U.S. ARMY AVIATION AND MISSILE LIFE CYCLE MANAGEMENT COMMAND

MISSILE CORROSION PREVENTION AND CONTROL

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Report Documentation Page

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INTRODUCTION TO CORROSION

WHY ARE YOU HERE?

- **Public Law 107-314 Sec: 1067 Prevention and mitigation of corrosion of military infrastructure and equipment requires that:**
  - **Department of Defense (DoD) must designate a responsible official or organization for the prevention and mitigation of corrosion**
  - **DoD develop a long-term corrosion strategy**
- **AR 750-1 Army Materiel Maintenance Policy**
  - **Establishes the Army Corrosion Prevention and Control Program**
- **AR 750-59 Army Corrosion Prevention and Control Program**
  - **For each system and equipment item, TMs and TBs will contain corrosion inspection requirements and techniques for preventing and controlling corrosion that are approved by the Army Corrosion Prevention and Control Program Manager**

INTRODUCTION TO CORROSION (Cont'd)

WHY WORRY ABOUT CORROSION?

- **United States General Accounting Office (GAO) estimated the cost of corrosion to the DoD to be between $9 and $20 Billion annually**

- **The Annual Cost of Corrosion for Army Aviation and Missile Equipment: Report SKT50T3 June 2007**

  - **$1.6 Billion estimated annual corrosion maintenance cost to the Army Aviation and Missile Life Cycle Management Command (AMCOM)**

- **The Annual Cost Of Corrosion For Army Ground Vehicles and Navy Ships: Report SKT50T1 April 2006**

  - **Over $2 Billion estimated annual corrosion maintenance cost to Army ground vehicles**

  - **US Air Force estimates $4.5 million spent over last 3 years on defected corrosive Ammunition**

INTRODUCTION TO CORROSION (Cont'd)

REFERENCES

- **AR 750-59 Army Corrosion Prevention and Control Program**
  - **Identifies the Army Corrosion Program Manager and prescribes the policies, responsibilities, and procedures for implementing the Army Corrosion Prevention and Control (CPC) Program**
- **TB 43-0213 Corrosion Prevention and Control (CPC) for Tactical Vehicles**
  - **Provides an overview of the Corrosion Prevention and Control (CPC) program, and it describes the types of corrosion prevention techniques used for Army tactical wheeled vehicles and trailers**

INTRODUCTION TO CORROSION (Cont'd)

REFERENCES

- **TM 1-1500-344-23 Volumes 1-4 Cleaning And Corrosion Control**
  - **Provides information on materials and procedures to prevent, control, and repair corrosion damage**

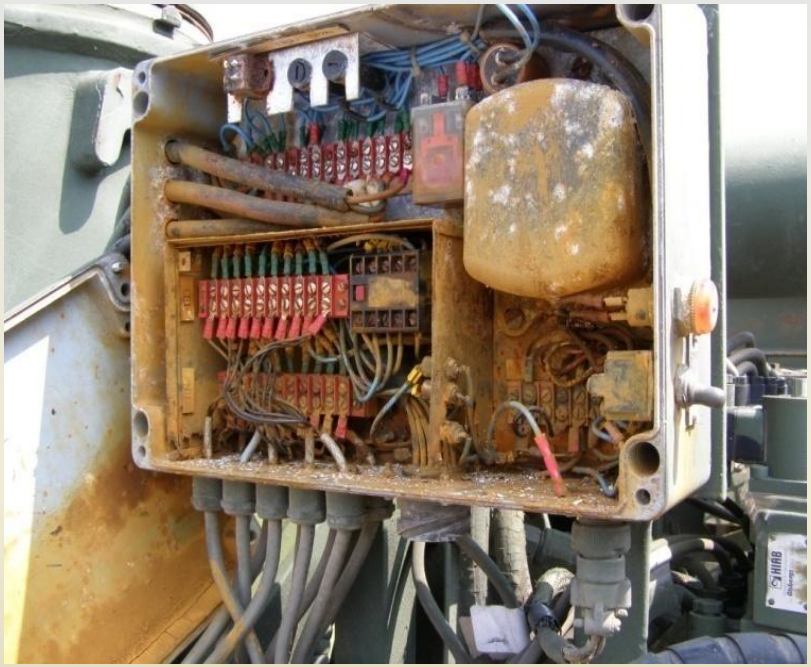
- **Equipment Technical Manuals (TM)**
  - **Contain corrosion inspection requirements and techniques for preventing and controlling corrosion**

