FORREST
Technical Coatings

Why Some Environments
Accelerate Corrosion



While corrosion itself is inevitable, the speed and severity at which it occurs are largely controlled by the environment surrounding the metal. Two components made from the same material, manufactured to the same specification, can experience dramatically different service lives depending on where and how they are exposed.

Understanding environmental severity is one of the most important steps in managing corrosion risk.

Environment Determines Corrosion Rate

Corrosion requires interaction between a metal and its surroundings. Factors such as moisture, air quality or pollution, contaminants, and temperature all influence how quickly corrosion reactions proceed.

In practical terms, environments that:

- Retain moisture for long periods
- Contain salts or pollutants
- Experience frequent temperature changes
- Combine heat with chemical exposure

will generally accelerate corrosion compared to clean, dry, and stable conditions.

However, no environment is entirely benign. Even indoor or seemingly mild conditions can become corrosive under the right circumstances.



Corrosion Is Environment-Driven.
Corrosion severity is often determined less by the metal itself and more by where and how it is used.

Common Corrosive Environments

For discussion purposes, corrosive environments are often grouped into broad categories. These categories frequently overlap, but they provide a useful framework for understanding relative corrosion risk.

Industrial Environments

Industrial atmospheres are typically characterized by airborne pollutants such as sulfur compounds, nitrogen oxides, and chlorides. These contaminants may originate from combustion processes, chemical manufacturing, material handling, or nearby industrial activity.

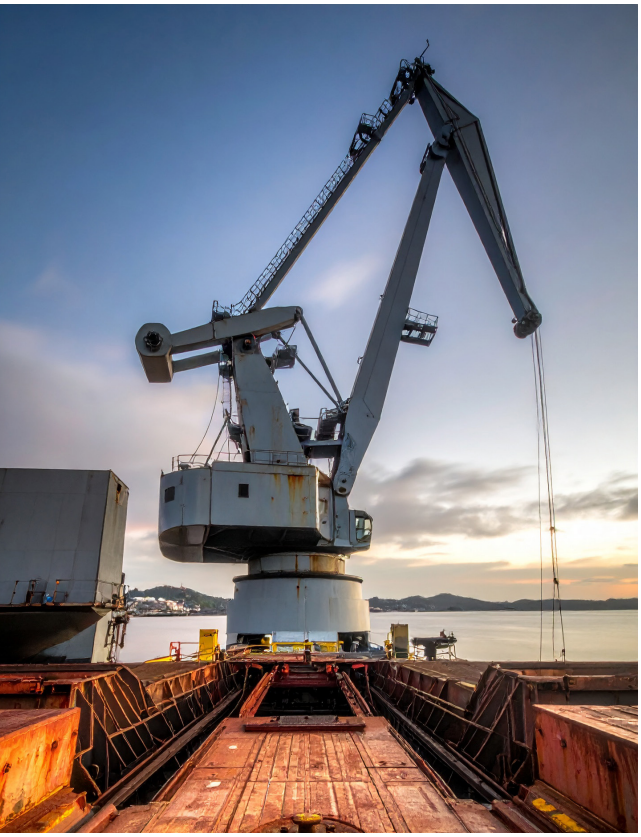
When combined with moisture, these pollutants can form acidic compounds that settle on metal surfaces, significantly accelerating corrosion reactions. Urban environments often fall into this category due to vehicle emissions and concentrated industrial activity.

Key contributors:

- Acidic gases
- Chemical vapors
- Particulate deposition
- Condensation on surfaces



Pollution + Moisture = Accelerated Corrosion
Many industrial pollutants are far more aggressive when moisture is present, even in small amounts.



Marine and Coastal Environments

Marine environments are among the most corrosive atmospheric conditions encountered in service. Salt particles carried by wind settle on exposed surfaces and readily dissolve in moisture, creating highly conductive electrolytes that promote corrosion.

Corrosion severity typically decreases with distance from the coast, but wind direction, elevation, and equipment orientation all influence exposure. Areas subject to sea spray, splash zones, or intermittent wetting experience especially aggressive attack.

Key contributors:

- Chloride contamination
- Persistent surface wetting
- Salt deposition in crevices and joints

Rural and Natural Environments

Rural environments generally lack strong chemical pollutants, but corrosion still occurs due to moisture, oxygen, and airborne dust. In these settings, corrosion rates are often controlled by humidity levels, rainfall frequency, and temperature cycles.

