

## Solution Note

### Honeywell Corrosion Solutions



Honeywell offers technology, services and software to provide comprehensive solutions to help industry detect and solve corrosion problems that can hinder their abilities to operate safely at optimal levels.

#### Benefits

Honeywell's field-proven corrosion solutions offer measurable improvements and benefits:

- Increased plant uptime due to improved reliability of assets
- Reduction in maintenance costs by moving from scheduled to reliability-centered maintenance
- Maximized production throughput while enhancing safety for plant assets
- Improved safety by minimizing the effects of process upsets and excursions
- Significant reduction in inhibitor costs

#### Corrosion as a Process Variable

Through integration with Honeywell's Experion® Process Knowledge System (PKS) or any DCS, operators can transform corrosion modeling and monitoring data into high-value process knowledge. Operators and engineers can correlate corrosion data with process parameters to gain an awareness of plant conditions, make critical business decisions quickly and take proactive actions to optimize short-term and long-term plant performance.

The use of advanced applications like Honeywell's asset, control, operations and simulation applications with real-time corrosion models and monitoring data is a further source of high-value process knowledge to help process engineers make the right decision at the right time.

#### Honeywell's Corrosion Solutions

Quantifying and detecting corrosion is just the first step toward solving a plant's corrosion problems. Honeywell offers an integrated approach to corrosion problem solving with a solution that includes software, services and products.

#### Systems

Honeywell's SmartCET® corrosion transmitter embeds proprietary, electrochemical corrosion measuring technology to provide a high-accuracy, high-value method to bring corrosion data online to the process control system. SmartCET provides four corrosion parameters from a single device, enabling a more complete understanding of the physical corrosion process and a framework for effective corrosion / asset management.

#### Software

Honeywell software models / products capture over 20 years of corrosion expertise derived from Honeywell's industry leading joint-industry projects (JIP), laboratory research benchmarked with actual field data and experience. Corrosion prediction models, available as DCS-integrated real-time solutions, provide operators / engineers a tremendous value in quantifying process-critical corrosion rates, selecting the right material of construction. Honeywell corrosion prediction software helps managing the integrity of pipelines and process equipment with respect to production dynamics.

#### Laboratory and Consulting Services

Honeywell's state-of-the-art Corrosion Lab is utilized by the world's largest process companies to simulate and study their most difficult process corrosion issues. Coupled with Honeywell's industry-leading corrosion expertise, we can offer turn-key consulting services that are fully capable of solving tough plant corrosion problems. Our consulting offer ranges from modeling complex corrosion-process problems through material selection and failure analysis to inhibitor and crude oil evaluation or plant corrosion risk assessment studies.

### Real-time, Online Corrosion Measurement

The patented SmartCET transmitter and the real time corrosion prediction / material selection models form the foundation of Honeywell's corrosion portfolio, uniquely providing online, real-time corrosion information. SmartCET gives plant operators access to current, actionable process variable information including a time-trended general (uniform) corrosion rate. The real-time models enable quick identification of corrosion hot spots and remediation solutions for critical materials questions.

SmartCET delivers online corrosion diagnostic data and improved accuracy of corrosion rate measurement previously unavailable to the process control system. Embedded within SmartCET is Honeywell's proprietary implementation of the Low Frequency Impedance as a variant of LPR technology. Linear Polarization Resistance (LPR) is a proven method for measurement of corrosion trends. In combination with two other electrochemical techniques: Harmonic Distortion Analysis (HDA) and Electrochemical Noise (ECN), SmartCET provides faster and more accurate measurements of main corrosion parameters including corrosion rate and localized corrosion potential (Pitting Factor).

SmartCET measures corrosion through a sensor or probe that is exposed to the process environment. Our experts can help in the proper selection of the probe to suit the specific process environment, which is essential to ensure accurate corrosion detection. The unique design of SmartCET enables it to connect to a range of different off-the-shelf and custom probe designs, each specially configured to provide the most accurate and reliable measurement of corrosion activity.

SmartCET technology can be applied to all conductive-liquid containing process streams. Honeywell corrosion specialists can review existing corrosion monitoring system and provide input for optimizing and updating the system for online, real-time monitoring.

