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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

Society of Petroleum Engineers
Distinguished Lecturer Program
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Jargon Buster.

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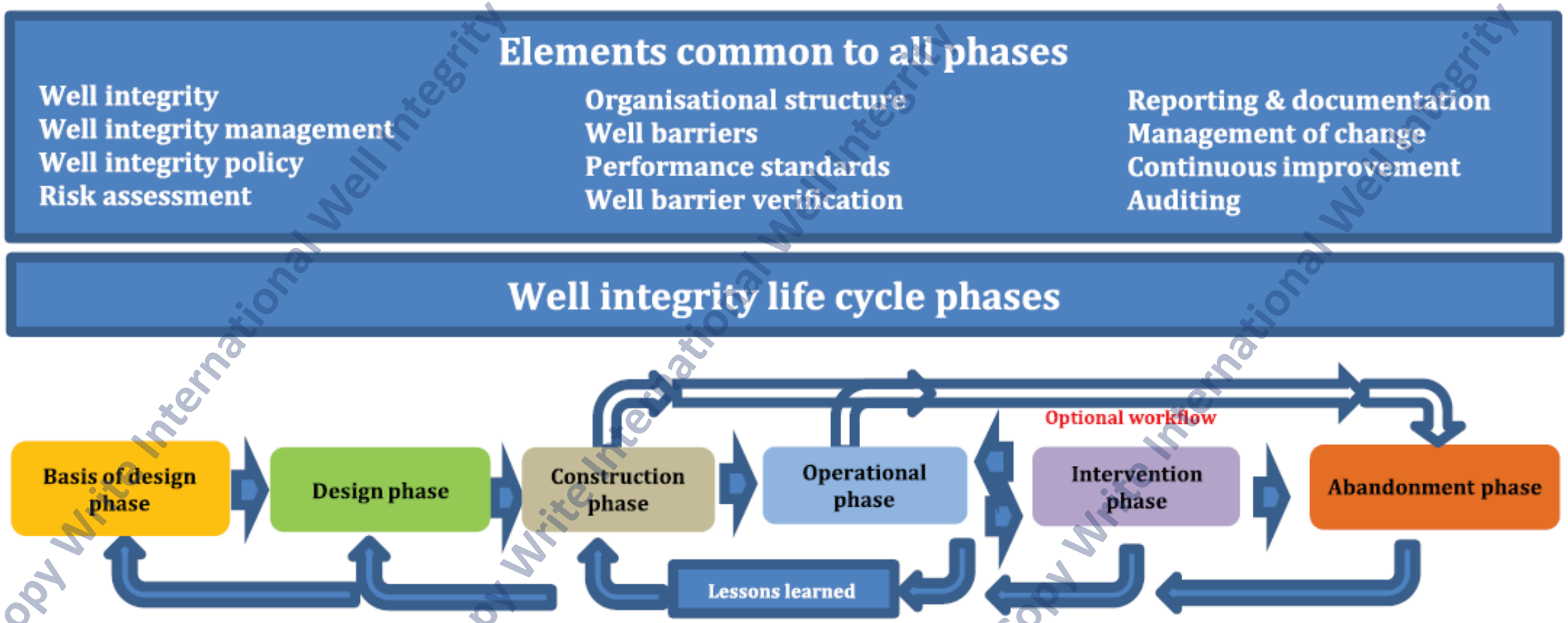
Acronym	Meaning	Acronym	Meaning
API	American Petroleum Institute	MAASP	Maximum allowable annulus surface pressure
BOEMRE	USA offshore regulator	MoC	Management of change
DCR	Design & Construction Regs (UK)	SCF/min	Standard cubic feet per minute
IOGP	International Oil & Gas Producers	SCSSSV	Surface controlled 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



After ISO 16530, 2017

What is a Barrier?

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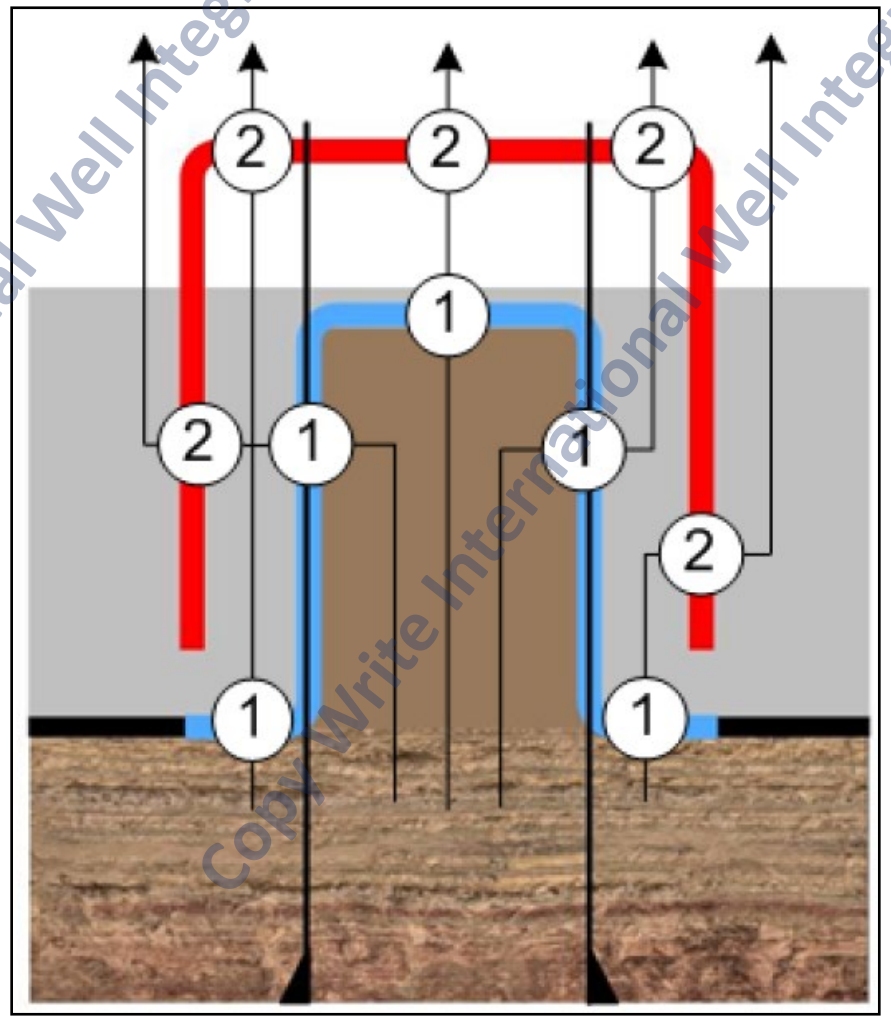
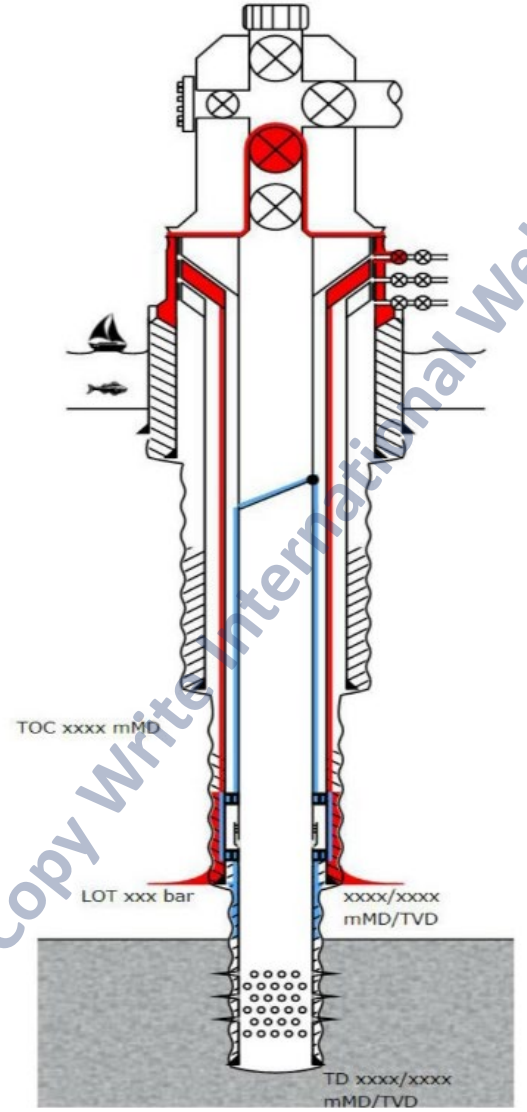
There are four type of barriers, and these consist of the following:

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 in the Operate Phase

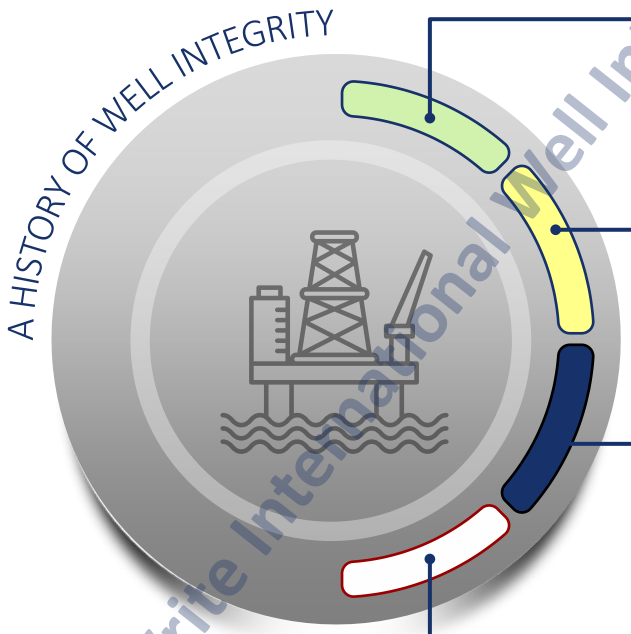
Norsok principle: Hat-over-hat envelope philosophy





