Scaled Solutions
A specialised global chemical testing laboratory

www.scaledsolutions.com

Quality, Integrity, Safety & Excellence.
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About Scaled Solutions

Scaled Solutions is an independent laboratory and consultancy company established in 1999 to service the Oil and Gas industry. Our customers are global operators, vendors and chemical manufacturers who require technical expertise to solve challenges and validate decisions critical to production chemistry, flow assurance, corrosion and formation damage.

We offer independent services and innovative solutions delivered by industry-leading experts in state-of-the-art facilities. In addition to laboratory testing, our capabilities include, modelling, consultancy, training, R&D and equipment design.

Scaled Solutions pride ourselves in providing a high quality service, and was successful in achieving registration to ISO 9002 in March 2000 and subsequently progressing to ISO 9001: 2000 in March 2001 and to ISO 9001:2008 in April 2008. We transitioned to ISO 9001:2015 in July 2018.

We know that quality matters so we’ll always keep up to date with current standards.

Scaled Solutions was established 20 years ago with only a handful of staff in a small industrial unit in Livingston, Scotland with a vision to become a truly international company. Today, we have achieved our vision and boast a large team of dedicated chemists, geologists, mathematical modellers, analysts and engineers across our international locations in the UK, Middle East and USA.

Our headquarters in Livingston, Scotland

Our second office and lab in Abu Dhabi

Our newest office in Houston, Texas

Dr Gordon Graham is the Managing Director of Scaled Solutions. Being active in production chemistry and flow assurance for over 25 years, he is a recognised industry expert.
Our Mission

To be recognised worldwide through our independent specialised laboratories as the leading supplier of bespoke equipment, training, consultancy & provider of solutions to challenges in Production Chemistry, Corrosion & Formation Damage.

Our Culture & Values

“We will meet or exceed our customers’ expectations and improve our service to our customers on a continual basis”

Team Work & Communication
Continual Improvement
Openness & Transparency
Trust

Meet our team

Our team has grown exponentially over the years as the company has experienced considerable growth. From starting out with just a handful of staff, Scaled Solutions now boasts over 60 highly experienced members.

Our number one asset is our people and without them we wouldn’t be a global company, helping a variety of clients in the field. We employ, dedicated chemists, geologists, mathematical modellers, analysts and engineers to help with a variety of projects and services.
Our Services

At Scaled Solutions, we offer a range of services to help find solutions for problems that our clients may have. Our expert scientists can provide testing and analysis for ease of mind.

Core Flood

Our core flooding experts work in our state of the art core flooding labs to help clients with hydrocarbon flow assurance.

Inorganic Scale

Scaled Solutions are renown experts in production chemistry. We provide testing solutions for inorganic scaling.

Corrosion

At Scaled Solutions we offer a range of corrosion testing services.

Organic Deposits

We have developed bespoke equipment to investigate and mitigate the formation of asphaltenes, wax and naphthenate deposits.
**Analysis**
At Scaled Solutions, our analysts use a variety of techniques both standard industry tests and in-house developed methodologies.

**Research & Development**
Research and development is integral to Scaled Solutions. We constantly want to experiment and find new ways to help solve our client problems.

**Consultancy, Training & Modelling**
Not only do we offer a range of chemical testing, we provide consultancy and training courses to our clients and offer modelling services for full-field and near-wellbore simulations.

**Engineering**
Our scientists use equipment that our engineers have built in house. We also sell bespoke rigs that suit client’s needs and wants.
Core Flooding

The Core Flooding Team draws on high levels of industry experience in Petroleum Geology, Chemistry and Engineering to provide the highest level of service to new and existing clients for hydrocarbon flow assurance.

With world-leading laboratory facilities, bespoke and case-specific protocols, and a team consisting of highly-qualified core flooding experts, the Core Flooding team have assisted a range of worldwide clients.
Scale inhibitor retention and release

Core flood tests are effectively utilised for management of field specific scaling issues. Scaled Solutions has extensive knowledge and experience of current inhibitor chemistries and have been integral in the development of appropriate analytical techniques to determine inhibitor concentration.

Drilling fluids, completion fluids and breakers

Our high specification bespoke test rigs allow assessment of the Formation Damage potential of oil- or water-based drilling & completion fluids under full reservoir conditions, for 3-phases (oil / brine / gas) and at HTHP. With our advanced test protocols, we are able to examine complex sequences.

