A New Approach to Well Completion Design, Surveillance

Hwei Fung Lim (Shell), Scott Glendinning (RESMAN)

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Agenda

- Introduction
- HPHT Well Condition
- Tracer Carrier Design
- Installation of Tracers and Carrier
- Results

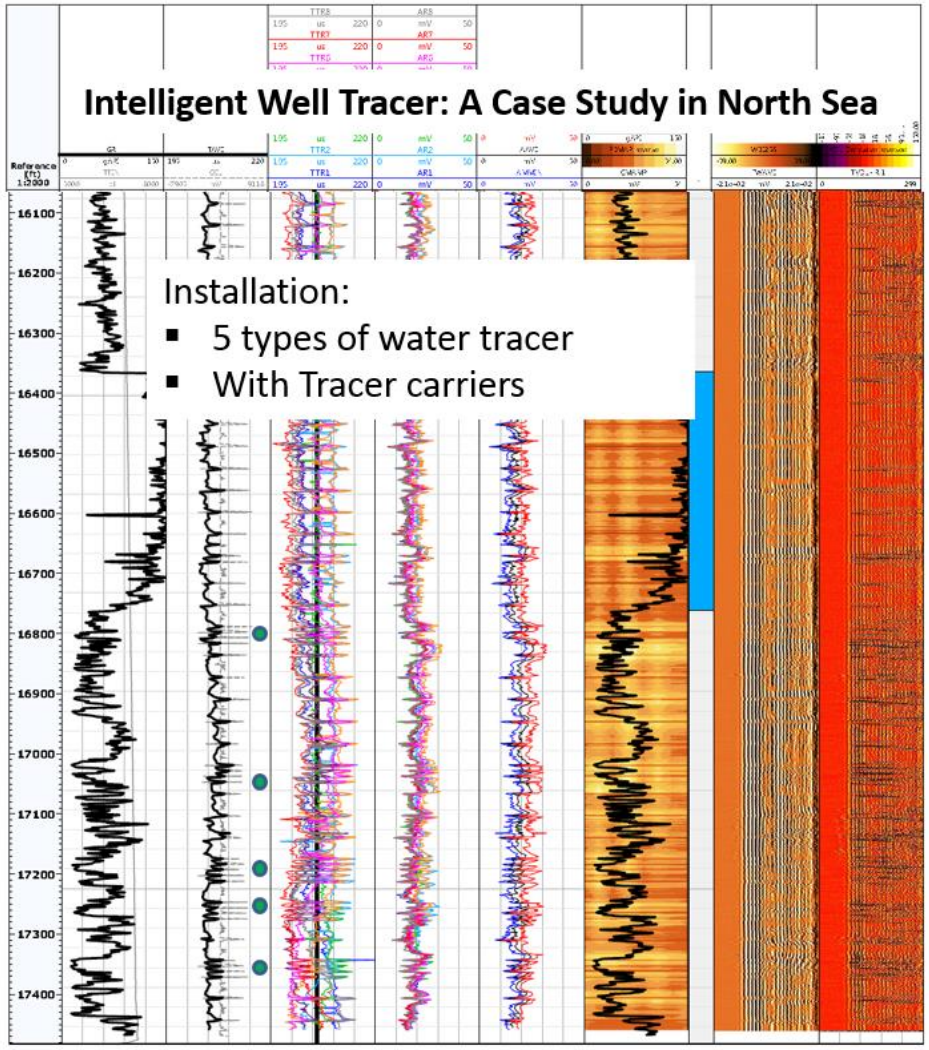
Introduction

- Intelligent well tracer system
  - Oil, gas or water sensitive
  - Installed downhole
  - Can be used for detection, surveillance, analysis or quantification

- The water tracer installed in this HPHT field are for
  - Information on the transient flow phases during well clean up
  - Water breakthrough detection during operate phase as this is a multilayer reservoir
- They are polymer tracer rods, chemical in low concentration and are compatible for water discharge
- Water Tracers stay dormant when not in contact with water
- Tracer Results: Qualitative and Quantitative, measurement up to **parts per trillion**

