E²G INDUSTRY INSIGHTS

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E²G’S MATERIALS AND CORROSION BUSINESS UNIT
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The Materials and Corrosion (M&C) Business Unit has a wide range of technical expertise in industries ranging from Refining and Chemical to Utilities. E₂G has more than 350 years of combined industry experience at our fingertips. Our engineers are actively involved in leading industry organizations including NACE, API, WRC, MPC, MTI, AFPM, and IPEIA.

Below are just some of the ways we can put our wealth of knowledge and experience to use for you.

CORROSION CONTROL DOCUMENTS

Jurisdictions are encouraging facilities to develop increasingly more comprehensive, proactive documents regarding mechanical integrity and the associated damage mechanisms for their units. Corrosion Control Documents (CCDs) not only provide detailed guidance on how to control or minimize corrosion, but also how to safely maximize mechanical integrity, throughput, and profits. The E₂G M&C team has been providing similar documents since the formation of the company in 2002. E₂G is an active participant on the API 970 committee, which is in the process of publishing guidelines for CCDs. Each CCD is a custom document, tailored to a specific process unit. It includes detailed information on the process; applicable damage mechanisms; methods to prevent, mitigate, and minimize, damage from those mechanisms; and safe limits on operating parameters (IOWs).

INTEGRITY OPERATING WINDOWS

Setting Integrity Operating Windows (IOWs) for equipment is an important component of a successful mechanical integrity program. Our experienced engineers develop customized limits, or “windows,” on operation within which potential damage is minimized. Knowledge of the potential damage mechanisms for a particular unit is critical for the formation of appropriate IOWs. Let E₂G put our vast experience to work for you by creating individualized IOWs for your units today.

DAMAGE MECHANISM REVIEWS

Another integral part of a successful, proactive mechanical integrity program is a Damage Mechanism Review (DMR). This review is performed on the
Process Flow Diagram (PFD) level and can be a standalone document or prepared for use in advance of a Process Hazards Analysis (PHA) or CCD. E2G’s DMRs help clients understand where additional process monitoring, inspection, or procedural safeguards are needed.

**HHTA EVALUATIONS**

High Temperature Hydrogen Attack (HTHA) can result in the catastrophic failure of components. Reduce the risk of this occurring at your facility by having our experienced M&C engineers perform a P&ID level HHTA review of your process units to determine which components are at risk for HHTA. Once those components have been identified, E2G engineers can use our proprietary modelling software to estimate remaining life of components subject to HHTA with a more thorough HHTA evaluation. This evaluation predicts the HHTA damage progression by modelling the operation of a component from its installation, resulting in the most accurate assessment of HHTA damage available.

**HIGH TEMPERATURE HYDROGEN ATTACK JOINT INDUSTRY PROJECT (JIP)**

The M&C group started the HTHA-JIP in 2012 in step with the planned revision of API 941. A benchmark incident occurred a few years prior that made the industry again reconsider how to design, operate, and assess equipment in HTHA service. E2G assembled a team of leading NDT service providers to evaluate a large and varied selection of ex-service samples. The initial findings were deemed significant enough to further define the NDT capabilities on damage detection and sizing. The JIP is revisiting the original data used in API 941 and is developing FFS rules in the API 579 format. Additionally, E2G is developing a new mechanistic model to assess the deterioration of a material due to HHTA. A parallel requirement would be validation testing of field supplied samples to benchmark the model with historical data. Many of the major petrochemical companies are collaborating with small and mid-size owner-users in progressing this timely initiative.

**HF ACID ALKYLATION**

Reduce the uncertainty and risk surrounding your Hydrofluoric Acid Alkylation process by consulting one of E2G’s two leading experts on HF Alkylation: Jonathan Dobis and Andy Gysbers. Both Jon and Andy have authored numerous technical papers on the subject. E2G can provide an industry expert in HF Acid for needs including Hazardous Waste Operations and Emergency Response Standard (HAZWOPER), PHA, IOW, DMR and CCD support.
HOT TAPS

E²G performs hot tap analyses to minimize the potential risk of burn-through and weld cracking due to high cooling rates. When a weld pool is cooled too quickly, the microstructure in the heat affected zone (HAZ) can become brittle, resulting in the formation of cracks. E²G can analyze your hot taps and provide acceptable ranges for the welding parameters (e.g., amps, volts, and travel speed) that minimize the potential for burn-through and HAZ cracking.

FIRE DAMAGE ASSESSMENTS

While we all strive to avoid any release of containment, it does occasionally occur. In the event the unthinkable happens to you, the experienced engineers at E²G can assist by performing a fire damage assessment per API 579-1/ASME FFS-1 Part 11. Our engineers use the available clues in the aftermath of an event to focus your inspection efforts to identify those components which need to be replaced, those that need to be refurbished, and those that remain safe to continue operating.

CREEP ASSESSMENTS

Our M&C experts perform remaining creep life assessments for fired heater tubes with and without Omega creep testing. If tube metal temperatures are available, we can provide accurate remaining life calculations per API 579-1/ASME FFS-1 Part 10. When data is not available, we can perform destructive testing to determine the current level of creep damage and estimate remaining life. Look for more information on creep assessments in a future article.

FAILURE ANALYSES

When a component fails, the contribution of an experienced M&C engineer to the Root Cause Failure Analysis (RCFA) is critical to ensure a quick and accurate conclusion. With more than 350 years of combined metallurgical experience, we can get to the bottom of any failure.

ENGINEERING PRACTICES

The M&C group stewards Section 10 of Equity’s Engineering Practices (EEPs), and provides expertise for the rest of the collection. The EEPs are a comprehensive set of best practices or guidelines for maintenance and construction of refining, petrochemical, renewal energy, pipeline, and midstream facilities. This collection is a living document maintained by E²G and updated based on user feedback and subject matter expert opinion.

TRAINING

On behalf of API, E²G’s M&C engineers teach the API RP 571 course, “Damage Mechanisms in the Refining Industry”. Our industry experience allows us to intersperse real world examples into the content and makes the course engaging. Other courses our M&C personnel have taught or assisted in teaching include Metallurgy, RBI, and Welding. Contact us if you would like a customized training course for your facility.

FROM UPSTREAM THROUGH MIDSTREAM AND DOWNSTREAM, AND FROM INDIVIDUAL FACILITIES TO MAJOR INTEGRATED OIL AND GAS COMPANIES, WHETHER YOUR NEEDS ARE IN THE MILLIONS OF BARRELS PER DAY OR PARTS PER BILLION LEVEL, E²G HAS THE M&C EXPERTS TO SOLVE YOUR PROBLEMS.
MATERIALS AND CORROSION

RISK-BASED INSPECTION

Knowledgeable M&C experts are at the heart of every successful Risk-Based Inspection (RBI) program. E2G’s M&C engineers have been at the core of our RBI implementation since the formation of the company in 2002.

FITNESS-FOR-SERVICE

E2G leads the industry in the caliber of Fitness-For-Service (FFS) personnel. Our M&C engineers are consulted to help provide clients with the “how,” “why,” and “what can I do about it” answers that go beyond whether the component is fit for continued service.

From upstream through midstream and downstream, and from individual facilities to major integrated oil and gas companies, whether your needs are in the millions of barrels per day or parts per billion level, E2G has the M&C experts to solve your problems.

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