Refining Corrosion Technologist

Exam Preparation Guide

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Introduction

The Refining Corrosion Technologist exam is designed to assess whether a candidate has the requisite knowledge and skills that a minimally qualified efining orrosion Technologist must possess. The 100 multiple-choice questions are based on the Refining orrosion body of knowledge. A candidate should know the processes and corrosion mechanisms that are specific o the corrosion industry including both low and high temperature principles. A minimally qualified candida e will know the basic functions of each refinery process unit, the feed, chemical reaction, equipment, and end product necessary for converting crude oil into a salable product.

Test Name	AMPP-Refining Corrosion Technologist
Test Code	NACE-RCT-001
Time	2 ½ hours
Number of Questions	100
Format	Computer-Based Testing (CBT)
Passing Score	A pass/fail grade is provided at the end of the exam.

**NOTE: Includes 4 minutes for the non-disclosure agreement and 6 minutes for the system tutorial.*

Target Audience

The Refining Corrosion Technologist is responsible for identifying, locating, and controlling corrosion in refinery environments. A Refining Corrosion Technologist may be:

- Design engineer
- Process engineer
- Procurement agents
- Maintenance planners
- Service company representatives who support refineries
- Corrosion and equipment engineers
- Metallurgists
- Inspectors
- Inspection supervisors who works in major integrated companies associated with the refining industry (i.e. oil, refining, petrochemi-cal, inspection, engineering and construction)
- Licensors, equipment, inhibitor and chemical treatment suppliers

Requirements

Requirements for Refining Corrosion Technologist

■ Work Experience and Education Prerequisite ■ Course ■ 1 Core Exam ■ Application

Prerequisite *(choose one of the following options)*:	
Option 1:	**Option 2:**
2 years verifiable Corrosion work experience in Refining **And** Bachelor's Degree in Physical Sciences or Engineering	4 years verifiable Corrosion work experience in Refining **And** High School Diploma or GED
Course Requirements:	
Successfully complete the following course: +**Course- Corrosion Control In The Refining Industry**	
Core Exam Requirements:	
Exam - Refining Corrosion Technologist Exam—NACE-RCT-001	
Application Requirements:	
Approved Refining Corrosion Technologist	

Submit Application

Candidates must apply for this certification y submitting an on-line application which is subject to approval. Applications must be submitted within 3 years of successful completion of exam.

Certification renewal requirements–

- Recertification application* equired every 3 years
- 1.5 years of Corrosion work experience in refinin
- 8 hours per year of ongoing Professional Development Activity (24 hours total for the 3 year cycle)

Upon successful completion of requirements, the candidate will be awarded a **Refining Corrosion Technologist Certification**.

**Approval required*

Exam Blue Print

Domain 1- Corrosion Principles–19%

Low Temperature Corrosion Principles
Corrosion Rates and Polarization
Passivity
Temperature and Concentration
Low Temperature Conditions

High Temperature Corrosion Principals
Rate Laws
High Temperature Conditions

Domain 2- Corrosion Mechanism–19%

Metal Loss—General and/or Localized Corrosion
Galvanic Corrosion
Pitting
Crevice Corrosion
Intergranular Attack
Erosion-Corrosion
Hydrogen Chloride
Ammonium Bisulfide (NH4HS
Carbon Dioxide
Process Chemicals (level 2)
Organic Chlorides
Aluminum Chloride
Sulfuric Acid

Hydrofluoic Acid
Phosphoric Acid
Phenol (Carbolic Acid)
Amines
Atmospheric (External) Corrosion
Corrosion Under Insulation (CUI)
Soil Corrosion
High-Temperature Sulfide orrosion (Without Hydrogen Present)
High-Temperature Sulfide orrosion (With Hydrogen)
Naphthenic Acid Corrosion
High-Temperature Oxidation

Domain 3- Stress Corrosion Cracking–10%

Chloride Stress Corrosion Cracking (ClSCC)
Alkaline Stress Corrosion Cracking (ASCC)
Carbonic Acid (Wet CO2)
Polythionic Acid Stress Corrosion Cracking (PTA SCC)
Ammonia Stress Corrosion Cracking (NH3 SCC)
Hydrogen Cyanide (HCN)
SCC Prevention

