

## Development of a world class Asset Integrity Management system



For organisations that operate power plants, refineries, chemical plants, utilities/ civil infrastructure and manufacturing sites, maintaining and protecting the operational integrity of their facilities and equipment is a high priority in delivering their product to consumers and clients.

Intertek's objective is to provide a comprehensive programme for the effective management of your corporate assets in order to gain maximum value while safeguarding personnel, the community and environment.



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# The development of a world class Asset Integrity Management (AIM) programme

The definition and urgency of AIM is typically determined by the time to failure and the potential impact of a loss of integrity. These factors vary across industry sectors as they are dependant on the design, materials, degradation, the environment in which the materials are exposed and the risks of operation. An understanding of these issues enables an AIM strategy to be developed and implemented that is tailored to the Oil and Gas industry, the Nuclear and Fossil Power Generation industry, Production and Process Industries, the Renewable Energy sector, Manufacturing Industries, Utilities (Water) and civil infrastructure



Intertek's unique AIM programme combines the understanding of process properties with a detailed knowledge of materials and equipment.

## What is the cost of failure?

Failure to implement an effective AIM system can result in numerous challenges and risks for not only commercial profitability, but also personnel, public, and environmental safety. Production losses, work stoppage and plant outages impact the bottom line as do fines and legal fees that could run into millions of dollars. Death, injury, and local community threats as well as negative environmental impact are costly and have an adverse effect on a company's approach to sustainability. All of these problems can damage your brand and corporate identity thus jeopardizing future investment.

The Intertek AIM programme is a strategic management system consisting of specialised expertise, resources, methodologies and tools to assist production and process industries to manage the integrity of their infrastructure, facilities and equipment.

## Benefits of AIM activities

- Maximise equipment reliability, availability, and maintainability
- Better the understanding of asset condition, aid maintenance planning, and optimise inspection costs
- Improve safety and reduce risk to personnel
- Increase efficiency of asset management which impacts the bottom line
- Enhance plant operations, performance, and increase profit
- Improve personnel safety and performance and track the proper use of equipment
- Enable facilities managers to optimise sparing and plan replacements in order to minimise disruption to production
- Ensure compliance with corporate and industry regulation and legislation
- Improve personnel know-how and expertise

Expertise in design, inspection and testing, process engineering, production chemistry, corrosion and material behaviour, underpinned by 30+ years of academic and industrial experience in materials and chemical performance, operations and failure investigation, defines us as leaders in the field. Intertek's knowledge of production chemistry and flow assurance issues include fluid properties, flow regime, composition and their effect on operations and process conditions as well as the degradation effect on materials, equipment and their life cycle.

## How Intertek can help

Intertek offers a comprehensive AIM suite of services that combines the understanding of processes and properties with a detailed knowledge of materials and equipment. These services can be customised according to your needs so as to provide a tailored suite of AIM activities that protect the integrity of your industrial assets.



### **Audits, Gap Analysis, and Benchmarking**

are carried out to collect data, understand the operational threats and risks, identify gaps within the current system and benchmark operations. The results of an audit, gap analysis or benchmarking will provide specific recommendations for improving a client's programme.

**Chemical Testing and Fluid Analysis** enable the process and production chemistry aspects that influence flow characteristics and material degradation to be fully understood. This optimises production and ensures corrosion mitigation measures are efficiently implemented.

**Condition Monitoring** measures degradation rates related to material durability, corrosion and mechanical wear where inspection is not practical. We offer audits, consultancy, modelling, bespoke equipment supply and site support to ensure that the most suitable corrosion monitoring devices are installed.

**Corrosion Management Strategy** includes Management Documentation (strategy, policy, philosophy, procedures) as well as the development of Data Management Tools (Software) and training to meet facility requirements and industry guidelines.

**Corrosion Maps/Loops and Management Manuals** identify which degradation phenomena (corrosion, cracking, and embrittlement mechanisms) are probable within each area of the facility and define their location degradation threats and mitigation measures to aid maintenance and inspection activities.

**Corrosion Mitigation Specification** includes chemical and materials testing /consultancy to justify material selection or define chemical injection strategies to mitigate corrosion.

**Design Review** compares the design, materials of construction and fabrication requirements (e.g., welding, post weld heat treatment [PWHT], hardness controls) of the facility equipment to industry recognised codes.