Impact of not Implementing a Corrosion Prevention Program

The item shown to the right was brought to the attention of the CPC trainers during the last training visit in July 2008.

The failure of this item due to corrosion rendered this equipment NMC and costs approximately $15K to replace plus the labor for removal, installation, not to mention the impact to unit readiness.

Implementing CPC program and training at the unit CPC level would have prevented this failure that rendered the equipment NMC.



Objective: Reduce Overall Corrosion Maintenance Cost and Improve Readiness

Our Strategy

•Assist Army Commanders implement the **Army Material Maintenance Policy, AR 750-1 sec 2-17.(15)**:

•"Establish effective corrosion prevention and control program for assigned equipment per AR 750–59."

•Reduce the total corrosion maintenance cost by performing more Preventative Corrosion Maintenance at the field level thus reducing the amount of Corrective Corrosion Maintenance at the field, organizational or depot level.

•Corrosion Prevention starts at PMCS. Therefore, the soldier **IS** the front line defense in preventing corrosion before it starts..

•Leverage the use of corrosion prevention technologies and procedures into the Army Ordinance community.

Strategy Implementation

Provide on-site CPC Assistance Visits to Army missile units. Topics Include :

- General Corrosion Theory
- Preventive Maintenance
- Repair Techniques
- Approved CPC Products
- Known Corrosion Trouble Spots specific to weapon platform
- Provide unit Corrosion Monitor training
- Provide support for drafting Unit Level CPC SOP

CPC Training

CPC Training and materials to include:

Provide classroom familiarization approved CPC technologies and application procedures (2.5 hrs per battery)

Provide hands-on training in the application of approved technologies and CPC Procedure (5.5 hrs per battery)

Provide “Seed” Corrosion Control Kits

Training and Materials have been provided at **NO COST** to the unit. The **only impact** to the unit is allocating:

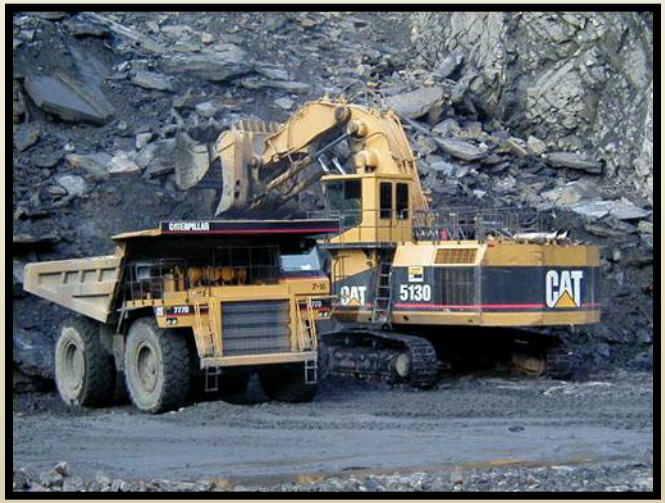
- Class/Training Time
- Soldiers/Maintainers

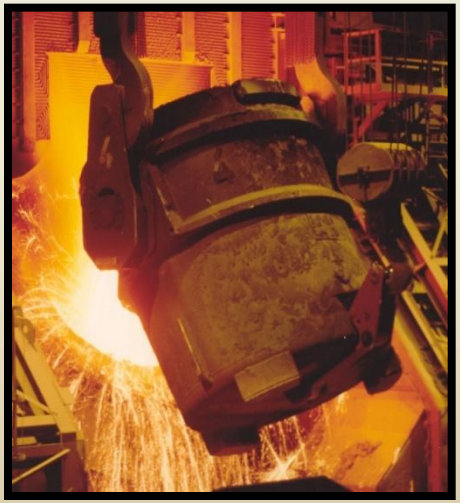
CORROSION THEORY

WHAT IS CORROSION?

