



ENGINEERED FOR THE JOURNEY

DEAR READER

The Energy industry is currently adapting to new realities such as extremely low oil prices due to oversupply and fierce competition from unconventional production. What is more, exploration is getting trickier and more hazardous.

Quads Asset Integrity Team (AIM) team is engineered to support your team’s reliability and asset integrity initiatives. We provide support to ensure you realize your plant efficiency and productivity goals while creating trust and developing your team’s technical capacity. Our operation-centric approach makes us different. Our core drive is to help optimize your operation and bottom-line. We engage our in-house experts and state-of-the-art technology to support your reliability and asset integrity initiatives going above and beyond in the process.

We have in-house experts with combined expertise of 50+ years giving your team an unparalleled advantage for technical support. We have expert understanding and are forerunners of industry best practices for reliability, asset integrity, and field services support for plant performance optimization.

Thank you for taking the time to learn more about Quad Industrial Groups' competencies.

Cameron Janvier
Executive Manager

INDUSTRY AND SERVICE AREAS.....4

OVERVIEW OF SERVICES.....6

ASSET INTEGRITY MANAGEMENT.....8

PLANT RELIABILITY AVAILABILITY / MAINTENANCE RAM + SUPPORT.....10

REASSESSMENTS & FITNESS FOR SERVICE STUDIES.....11

ROTATING SYSTEMS CONDITION MONITORING.....12

CATHODIC PROTECTION (CP) SERVICES.....14

IS THE PRESSURE EQUIPMENT SAFE?.....16

OWNER-USER QA INSPECTIONS.....17

MATERIALS & WELDING.....18

CORROSION MONITORING NON-DESTRUCTIVE TESTING (NDT).....19

EARTH ENGINEERING SERVICES.....20

ASSET INTEGRITY COURSES.....22

GLOBAL REACH.....24

INDUSTRY AND SERVICE AREAS

OIL & GAS



MINING



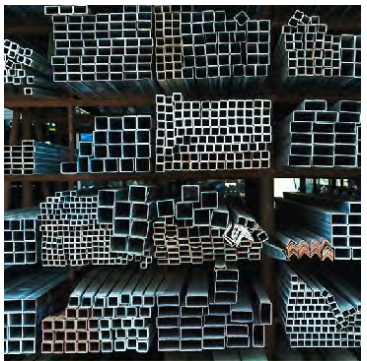
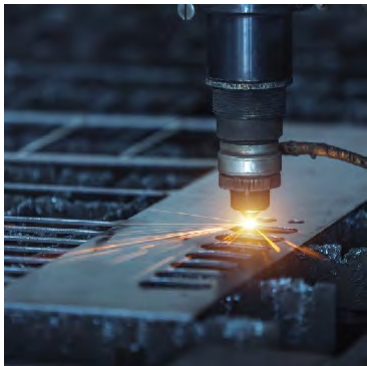
FERTILIZER &
CHEMICAL PLANTS