SmartCET (wired version) communicates via the industry standard HART protocol and can easily connect to existing control systems. As an input to the process control system, corrosion data can be trended, analyzed from historical perspective, alarmed and assigned to process groups. Corrosion data can seamlessly correlate with other process variables allowing the corrosion specialist and plant operator or engineer to work together with a broader view on plant operating conditions and methods of mitigation.

Improving on the communication of the industry-leading design, Honeywell introduced the OneWireless™ SmartCET corrosion transmitter. This transmitter features wireless communication

over the Honeywell OneWireless network through ISA100.11a, which can greatly simplify the implementation task and reduce the overall cost of a corrosion monitoring system.

The SmartCET is featuring an industry-best update rate of approximately 30 seconds. Improved update rate (was 7 minutes) allows users to react to corrosion changes in real time and to correlate exact process changes to the corrosion event. Another benefit of faster update rates is that corrosion variables are able to serve as inputs to a control loop such as automated loop for chemical inhibitor addition.



OneWireless SmartCET Corrosion Transmitter

### Expert Consulting Services

Honeywell's experienced staff of materials engineers and corrosion specialists provide expert services in the fields of corrosion modeling, material selection, corrosion control, plant integrity assurance, metallurgical and mechanical behavior, and failure analysis. Our staff of specialists is equipped to support these services with a state-of-the-art, fully equipped corrosion testing laboratory and research center.

### Laboratory Simulation and Testing

Honeywell's corrosion research laboratory specializes in the evaluation of metals, polymers, ceramics and coatings. Complete investigations are conducted in confidence, from initial field survey to delivery of the final report. The most advanced materials and sophisticated simulated service environment test

equipment is available to support field and plant engineering staff. Full-scale evaluations of load-carrying and pressurized components can be provided. Test services include:

- High Pressure, High Temperature (HPHT) applications
- Refinery corrosion, including crude oil corrosivity tests
- H<sub>2</sub>S and sour service testing
- Hydrogen embrittlement
- Naphthenic acid corrosion
- Simulated service tests
- Electrochemical testing
- Dynamic sour water testing
- Mechanical testing

Honeywell can also design and deliver customized corrosion and metallurgical testing including proof rings, CERT machines, high pressure reference electrodes, autoclaves, flow loops and more. Our research specialists have an excellent track record of designing test equipment to meet specific needs of our customers in all industries.

### Engineering Services

With over 30 years of practical work experience in troubleshooting corrosion problems, Honeywell corrosion experts have assisted customers by augmenting their in-house corrosion capabilities and functions. In addition to engineering services we can also develop and implement cost-effective corrosion control procedures that are tailored to the unique needs of your process plant. Services include:

### Plant Corrosion Surveys

- Review and analysis of historical corrosion data, failures, maintenance records, asset replacement
- Corrosion monitoring location recommendation
- Probe specification and electrode configuration
- Process-correlated analysis
- Plant diagnosis

### Expert Consultation

- Plant material selection
- Material Selection Diagrams (MSD)
- Corrosion Control Documents (CCD)
- Inhibitor screening
- Failure investigation and analysis
- Process and corrosion simulation

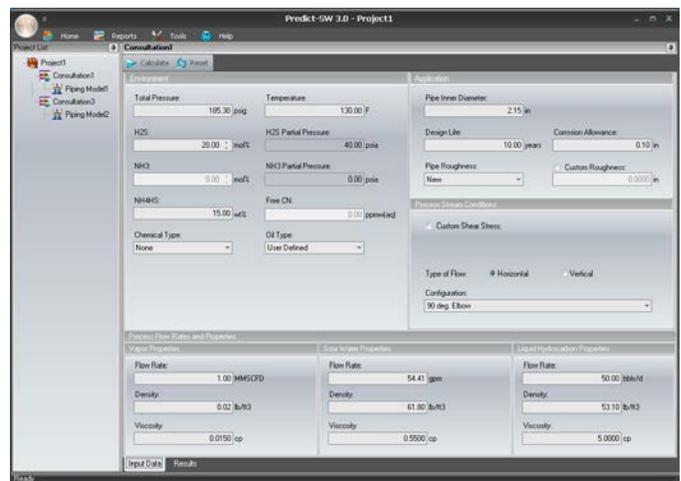
### Corrosion Testing and Modeling

- Corrosion prediction and Ionic modeling

- Operating condition analysis
- Sensitivity studies
- Process and service life projections
- Simulation of service environments

### Software

Honeywell's comprehensive set of software / modeling applications facilitates effective decision-making with efficient and robust solutions to critical problems in corrosion, cracking and materials selection. Built from proprietary, unique Joint Industry Program data, these models offer easy-to-implement solutions to complex corrosion prediction and material selection problems. Honeywell software models are applicable for corrosion prediction and material selection for process piping (refinery units), oil/gas pipelines and production systems.



