

Schlumberger



North America Cementing Technology Center

Well Construction Engineering and Support



“Our mission is to support a wide range of engineered, fit-for-purpose cementing technologies.”

Heath Williams

Cementing Technology Center
Manager for North America

A History of Innovation

Since the early 1930s, Schlumberger has led the drilling and well construction industries in development of innovative well integrity technologies.

1932

1940s

1950s

1960s

1970s

1980s

1990s

2000s

2010s

Dowell established, performs first pumping treatments.

Opens 37-acre R&D center and manufacturing plant in Tulsa.

Launches latex cement for fluid loss control.

Schlumberger enters 50/50 joint venture with Dowell.

Introduces expanding cement.

Schlumberger acquires remaining 50% of Dowell Schlumberger North America.

Launches CemCRETE® trimodal cementing system.

Introduces CemNET® fiber-based lost circulation additive.

Launches FlexSEAL® flexible expanding cement for gas shales.



Fit-For-Purpose Technology Center

The Schlumberger North America Cementing Technology Center (CTC), located in Houston, supports a wide array of environmentally sound well construction and engineering services. Using the latest, most-advanced laboratory equipment, our highly experienced scientists, engineers, fluid specialists, and supporting laboratory technicians provide engineering and technical support for operations across North America.

The North America CTC employs the latest well cement stress theory and simulation methods.



Our Mission

To support a wide range of engineered, environmentally sound well integrity best practices and fluid technologies by

- providing insight for unconventional gas, ultrahigh pressure and temperature, and deepwater well integrity challenges
- optimizing fluid designs to meet objectives
- facilitating the rapid deployment of new technology
- delivering new ideas, value, and best practices to the field
- leading American Petroleum Institute (API), Society of Petroleum Engineers (SPE), American Society for Testing and Materials (ASTM) and petroleum industry events
- ensuring that all products and lab equipment comply with key customer objectives
- performing specialized laboratory testing beyond the capabilities of area-district labs
- training field personnel on fluids design and safe, effective lab testing
- educating the industry about Schlumberger well integrity vision, methods, and best practices.



Superior Environmental and Technical Performance

When designing well integrity strategies for unconventional shale zones commonly lying below environmentally sensitive water aquifer intervals, it is critical to take a balanced, measured approach, incorporating the latest in cementing technological advancements along with time-tested mud removal and cementing practices.

The primary objectives of the CTC are to

- maintain well integrity under high-stress environments, such as during hydraulic fracturing treatments
- customize formulations for each shale zone, pressure, temperature, and stress environment
- employ the latest well cement stress theory and simulation methods
- use cutting-edge mechanical property measurement tools to measure cement compressive strength, tensile strength, Young's modulus, and Poisson's ratio
- encourage engagement with field locations and client cementing specialists to ensure proper cementing best practices are followed
- meet or exceed local environmental regulations
- maintain industry-leading disclosure processes.

Our North America cementing team has over 250 years of combined experience.



Long-Term Zonal Isolation at Any Temperature

For long-term zonal isolation and well integrity across highly demanding steam injection or steam-assisted gravity drainage (SAGD) heavy oil environments, Schlumberger delivers technologies that

- provide cost-effective, long-term zonal isolation
- ensure well integrity and thermal stability
- eliminate time and costs associated with remedial cement jobs
- demonstrate low-temperature setting properties and resist high-temperature environments
- maintain engineered mechanical properties for each field and well, regardless of temperature
- resist corrosion
- work with conventional cement equipment and placement practices.

Unmatched Experience and Training

The North America CTC—along with other client support centers, research centers, and North American field labs—has over 250 years of collective experience.

Our laboratory technician training is recognized by the industry. It involves 5 years of intense, hands-on exposure in a field laboratory, backed by 6 weeks of formalized classroom training.

Fluids engineers and specialists undergo further specialized training, such as an 8-week operational and technical school and hands-on exposure in the field.

Scientists undergo a comprehensive métier program to hone their advanced skills in chemistry, physics, and other disciplines, along with prolonged field exposure to better connect theoretical concepts with field applications.



Industry-Leading Knowledge Transfer

Our senior scientists, engineers, and technicians provide valuable mentorship to the next generation of technical leaders.

Throughout the training program, regardless of position, our technical staff acquires the technical skills and extensive knowledge necessary to successfully support oil and gas operations. During this training period, they learn how to use industry-leading technologies, methods, and equipment to meet client needs with specialized solutions and designs.

Capabilities

Dry Cement and Blends Characterization

- Particle size distribution analysis with both dry and wet techniques: 0.04-2,000 micron range
- Dry density measurement
- Microsphere-crushing resistance evaluation
- Light-microscopic evaluation of particle morphology and size measurement

Cement Slurry and Set-Cement Properties

Conventional API Testing

- Designing, mixing, and testing slurries as per API specifications and recommended practices, tailored to client requirements.

Specialized

- Testing slurries, set cement, and spacers at temperatures up to 600 degF and pressures reaching 40,000 psi
- Static gel strength measurements using both acoustical and mechanical techniques
- Set-cement properties evaluation, including compressive strength, tensile strength, Young's modulus, and Poisson's ratio mechanical properties, following appropriate American Society for Testing and Materials (ASTM) and client-specified guidelines.

Cement Slurry Design Process

Schlumberger cement slurry design includes thorough evaluation of well-specific challenges, software tools to optimize a cement placement solutions, and the latest in spacer and cementing technologies.

Software for

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| ■ cementing fluids design and placement | ■ plug placement simulation |
| ■ cementing sheath integrity | ■ foam placement simulation |
| ■ gas migration risk evaluation | ■ lost circulation risk evaluation |

Spacer Fluid Properties

- Spacer formulation selection for effective mud removal
- Cementing fluids compatibility assessment
- Mud thinners and surfactants optimization

Rheological Hierarchy Characterization of Muds, Spacers, and Cement Fluids

Accurate measurement of rheological properties for muds, spacers, and cement fluids up to 600 degF and 30,000 psi using the Grace Instrument® 7500 UltraHPHT rheometer.

Rigorous QA/QC Standards

The North America CTC is designed with a fit-for-purpose workspace that provides performance-based lab testing and ensures the highest QA/QC standards. Specialized testing capabilities are in line with industry-leading benchmarks.

Key Spacer and Cement Technologies

FlexSEAL

Flexible expanding cement

ThermaSTONE

Thermally responsive cement

PressureNET

Lost circulation material for induced fractures

Losseal

Engineered lost circulation control solution

CemNET+

Advanced fiber technology to control losses

DeepCEM

Low-temperature cement slurries

MUDSCRUB

Family of microemulsion spacers for enhanced fluid removal

MUDPUSH Express

Stable, continuously mixed mud removal system

Unique, fit-for-purpose technologies for low-density, Arctic, and high-stress applications



North America Cementing Technology Center

The North America Cementing Technology Center supports field operations by testing and developing a wide array of high-performance, environmentally acceptable cementing technologies.



www.slb.com/cementing

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