

CCGT/HRSG WATER CHEMISTRY

COURSE OUTLINE

1.0 WATER CHEMISTRY CONCEPTS

- 1.1 The Atom, Atomic Structure, and Chemical Periodicity
 - 1.1.1 Introduction
 - 1.1.2 The Atom and Atomic Structure
 - 1.1.2.1 Atomic Structure
 - 1.1.2.2 The Electron Structure of Atoms
 - 1.1.3 Elements, Chemical Symbols, and Avogadro's Number
 - 1.1.3.1 Symbols for Elements
 - 1.1.3.2 Atomic Number
 - 1.1.3.3 Atomic Weight
 - 1.1.3.4 Avogadro's Number
 - 1.1.3.5 Isotopes
 - 1.1.4 The Periodic Table
 - 1.1.4.1 Chemical Periodicity
 - 1.1.4.2 The Periodic Table of the Elements
 - 1.1.4.2.1 Organization of the Periodic Table
 - 1.1.4.2.2 Electron Structure and Chemical Properties
 - 1.1.4.3 Classes of Elements in The Periodic Table
 - 1.1.4.3.1 Metals
 - 1.1.4.3.2 Nonmetals
 - 1.1.4.3.3 Metalloids
 - 1.1.4.3.4 Noble Gases
- 1.2 Compounds, Compound Formation, and Chemical Reactions
 - 1.2.1 Introduction
 - 1.2.2 Compound Formation and the Chemical Bond
 - 1.2.2.1 Stable Electron Structure: The Octet Rule
 - 1.2.2.2 Valence: Combining Power of Elements
 - 1.2.2.3 Chemical Formulas for Representing Compounds
 - 1.2.2.4 The Ionic Bond
 - 1.2.2.4.1 Ionization and Ions
 - 1.2.2.4.2 Properties of Ionic Compounds
 - 1.2.2.5 The Covalent Bond
 - 1.2.2.6 Molecules
 - 1.2.2.7 Radicals
 - 1.2.2.8 Chemical Nomenclature and Formulas
 - 1.2.3 Chemical Reactions and Stoichiometric Calculations
 - 1.2.3.1 Chemical Reactions
 - 1.2.3.2 Reason for Chemical Reactions
 - 1.2.3.3 Energy Changes Associated with Chemical Reactions
 - 1.2.3.4 Chemical Reactions versus Physical Changes
 - 1.2.3.5 Conservation of Mass in Chemical Reactions
 - 1.2.3.6 Conservation of Atoms in Chemical Reactions
 - 1.2.3.7 Chemical Equations

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- 1.2.4 Stoichiometric Calculations
 - 1.2.4.1 The Mole and Weight Relationship in Chemical Reactions
 - 1.2.4.2 Molecular Weights and the Law of Definite Composition
 - 1.2.4.3 The Mole
- 1.3 Summary

2.0 WATER CHEMISTRY CONCEPTS - CONTINUED

- 2.1 Solutions in Power Plant Chemistry
 - 2.1.1 Introductions
 - 2.1.2 Solutions: Solvent and Solutes
 - 2.1.2.1 Definition of a Solution
 - 2.1.2.2 Dispersions and Suspensions
 - 2.1.2.3 Polar and Non-Polar Solvents
 - 2.1.2.4 Water as a Solvent
 - 2.1.2.5 Ionic Solutions in Water
 - 2.1.2.6 Solubility
 - 2.1.2.7 Effect of Temperature and Pressure on Solubility
 - 2.1.3 Concentration of Solutions
 - 2.1.3.1 General Terms for Expressing Concentration
 - 2.1.3.2 Percent by Weight
 - 2.1.3.3 Density, Specific Gravity, and the Baume` Scale
 - 2.1.3.4 Percent by Volume
 - 2.1.3.5 Parts per Million (ppm) and Parts per Billion(ppb)
 - 2.1.3.6 Molar and Molal Solutions
 - 2.1.3.7 Normal Solutions and Equivalent Weights
 - 2.1.4 Preparing Solutions
 - 2.1.5 Gas Concentrations
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 - 2.2.2 Acids and Bases
 - 2.2.2.1 Properties of Acids and the Hydronium Ion
 - 2.2.2.2 Properties of Bases and the Hydroxide Ion
 - 2.2.3 Neutralization Reactions and Salt Formation
 - 2.2.4 The Definition of pH and the pH Scale
 - 2.2.4.1 The Ionization of Water
 - 2.2.4.2 The pH Scale and Other Logarithmic Functions
 - 2.2.4.3 The Effect of Temperature on pH
 - 2.2.5 Conductivity
 - 2.2.5.1 Equivalent Conductance
 - 2.2.5.2 Solvent Effects: The Conductivity of Pure Water
 - 2.2.5.3 Temperature Effects on Conductivity

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- 3.1 Overview of Corrosion Mechanisms and Types of Corrosion
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 - 3.1.2 Localized Corrosion: Macroscopic Attack
 - 3.1.2.1 Galvanic Corrosion
 - 3.1.2.2 Erosion Corrosion
 - 3.1.2.3 Flow Accelerated Corrosion (FAC)
 - 3.1.2.4 Crevice Corrosion
 - 3.1.2.5 Pitting Corrosion
 - 3.1.2.6 Exfoliation
 - 3.1.2.7 Selective Leaching
 - 3.1.3 Localized Corrosion: Microscopic Attack
 - 3.1.3.1 Intergranular Corrosion
 - 3.1.3.2 Stress-Corrosion Cracking
 - 3.1.4 Corrosion Resistant Alloys Used in Plants
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 - 3.1.4.2 Copper Based Alloys
 - 3.1.4.3 Specialty Materials
- 3.2 Chemistry Aspects of Corrosion
 - 3.2.1 Oxidation and Reduction
 - 3.2.2 Passivity
 - 3.2.3 Corrosion of Iron in High Temperature Water
 - 3.2.4 Oxygenated Treatment
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 - 3.2.4.3 Effect of Dissolved Oxygen
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 - 3.2.5.2 Chloride Stress-Corrosion Cracking
 - 3.2.5.3 Concentrated Caustic Cracking
 - 3.2.5.4 Underdeposit Corrosion
- 3.3 Summary

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 - 4.1.1 Elements of Chemistry Control Programs
 - 4.1.2 Phosphate Chemistry Control
 - 4.1.2.1 Coordinated Phosphate - pH Control
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 - 4.1.2.4 Oxygen Treatment (OT) Control
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 - 4.1.4.2 Effect of Feedwater Heater Tube Material
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 - 4.1.4.4 Effect on Turbine Blading
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 - 4.1.6.2 System Chemistry Specifications
 - 4.1.6.2.1 Makeup System
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 - 4.1.6.2.5 Silica Control in Boiler Water and Steam
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- 4.1.6.5.3 Biocide Treatment
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 - 5.2 HRSG Designs
 - 5.2.1 Pre Combined-Cycle
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 - 9.2 Terms Used in Water Treatment
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 - 9.2.3 Free Mineral Acidity
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 - 9.3.2.4 Coagulant Chemicals
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 - 9.3.2.4.2 Polymers and Polyelectrolytes
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- 12.1.3 Daily Chemistry Logs
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- 14.2 Chemical Cleaning Solutions
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 - 14.2.2.1 Hydroxyacetic-Formic Acid
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 - 14.2.3 Other Solvents and Cleaning Solutions
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 - 16.1.4 Superheater and Economizer Flushings
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- 17.2.6 The Limitation of NDI
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