Predict@-SW 3.0 program input interface, showing relevant inputs required for corrosion prediction

Our corrosion software applications include:

**Predict 6.1:** Assessment and prediction of corrosion rate for carbon steel in CO<sub>2</sub>/H<sub>2</sub>S production / transmission environments.

**Socrates 9.1:** Provides comprehensive selection of corrosion resistant alloys for oil and gas production / transmission applications.

**Predict-Pipe 4.0:** Automated Internal Corrosion Direct Assessment (ICDA) for gas transmission pipeline systems.

**Predict-Amine 3.0:** Prediction and assessment of corrosion in rich amine systems for increased throughput and process optimization.

**Predict-Crude 2.0:** Corrosion prediction and material selection tool designed to quantify high temperature naphthenic acid and sulfidation corrosion in refinery operations.

**Predict-SW 3.0:** Assessment of corrosion and flow effects.

Materials optimization and risk reduction for refinery sour water systems (REAC, strippers, etc.).

**Predict-SA 2.0:** Corrosion prediction and material selection for sulfuric acid alkylation units.

**Strategy-A 4.0:** Provides assessment of sulfide stress cracking and hydrogen induced cracking in steels, and prioritization of inspection in oil and gas production environments.

**Strategy-B 3.0:** Provides assessment of sulfide stress cracking and hydrogen induced cracking, and prioritization of inspection in steels in refinery sour water systems.

**Risk-IT 2.0:** Provides risk and integrity analysis for plant equipment and evaluates common forms of corrosion degradation.

Honeywell software models work together or singly to provide unique solutions to a range of process corrosion problems.

Additionally, coupled with Predict-RT, a Honeywell Real Time data management framework allows operators/engineers to see the impact of process transients on corrosion rates and enables them to use process data to account for corrosion effects and consequences as well as planning appropriate mitigation strategies.

Honeywell software models come 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.

#### For More Information

Learn more about how Honeywell's Corrosion prediction and assessment software can help you move to proactive maintenance, visit our website [www.honeywellprocess.com/corrosion](http://www.honeywellprocess.com/corrosion) or contact your Honeywell account manager.

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## Joint Industry Programs

Honeywell's Joint Industry Programs provide specialized corrosion engineering and research services for the investigation of critical, complex industrial corrosion problems. The sponsoring members share equally in the results of the research study.

Sponsors have the option for additional tests conducted on their behalf under similar operating conditions on a proprietary basis.

Current and past JIP programs include:

- H<sub>2</sub>S serviceability limits of modified 13-Cr materials in oil/gas production environments
- Predicting and quantifying corrosion in refinery crude units (CDU Overhead Corrosion)
- Minimizing refinery crude oil corrosivity (High Temperature Naphthenic and Sulfidic Corrosion)
- Sour Water (NH<sub>4</sub>HS) corrosion quantification and material selection for refinery applications
- Corrosion prediction and material selection for lean amine and rich amine systems
- Titanium alloys for high pressure, high temperature (HPHT) wells
- Remote monitoring of deep water pipelines
- Prediction and assessment of corrosion in amine systems (Phase 2)
- Corrosion prediction and assessment in sulfuric alkylation units
- Sulfide stress cracking (SSC) limits for sour service and deepwater offshore applications
- Predicting crude oil corrosivity, effects of velocity, interactions of crude oil composition, temperature and alloying
- Guidelines for coiled tubing in corrosive workover and production environments

Potential customers may either join on-going programs or access data / software from concluded JIP programs. For completed JIP programs, available deliverables include corrosion prediction / material selection software models and comprehensive JIP reports of data and analyses.