Certain rural variations can be unexpectedly aggressive:

- Arid regions with high humidity and condensation
- Tropical climates with heat, moisture, and long condensation periods
- Sheltered areas where moisture persists after sunrise



“Mild” Does Not Mean Non-Corrosive
Even environments without visible pollution can support corrosion if moisture and oxygen are present.

Indoor and Enclosed Environments

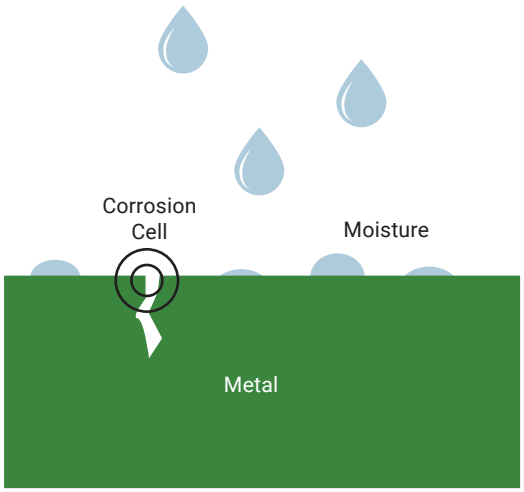
Indoor environments are often assumed to be non-corrosive, but this assumption can be misleading. Enclosed spaces may trap humidity, fumes, or chemical vapors that accelerate corrosion. This is particularly true if ventilation is limited.

Condensation inside buildings, tanks, or enclosures can create localized corrosive conditions even when exterior exposure appears minimal.

Common indoor risk factors:

- Poor ventilation
- Chemical fumes
- Temperature fluctuations
- Intermittent condensation





The Role of Moisture and Time-of-Wetness

Moisture is one of the most critical variables in atmospheric corrosion. Even small amounts of condensation can act as an electrolyte, enabling corrosion cells to form on metal surfaces.

The concept of time-of-wetness, or how long a surface remains damp, often matters more than total rainfall. Surfaces that dry quickly may experience less corrosion than those that remain wet for extended periods, even if overall exposure appears similar.

Time Matters
Short, frequent wetting cycles can be more damaging than occasional heavy exposure if surfaces do not fully dry.



Temperature Effects on Corrosion

Temperature influences corrosion in two important ways:

1. It accelerates chemical reaction rates
2. It affects moisture behavior through evaporation and condensation

Higher temperatures in conjunction with humidity or contaminants, generally increase corrosion rates, but temperature cycling can be equally damaging. Repeated heating and cooling promotes condensation, coating stress, and breakdown of protective barriers.

At elevated temperatures, corrosion mechanisms may change entirely, transitioning from moisture-driven electrochemical reactions to direct chemical attack by gases. These conditions are addressed later in this guide.

Why Environmental Understanding Matters

Corrosion failures are often traced back not to material defects, but to misalignment between the environment and the protection strategy. When environmental severity is underestimated, corrosion progresses faster than anticipated.

By understanding the environmental conditions an asset will face, it becomes possible to:

- Anticipate corrosion risks earlier
- Select more appropriate protection methods
- Extend service life and reduce unplanned downtime



Corrosion Risk Starts with Environment
Effective corrosion control begins with understanding exposure - not with selecting a product.

Key Takeaway

Corrosion does not occur in isolation. The environment determines how aggressively corrosion progresses and where damage is most likely to occur. Even subtle differences in exposure, such as moisture retention, pollutants, or temperature cycling, can dramatically alter outcomes.

Recognizing environmental severity is a critical step toward controlling corrosion and improving long-term performance.

About Forrest Technical Coatings

For more than 50 years, Forrest Technical Coatings has manufactured specialty coating systems designed to perform in demanding service environments. Based in the United States with a global customer footprint, Forrest works closely with equipment manufacturers, engineers, and operators to address corrosion, heat, and environmental exposure challenges across a wide range of industries.

Forrest's portfolio includes industrial and high-temperature coating systems for applications such as biomass processing, exhaust and thermal equipment, power generation, and other corrosion-prone environments. Products such as the INFERNEX® high-temperature coating systems are engineered to withstand elevated temperatures, aggressive atmospheres, and real-world operating conditions.

As a manufacturer, Forrest focuses on understanding how the environment, substrate, and service conditions interact, and on formulating coatings that align with those realities.

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