Rule by the Safety and Environmental Enforcement Bureau on 09/28/2018

PUBLISHED DOCUMENT

Start Printed Page 49216

AGENCY:
Bureau of Safety and Environmental Enforcement, Interior.

ACTION:
Final rule.

SUMMARY:
The Bureau of Safety and Environmental Enforcement (BSEE) is amending the regulations regarding oil and natural gas production safety systems. After a thorough reexamination of the current regulations, and consideration of recent experiences from implementation of those regulations and of public comments on the proposed rule to amend those regulations, BSEE is revising or removing certain regulatory provisions that create unnecessary burdens on stakeholders, and clarifying other provisions, while ensuring safety and environmental

DOCUMENT DETAILS

Printed version:
PDF

Publication Date:
09/28/2018

Agencies:
Bureau of Safety and Environmental Enforcement

Dates:
This rule becomes effective on December 27, 2018.

Effective Date:
12/27/2018

Document Type:
Rule

Document Citation:
83 FR 49216

Page:
49216-49263 (48 pages)

Bradenhead Pressure Management

Example Supporting Documents

Annular Casing Pressure Management for Offshore Wells

API RECOMMENDED PRACTICE 90
FIRST EDITION, AUGUST 2006

REAFFIRMED, JANUARY 2012

Specification for Wellhead and Tree Equipment

API SPECIFICATION 6A
TWENTY-FIRST EDITION, NOVEMBER 2018

API MONOGRAM PROGRAM EFFECTIVE DATE: JANUARY 2021

ERRATA 1, APRIL 2019
ERRATA 2, JUNE 2020
ERRATA 3, SEPTEMBER 2020
ADDENDUM 1, JULY 2020



API 6ACRA : 2015

AGE-HARDENED NICKEL-BASED ALLOYS FOR OIL AND GAS
DRILLING AND PRODUCTION EQUIPMENT

American Petroleum Institute



AMERICAN PETROLEUM INSTITUTE

API Recommended Practice 14B Design, Installation, Operation, Test, and Redress of Subsurface Safety Valve Systems

SIXTH EDITION | SEPTEMBER 2015 | 37 PAGES | \$126.00 | PRODUCT NO. G14B06

This document establishes requirements and provides guidelines for subsurface safety valve (SSSV) system equipment. This includes requirements for SSSV system design, installation, operation, testing, redress, support activities, documentation, and failure reporting. SSSV system equipment addressed by this document includes control systems, control lines, SSSVs, and secondary tools as defined herein. SSSV types including surface controlled (SCSSV), sub-surface controlled (SSCSV), and sub-surface

For ordering information:

Online: www.api.org/pubs

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(+1) 303-397-7056
(Local and International)