HPHT Well Condition

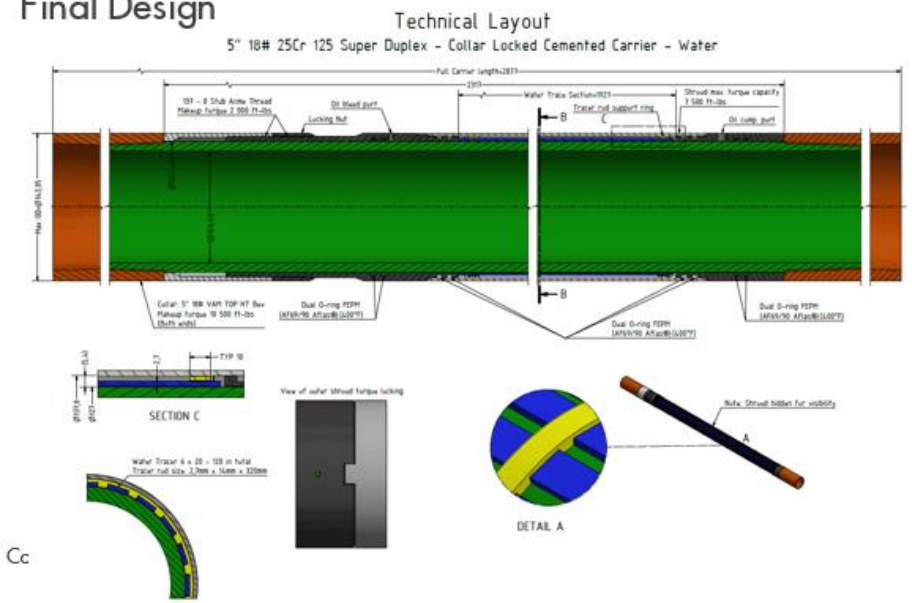
- North Sea.
- HPHT: High Pressure & High Temperature
- Initial pressure 15,500psi,185degC
- Gas condensate well
- Multilayer reservoir
- Well length more than 15,000ft
- 5″ liner cased and perforated



Tracer Carrier Design

Initial Design

Final Design

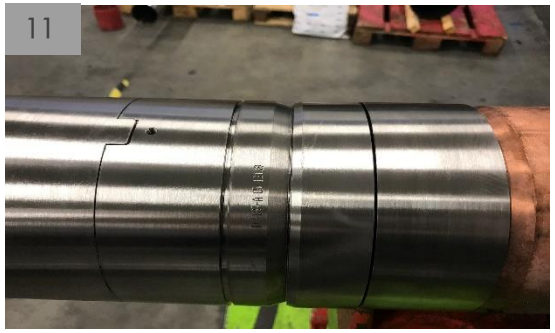


- Initial Design
  - Tracer OD is bigger than liner coupling OD
  - Gripper assembly hold the required Load & carried in place
- Final Design
  - OD of the carrier is 5.632" (same as coupling)
  - No gripper/ slips
  - The carrier itself is held in place by tubing collars, and is non loadbearing
  - No potential hang-up point

Installation of Tracers and Carrier

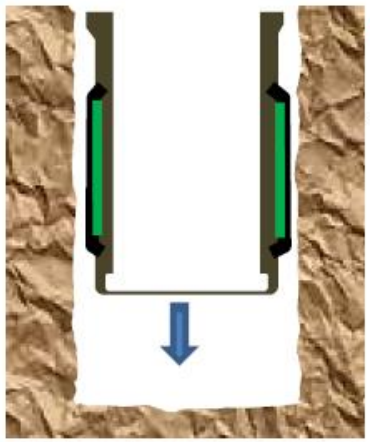
- The tracer rod will be installed outside of the 5″ liner, integrated with the production liner
- OD of the carrier is 5.632″ (carrier material same as liner)

Installation of Tracers and Carrier



- The tracer rods are put in place and held by rings, the carrier shroud is then slid over and connected at both end
- The OD tracer carrier is similar to liner joint couplings

