

Production Chemistry & Microbiology
Materials Consultancy & Testing
Corrosion Management & Monitoring

Intertek

Valued Quality. Delivered.

Production & Integrity Assurance



A strong commitment to meeting our clients' needs and expectations is at the core of our Production & Integrity Assurance business.

We have a long standing reputation for providing high quality, independent services to our clients. Our dedicated, highly qualified staff set the bar high for customer care, trust, expertise and responsiveness.

Intertek's global reach enables us to offer you an unrivalled service, wherever you are.

01 Expertise, Experience, Excellence

- 02 Our extended team
- 03 Industries we serve
- 04 Production Chemistry & Microbiology
- 06 Corrosion & Materials Testing
- 08 Consultancy
- 10 Instrumentation & Monitoring
- 12 Services & Sector Index
- 14 Our locations

Expertise, Experience, Excellence

Intertek Production & Integrity Assurance is a world-renowned provider of consultancy and specialised testing services related to production chemistry, materials performance and corrosion management. We form an integral part of Intertek's global Asset Integrity Management services.

Our heritage is from Capcis Ltd and Commercial Microbiology Ltd; two companies acquired by Intertek for their high-end consultancy capability and international reputations. We are part of Intertek's Exploration & Production Services business line.

Key to the services we offer is our fundamental understanding of the interactions between corrosive environments and materials in a wide range of operating environments. Our expertise covering chemistry & microbiology, metallurgy & materials science, electrochemistry & corrosion control coupled with strong mechanical, petrochemical and civil engineering knowledge enables us to deliver a unique blend of services across a range of industries.

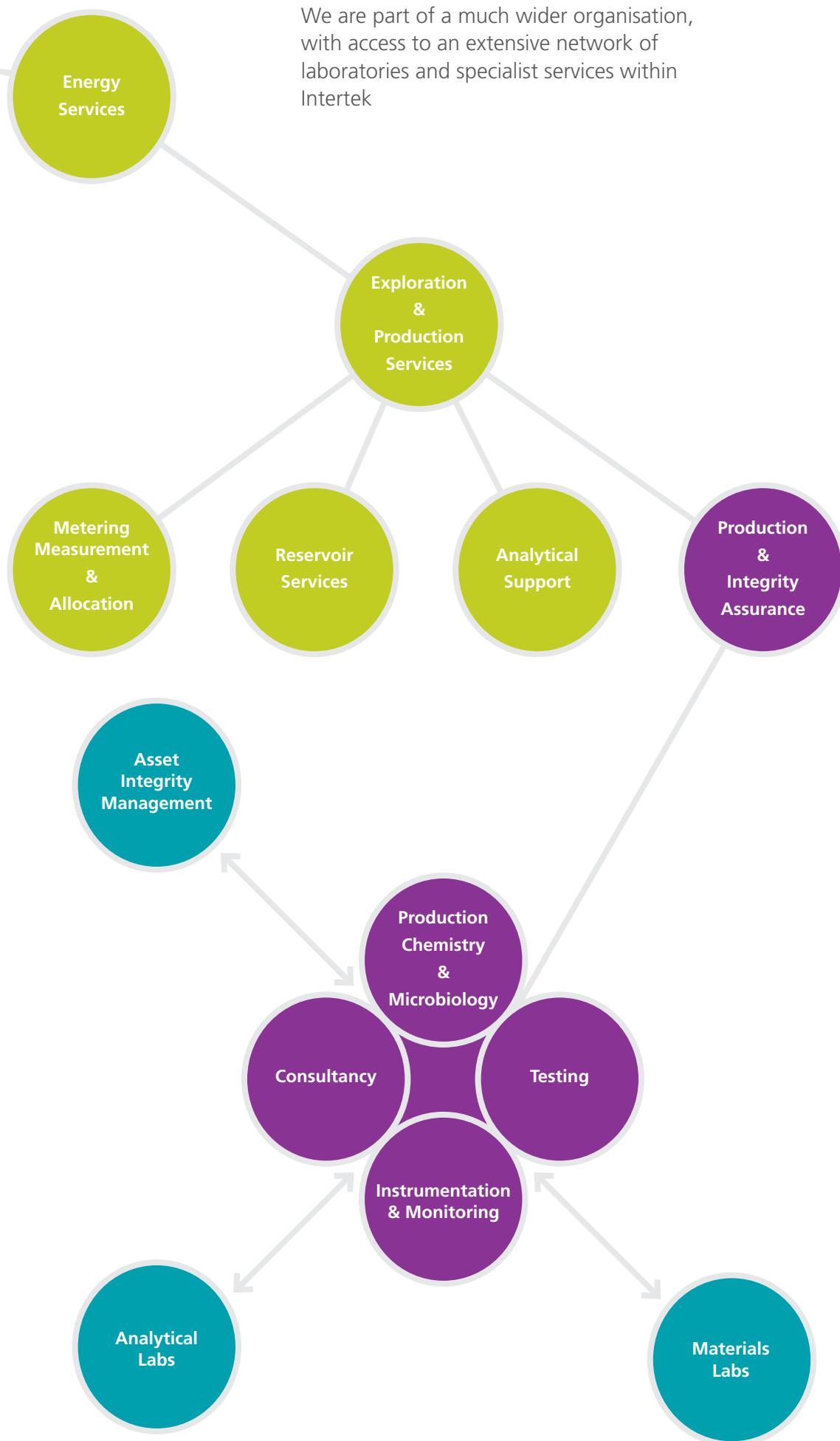
Accurate fluid and materials chemistry data is fundamental to much of our work, which gives us a strong interaction with Intertek's broader global network of analytical laboratories.