Formation damage

The Core Flooding Team at Scaled Solutions employ state of the art rig equipment and techniques to evaluate oilfield chemicals, protocols and sequences. We have standard protocols for evaluating Inhibitors, Dissolvers, Diverters, Biocides, Drilling Fluids, Completion Fluids, Breakers and other oilfield chemicals.

Water injection

In addition to formation damage testing to support producer well operations, Scaled Solutions has extensive experience in laboratory testing to examine water injection feasibility.

Enhanced oil recovery

Scaled Solutions offer EOR core testing services. For advanced tests, our bespoke rig and enclosure is optimised to allow the use of live and re-livened fluids.

Core preparation and analysis

When it comes to formation damage assessment, analyses are vital tools for interpreting core flood test results. Scaled Solutions offer a wide range of analyses to assist with core selection and formation damage diagnosis.
Inorganic Scale

Our expert senior consultants can support your business with assessing the scale risk in your production system by working with you to review your field data, conduct scale prediction modelling and provide recommendations on strategies to mitigate and resolve potential risks.

Where scale inhibition via chemical deployment is desirable, we can propose appropriate test programs to determine the best chemistries for your system including best in class chemical qualifications. We provide scale formation, inhibition and dissolution studies for conventional and exotic scale species under field representative conditions. Quality results are produced and reported through our decades of experience, expertise and in our state of the art facilities.

Tests are supported by in-house analytical services to qualitatively and quantitatively characterise deposited solids. Following selection of the best performing chemicals, our laboratories offer extended services that can then ensure that the chemicals are suitable for the designed method of deployment. Effectiveness of squeeze treatments are assessed via core flood testing, downhole continuous injection application testing, gas lift application testing and material compatibility testing.

Solutions to help you understand, mitigate and resolve scaling risks
Scale Testing

Scale testing protocols have been established together with custom-designed equipment. This allows chemicals performance testing under field representative field application conditions, critical for today’s challenging production environments. This includes a variety of equipment that can test a range of conditions, from simple ambient pressure type test conditions (bottle type tests), up to higher temperatures and pressures, e.g. Ultra High Pressure High Temperature (UHPHT) up to 250°C & 19,000psi. Testing of varying shear; stagnant to high shear conditions, and at a range of flow volumes (millilitres to 10’s litres per minute).

Types of scales investigated include:
- Conventional scales
- Iron scales
- Sulfide scales
- Silicates
- Halites

Scaling formation and inhibition as a consequence of:
- Self-scaling conditions
- Mixing of incompatible waters
- Changes in production conditions
- Enhanced Oil Recovery operations
- H₂S scavenger addition
- Stimulations– spent acid production
- Evaporative processes

Other:
- Sulphate removal limits required to prevent scale

Our facilities include:
- Expert consultancy
- Specialist high temperature visibility cells
- Static bottle tests
- Dynamic tube blocking
- Jet impingement
- High pressure high temperature autoclaves
- Large flow pilot rig
- Evaporative halite testing
We provide a full range of electrochemical and coupon weight loss laboratory techniques, both under ambient and elevated pressure conditions. We also provide application-specific testing.

Electrochemical screening testing:
- LPR bubble tests
- Higher shear RCE testing
- HPHT LPR tests
- HPHT RCE tests

Weight loss tests:
- Bubble tests
- Ambient & HPHT rotating cage coupon weight loss tests
- Rotating wheel tests
- Material compatibility tests

Application-specific tests:
- Inhibitor portioning
- Film persistence
- Jet impingement
- Under deposit corrosion
- Artificial pitting
- Preferential weld corrosion
- Volatile corrosion inhibitor content
- Top of the line corrosion

Maintaining the integrity of oilfield equipment is essential to its safe operation and to maximise the efficiency of production.

This typically relies on careful material selection combined with chemical applications that either aim to shield the steel physically from the corrosion environment or to favourably alter that environment.

To determine this, it is prudent to carry out a detailed background review, modelling and representative laboratory testing.

At Scaled Solutions we offer a range of services in order to adequately support this taking into account the key aspects from the field.

Each project is tailored and designed for specific requirements, and utilises the knowledge of our in house experience and industry experts.
Specialised Services

Scaled Solutions also offer specialised services which include jet impingement, under-deposit corrosion and top-of-the-line corrosion. These techniques are accompanied by the ability to conduct optical, 3D profilometry, scanning electron microscopy and pit depth measurements for pitting analysis.

