

PRODUCTION TECHNOLOGIES. **FULL SERVICE.**

DeScal

Descaling, decontamination, and decommissioning service





COMPLETE DESCALING, NORM DECONTAMINATION, AND DECOMMISSIONING SOLUTION

Firmly established at the forefront of technology, Schlumberger specialists deliver targeted, integrated strategies to decisively remediate production issues, ensuring customers restore and improve flow performance and revenue.

Deposits such as scale and naturally occurring radioactive material (NORM) present significant challenges for operators throughout the lifetime of production assets and during decommissioning. These include restricting production as well as increasing the costs and risks associated with effective descaling, decommissioning, and decontamination.

The DeScal* descaling, decontamination, and decommissioning service incorporates software, chemical, and mechanical services to give operators a project-specific, single-source

solution for even the most challenging applications. Optimal production is restored, wastesreams are addressed, and any trapped productionis released.

The DeScal service uses the Schlumberger CURE portfolio of chemical-based removal technologies that maximize production by intercepting and removing production impurities and risks. These include concentrated blends of scale dissolvers to effectively reduce chemical volumes to manage overall treatment costs. Every component within the extensive DeScal service portfolio demonstrates the best possible environmental performance and elastomer compatibility while posing little or no corrosion threat when in contact with standard oilfield metallurgies. Schlumberger brings together specialists in scale and other production deposit management, production technologies, and environmental solutions to meet all scale-related production challenges and to deal with waste in three key areas:

- descaling—optimize performance from the reservoir and equipment by efficiently and effectively removing scale deposits
- NORM decontamination—treat or remove contaminated equipment more safely to ensure environmental compliance
- decommissioning—efficiently decommission and deliver trapped oil and gas to maximize returns toward the end of field life.

Advanced mechanical solutions complement the chemical components of DeScal service.

The comprehensive DeScal service package can be delivered onsite, making it ideal for remote locations or projects where access is difficult with restricted water and energy consumption.

FEATURES

- Scale, production chemistry, and waste management technologies
- Comprehensive suites of cost-effective scale dissolvers
- Mobile, onsite NORM decontamination
- Downhole, topside, and midstream scale treatment
- Preproject analytical services
- Service sector's only accredited laboratory to handle NORM-contaminated materials
- Decommissioning technologies and services
- Specialized software for posttreatment analysis

BENEFITS

- Compliance with strict environmental regulations and minimized environmental impact
- Removal of scale-related production restrictions
- Reduced personnel risk
- Effective operation in remote, constrained locations
- Hydrocarbon recovery during decommissioning
- Safer, cost-effective decommissioning
- Maximized value of producing assets
- Reduced treatment and waste management costs







UNRIVALED INTEGRATION, MAXIMUM DEPOSIT REMOVAL

Schlumberger specialists analyze each situation and devise a treatment strategy that incorporates a wide portfolio of nondamaging scale dissolvers and related services.

- Waste injection technology
- Production chemistry expertise
- Drilling waste management capabilities
- Chemical recycling and reuse
- Waste stream modification to meet local regulatory requirements
- Solids reinjection

- Integration with the EPCON CFU* compact flotation unit technology to separate and treat waste materials prior to discharge or injection
- Integration with Schlumberger coiled tubing services, flow assurance processes, Jet Blaster* engineered high-pressure jetting service, and related services

ENGINEERED CHEMICAL SOLUTIONS TO REMOVE DEPOSITION

A portfolio of field-proven scale dissolvers focused on safety.

Together with advanced and site-specific analytical methodologies, Schlumberger provides an extensive suite of new-generation, noncorrosive, environmentally compatible scale dissolvers that remove the largest amount of scale by volume, thereby reducing the overall treatment costs.

BaSOL 2000 HP* scale dissolver: Rapid capture of barium and strontium sulfate scale.

This powerful yet nonhazardous and noncorrosive scale dissolver and sequestrant provides the optimal pH for sulfate scale dissolution.

With capacities of up to 80 g/L, the BaSOL 2000 HP scale dissolver contains converting and catalyzing agents that ensure rapid dissolution rates compared with other industry products.

BaSOL 2020* environmentally friendly barium sulfate scale dissolver: Low-environmental-impact barite and strontium

sulfate scale dissolver.

