Corrosion Prediction and Material Selection for Crude Corrosivity Applications

Product Information Note

Accurately predict and assess the corrosion you cannot see

Corrosion problems related to crude oil refining were identified early in the 20th century as the industry expanded to serve global energy demands. Non-aqueous corrosion issues continue to be a major concern for refining as market growth leads to feedstock with increasing impurity content, leading to higher potential for corrosion damage. Naphthenic acid and sulfidic corrosion (termed crude corrosivity) in crude refining are key corrosion mechanisms contributing to asset degradation and failure in different areas of atmospheric and vacuum distillation units, such as in transfer lines and side cut piping. Accurate quantification of corrosion due to these factors is critical to safe crude unit operations and gives refiners the ability to work with opportunity crudes at a higher level of confidence and safety.

The Predict®-Crude 2.0 software system encapsulates inferences, experimental results, and research data from a comprehensive Joint-Industry Program (JIP) sponsored by global, industry-leading refining and engineering companies. The four year research program resulted in the development of a quantitative engineering database and decision-support model to predict crude corrosivity in naphthenic acid- and sulfidic-dominated systems as a function of critical environmental parameters such as: Total Acid Number (TAN / NAT), Sulfur (H_2S) content, temperature, hydrocarbon content, flow regimes and wall shear stress.
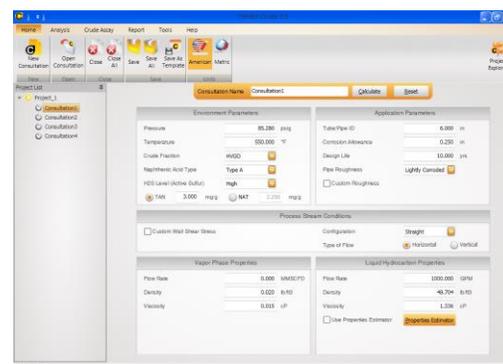

Figure 1: Predict®-Crude 2.0 program input interface, showing relevant inputs required for corrosion prediction

BENEFITS

- For the first time ever, refinery operators have the ability to plan utilization of opportunity crudes with varying TAN and sulfur content, without fear of expensive corrosion failures

- Effectively characterize and predict corrosion and identify appropriate, resistant material (when carbon steel is not applicable)

- Ability to store/manage crude assays and tie-in with corrosion prediction data

- Helps in the development and implementation of Integrity Operating Windows (IOWs) through crude and process analyses

- Pinpoint parameters contributing to corrosion and develop effective mitigation methods

- Automate evaluation and analysis of complete piping systems and refinery crude/vacuum columns

- When combined with Crude Scheduling and Optimization programs, Predict-Crude offers compelling financial advantages in identifying appropriate crude blends to process

Corrosion Prediction Made Easy

Predict-Crude 2.0 offers an intuitive user interface that takes little time to master and delivers results quickly. The user interface presents pertinent inputs needed to quantify the crude corrosivity for CDU or VDU side cut piping. These inputs are the commonly available environmental and operating factors such as:

- Naphthenic acid content and H_2S level (active sulfur) – from crude assay
- Pressure, temperature and stream information

Once the input data is entered, Predict-Crude 2.0 performs an in-depth analysis and generates:

- Predicted corrosion rate for eight materials, expressed in MPY or MMPY
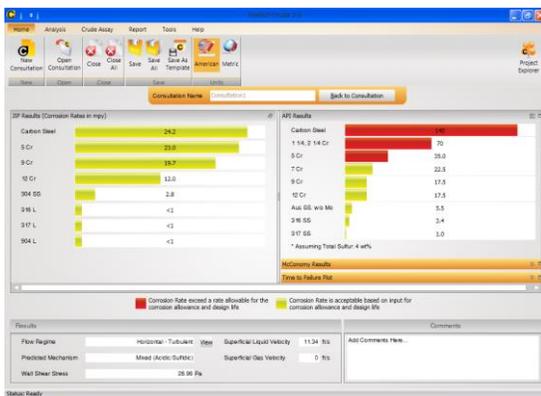- Comparison with industry guidelines (API or McConomy results)

Figure 2: Predict®-Crude 2.0 program output interface, showing corrosion predictions

- Flow results – flow regime and wall shear stress
- Dominant corrosion mechanism – Naphthenic, Sulfidic or Mixed
- Time-to-failure plot – predicted time to failure based on current corrosion rate

Features

Predict-Crude 2.0 offers the following critical functionality:

- A tool to quantify corrosion in crude distillation systems as a function of TAN/NAT, active sulfur levels, naphthenic acid type, temperature, and various additional parametric variables
- Provides data for up to eight materials ranging from carbon steel to Alloy 904 L
- A multi-phase flow modeling module correlating key flow parameters and corrosion rates to quantify contribution of typical flow-induced corrosion parameters
- Ability to estimate the density and viscosity of oils at elevated temperatures from crude assay properties
- Provide indication of relative dominance of sulfidic or naphthenic acid corrosion mechanisms
- Estimate equivalent Naphthenic Acid Titration (NAT) number from TAN number and type of crude fraction (vice versa)
- Ability to store and manage real world crude assays
- Ability to perform analysis on multiple crudes based on crude assays
- Graphically view service life of pipe from predicted time-to-failure plot
- Study parametric effects with sensitivity analysis tool
- On-the-fly and secure, electronic access to actual laboratory test data and program reports
- Supports generation of extensive data reports, multiple case analyses and data-sharing across platforms
- Extensive Online Help System that guides users to effectively use the software and accurately interpret program results
- Real Time (RT) version of Predict-Crude that may be easily linked to Process Historian and DCS

Analyzing Side Cut Piping with Ease

The latest developments in graphical piping simulation have been made available in Predict-Crude 2.0, giving users the ability to map side cut piping for atmospheric and vacuum distillation units.