ENERGY & UTILITIES
POWER GENERATION



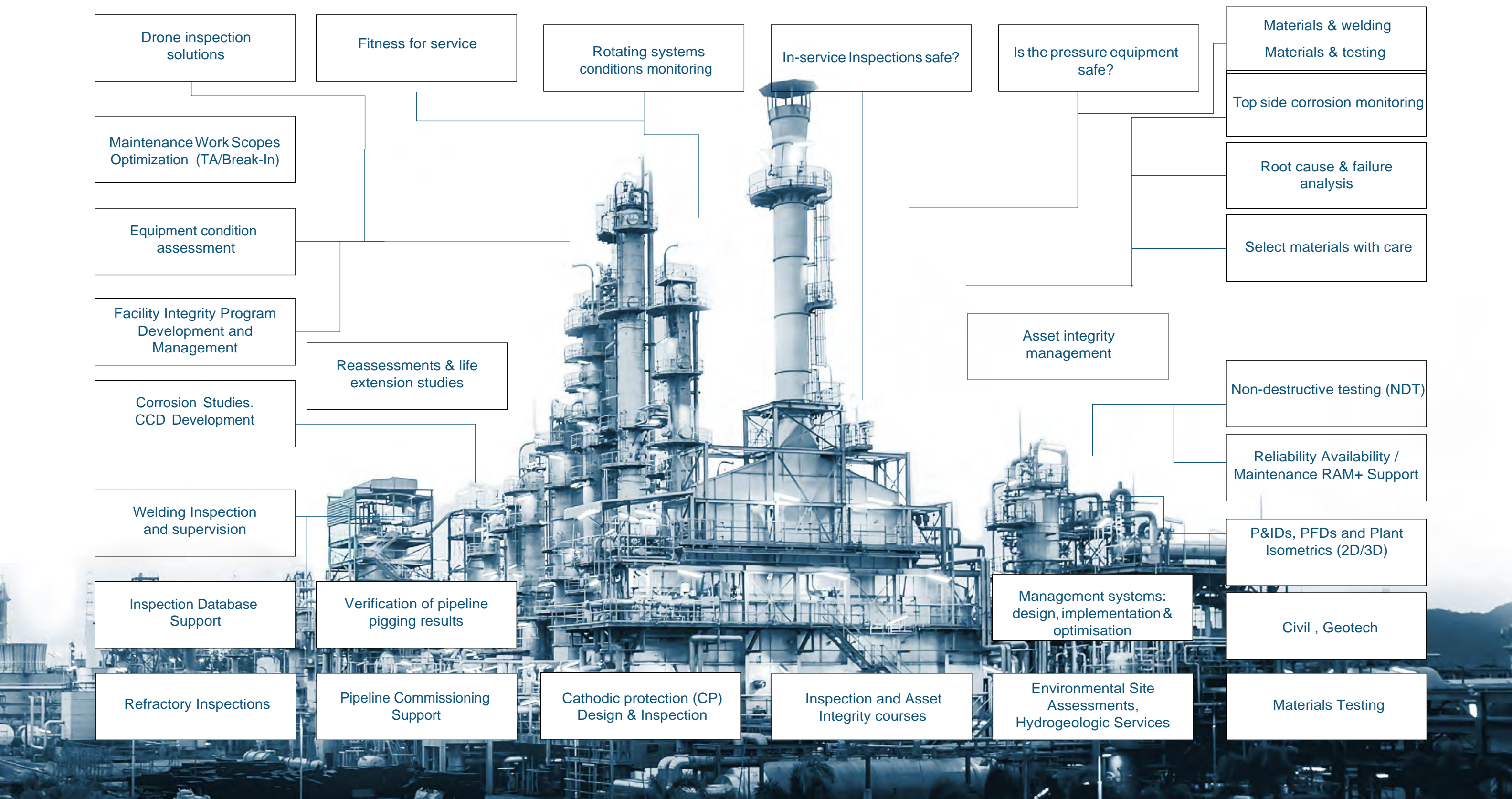
MANUFACTURING



RAIL INFRASTRUCTURE



OVERVIEW OF SERVICES



ASSET INTEGRITY MANAGEMENT

An essential aspect to complying with health, safety and environmental requirements is establishing excellent routines for inspection planning and inspection. Through systematic approaches, we provide full management of all inspection related tasks throughout an asset's life cycle.

INSPECTION & INTEGRITY MANAGEMENT

We provide inspection planning to upstream and downstream facilities. Through collaboration with our clients, we contribute to reduce risk, increase safety, and improve environmental performance of assets.

We offer customized solutions that aim to:

- Reduce the risk of pollution and incidents through corrosion and erosion control.
- Prevent unexpected down time and production loss.
- Enhance profits through asset life cycle.

INTEGRITY PROJECT MANAGEMENT

A large amount of the unforeseen incidents that occur in process plants are related to corrosion and erosion. Corrosion management is therefore essential to maintain the integrity of the facility, increase the level of safety and improve cost-effectiveness of operations.

Safe operation depends on preventing containment loss. However, cost savings are also obtained through managing critical parameters and activities related to corrosion and material degradation.

By achieving corrosion control, ensuring focus on high-risk items, one can reduce the amount of hydrocarbon leaks and several unplanned shutdowns due to material degradation.

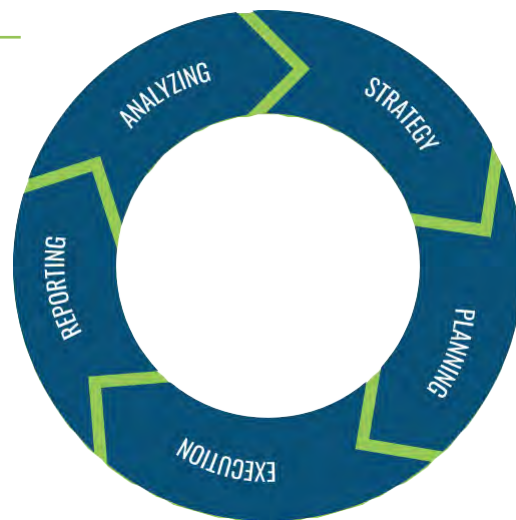
The activities we perform with regards to topside corrosion management are:

- Risk based analyses/assessments (RBA) and Risk inspection (RBI) planning.
- Advanced Corrosion Studies, End of Life Progression Studies.
- Fitness for Service Studies. Level 1-3.
- Follow-up of inspection and analysis of findings. (Repairs /rerates).
- Database Evergreening / Migration: Meridium, RBMI, Metegrity, Ultrapipe, PCMS, MS Access /Excel.

RISK BASED INSPECTION PLANNING

Quad uses risk-based inspection (RBI) planning, which is a method for identifying the probability and consequence of components failure. By this systematic approach, the optimum inspection schemes are determined, and detailed inspection plans are furnished, based on these schemes.

Inspection planning envelops various activities performed in order to optimize the use of inspection resources, while at the same time ensuring the technical integrity of the asset. By targeting areas strategically based on an RBI, you acquire an inspection program that is both safe and cost-effective.



PIPELINE INSPECTION MANAGEMENT

Pipelines equipment represent a very important part of the energy infrastructure. Proper management of pipelines equipment is critical for maintaining continuous production for oil companies. This includes identification of high-risk areas for corrosion, effective use of mitigation, implementation of monitoring activities and inspection resources in addition to improved public health, safety, and environmental protection. We offer several solutions for these types of challenges.

This includes among others:

- Inspection planning.
- Data analysis (e.g. pipeline degradation).
- Corrosion modeling (e.g. remaining service life estimations, software).
- Recommendations regarding corrosion and materials.
- Cathodic protection inspection, modelling and analysis.
- Advanced inspection/monitoring for pipelines e.g. vibration, field gradient sensor).
- Operational support.

ROTATING EQUIPMENT CBM

Quad-AIM offer turn-key reliability systems support for your plant rotating equipment needs. Our core offering is related to systems dynamic and vibration analysis, systems lubrication support and other preventive maintenance activities to ensure plant uptime is optimized and impending rotating equipment failure prevented.

