HANDOUTS

The Perf-Wash-Cement, PWC® revolution

27 June 2017

Arne G. Larsen

PATENTED TECHNOLOGIES

HydraWell Intervention

SPE International
Society of Petroleum Engineers

PWC®

PATENTED TECHNOLOGIES

Society of Petroleum Engineers

PWC®

GENERATION 0 HydraPerf

GENERATION 1 HydraWash

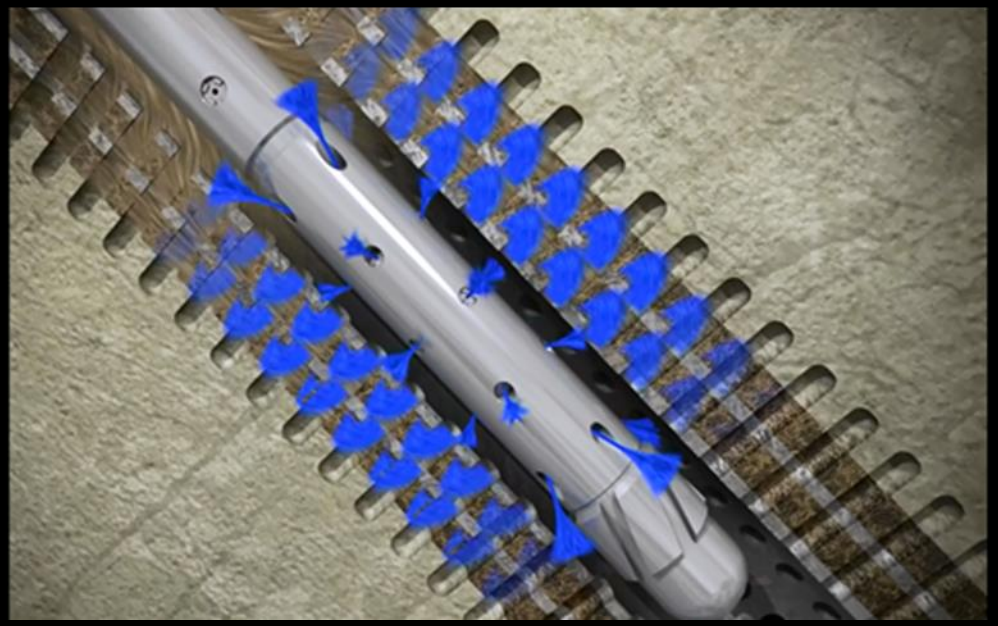
GENERATION 2 HydraHemera

GENERATION 3 HydraArtemis

HS&E ENVIRONMENTAL FOOTPRINT