Intertek offers a comprehensive and integrated service delivered by cross divisional teams around the world.

**Fitness for Service Evaluations** levels 1, 2 and 3 are conducted according to API 579-1/ASME FFS-1, JUNE 5, 2007 (API 579 SECOND EDITION) and ASME Section XI guidelines.

**Flow Assurance** helps to prevent impaired process flow that can impact production capacity and result in reliability related failures. We provide consultancy, modelling and laboratory testing of production fluid and chemicals.

**Product Inspection and Certification:** Utilizing highly trained and certified inspectors and examiners, Intertek offers a comprehensive service solution to clients that are seeking specialised, in-depth knowledge of in-service and new equipment inspection. Services include:

- API pressure equipment inspections
- Jurisdictional boiler and pressure vessel inspections (in USA)
- Statutory inspections on pressure equipment to local requirements outside USA

**Approved Inspection Authority:** Intertek is an approved Inspection Body for boiler, pressure vessels, and piping systems in certain countries around the world for new manufacture, repairs, modifications, and other in-service activities where AIA involvement is mandated by local legislation.

Inspection plans are based on degradation, reliability and risk analysis. Specific inspection plans can be developed for each equipment item or subcomponent and enable comprehensive data collection and trending.

**Laser Scanning and 3D Modelling** deliver high resolution 360-degree images for 3D modelling of structures. Intertek's dimensional control service can be applied to a variety of projects such as existing status survey of current facilities and pipe work.

**Material Review:** It is helpful to conduct a design and materials review, on new or old facilities to ensure that correct materials have been used for the various process conditions. Materials and Corrosion Testing can be conducted in simulated oil and gas related environments, utilising high pressure / temperature or dynamic environments to assess material performance.

#### **Mechanical Integrity Programme (MIP) Services:**

Intertek provides mechanical integrity consulting and inspection support including:

- MIP audits, due diligence
- MIP training, written programmes and procedures, implementation assistance, and fitness for service and risk evaluations
- Assurance of compliance to company specifications, codes, and OSHA/EPA requirements
- Turn-key assistance in writing and implementing workable mechanical integrity inspection programmes with procedures to meet all OSHA/EPA requirements

**Microbiological Testing** in the field or the laboratory can be conducted on fluid samples to detect bacteria that may cause problems such as corrosion, generation of toxic gas, product contamination and reservoir souring. Such actions positively contribute to production e.g. microbial enhanced oil recovery (MEOR) and the bioremediation of oily drill cuttings.

**Non-destructive Testing:** On site Positive Material Identification [PMI] is carried out to ensure the construction materials are in accordance with the design intent. Other specialised non-destructive testing techniques are used to verify dimensions and conditions of assets.

#### **Process Optimisation and Operational Support**

includes fitness for Purpose Assessments, Annual Integrity Reviews, CO<sub>2</sub>, Microbial, O<sub>2</sub> Corrosion and Erosion Modelling and Predictive Condition Assessment Modelling.

#### **Reliability and Risk Based Inspection (RBI)**

identifies the potential impact of degradation and deficiencies on an operating plant, as well as ascertaining inspection methods to mitigate these deficiencies. RBI provides a systematic methodology for factoring risk into infrastructure maintenance and inspection decision making. Reliability, Availability and Maintainability [RAM] modelling calculates reliability of equipment and highlights the cause of operational downtime.

Training and support is the basis of any successful system implementation. We offer a variety of levels of service from training and simple handover to full responsibility of integrity management activities.

## Key elements of the Intertek AIM system

AIM activities must span all of an organisation's operating teams - from HR, Quality and Finance to Operations, Inspection, Engineering, IT and even partner organisations who provide other related services.