In this field, we offer, among others:

- High Speed Machinery Health Monitoring and Diagnostics Studies.
- Vibration Data Collection, Monitoring and Analysis (Turbines, Compressors, Pumps, Fans, etc.).
- Commissioning Support for Rotating Equipment and Performance Studies.
- Lubrication and Oil Studies / Management.
- PM Support: Maintenance / Repair Strategies & Failure Evaluation.

Failures in plant machinery and constructions are highly unwanted because they may be extremely costly and may compromise safety. Once a failure has occurred or the early stages of a potential failure have been identified, it is important to identify the cause of the failure and initiate preventive measures to stop the failure or avoid recurrence of the failure.

Quad provides on-site inspection and root cause analysis based on your background data, our own observations, and measurements.

The most important goal of a root cause analysis is to prevent both new and recurring failures and thereby improve the safety for workers and environment and prevent loss for the operator.

OUR MAIN SERVICES

- Preventive/Predictive Maintenance plan and scope Development.
- Repair and alteration / Design Recommendations for Rotating and Fixed Equipment.
- Maintenance Work Scopes Optimization (TA/Break-In).
- Facility Integrity Program Development and Management.
- Root Cause Analysis and Defect/Failure Management.
- Plant PSI: P&IDs, PFDs ISO (2D&3D Drawings).

ROOT CAUSE ANALYSIS

Quad performs failure investigations and subsequent analysis to find the root cause of failures. This procedure is often referred to as root cause analysis (RCA). The first part of the failure investigation is typically performed by our specialists on-site and based on their recommendations, samples are examined in detail with advanced laboratory techniques.

IDENTIFICATION AND SOLUTION

Identification of the cause of failure is the first step towards mitigating future corrosion. The solution may for example be injection of corrosion inhibitors or biocides or introduction of more corrosion-resistant materials, for example a suitable stainless steel or nickel alloy. For coatings or polymer/rubber/composite constructions such as pipes, tanks and seals, the cause of failure is often poor materials selection for the specific conditions (temperature, pressure, chemicals). Failure may also be due to conditions differing considerably from originally specified conditions.



We extend the service life of ageing assets through reassessments and lifetime extension studies, leaving you confident in the current state and future performance of your asset. Additionally, through SRS, we ensure that models of your structures are kept up to date with any recent changes, in addition to performing analyses for revised process operations and loads, when necessary.

ASSESSMENTS AND EXTENSIONS

Most plant/pipeline assets in use today, have a projected service life of about 20 to 40 years. The improvement of general oil and gas processes, which has allowed for extended oil recovery, has led to an increased interest towards extending the service life of these structures.

We offer an accurate and well-founded assessment of your structure with regards to fatigue life, new environmental conditions and subsidence to verify life-time extension.

WORK PROCESS AND OUTCOMES

In addition to evaluating the general condition of the asset, we also determine the effects of modifications, tie-in and corrosion - possibly revealing reserve capacities.

When suited, this is carried out via inspection and non-destructive testing (NDT) monitoring, involving continuous monitoring of critical components or areas.

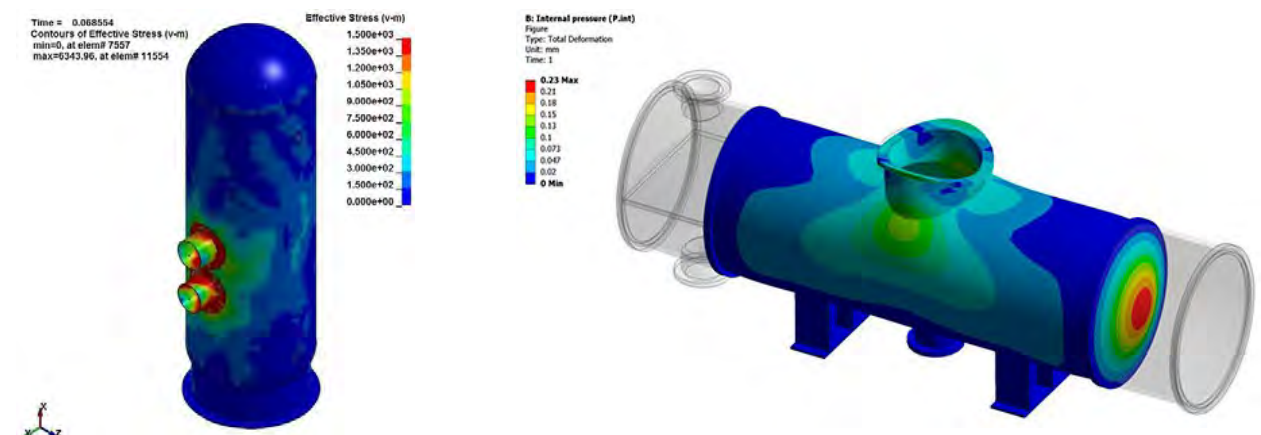
The outcome of these analyses is either an inspection programme, a proposal for structural modifications or validation for extended operation. A few of our services are listed under:

Engineering

- Evaluations.
- Analyses.
- Documentation.

Drafting

- 2D & 3D models.
- Conceptual level drawings.
- Detailed level shop drawings.