With a loading capacity of 70 g/L, the BaSOL 2020 dissolver delivers a significantly improved environmental profile while retaining the reactivity and low corrosivity of the BaSOL 2000 HP dissolver.

BaSOL 2000 CW* cold weather scale dissolver: Barium

and strontium sulfate dissolver, specially designed for low and ultralow temperatures.

This unique blend of chelating agents—which serves as the basis of the BaSOL 2000 HP dissolver—delivers the same excellent dissolution results while remaining in a liquid form at temperatures of -40 degF [-40 degC].

CAL-Acid* scale dissolver: Noncorrosive alternative to hydrochloric acid.

The uniquely formulated CAL-Acid scale dissolver and sequestrant provides a viable, fast-acting, noncorrosive alternative to conventional and mineral acid treatments for carbonate scales. It has the same calcium carbonate scale dissolution capacity [260 g/L] as hydrochloric acid (HCl); however, it has an inherent sequestering capacity that prevents the reprecipitation of undesired substances, such as iron, that could potentially cause formation damage.

CAL-Acid NT* scale dissolver: Same scale dissolution results and maintains the same parameters as the CAL-Acid dissolver while reducing costs.

The CAL-Acid NT dissolver is deal for CAL-Acid dissolver treatment jobs and does not require a tracer for the backflow.

CAL-Acid 2020* environmentally friendly calcium carbonate scale dissolver: Low-environmental-impact, rapid-acting dissolver. Effective against carbonate, sulfate, and sulfide scales, this dissolver exhibits a rapid, hydrochloric acid-like dissolution profile.

CAL-Acid AL* environmentally friendly aluminum-equipment scale dissolver: Low-environmental-impact, rapid-acting scale dissolver for aluminum equipment.

The scale dissolver is effective against carbonate, sulfate, and sulfide scales and provides rapid, hydrochloric acid-like dissolution profile and gentle decontamination of aluminum-based equipment, such as heat exchangers and distillation towers. It is also compatible with H_2S scavengers for decontamination of sulfide scales.

CURE SCALE DEPOSITION, MAINTAIN OPTIMAL PRODUCTION

As well as the nature of scale, Schlumberger global specialists determine its location, specifically whether it is reducing reservoir permeability downhole or restricting fluid flow in surface process equipment.

Types of scale

- **Sulfate**—Usually the result of mixing brines such as barium- or strontiumrich formation water and sulfate-rich seawater for reservoir pressure maintenance. This mixture leads to the deposition of barium sulfate scale.
- **Carbonate**—The most common oilfield scale, which occurs when CO₂ comes out of solution during production, resulting in calcium carbonate deposition.
- Sulfide—Formed in the presence of sour waters. H₂S can occur naturally
 or as a result of sulfate-reducing bacteria that produce H₂S gas as a
 by-product of their respiratory process. In the presence of ferrous iron,
 this gas can form pyrophoric iron sulfide deposits. Other metal sulfides,
 such as zinc or mercury, may also occur.
- Elemental radioactivity—The result of electrochemical processes in wells and process streams that can lead to the radioactive plating of surfaces and contaminate equipment with Pb-210 and other isotopes.

Experts analyze scale deposit samples to determine factors such as dissolution rate and sequestering capacities, which are used as input data for treatment designs.

For downhole applications, the deposit thickness, specific intervals where scale has accumulated, and candidate dissolver performance are evaluated to calculate the treatment volumes, placement procedure, and contact times.

Posttreatment analysis

As a routine part of its descaling operation, the DeScal service team uses a proprietary diagnostic software package to provide solid analysis. This package determines the efficiency of the treatment by separating the complex mixture of returning fluids into spearhead, dissolver, formation water, and seawater. The known chemical compositions of each of the component fluids then enable the mineralogy of the removed scale species to be identified.



Case Study

ONSHORE MEXICO: EFFECTIVELY RESTORING PRODUCTIVITY WITH RAPID BARITE SCALE DISSOLUTION

CHALLENGE

Severe scale deposition meant an onshore oilfield operator in southern Mexico was experiencing severe flow assurance issues, resulting in a steady production decline with a number of wells deemed uneconomic and closed in.

A range of chemical treatments deployed by other oilfield service companies had failed to restore production.

