Microbiologically Influenced Corrosion Detection

Quick Break Training **14 March 2009**

Corrosion is more recognized by its effects than cause. Effects stand out through leaking tanks and pipes, sudden pressure drops in an industrial complex, increases in the treatment costs, reduced efficiencies in the system, and increased secondary environmental impacts. All of these events are acute problems that require immediate expenditures to achieve control. The chronic causes of corrosion are often forgotten while the acute symptoms are more easily recognized and corrected but often at a high cost. Acute causes of corrosion most commonly are reflected sudden onsets of perforations leading to leakages and plant system failures. Recognition of these risks is often achieved by building a greater corrosion allowance in the materials but this does not address the cause merely controls to some extent the effect.

Cause of corrosion is fundamentally two fold. First the microbes associated with corrosion (i.e. MIC) would need to be present and active. Second the environment should be conducive to the development of the various MIC events that would lead to corrosion. Detection can involve three stages that are not necessarily always performed in the same order: (1) determine the presence of active MIC communities; (2) diagnose the corrosion risk potential based upon the determination of levels of MIC activity; and (3) evaluate the nature of the corrosion through its form and function. Ideally the order to conduct the survey would be to go from 1 through to 3. If corrosion has already occurred then it necessary to: determine the effect (3) and then undertake the establishment of cause (1 and 2). In industrial practices it is often this latter route that is followed.

There are three critical components to the determination of an MIC activity. One method is biochemical and involves and assessment of the ATP at the site. If there is biological activity then there would be a significant level of ATP associated with the growing MIC biomass. The other two methods are cultural and determine the activity of the sulfate reducing bacteria (SRB) and the acid producing bacteria (APB) using the BART tester system. These BART methods allow the amount of corrosion risk to be assessed on the basis of the activity (recorded as time lapses) and reactions. If ATP levels are high and the SRB- and/or APB- BART data shows very active bacterial communities then the causative agents can be recognized.

Diagnosis of the corrosion risk in the sampled environment is based firstly on the ATP which is measured in picograms with significant MIC presences being at greater than 1,000pg/g or pg/ml. For the SRB- and APB- BART test data the critical risk would be generated when the time lapse is less than three days. In the SRB-BART test then a BB reaction would indicate that it would be more difficult to achieve control because of the more covert (pitting) nature of these growths. BT reaction is generally more manageable since here the SRB are site deep within the biomass and can be treated by disruption of that biomass. APB-BART data has one reaction (DY) and this type of MIC is more associated with lateral slow growing biofilms that eventually lead to more generalized failures.

Nature of the MIC at site may be examined by looking for pits and perforations, encrustations, nodules, tubercles, ochres, and various forms of biomass plugging. It is also important to determine whether there are any significant electrical motive forces (e.g. buried power cables) that might be attracting the attention of MIC.

Droycon Bioconcepts Inc., 315 Dewdney Avenue, Regina, SK, Canada S4N 0E7
(306) 585 1762; fax: (306) 585 3000 www.dbi.ca