Intertek's global reach and local presence in more than 100 countries means that we can deliver effective, innovative solutions to our worldwide client base. We support these through our dedicated specialist Production & Integrity Assurance facilities in Manchester, Aberdeen, Oxford, Dubai, Fujairah, Houston, Tripoli and Kuala Lumpur.

World renowned
provider of
consultancy and
specialised testing
services

Our extended team

We are part of a much wider organisation, with access to an extensive network of laboratories and specialist services within Intertek



Industries we serve

Oil & Gas

We have an outstanding, worldwide reputation for the provision of independent consultancy and testing services relating to materials performance, production chemistry and corrosion management.

Our clients include major international operators, state oil companies, independents, contractors, manufacturing companies, materials and chemical suppliers. At any one time we are typically working on over 250 projects in the industry.

As part of Intertek's Exploration & Production Services business unit, our capabilities extend across the upstream value chain to cover analytical services, metering & allocation, and reservoir services.

Legal & Insurance

Our experts have an unrivalled ability to provide you with a complete managed service, in support of the technical aspects of legal and insurance cases.

We have a strong track record acting as expert witnesses, and managing a wide range of independent programmes of investigations for our clients. Our findings and opinions are always presented in a clear and concise way, which can be relied upon in court. We are happy to manage cases over long periods of time if necessary.

Infrastructure

We support the construction, transportation and utility industries with a mix of consultancy, laboratory and site services. We offer guidance on maintenance of engineering materials, throughout their life-cycle. From large capital projects to individual assets, we have specific services to address key issues; including materials durability, asset life extension, asset degradation, corrosion protection, stray current protection and structural health monitoring.

Our teams apply these services to a mix of new build and existing assets, and work across many regulator, client, contractor and stakeholder interfaces, to ensure successful implementation. We work closely with your teams to translate materials expertise into workable operating policies and procedures.

Serving a
wide range of
industries



Production Chemistry & Microbiology

The context of a changing market

The development of ever more demanding oil reserves can mean having to deal with higher temperatures and pressures, more complex fluid chemistries, and increased levels of CO₂ and H₂S. Consequently, operators increasingly rely on high level production chemistry expertise to gain a greater understanding and improved management of these issues. Their aim, ultimately, is to avoid costly shut-downs and workovers.

The quality we bring

We have over 30 years experience in providing production chemistry consultancy and testing services to the oil and gas industry. We have grown considerably and have an established team of highly qualified and experienced personnel who have core competencies in microbiology, corrosion, scale management, coreflood studies, wax control, chemical selection and treatment optimisation, gas hydrate control, and a wide range of modelling capabilities.

Microbiology

Microbiological control has an important role to play in oil and gas industries. Bacteria can cause problems such as corrosion, generation of toxic gas, product contamination and reservoir souring. Conversely, bacteria can also make a positive contribution, eg. microbially enhanced oil recovery (MEOR), treatment of offshore facilities prior to abandonment, and the bioremediation of oily drill cuttings.