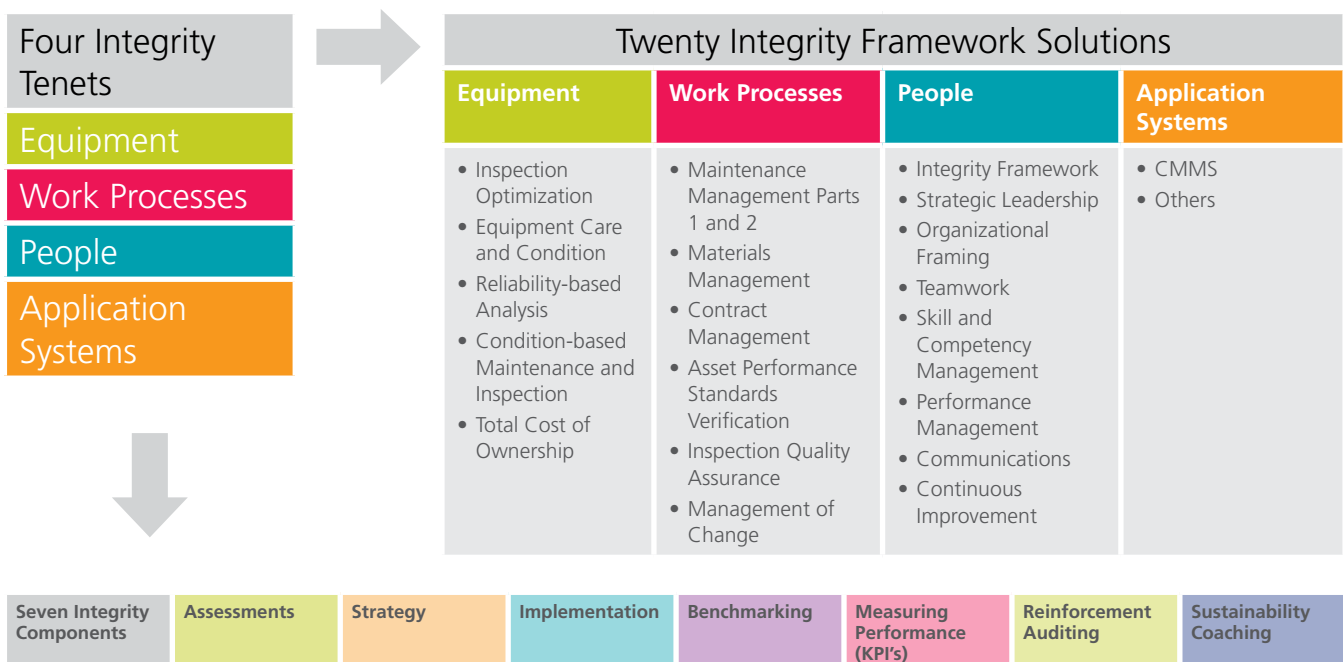
The Intertek AIM process considers the following:

- design of both site and equipment for safety, production and flow assurance
- corrosion and metallurgy
- root cause failure analysis
- risk and reliability analysis
- stress and hazard analysis
- process optimisation
- safety and mechanical integrity
- inspection and maintenance planning
- training and management solutions.



Acceptable risk is dependent on asset type, High risk assets require detailed assessment while low risk assets require periodic assessment.

Integrated management is therefore a key strategy.



### Definition of Scope, Strategy and Implementation

Stating the function, performance, condition requirements of assets, and prioritises and optimises assets based on risk and reliability. This includes all stake holders such as inspection, maintenance, engineering, HSE, QA, operations and management.

### Provision of Services

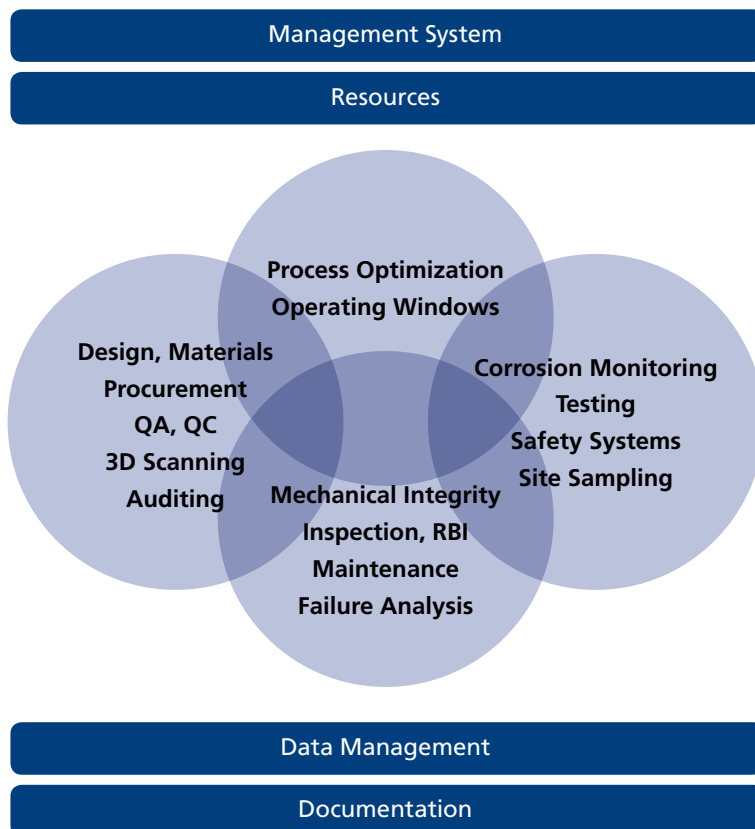
On site data gathering, in-service inspection, data review and interpretation, analysis, consultancy, turnaround inspection and maintenance.

