

EXEDRA

The ultimate method for P&A barrier verification

May 7, 2024

Bernt Pedersen, Founder & CEO



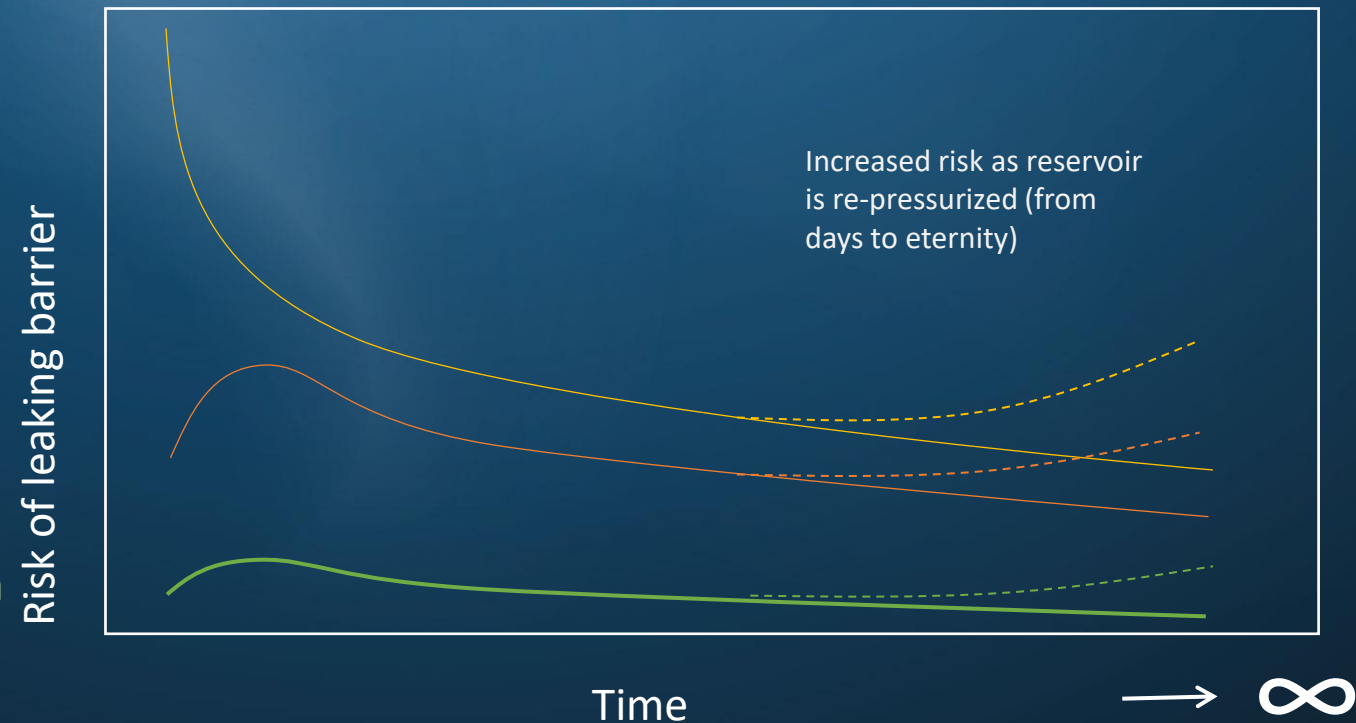
Governments requirements are - no leaks of HC into the eternity

- Nobody can guarantee NO leaks into eternity, however the accumulated probability will be greatly reduced with a high-quality verification
- Hence verification of the integrity of a permanent barrier is a critical data point
- New EU methane provisional regulations Nov 2023, to be finalised June 2024, with leak detection and repair (LDAR) requirements, setting minimum detection limits

