



■ INTEGRATED CAPABILITIES ENHANCE RESULTS AND REVENUES.

Weatherford Laboratories is the world leader in experience for complex gas injection, thermal operations and testing. Weatherford Laboratories operates the only commercial lab in the world with certified sour gas facilities. Our integrated capabilities lead the way in defining and comparing the validity and value of the complete suite of EOR strategies.

Precision analyses and scalable results help improve all your EOR requirements from steam flood performance while minimizing the corrosive impacts of H₂S, to correct chemical selections and optimized gas injection schemes. They yield better understanding of your reservoir as well as optimized production options. And because **Weatherford Laboratories'** in-depth experience includes a variety of plays in a range of reservoir types worldwide, we can apply our science and our technology to support you from the pore-scale to field-scale, wherever you are.

Higher **Weatherford Laboratories** standards of interpretation and integration with field processes improve the flexibility of your on-site, in situ solutions so that hydrocarbon recovery and revenue are enhanced to the greatest extent possible.

■ HISTORY

Papers

Dozens of technical publications in the area of EOR.

- "Enhanced Oil Recovery by Gas Injection: Proposed Screening Criteria" JCPT 1995
- "Does Miscibility Matter in Gas Injection?" JCPT 1995
- "New Approach in Gas Injection Miscible Processes Modeling" JCPT 2008



Studies

- EnCana Weyburn Water Alternating Gas Flood (WAG and SWAG)
- Worldwide Reservoirs Determination of Minimum Miscible Pressure (MMP)
- Miscible Gas Injection (MENA, Asia & E, Canada and USA)
- Monell Field, Wyoming, Gas Injection for Incremental Oil Recovery
- Amal Field, Libya, Gas Injection with Various Injectants

PRECISION ANALYSES YIELD BETTER UNDERSTANDING OF YOUR RESERVOIR.

Multi-contact Experiment

- Quantify IFT, viscosity, solubility associated K values, Bo & Rs result in accurate modeling of the vaporizing and/or condensing processes that occur in the actual reservoir

Constant IFT Core Flooding

- No mass transfers during the constant IFT core flood result in true residual oil recovery and none of the core stack is used for establishing a miscible bank

Aquathermosolysis

- High heat + oil + water + sand often results in the generation of H₂S and CO₂. Aquathermosolysis testing can verify the formation of this corrosive gas during the steam flooding process

Acid Gas Testing for Applicability to EOR & Sequestration

- The isolation lab permits the testing of any (lab) volume at any pressure/temperature of acid gas for sequestration or EOR applications in a safe and effective manner

Low and High Temperature Multi-Phase and Heavy Oil and Bitumen Core Flooding Capability

- The only true laboratory model of actual reservoir conditions

Chemical Flooding

- Screening & optimization of chemical flood reservoir candidates

■ INNOVATIONS

Processes

- In Situ Saturation Monitoring (ISSM)
- Multi contact study to evaluate miscibility between injectant and reservoir oil. Forward and reverse contact data set far superior to slim tubes & Px



- Constant interfacial tension core floods using equilibrium phases from the multi contact test results in high definition of enhanced oil recovery sensitivity to interfacial tension, pore geometry, gravity effects, phase behavior and wettability
- HPHT interfacial tension testing of gas/oil, oil/water and gas/water at reservoir conditions

TURNKEY SERVICES SUPPORT YOUR ENHANCED OIL RECOVERY PLAYS.



