# PREMIER COREX

## FORMATION DAMAGE ANALYSIS SERVICES BROCHURE

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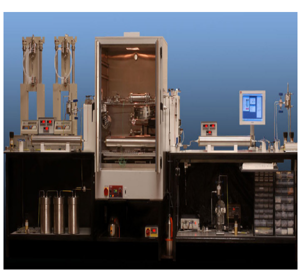
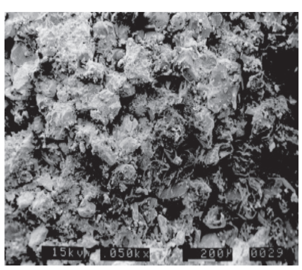

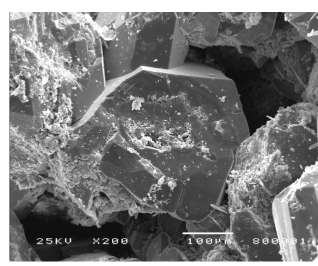

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## INTRODUCTION

Formation Damage can be defined as, **"a reduction in permeability around a wellbore, which is the result of drilling, completion, injection, attempted stimulation or production of that well."**

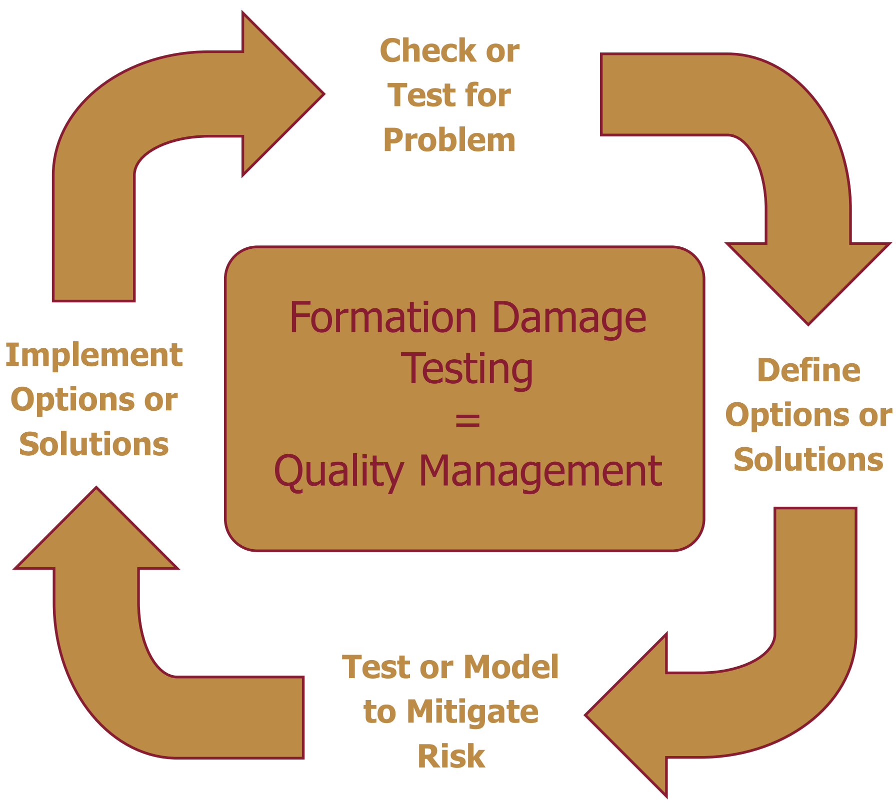
Formation Damage can cause significant decrease in well productivity and worldwide yearly lost production is equivalent to billions of dollars in lost revenue. Identification and reduction of Formation Damage problems can lead to immediate returns in the form of increased production rates and extension of the life of any field.

Laboratory testing of candidate drilling, completion, remedial, treatment or workover fluids is commonly performed by many operators to help in understanding and avoiding lost productivity or injection.

PREMIER COREX have, for over 20 years, been independently carrying out reservoir conditions testing for operators worldwide. PREMIER COREX excel in covering a vast range of test types and conditions, from producer to injector or disposal well, from room temperature to over 250°C (almost 500°F), examining the majority of fluid types, treatments, and completion types currently in use.

Formation Damage testing is viewed by many operators as a key component in Total Quality Management.

The flow of work (and design of a study) meets the requirements of quality management to **"plan, do, study, act"**:



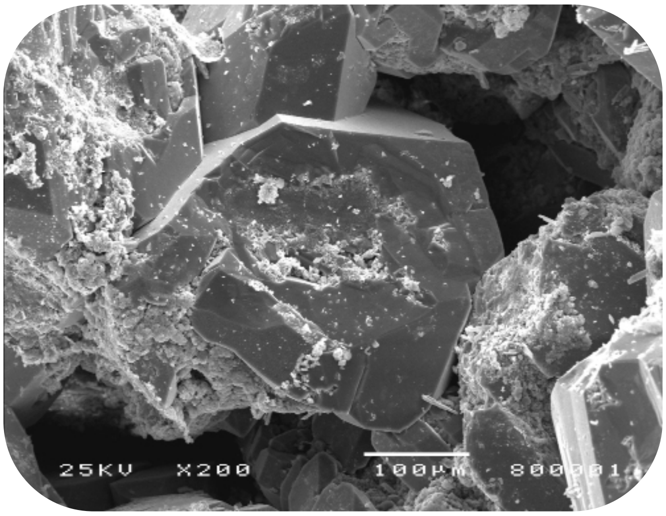

**This feeds back as a "continuous improvement" cycle to assist in the selection of the best fluids and hardware for the field. It is cheaper and easier to experiment in the laboratory than the field.**

