Center for Curriculum and Transfer Articulation

Reactor Plant Chemistry and Materials

Course: **PPT222**	Lecture **2** Credit(s) **2** Period(s) **2** Load
	Course Type: **Occupational**
First Term: **2014 Fall**	Load Formula:
Final Term: **Current**	

Description: Basic nuclear reactor theory to include reactor chemistry, water chemistry, radiation detection and protection principles, and reactor plant materials.

Requisites: Prerequisites: PPT120.

MCCCD Official Course Competencies

1. Apply the basic fundamentals of chemistry. (I)
2. Apply basic water chemistry control fundamentals. (II)
3. Apply reactor water chemistry fundamentals. (III)
4. Explain the basic concepts of the properties of metals and alloys. (IV)
5. Explain brittle fracture characteristics. (V)
6. Explain various types of plant material problems. (VI)
7. Explain the principles and operation of radiation detection and monitors. (VII)
8. Explain radiation effects, including the effects of radiation on matter and body tissue. (VIII)
9. Perform calculations that involve radioactive dose and matter. (IX)
10. Explain radiation exposure control. (X)

MCCCD Official Course Outline

I. Chemistry Fundamentals
A. Acids and bases
B. Conductivity (of water in ?mhos/cm)
C. Ion exchangers
D. Mixtures, solutions, and compounds
E. Molecules
F. Periodic Table
G. pH
H. Properties and uses of gases
I. States of matter
J. Units of measure
II. Basic Water Chemistry Control
A. Effects of impurities
B. Ion exchange theory
C. Parameters monitored (such as pH, conductivity, sodium, chlorides, fluorides, sulfates,

hardness, silica)
D. Principles of water treatment (such as water purification with filters/reverse osmosis)
E. Sources of impurities
F. The corrosion process
G. Water chemistry control methods
III. Reactor Water Chemistry Fundamentals
A. Analytical results and core conditions
B. Control/removal of impurities
C. Effects of impurities
D. Hydrogen gas in reactor water (such as for the use of O2 control)
E. Radioalysis and recombination
F. Radiochemistry
G. Sources of impurities
H. Types of impurities
IV. Basic Material Properties
A. Alloy definition and application
B. Compressive strength
C. Expansion/contraction associated with temperature changes
D. Heat treating and annealing related to the properties of metals
E. Radiation-induced embrittlement by neutron exposure
F. Material strength
G. Structure basics and changes in structure (overview of general metals properties, not a discussion of crystalline structure)
H. Torque limits
I. Yield and tensile strength
V. Brittle Fracture Characteristics
A. Temperature effects
1. Heatup
2. Cooldown
B. Fracture mechanisms
VI. Plant Material Problems
A. Corrosion?types, including general and specific
B. Effects of contaminants on corrosion and material properties
C. Erosion, including flow-accelerated corrosion and cavitation
D. Fatigue failure/work hardening
E. Thermal shock/stress definition, causes and effects
F. Vibration-induced cracking
VII. Radiation Detection and Monitors
A. Area radiation monitors
B. Electronic dosimeter (self-reading pocket dosimeters)
C. Gas-filled detectors
D. Personnel dosimetry (for example, thermoluminescent dosimeter)
E. Personnel monitors, whole-body monitors
F. Process radiation monitors (liquid and gaseous)
G. Scintillation detectors
VIII. Radiation Effects
A. Somatic
B. Genetic

B. Genetic
C. Acute
D. Chronic
IX. Radiological Calculations
A. Conversion of units (curies, roentgen, rems, rads)
B. Simple calculations to estimate dose (rate x time = dose)
C. Units of measurement
X. Radiation Exposure Controls
A. Contamination
B. Decontamination
C. Exposure reduction methods
D. Protective clothing and respirators
E. Provisions of 10CFR20
F. Radiologically controlled areas
G. Site administrative controls and limits (margin from regulatory limits)

Last MCCCD Governing Board Approval Date: **June 24, 2014**