SOLUTION

The scale, partially blocking the oil-producing zone, was a mixture of barium sulfate and strontium sulfate. The DeScal service team proposed using the BaSOL 2000 HP scale dissolver, which is capable of rapid dissolution rates compared with other industry products. The BaSOL 2000 HP dissolver was capable of dissolving all of the scale within 24 hours and was pumped by coiled tubing for a specific number of batches at 1.5 m³, with contact time calculated to be 2 hours per batch. A small quantity of dissolver provided agitation, and fresh batches of BaSOL 2000 HP dissolver displaced the spent product.

RESULTS

The treatment was extremely successful and fully restored the productivity of the well resulting in an increase in production, from 81 to 675 bbl/d. The cost of the intervention was a fraction of the value of the oil produced.



Caliper and gamma readings were conducted before scale dissolution treatment to identify the location and thickness of the scale deposit (red curves and line, gray shaded areas) and facilitate design of the chemical treatment for removing scale.

After chemical deployment, caliper and gamma readings were again taken to confirm successful removal of barium sulfate scale (green curves, black shaded areas).







EFFICIENT AND SAFETY-FOCUSED NORM DECONTAMINATION

During hydrocarbon production, coprecipitation or electrochemical deposition of radioactive elements such as radium, polonium, and lead can generate potentially hazardous naturally occurring radioactive material (NORM).

Typically taking the form of radium sulfate or elemental metallic lead, NORM deposits may pose HSE issues, most of which cannot be completely rectified with high-pressure waterjetting or other conventional treatments.

DeScal service teams have extensive experience in conducting successful NORM decontamination operations using technologies and processes that minimize both HSE and economic risks.

Mobile units to reduce transportation risks

In addition to chemical solutions, the DeScal service team uses mobile decontamination units comprising tanks, cradles, pumps, and interlinking bunds. The mobility of these units enables onsite, point-of-generation decontamination, eliminating the risks involved with transporting hazardous radioactive equipment or waste.

Irrespective of location, at a minimum, every NORM decontamination project undertaken is managed under the auspices of UK Ionising Radiations Regulations 2017 (IRR17) and in compliance with Radioactive Substances Act 1993 (RSA93) standards.



REDUCE DECOMMISSIONING RISKS FOR MAXIMUM HYDROCARBON RECOVERY

Because of the wide variety of hydrocarbon-producing installations worldwide, technical solutions for decommissioning differ and are often unique and customized for each specific activity throughout the operation.

From releasing trapped hydrocarbons to effectively managing issues such as wax deposits and bacteria buildup to clear the way for safer decommissioning, DeScal service teams identify the optimal strategy for each application, ensuring efficient technical process design and HSE compliance. The challenges frequently associated with decommissioning projects include

- trapped oil
- mothballing of flowlines
- gas and bacteria buildup
- emulsions
- wax and asphaltene deposits
- seabed cuttings
- reinjection and riserless operations.

Case Study GULF OF MEXICO: TAILORED NONCORROSIVE SCALE REMOVAL IN HPHT FIELD

CHALLENGE

While preparing for a major intervention in one of the largest producing fields in deepwater Gulf of Mexico, an operator discovered calcium carbonate scale just below the subsurface safety valve.

The blockage prevented the use of downhole tools to mitigate the effect of increased water production and sampling for assessing asphaltene onset conditions. In addition, hydrochloric acid could not be used to remove the scale due to corrosion concerns of the Cr-25 completion.

SOLUTION

For the descaling operation, the DeScal service team qualified CAL-Acid scale dissolver, a noncorrosive alternative to conventional mineral acid treatments, for effective carbonate removal. Given the HPHT conditions, additional laboratory testing verified the descaling capability at 10,000 psi when any evolved CO_2 remained in solution.

A scale dissolver design was developed around staging a batch of 50% CAL-Acid dissolver in the completion workover riser and overflushing the dissolver pill with base oil, placing it over the affected area.

Slowly pumping a small quantity of base oil during the soak ensured dissolver refreshment.

RESULTS

A comprehensive wireline inspection confirmed that the carbonate scale blockage was successfully removed following three placements of 125-bbl 50% CAL-Acid dissolver.

Case Study ANGOLA: FLEXIBLE TREATMENT PROGRAM PROCESSES 830 TONS OF NORM

CHALLENGE

The hydrocarbon residue within the topside process pipework and cargo tanks of a large, soon-to-bedecommissioned FPSO vessel was found to be contaminated with NORM. With no NORM repository available, all NORM-contaminated waste produced from the decommissioning process had to be shipped to a neighboring platform for processing prior to injection in a disposal well.