**Formation Damage Services offered by PREMIER COREX cover a broad range of subjects including:**

- Reservoir Properties
- Wellbore Operations
- Treatment Fluid Assessment (scale modelling and testing, matrix acid, corrosion, drag reducers etc.)
- High Pressure High Temperature (HPHT) Assessment
- Injection Wells
- Sand Production and Control
- Microbial Formation Damage
- Consultancy and Data Mining
- Formation Damage Training

## GEOLOGICAL SAMPLE EVALUATION

Generally, testing will involve using real reservoir core and fluids (wherever possible), at reservoir conditions (including HPHT), with the test itself designed by PREMIER COREX experts to meet the specific aims of the end user. Examples of common aims of testing are to evaluate the relative impact of two potential drilling fluids on reservoir core, to examine damage caused to reservoir core during flow (injection or production), or to compare screen and gravel options from different hardware vendors for sand control wells.




Typically, core testing utilises measurement of changes in permeability, volumes of fluid loss (for example during drilling or during a remedial treatment), rates of flow through the core during production or injection, and visual observations of the core before and after testing. Geological analysis of samples after testing is an essential technique in understanding what has happened during testing.

Novel techniques are constantly in development within PREMIER COREX as the scope of tests change, and as new drilling and completions practices are adopted. A key development in the understanding and application of Formation Damage testing has been the **"integrated approach"**. Whilst permeability measurements and graphs of flow through core samples provide useful information, it can be dangerous and misleading to take this data and try to apply it to field rates or productivity.

For example, in a short core sample it is fairly easy to remove one pore filling and lining material (such as clays) during flow, which will cause an increase in the permeability of the sample; in the reservoir, increased transit distance and concentration of fines could mean that this is a permeability-reducing mechanism. This is why geological techniques (such as scanning electron microscopy) are used to understand what has caused many alterations in permeability to core plug samples, and apply this understanding to the field situation.

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## GEOLOGICAL SAMPLE EVALUATION (CONTINUED)

In addition, multiple mechanisms often act concurrently in samples, meaning that understanding the interactions between fluids and core is not necessarily as simple as measuring changes in permeability. The industry has relied on permeability measurements alone for many years, which is wrong: it is essential to recognise that independent laboratory testing utilising the **"integrated approach"** helps to reduce the risk of failure in a well. These issues are covered in detail in a technical paper **(SPE 107812)** written by PREMIER COREX.

Each reservoir presents a different set of parameters and circumstances, meaning that the level of Formation Damage is very difficult to predict ahead of time. Even in two wells with similar characteristics, small variations in lithology, permeability, pressure, temperature, drilling fluids, and drilling/completion conditions can have large impacts on the types of Formation Damage present. Whilst it is not difficult to predict that poor design of drilling and completion fluids or a lack of understanding of the reservoir will lead to Formation Damage issues, it is not so simple to blame Formation Damage on human error. The solution, however, is clear: the better the understanding of reservoir properties and sensitivities, the higher the chance of avoiding productivity impairment and the greater the subsequent financial savings. ***Understand Formation Damage to avoid Formation Damage.***

Improved simulation of the wellbore in laboratory testing will lead to improvements in prevention and mitigation of Formation Damage. As this type of testing becomes more commonplace around the world, the database of test results increases in size and PREMIER COREX are able to innovate and improve testing procedures.

For example, PREMIER COREX have recently pioneered advances in HPHT testing to allow examination of gas reservoirs, and have over a 20 year period built up a wealth of experience and test apparatus to cover independent testing facilities to all operators and vendors. As there are very few independent laboratories with the capacity or knowledge to perform meaningful Formation Damage testing, it is fortunate that this industry is not geographically-tied. Core material and fluids can be sent to international **"centres of excellence"**, such as the PREMIER COREX facility in Aberdeen, where tests can be carried out by independent consultants with a deep understanding of Formation Damage issues.

# RESERVOIR PROPERTIES

## Reservoir Properties can cover a wide range of subjects, such as:

- Characterisation of reservoir core material by geological techniques such as particle size distribution, scanning electron microscopy (SEM), thin section, x-ray diffraction (XRD), and CT scanning.
- Characterisation of reservoir fluids or water samples by techniques such as chemical analysis, particle size distribution, and total suspended solids.
- Testing to examine natural tendencies in the reservoir for damaging mechanisms such as fines mobilization, scale precipitation, or wax deposition.