Wet H2S Cracking
Hydrogen Blistering
Sulfide Stress Cracking (SSC)
Hydrogen Induced Cracking (HIC)
Stress Oriented Hydrogen Induced Cracking (SOHIC)
High-Temperature Hydrogen Attack (HTHA)

Domain 4- Metallurgical Failures–8%

Grain Growth
Graphitization
Hardening
Sensitization
Sigma Phase
885°F (475°C) Embrittlement

Temper Embrittlement
Liquid Metal Embrittlement (LME)
Carburization
Metal Dusting
Decarburization
Selective Leaching

Domain 5- Mechanical Failures–2%

Incorrect or Defective Materials
Mechanical Fatigue
Corrosion Fatigue
Cavitation Damage
Mechanical Damage
Overloading
Overpressuring

Brittle Fracture
Creep
Stress Rupture
Thermal Shock
Thermal Fatigue

Domain 6- Unit Specific Corrosion Issues–34%

Crude Distillation and Desalting
Fluid Catalytic Cracking
Cracked Light Ends Recovery
Hydrofluo ic Acid Alkylation
Sulfuric Acid Alkylation
Hydroprocessing
Catalytic Reforming
Delayed Coking
Amine Treating
Sulfur Recovery

Domain 7- Corrosion Monitoring–3%

Radiography
Ultrasonic thickness measurements
Corrosion coupons
Electrical resistance probes
Hydrogen flux moni oring
Corrosion monitoring sites
Automated on-line monitoring

Domain 8- Failure Analysis and Nondestructive Testing–3%

Surface deposit analysis
Field metallographic replication
Hardness Testing
Positive material identificatio
Macroscopic examination of fracture surfaces
Microscopic examination
Magnetic testing
  Wet method
  Dry method
Penetrant testing
Sectioning

Types of Questions

Description of Questions

The questions on this exam are multiple-choice where there ***may be more than*** one correct answer. **Items with more than one correct answer may contain the phrase *"SELECT ALL THAT APPLY"* and you will need to select more than one answer choice.** The questions are based on the knowledge and skills required in the refining industry for a Refining Corrosion Technologist. While the NACE training course is an excellent method of preparation it is not the only reference used in the development of the questions.

Sample Questions

The sample questions are included to illustrate the formats and types of questions that will be on the exam. Your performance on the sample questions should not be viewed as a predictor of your performance on the actual test.

Domain 6-Unit Specific Corrosion

1. Which one of the following materials is NOT a common material of construction for sulfur pump component?

   a. Type 316 stainless steel
   b. Alloy 400
   c. Ductile iron
   d. Carbon steel

Domain 2- Corrosion Mechanisms

2. When two different metals or alloys are electrically joined in an electrolyte, the worst corrosion occurs on the metal or alloy closer to the

    a. Cathodic (noble) end of the galvanic series
    b. Anodic (active) end of the galvanic series
    c. Both metals
    d. No corrosion takes place

Domain 8- Failure Analysis and Nondestructive Testing

3. Penetrant testing is best at findin

    a. Creep voids
    b. Porosity
    c. Sub-surface cracks
    d. Surface-breaking cracks

Domain 4- Metallurgical Failures

4. High temperature carburization occurs in which part(s) of an FCC unit?

    a. Reactor and preheater
    b. Regenerator and flue gas t eater
    c. Fractionator and crack light ends unit
    d. Reactor and regenerator

Answer Key

1. b

Reference: AMPP Corrosion Control in the Refining Industry course materials. Chapter 12

2. b

Reference: AMPP Corrosion Control in the Refining Industry course materials. Chapter 2

3. d

Reference: AMPP Corrosion Control in the Refining Industry course materials. Chapter 13

4. d

Reference: AMPP Corrosion Control in the Refining Industry course materials. Chapter 4

Preparation

Training

AMPP Course: Corrosion Control in the Refining Industry. The course table of contents is listed in APPENDIX A**.**

Reference Material

AMPP Corrosion Control In The Refining Industry course materials, included with training.

Select AMPP Standard Practices and Technical Committee Reports, included with training.