Well Integrity Toolkit



Anomaly management

Risk Assessment

Well Operating Envelope

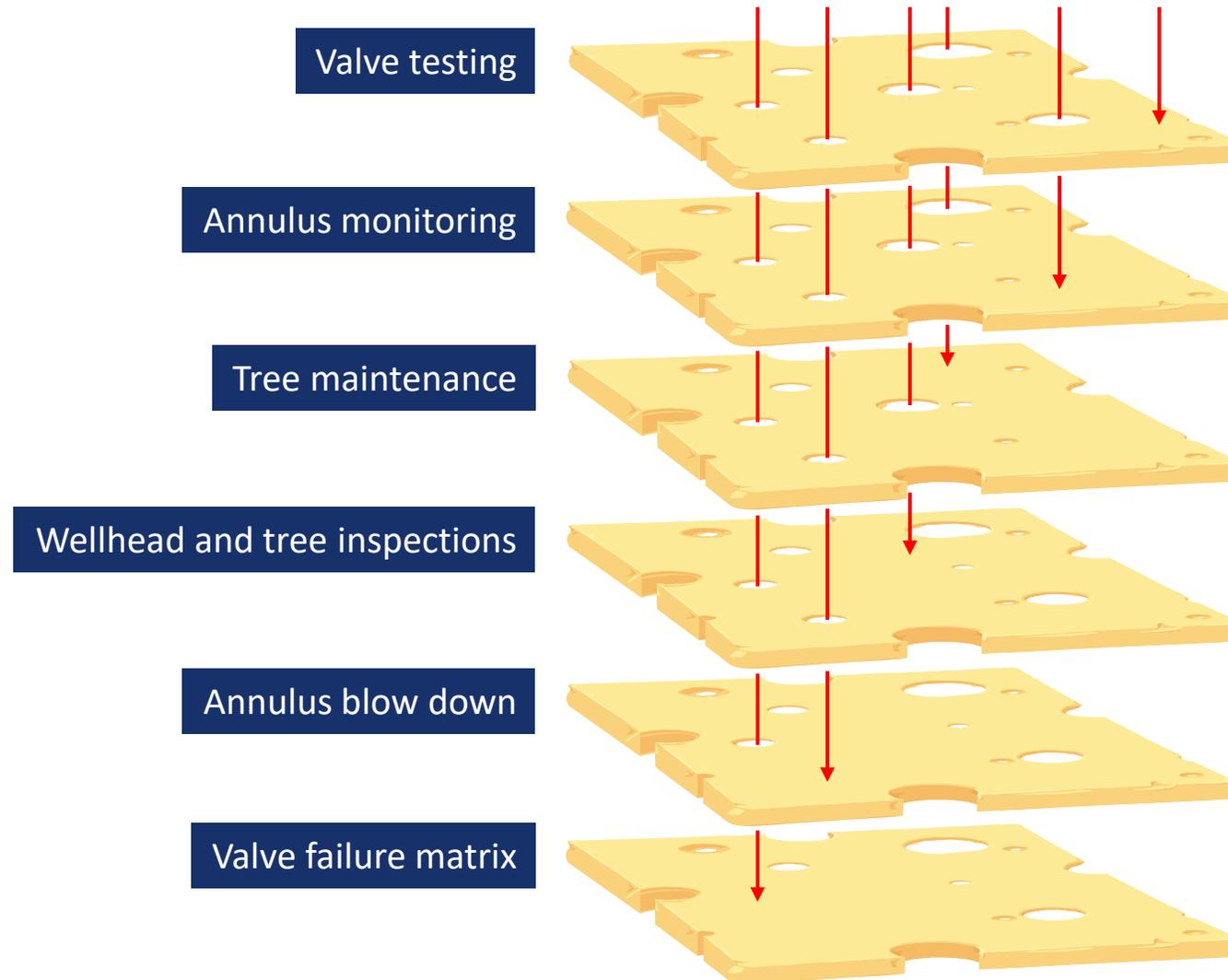
Well Handover

MAASP

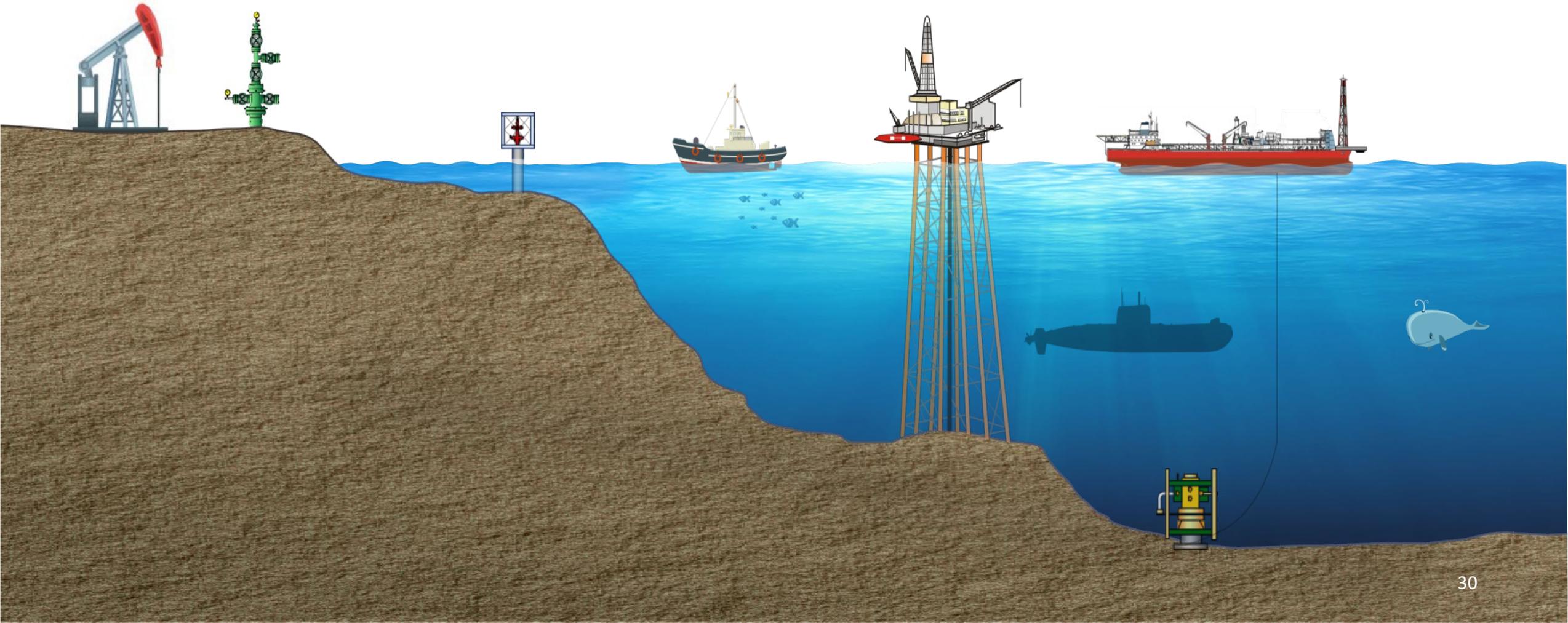
Well construction data

WIMS software

How does this all fit together?



Abandonment Considerations



Abandonment Considerations



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