No verification

Conventional
pressure verification

Pressure from below
tracer-based verification



BALDER™

System benefits

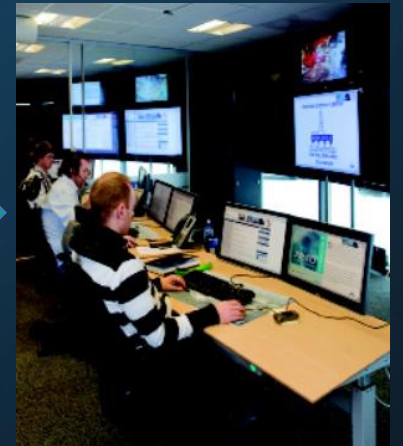
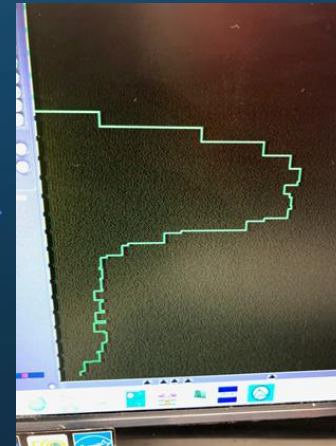
- The only method giving direct evidence of a leak tight barrier
- Unambiguous result – testing in right direction towards external environment
- Extreme sensitivity, low cost & quick response
- Covering wide range of P&AA offerings - internal and annulus verification and including rigless/riserless applications

Value for customers

- Enables deployment of new more cost-efficient plugging solutions
- Enabling verification of competent barrier behind casing
- Enables shorter barriers, such as section milling lengths

Detection system provided by third party

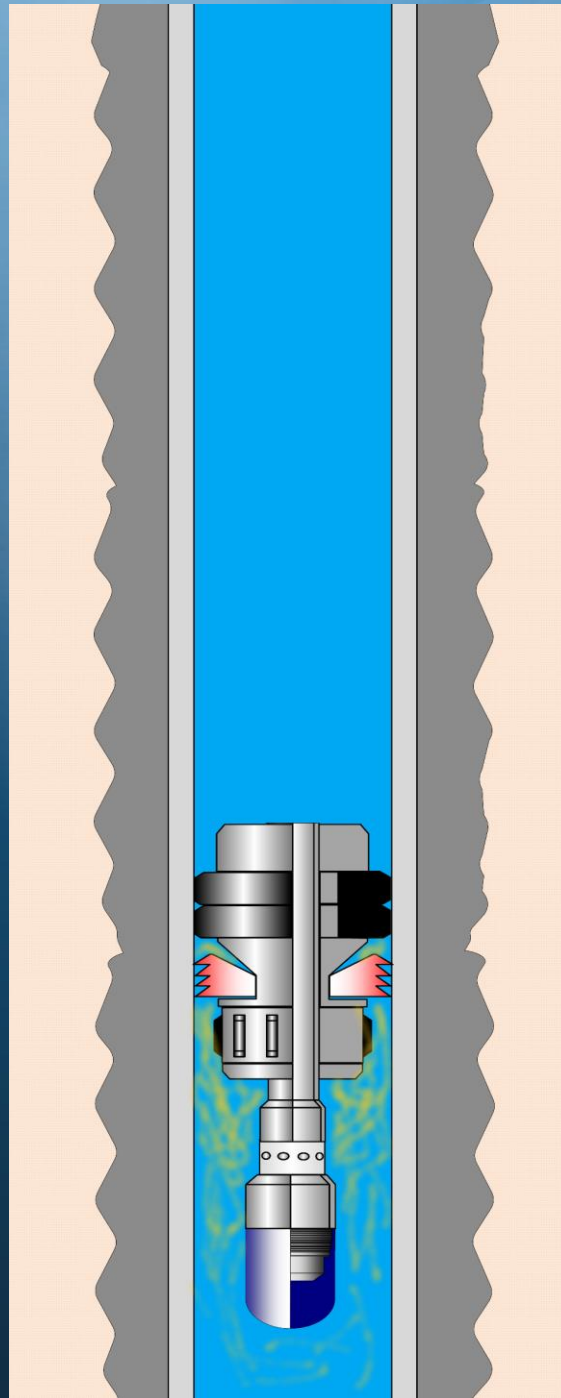
- Provides unmanned, autonomous detection system, using existing rig infrastructure