SOLUTION

The DeScal service team customized a chemical and mechanical treatment process that employed proprietary chemicals and specialized equipment. The original strategy was designed to treat the initial waste stream with scale dissolvers, targeting all NORM-contaminated solids in suspension prior to injection. It was discovered that the wastestream differed frequently, thus requiring constant reengineering to develop and implement a more efficient solution.

RESULTS

The revised and continuously reengineered treatment methodology successfully processed the entire volume of NORM-contaminated waste, which was disposed of in a safer and environmentally acceptable manner. During the operation, a number of mechanical tools were used to hold, transfer, and mobilize the slurry in preparation for injection into the disposal well.

Case Study

NORTH SEA: STORAGE SYSTEM DECOMMISSIONING RECOVERS 335,456 BBL OF ATTIC OIL

CHALLENGE

In preparation for the cessation of production (COP), an operator planned to bypass a mature deepwater seabed storage system within a concrete structure and remove the attic oil. These gravity-based structures are globally used to facilitate large-scale bulk separation and storage of crude stock prior to export.

Although the latent volume in the upper part of the subsea storage cells would not pose a challenge at COP, the "dead" volume represented an obstacle for secure decommissioning.

SOLUTION

The Schlumberger DeScal service team customized a strategy that included novel and patented technology for facilitating the recovery of attic oil trapped within the subsea concrete structures. The method included the in situ generation of inert gas designed to displace the layer of crude oil to the level of the export pipe for recovery.

Following complete oil recovery, the gas cap would be absorbed using a gas scavenging system that would leave the cells full of seawater.

RESULTS

The successful deployment of the technology resulted in the recovery of crude oil from 76 subsea storage cells. All of the oil was removed from the cells, clearing the way for safer decommissioning. The project recorded more than 14,000 hours with no HSE incidents.





Case Study

ONSHORE KUWAIT: EFFECTIVELY DELIVERING IN SITU DECONTAMINATION OF RADIOACTIVE PUMPS

CHALLENGE

NORM scale deposits within ESPs and other artificial lift assemblies can cause mechanical failure, shorten service life, and restrict production.

An onshore operator in Kuwait sought to restore production rates and decontaminate ESPs obstructed with NORM scale deposits. An in situ solution was required to prevent any unnecessary shut-ins and to minimize rig time and costs.

SOLUTION

The DeScal service team proposed applying BaSOL 2000 HP scale dissolver to establish optimal pH conditions for in situ removal of NORM sulfate scale. The active dissolution and catalyst agents in the scale dissolver ensured a rapid reaction rate and provided a dissolution capacity of up to 0.67 lbm/galUS [80 g/L].

The lower part of the completion was shut off by thru-tubing and cement. The upper completion with the ESP was then flushed with diesel and treated to render the NORM scale contaminant water-wet Heated BaSOL 2000 HP dissolver was circulated within the ESP assembly, and continual sample analysis was performed topside to confirm optimal dissolution conditions.

RESULTS

The treatment was achieved with low well downtime and remediation time and costs. Following the application of the BaSOL 2000 HP dissolver, data comparisons from before and after confirmed that no radiation was present after treatment, indicating successful dissolution and removal of NORM scale from the ESP.

In addition, the treatment had an excellent QHSE profile because it avoided any surface handling of NORM-contaminated materials.

UNLOCK POTENTIAL OPTIMIZE PRODUCTION

A full-service offering to maintain and restore full production.

Schlumberger production technology specialists deliver targeted, integrated strategies that help to decisively remediate production issues such as deposit formation and enable customers to more safely restore and improve flow performance and revenue while avoiding costly repairs and shutdowns.

Firmly established at the forefront of technology, Schlumberger has a full-service offering that integrates pioneering chemical and process solutions, equipment, and software with unrivaled technical expertise.

Working with the world's largest oilfield services provider, customers benefit from a unique combination of outstanding technological capabilities and improve their understanding of how to successfully address production challenges in an increasingly competitive marketplace.

The team's global footprint and extensive suite of technologies help customers to reliably and efficiently maximize production—regardless of system complexities or geography.

MAXIMIZE PRODUCTION FROM RESERVOIR TO REFINERY

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UNLOCK POTENTIAL OPTIMIZE PRODUCTION



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