

## **Corrosion Protection during Storage & Transit using Vapor Phase Corrosion Inhibitors**

Compiled for CII by:



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### **Definition of Corrosion:**

Corrosion is defined as the destruction, degradation or deterioration of material due to the reaction between the material and its environment.

### **Industry's Enemy:**

Corrosion is a constant indiscriminate and costly enemy of metal parts, whether the parts are packaged for storage and distribution, or whether they are under manufacture inside the plant.

## **Corrosion Control and Prevention:**

### **Traditional methods:**

- Materials selection – use more resistant metal
- Traditional Coatings – metallic and organic
- Cathodic and anodic protection
- Use of barrier bags and dessicants

Traditional anti-corrosion methods are sometimes messy, costly and can be hazardous to personnel and the environment. Too often, they are ineffective as well.

### **Current Trend:**

- Use of Corrosion Inhibitors

Classification of Corrosion Inhibitors:

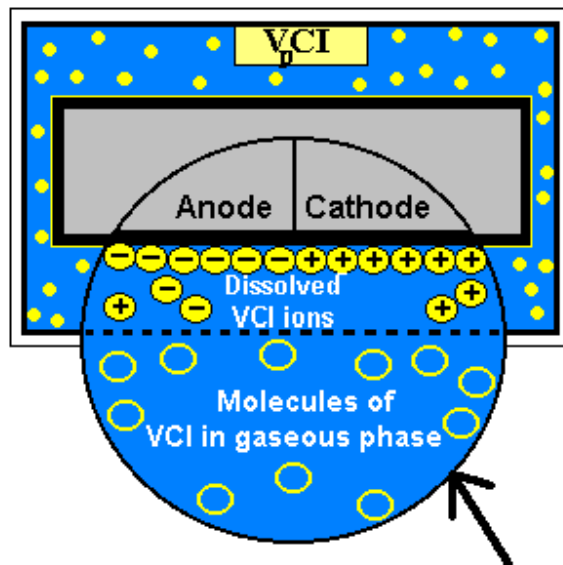
- Anodic (nitrites)
- Cathodic (arsenic, bismuth, antimony)
- Precipitation (silicates, phosphates)
- Organic/Filming (amines, sulfonates)
- Vapor-Phase

## **VpCI - Vapor Phase Corrosion Inhibitor**

What are Vapor Phase Corrosion Inhibitors:

- Organic Chemicals
- Comprise of Carboxylate Amine Salts
- Vaporises under atmospheric conditions and condenses on all metal surfaces including recessed areas and cavities
- Passivates the corrosion cells on metal surfaces
- Provides both anodic and cathodic protection

## How does VpCI work:



Enlarged view of metal surface

VpCI vaporizes and ionizes

VpCI Ions dissolve in the electrolyte (Moisture)

VpCI Ions always travel towards the metal

VpCI Migrates to recessed areas and cavities

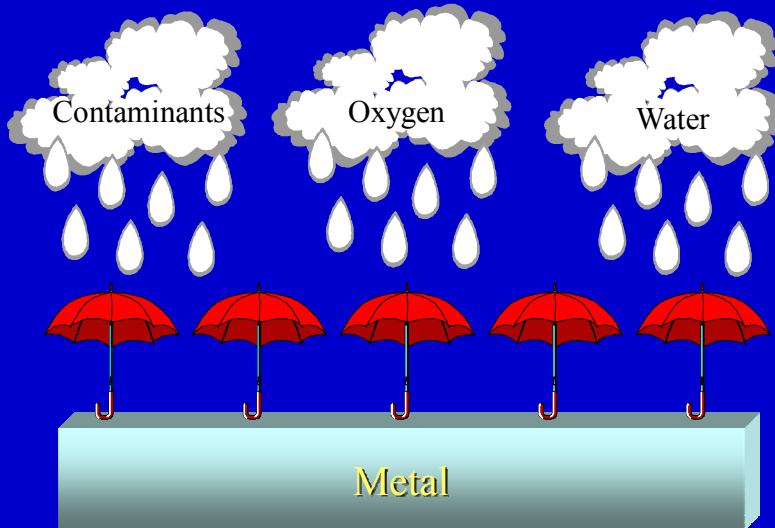
VpCI Ions form a thin monomolecular protective film on the metal surface