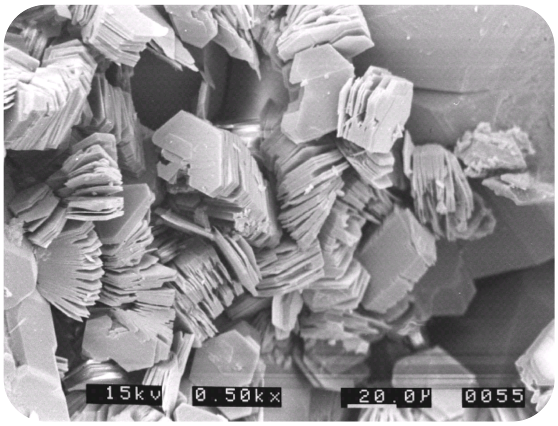
To compliment the laboratory testing, and to further identify the potential Formation Damage mechanisms occurring within core samples, a range of geological techniques are employed to aid in interpretation.

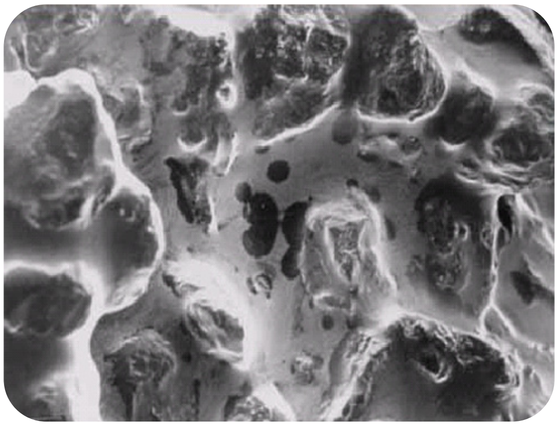
Geological sample evaluation allows an understanding of test results, and is essential when the results of testing are going to be used in a model (for example computational fluid dynamics "CFD"). Interpreting test results using permeability measurement alone increases risk by ignoring the possibility of mechanisms which both improve and reduce permeability occurring simultaneously in the samples.

In short, core plugs, mechanisms which lead to an increase in permeability (such as clay fines removal) can occur relatively easily, whilst in the field (with increasing transit distance and concentration) they can be significant damaging mechanisms. Although Geological techniques are therefore used to properly interpret results, and reduce risk.

## These include, but are not limited to:

- Computed Tomography (CT) scanning to identify bedding, cements, fractures, and other geological features in core samples.
- X-ray diffraction, to determine the minerals present in the core, with clay fraction XRD the only method of definitively identifying the clay minerals present.
- Thin section, to determine the relationship between minerals and bulk mineralogy, and after testing, to examine changes in clay distribution, cement etc.
- Dry scanning election microscopy (SEM), to examine pore-filling minerals at high magnification and, after testing, to examine solid damaging mechanisms such as poor mud-cake clean-up, mud infiltration into the core, fines mobilisation, insoluble precipitates, and cement removal.
- Cryogenic SEM, to examine pore-lining and pore-filling fluid phases and, after testing, to examine fluid damaging mechanisms such as saturation change, fluid retention, emulsions, incompatibilities, and precipitates.



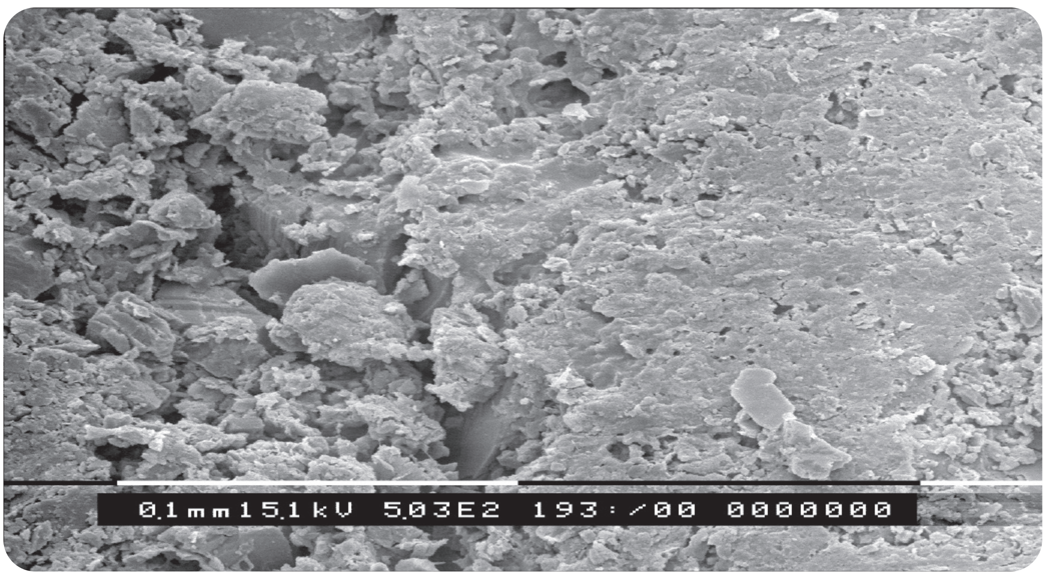



## WELLBORE OPERATIONS

In the selection of wellbore fluids and of operational procedures, independent reservoir conditions Formation Damage Testing is routinely used. The results of testing can be used to aid in selections, as well as assisting in improving models (such as CFD). Testing is used as part of the Total Quality Management model by first identifying problems, subsequently identifying potential solutions, testing the solutions, and implementing the solution.