Select API Recommended Practices–**www.api.org/standards**

Select ASTM Standards–**www.astm.org/Standard/**

Appendix A

CORROSION CONTROL IN THE REFINING INDUSTRY

TABLE OF CONTENTS

Chapter 1: Corrosion and Other Failures

Chapter 2: Crude Distillation and Desalting

Chapter 3: Fluid Catalytic Cracking Units

Chapter 4: Cracked Light Ends Recovery Units

Chapter 5: Hydrofluoric Acid Alkylation Units

Chapter 6: Sulfuric Acid Alkylation Units

Chapter 7: Hydroprocessing Units

Chapter 8: Catalytic Reforming Units

Chapter 9: Delayed Coking Units

Chapter 10: Amine Treating Units

Chapter 11: Sulfur Recovery Units

Chapter 12: Refinery Injection Systems

Chapter 13: Process Additives and Corrosion Control

Chapter 14: Corrosion Monitoring in Refineries

Chapter 15: Materials of Construction for Refinery Applications

Chapter 16: Refinery Operations and Overview

Chapter 17: Failure Analysis in Refineries

Appendices

A NACE Standard MR0103, "Materials Resistant to Sulfide Stress Cracking in Corrosive Petroleum Environments"

B NACE Standard TM0284, "Evaluation of Pipeline and Pressure Vessel Steels for Resistance to Hydrogen-Induced Cracking"

C NACE Standard TM0177, "Laboratory Testing of Metals for Resistance to Sulfide Stress Cracking and Stress Corrosion Cracking in H_2S Environments"

D NACE Standard TM0103, "Laboratory Test Procedures for Evaluation of SOHIC Resistance of Plate Steels Used in Wet H_2S Service"

E NACE SP0403, "Avoiding Caustic Stress Corrosion Cracking of Carbon Steel Refinery Equipment and Piping"

F NACE Publication 34105, "Effect of Nonextractable Chlorides on Refining Corrosion and Fouling"

G NACE SP0472, "Methods and Controls to Prevent In-Service Environmental Cracking of Carbon Steel Weldments in Corrosive Petroleum Refining Environments"

H NACE SP0296, "Guidelines for Detection, Repair, and Mitigation of Cracking of Existing Petroleum Refinery Pressure Vessels in Wet H_2S Environments"

I NACE Publication 8X194, "Materials and Fabrication Practices for New Pressure Vessels to be Used in Wet H_2S Refinery Environments"

J NACE Publication 8X294, "Review of Published Literature on Wet H_2S Cracking of Steels Through 1989"

K NACE Publication 5A171, “Materials for Receiving, Handling, and Storing Hydorfluoric Acid”

L NACE Standard RP0391, Materials for Handling and Storage of Commercial (90 to 100%) Sulfuric Acid at Ambient Temperatures”

M NACE SP0294, “Design, Fabrication, and Inspection of Tanks for the Storage of Concentrated Sulfuric Acid and Oleum at Ambient Temperatures”

N NACE SP0205, ”Recommended Practice for the Design, Fabrication and Inspection of Tanks for the Storage of Petroleum Refining Alkylation Unit Spent Sulfuric Acid at Ambient Temperatures”

O API Publication 941, “Steels for Hydrogen Service at Elevated Temperature and Pressure”

P NACE Standard SP0170, “Protection of Austenitic Stainless Steels and Other Austenitic Alloys from Polythionic Acid Stress Corrosion Cracking During Shutdown of Refinery Equipment”

Q NACE Publication 34103, “Overview of Sulfidic Corrosion in Petroleum Refining”

R NACE Publication 34101, “Refinery Injection and Process Mixing Points”

S NACE SP0198, “The Control of Corrosion Under Thermal Insulation and Fireproofing Materials—A Systems Approach”

T NACE Standard MR0175/ISO15156-1, “Petroleum and natural gas industries-Materials for use in H_2S-containing Environments in oil and gas production”

U NACE Standard TM0169, “Laboratory Corrosion Testing of Metals”

V NACE SP0590, “Recommended Practice for Prevention, Detection and Correction of Deaerator Cracking”

W

X NACE International Publication 34109 Crude Distillation Unit—Distillation Tower Overhead System Corrosion

Y UNS Numbers/Composition of Alloys

Z Glossary of Refinery Corrosion Related Terms