After Well Barrier.com

Colour coding explanation



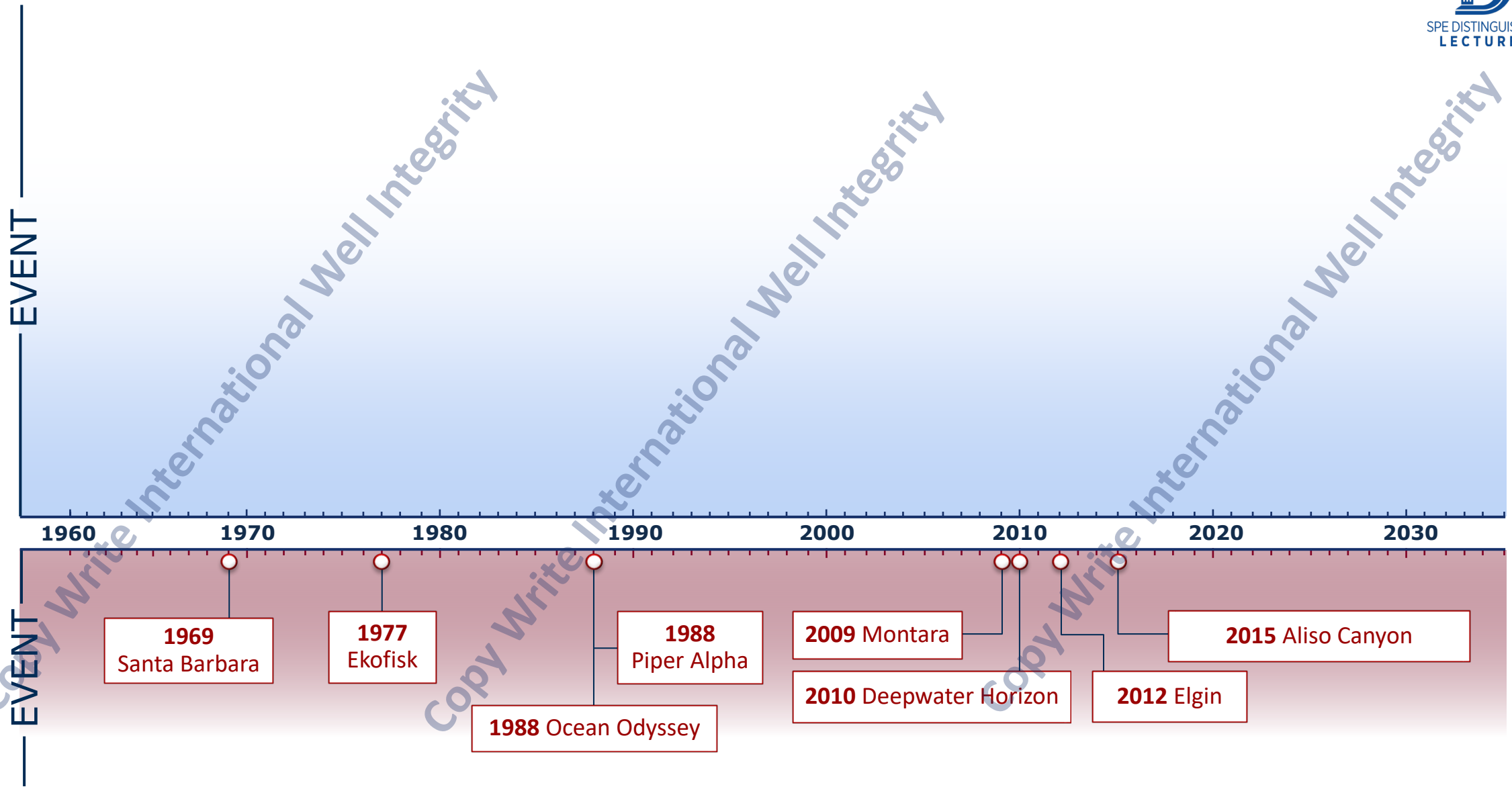
Standard or recommended practice published

Significant technical advancement

Data sharing

Industry failure

A History of Well Integrity



Spindletop, Texas

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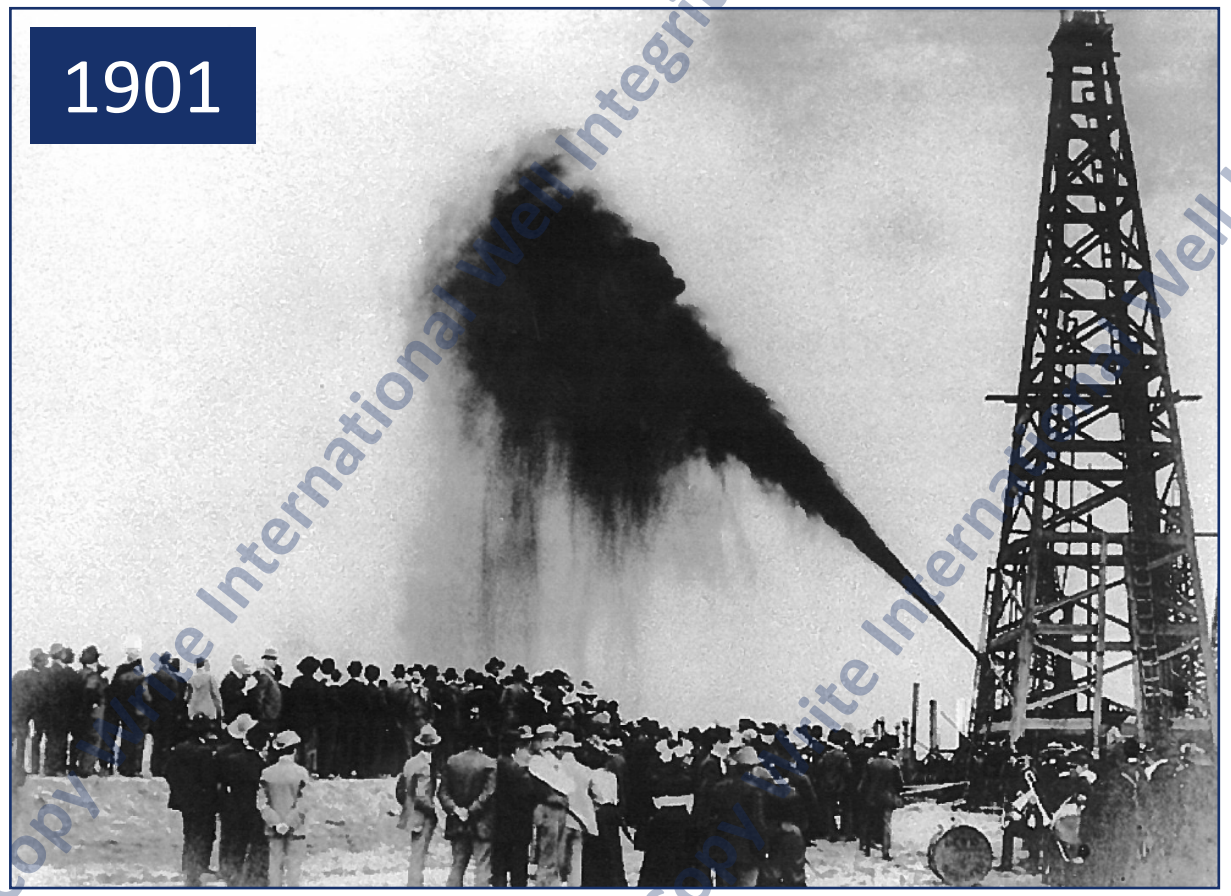
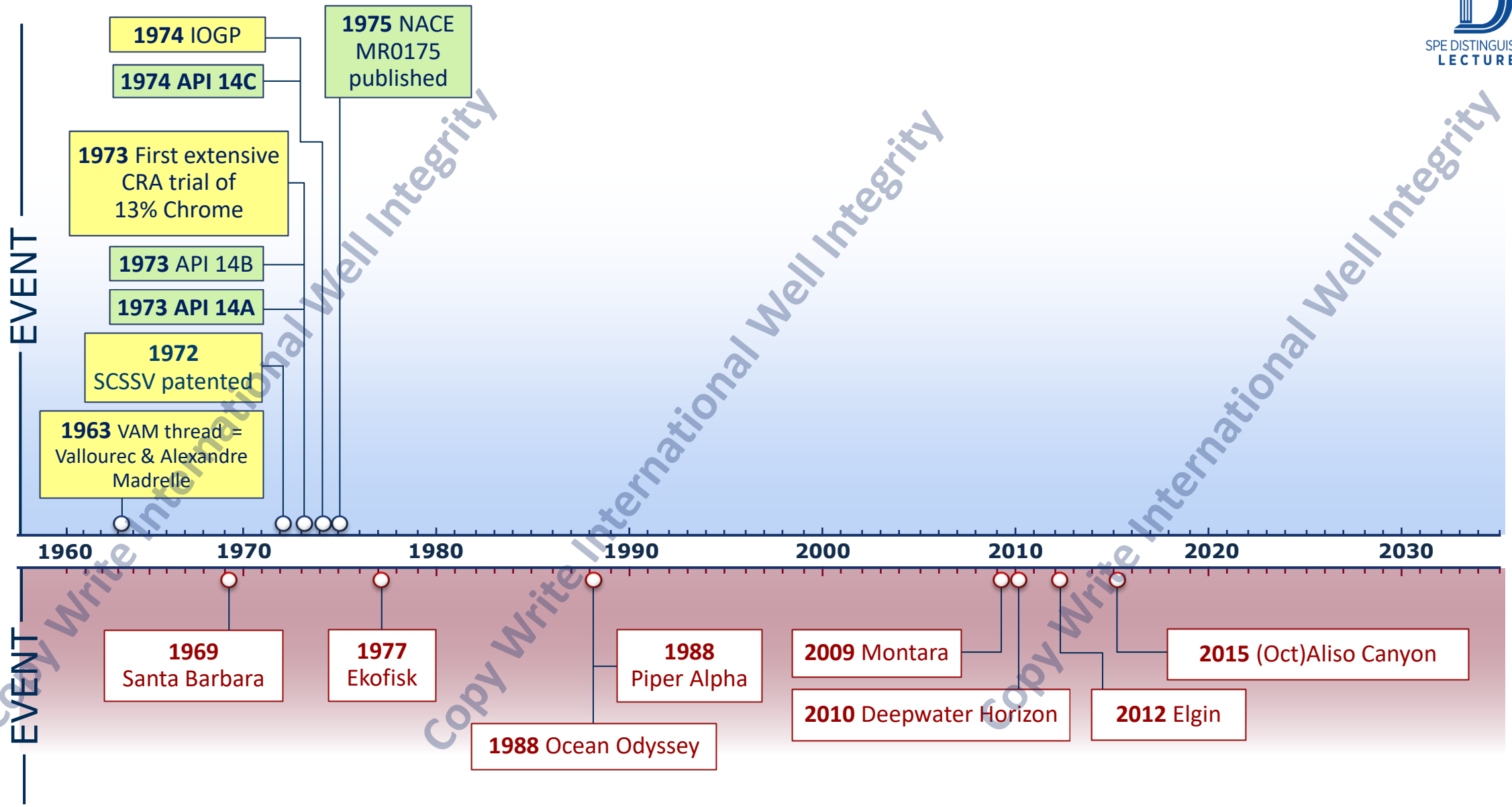
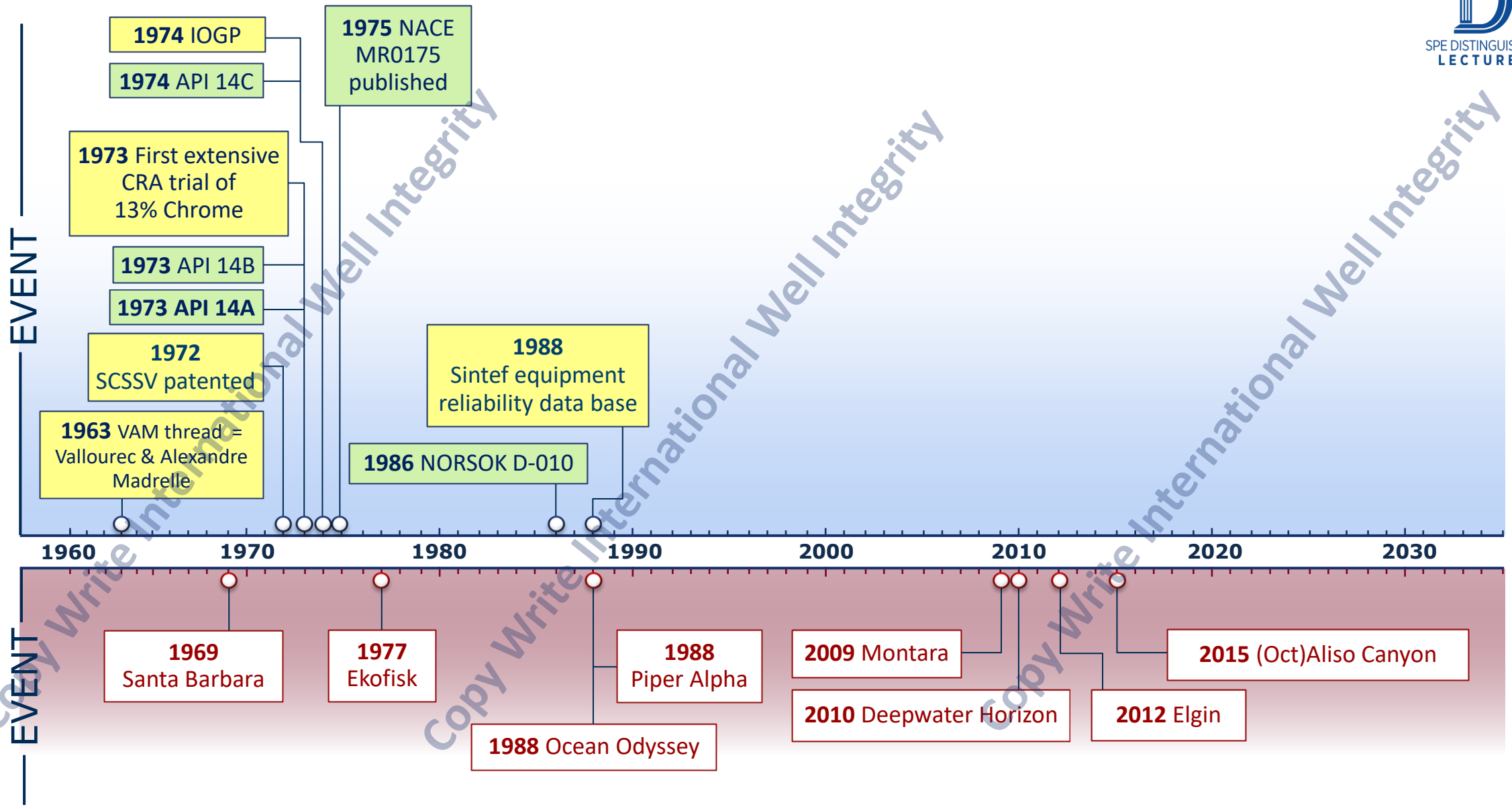