Related testing including foaming and emulsion tendency, production chemical interactions, thermal ageing and chemical and materials compatibility testing are also available. Testing is offered under sweet (CO₂) and sour (H₂S) conditions.
Organics Testing

The formation of asphaltenes, wax and calcium naphthenate deposits are recognised as major flow assurance issues in many fields, and will continue to grow in importance as the volume of more challenging crude produced increases. Likewise, the formation of stable emulsions is problematic for many of our clients, as it leads to poor oil/water quality and in some cases fouling of topsides equipment with heavy sludges. Scaled Solutions have developed novel equipment and testing methods to provide insight into the conditions under which organic deposits form, and to help mitigate against them.

Asphaltenes

We have developed a deposition flow rig for representative testing, up to 200°C and up to 5000 psi.

We also offer supportive testing including SARA analysis, asphaltene dispersancy testing (ADT), determination of asphaltene content, asphaltene onset by titration and hydrocarbon composition by GC.

Our asphaltenes and wax testing can be carried out using live crude samples or ‘re-livened’ dead crude.

Wax

Scaled Solutions has developed a bespoke flow loop that enables assessment of pipeline restart pressures, WAT and deposition characteristics under conditions selected to represent those prevailing in the field. Tests are conducted at representative temperatures (-30 to +100 degrees) and pressures (up to 5000psi).

Naphthenates

At Scaled Solutions, we have designed dynamic naphthenate flow rigs that have been used to investigate the formation and inhibition of calcium naphthenate deposits in the laboratory under conditions closely resembling those found in the field. Our dynamic flow rigs have been validated in field studies and are routinely used to assist in new field risk assessments and the determination of field treatment designs. Tests are conducted at temperatures (up to 100°C) and pressures (up to 100 barg) and can include the presence of CO₂, known to be critical to accurately simulating field conditions.
**H₂S Scavengers**

As H₂S scavengers are widely used within the oil and gas production industry on a continuous or batch basis, their performance and side effects require testing. Also, compatibility with other chemicals requires laboratory testing prior to field application. Sulphide scavengers, can also cause significant scaling issues depending on the field conditions.

Scaled Solutions provides laboratory tests designed to assess scavenger performance, measure the impact on alkalinity, generate data to support scale prediction modelling and verify scale predictions using dynamic scaling tests. Projects can also be designed to evaluate the chemical compatibility of scavengers with other production chemicals.

**Modelling**

We also offer modelling using PVTsim Nova and Scalechem to support laboratory testing for asphaltenes, waxes, naphthenates, emulsions, hydrates and H₂S.
In addition to utilising standard industry methods, we offer method development & validation services which are performed by highly experienced analysts. We also offer analytical support services for routine brine, chemical and solids analysis, through a variety of methods, including:

- Scanning Electron Microscopy (SEM)
- Compositional solids analysis by Energy Dispersive X-Ray Analysis (EDX)
- Optical Microscopy
- Topographic Microscopy (3D Microscopy)
- Viscometry & Rheometry (Brookfield II & Anton Paar)
- Karl Fisher (Water in Oil analysis)
- Infracal (Oil in Water analysis)
- Turbiscan (Emulsion & Solids Deposition)
- Asphaltene Dispersant Testing (ADT)
- Formation Damage evaluation by ICP
- Oil Analysis
- Fluorescence Spectroscopy
- Gas Chromatography (GC-MS, GC-FID, GC-FPD)
- High Pressure Liquid Chromatography (HPLC) with various detection methods
- Ion Chromatography
- Fourier Transform Infra-Red Spectroscopy (FTIR)

The diverse and dynamic production environments of the oil industry continually drive the demand for more effective scale, corrosion and separation control, while increasing environmental concerns push forward the development of environmentally friendly, preferably biodegradable production chemicals.

Scaled Solutions has extensive experience in the analysis of field water samples, production chemicals and oil samples utilising a variety of different techniques, including Inductively Coupled Plasma (ICP), Wet Chemical analysis, and Gas and Liquid chromatography. We offer method development & validation services carried out by highly experienced analysts.

Our qualified analysts use state of the art equipment to perform complex analysis and provide results that you can have confidence in.

