



## ***Chilled Water Plant Design***

### ***Detailed Topic Agenda***

#### DAY 1

- 7:30            *Registration*
- 8:00            Welcome and Overview
- 8:30            Determining the Need for Chilled Water & Load Determination
- Many choices in system type
  - Comparison of system types
  - Advantages of chilled water system
  - Advantages of central plant
  - Chilled water options
  - Load definition and evaluation
- 9:45            *Break*
- 10:00          Chiller Basics (until 2:15)
- Chiller types
  - Compressors; evaporators; condensers; drive types
  - Refrigerant cycle
  - Starter types; constant and variable speed
  - Chiller efficiency
  - Chilled and condenser water flow rates
  - Heat recovery chillers
  - Refrigerants
- 12:00          *Lunch*
- 1:00            Chiller Basics continued
- 2:15            *Break*
- 2:30            Related Chiller Topics
- Steam turbine drives
  - Factory and field erected units
  - Industrial and commercial design
  - Absorption and adsorption chillers
  - Chiller prime movers
- 3:15            Pump Basics
- Hydraulics
  - Centrifugal pump fundamentals and configurations
  - System curves

- Pump curves
  - Pump and system curve interaction
- 3:45 Pumping Schemes
- Condenser water pumping schemes
  - Chilled water pumping schemes
- 4:15 Class Problem Workshop
- 5:00 *Daily Adjournment*

DAY 2

- 8:00 Cooling Tower Basics (until 10:15)
- Principles of operation
  - Components
  - Selection parameters
  - Tower types
  - Heat transfer surfaces
  - Capacity control
  - Water losses
  - Water quality
- 9:00 *Break*
- 9:15 Cooling Tower Basics continued
- 10:20 *Break*
- 10:30 More Cooling Tower Design Issues
- Noise issues
  - Other factors influencing performance
  - Location; wind direction
  - Free cooling
  - Make-up water requirements
  - Free cooling systems
  - Cold weather operation
- 11:40 Class Problem Review
- 12:00 *Lunch*
- 1:00 Thermal Energy Storage
- Chilled water
  - Density-depressed chilled water
  - Ice harvesting
  - Ice on coil; encapsulated ice; ice slurries
- 1:45 System Design Issues
- Delta temperature
  - Supply and return temperatures
  - Effects of supply temps and delta T
  - Other chiller issues

- 2:15            *Break*
- 2:30            System Design Issues continued
- 3:15            Plant Siting Issues
- Building construction
  - Aesthetics
  - Utility Infrastructure
  - Noise Issues
  - Modular Plants
  - Central Plant General Arrangements
  - Phasing
- 4:30            Class Problem Workshop
- 5:00            *Daily Adjournment*
- DAY 3
- 8:00            Class Problem Review
- 8:30            Distribution Systems (until 10:30)
- Configuration options
  - Sizing
  - Hydraulic modeling & gradient
  - Installation options: direct buried, shallow trenches, tunnels
  - End users (buildings, etc.)
    - direct connected
    - indirect heat exchangers
    - interface options
- 9:30            *Break*
- 9:45            Distribution Systems continued
- 10:30           Controls
- Control valve fundamentals
  - Pressure independent control valves
  - Control schemes and optimization
- 11:00           *Break*
- 11:15           Code and Certification Issues
- Code requirements
  - Machine room design
  - Energy efficiency
  - LEED
- 11:30           Costs
- Capital costs
  - Operation costs
- 12:00           *Course Adjourns*