Our experts specialise in the identification and mitigation of reservoir souring and microbiologically influenced corrosion – the potential results of microbial growth in oil and gas production systems in locations around the world. Our research and development team develop and evaluate new monitoring tools and control strategies, which can improve productivity. We are at the forefront of applying the latest molecular analysis technologies and in addition, we manufacture and supply test kits for bacterial monitoring in a wide range of applications.

Health and Hygiene

Our health and hygiene department carries out legionella risk assessments, as laid out by the UK Health and Safety Executive's code of practice. We can implement our web based legionella management system, to ensure clients are fulfilling their legal obligations. Potable water and fuel sampling/analysis are carried out by our laboratory personnel, and we also run training courses in legionella awareness for responsible people, managers, medics, health and safety personnel and engineers. We provide courses for hospitality and local authorities, as well as offshore oil and gas facilities.

Reservoir Souring

As reservoirs age, they become susceptible to reservoir souring. This occurs as a result of the downhole activity of a specialised group of micro-organisms - sulfate reducing bacteria (SRB). Some petroleum reservoirs exhibit much more favourable conditions than others for the growth of SRB, making them more susceptible to souring. We have developed a reservoir souring model, which can be used as a predictive tool for future souring patterns. Our model simulates:

- Microbial generation of H₂S
- Transport and scavenging of microbiologically generated H₂S in the reservoir
- Partitioning of the H₂S between various fluid phases

We are at the forefront of the evaluation and optimisation of souring control measures, such as nitrate treatment. In addition, we provide advice on the consequences of souring, with respect to materials degradation.

Maximise
Production



Operators increasingly need high level Production Chemistry expertise in order to avoid costly shut-downs and workovers

Hydrotesting

Pipelines and plant under hydrotest and wet lay-up, are at risk of corrosion, due to either dissolved oxygen or anaerobic pitting corrosion mediated by sulfate-reducing bacteria (SRB). These problems are often compounded by complex biofilms and the chemical treatments used to control them. There is increasing pressure from regulatory authorities to justify and minimise the use of toxic chemical discharges arising from this.

We have a strong track record with chemical treatment packages for pipeline hydrotest/storage waters; specifying, laboratory screening, on-site QA. We are able to offer a comprehensive range of services in relation to both corrosion protection and environmental issues.

Scale Management

Scale deposition, and its potential impact on oil and gas infrastructure, is not a new phenomenon, but it has growing implications for the industry. There is increased use of water injection for pressure maintenance, often combining seawater, aquifer waters, or recovered produced water. The risks of scale formation, injectivity, or production loss are increasing. Our services include field audits and troubleshooting, scale modelling, and laboratory evaluation of scale inhibitors.

We can manage oil field scaling issues on behalf of operators, who may not always have the expertise in-house. The level of support can vary between the basics such as the regular monitoring of oil field water chemistries, to the design and implementation of a scale management database. Reservoir conditioned core flooding simulation may be carried out in order to evaluate return performance of scale inhibitors. Static adsorption tests may be conducted under ambient and simulated downhole conditions, to obtain comparative adsorption data for the chosen inhibitors. Calculations may be undertaken, using a 3D-Model, to determine a variety of other criteria.

H₂S Scavengers

The use of H₂S scavengers in the petroleum production industry has been growing rapidly as fields age and sour. They are used for removing H₂S in cases where amine treating is not economically feasible. Heightened concerns about safety, and environmental impact of traditional scavenging technologies, have prompted the introduction of new H₂S scavenger chemistries, generating a need for guidance on their application and performance.

We can provide and manage a range of scavenger services, and offer comprehensive advice. We possess extensive experience of H₂S scavenger behaviour in all fluid phases (liquid hydrocarbon, water and gas). Atmospheric pressure test rigs are used to test at lower partial pressures of H₂S, while our autoclave facilities permit flexible testing of H₂S scavengers, at a wide range of pressures and temperatures, and in different fluid phases. The kinetics of H₂S removal under specific process conditions can also be effectively studied for different products.