VpCI re-heals and self-replenishes

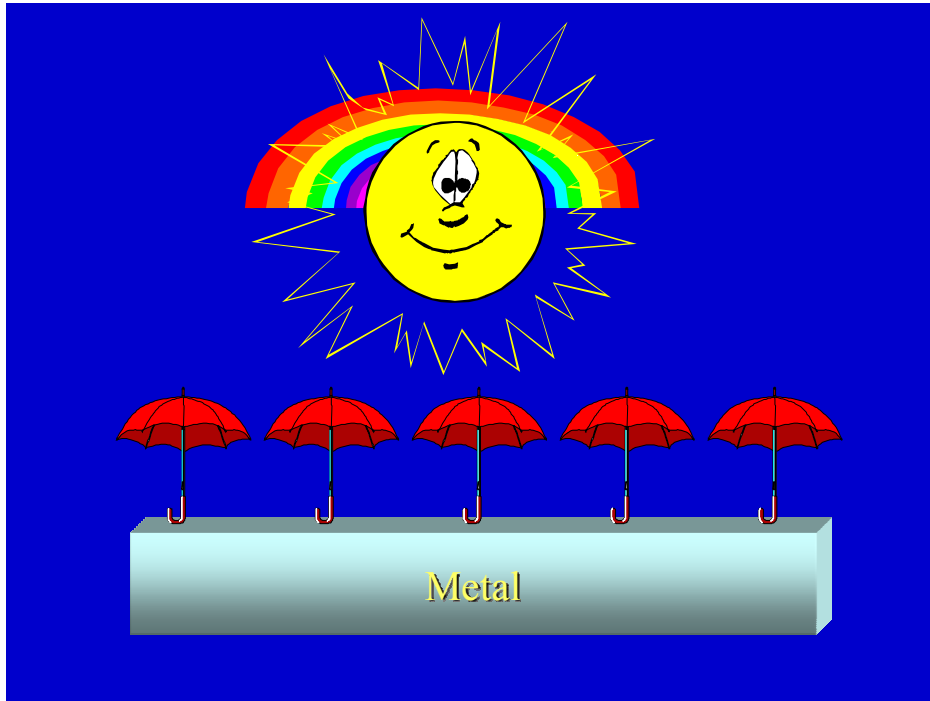
## How to Weather Bad Conditions?



Metal



Metal



The coverage is complete – all surfaces, including crevices, cavities and other inaccessible void areas receive protection. These provide exceptional product protection, clean, rust-free and ready to use parts and equipments, resulting in increased savings, profitability and growth.

**Some of the different shapes and forms that VpCIs can take:**

- Packaging products such as extruded plastic, coated paper, liner boards, bubble sheets, pipe strips, impregnated foam, stretch film, shrink films, anti-static films, pouches, etc
- Biodegradable and compostable plastics
- Emitting devices and sprays for the Electrical & Electronic Industry
- Liquids, Coatings, Aerosols, Powders, tablets, etc for the Process Industry, Cooling Water & Water Treatment, Metal working, Oil & Gas industries, Auto and General manufacturing industries
- Additives to oil, water, paint, ink, polymers, etc
- Cleaners and degreasers with flash rust protective additives
- Rust Removers and paint/graffiti removers that are mild on the metal
- Products for the construction industry – to protect rebar

### **Efficient Delivery Systems for VpCI:**

- Fog
- Inject
- Migrate
- Brush
- Dip
- Spray
- Add
- Attach
- Automatic Dispense
- Disperse
- Package
- Roll On
- Wrap

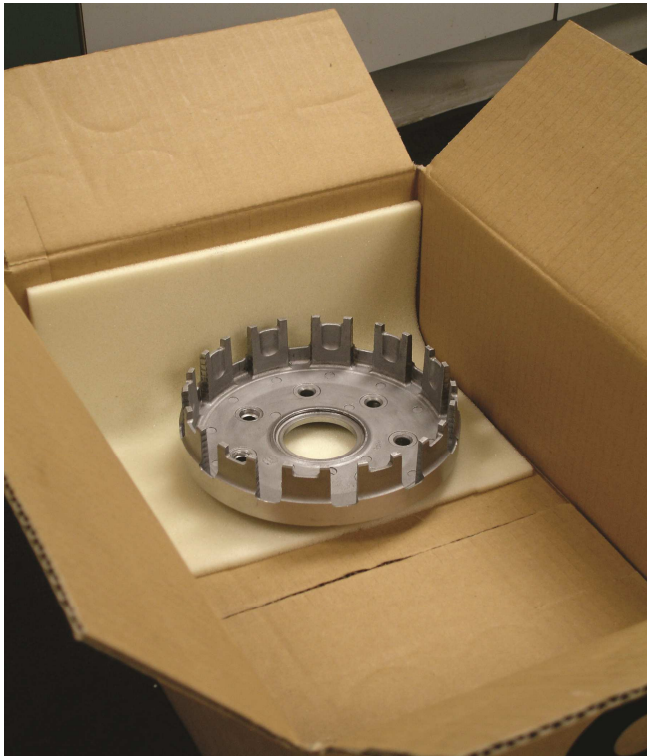
### **Benefits to the Industry using VpCI:**