WELLSITE

- Wellsite Personnel for Core Stabilization, Packaging & Transport
- Aluminum 4x4x4 Core Transport Containers
- Portable Wellsite Gamma
- Wellsite Plug Drilling for Saturation Studies

CORE PROCESSING

- Specialized Slabbing Techniques to Optimize Photography and Sedimentological Studies
- Specialized Plugging Techniques to Preserve As-Received Saturations
- Proprietary Procedures to Minimize Evaporation



PHOTOGRAPHY

- High Resolution Core Photography in Multiple Formats

CORE STORAGE & VIEWING

- Core Storage Facilities at 5 Temperatures Ranging from Ambient to Dry Ice
- State-of-the-Art Core Viewing Rooms



PROJECT MANAGEMENT

- Secured Client Websites for Data Retrieval & Archival
- CoreTrac™: Internal Management Information System for Project Tracking, Accessible Worldwide

ENHANCED OIL RECOVERY LABORATORY TESTS

ADVANCED FLUIDS PHASE BEHAVIOR ANALYSIS

- Differential Liberation
- Swell Tests
- MMP Evaluation by Rising Bubble Apparatus (RBA)
- MMP Evaluation by Slim Tube Tests
- MMP Determination by Multi Contact Ternary Phase Diagram
- Multi Contact Swell Test
- Explicit Measurement of Inter Facial Tension (IFT)
- Generation of Constant IFT Fluids
- Equation of State (EOS) Modeling

SPECIAL CORE ANALYSIS – GAS INJECTION

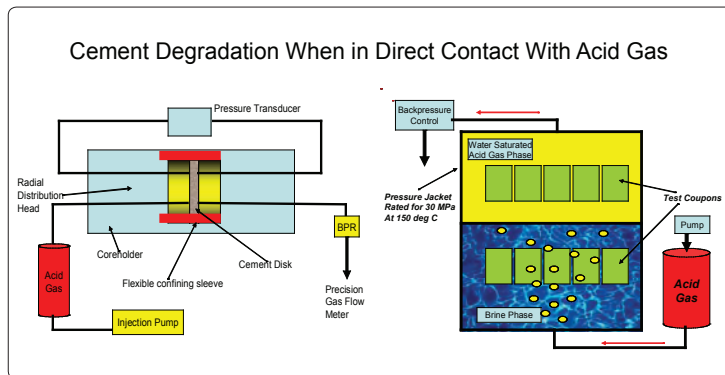
- Relative Permeability
 - Low IFT Relative Permeability
 - High IFT Relative Permeability
- Wettability and Capillary Pressure Measurement
- Determination of Pore Throat Size Distribution

CHEMICAL FLOOD SCREENING

- Alkali, Surfactant and Polymer (ASP) Screening
 - Optimization of the AS&P
- Static and Dynamic Adsorption
- Gravity Stabilized Floods
- Secondary Modified Water Flood
- Tertiary ASP Floods
- Mobility Control Polymer Flood
- Sequential and Parallel Modified Water Floods

HEAVY OIL THERMAL CONDITIONS EOR

- Fluid Phase Behavior
- Steam Flood Evaluation
- Solvent Assisted Gravity Drainage Floods
- Vapex Evaluations
- Aquathermolysis Testing
- Cap Rock Evaluations
- Formation Damage Assessment



EXPECT MORE FROM WEATHERFORD LABORATORIES.

At Weatherford Laboratories, we hold fast to Higher Standards. Our purpose is to continually push past conventional solutions to find new and better ways to optimize oil and gas production.

With 38 laboratories around the globe, our team raises the bar for wellsite sampling, core management services, geochemical analyses, and evaluation of traditional and unconventional reservoirs.

At Weatherford Laboratories, we expect more from ourselves so you can expect more from us.

38

LABORATORY LOCATIONS

18

COUNTRIES

1

WORLDWIDE RESOURCE

38 LABORATORY LOCATIONS IN 18 COUNTRIES

NORTH AMERICA

Canada
United States

EUROPE

Norway
United Kingdom

LATIN AMERICA

Brazil
Mexico
Trinidad
Venezuela

MIDDLE EAST / NORTH AFRICA

Kuwait
Libya
Oman
Saudi Arabia
United Arab Emirates

ASIA PACIFIC

Australia
India
Malaysia
Thailand
New Zealand

For contact information, please visit our website:
www.weatherfordlabs.com