ENGINEERING CRITICAL ASSESSMENT AND FFS EVALUATIONS/STUDIES

An engineering critical assessment is an analysis based on fracture mechanics principles. The analysis is applied in cases where our inspection department has detected weld flaws or initial fatigue cracks. With knowledge of the weld flaw size and the stress spectrum, the remaining fatigue life is estimated by fracture mechanics calculation.

Quad has comprehensive experience in performing stress analysis for FFS results based on API579 for L1-L3 assessments, on typical pressure equipment types. Further, we have extensive experience with analysis of strength and engineering critical assessment of welded joints etc.

ROTATING SYSTEMS CONDITION MONITORING

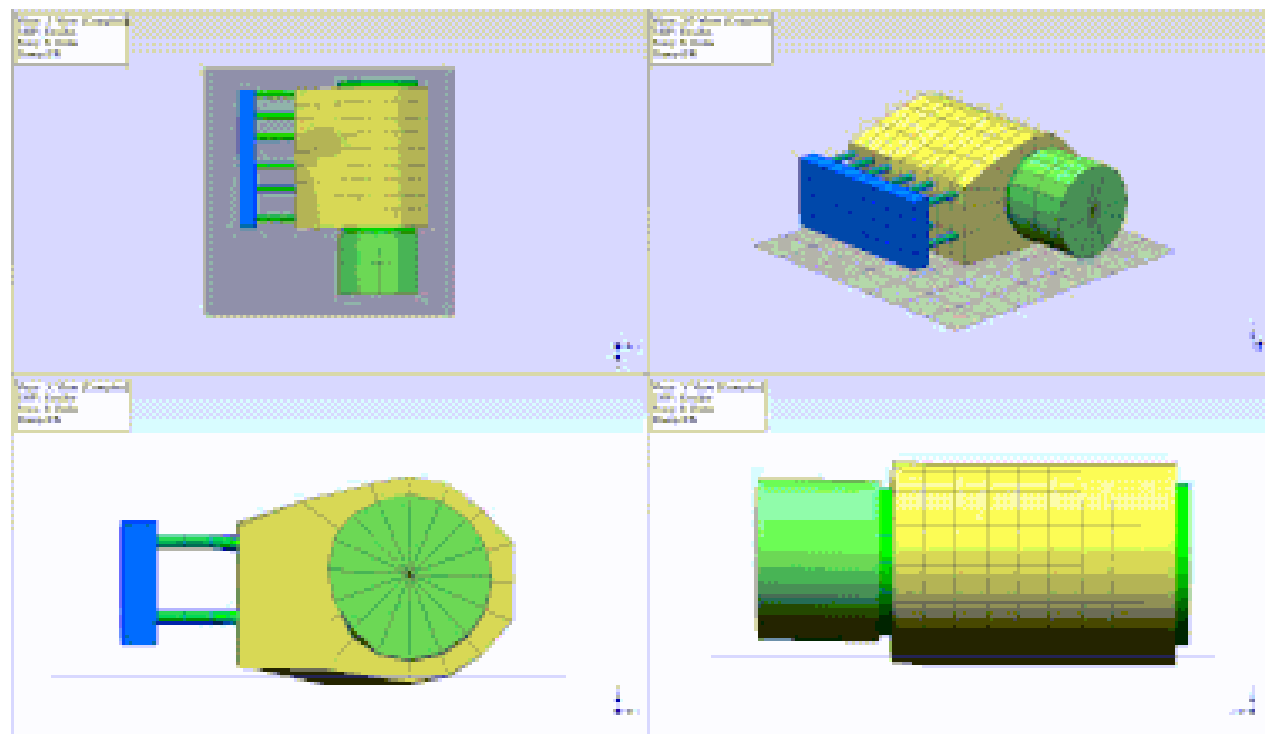
Quad-AIM offer turn-key reliability systems support for your plant rotating equipment needs. Our core offering is related to systems dynamic and vibration analysis, systems lubrication support and other preventive maintenance activities to ensure plant uptime is optimized and impending rotating equipment failure prevented. With a team of over twenty years in the field of reliability engineering, we focus on condition-based monitoring techniques and best industry practices with depth practical knowledge and expertise that is unparalleled in this field to ensure we achieve good results always.

5-POINT ROTATING RELIABILITY SUPPORT

- High Speed Machinery Health Monitoring and Diagnostics Studies
- Vibration Data Collection, Monitoring and Analysis (Turbines, Compressors, Pumps, Fans, etc.)
- Commissioning Support for Rotating Equipment and Performance Studies
- Lubrication and Oil Studies / Management
- PM Support: Maintenance / Repair Strategies & Failure Evaluation

Rotating / High speed Machinery Classification:

- Rotary Pumps (positive displacement and centrifugal).
- Centrifugal Compressors, Fans, Blowers and Mixers.
- Reciprocating and Rotary compressors.
- Steam turbines and gas turbines. Diesel powered generators.
- Electric Motors and Generators.



Quad has seasoned local resident staff in Edmonton and Fort McMurray Alberta with each employee having an average of over 15 years of experience in maintenance, reliability, and condition-based monitoring applications for high speed mechanical systems. We have an exceptionally knowledgeable team with the ability to perform a wide range of duties from basic vibration data collection to advanced analysis of complex machinery problems and diagnostics. All analysis and assessment are reviewed by a level 3 vibration analyst and a professional engineer specialized in rotating equipment.

Our rotating specialist have over 10,000 hours/year over the past 10 years on the PLG / chemical processing, LNG, and Oil Sands site plants, with the majority of that time spent in the field with proven track record of contributing to accurate failure prediction, reduced maintenance costs, increased availability and overall increases in profitability as result.

