Company Profile

NAI TRADING
Pipeline Integrity Management Services

The mark of quality and growth

Pipeline Integrity Management Services for
Gulf Cooperation Council Countries
(Bahrain, Kuwait, Oman, Qatar, Saudi Arabia & United Arab Emirates)

www.thenaicompany.com
PURPOSE
The Proposed of the Pipeline Integrity Management Services to investigate and study the existing pipes in order to prevent a major breakdown or failure in the pipes system due to the existing physical conditions of the pipeline carrying liquid, gas, LNG, LPG and multi-phase products.

INTRODUCTION
NAI Trading is the industry partner with the most comprehensive integrity management capability for the maintenance and rehabilitation of oil and gas transmission, gathering and distribution pipelines as well as above ground hydrocarbon liquid storage tanks.

Mission
Our mission is to help associates achieve success in both their Professional and Personal lives through Development Opportunities, Technology and Training.

The well being of our associates and customers is our focus as we continuously pursue Innovation, Balanced Growth, Industry Leadership and Diversity.

Our culture which is focused on Quality Growth and Personal Success, enables our customers consistently receive the best value and services in the Industry.
Pipeline Integrity Management Services
Leak Detection System

- The Acoustic Leak Detection System is designed to detect the occurrence and determine the location of leaks in gas, liquid, and multiphase flow pipelines.
- At the instant of a break in the pipe wall a transient acoustic wave is created.
- This acoustic wave travels at the speed of sound for that fluid guided by the walls of the pipe in both directions from the source of the break.
- The acoustic wave is detected by sensitive acoustic sensors and analyzed by Wave Alert Site Processors situated along the pipeline.
- After further analysis by the Master Comm, the location of the leak is determined from the arrival times of the expansion waves at the sensor locations.

Scraper Tracking

- A method for tracking a scraper within a pipeline has the steps of moving the scraper along a path in the pipeline such that the scraper produces an acoustic signal, sensing the acoustic signal as produced by the scraper by at least a pair of acoustic sensors positioned in spaced relation along the pipeline, time-stamping the sensed acoustic signal, and calculating a location of the scraper based on the time-stamped acoustic signal. The acoustic signal can be a transient pressure wave produced by the movement of the scraper or a pressure signal produced by a mechanism positioned on the scraper.
- Scrapers, also known as pigs, are pieces of pipe where elastomer discs are attached radially at various points along the pipe. The elastomer discs of the scraper slide along the internal wall of the pipeline and remove the adhered corrosion and other undesired substances.
Hydraulic Profile

- Our Experience includes providing engineering and planning support for the maintenance, operation and capital improvements to natural gas transmission, distribution, gathering and underground storage systems.
- Project management and engineering consultancy work performing hydraulic analysis and detailed design of oil and gas pipelines and meter stations, locating compressor and pumping stations, reviewing process flow diagrams and piping & instrument designs.

Pipe Corrosion Monitoring & Tracking

- Cathodic Protection System, an impressed current type cathodic protection method that continuously guards underground pipelines against rust and corrosion in all kinds of soils and weather. This system forces a continual flow of electric current to pass from the embedded anode through the soil and into the pipeline, thus creating an electric field at the surface of the metal. The result is an invisible shield over the entire length of the pipeline to guard against all corrosive elements, at all times.

  This extends the life of the pipeline and eliminates the need for replacement. In addition, the system is solar powered and runs on solar energy which is entirely free! This system also stores the energy provided by the solar photovoltaic cells in a battery bank. This enables it to provide a continual source of energy, even in remote, un-electrified areas. This makes running costs almost negligible. However, it also compares favorably on investment even when it is worked on A.C. mains.

Complex and sensitive pipe handling requires safe, reliable and economical systems for the tracking and monitoring of each single pipe. Our product addresses the need for miscellaneous, and often very expensive, tracking, monitoring, and security measures by providing intelligent and tailored solutions from a single source.
Density & Temperature Tracking

- With the latest Global Warming cold and hot weather has effected various pipelines and it become necessary to monitor Density and temperature electronically in order to avoid an increasing concern by cold weather environments.

Pipeline Stress Monitoring

- Based on actual pressure values for monitoring pipeline segments which are stored continuously in the database, the Stress Monitor analyses permanently pressure trend curves, determine maximum and minimum possible thresholds and calculates the impacts of pressure changes.

Pipeline Inventory Monitoring

- During operation days a pipeline contains different amounts of products, which is caused by temperature and pressure variations. Inventory Monitor stores the quantities of all pipeline segments in the real-time database and compares each quantity to all threshold levels. The system determines the quantities for each pipeline segment and also for every product in multi product pipelines.

Batch Tracking

- Batch Tracking monitors the head and tail position of each product batch as it enters a pipeline, it calculates the Estimated Time of Arrival (ETA) of each batch at every delivery point continuously, and provides a detailed account of batch volume in the line, delivered and to be delivered. BATCH Tracking also enables detailed interface analysis to assist the operators in cutting the batch interface correctly so that minimum product is downgraded and no product contamination occurs.

- Pipeline operators will be able to monitor and control the product batch or quality, easily with the help of Batch on-line Tracking. The batch summary report and Graphic User Interface including the pressure profile along the pipeline provide valuable management information for pipeline companies to audit and supervise daily operations.

