HIGH-RISK FACILITY TYPES AND BUILDING COMPONENTS FOR CPC

by Joseph C. Dean, P.E. for the Director, Corrosion Policy & Oversight (D, CPO) [OUSD (AT&L)]

Updated: 11/9/2017

This list of high risk facility types and building components (e.g. utilities, structures, and building systems) with significant cost of corrosion impacts (i.e. life cycle durability, sustainability and longevity) requires or benefits from careful selection of appropriate CPC features. The effect of corrosion due to the environment both outside and inside facilities can be considerably intensified by the facility type, use and location. In many instances, appropriate CPC features may not be sufficiently covered by standard unit costs and area cost factors. Note that the environment that affects a specific material or system correlates directly to the conditions of the "micro-environment," which is the "local environment" that occurs on the surface of the material or system that it actually experiences. For an explanation of Environmental Severity and how it affects facility condition see the CPC Source Environmental Severity Classification (ESC) page (http://www.wbdg.org/ffc/dod/cpc-source/environmental-severity-classification). See the Corrosion Science Knowledge page (http://www.wbdg.org/ffc/dod/cpc-source/corrosion-science-knowledge-area) for additional background.

FACILITY TYPE	RISK DESCRIPTOR	CORROSION STRESSORS	ENVIRONMENTAL SEVERITY	MISSION IMPACT
Pavements	Asphalt binder breakdown, loss of flexibility, cracking & pothole failure, base course & structural failure. Concrete pavement reinforcing steel corrosion causing spalling and surface failure.	Thermal & photo oxidation, ultra-violet radiation degradation, Freeze Thaw (frost heave). Corrosion of reinforcing steel (Concrete Pavements). Chemical impacts (salt & other chemicals). Heat impacts of jet blast.	Varies based on Environmental Severity Zone.	For operational pavements such as airfields & critical road infrastructure, loss of mission capability affecting the National Defense. For roads & related pavements, inability to support designed functions creating delays, congestion, disruption. Access denial.
Waterfront & Coastal	Extreme corrosion	Salt water, dramatic shifts in	Varies based on Environmental	Facility availability, high sustainment

Structures	exposure, high risk of structural failure, sea level rise (fixed elevation exposure to high salinity impacts from dramatic variations in sea level).	tides, temperature, moisture, water borne pollutants.	Severity Zone. Typically, C3 (coastal areas with low salinity), C4(coastal areas with moderate salinity), and C5(coastal areas with high salinity).	costs, reduced life cycle, structural degradation. Shoreline erosion, reduced capacity and berthing availability.
Wastewater Plants	Highly corrosive environment, catastrophic equipment failure, rust, mildew, cathodic protection related corrosion risks (see UFC 3-240-13FN).	Water borne corrosive pollutants, temperature, moisture, corrosive chemical reactions, abrasive, pitting, cathodic, mold, mildew, organic growth & reactions.	"Micro-environment" and based on Environmental Severity Zone.	Public health risks, environmental pollution, high cost repairs and recovery.
Interior spaces with high humidity, plumbing & fixtures	Mold, Mildew, Humidity, Corrosion.	Humidity, temperature, moisture, poor air circulation, air borne corrosive pollutants.	"Micro-environment"	Health, morale, safety, high maintenance costs.
HVAC SYSTEM	Corrosion, air quality, galvanic corrosion, coatings, mold, mildew, disease, humidity control, facility surface and structural deterioration.	Air borne corrosive pollutants, temperature, moisture, corrosive chemical reactions, abrasive, pitting, galvanic corrosion, mold, mildew, dissimilar metals, corrosion soils affecting buried chilled water lines.	"Micro-environment" and varies based on Environmental Severity Zone.	Health, structural integrity, morale, safety, high sustainment cost impacts, reduced life cycle, interrupted operations that require HVAC.
Fire Protection System	Rust in high risk areas impacting system operation and availability, with associated risk to structure and life safety (See UFC 3-600-	Moisture, salt water/air, inadequate coatings, pitting, internal corrosion.	"Micro-environment" and varies based on Environmental Severity Zone.	Denial of facility availability, safety, asset protection, high cost of facility replacement, potential loss of life.

	01).			
Building Envelopes	In highly corrosive environment, exterior equipment and system failure (e.g. roof, windows, doors), rust, mildew, weather affects and related corrosion risks.	Humidity, wind, temperature, moisture, corrosive chemical reactions, efflorescence, abrasive, pitting, galvanic corrosion, mold, mildew, air borne corrosive pollutants.	Varies based on Environmental Severity Zone.	Structural integrity, morale, safety, high sustainment cost impacts, reduced life cycle.

Note:

1. Interior structural impacts will vary in intensity based upon Environmental Severity area (http://www.wbdg.org/ffc/dod/cpc-source/environmental-severity-classification) and environmental controls.
2. In areas of high humidity or industrial pollutants, the HVAC will have to be designed to address the "micro environment" impacts on the system. The cost of management and associated impacts of the "micro environment" are generally costly and, therefore, a significant cost of the total project. Addressing this in initial estimates along with high-level documentation in the 1391 will ensure that the system and components are adequately funded and constructed once approved.
3. In addition to environmental severity, the rate of corrosion can be affected by:
    a. Chemical stresses - increased presence of corrosive atmospheric contaminants due to facility type/use (i.e. pollutants derived from operation of a facility generating pollutants).
    b. Mechanical stresses:
        i. Atmospheric - abrasive stresses such as erosion from wind due to presence of particulates such as sand.
        ii. Hydro-dynamic - abrasive stresses in water from solid debris or flow/current affecting waterfront and/or immersed structures and components.
        iii. Structural - stresses on structural materials or components due to strain, compression, elasticity, tensile forces, etc. and/or high temperatures causing stress corrosion cracking
    c. Condensation - can be particularly corrosive in areas where condensation may occur at regular intervals such as in cooling pipes and contributes to surface wetness.
    d. Increased salinity and associated negative impacts due to areas where deicing salt is used.