### Provision of Data Management Tools and Documentation

Training, documentation, operational controls and software tools for the successful implementation of the system by qualified personnel following appropriate procedures, guidelines and work instructions.



Assessing material durability of infrastructure projects requires long term monitoring programmes and data analysis expertise.



## Understanding industry sectors and equipment life cycles

The AIM process begins at project conception and is active through all stages of the asset life: design, construction, commissioning, operations, refurbishments, life extension and de-commissioning phases

Asset integrity relies on many things throughout the asset life cycle: design (of both product and site), maintenance, monitoring, inspection, process, operations, usage and management concepts - since all these disciplines impact on the integrity of infrastructure and equipment. The challenge is to combine these activities together in a strategic, yet manageable and cost effective way.

Implementation of our AIM programme may include:

- Audit, Gap Analysis and Benchmarking
- Development of Management System and KPIs
- Design, Materials, Corrosion Review - Design Verification
- Data Collection and the Development of Documentation
- System, process, production chemistry, corrosion evaluation
- Identification of Safety Critical Equipment (RBI, RAM)
- Inspection, Maintenance, Testing and Monitoring, Inspection Planning
- Risk Management and Deficiency Resolution, Evergreen, QA, QC
- Integration of Key Elements, Processes and Tools (including software tools)
- Training

### Lifecycle Considerations and Integrity

Intertek AIM was developed to offer assistance in establishing integrity while offering expertise in safeguarding integrity. The combined approach of establishing and safeguarding integrity offers a total lifecycle perspective from design to decommission, as shown below.



Intertek's knowledge of production chemistry and process engineering underpins a fundamental understanding of material behaviour in oil field environments.







## Why you should work with Intertek

Intertek offers a comprehensive solution for all AIM activities, including on site data gathering, analytical service (worldwide lab network), data review (project engineers in each office) and interpretation, analysis, consultancy, and operational experience (knowledge centres).

Our service is comprehensive and integrated, with cross divisional teams around the world ready to deliver assistance wherever your site is located.

We add value to your existing investment with our real-world understanding of production chemistry and flow assurance issues including fluid properties, flow regime, composition and effect on operations and process conditions as well as the degradation effect on materials of construction, equipment and their life cycle.

Unique centres of excellence based on years of industry and academic experience complement our traditional analytical testing services and offer a greater integrated integrity management capability to new and established clients.

Our experts are guided by regulatory compliance, industry codes and standards and have implemented AIM programmes worldwide, delivering a combination of experience and perspective on government regulations and the implementation of compliance programmes.

Intertek makes full use of Data Management Tools you've already invested in to help maximise your return on investment. In the absence of your own tools, Intertek has a range of proven programmes and systems that can be applied. Tools include: Compress, CADWorx, Nozzle Pro, CodeCalc, ANSYS, AutoCad, FLI, PCMS, UltraPipe, Cassandra, ECE, Norsok, Hysis, PipeSims, Multiflash, MultiScale, Olga, Idecide, @risk, Crystal Ball, CORAM, STaPCom, RDMIP, API, Meridium, Metegrity, ACET, CREDOSoft, Amulet, Matrix, Titan, SAP and Maximo.

Intertek AIM subject-matter-experts have implemented initiatives in virtually every region of the globe.

Intertek staff are fully conversant with regulatory requirements. This includes programmes such as the UK safety case and written scheme of examinations, European Seveso II and the US OSHA PSM programmes. In addition to this Intertek's AIM programme follows generally accepted engineering codes, standards and practices. These include ISO, PAS 55, API, NACE, NFPA, ASME, Six Sigma, etc.

**Valued Quality. Delivered.**

The services that Intertek provides 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 p02-03.