A basic test involves a permeability measurement followed by test fluid application and a final "return" permeability and interpretation with geological evaluation. Permeability versus throughput and fluid loss versus time measured at reservoir conditions are produced as standard. Permeability results alone do not allow interpretation of results, so it is essential to integrate geological techniques to determine the causes of damage and potential solutions to Formation Damage problems. Combining permeability / fluid loss results with all of these techniques greatly enhances the value of reservoir conditions core flood tests.

For many years laboratory flood tests have been used to pre-screen various introduced wellbore fluids such as drilling muds and completion fluids. In order to fully interpret the results of such flood tests PREMIER COREX continues research and development of recognised geological techniques which have a particular relevance to flood test interpretation. In essence, to clearly identify favourable non-damaging fluid candidates, remedial treatments and/or incorporate mechanisms or design operations to improve results for field use the permeability results, cryogenic SEM analysis, dry SEM analysis, thin section analysis and XRD are all required.




Drilling mud blocking pores and reducing permeability

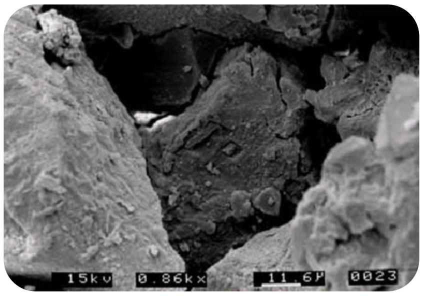
## TREATMENT FLUID ASSESSMENT

Treatment fluids can be included in operational sequences, and are also commonly examined in isolation to examine Formation Damage mechanisms or to provide specific information such as reaction rate, minimum inhibitor concentration, or breakthrough time. The results of testing can be used to aid in selections, as well as assisting in improving models (such as CFD). Testing is used as part of the Total Quality Management model by first identifying problems, subsequently identifying potential solutions, testing the solutions, and implementing the solution.

As with wellbore operations testing, permeability measurements, pressure readings, and geological analysis are used to understand damaging mechanisms and interactions. In addition, when required, specialist techniques such as effluent analysis are used to meet the aims of testing. When the "integrated approach" is used to understand test results with geological analysis, the risk associated with decisions on the selection of the fluid(s) and/or design for successful field deployment can be reduced based on knowing the full scope of damage mechanisms (nature and distribution).

## ACID STIMULATION

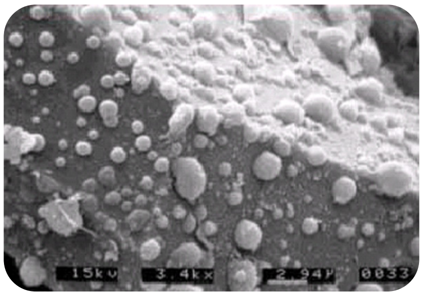
Acid stimulation tests can include examinations of the compatibility of introduced fluids with reservoir fluids and core, comparing the effects of different acids on the reservoir core, and examining mechanisms of acid stimulation. Geological analysis is particularly important in these tests, allowing an understanding of how the acids have interacted with the core. Relying on permeability measurements alone increases risk, as mechanisms such as clay fines mobilisation, insoluble metal precipitates, and loss of wellbore integrity can all be associated with acid treatment fluids. After design of treatments by vendors, PREMIER COREX can independently perform various acid stimulation sequences tailored to individual requirements. The laboratory has staff trained specifically in the use of chemicals from organic acids to hydrochloric acid (HCl) and hydrofluoric acid (HF).




## SCALING AND SCALE INHIBITION

The development of scale precipitates (carbonate, sulphate, or "exotic") can have a significant impact upon productivity or injectivity. Prediction of a problem and the selection of an appropriate treatment are key to limiting the impact of scale.

Formation Damage mechanisms can be associated with both scale development and scale treatment or inhibition (compatibility issues with the reservoir, saturation changes, surface chemistry changes, treatment life) and so "standard" scale testing as well as Formation Damage testing is highly recommended.



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**After design of treatments by vendors, a full range of independent scale testing is performed at PREMIER COREX, including:**

- Scale Modeling and Prediction.
- Dynamic Scale loop testing to determine the efficiency and minimum inhibitor concentration (MIC) of inhibitors in a flowing situation (e.g. during production).
- Static Jar testing to determine the efficiency and minimum inhibitor concentration (MIC) of inhibitors in a stagnant situation (e.g. in a separator).
- Coreflood testing to examine treatment life, including analysis of effluent to determine time taken to reach MIC.
- Formation Damage coreflood testing to examine mechanisms associated with inhibitors (either in isolation or as part of a wellbore operational sequence).

## DIVERTERS

Fluids tend to flow along the path of least resistance, which can mean that some areas of low permeability in the formation are subject to less treatment fluid than others. A diverter is designed to enable fluids to target the areas that need it the most. After design of treatments by vendors, PREMIER COREX perform independent tests to assess chemical diverters' capabilities in the selected intervals to restrict or improve fluid flow. This can include testing separate zones in isolation or testing two or more zones in parallel in a single test, in order to assess whether the diverter is performing as expected.