Pilot run March 2023 for Equinor, Norway

Scope

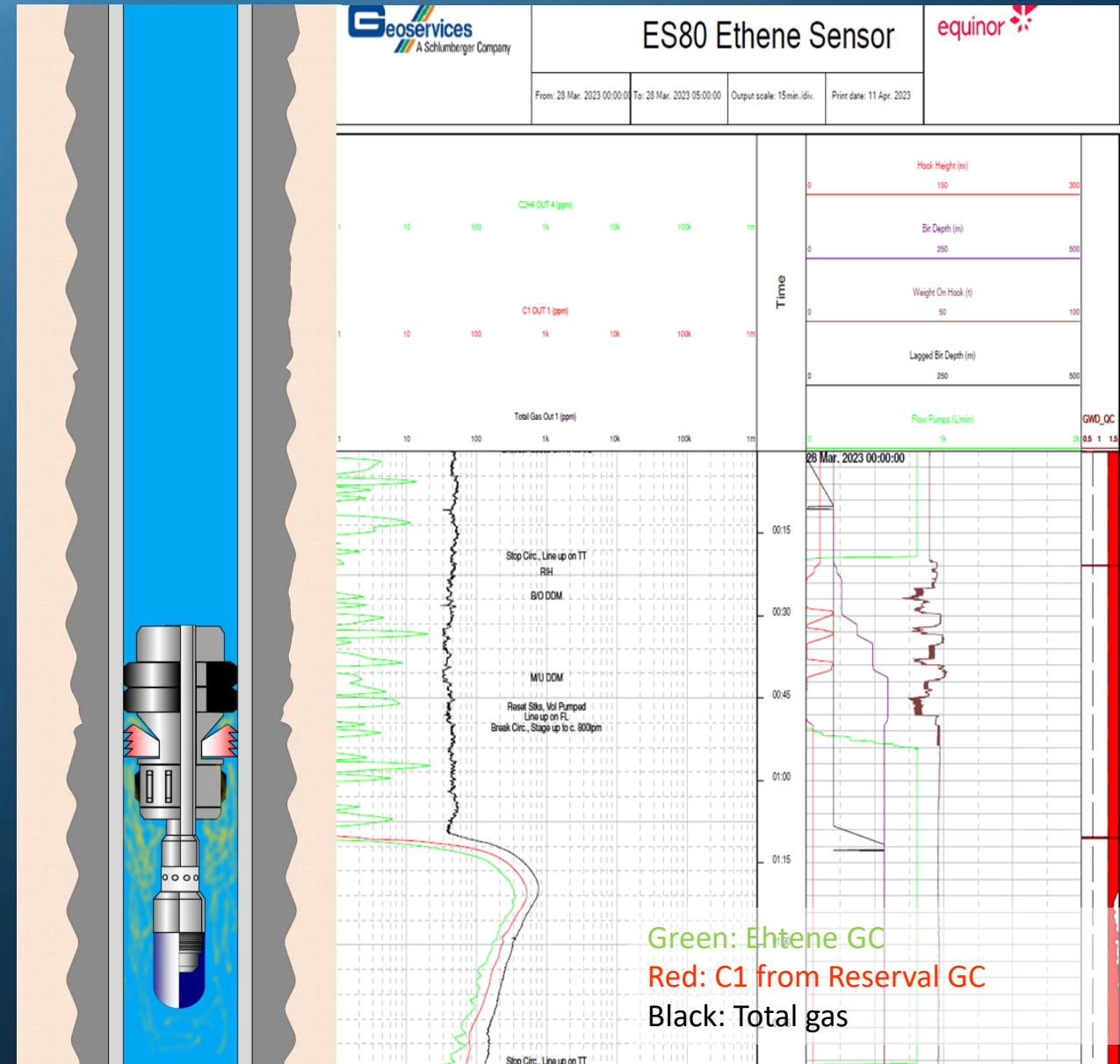
- To test ability and sensitivity of detection, using standard gas chromatograph (SLB Reserval), and dedicated Ethene GC (SLB ES80)
- Tracer gas: Ethene (C_2H_4) 4% mix
- Test ability to build pressure below bridge plug
- Test depths 150 m and 300 m



Pilot run March 2023 for Equinor

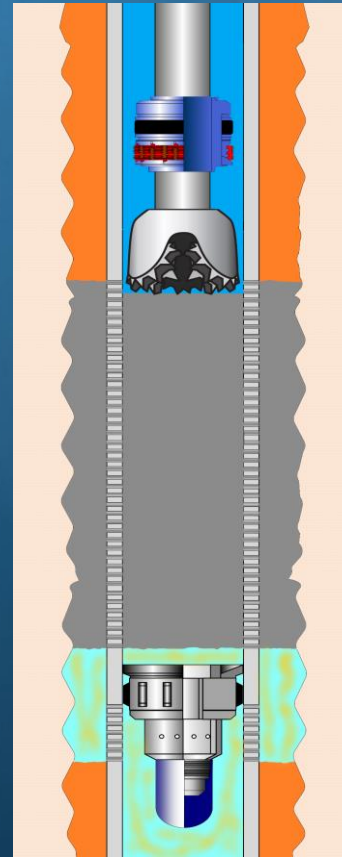
Results

- Molar sensitivity < 1 ppm
- Lower Detection Level 2,5 ml/min, with noise level @10 ppm
- Detectable using conventional field installed FID gas chromatograph (SLB Reserval)
- Pressure buildup below bridge plug 200 psi, in 10 3/4" Casing and 1100 meter fluid column