In summary, we offer:

- **Testing** services to help you protect your reputation
- **Inspection services** to help you manage risk
- **Certification services** to help you reach new markets
- **Auditing services** to help you control operations
- **Outsourcing services** to help you focus on core activities
- **Advisory services** to help you advance your business
- **Training services** to help you improve your performance
- **Quality Assurance** services to help you meet expectations

## Cross industry services

Advisory Services  
Analytical Problem Solving  
Auditing Services  
Certification  
Climate Change  
Consulting Services  
Corporate Social &  
Environmental Responsibility  
Corrosion Measurement  
& Consultancy  
End of Life & Waste Compliance  
Engineering Consultancy  
Environmental Compliance  
Expert Legal Witness  
Laboratory Design & Consulting  
Laboratory Outsourcing  
Laboratory Services  
Legal & Insurance  
Life Cycle Assessment  
Management Systems Auditing  
& Certification  
Materials Analysis &  
Consultancy  
Outsourcing  
Quality Assurance  
REACH & RoHS Compliance  
Services  
Registration & Certification  
Regulatory Services  
Restricted & Controlled  
Substances  
Retail, Distribution Import  
Risk Management  
Second Party Auditing  
Supply Chain Management  
Sustainability  
Technical Staffing  
Training  
Toxicology

## Aerospace & Automotive

Airbags  
Ballistics  
Batteries Testing  
Catalyst Testing & Optimisation  
Composites Testing (NADCAP  
Certified)  
Durability  
EV Battery  
EV Component  
EV Charge Station  
Engine Emissions Testing  
Engine Services  
Fuel System Services  
Lighting  
Lubricant Services  
Marine  
Metallurgy & Materials  
Personal Protective Equipment  
Plastics Testing  
Used Oil Analysis  
Vehicles  
VOC Testing

## Building Products

Construction Products  
Door & Openings  
Fenestration  
Fire Doors  
Fire Testing  
Furniture  
Hardware  
Hearth Products  
Manufactured Wood  
Plumbing  
Roofing Products

## Chemicals

Additive Analysis  
Advanced Materials  
Air Pollution Consultancy  
Analysis & Testing  
Cargo Inspection & Testing  
Catalysts  
Chemicals Analysis  
Coatings, Inks & Adhesives  
Engineering & Consulting

Environmental, Regulatory  
& Safety  
Industrial Inspection  
Inline & PAT Services  
Pilot Plant Services  
Plastics & Polymers  
Power Handling Safety Testing  
Print & Paper Testing  
Registration & Notification  
Speciality Chemicals  
Waste Water Treatment  
Consultancy  
Water Services  
UN Transportation Testing

## Consumer Goods & Retailers

Accessories  
Apparel  
Chemicals  
Cosmetics  
Deformation and Product  
Analysis  
Electronic & Electrical Products  
Food & Beverage  
Footwear  
Furnishings & Furniture  
Gifts & Premiums  
Hardlines  
Healthcare & Beauty  
Home & Personal Care  
Home Appliances  
Juvenile Products  
Leather goods & Luggage  
Packaging & Packaging  
Materials  
Product & Packaging Testing  
& Certification  
Product, Process & System  
Inspection  
Product Safety Training  
Quality Management &  
Outsourcing  
Soft Home Furnishings  
Textiles  
Toys & Games

## Electrical & Electronic

Commercial Kitchen Ventilation  
Components  
Energy Storage  
Food Equipment  
Hazardous Locations  
Home Appliances  
HVAC  
Industrial Machinery  
Life Safety  
Luminaires & Lighting  
Multimedia & AV  
Pool & Spa  
Power Tools  
Renewables  
Semiconductor  
Toys & Gaming  
Wire & Cable

## Energy

Biofuels & Alternative Fuels  
Cargo Inspection & Testing  
Coal & Pet-Coke  
Distribution & Retail  
Engineering & Consulting  
Environmental & Safety  
Exploration & Production  
Flow Assurance  
Industrial Inspection  
Integrity Management  
Loss Control  
Materials Consultancy & Testing  
Metrology  
Microbiology Consultancy  
Nuclear  
Oil & Gas  
Power Systems  
Petroleum  
Photovoltaic & Solar  
Pilot Plant Services  
Production Assurance  
Production Chemistry  
Refining  
Renewable Energy  
Wind

# Intertek - the mark of quality

For more than a 100 years, Intertek has guided clients through the challenging certification process. Offering the broadest range of certification and accreditation marks accepted in markets around the world, Intertek can help clients to succeed in new and existing markets, meet evolving regulatory requirements and win new customers.