## OTHER TREATMENT FLUIDS (DRAG REDUCERS, BIOCIDE, CORROSION INHIBITOR ETC.)

There are many other types of treatment fluid designed for specific purposes. A wide range of test types are performed to independently examine these (after design of treatments by vendors), including fluid-fluid compatibility tests and coreflood tests to understand fluid capabilities and Formation Damage mechanisms. A combination of permeability measurements, pressure data, geological analysis, and other evaluation (such as effluent analysis) are vital in understanding the damage mechanisms associated with these types of fluid.

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# HIGH PRESSURE HIGH TEMPERATURE (HPHT)

HPHT testing can cover many of the other topics listed, including Wellbore Operations, Treatment Fluid Assessment, Injection Wells, Microbial Formation Damage, and Reservoir Properties. Formation Damage issues are often very significant in HPHT wells, such as low permeability gas reservoirs. Operators therefore consider independent Formation Damage testing a key aspect in the QA process of ensuring successful development in this type of reservoir by increasing knowledge and reducing risk.

HPHT testing is not, however, a case of simply performing the same tests at higher temperature and pressure. PREMIER COREX have performed in-house research to ensure that test results are representative and meaningful, which is achieved by design of specialist equipment and procedures for this type of test.

## The tests performed depend on the aims of the study, but can include:

- Drilling Fluid selection
- Brine or Completion Fluid compatibility with the formation
- Examination of the full sequence of drilling and completion operations
- Suspension or kill fluid selection
- HPHT Microbial Formation Damage

As with the other types of testing, a combination of permeability measurements, filtrate loss volumes, pressure data, and geological analysis is key to understanding the results. Many HPHT reservoirs are low permeability, and therefore damaging mechanisms (such as clay fines migration and fluid retention), which can only be identified by geological sample evaluation, can be very significant and understanding them is vital in reducing risk in wellbore operational decisions.

PREMIER COREX have designed procedures and tests which allow testing at temperatures up to 250°C (almost 500°F) including humidification at reservoir conditions.

Further information on this **"gold standard"** testing can be found in SPE paper **(SPE 121649)**.

4 FORMATE MATTERS — CABOT — Issue no. 4 – July/August 2009

TECHNICAL FORUM

### Corex sets new Gold Standard for HPHT coreflood testing with cesium formate brine

How do you accurately measure gas permeability in reservoir core samples while conducting HPHT formation damage testing on cesium formate brine? This was the challenge facing Corex Ltd., one of the world's leading core analysis companies and experts in formation damage, when asked by Cabot to carry out HPHT core flood tests for a major North Sea operator. A review of their test procedures identified two areas of concern that could introduce errors into gas permeability determinations:

- Gas leakage from the cores through the surrounding elastomer seals at extreme temperature and pressure.
- Dehydration of core's fluid contents if the test gas is not fully saturated with water vapour under test conditions.

To solve the problem of gas leakage Corex came up with a gold-plated solution. The core was wrapped in a gas-impervious layer of 24-carat gold before fitting the elastomer sleeving and O-rings.

The second problem of dehydration was overcome through the installation of a pressurised high-temperature gas humidifier to ensure that gas entering the core was fully saturated with water.

**24-carat gold film prevents gas leaking from the core under hydrothermal conditions**

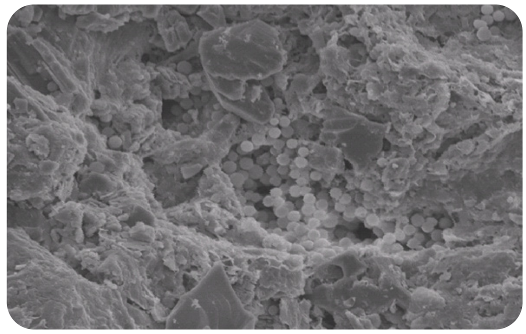
Using this new test set-up Corex carried out two formation damage tests with cesium formate brine on cores from a major HPHT field located in the UK North Sea. The test temperature was 200°C (392°F) and the pore pressure inside the core was maintained at 5,800 psi. In one test, the gas used during drawdown and permeability measurements was passed through a pressurised humidifier held at room temperature. In the other test, the gas was passed through the new pressurised high-temperature gas humidifier.

Commenting on the outcome of the tests reported in SPE paper 121649[1], Ian Patey, manager of Corex's Formation Damage group, said: "The overall permeability of the reservoir core sample to gas was unaffected by injection of 10 pore volumes of cesium formate brine, followed by a 48-hour static soak at 200°C and back-production using 4 litres (>1,000 pore volumes) of HPHT humidified gas under 100 psi drawdown. In the other test permeability was reduced by nearly 15%. This shows that full HPHT humidification of the gas phase results in higher gas return permeability when compared with a comparative test using gas humidified at room temperature and high pressure. Consequently, it's critical that gases used in HPHT core flooding tests are fully saturated with water vapour at the test temperature and pressure to ensure correct and realistic results."

This innovative use of gold-coated cores and HPHT humidified gas sets new levels of accuracy for core flood testing of high-density completion brines at high temperatures. It also helps match laboratory test results with operators' experience of using cesium formate brines in HPHT wells over the last ten years.