The Analysis Team at Scaled Solutions have developed several methodologies for effective evaluation of production chemicals in sea water, produced water and formation water matrices.
Analytical development for scale inhibitors

Scaled Solutions have well-established techniques for conventional scale inhibitor analysis via ICP and wet-chemical methods. As part of the SWELL JIP series, new analytical techniques have been developed for analysing residual scale inhibitor concentrations, providing accurate, repeatable and reliable results. These methodologies focus on automated HPLC-based, solid-phase extraction and fluorescence based techniques, and analyse for the "active" scale inhibitor component, as opposed to other analysable moiety that can be detected by less focused techniques. These methods are used routinely in our laboratories.

Scaled Solutions have developed a range of methods for inhibitor analysis, including the use of Gel Permeation, Reversed Phase and Ion Chromatography.
Method development and validation

All of our analysis is performed in-house. The analytical department of Scaled Solutions can offer practical solutions to the most challenging of testing conditions. We have extensive experience in developing procedures that optimise method accuracy, precision, robustness & sensitivity.

Scaled Solutions offer technical expertise and consultancy on analytical methods for both onshore and offshore applications.

SEM/EDX

The Hitachi S-2600N Environmental SEM has a wide range of applications including formation damage evaluation, compositional analysis and routine scale monitoring in field samples. The Hitachi S-2600N provides high quality imaging and elemental analysis through the energy-dispersive X-ray system. With backscatter and EDX detector upgrades within the last six months, this instrument produces the cutting-edge quality imaging you need to analyse rock, scale samples, paper filters, metal filters, coupon surfaces, screens and more.

Our expert analysts can identify and differentiate between active and inactive scales on the basis of morphology and distribution, so you can be confident that your inhibitor is performing.
Joint Industry Projects (JIP)

Scaled Solutions has been involved with large Joint Industry Projects (JIPs) to tackle some of the industry’s most pressing challenges. Currently, Scaled Solutions are engaged in the SWELL JIP.

SWELL is a JIP sponsored by multiple operators, vendors and service companies, to perform research and development aimed towards improving inorganic scale management and scale inhibitor treatments in complex and challenging oilfield production environments. 12 years on, the project is now in its fourth phase, which runs from March 2017 until February 2020.

Areas of research in the current SWELL IV programme include:

- Investigating the effect that kinetics and hydrodynamics have on the formation, deposition and inhibition of scale.
- Core flood testing of scale inhibitor squeeze treatments and development of new additives to enhance the lifetime of treatments under both conventional production conditions and more challenging conditions associated with chemical EOR.
- Techniques for analysis of residual scale inhibitor concentrations from squeeze treatments.
- Modelling of squeeze treatments. Place iT™ is our near-wellbore placement simulator that has been developed as part of the SWELL JIP over the past 15 years.
Research and Development

Research and Development is integral to Scaled Solutions. We have been involved in multiple joint industry projects for many years. In addition to that, we also run our own internal R&D programme with support from Scottish Enterprise.

As a community of scientists, we are passionate about discovering new things that help us to improve our understanding of oil and gas production. All of our R&D projects benefit from a multi-disciplinary team including in-house consultancy, modelling, engineering and analytical capabilities.

We also conduct a number of one-to-one R&D projects for our clients covering a wide range of topics including:

Chemical Delivery, High Pressure/High Shear Scale Formation, Naphthenates, Asphaltenes, Wax, Fluid Dynamics, Corrosion, Drilling Fluids, Advanced Analytical Techniques and EOR.
Scaled Solutions are currently engaged in a number of exciting activities as part of a large self-funded R&D project supported by a Scottish Enterprise Award. We are proud to be viewed as one of Scotland’s most innovative companies, and have invested in cutting edge equipment and high calibre personnel to help us reach our R&D goals. Our current R&D activities are aimed at pushing the boundaries of what is possible in laboratory testing, going to higher pressures, temperatures and shear, exploring new analytical methods and procedures to ensure our testing is as field representative as possible.

Improving our understanding of oil and gas production...

Internal R&D Programme Topics:

- Pilot Rig
- Corrosion
- Asphaltenes, Waxes and Crude Analysis
- HP/HT Core Flood
- EOR Core Flood
- UHPHT Rig
- Stim Modelling
- Fluid Dynamics
- TRF Analysis
- Hydrogen Sulphide
Modelling

Scaled Solutions offer a range of well modelling services as part of our complete ‘Scale Prevention Cycle Analysis’. Modelling is used to examine scaling and flow assurance challenges in the oil and gas production industry, including full field reservoir modelling, near-wellbore modelling and flowline modelling.