## Food & Agriculture

Cargo Inspection & Certification  
Chemicals  
Claim Substantiation  
Customs & Excise Support  
Environmental Standards  
Exposure Assessments  
Feed Additive & Approval  
Food Contact Migration Testing  
Food Packaging Testing  
Food Testing  
Health Claims  
Label Verification  
New Food Ingredient Safety  
Assessment & Regulatory  
Support  
Product & Process Inspections  
Product Contamination & Safety  
Quality & Safety Compliance  
Assessments  
Quantity Determination  
Study Monitoring  
Traceability  
Transport, Distribution  
& Handling

## Government and Trade Services

Government Institutions  
Cargo Scanning  
Certification of Origin  
for Exports  
Certificate of Quality for Exports  
Destination Inspection of  
Imports  
Pre-shipment Inspection  
for Exports  
Product Conformity Programme  
for Exports  
Supply Chain Security Services  
Verification Services for  
Container, Production, Exporter/  
Importer & Donor Organisation

## Industrial

3D Laser Scanning  
3D Modelling  
Asset Integrity Management  
Capability Assessment  
Civil & Construction  
Condition Assessment  
Dimensional Control  
Education & Training  
Engineering, Procurement  
& Construction  
Failure Analysis & Forensic  
Investigation  
Industrial Manufacturing  
Infrastructure  
Maintenance In-Service  
Inspection  
Non-Destructive Evaluations  
Oil & Gas Technical Training  
Operational Performance  
Improvement & QHSE Training  
& Consulting  
Photogrammetry  
Risk-based Inspection  
Topographic Survey  
Vendor Assessment  
Vendor Inspection & Expediting

## IT & Telecom

Central Office Equipment  
Outside Plant Equipment  
Mobile  
Radio  
Software  
Wired Equipment  
Wireless Equipment

## Medical & Pharmaceutical

Accelerated Stress Testing (AST)  
Accredited Persons (AP)  
Inspection Programme  
Bioanalysis  
CE Marking  
cGMP Biopharmaceutical  
Analysis  
cGMP Pharmaceutical Analysis  
Electrical Safety Testing

Electromagnetic Compatibility  
(EMC) Testing  
Environmental Compliance  
Services  
Environment Qualification  
Extractable Leachables Testing  
FDA 510(k) Third Party Reviews  
GLP Chemical, Pharmaceutical  
& Immunochemistry  
Investigation  
Immunochemistry  
In-Vitro Diagnostic Directive  
Kinetics™ (Integrated  
Clinical Bioequivalence & PK  
Programme)  
Mechanical Testing of Medical  
Devices  
Medical Device Directive  
Metals & Inorganic Bioanalysis  
Microbiology of Medical Devices  
to GMP  
On-site Manufacturing Support  
& In-Service Failure Investigation  
Performance & Benchmarking  
Testing  
Pharmaceutical Auditing  
& Compliance  
Pharmaceutical Process Safety  
Testing  
Process Qualification  
Documents & Tests  
Star of Life Ambulance  
Certification  
Toxicology & Exposure Risk  
Assessment  
Validation Services

## Minerals

Mineral Sample Preparation  
Precious Metals Analysis  
Exploration Geochemistry  
Minerals Environmental Services  
Ore Grade Analysis  
Mine-Site Laboratories  
Coal Inspection & Testing  
Minerals Cargo Inspection  
Robotics & Automated Minerals  
Laboratory Systems

## Textiles, Apparel & Footwear

Accessories  
Apparel  
Care Labelling  
Chemicals  
Footwear  
Leather goods & Luggage  
Product & Packaging Testing  
Product, Process & System  
Inspection  
Soft Home Furnishings  
Textiles

## Toys, Games & Hardlines

Accessories  
Chemicals  
Electronic & Electrical Products  
Furnishings & Furniture  
Gifts & Premiums  
Hardlines  
Home Appliances  
Juvenile Products  
Packaging & Packaging  
Materials  
Premiums Testing  
Product & Packaging Testing  
Product, Process & System  
Inspection  
Toys & Games



Valued Quality. Delivered.



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