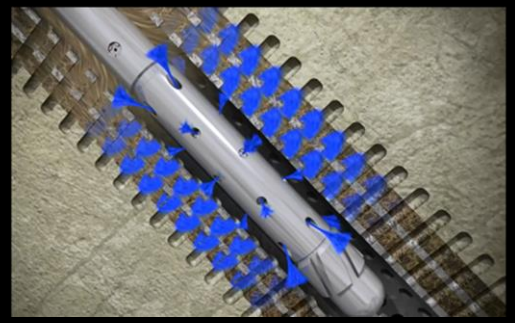
GENERATION 1: Cup system

GENERATION 2: High pressure cleaning



GENERATION 1: Cup system

GENERATION 2: High pressure cleaning

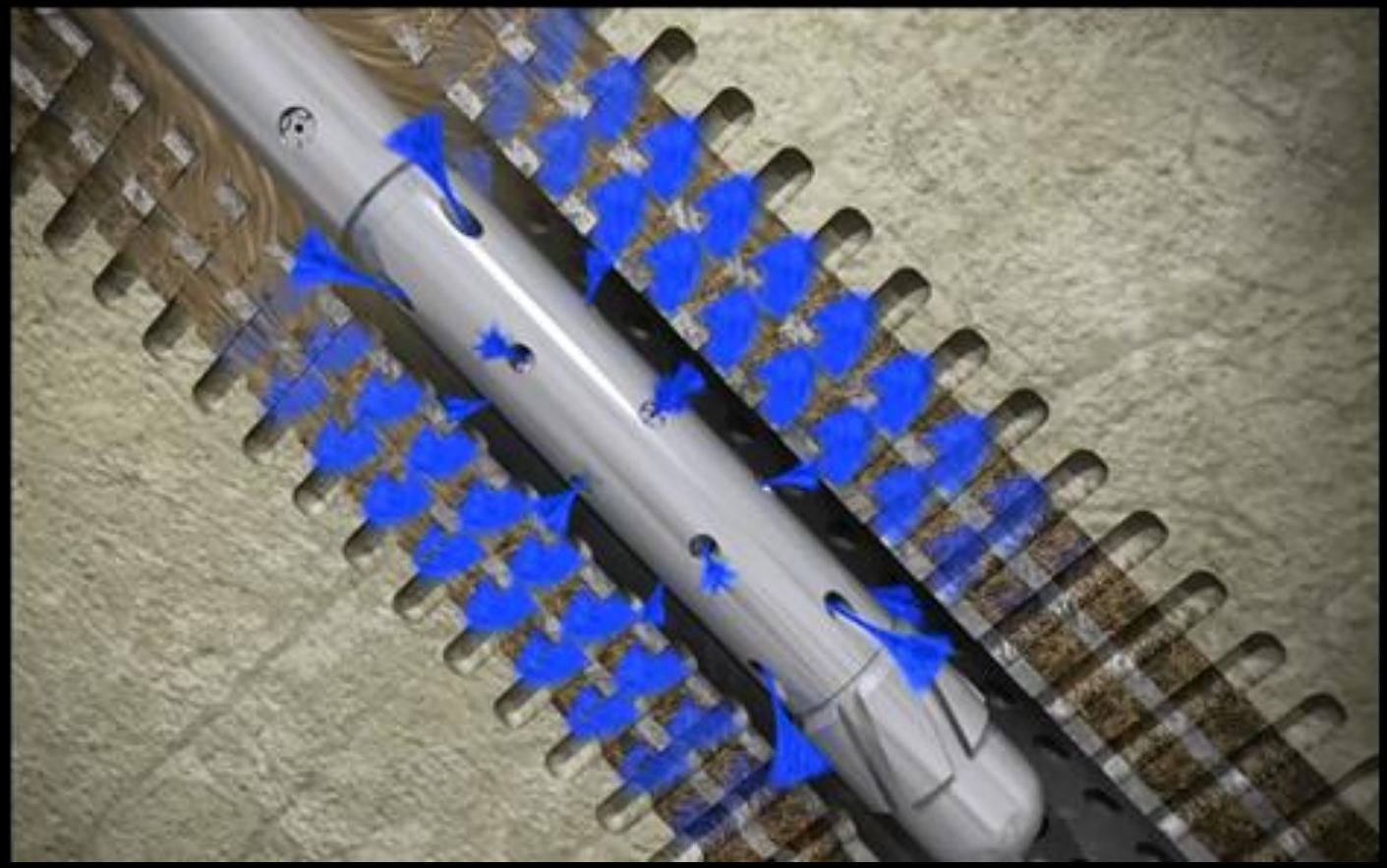


Cup System replaced by High Pressure Cleaning

RELIABILITY
LOW COMPLEXITY
TIME EFFICIENT

CUSTOMER DRIVEN PROCESS

GENERATION 2: High pressure cleaning



Cement Ensurance Tool

Cement Spray Tool

Jet Washing Tool

FOUNDATION

TCP