A History of Well Integrity – The past

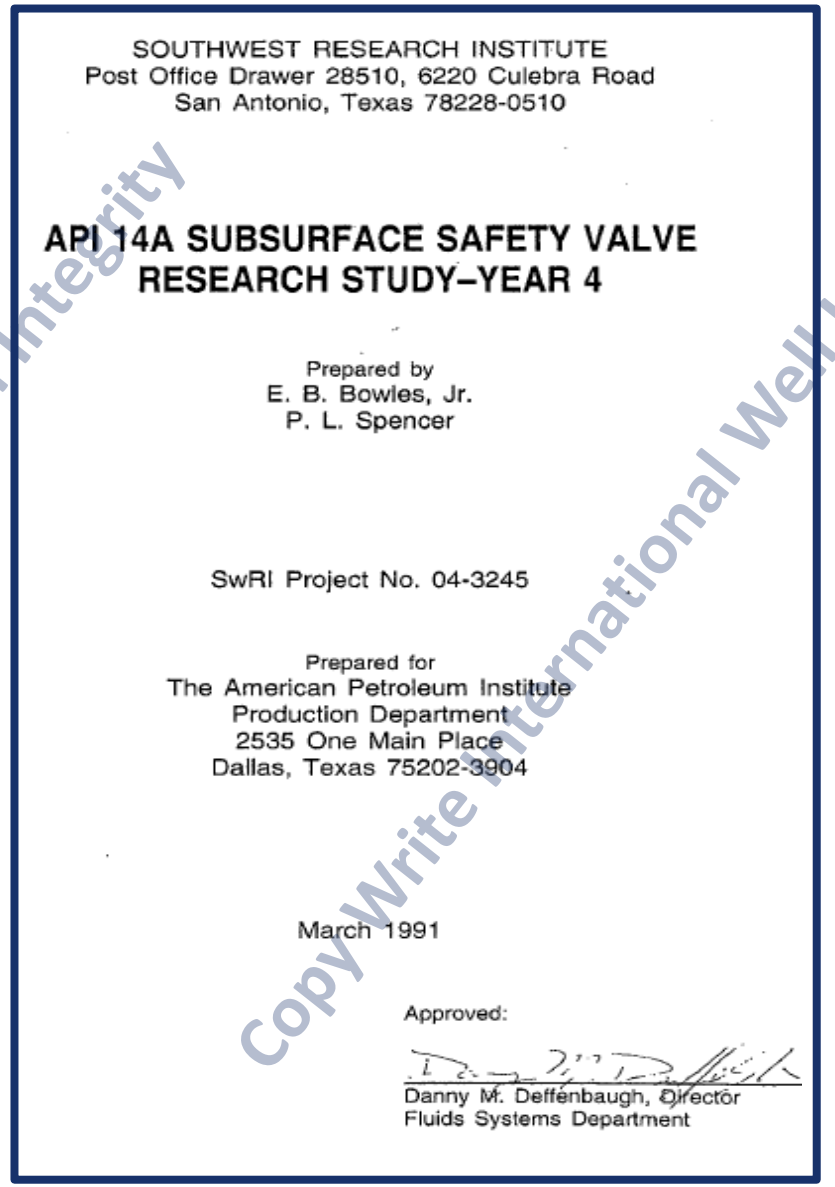


A History of Well Integrity – The past



Acceptable leak rates

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



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API 14A SUBSURFACE SAFETY VALVE RESEARCH STUDY–YEAR 4

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

SwRI Project No. 04-3245

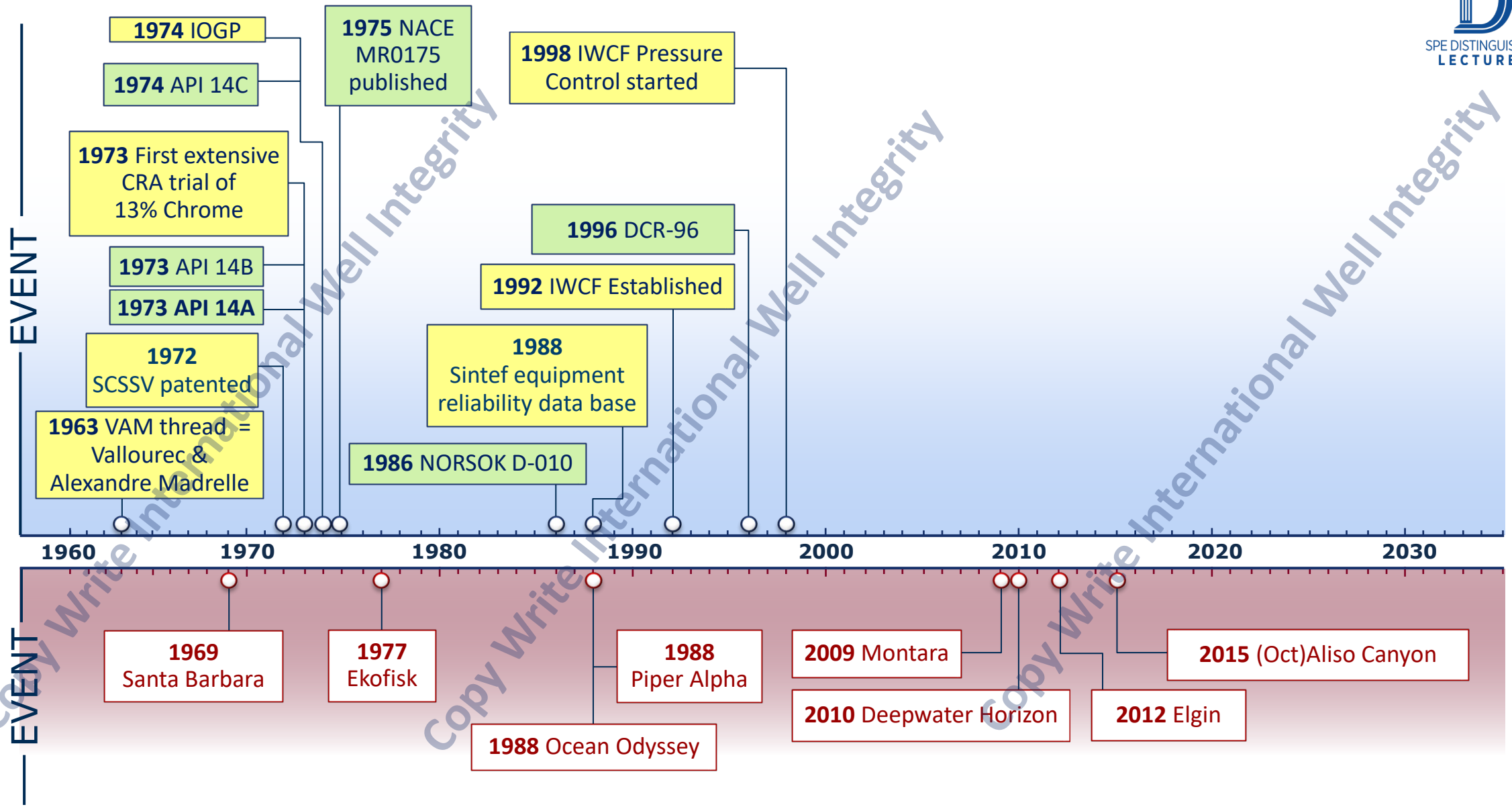
Prepared for
The American Petroleum Institute
Production Department
2535 One Main Place
Dallas, Texas 75202-3904

