Protection from the Elements

When a significant capital investment is made to acquire an asset, it is common for the owner to insist that a protective coating be applied. Unfortunately, coating systems fail from exposure to ultraviolet (UV) radiation, moisture, chemical and biological agents, and abrasion, often exacerbated when experienced cyclically. How can the life of the coating be maximized?

Prolonged exposure to UV radiation causes organic coatings to deteriorate. This is a process known as photo-oxidation deterioration. CARC1 coating systems, which are widely applied to military vehicles, are considered "flat gloss" finishes. Flat gloss finishes absorb UV and infrared radiation much faster than gloss finishes do [1], making additional protection critical to the longevity of CARC coatings.

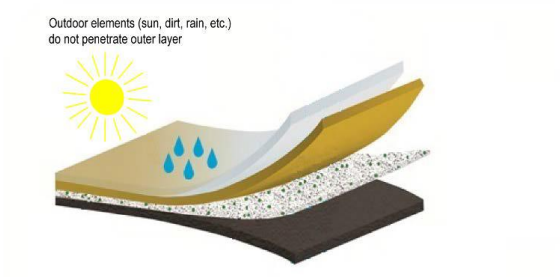

Figure 1. Advanced corrosion control covers protect against many agents.

Coating failures create openings for moisture and oxidation agents to accelerate corrosion of the substrate. Substrate corrosion leads to more severe and widespread coating failure [2]. Once a coating fails it starts a cycle that degrades over time, as shown in Figure 2.

Precipitation and humidity accelerate the rate of corrosion. Daily condensation and dew will pond in all surface micro-cracks in a coating. As the water expands during a freeze-thaw cycle, it opens the micro-crack further, allowing more water to pond. As the cycling continues, the micro-cracks grow both wider and deeper, until the crack penetrates the full coating thickness and the metal substrate is exposed to water and other elements of the corrosion cycle.

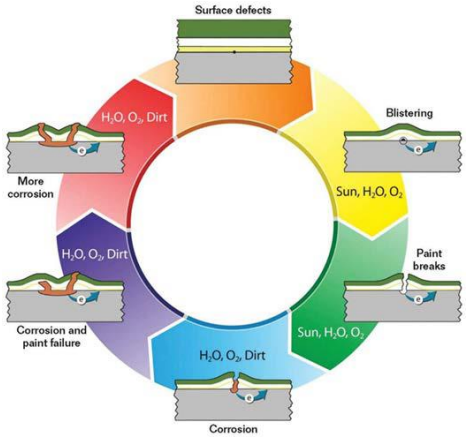

Figure 2. Paint failure and corrosion cycle.

Acid rain forms in the presence of water-soluble salts. These salts result from high concentrations of carbon dioxide (CO_2), sulfur dioxide (SO_2), nitric oxides (NO_X), greenhouse gases, and other pollutants in the atmosphere. Over time, acid rain damages and breaks down all coatings and finishes.

Abrasion causes coating damage when sand, dust, or dirt come in contact with the coating. It should also be noted that structural strains [3] from cyclical and thermal fatigue [4] can also contribute to coating degradation.

It is recommended that corrosion control covers be employed on important assets to protect against the elements CARC paint alone cannot defend.

References
[1] Ozol, S., Todt, G., Vold, J. Preserving CARC with Corrosion Control Covers, Materials Performance NACE International, Vol. 53, No. 2, 2014, pp. 34-39
[2] Broesder, E., Forever Young, *World Pipelines,* January 2012.
[3] Hare, C. H., Trouble with Paint, Adhesive and Cohesive Failure: Definitions and Fundamental Macro-Effects, Journal of Protective Coatings and Linings, Vol. 12, No. 10, 1995, pp. 177
[4] Holmes, J. W., McClintock, F. A., The Chemical and Mechanical Process of Thermal Fatigue Degradation of an Aluminide Coating, Metallurgical Transactions A, Vol. 21, No. 4, 1990, pp. 1209-1222

1 CARC - chemical agent resistant coatings

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