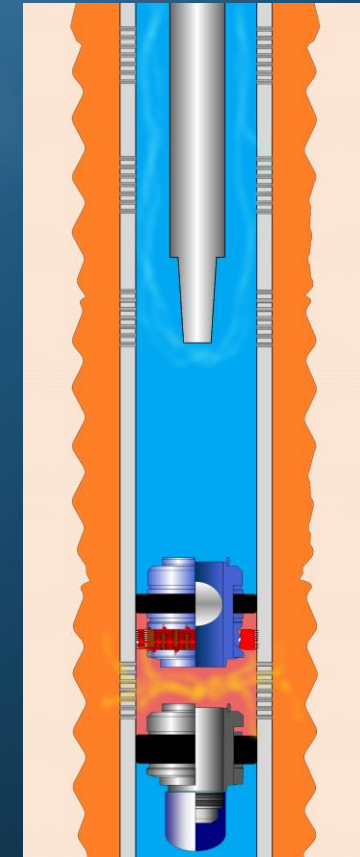


Examples of applications

- PWC single/dual barrier testing, perforations or punching
- New barriers qualification and verification, i.e. bismuth alloys
- Barrier solution with tubing left in hole
- Verification of shorter natural barriers, i.e. creeping shale, settled barite, etc.
- Rigless/riserless applications



PWC single/dual barrier testing, perforations or punching



Short annulus barrier testing

Well Barrier Leak Estimator WellBEST

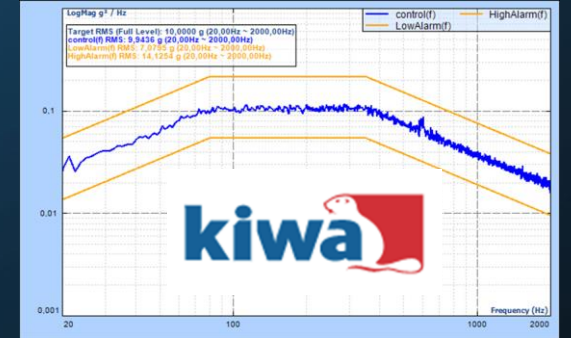
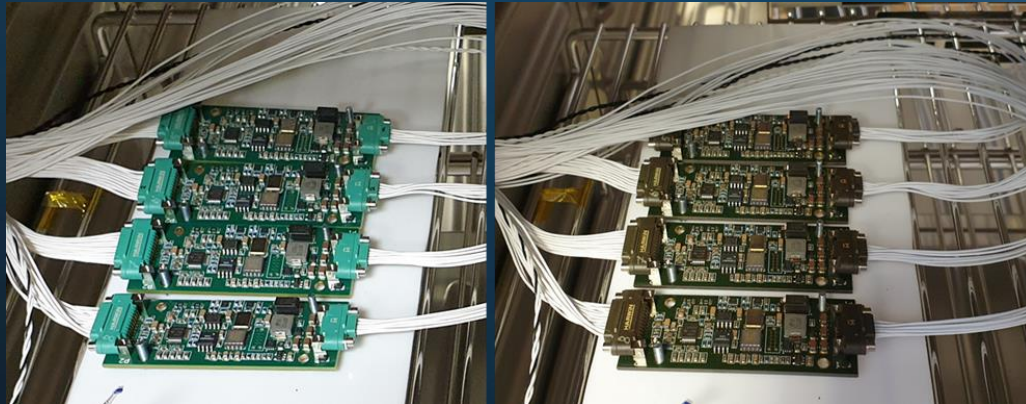
- Free and available for everyone
- Planning tool to estimate leak breakthrough times and rates
- Post analyses if breakthrough occurs – analysis of leak paths and micro fracture sizes
- Model to be tested, and adjusted against experimental test results from NORCE