TUBING CONVEYED
PERFORATIONS

RUN	CUSTOMER	FIELD	WELL	PLUG	TOP PERF RKB	SIZE	TYPE

>200 PLUGS

AkerBP

ConocoPhillips

bp

centrica

FairfieldEnergy

MAERSK

PETRONAS

Shell

Statoil

TAQA

TOTAL

TALISMAN SINOPEC ENERGY UK

GZADCO

Chevron

PCPP OPERATING CO. SDN

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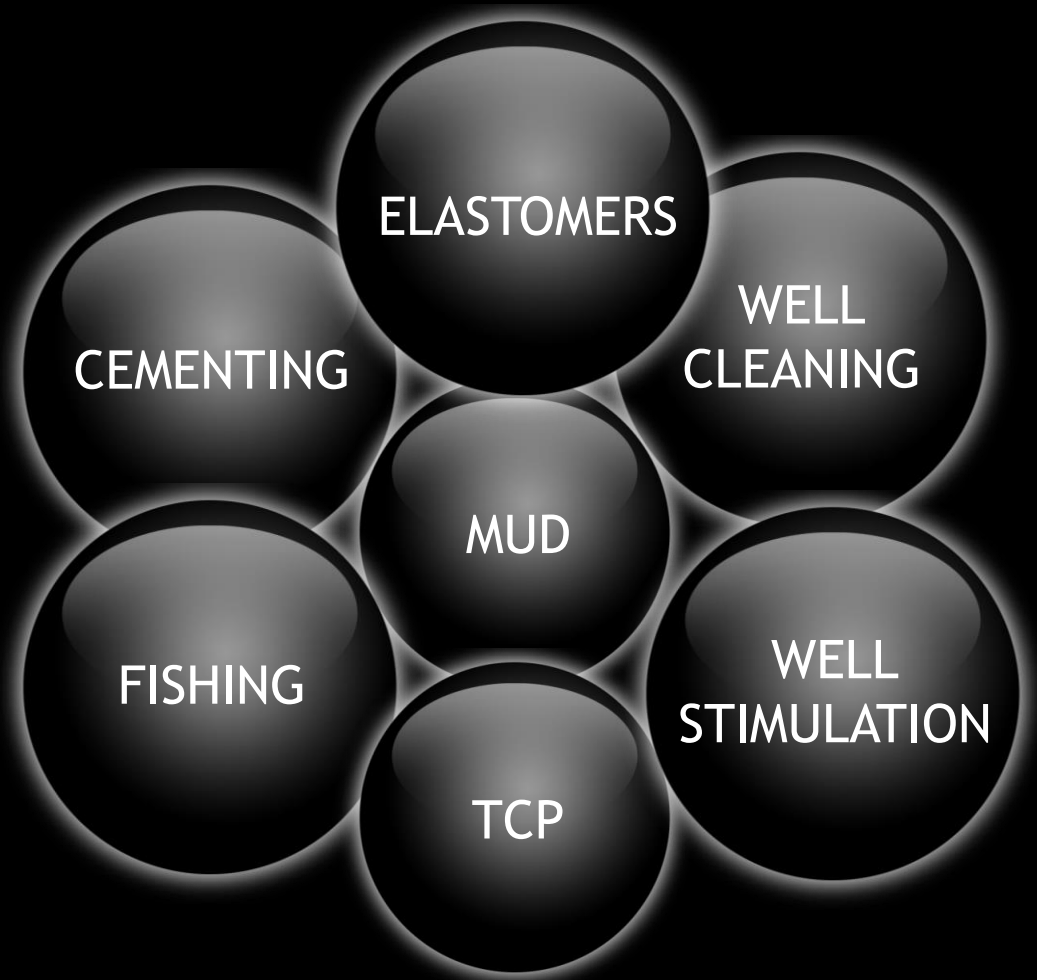
TOOL SUCCESS RATE	SYSTEM SUCCESS RATE	PLUG SUCCESS RATE
99.2 %	95.8 %	97.1 %