DRA Management of Pipeline

- DRA (Draw Reducing Agents) is used in reducing the pipelines carrying crude oil, refined products etc. The DRA use is a fast-dissolving, ultrahigh molecular weight copolymer that delivers a high level of pipeline friction reduction. This active polymer dissolves fully in the hydrocarbon fluid and does not coat the pipeline wall or adversely affect the hydrocarbon fluids being treated.
Pumps and Valves Operation Monitoring

- The reduction of pumping costs and energy consumption is a major objective for all pipeline operating companies. Optimal pumping is essential to keep the lifetime of pipelines. In order to obtain the required flow within a pipeline the Pump and Valve Optimization module utilizes the pressure and flow characteristics and pump efficiency curves as well. Based on the Real-Time Transient Model and actual hydraulic conditions like line fill, the pipe friction factor, etc. the system determines the most efficient pump and valves operations and provides the results to the operator.

- Pipelines are equipped for safety reasons with special shutdown and controlling devices. Shutdown Monitor follows the same logic as for emergency control and shutdown, but permits the setup of different thresholds. The system triggers warnings before any action in the field is automatically started.

PIPELINE WALL ROUGHNESS MONITORING

- Pipeline configuration, wall roughness and pipe friction factor are usually defined as standard values during the design stage. Any changes of these values will be compensated by the Real-Time Transient Model tuning methods. Tuning factors which are calculated for each pipeline segment are also monitored against thresholds. The Wall Roughness Monitor triggers alarms to indicate new scraper runs.

PIPELINE BLACK POWDER MONITORING

- Black Powder has become a more widely recognized hazard for safe and economic gas pipeline operation. Black powder is a generic name for small-particle ferrous corrosion by-product.

- Much discussion has been going on as to the causes and sources of the problem, but in general the following roots of the problem can be discerned:
  - Sour gas services. Higher levels of hydrogen sulfide cause the formation of iron-sulfides in the pipeline.
  - Moisture. Water that remains from the hydro test phase or that is present as a result of wet gas, leads to formation of iron-hydroxides and iron oxides in the pipeline.
  - Mill scale deterioration. In older and uncoated pipelines, mill scale may be of poor quality and in the process of pipe manufacturing disbandment may be initiated.
CHEMICAL PROCESS IN THE PIPE

- Iron sulfide, and apparently many of its variations, can be quickly and efficiently created in a gas pipeline from the chemicals naturally available in many systems. Hydrogen sulfide (H2S) easily reacts with the iron in piping to form iron sulfide as in the formula:
  \[ H_2S + Fe = FeS + H_2 \]

- The presence of a small percentage of water (approximately 3 to 9 percent) aids this reaction. Under more oxidizing conditions, pyrite (FeS2) may form in accordance with the formula:
  \[ 2H_2S + Fe = FeS_2 + 2H_2 \]

- In addition to hydrogen sulfide, sulfur can also react to form iron sulfides. Sulfur compounds are present in relative abundance in gas and oil wells. Older fields might have sulfate reducing bacteria that have grown in the formation or have used chemical injection to increase well production.

MICROBIOLOGICALLY INFLUENCED CORROSION (MIC)

- Microbiologically influenced corrosion (MIC) is a serious form of corrosion that can occur in pipelines and produces black powder or iron sulfide.

- MIC is pitting of the pipe wall as a result of the activities of microbial communities in areas that provide their required habitat.

- It can occur on either the inside or outside of the pipe.

FILTERING

- The most common and historical means of dealing with black powder is to filter it just before it enters a compressor, station, or processing plant. Filters of various technologies and names are usually specified and supplied as a part of the compressor design package when the unit or piping is installed. Sometimes purchasers specify filter performance requirements in their bid request.

- Sometimes the design requirements given are accurate and sometimes they are hardly known. At other times the conditions change after the initial installation. The net result is that regardless of what is requested or promised, it is usually impossible to get field measurements to accurately determine the performance of filters and separators at any one condition.

- It is well-known in technical circles, however, that sulfur, hydrogen sulfide, oxygen, and water vapor, some in parts per million, can be important in the formation of iron sulfide and other corrosion products. The presence of these components in very small quantities can provide:
  - The constituents for chemical formation of iron sulfide
  - The environment for growth of sulfate reducing bacteria and acid producing bacteria whose metabolic processes result in the production of iron sulfide; and
  - Direct corrosion of steel by oxygen, carbon dioxide, or combinations of the two.

- Therefore, it is important to test gas composition samples for these lesser components, to monitor the likelihood of iron sulfide formation.
**POWDER COMPOSITION TESTING**

- When black powder is found in piping, instrumentation, or compression equipment, it is sometimes helpful to verify its composition by chemical testing to identify or verify its likely origin.

- The origin could be chemical combination or microbial corrosion. There are dark materials that can occur from other materials or chemical reactions that may not be iron sulfide.

**MasterComm Node Processor**

**Acoustic Sensor**
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<tr>
<th>SL#</th>
<th>PROJECT#</th>
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<td>1</td>
<td>BI-10-00194</td>
<td>EAST WEST TO RABIGH*</td>
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* Represents materials supplied by ASI
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