THE COMPETENCES OF THE STAFF

The rotating team matrix has a minimum of the following:

Vibration data collection: CMVA or equivalent certification (Category/Level 1 or 2).

Vibration analysis: CMVA or equivalent certification (Category/Level 2 or 3).

Mechanical Engineer or Industrial Mechanic (Millwright L3 or L4).

Plant HSE representative: To ensure compliance with Client HS&E requirements.



CATHODIC PROTECTION (CP) SERVICES

In order to prevent corrosion from damaging and tearing down valuable assets, cathodic protection systems are installed. Our CP support team has more than 20 years of experience within cathodic protection and offer various types of solutions.

We provide a wide range of cathodic protection (CP) services and solutions that prevent and control corrosion as a part of integrity management of fixed platforms, including:

- CP modeling and design
- CP inspection Management

Our combination of practical and theoretical approaches provides more accurate results, which is important when considering inspection intervals and life extension studies.

CP MODELLING & DESIGN

We provide cathodic protection modelling of all types of structures and pipelines. Our experts use software solution which can be used to simulate a wide range of structures. The main objective of CP modelling is to demonstrate the actual performance of a CP system.

We simulate CP performance throughout its service life on structures, with or without coating, using sacrificial anodes, impressed current and hybrid systems as well as a unique database with real-life data in order to simulate the exact amount of retrofit anodes needed for retrofitting and life extension.

This comprehensive approach gives us a competitive edge with regard to the quality and reliability of our CP modelling results, and we can demonstrate large savings by using real-life current densities as opposed to conservative design codes. We can also verify CP designs, using design code values.

Typical cases evaluated by CP modelling:

- Current shadow effects, current-drain, and anode distribution issues
- Uneven anode consumption
- Over or under protection
- Protection in confined areas, small annuluses, etc.
- Galvanic corrosion
- Anode interference
- Interaction between connected structures
- Pipeline attenuation.

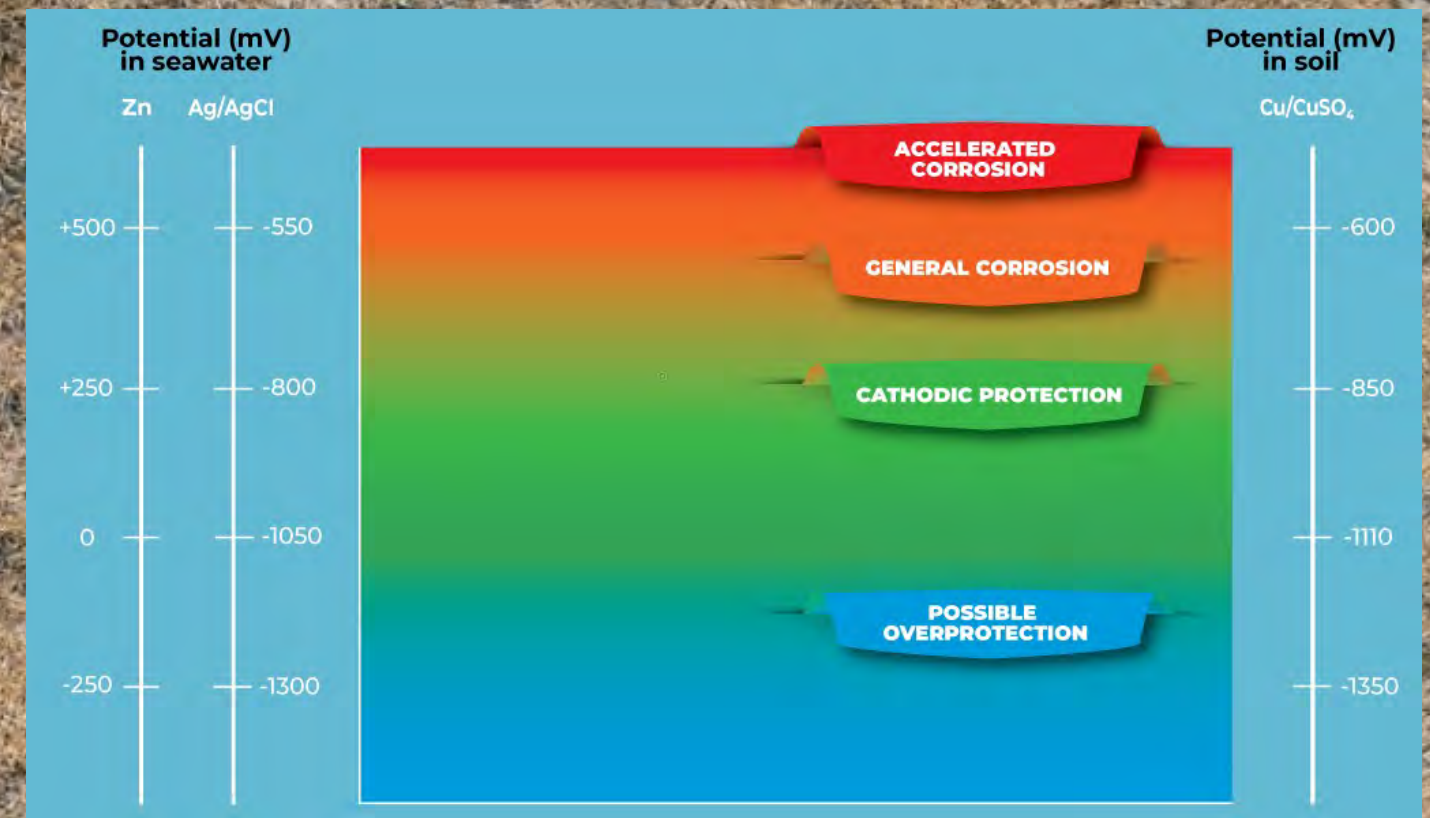
With CP modelling, you can try out different scenarios in order to ensure the optimal protection of your asset.