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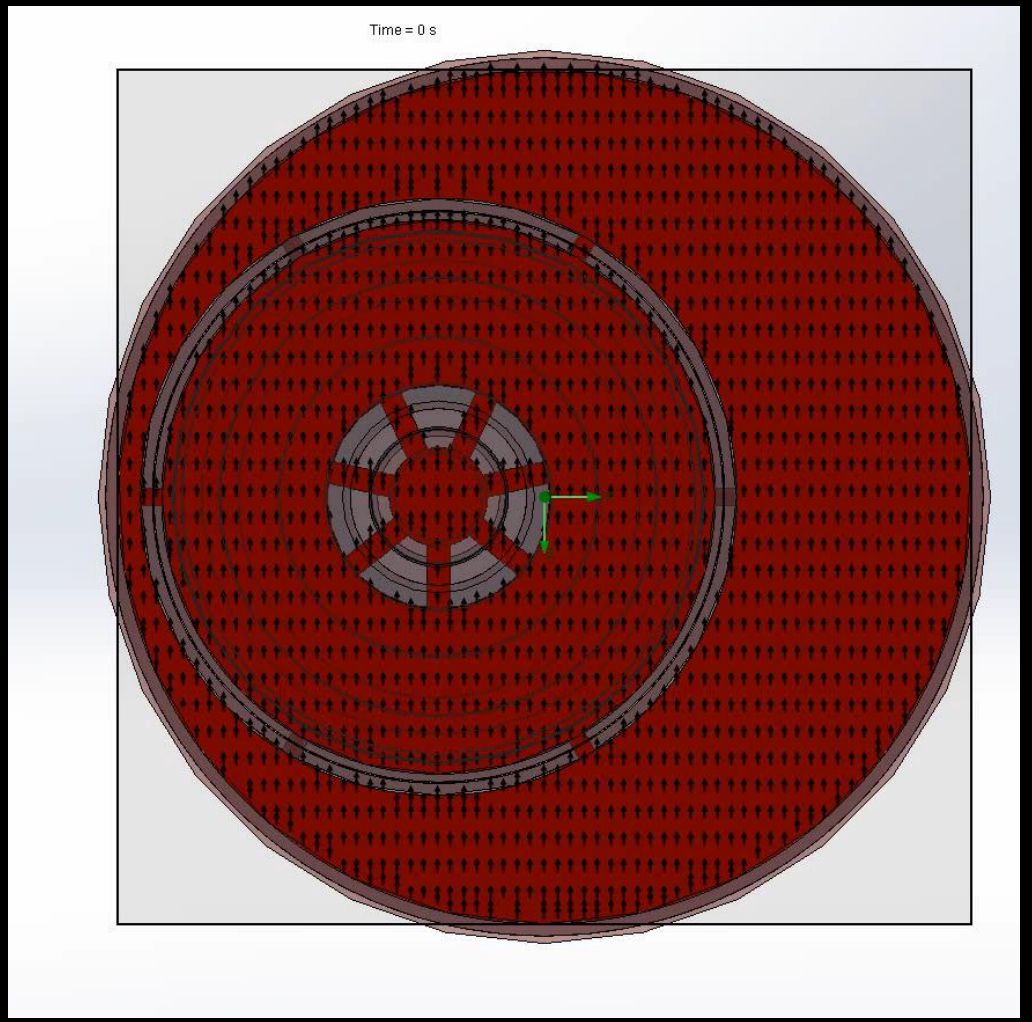
C F D - Computational Fluid Dynamics



WHY

TIMING

9-5/8" SINGLE RUN 50 METERS

51 HRS to RIH, perf, condition mud, wash, cmt and POOH. Including 9 hrs of mud rheology adjustments

42 hours - net

20.04.2015	**09:30**	**Start PU TCP guns and Jetting Tool BHA.**
	15:20	TCP fired. Circ 1-1/2 bottoms up.
	16:03	Close in well due to gas.
		Circulate out gas. Condition mud.
21.04.2015	03:38	Disconnect Isolation BHA.
	04:30	Land Jetting Tool ball.
		Wash 375-400 gpm, 8.9-9.5 bpm.
	18:35	Finished washing perfs, 14 hrs including 3 separate BU.
22.04.2015	01:15	Start pumping spacer.
	03:00	Opening Spray Cementing Tool.
	03:30	Start pumping cement.
	04:03	Cement pumped, displace with mud.
	05:06	Finished pump/pull/rotate.
	09:00	POOH
	12:30	**OOH**