Bacteria can cause problems such as corrosion, generation of toxic gas, product contamination and reservoir souring

Minimise
risks to
personnel

Materials testing

The evaluation of corrosion and materials degradation under simulated service conditions has been a core part of our business for over 30 years

Corrosion & Materials Testing

The context of a changing market

Advancements in technology in many industries, coupled with challenging operating conditions, means that greater demands are placed on materials, such as higher temperatures and pressures. To maximise asset life, and to get the most out of capital investments, it is essential to make sure that the right materials are selected.

The quality we bring

The evaluation of corrosion and materials degradation under simulated service conditions has been a core part of our business for over 30 years. We are at the forefront of developing test methods for a wide range of applications such as corrosion inhibition, corrosion fatigue of flexible pipes and sour service materials evaluation.

Whether simulating high pressure/temperature conditions, dynamic loading, or high flow rate systems, our laboratories can handle virtually any scenario.

Over recent years we have invested to support materials testing in applications such as carbon capture and storage, enhanced oil recovery (EOR) and nuclear power generation. This involves testing with 'dense phase' CO₂ as a supercritical

fluid. This has generated significant interest in material performance in such environments. We have therefore developed systems that enable us to simulate these conditions.

We have extensive sour gas handling capabilities, including a state-of-the-art oxidation unit for scrubbing sour test gases. We have developed specialised techniques, which allow extreme acid gas partial pressures to be replicated.

Environmentally Assisted Cracking

We study all aspects of environmentally assisted cracking and we routinely conduct sulphide stress corrosion and hydrogen induced cracking tests in accordance with standards such as EFC 16 & 17, NACE TM0177-2005 and TM0284-2003. Slow strain rate testing equipment (including autoclave SSRT) is also available.

Corrosion Fatigue

We have been operating a corrosion fatigue testing facility for many years, with a particular emphasis placed on the testing of high strength wires used in offshore flexible pipelines.

Our test rigs are used in conjunction with pressure vessels to enable the replication of pressurised

To maximise asset life, and to get the most out of capital investments, it is essential to select the right construction materials

Reliable advice

aqueous environments. The equipment can, however, be modified to allow testing in any type of liquid environment. Test and equipment design is carried out in collaboration with clients, in order to develop tests which accurately replicate the service conditions, and the test parameters required.

Corrosion Inhibition

We have a long-standing international reputation for fundamental studies relating to corrosion inhibition, test method development, and chemical selection. Expansion of our laboratory capability within the Intertek network enables us to provide these high level services locally in the UAE, USA and Malaysia, in addition to our centre of excellence in Manchester UK.

Testing of Non Metallic Materials

Our capability includes materials and chemical compatibility testing. Performance evaluation and life time prediction and has been undertaken for umbilical hoses, flexible pipe, seals, linings and coatings, and items for downhole service; including linings for tubes.

Chemical ageing and compatibility with oilfield treatment chemicals, and compatibility and ageing

in produced fluids (including sour service), are undertaken at standard laboratory conditions (ambient pressure) and at high pressures and temperatures, in our autoclave facility.

Explosive decompression/blistering resistance testing is undertaken for seals, subsea connectors, flexible pipe linings (PE, PVDF) and hoses. This is done in our high pressure autoclave vessels, which are rated up to 1240 bar. Repeatable cyclic decompression tests at controlled rates up to 70 bar/minute are carried out, for testing to API 17J and other procedures. A rig for gas permeation testing of polymers by differential pressure methods is also available.

We also have capabilities and expertise for coatings testing, including pipeline coatings.

Advanced Materials Characterisation

In addition to our own extensive materials capabilities, we can manage a wide range of advanced studies, carried out at other Intertek laboratories. We have direct access to further state of the art equipment (including ESEM, TEM, XRD, XPS, SIMS, FTIR techniques), in the EU and across the world.



Consultancy

The context of a changing market

Globally, many high value assets (pipelines, production plant, rail networks, oil and gas facilities etc) are approaching, or have gone considerably beyond, the end of their design life. With many new developments being built in more challenging conditions, the review, assessment, selection and management of materials is more critical than ever. Materials failures have both a safety and financial consequence (from loss of earnings, as well as damaging an organisation's reputation). There is also an optimisation aspect to be considered when it comes to managing asset degradation, with potential savings in maintenance budgets.