March 1991

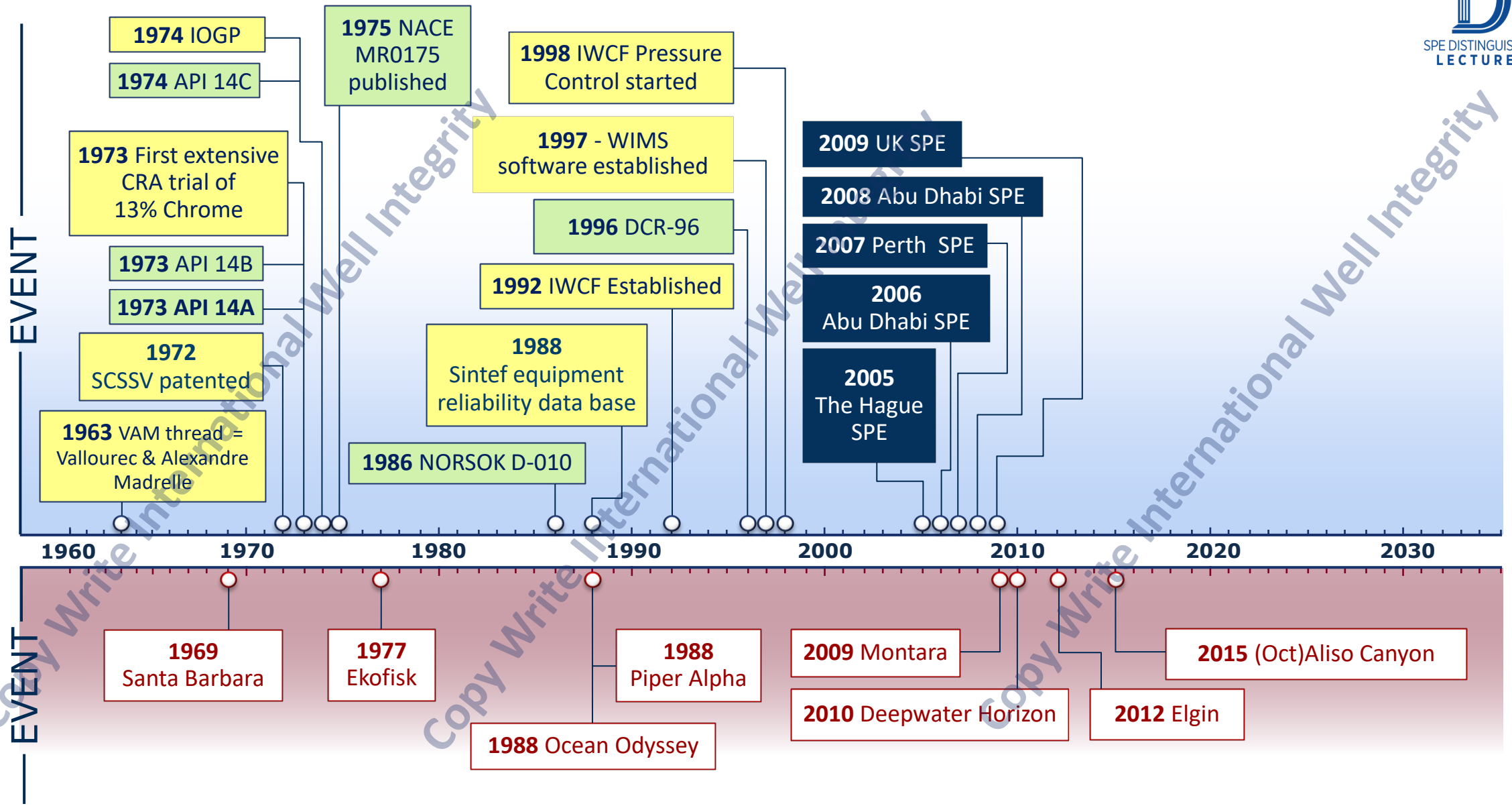
Approved:

Danny M. Deffenbaugh, Director
Fluids Systems Department

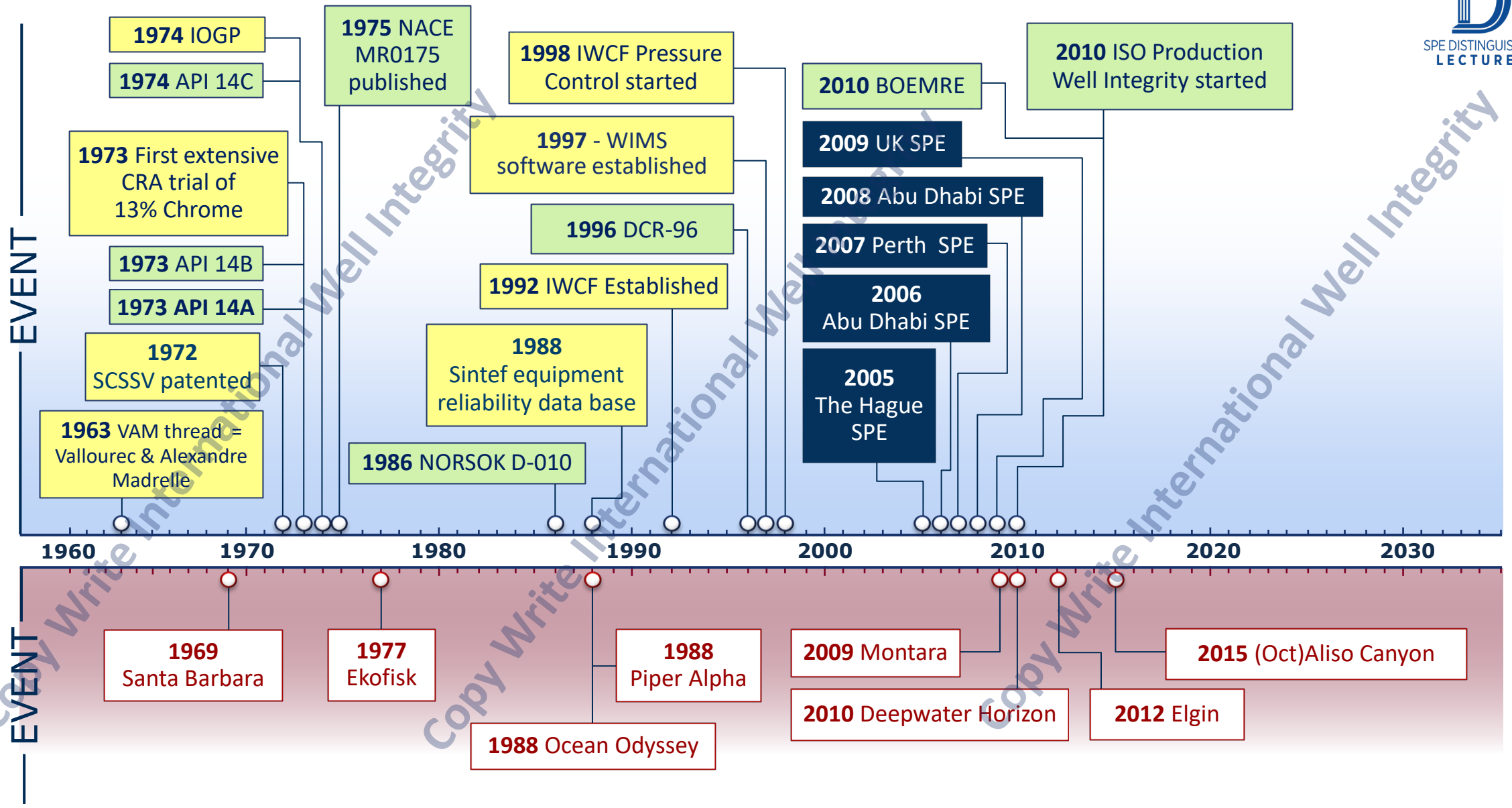
A History of Well Integrity – The past



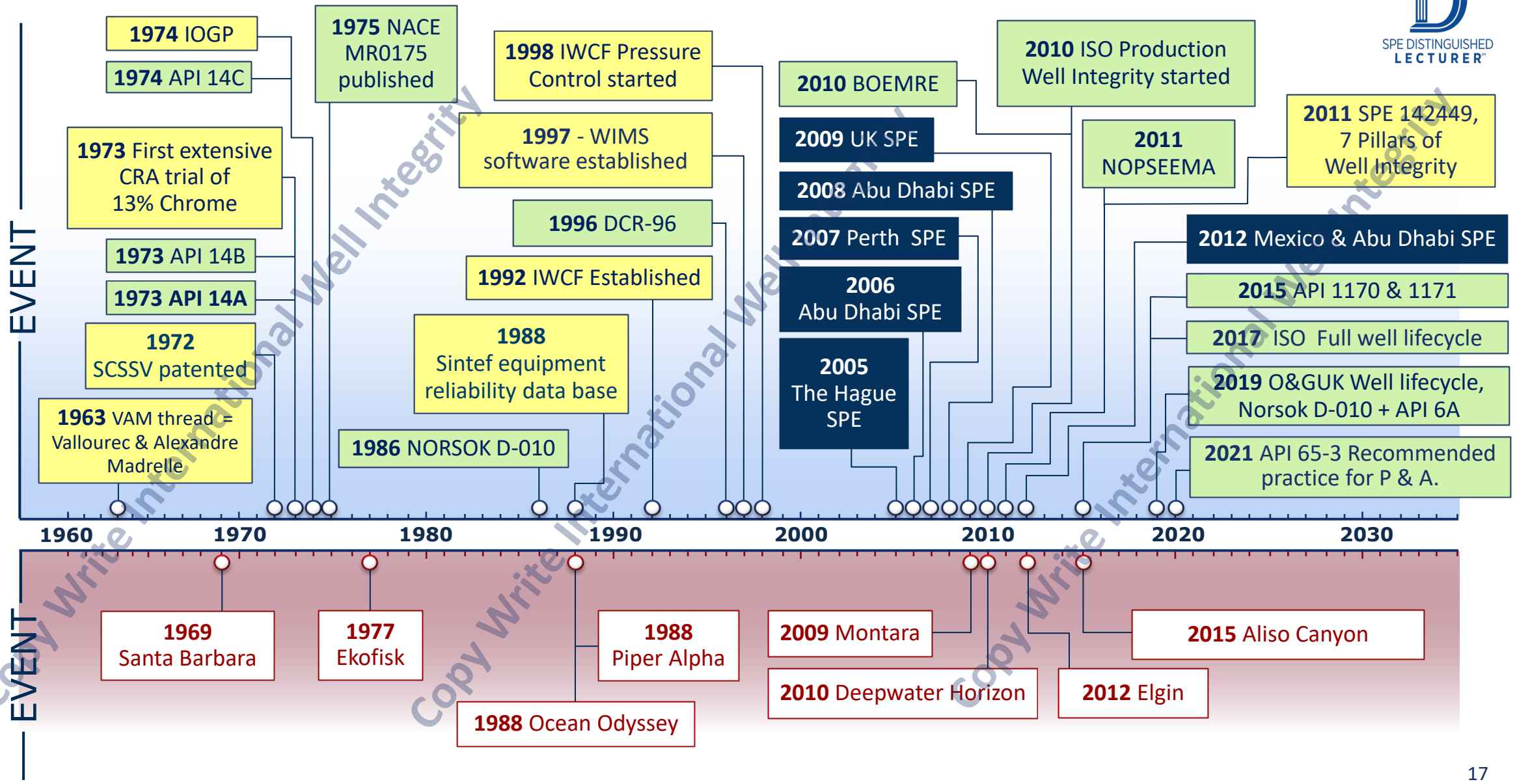
A History of Well Integrity – The past



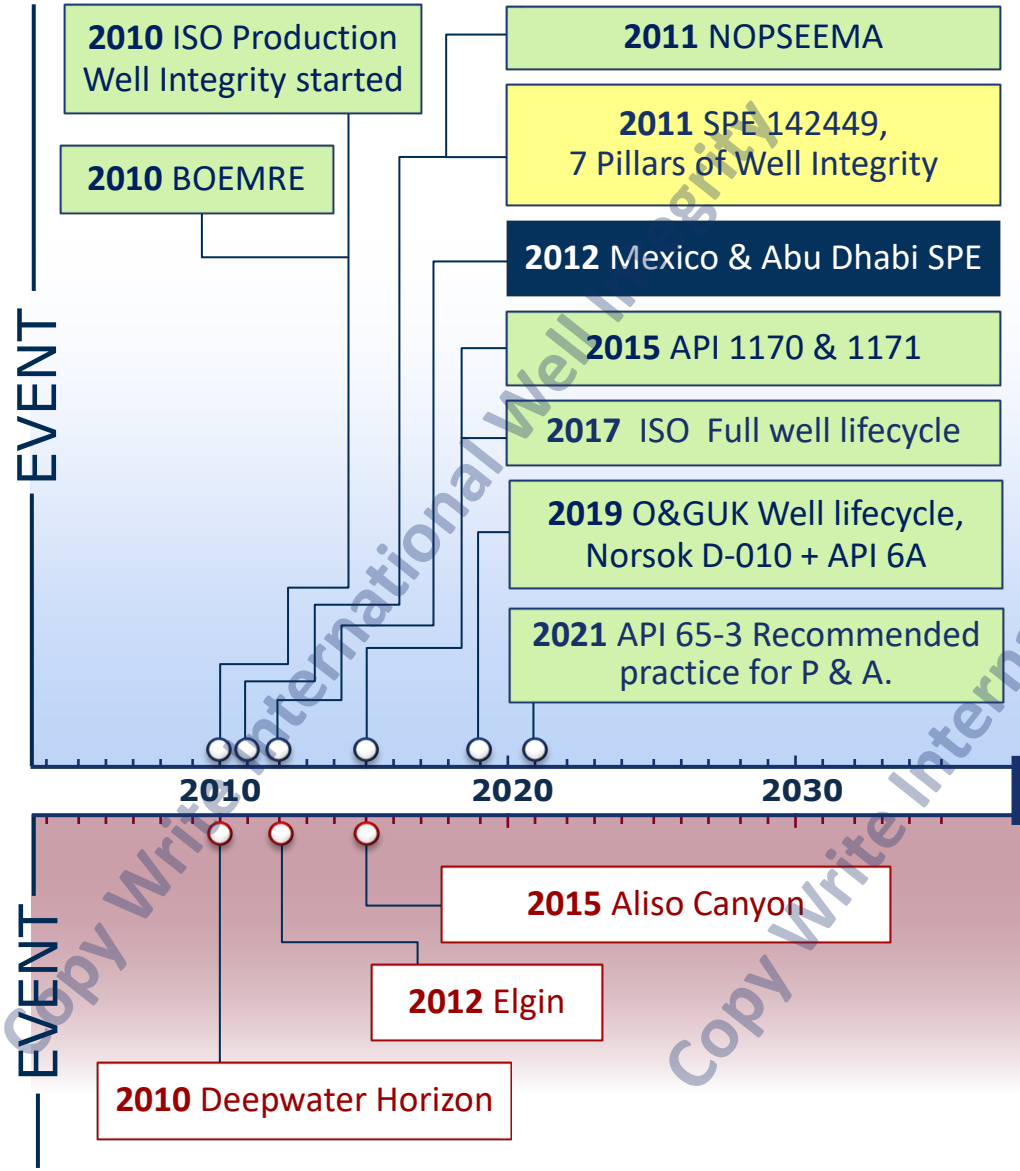
A History of Well Integrity – The past



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

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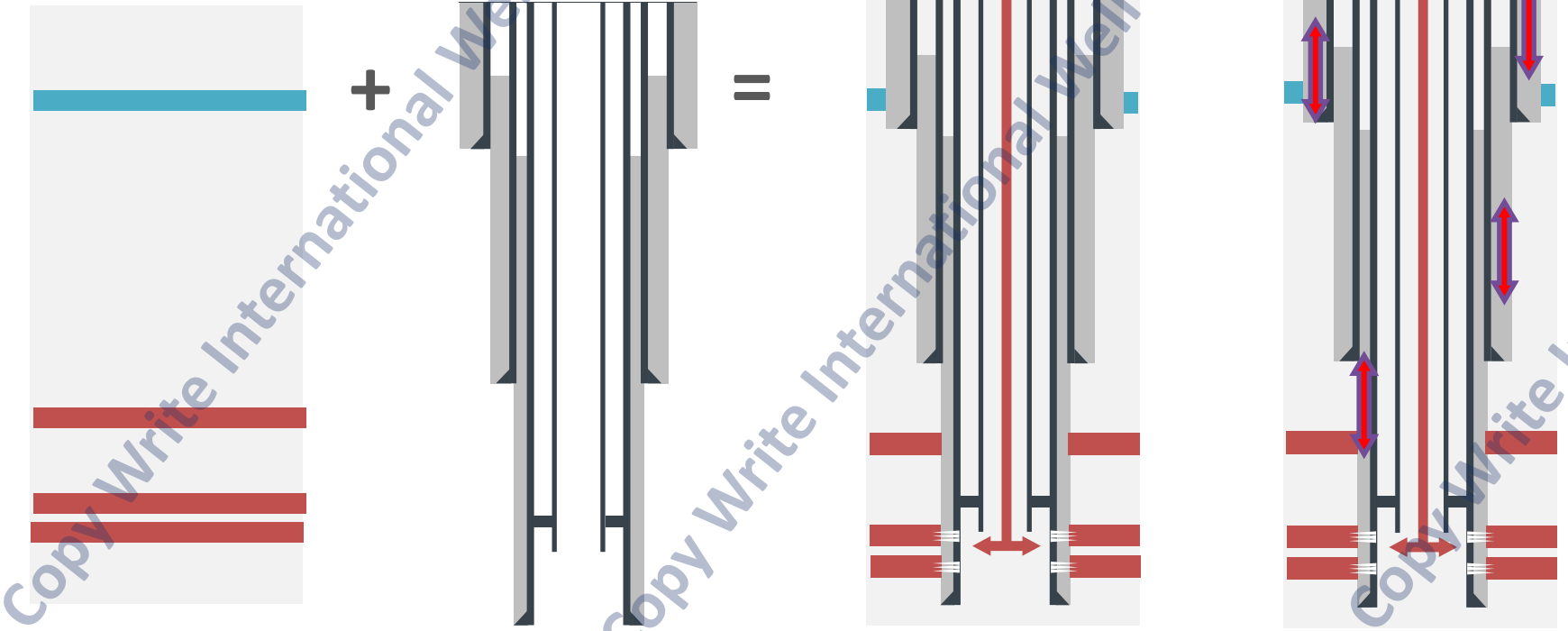
The world as nature created

