Using Intelligent Tracer technology as an interventionless alternative to production logging

What It Does

RESMAN Intelligent Tracer technology accurately quantifies zonal inflow contribution and detects the location of water breakthrough. Applications include:

• Quantification of oil inflow contribution (Fig. 1).
• Water breakthrough monitoring.
• Inflow assurance monitoring (flow control valves and packers functionality, multilateral and zonal inflow conformance).

Benefits

The information obtained with RESMAN Intelligent Tracer technology provides the equivalent of a production log, but without the risk and cost of well intervention. Benefits include:

• **Risk-free:** no cables, no connections, no intervention, and no major changes to completion design.
• **Long-term:** RESMAN oil Intelligent Tracers (RES•OIL) can achieve up to 10 years of life. The water Intelligent Tracers (RES•H2O) can have longer life-spans because they are dormant until activated by contact with water.
• **Cost-efficient:** no additional rig time, no expensive completion hardware, and no extra personnel required at the well site.
• **HSE-friendly:** RESMAN chemicals are used in extremely low concentrations (down to parts per trillion) and are compatible for water discharge. No radiation is used.
• **Robust:** systems are resistant to harsh downhole conditions and high pressures.

Fig. 1 - RESMAN provides a chemical production log without intervention operations.
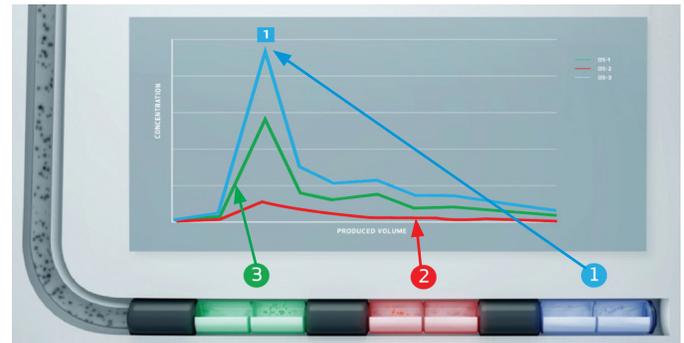
Inflow contribution: 30%   10%   60%

Field-proven technology

Since its inception in 2005 by Statoil Technology Invest, RESMAN maintained exclusive focus on inflow monitoring with Intelligent Tracer technology.

RESMAN's unique capabilities include:

• **Proven system life:** life capabilities are proven by historical field sample analysis and are continuously verified by rigorous laboratory qualification testing of every produced system.
• **In-house designed molecules:** RESMAN designs in-house each of our 160 unique Intelligent Tracer signatures, so they cannot be mistaken for any other chemicals found in production operations.
• **Accurate inflow models:** accurate inflow models were developed in-house, verified in full-scale, flow-loop testing, and proven in wells with complex completion designs and long production tie backs.
• **Superior expertise in complex well environments:** over 70% of RESMAN's track record is in subsea fields. The company's expertise was built by designing and managing the implementation of intelligent tracers for the most complex and challenging well completions in the oil and gas industry.

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How It Works

RESMAN Intelligent Tracer technology can be formed into a variety of shapes to allow it to be integrated into a wide range of completion designs (Fig. 2).

The Intelligent Tracer systems are either oil sensitive or water sensitive and are designed to remain dormant until contacted by the target fluid. That is, the oil-sensitive systems remain dormant when in contact with water and the water-sensitive systems remain dormant when in contact with oil. Both systems are dormant in air.

When contacted by the target fluid, tracer molecules are released in very small quantities (Fig. 3). This release is independent of flow conditions and happens at a lab-designed rate.

RESMAN chemists have developed more than 80 uniquely identifiable chemical signatures for oil (RES•OIL) and another 80 for water (RES•H2O). It is important to note that these chemical signatures are unique in nature and cannot be found in any commercially available chemical library. This eliminates the possibility of mistaking RESMAN's chemical signatures for various other chemicals found in production operations.

The Intelligent Tracers are strategically integrated with the completion equipment to monitor segments of the reservoir interval. Depending on the surveillance objectives, sections of the well or individual reservoir compartments are assigned with a separate and identifiable chemical signature for oil and/or water.

After well installation, the oil flows from the reservoir, contacts the RES•OIL systems, and the chemical signature is released into the oil, thereby marking it with a unique identification. Production from each reservoir compartment transports the tracer signatures to the surface (Fig. 4), where production fluid samples are collected. The same process applies to the RES•H2O systems.

RESMAN analyzes the samples and a dedicated team of experts models the results using proprietary software and inflow models that have been empirically verified in full-scale, flow-loop testing.

For field data examples, see the RESMAN case studies and papers at www.resman.no/knowledge.

Fig. 2 - RESMAN systems can be easily integrated with a variety of completion devices, including screens and pup joints.
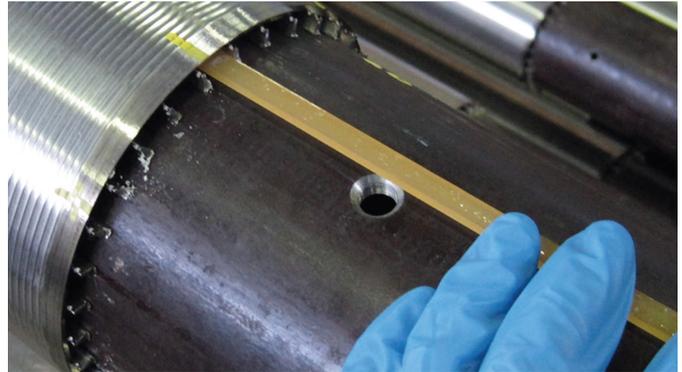

Fig. 3 - When contacted by the target fluid, RESMAN Intelligent Tracers (red strips) release their chemical signature (red dots) independent of flow and at lab-designed rates.
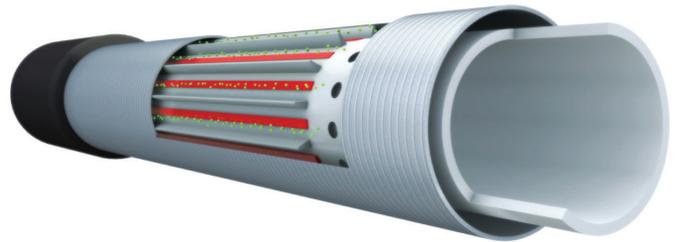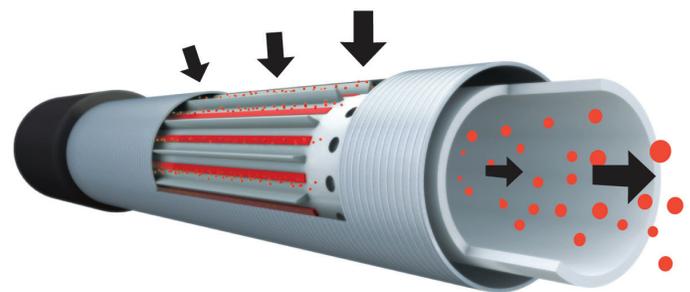

Fig. 4 - Well production transports the Intelligent Tracer molecules to the surface, where production fluid is sampled.