Our services within CP design include:

- Traditional CP design with both impressed current and sacrificial anodes
- CP design verification
- CP retrofit design
- Anode protection range and attenuation calculations
- CP design of stainless steels (see RCP further down)
- Material compatibility with cathodic protection systems.

CP INSPECTION MANAGEMENT

Detailed design specifications for the installation of sacrificial and impressed current systems, maintenance, and repair recommendations for Conventional and Deep anode groundbeds, Monitoring program development (including Anode life and efficiency, current ratings audit, and requirements).



SOIL CORROSIVITY ANALYSIS

- Soil resistivity, pH, sulfate / chloride content, bacteria, Redox Potential assessments, and indicators of anaerobic conditions.
- Determination of the corrosivity of the environment and make recommendations on the type of corrosion prevention techniques to utilize.
- Using certified labs, soil samples are analyzed for various constituents that contribute to a corrosive environment.

STRUCTURE-TO-ELECTROLYTE POTENTIAL SURVEYS

- Assessment and performance evaluation of existing corrosion prevention systems to determine compliance with regulatory requirements.
- AC/DC Interference analysis. Performing troubleshooting techniques to determine if interference conditions exist and make recommendations to mitigate the effects.
- DCVG & ACVG, Close Interval Surveys, Interrupted Potentials.

COMMISSIONING & ACCEPTANCE TESTING

- Performing initial energization tests on newly installed corrosion prevention systems.
- Structure/coating non-destructive integrity inspection and evaluation.
- Detailed reports on the status of your corrosion control systems, including detailed solutions to any issues.

DESIGN OF CORROSION PREVENTION SYSTEMS

- Design of Corrosion Prevention Systems, Details, Specification compliant with the latest regulatory and industry standards (NACE International/ISO/USEPA/USDOT).
- Design Engineering Oversight of installation and construction activities.
- Designs are performed by NACE Certified CP4s (Cathodic Protection Specialists) with Professional Engineering Licenses in the local jurisdiction.

Pressure equipment may present a large safety risk, and it is therefore important to meet the specific requirements for engineering and application.

THE AIM OF THE RULES RELATED TO PRESSURE EQUIPMENT IS TO ENSURE THAT THE EQUIPMENT IS

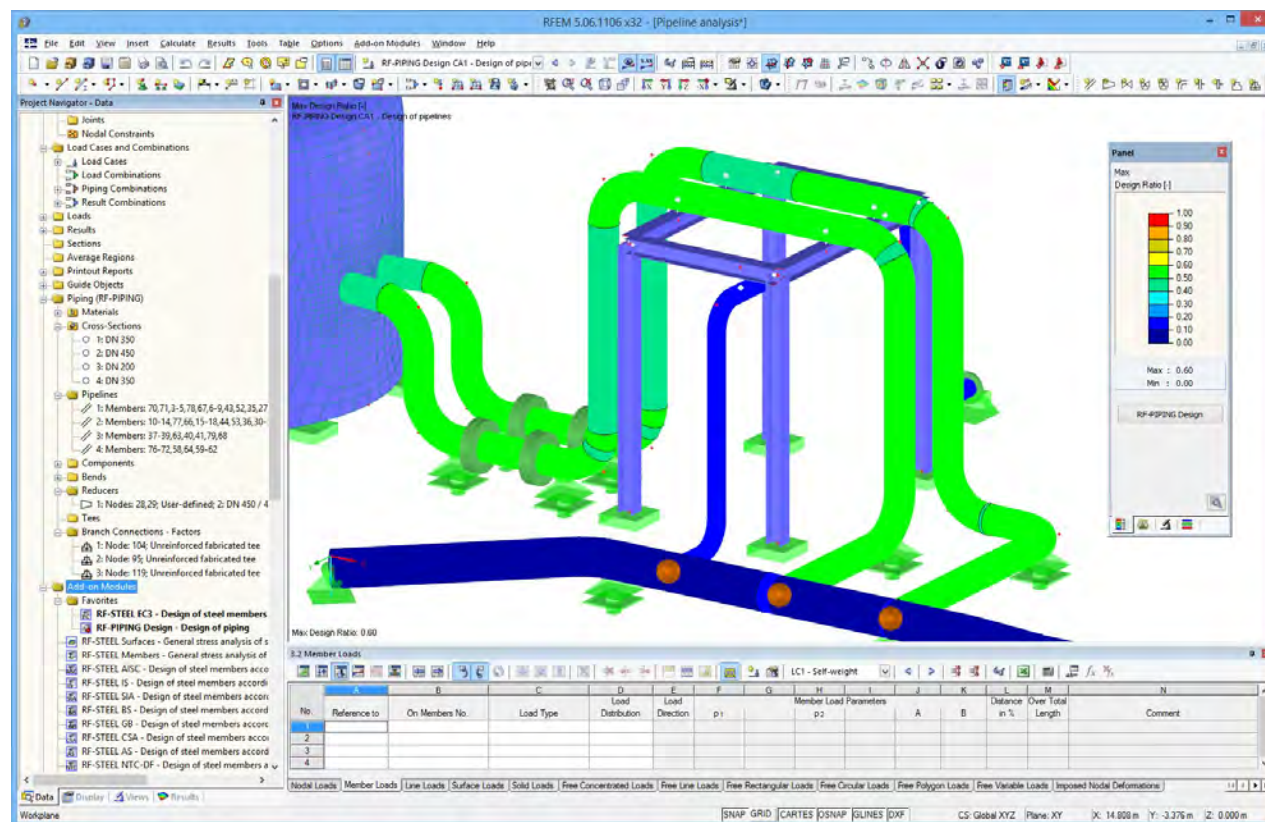
- Engineered in a proper manner regarding health and safety, or in other words, designed and manufactured correctly
- Applied in a proper manner regarding health and safety.