- Multifunctional products
- Cost Effective – reduces operations and saves costly time and labor
- Eliminates extra processing steps in a manufacturing cycle such as sandblasting, cleaning, degreasing, rust removal, pickling and re-protecting
- Eliminates requirement of other rust preventive oils and desiccants
- Eliminates disposal costs
- Reduces rejects, rework and customer complaints and claims
- Multimetal Protection from tiny electronic devices to large equipments, from components stored indoors to equipments located outdoors in adverse conditions, VpCI Technology makes it more profitable to solve a corrosion problem than to ignore it.

- Convenient & user-friendly to applicator and end user
- Clean and Safe for Personnel and Environment
- Gives short term & long term protection during storage, work-in-process & shipment
- Extends equipment life
- Effectively protects against humidity and aggressive atmospheres as well as against corrosive industrial, marine, and tropical atmospheres.
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- Total corrosion control from raw materials at the manufacturer's end to final user, in a variety of industries

**Some typical Storage and Transit applications for VpCIs  
(not an exhaustive list, only examples):**

**1. VpCI Foam**



## 2. Extruded VpCI Film







### 3. VpCI Shrink Film



### 4. Anti-Static Film



## 5. De-rust and protect using VpCI liquids



### Few other examples of VpCI applications for the industry (not exhaustive):

- Bulk packaging of automotive components in crates lined with VpCI Film
- Store service parts in VpCI bags
- Install VpCI Emitting devices into electrical, electronic and telecomm equipments for protection during transit as well as in service
- Preserve military assets in a readiness state outdoors by adding VpCI to all functional fluids and then simply wrapping in VpCI shrink wrap
- By adding VpCI additives to existing coolants or by using VpCI based Cutting Fluids, secondary RP dips can be eliminated because the VpCI<sup>®</sup> protection is built-in to the machining
- Semi finished parts are protected against work-in-process corrosion by exposing them to VpCIs. Parts need not be cleaned or prepared for the next operation
- Rusted parts and equipments can be salvaged by using rust removers and cleaners containing VpCI

- Fog a heat exchanger with a VpCI powder in a few minutes to eliminate subsequent shipping and storage corrosion problems
- Spray or coat valve flanges and stems with outdoor VpCI coatings for extended protection
- Boost the protection of lubricating oils with a VpCI additive effective for multi metal systems.
- Three phase protection for gear box internals during storage and service by using a VpCI additive to the existing oil
- Protect tank bottom plates by injecting VpCI powders or liquids
- Protect metal under insulation by injecting VpCI at predetermined intervals
- Use VpCI as additive to hydrotest fluid to protect equipment internals even after the fluid is drained off
- Protect rebar at site as well as inside concrete

The list is endless and opportunities unlimited for the industry to save time and money through the judicious deployment of Vapor Phase Corrosion Inhibitors.

### **Frequently Asked Questions on VpCI:**

1. Is VpCI safe? Yes, it is safe to humans and the environment
2. Is it expensive? No, it is cost effective
3. Is it user friendly? Yes, it can be used in a variety of friendly and convenient ways
4. How does VpCI differ from traditional methods and coatings? While they try to keep the moisture and environment away from the metal by creating a barrier/shield and thus protect, VpCIs protect metal in the presence of moisture
5. Is skill required for proper use of VpCI? Not really, as VpCI works by itself once the right VpCI is deployed at the right place and in the right dosage. However application knowledge will help
6. How to choose the right VpCI? This is dictated by the application and the customer expectations. If in doubt, ASK the VpCI expert.