Qualification of downhole tool

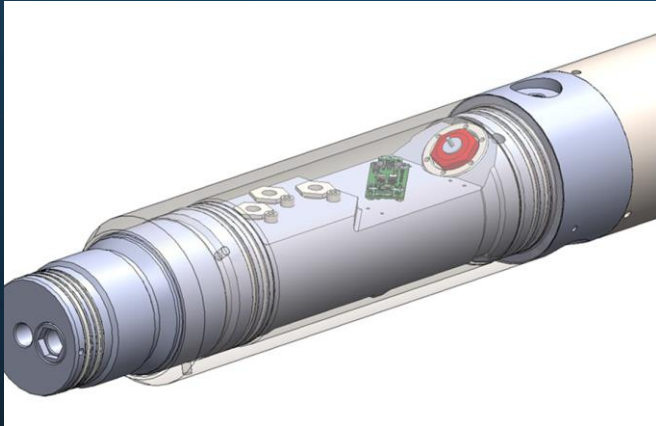
Reviewed and verified separately by DNV, according to RP-203

- Fully tested according to “Advanced Well Equipment Standards”:
 - ✓ Extended reliability testing of double check valve solution, at full T and P (130° C, 7500 psi)
 - ✓ System testing of tool (downhole conditions)
 - ✓ Shock, vibration, temp cycling testing at KIWA
 - ✓ Electronic board Highly Accelerated Life Testing (HALT)
- ✓ Estimated system reliability of > 99%



2 Technical Specification

Parameters	Units	Data
Outer Diameter	In (mm)	5 (127)
Length (including X-over)	In (m)	984,3 (2,5)
Weight	kgs	110
Connections	N/A	Standard Oilfield Connections (X-over from Stub Acme)
Yield tensile load	Lbf	400.000 lbf
Maximum compression load	Lbf	400.000 lbf
Maximum torque through tool	Lbf	5.000 ft.lbs.
Gas Canister volume	L	10
Maximum Operating Pressure (Gas Canister)	Psi (bar)	7500 (517,1)
Maximum Pressure Rating (Tool)	Psi (bar)	10 000 (690)
Maximum Operating Temperature	deg C	130
Minimum Operating/Storage Temperature	deg C	-20
Pressure sensor accuracy	Psi (bar)	+/- <u>7</u> (+/- 0,5)
Temperature Sensor accuracy	deg C	+/- 3
Calibrated temp range	deg C	20-130
Shock and vibration	g	As per AWES standard
Tool current consumption (idle)	mA	30
Tool current consumption (while operating solenoid)	mA	630
Tool Operating Voltage (single battery pack)	V	22
Normal operational time	days	7





Exedra's contribution towards UN's Climate Sustainability Goal

SUSTAINABLE DEVELOPMENT GOAL 13

Take urgent action to combat climate change and its impacts*



- Exedra's new barrier verification system can assist Operators to PP&A wells safer and more cost effective.
- One unit of Methane gas leaked from an oil well contributes **80 times** more to global warming than one unit of CO₂ leaked to the atmosphere.
- Studies show that 20% of all wells in NCS have integrity issues and 38% of all temporary plugged barriers show some deficiencies.
- Studies from Canada shows that yearly leaks of methane gas is equivalent to CO₂ emission from 12 million cars every year.
- Indirectly significant reduction in emissions through reduced time required to P&A wells, offshore in the range of 150 tonnes CO₂ reduction per well.

6 CLEAN WATER AND SANITATION



7 AFFORDABLE AND CLEAN ENERGY



9 INDUSTRY, INNOVATION AND INFRASTRUCTURE



14 LIFE BELOW WATER



15 LIFE ON LAND



EXEDRA

See more at www.exedra.no

EU provisional agreement Nov 2023 regulating on methane emissions reductions

- Mandatory measurement, reporting and verification requirements for emissions at the source level, including for non-operated assets
- Mandatory leak detection and repair of equipment for all oil and gas facilities
- Obligation to complete inventory, emissions monitoring and mitigation plans for closed, inactive, plugged and abandoned assets
- Limit of 7000 ppm/hr, equivalent of 18 ml/min leak rate @ 200 m water depth
- To be endorsed by June 2024, EEA relevance to be decided

Operators shall repair or replace all components found to be emitting *methane at or above the following levels at standard temperature and pressure and using detection devices in accordance with the manufacturer specifications for operation and maintenance:*

(a) for type 1 LDAR surveys: 7000 parts per million in volume of methane or 17 grams per hour of methane;

(b) for type 2 LDAR surveys:

(i) 500 parts per million in volume of methane or 1 gram per hour of methane for aboveground components and for offshore components above the sea level;

(ii) 1000 parts per million in volume of methane or 5 grams per hour of methane for the second step of LDAR surveys of underground components;

(iii) 7000 parts per million in volume of methane or 17 grams per hour for offshore components below the sea level or below the seabed.

Amendment 281, 27.03.2024, for EU Methane Emissions Regulation 2019/942