Reviewing of field information is often the necessary first stage in any major laboratory testing campaign or computer-based study. Design of test programmes and prediction exercises must be based on realistic field conditions. Scaled Solutions therefore work closely with our clients to ensure that the right questions are asked and the best data are obtained for input into a test programme or study.

In conjunction with field review and consultancy services, we routinely perform scale prediction work using state of the art software. This covers common scales, scale types and exotics and evaporation-sensitive halite scales, using:

- ScaleChem (OLI Inc.)
- Other commercial software, subject to licensing
- In-house developed spreadsheet methods based on published algorithms

Full field, near wellbore and scaling simulations to support your project
Computational fluid dynamics (CFD) is the study of flow regimes in a system. Pressures, velocities, viscosities and many more flow properties can be obtained and correlated to physical observations. Scaled Solutions uses CFD modelling to modify laboratory test apparatus and then upscale to field conditions to ensure the flow regimes are consistent.

Understanding how fluid flow regimes affect corrosion and scaling processes is of critical importance to ensure that the appropriate laboratory test methods are used to achieve field representative results.

**Place iT**

Place iT™ is Scaled Solutions’ own created near-wellbore simulation package. Place iT allows chemical placements to be simulated either in the near wellbore area or in a single/dual linear core flood.

Place iT can be used for:
- Scale Inhibitor Squeeze Treatments
- Corrosion Inhibitor Squeeze Treatments
- Core Flood Return Modelling
- Fractured Well Squeeze Treatments
- Stage Division Treatments
- Acid Stimulation Treatments
- Skin Factor Modelling
- Wellbore Temperature Modelling
Engineering

Scaled Solutions design and build all of the test rigs used in their laboratories, from routine testing rigs such as dynamic tube-blocking and core flood rigs, to complex highly innovative R&D rigs for specific projects. All the rigs we make can be custom-built, tailored to customers’ needs and made to order. Our designs have been rigorously tested within our own laboratories. All of our rig-building projects include the following additional benefits:

- Equipment fully tested and commissioned (up to maximum pressure and temperature)
- Onsite setup and installation by our own trained Engineers
- One years warranty

We also offer a number of other products and bespoke rig setups, including Gas Lift Rigs, Product Stability Rigs, High Pressure Cells, Dual Purpose Rigs and Compatibility Test Apparatus. We are able to build Client Customised Designs and Customised Software Controls to suit your needs.

Buy your laboratory equipment from the people who use it, day-in, day out!
Dynamic Scale Rig

The dynamic scale rig allows for dynamic scale testing to be carried out following quick and straightforward protocols. Differential pressure is measured independently across the scaling coil and inline filter, allowing for investigation of different scaling mechanisms.

Dynamic Naphthenate Deposit and Emulsion Rigs

The dynamic naphthenate deposit rigs have been designed and fabricated in-house within Scaled Solutions and give a new and more realistic approach to standard naphthenate bottle testing.

Core Flood Rig

Scaled Solutions has been building and using core flood rigs for twenty years. During that time, we’ve refined and improved our designs to give you a streamlined, reliable and intuitive product that will allow you to achieve excellent test quality in the laboratory.

Service Contracts

Following on from the initial warranty, which is included in the cost of the rig, Scaled Solutions also offers our customers the option of an additional service contract. This service contract includes the facility to loan equipment in the unlikely event of a fault developing, and also re-plumbing the ‘hot’ tubing of the rig after a specific period.

Corrosion kits

Scaled Solutions supplies a variety of corrosion equipment to suit your needs. We can advise on what kind of equipment you will need to perform your tests, and help you set up your corrosion testing apparatus.

Training and support

When you buy new equipment, you want to be able to start using it straight away. We recognise this, and so we will train your staff to use your new rig, in order to minimise downtime and maximise efficiency.
Technical experts you can trust

In addition to providing consultancy and training in support of our laboratory studies, Scaled Solutions also offer a wide range of external consultancy services and training courses to our clients. Our training products are provided by experienced laboratory staff, technical experts and senior internal consultants from a variety of disciplines, each having over 20 years’ experience in the Operations and Service sectors. Scaled Solutions also offer modelling services for full-field and near-wellbore simulations.

Each year, we hold bespoke training courses around the world bringing together our senior experts to present Scaled Solutions’ internationally-recognised Production Chemistry Course. In 2020 we will be launching a series of practical training courses.
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