CORROSION IS THE ELECTROCHEMICAL DETERIORATION OF A METAL THAT ALLOWS IT TO RETURN TO ITS NATURAL STATE.

- **Metal refining starts with ore and involves adding energy and alloying elements to create metals used in manufacturing**





CORROSION THEORY (Cont'd)

TYPES OF CORROSION

- UNIFORM SURFACE
- PITTING
- GALVANIC
- INTERGRANULAR/EXFOLIATION
- CREVICE
- FILIFORM
- STRESS CRACKING
- FRETTING
- MOLD/MILDEW

IDENTIFY AND UNDERSTANDING

CLEANING

PURPOSE

- Equipment should be cleaned regularly in order to:
  - Prevent corrosion by removing electrolytes
  - Allow a thorough inspection for corrosion and corrosion damage
  - Improve overall appearance
  - Maintain special paint scheme characteristics
- Keeping your equipment clean is your first and best step for minimizing corrosion
- Operational environment considerations must be taken into effect when dealing with corrosion control
- Operations in a marine environment is the number one cause for corrosion on equipment
  - A marine environment is operating within 1.25 miles of salt water
- Cleaning must be completed PRIOR to performing any inspections

IDENTIFY AND UNDERSTANDING INSPECTION REQUIREMENTS

PURPOSE

- Early detection, identification, and treatment reduce costs resulting from corrosion
- Without regular systematic inspections, corrosion will seriously damage equipment
- Frequent corrosion inspections are essential to the overall corrosion control program

RESPONSIBILITIES

- Corrosion detection is everyone's responsibility
- Since corrosion can occur almost anywhere, all personnel must be able to identify and report corrosion issues
- Personnel performing any scheduled inspections shall be trained in corrosion detection

INSPECTION (Cont'd)

FREQUENCY

- **Deciding when and how often to conduct inspections is based on such factors as:**
  - **Environment**
  - **Operational conditions**
  - **How prone the component is to corrosion and wear**
  - **Existing Preventive Maintenance Checks and Services (PMCS) inspections required by the TM**

INSPECTION (Cont'd)

VISUAL EVIDENCE OF CORROSION

- Paint blisters, or bubbles, or other coating irregularities
- Aluminum corrosion products will be white, gray, or black and may appear as a paste when wet or a hard, adherent film or crumbly deposits when dry
- Steel corrosion products are red, brown, or black rust deposits
- Copper corrosion products are blue or blue-green and are also easily detected

INSPECTION (Cont'd)

DEGREES OF CORROSION

- **Light Corrosion**
  - **The protective coating is scarred or etched**
  - **The condition of the metal is characterized by discoloration and pitting to a depth of approximately one mil (0.001 inch)**
  - **Normally removed by light hand sanding**

INSPECTION (Cont'd)

DEGREES OF CORROSION

- **Moderate Corrosion**

  - **Appears similar to light corrosion, with the addition of blistering or evidence of scaling and flaking of the coating or paint system**

  - **The pitting depths may be as deep as 10 mils (0.010 inch)**

  - **This type of damage is normally removed by extensive hand sanding or light mechanical sanding**

INSPECTION (Cont'd)

DEGREES OF CORROSION

- **Severe Corrosion**

  - **Its general appearance is similar to moderate corrosion, with the addition of severe intergranular corrosion, blistering, exfoliation, scaling, or flaking**