The world Big Oil designed

The world Big Oil constructed

The world as Big Oil had to manage



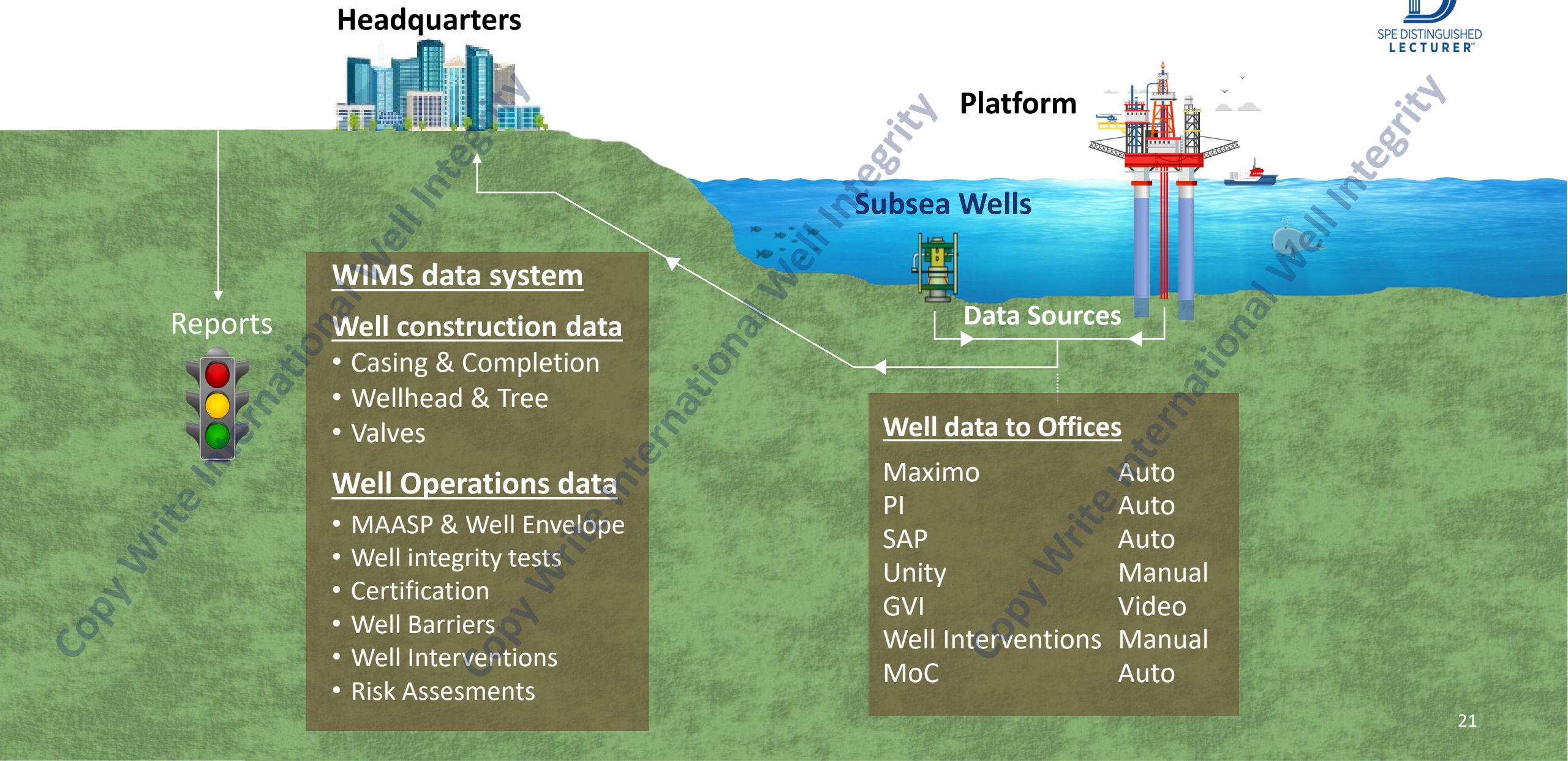
After Ken Feather

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

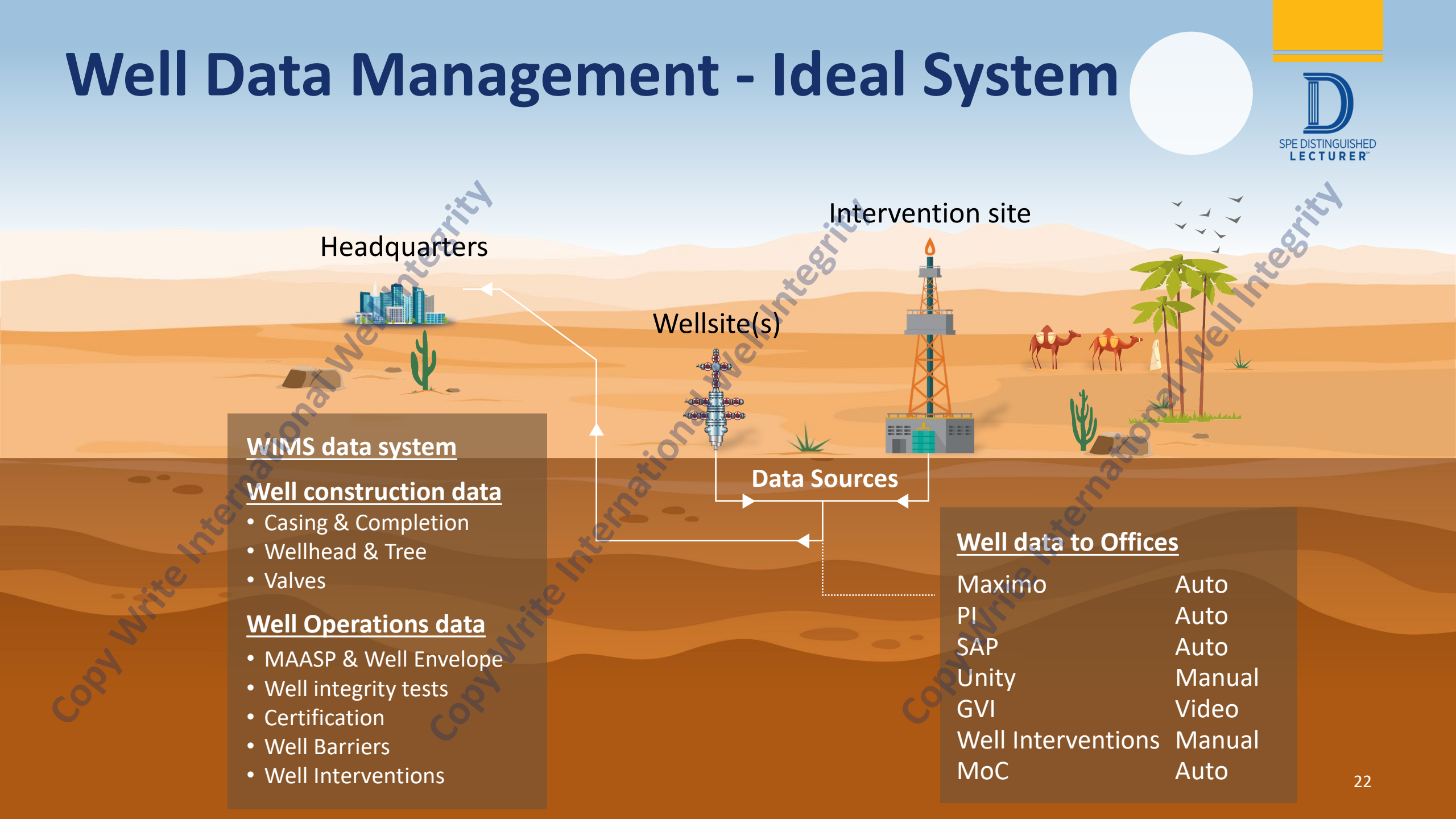
To the Production wing valve or associated flange