TIMING

9-5/8" SINGLE RUN 100 METERS

2 DAYS 15 HRS 20 MIN hrs to RIH, perf, wash, cmt and POOH.

63 hours

04.11.2015	**11:45**	**Start PU TCP guns and Jetting Tool BHA.**
	21:15	TCP fired. Circ 1-1/2 bottoms up.
05.11.2015	05:50	Disconnect Isolation BHA.
	07:40	Land Jetting Tool ball.
	11:20	Wash
06.11.2015	14:00	Start pumping spacer.
	17:45	Start pumping cement.
	20:05	Finished pump/pull/rotate. Circ sub opened.
07.11.2015	00:30	POOH
	03:05	**OOH**

VERIFICATION

INSTALL PWC® PLUG

TEST PLUG

DRILL OUT AND LOG

INSTALL NEW INTERNAL PLUG

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SPE-185938-MS

Perforate, Wash and Cement PWC Verification Process and an Industry Standard for Barrier Acceptance Criteria

Laurent Delabroy, David Rodrigues, Espen Norum, and Martin Straume, Aker BP; Knut H. Halvorsen, Statoil

This paper was prepared for presentation at the SPE Bergen One Day Seminar held in Bergen, Norway, 5 April 2017.

Abstract

When permanently abandoning a well, each seal above a Distinct Permeable Zone (DPZ) needs to be restored with a cross-sectional barrier that will withstand the test of time. The Perforate, Wash and Cement (PWC) technology was developed as an alternative to section milling in situations where the wellbore barrier needs to be placed across a section of uncemented casing. Section milling is time consuming and results in exposing the BOP to swarf. The PWC method, on the other hand, is a more time-efficient process that consists of perforating the casing, washing the annulus behind it, and placing cement across the whole cross-section of the wellbore in a single run. However, some of the efficiency gain of the PWC method over section milling is lost when it comes to the barrier verification process. For section milled plugs, the verification process is usually the same as the one used for conventional wellbore cement plugs, since all the casing has been removed across the section milled window: the plug needs to be tagged/weight tested and pressure tested (except for section milled plugs where the top of the plug is left in open hole). On the other hand, as over 90% of the casing remains when installing a cross sectional barrier with PWC, the verification process typically involves two steps: 1) verify the annular component of the barrier, and 2) verify its internal one. In order to verify the annular part of the barrier, the internal barrier (cement plug) needs to be drilled out, and the annulus logged with a cement bond logging tool. A new internal cement plug then needs to be re-set and verified using the same verification method as for section milled plugs.

During the first phase of the Valhall DP Plug & Abandonment (P&A) campaign, the PWC technique was used repeatedly to create primary and secondary barriers in the 9 5/8" casing and 9 5/8" casing × 12 1/4" hole annulus, each time using the same design and execution parameters. After building a successful track record of PWC jobs in 9 5/8" casing, a process was initiated to develop a non-destructive and more efficient alternative verification process, specific to PWC operations that would not require to systematically having to drill out the wellbore cement to log the annular barrier. The intention was to base this alternative verification method on a consistent track record, a strict design and operational parameter set (Qualification Matrix), and to include this alternative verification method in a proposed NORSOK Element Acceptance Criteria (EAC) Table specific to barriers installed using the PWC technique. This PWC EAC Table is intended to be used as a best practice for designing, executing and verifying PWC jobs, and is recommended for implementation into the next revision of the NORSOK D-010 Guideline.

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SAVINGS:
Eliminating
803 ton of swarf / cuttings

1429 RIG DAYS

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PROCESS DRIVEN RESULTS

FEATURE	BENEFITS
DATA GATHERING	CUSTOMIZED JOB PLANNING
INHOUSE DESIGN ENGINEERING	CONTINOUSLY IMPROVED EQUIPMENT PERFORMANCE
CFD / FEA	SYSTEMATIC AND ANALYTICAL PROCESS
DETAILED OPERATION PROCEDURES	CONSISTENT JOB EXECUTION
POST JOB DATA ANALYSIS	EXPERIENCE TRANSFER

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TAKE NOTHING FOR GRANTED

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HYDRA WELL INTERVENTION

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