Materials consultancy plays a very important role; from the design stage, through operation, to extension of asset life. The management of materials degradation usually takes one of two routes. Basic materials may be used, such as carbon steels, and unmodified concretes, however these need regular inspection and monitoring. Alternatively degradation resistant materials such as CRAs, polymers, and modified concretes may be used, which often require less ongoing management. Both options can have their issues, and may require re-assessment as operating conditions change; however, all assets can benefit from appropriate materials management practices.

The quality we bring

We have an established team of highly qualified engineers who have vast experience and core competencies in corrosion fundamentals, corrosion management, materials selection, sour service, corrosion resistant alloys, cathodic protection, stray current, nonmetallic materials, corrosion monitoring and failure investigation.

Our team of senior and principal engineers and senior consultants are all specialists in their fields. They have a key role to play in our work for clients in more than 20 countries around the world, providing desk-top consultancy, on-site survey work and training.

Materials Selection

Our detailed first principles understanding of corrosion chemistry and materials degradation issues gives us a unique focus and ability when it comes to ensuring the correct materials selection. We get involved at several stages – ideally at the initial design stage, but also post design to ensure the correct materials have been chosen, and if not, what can or should be done about it.

We have broad expertise in internal process environments, and we cover their impact on carbon steels, as well as 'corrosion resistant alloys', nonmetallic materials and concretes. Similarly, we have broad expertise in relation to external environments, and how these can affect degradation. We take into account environmental circumstances for each project, for example systems may be buried and protected by coatings, exposed to the atmosphere or under insulation. They may have cathodic protection already applied or require new protection schemes to be installed.

When conditions are sufficiently unusual, theoretical assessment and specification may not be possible. Then, we also have the ability to conduct selection by appropriate testing, as covered on page 6.

Corrosion Management

We were instrumental in the development of oil and gas corrosion management practice in the UK. We were the main authors of the original UK HSE corrosion management guidance document, on management strategies and systems for clients; this practice has since been adopted across several global regions. We also conduct corrosion management audits of existing systems.

Our approach to pipeline corrosion risk assessment is based upon statistical uncertainty modelling principles. This method is particularly useful where inspection is too difficult, and prioritisation across a network of pipelines is required.

In addition to conducting corrosion risk assessments, we cover broader risk based assessment/inspection and fitness for service assessment. We work with other specialist units within Intertek where necessary, who have wider asset integrity management capability. Additionally, we provide ongoing O&M support to back-up the corrosion management solutions, with support to on-site and remote condition monitoring needs

Failure Investigation

When something goes wrong it is important to understand why, in order to avoid the same problems occurring in the future. We have a specialist team to manage and investigate failures. We cover all manner of component, material and analysis exercises, making use of other Intertek units when necessary to provide a truly managed service.

Our expertise and experience extends to failure investigations and causation studies, often relating to legal and insurance matters. We support clients from initial site assessment through to expert witness court appearances.

Our specialist expertise assists in determining the root cause, as well as the failure mechanism of an incident, whether it is an engineering and/or management solution.

Extending design life

Materials consultancy plays a very important role from the design stage, through operation to extension of asset life

When something goes wrong it is important to understand why in order to avoid the same problems in the future

Managing corrosion



Instrumentation & Monitoring

The context of a changing market

Deterioration of transport infrastructure, such as road bridges, is of growing concern, and has come under particular scrutiny in recent years. Reinforced concrete structures can be highly durable and long-lasting; however, they can suffer from premature degradation due to a variety of environmental conditions. Corrosion can affect the steel reinforcement bars, causing early failure of structures. Asset engineers need to know about potential problems before they occur, so that remedial works may be carried out.

The quality we bring

We have a dedicated team of engineers based near Oxford who design and build a wide range of instruments for corrosion monitoring, to suit a variety of needs and applications.

Corrosion monitoring in concrete

A range of sensors and systems to monitor the corrosion rate and condition of reinforced concrete structures such as bridges, tunnels, dams, and buildings.

Corrosion monitoring in water systems

Specialist solutions to monitor corrosion in water systems which measures a range of parameters to help you optimise treatment regimes and better manage your assets.