Such analyses can be effectively parlayed into crude procurement decisions, where users can buy, with fore-knowledge, high acid/high sulfur crudes to process.
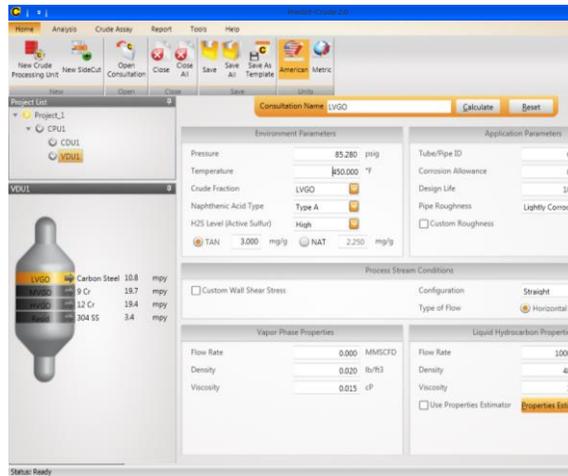

Figure 3: Predict-Crude 2.0 program unit-based project consultation

Secure Access to JIP Data

Users can securely and electronically access the actual laboratory test data and program reports utilized within Predict-Crude 2.0 to make predictions.
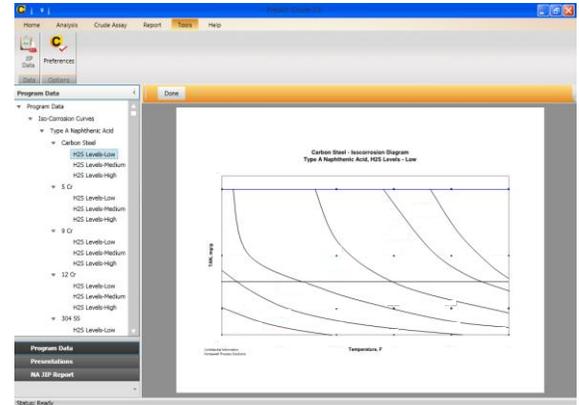

Figure 4: Predict®-Crude 2.0 JIP data for carbon steel

Crude Assay Database

Predict-Crude 2.0 Crude Assay Database provides users the capability to store/manage and access crude assay data. These data can be imported into Predict-Crude 2.0 program for corrosion evaluation, material selection, and to support crude procurement decisions.

Figure 5: Predict®-Crude 2.0 Crude Assay Database

Evaluate Multiple Crude Assays

Users can easily perform corrosion analysis for various side cuts on multiple crudes and build an experiential crude assay database.

Figure 6: Predict®-Crude 2.0 Crude Assay Comparison Tool

Predict®-Crude 2.0 software is the first and the only system of its kind giving refinery operators the ability to quantify crude oil corrosion and plan safe operating procedures. This also facilitates planners and operations managers to make fact-based financial and engineering decisions related to crude procurement and processing.

Benefits Guardianship Program

This product comes with worldwide, premium support services through our Benefits Guardianship Program (BGP). BGP is designed to help our customers improve and extend the usage of their software applications and the benefits they deliver, ultimately maintaining and safeguarding their software investment.

Honeywell Predict® Corrosion Suite

Honeywell Predict Corrosion Suite provides next generation corrosion management solution or oil and gas and refining industries seeking to move from reacting to corrosion damage to a more proactive and effective approach, Honeywell Predict Corrosion Suite provides the next generation of corrosion management solutions. Unlike conventional corrosion management methods, we employ unique prediction models that encapsulate deep expertise and extensive process data to correlate corrosion rates to specific process units, damage mechanisms, and operating conditions. Using Honeywell's tools, global major companies have achieved significant operational and business benefits.

The Honeywell Predict Corrosion Suite is a unique solution for today's industrial facilities, driving a paradigm shift in tackling difficult corrosion problems, and enabling efficient and safe operations. These software tools help users move away from a reactive response to corrosion based on qualitative, manual inspections, to a proactive, reliability-centric predictive approach based on quantitative information from soft sensors, sound process deviation management, and "what-if" scenario analysis tools.

Why Honeywell?

Your operation can benefit from partnering with a proven leader in corrosion asset integrity and preventive/predictive corrosion management. Honeywell has extensive intellectual property in the corrosion field, including unique corrosion prediction and material selection models, and patented corrosion monitoring technology. Our deep expertise includes an in-house team of experts with decades of experience in developing corrosion solutions. Honeywell's IP-based models are licensed and used by many global oil & gas majors, and our company has a recognized track record of world-class execution of projects.

Honeywell has also established a unique corrosion knowledge community through our Center of Excellence (COE). We assist customers with expert local and remote support. Our state-of-the-art corrosion and materials research and engineering laboratory provides a host of standard and tailored services. Utilized in Joint Industry Programs and customized testing, this facility can simulate any service environment.

For More Information

Learn more about Honeywell's Corrosion Solutions, visit
www.honeywellprocess.com/Corrosion or contact your Honeywell Account Manager, Distributor or System Integrator.

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