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DO YOU KNOW WHAT CORROSION IS COSTING YOUR ORGANIZATION?

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In 2001, a study conducted by CC Technologies Laboratories, Inc. estimated that the effects of corrosion in the United States cost an estimated $276 billion dollars a year. This equated to approximately 3.1percent of the nation's gross domestic product (GNP - market value of all final goods and services made within the borders of a nation in a year) at the time. In the subsequent nine years, we can project that the cost of corrosion problems in the US today has increased.

The question beckons - "do we know what corrosion is costing our respective companies?" What is the decreased reliability of machinery, equipment and structures caused by corrosion costing us? What is the potential cost of lost revenue due to disruption of services? What are we spending on labor and equipment for corrosion repair and maintenance?

When we stop and give some thought to such things as: what is the leaking cooling tower costing us, the potential liability associated with spalling concrete in the parking garage or the likely repercussions of an hydrostatic water issue in the elevator pit saturating the machinery, we quickly come to the realization that corrosion is costing us much more than we ever imagined. So what do we do about it?

I believe if we are aware of an issue and have a basic level of knowledge regarding the challenges of that issue then we are better prepared to deal with it. To this end, let's define corrosion and quickly identify the most basic forms we might encounter in our industry on a daily basis.

Generally, corrosion encompasses the process that involves the deterioration of metal. Ultimately, corrosion is the chemical wearing away of a metallic substrate. The most common forms we see in our industry are:

General/Uniform Corrosion - example: rusting steel - the metal loss occurs at essentially the same rate (uniformly) over the metal surface (no pitting/deep pockets of corrosion are evident), hence the term uniform corrosion. Uniform corrosion is considered to be one of the most common forms of corrosion and is relatively easy to address through the thoughtful selection of materials, coatings and corrosion control methods. Although unsightly, uniform corrosion is generally insignificant in that it is usually addressed prior to becoming an issue.

If the corrosion is left untreated, it can weaken the structure or pipe to the extent that the entire substrate or pipe will need to be completely replaced, a costly solution. Untreated metal wants to return to its natural state which is not a solid formed material but rather an unstable material that would have little no structural integrity. This is why it is critical to use preventative maintenance and address these issues before a bigger problem arises.

Atmospheric Corrosion - Degradation of a material as a result of coming in contact with substances present in the atmosphere. Atmospheric corrosion occurs on a steel surface when the steel becomes wet from rain, humidity, etc and the moisture is combined with impurities/pollutants present in the air; such as: chlorides from sea air and/or industrial pollutants (carbon dioxide, sulfur, etc.). In moist environments where atmospheric impurities are high, corrosion can occur rapidly. The corrosion can have marked visual differences dependent on the location and the environment/atmosphere. For example in an atmosphere near the ocean (chlorides) or in an industrial area (carbon dioxide) the surface can have a very rough corrosion face with evident pitting present, where in a different environment the corrosion might be smoother. Both are certainly worthy of concern; however, keep in mind the chemical reactions taking place (due to the atmosphere) can give rise to different corrosion mechanisms and therefore a different appearance.

Galvanic Corrosion/Bi-metallic Corrosion - A galvanic reaction occurs when two dissimilar metals are in contact with one another in an electrolyte. The end result is that the less noble metal (anode) will sacrifice itself to the more noble metal (cathode). The more disparate the metals are in the galvanic series of metals, the more rapidly the corrosive action will occur. As an example, zinc anodes which are very low on the galvanic series are often used to intentionally create a galvanic reaction so, they will sacrifice themselves in lieu of the steel, like a ship hull or pipeline,

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they are protecting. However, many times galvanic reactions are set-up unintentionally, which often leads to severe consequences.

As this relates to bi-metallic corrosion – unaddressed, the less noble metal will sacrifice itself to the point of failure. The classic example that comes to mind involves the use of a carbon steel tube sheet in conjunction with titanium tubes. The tube sheet deteriorated to the point of requiring replacement in less than two years. The advantage of utilizing advanced polymer composite coatings is that, oftentimes, it is possible to insulate the dissimilar metals so the galvanic/bi-metallic reaction is eliminated.

When applying any polymer coating the surface has to be properly prepared or the material will not bond to the substrate. A rule of thumb is to have the surface clean, dry and rough. Clean means using a solvent such as an MEK to remove all surface contamination. If necessary, apply moderate heat and/or allow the components to leach to remove ingrained contaminants. Dry means that the surface is free of moisture and cannot cause the material to fail after curing. Rough means to roughen the surface by abrasive blasting to achieve a white metal degree of cleanliness and an anchor pattern of three mils. Generally a size 16 white aluminum oxide is ideal to achieve this profile.

Concrete Corrosion/Corrosion in Reinforcing Steel - Needless to say, concrete itself doesn't corrode; however, a vast majority of the concrete used in buildings and structures contains reinforcing steel. In instances where the quality of concrete is poor and, therefore, highly permeable to moisture, or in which calcium chloride was used as an additive due to having to pour concrete in cold weather, or the thickness of the concrete over the reinforcing steel was not adequate to protect the steel from moisture, corrosion of the reinforcing steel is often a major problem. Once the reinforcing steel begins to corrode, the rust expands and flakes, thereby cracking the concrete and delaminating it from the reinforcing steel. The cracking then allows further moisture to penetrate the concrete, exacerbating the problem

The preceding is certainly not an exhaustive list of the corrosion issues that might be seen in industrial refrigeration. Keep in mind, complete books have been written on the subject of corrosion, there are entire fields of study on the subject and, of course, there are people who have chosen to make the identification and prevention of corrosion their life's work. However, if this short article has made you more aware of corrosion and what it might be costing your compnay, it has served its purpose.

Now that you are more aware of the potential corrosion issues in your facility and the challenges they present, what do you do about them? There are a number of options available, ranging from traditional paint to ultra-high performance polymer composite rebuilding and coating systems to corrosion inhibitors, alloys and catholic protection.

During the last decade, a great deal of research has gone into the development of a new breed of a highly advanced polymer composite coating and rebuilding systems. Some of these systems are quite unique as a result of their physical properties, in that some possess extremely high bond strengths, often in excess of the rate at which ferrous corrosion/rust grows, are 100 percent solids and have no odor, and can be used to rebuild (paste grade components) and protect (liquid grade) vital machinery, equipment and structures from the effects of erosion, corrosion, wear, chemical attack and hydrostatic water transmission.

Hopefully, this information has motivated you to begin exploring what corrosion is costing your company and has provided a method to evaluate your findings. As you explore potential remedies for your corrosion challenges, keep in mind, every solution has it application. So, look at all your options, be curious and make good informed decisions based on long-term results and you will be a winner in your battle against corrosion.

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