*Downs, J.D.: "Observations on Gas Permeability Measurements under HPHT Conditions in Core Materials Exposed to Cesium Formate Brine", SPE 121649 presented at 2009 SPE European Formation Damage Conference, Scheveningen, The Netherlands, 27-29 May 2009.*

## INJECTION WELLS



Injection wells are frequently examined in wellbore operations testing, to aid in the understanding of damaging mechanisms associated with drilling and completion fluids and operations.

Injection-related issues are commonly independently investigated in a separate suite of tests, as an aid to the QA process of understanding or reducing risk through appropriate decisions; this testing is also used as input data to models (such as CFD) or turnkey systems.

### A wide range of tests can be performed, including:

- Raw injection/source water testing, to examine whether significant damaging mechanisms are associated with the candidate fluids for injection
- Fines migration testing, to examine any natural tendency for alterations in permeability associated with fines mobilisation in the reservoir core
- Scale prediction and testing to identify scale-related damage
- Evaluation of candidate additives to the injection water, such as scale inhibitors, drag reducers, and biocides
- Evaluation of filtration requirements for solids removal (hydrophilic testing) and oil removal requirements (hydrophobic testing) for injection
- Examination of sensitivity to candidate injection/source waters
- Fractional flow of candidate injection/source waters, for example various ratios of produced water and seawater
- Microbial Formation Damage associated with injection operations

Permeability measurements are produced as standard. Using these results and integrating geological techniques, it is possible to determine the causes of damage and potential solutions to Formation Damage problems.

Combining permeability/fluid loss results with all of these techniques greatly enhances the value of reservoir conditions coreflood tests.

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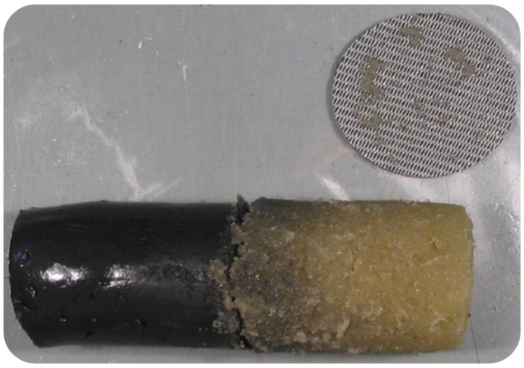
## SAND PRODUCTION AND CONTROL



Selection of appropriate sand control and operational fluids in many wells (with high well costs associated with this type of completion), can be critical to the success of a development. Testing can be customised or tailored to meet specific aims, and results are commonly used to aid in hardware selection and as inputs to models.

### PREMIER COREX perform testing to examine many of the issues relating to sand control selection, including:

- Static sanding prediction by rock mechanics
- Dynamic sanding or fines prediction by reservoir conditions coreflood testing
- Particle size distribution of sand samples
- Sand retention testing to evaluate candidate hardware
- Wellbore operations testing to examine the selected candidate hardware with the proposed operational

In-house research at PREMIER COREX has shown that artefacts can be created in this type of testing due to the design of equipment and coreholders. This has led to the design of equipment by PREMIER COREX that is accepted to provide meaningful laboratory data.

After candidate hardware has been identified and tested, it is essential to include reservoir conditions coreflood testing to examine both the hardware and fluids. These full sequence laboratory tests represent the closest possible simulation of real well performances and any damage which may result from combined drilling, completion and clean-up operations.

This means that it is possible to optimise the fluid and hardware options to ensure well performance and sand control. Laboratory tests have often led to huge improvements in well design which have helped prevent costly mistakes in real wells. The principal of experimenting in the laboratory rather than in the field is seldom more applicable than in expensive wells with sand control.

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## MICROBIAL FORMATION DAMAGE

A growing area of concern in wellbore operations is the Formation Damage Mechanisms produced by various types of bacteria, such as reservoir souring as a result of sulphate reducing bacteria activity; the ability to predict and control bacterial activity is of major operational significance. Topside evaluation of bacterial activity is not sufficient to mitigate risk, and the downhole conditions must also be considered. Souring of oil is often thought of as a problem in terms of facilities and health & safety, but when these bacterial by-products are observed there must be bacteria active in the well. These bacteria can generate reductions in permeability due to cells, organic material, and insoluble metal sulphides all restricting pores.

The recommended practice to identify microbial Formation Damage follows the same Quality Management cycle as all Formation Damage testing.

### In the case of Microbial Formation Damage, the flow path is:

- Identify whether there is a problem. Initial screening can be performed on reservoir core and fluids (oil and/or produced water), drilling & completion fluids, and injection fluids. This testing is used to determine whether bacteria are present, whether they are native (autochthonous) or introduced (allochthonous), the type or species of the bacteria, and the conditions that they are likely to develop in.

- Understand the consequences of the problem. If the potential for bacterial activity is identified, testing is then performed to identify the consequences. Testing can range from fluid incubation tests to full reservoir drilling & completion sequence testing. Damaging Mechanisms identified can include $H^2O$ generation, cells blocking and filling pores, biopolymers blocking and filling pores and precipitation of insoluble metal sulphides.