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

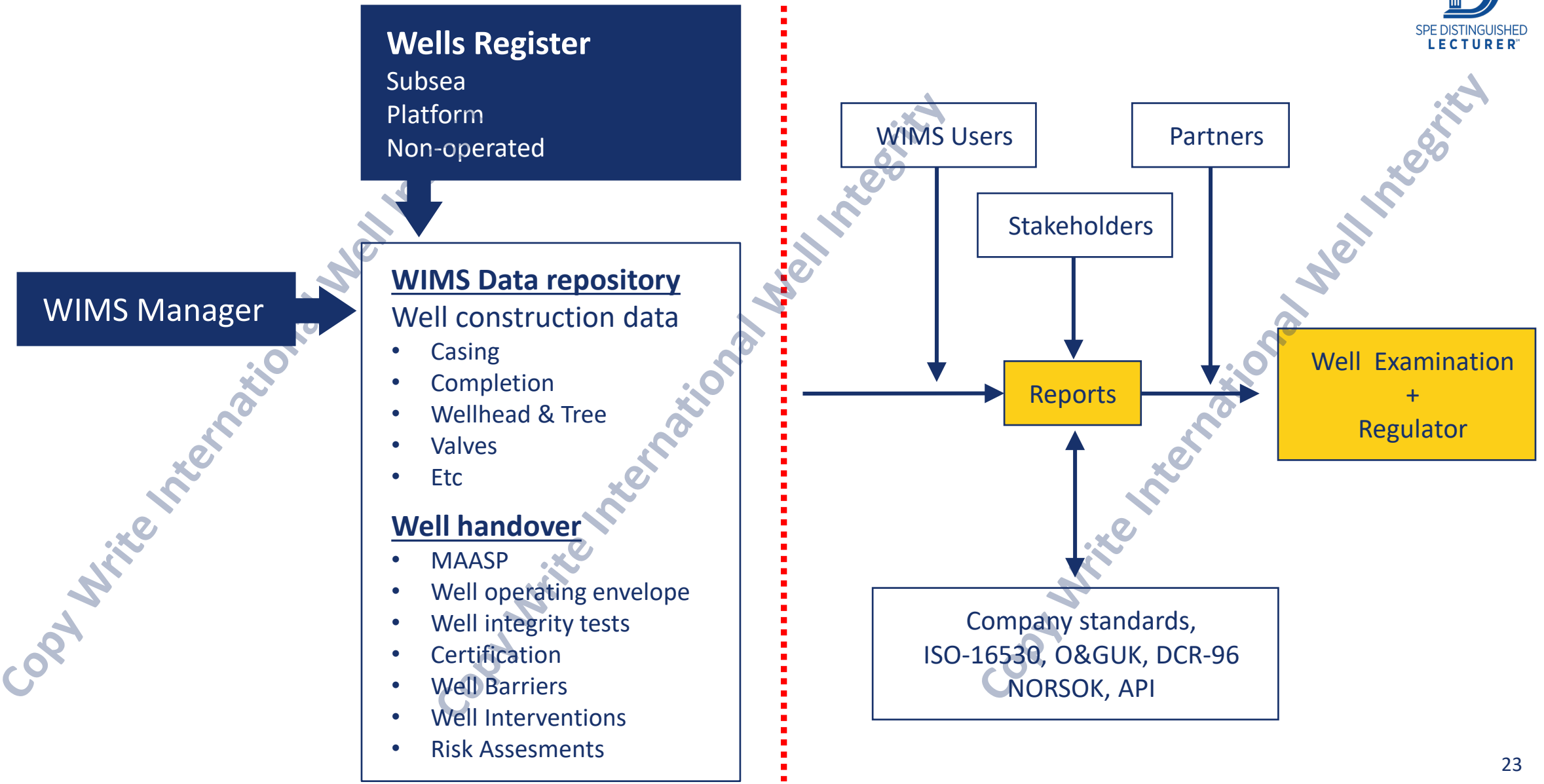
Well Operations data

- 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

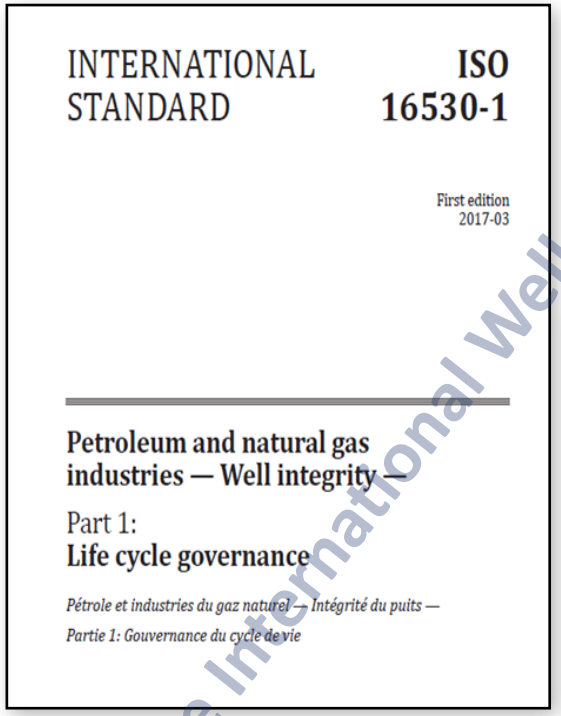
Typical Data Path

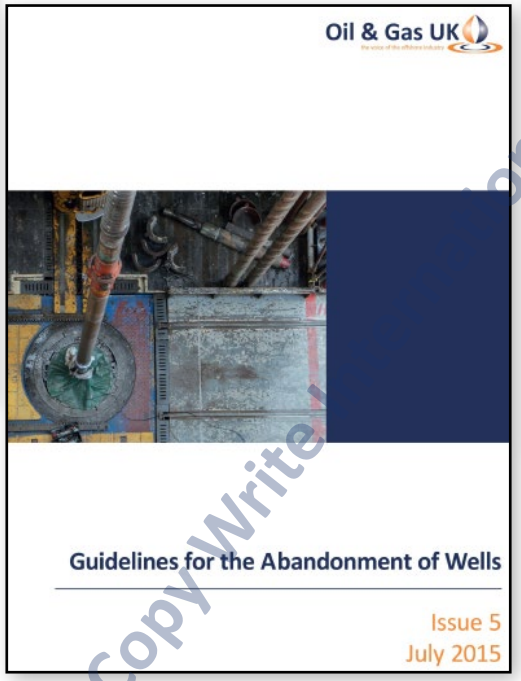


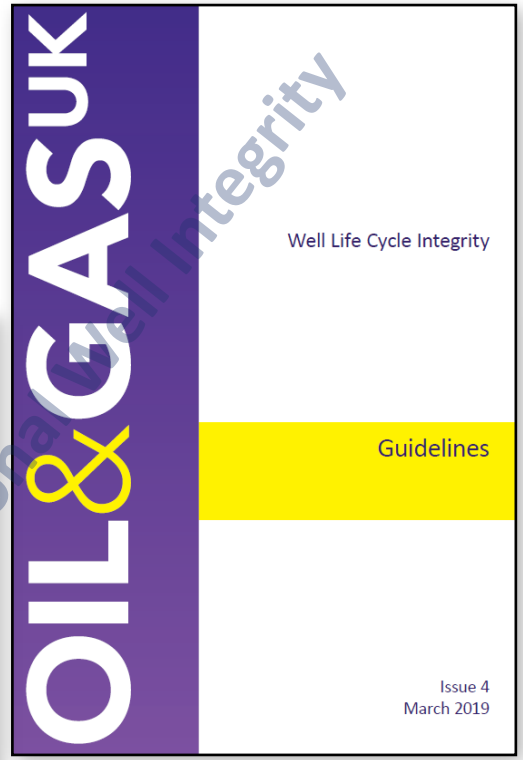
Three Key Features to the WIMS

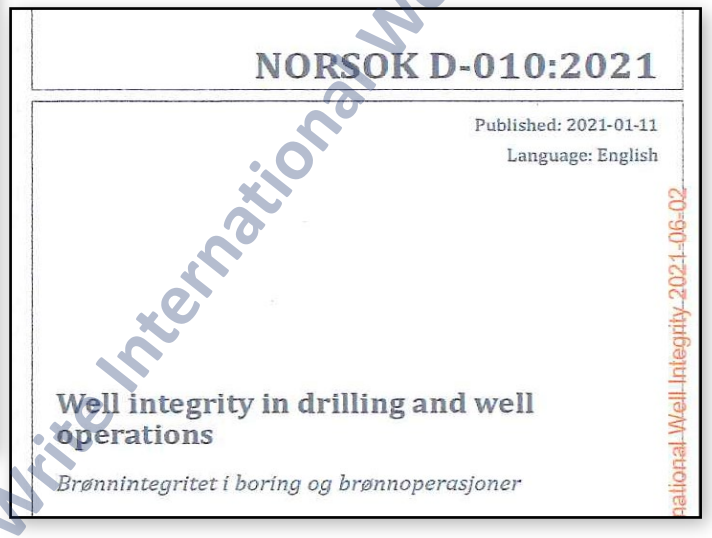
- Legislative – what do I have to do
- Responsibilities – how will I do it
  - Well examination scheme
  - Wells register
  - Well integrity policy
  - Well handover process
- Data management – how do I collect/present my data, and provide status report(s)

Example Regulatory Documents









Example Supporting Documents

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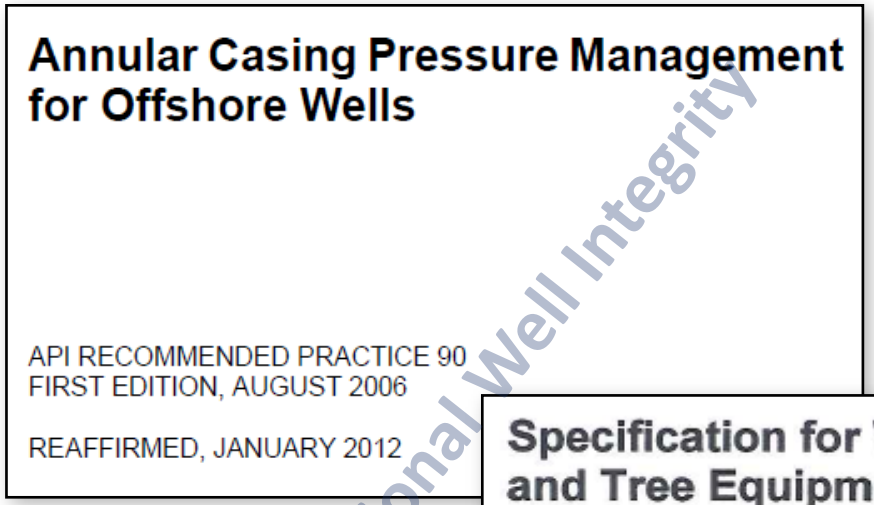
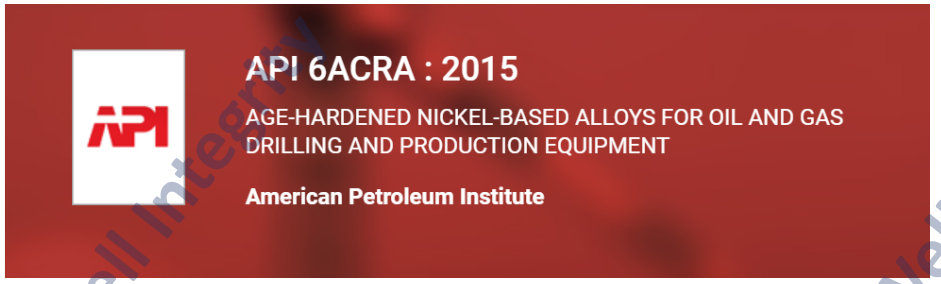