  - **The pitting depths are deeper than 10 mils (0.010 inch)**

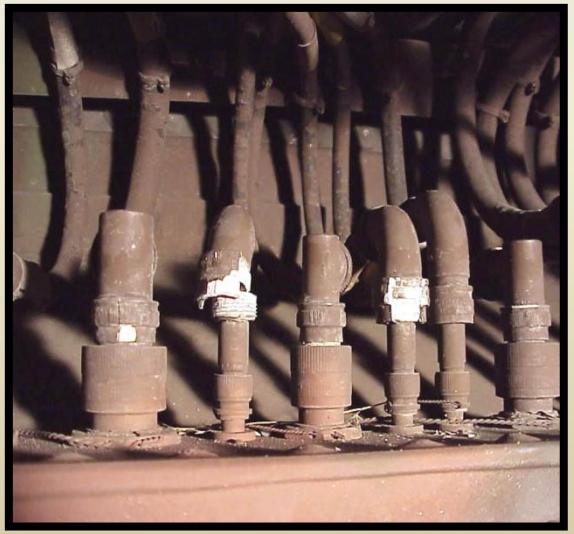
  - **This damage must be removed by extensive mechanical sanding or grinding**

INSPECTION (Cont'd)

CORROSION PRONE AREAS

FAYING SURFACES AND CREVICES

ELECTRICAL CONNECTORS



PRESERVATION

CORROSION PREVENTATIVE COMPOUNDS (CPCs)

- **Used to protect metal parts and components**
- **Function by preventing corrosive materials from contacting and corroding bare metal surfaces**
- **Displace water, and other contaminants from the surfaces to be protected**
- **Provide lubrication, as well as corrosion protection**
- **Prevent the intrusion of moisture, rain, salt water, dust, and fluids, which can lead to extensive corrosion and possibly equipment failure**

PRESERVATION (Cont'd)

CORROSION PREVENTATIVE COMPOUNDS (CPCs)

- **CPCs are separated into two major categories:**
  - **Water displacing (MIL-C-81309, MIL-DTL-85054, MIL-PRF-63460, and MIL-PRF-32033) : Used to remove electrolytes from metal surfaces**
  - **Non-water displacing (MIL-PRF-16173 or MIL-L-87177): Used on dried surfaces or on surfaces which have been first treated with water displacing CPCs**

- **Preservatives should be used after equipment cleaning, before and after deployment, and when an extended period of equipment storage is anticipated**
- **Because of their temporary nature, CPCs must be regularly removed and replaced to provide continuing corrosion protection**

PRESERVATION (Cont'd)

TOUCH-UP PROCEDURES

- **Why paint**
  - **The primary purpose of any paint system is to protect exposed surfaces against corrosion and other forms of deterioration. Other purposes include:**
    - **Glare reduction**
    - **Reduction of heat absorption**
    - **Camouflage protection and limited infrared means of detection**
    - **High visibility requirements**
    - **Identification markings**

PRESERVATION (Cont'd)

TOUCH-UP PROCEDURES

- **When to paint**
  - **Touch-up painting is done to prevent corrosion, not for purely cosmetic reasons**
  - **Scratches, chips, or marring of the paint surface observed during maintenance will be repaired at the field level to prevent corrosion damage**
- **What to paint with**
  - **Chemical Agent Resistant Coating (CARC) is the approved coating for all combat and combat support equipment, tactical vehicles, aircraft, and essential ground support equipment and reparable containers**
  - **Touch-up painting of CARC painted equipment will be with CARC only**
  - **Painting at the field level using a brush or roller is limited to touchup painting in accordance with TB 43–0242**

PRESERVATION (Cont'd)

CPC STARTER KIT

- The AMCOM Corrosion Program Office self-contained kit is a great start
- They are issued to units as a "CPC Starter Kit" and are maintained and upgraded by the unit
- It is not all encompassing and we are always looking for suggestions from YOU
- It includes the most up-to-date prepping to finishing system materials essential for corrosion touch-up repair tasks
- It is environmentally friendly which will aid in the reduction of HAZMAT costs normally associated with overfills, spills, excess paint, clean-up and the handling of bulk material

PRESERVATION (Cont'd)

CPC STARTER KIT

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