RIH Installation **Pictorial**

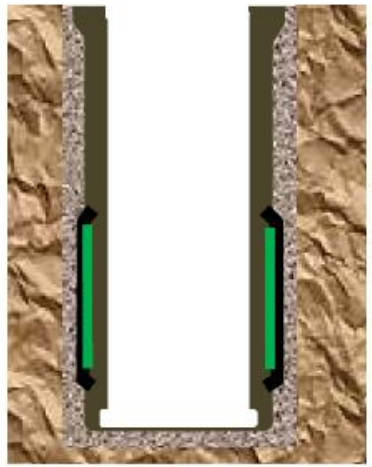


Step 1

Liner run into the well with the RESMAN tracer carrier attached to outside

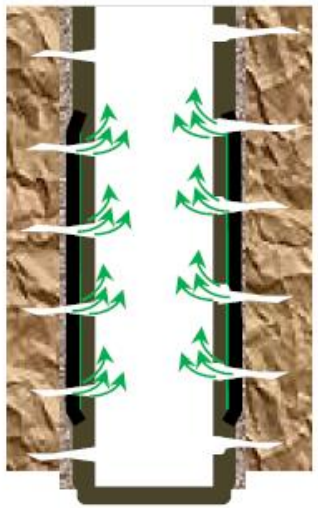
Step 2

Place cement in casing and up annulus



Step 3

Cement is bonded to casing and wellbore formation



Step 4

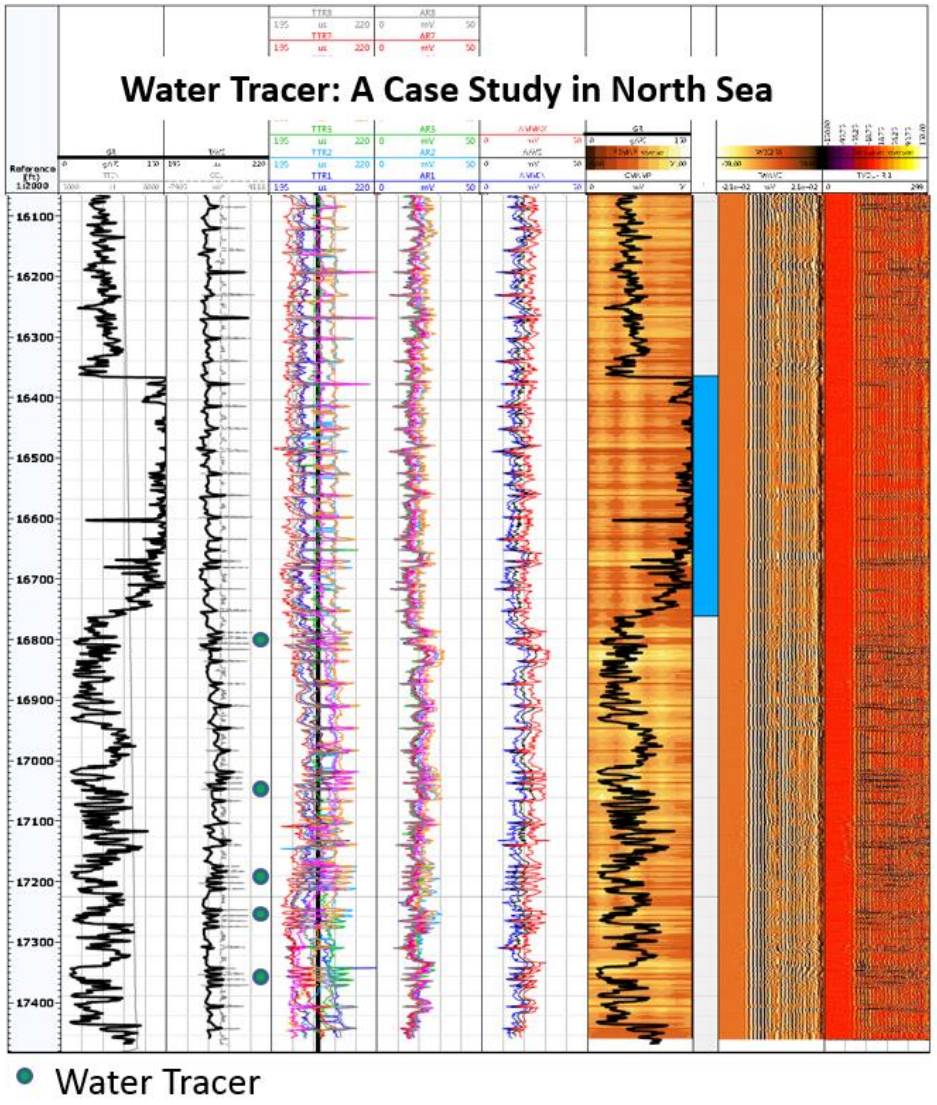
Perforate through tracer carrier, cement and formation

Detect tracers at surface assuming inflow from reservoir at start of production

- Perforate run as normal
- no additional rig time
- or personnel required on site to run the completion

Results: Cement Bond Log Run

- Installation:
  - 5 unique water tracer
  - Installed with carrier, cased and perforated
  - Strategically integrated with the completion design
  - Cement bond was run before the perforations
  - Indication of the tracer pups can be seen from the log



Results: Well Clean Up

- Samples were taken downstream of the test separator
- Results Pending

Questions and Answers