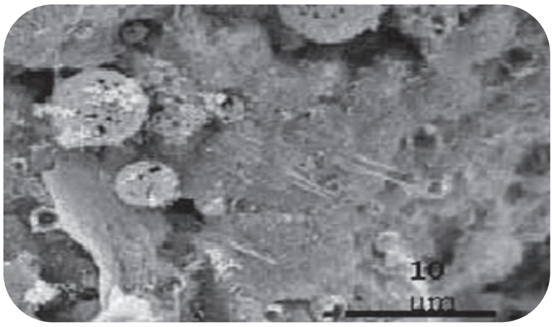
- Evaluate solutions to the problem. If the conditions under which bacteria may cause damage and the types of mechanism expected are both known, it is possible to evaluate a range of treatments proposed by a vendor. These could be both preventative and remedial treatment. Multiple treatments may be evaluated in similar tests to evaluate their relative performance.

- Deploy selected treatments. The QA cycle continues at this point by determining whether the treatments have been successful in the field.

## CONSULTANCY AND DATA MINING

PREMIER COREX have offered Formation Damage services for over 30 years, and are the largest laboratory in the world in terms of facilities (more than 10 dedicated test rigs) and experience (over 100 years of Formation Damage experience within the department); our database contains the results of thousands of tests.

This means that PREMIER COREX are considered to be the ***leading consultants*** on Formation Damage.



### Uses of PREMIER COREX for Consultancy include:

- Data-mining of the information within an operator on a well or field (such as core analysis data, drilling and completion information, end-of-well reports, well test data, well histories, laboratory test results) with the aim of making comments on possible damaging mechanisms that may be present in past or future wells. This exercise is often used when building models such as Computational Fluid Dynamics.

- Data-mining (as above) to "calibrate" well test results. This approach has been taken by several operators to aid in the bidding process for blocks that have been tested and relinquished by other operators in the past. The existing data was reviewed with the aim of determining whether there was the possibility of damaging mechanisms which were overlooked by the previous operator. In the cases where the well may have been "badly drilled" rather than being a "bad reservoir", Formation Damage was performed whenever core (or suitable analogue core) was available: the tests replicated the history of the wells in question, identifying damaging mechanisms through test results and geological interpretation. This method was used to identify several prospects for development; additional testing was performed to select the appropriate drilling and completion operations, and the fields are currently producing.

- Review of drilling, completion, well test reports etc. to identify potential damaging mechanisms and the possibility for a remedial treatment. These types of "paper studies" are often performed when wells have not performed as expected. Data is reviewed and compared to similar rock types in the PREMIER COREX database, with an indication of what types of treatment have been successful in the past. This type of study often feeds into a laboratory testing program to evaluate remedial treatment options.

- Review and interpretation of testing performed by an external laboratory. This has included commercial laboratories, operator laboratories, and research centres or national/government laboratories.

## FORMATION DAMAGE TRAINING

PREMIER COREX offer a range of training courses in Formation Damage, which can be customised to fit a client's requirements.

### PREMIER COREX Training Courses typically last from half a day to four days, and can cover topics such as:

- Introduction to Formation Damage
- Financial Impact of Formation Damage
- Geological Influences on Formation Damage
- Formation Damage Causes and Mechanisms
- Laboratory Evaluation of Formation Damage
- Microbial Formation Damage
- Sand Production and Control
- Scale Testing

These courses are commonly used to help provide clients with the background needed to help with project management of formation damage testing, or to give practical laboratory experience. Hands-on laboratory training courses commonly last from 1 week to 1 year.

## KEY TECHNICAL PUBLICATIONS

- ***"A Laboratory Drilling Mud Overbalance Formation Damage Study Utilising Cryogenic SEM Techniques"***
  M Byrne, I Patey, I Spark, A Twynam, BP. Presented at the 2000 SPE International Symposium on Formation Damage held in Lafayette, Louisiana, Feb 2000.

- ***"Visualisation of Drilling - Induced Formation Damage Mechanisms using Reservoir Conditions Core Flood Testing"***
  I Patey, I Spark, P A Francis, Shell (UK) Ltd. Presented at the European Formation Damage Conference held in The Hague, Netherlands, May 95.

- ***"Development of Methods to Minimise Microbial Formation Damage of Hydrocarbon Reservoirs"***
  I Patey, I Spark, C McGovern-Traa, Prof. A Hamilton.

- ***"A Comparison of Underbalanced and Overbalanced Drilling-Induced Formation Damage Using Reservoir Conditions Core Flood Testing"*** I Patey, I Spark, P A Francis.

- ***"Sulphate Reducing Bacteria in Live Reservoir Core and Drilling Muds"*** I Patey, I Spark, J Leu, C McGovern-Traa, Prof A Hamilton.

- ***"The effects of indigenous and introduced microbes on deeply buried hydrocarbon reservoirs, North Sea"***
  I Patey, B Duncan, I Spark, W Hamilton, C Devine & C McGovernTraa.

- ***"The Presence of Sulphate-Reducing Bacteria in Live Drilling Muds, Core Materials and Reservoir Formation Brine from New Oilfields"*** I Patey, I Spark, C McGovern-Traa, J Leu, W Hamilton.

