Asset Integrity Management

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.
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.

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

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

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.
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.
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, CO2, Microbial, O2 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.
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.

Integrated management is therefore a key strategy.

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

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### Key elements of the Intertek AIM system

#### Four Integrity Tenets

- **Equipment**
- **Work Processes**
- **People**
- **Application Systems**

#### Twenty Integrity Framework Solutions

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<tr>
<th>Equipment</th>
<th>Work Processes</th>
<th>People</th>
<th>Application Systems</th>
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<tr>
<td>- Inspection Optimization&lt;br&gt;- Equipment Care and Condition&lt;br&gt;- Reliability-based Analysis&lt;br&gt;- Condition-based Maintenance and Inspection&lt;br&gt;- Total Cost of Ownership</td>
<td>- Maintenance Management Parts 1 and 2&lt;br&gt;- Materials Management&lt;br&gt;- Contract Management&lt;br&gt;- Asset Performance Standards Verification&lt;br&gt;- Inspection Quality Assurance&lt;br&gt;- Management of Change</td>
<td>- Integrity Framework&lt;br&gt;- Strategic Leadership&lt;br&gt;- Organizational Framing&lt;br&gt;- Teamwork&lt;br&gt;- Skill and Competency Management&lt;br&gt;- Performance Management&lt;br&gt;- Communications&lt;br&gt;- Continuous Improvement</td>
<td>- CMMS&lt;br&gt;- Others</td>
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### Seven Integrity Components

- Assessments
- Strategy
- Implementation
- Benchmarking
- Measuring Performance (KPI's)
- Reinforcement Auditing
- Sustainability Coaching
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.
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
- Testing
- 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
- Specialty 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
For more than 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
- 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 & QMSE Training & Consulting
- Photogrametry
- 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 & Immunohemistry Investigation
- Immunohemistry
- 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

**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

**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