Today, the main part of Canada and the US fortunately has a common set of rules for construction and manufacture of new pressure equipment for use onshore. These rules include guidelines for evaluation of the equipment to ensure that the equipment fulfils specific requirements for engineering. Before these rules have been fulfilled, the equipment cannot be traded, commercialised, or commissioned.

In other words, the set of rules helps to get a common level of safety for new pressure equipment, regardless of the country it is used in. The same set of rules has also been adopted by the various provincial authority in Canada and the USA.

HOW IS IT CHECKED THAT NEW PRESSURE EQUIPMENT FULFILS THE REQUIREMENTS?

Pressure equipment is classified in four categories (I-IV). The highest category represents the most hazardous equipment. The manufacturer of the pressure equipment handles the conformity assessment and must also take care that the equipment is rated and registered as per code.



Experience shows that placing a qualified owner's representative at the construction site during the project can have a significant impact on the final success of the project.

Quad is an authorized inspection and asset integrity company. We can support your QA inspectors and plant engineers with new-build and In-service inspectors and ensure your pressure equipment meet all safety regulations as per the governing authority.

Our representative can act as:

- Owner's representative – direct reference to end user, serving only one "master"
- Process (welding, NDE and coating) specialist surveyor – monitoring craftsmanship, better quality
- First-hand monitoring of progress – any delays can be identified early, and action initiated without delay.
- Flexible resource – man up/down according to project intensity.

The quality of the entire delivery depends on numerous factors:

- Design quality
- Specification detail
- Communication between designer, owner, workshop, and classification body
- Experience and attitude of workshop
- "Enforcement" of procedures and specifications.

OWNER'S REPRESENTATIVE

Numerous consequences of poor quality in the manufacturing processes normally show after delivery and commissioning. They can result in leakages, cracks, corrosion, or excessive wear, often during operation when most inconvenient, maybe resulting in unplanned shutdown etc. at great costs to the operation.

Quad has a long history of acting as an owner's representative in all phases from design, evaluation of suppliers, processes, construction, installation, in-service monitoring, maintenance, and repair. Assignments can vary from participating in meetings for a few hours to surveying on site for the entire duration of the project.

Quad has the skill and experience to fulfill condition inspections in all classes of pressure equipment as well as structural welding, rotating equipment, cranes, vessel, and pipe systems to evaluate the condition and extent of possible repair work. Typical Field Inspection Activities Include:



- Regulatory Inspections for Clients (Owner/Users)
- Welding Inspection, Pressure and Structural Assets.
- API510 Pressure Vessels Inspections.
- API570 Piping Inspections.
- API1169 Pipeline Inspections.
- API653 Storage Tank Inspections.
- API963 Refractory Systems Inspections.
- API610, API674 for rotating systems.
- NACE Coatings Inspections.

Quads consultancy is based on extensive knowledge of materials and practical experience obtained through many years' intensive work within this field.

We have wide experience in performing welding supervision/inspection in companies with production or as a third party auditor to verify the capacity of other companies within steel producing companies, shipyards, refineries, power plants, fuel oil installations on new constructions, repair and overhauls worldwide.

With insufficient welding inspection you risk quality problems, and it is therefore important to make 'prior to', 'during' and 'after' welding inspection.



WELDING SUPERVISION/INSPECTION PRIOR TO PRODUCTION START

This is a crucial point at which to ensure the correct quality of the product, whether you are the contractor or a supplier. We may participate in pre-qualification of suppliers and sub-suppliers as well as review of production and product requirements in co-operation with the contractor and supplier.

WELD TECHNICAL CONSULTANCY

We provide practical as well as theoretical consultancy in connection with weld technical questions. We have welding engineers, welding technicians and specialists with many years' experience.