- ***"Core Preservation Container - An Alternative Solution"*** C K Cornwall.

- ***"High Resolution Probe Permeability - An Aid to Reservoir Conditions Description"***. G M Robertson, C A McPhee.

- ***"Recommended Practice For Probe Permeametry - Marine & Petroleum Geology"*** G M Robertson, W J Sutherland.

- ***"Mixed Carbonate-Siliciclastic Deposits in a Storm - Influenced Tidal Environment: Facies Control on Reservoir Quality in the Lower quality in the Lower Bahariya Formation (Cenomanian), Khepri -Sethos Fields, Western Desert, Egypt"*** J Melvin, M A Hegazy.

- ***"Innovative Formation Damage Sample Evaluation Techniques"*** M Byrne, I Patey, I Spark, N Fleming.

- ***"Variations in Reservoir Microbial Populations using Temperature as a First Step Field Model"***
  M Byrne, S Anthony, G Robertson, I Spark.

**Premier Oilfield Group operate out of global laboratories based in Houston, Oklahoma City, Denver, Midland, Aberdeen, Cairo, Basrah, Kuwait, Abu Dhabi, and Delhi (Noida).**

**Please contact us for more information regarding COREX and Premier Oilfield Group international operations, capabilities and service portfolios.**

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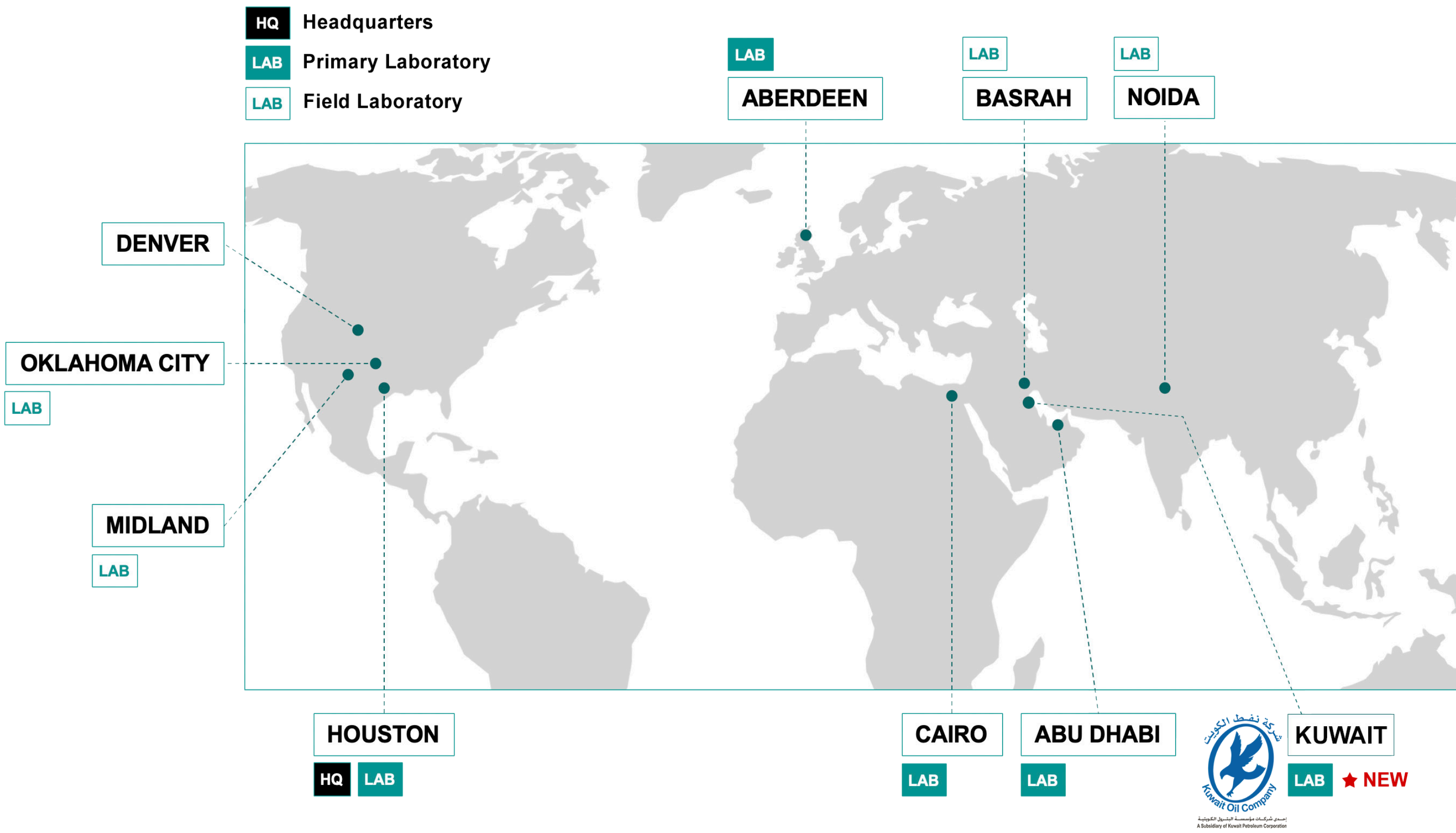


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