Annular Casing Pressure Management for Offshore Wells

API RECOMMENDED PRACTICE 90
FIRST EDITION, AUGUST 2006

REAFFIRMED, JANUARY 2012


API 6ACRA : 2015

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

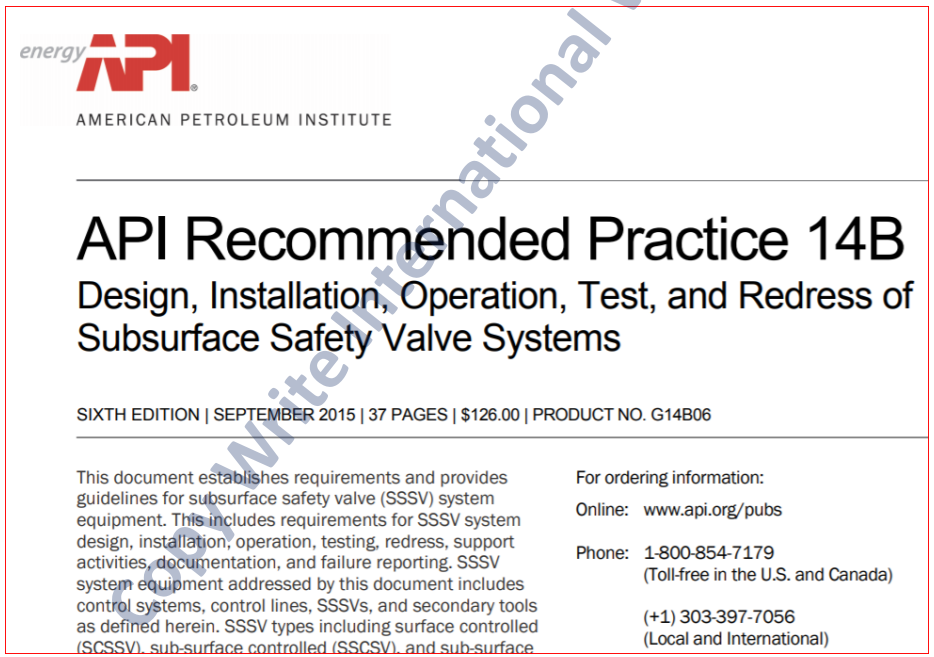
American Petroleum Institute


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


energy API

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

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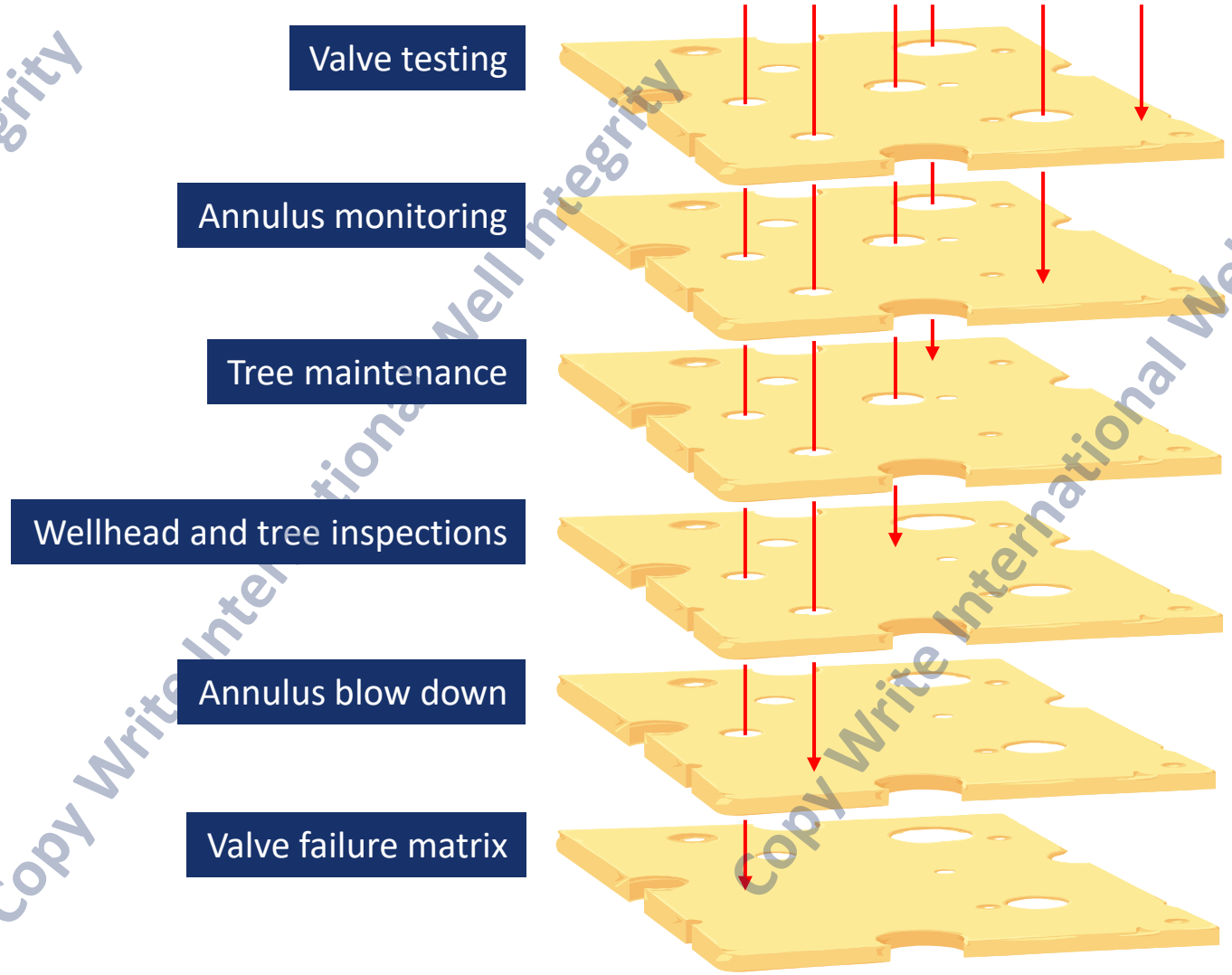
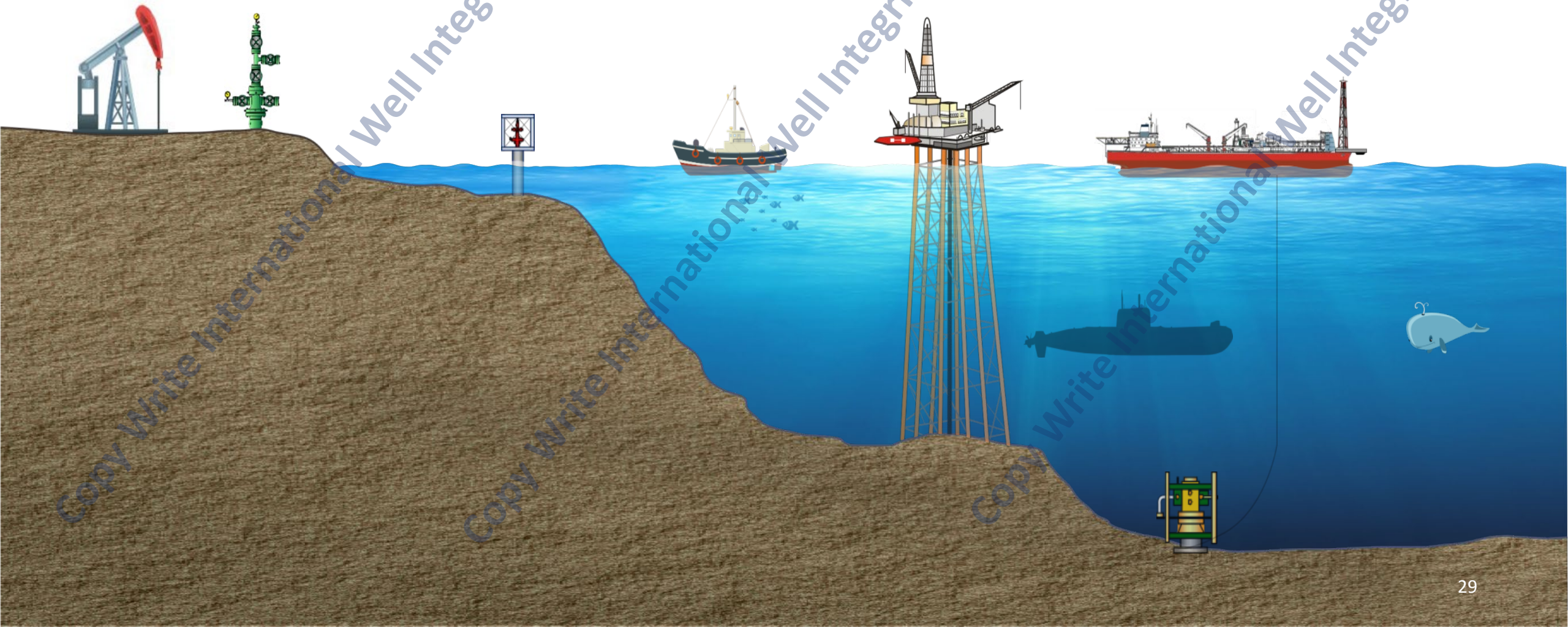
Well Integrity Toolkit

- 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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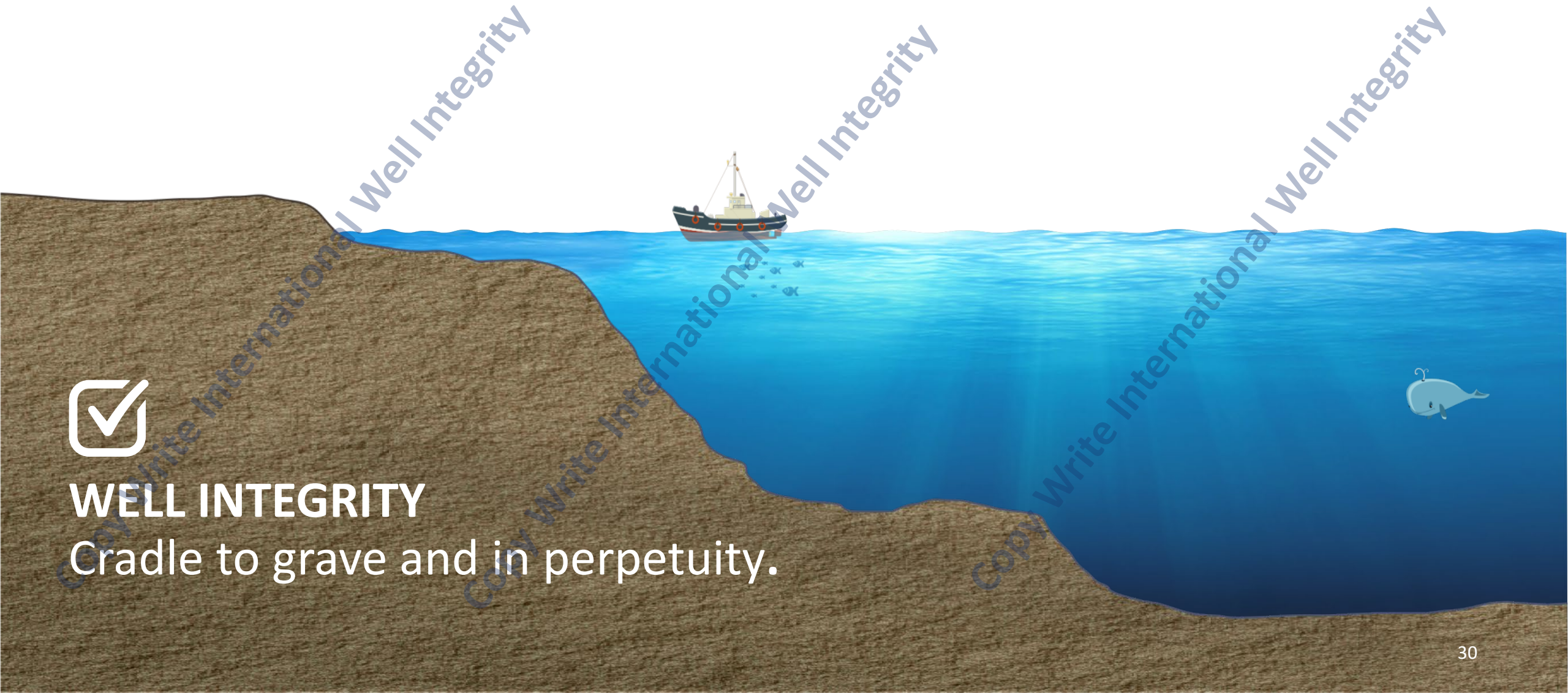

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