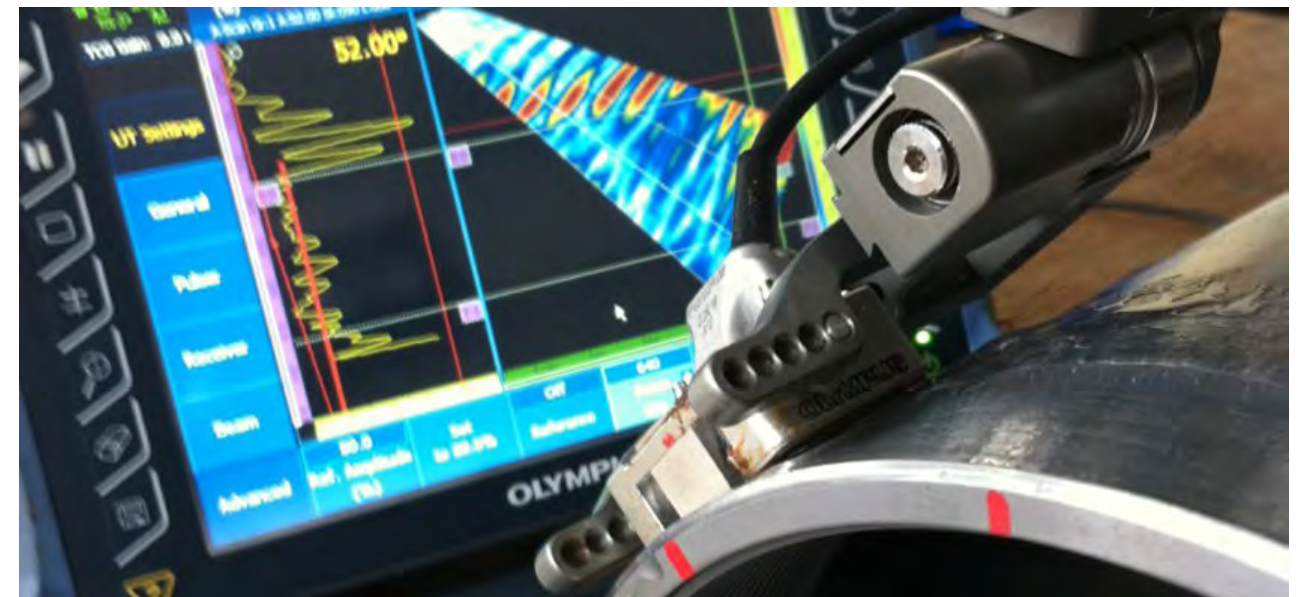
We advise on interpretation of standards and material tenders as well as in interpretation of specifications for welding, WPS' for your requirements. Furthermore, we optimise welding processes and choice of equipment and solve problems regarding production equipment and optimisation.

PROCEDURE TESTS

We supervise and verify procedure tests according to AWS, CWB and other relevant standards.

We supply surveyors, material specialists, mechanical specialists, welding specialists and NDT specialists to ensure that you meet the technical rules, standards, and other specific requirements.

Reliable non-destructive testing (NDT) is essential to ensuring and documenting full visibility of equipment's during construction, quality verifications of the materials and craftsmanship in casting, forging, and welding. Subsequently and ultimately, credible, and reliable NDT is paramount when monitoring assets in operation; structures, vessels, piping, columns, tanks etc. for in-service induced flaws such as corrosion, fatigue cracks and similar.



NDT RESULTS CAN BE REPORTED

- In digital easy-to-read reports delivered by mail and accessible Online
- Quad's database format for easy automated export to the customer's system
- Directly into the customer's own reporting system, database, or integrity management support system.

In connection with operation and maintenance of vessels and pipe systems in upstream and downstream installations, Quad has for several years carried out the following in-service inspections:

- Phased Array Ultrasonic Testing PAUT.
- Guided Wave Ultrasonic Testing.
- Automated and Manual Ultrasonic Testing.
- Digital Radiography Testing RT.
- Liquid Penetrant Inspection LPI.
- Magnetic Particle Inspection MPI.
- Positive Material Identification PMI.

CIVIL, GEOTECH

- Geotechnical Engineering Analysis and Desktop Study
- Subsurface Investigation, Test Boring, Core Sampling
- Exploratory Excavations
- Foundation Design and Tank Settlement Analysis
- Groundwater Control, Slope Stability and Seismic Analysis
- Deep Foundation Recommendations Flexible Rigid Pavement Design

MATERIALS TESTING

- Nuclear Gauge Compaction Testing
- Pull Out Capacity Test, Compression Test
- California Bearing Ratio, Coring Test
- In-Situ Density Test
- Permeability Test

ENVIRONMENTAL SYSTEMS DESIGN

- Preliminary, Phase I and II, Remedial Studies
- Environmental Site Assessments, Hydrogeologic Services
- Brownfield Investigation and Remediation
- Air Resources and Pollution Control
- Environmental Compliance, Solid Waste Management
- Wetland Identification, Delineation and Mitigation



ASSET INTEGRITY COURSES

Drawing on more than 50 years of experience in applying standards, recommended practices and industry best practices, we are able to offer comprehensive trainings in Asset Integrity and inspection courses for the Oil and gas and allied sector as well as in shipping. Our courses can be tailored based on the individual customer.

API579 Introduction to Fitness for Service (+Software Tutorial)

API571 Damage Mechanisms. (+Software Tutorial Using DM Simulator)

API510 Pressure Vessel Inspections Certification

API1169 Pipeline Inspections Certification

API570 Piping Inspections Certification

API936 Refractory Personnel Inspections Certification



GLOBAL REACH

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OUR CAPABILITIES

Our ability to empower clients with the knowledge to make the best business decisions supersedes common reliability consulting approaches. It's our thorough, detailed approach that puts us a cut above the rest.

TECHNICAL EXPERTISE

In our 100+ years of combined expertise, we have accumulated rich knowledge and experience in reliability methods which allows us to provide more efficient and effective reliability studies, best-in-class software, and valuable training.

PROVEN SUCCESS

We have gained a reputation for reliability engineering services that deliver positive outcomes. We have completed many successful projects with some of the major players across a range of industries - global companies that trust us to deliver results.



CERTIFIED
Aboriginal Business

Canadian Council for
Aboriginal Business



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