STEM-Corrosion™

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Learning from the Mistakes

Time-tested and proven for effective, economical, and holistic corrosion control strategy is the **5-M Methodology**. The implementation of the 5-M Methodology is tracked using fifty (50) key performance indicators (KPI).

Twenty-five plus (25+) case studies explaining how the 5-M Methodology has been implemented around the world are available at **CorrMagnet Journal**. These papers have been reviewed by at least two industry experts.

Despite careful implementation of technically proven solutions in the oil and gas industry, failures do happen. Lessens-learned from such failures will help to avoid recurrence of such and similar failures. One case study (that CorrMagnet co-authored) on failure analysis of once-through steam generators (OTSG) is included in the recently published **Canadian IMPACT** study.

Software products, **STEM_Risk_Pipeline™**, **iFILMS™** and **Expedition™** were developed based on review of 200+ failure analysis and, hence, are effective tools to control corrosion in the oil and gas industry.

Top Influencer of This Newsletter:

Narasi Sridhar

My Story

I came to the United States in 1975 after finishing an undergraduate degree in Metallurgy in Indian Institute of Technology, Madras (Chennai), India.

My original goal was to continue my research from my undergraduate studies in X-ray diffraction of deformation structures, but I got interested in environmentally assisted cracking phenomena, which also brought me to an alloy manufacturer (Haynes International), where I was involved in Ni-base, Co-base, and stainless-steel alloy development for nine years. Those were heady days for alloy development research because we had the resources and management encouragement to try out a lot of different combinations of alloying elements, but our laboratory and modeling capabilities were limited. An important collaborator and mentor during this time was Juri Kolts.

I then moved to a non-profit research organization (Southwest Research Institute, SwRI) focusing on life prediction and risk assessment, principally related to metallic nuclear waste containers, but also involving pipelines, upstream, and downstream oil and gas systems. It also brought me in contact with a diverse group of experts in earth sciences and risk assessment. Along the way, my group developed novel sensors for monitoring internal corrosion in pipelines and sensors for coating degradation. My time at SwRI involved deep collaborations with people such as, Gustavo Cragnolino (deceased) and Darrell Dunn, among others. I also started a collaboration with Andrzej Anderko at OLI Systems in developing a model for localized corrosion in complex chemical environment that continues to this day.

After 19 years at SwRI, I was fortunate to go to DNV and grow a research group focused on materials and work as a Research Professor at the Fontana Corrosion Center in The Ohio State University. This phase of my career involved developing new methods of risk assessments using Bayesian network models, sensors, and electrochemical processes for converting CO_2 into useful products. We also did quite a bit of work on SCC problems related to ethanol storage and transportation, nitrate/nitrite environments for storage of defense nuclear wastes, and sour service environments. We combined wireless sensor networks with Bayesian networks to develop the concept of "real-time" risk assessment. Most importantly, I benefited from interactions with leading corrosion experts, such as John Beavers, Gerry Koch, and Jerry Frankel (OSU), as well as many talented younger researchers.

After 13 years at DNV, I started my own consulting company, MC Consult LLC (https://www.mcconsultco.com). I am engaged in diverse consulting services and developing Bayesian network-based models.

My wife and I live in the beautiful town of Temecula, California, surrounded by nice wineries.

My Style

Early in my career, I was more "I" shaped – deeply knowledgeable in one area at the exclusion of others. I have become more "T" shaped. I like to look across different disciplines and integrate the knowledge from diverse areas. I think such a cross-cutting approach is essential to solving problems in complex industrial systems and in our society.

I consider my style to be collaborative, but with a focus on driving towards decisions based on quantitative understanding of the problem. In my consulting work, I focus on more than delivering my specific experience in an industry – I try to add value to my experience by capturing what is known in other fields that may have a relationship to the problem at hand. I use data, experience, and computational models to extrapolate these results from known to unknown conditions.

Greatest Contribution

I would say that predicting the occurrence of corrosion or cracking in diverse systems is probably my most extensive contribution to the corrosion field. The approach involves quantifying the chemistry of the environment and combining it with metallurgy and electrochemistry. A key has been the simplification of detailed fundamental models and combining them in a Bayesian Network to predict the likelihood of a threat. This approach has been used in pipelines, chemical process industry, oil and gas upstream systems, and nuclear waste storage.

PS: Industry recognizes that Narasi Sridhar started the task group that eventually developed NACE SP 0110, "Wet Gas Internal Corrosion Direct Assessment" Standard. He was the first chair of this task group.

Pinnacle Moment

I don't have one pinnacle moment. My career has seen a series of plateaus. I have acquired new knowledge, capabilities, and perspectives with every new job and collaboration. Nevertheless, I still consider my leading the group involved in long-term life prediction of nuclear waste containers at SwRI as an important time period in my career because it brought together the many streams of ideas that I continue to work on today.

During that time, I worked with a diverse group of talents from different national and cultural backgrounds, and we were socially well-knit. Science is, after all, a social enterprise. We felt that we were working on an important problem, but we had a lot of fun doing it.

I was privileged to deliver the 2011 NACE Annual Conference Plenary Lecture and the 2017 NACE Frank Newman Speller Award lecture, both devoted to risk assessment of corrodible systems. These topics continue to attract attention in the materials and corrosion community.

Advice to Industry

Avoid becoming siloed – it is important to look around and seek out knowledge from other experts. Do not discount inputs from those who may not speak the language of your industry – outside experts may have critical insights to problems that may have been passed over by the experts who are deeply entrenched in your industry. Sometimes a deeply involved expert may be reluctant to try solutions because he/she has seen too many failures or dead ends.

Secondly, acquire mentors at every stage of your career. Mentors have been the keys to my success. They do not have to be within your organization or even be older than you.