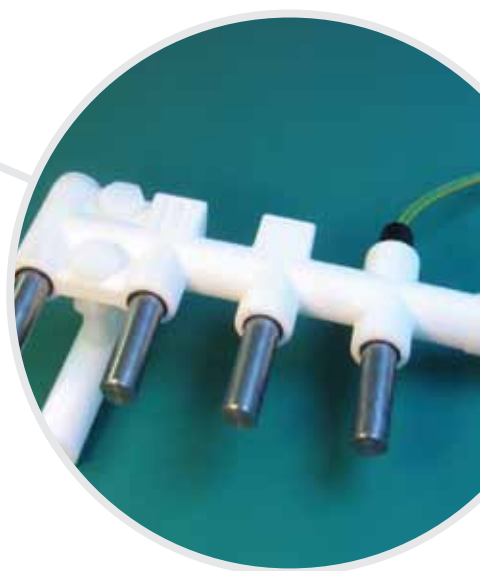
Oilfield instrumentation

We design and manufacture several high quality instruments supporting oil extraction:

- Precision resistivity meter for mud logging
- Potential monitor for safe well perforation
- Backup depth odometer for accurate well depth measurement

Protecting
your
Assets

Engineers need to know
about potential problems
before they occur, so that
remedial works may be
carried out



A complete service to you

The services that we provide meet the needs of all kinds of organisations working in the widest range of fields, markets and geographies. Whatever safety or quality issues you face, we have the flexibility and the experience to deliver the right solutions for your business.

A list of the services we offer and the sectors that we serve within each industry area, as well as our cross-industry services, can be found below.

The broad categories that cover these individual services are explained in detail on pages 04-11.

In summary, we offer:

- **Testing** services to help you protect your reputation
- **Investigation services** to help you know the facts
- **Consultancy services** to help you manage your assets
- **Auditing services** to help you control operations
- **Advisory services** to help you advance your business
- **Training services** to help you improve your performance

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Intertek is prepared to partner with you from the early material selection and design stage, through to asset management, and investigating failures



Oil & Gas

Annual Integrity Reviews
Asset Integrity Management
Bacteria Testing
Batch Inhibitor Treatments
Biocide Tests
Cathodic Protection
Chemical Compatibility Testing
Chemical Management Audits
Chemical Selection and Optimisation
Coatings Consultancy
Coatings Testing
Compositional Analysis
Coreflooding
Corrosion Control Schemes
Corrosion Fatigue Testing
Corrosion Management Audits
Corrosion Management Systems
Corrosion Monitoring
Corrosion Monitoring Equipment Supply
Corrosion Rate Modelling
Corrosion Risk Assessments
Cracking Tests
Crude/Brine Emulsion Analysis
Decompression Tests
Electrochemical Evaluation
Failure Investigation
Field Audits
Fitness for Service Assessments
Gap Analysis
H₂S Partitioning Modelling
H₂S Scavenger testing
Hydrodynamic Assessment
Hydrogen Induced Cracking
Hydrotesting Consultancy & Chemical Evaluation
Impressed Current
Inhibitor Tests
Inspection Planning
KPI Tracking
Material Performance Tests
Material Selection
Microbiological Survey
Microbiology Media Kits
Nonmetallic Materials Testing
Pipeline Condition Modelling
Planktonic Testing
Potable Water Testing
Predictive Condition Assessment Modelling

Production Chemistry
Reservoir Souring Studies
Scale Inhibitor Testing
Scale Predictions
Sessile Biocide Testing
Site Audits
Site Corrosivity Studies
Slow Strain Rate Testing
Sulphide Stress Corrosion Tests
Supercritical CO₂ Testing
Thermal Stability Tests
Training
Water Handling
Wax Deposition Modelling
Wax Inhibitor Testing
Weld Corrosion

Legal & Insurance

Causation Studies
Design Appraisal
Environmental/Product Contamination
Expert Testimony
Failure Investigation
Material Selection Review
Risk Assessments
Technical Audits
Water Treatment

Infrastructure

Asset Degradation
Asset Management
Cathodic Protection
Concrete Degradation
Concrete Probes
Corrosion Control Design
Corrosion Monitoring
Degradation Modelling
Design Assessment
Electrochemistry
Inspection Strategies
Material Selection
Railway Corrosion
Refurbishment Strategy
Stray Current Stakeholder Management
Water Treatment

Our time-tested service, wealth of experience, and depth of knowledge allow us to offer dedicated solutions to help you design, manage, and extend the life of your assets.



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