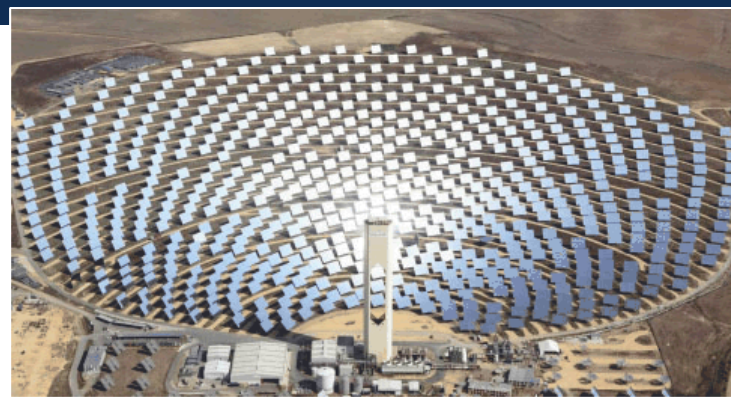


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CSP Training Module 9: Water Chemistry

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Sponsored by College of the Desert

BrightSource Ivanpah, CA

September 5 and 6, 2012



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Agenda

- 1. Basic Theory of Operation
- 2. Fuel
- 3. Modeling CSP plants
- 4. Basic construction and Design
- 5. Startup and Shutdown
- 6. Major System Operations
- 7. Plant Operation influences on the grid
- 8. Response to Weather Changes
- 9. Water Chemistry
- 10. Plant Performance Measurements
- 11. Safety Concerns

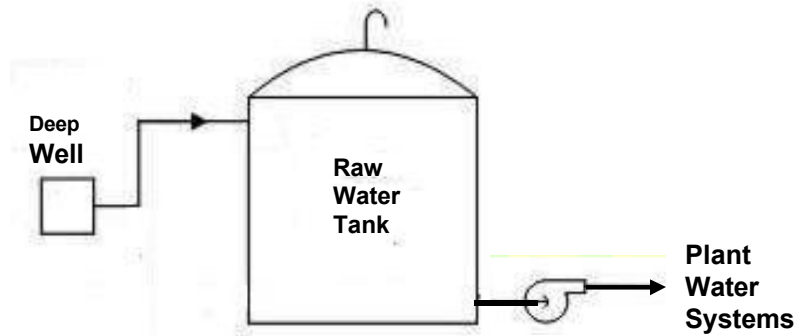
9. Water Chemistry

- Treatment
- Blowdown

Water Treatment

- Water treatment is highly dependent on the constituents in the source water
- Various levels of water treatment depending on use
 - Raw water- supplies plant and fire suppression system
 - Circulating water system – cooling tower (wet cooling)
 - Mirror washing water
 - Steam cycle
 - Receiver (boiler) water
 - Potable water
 - Sewage water
 - Evaporation ponds
 - Oily waste water

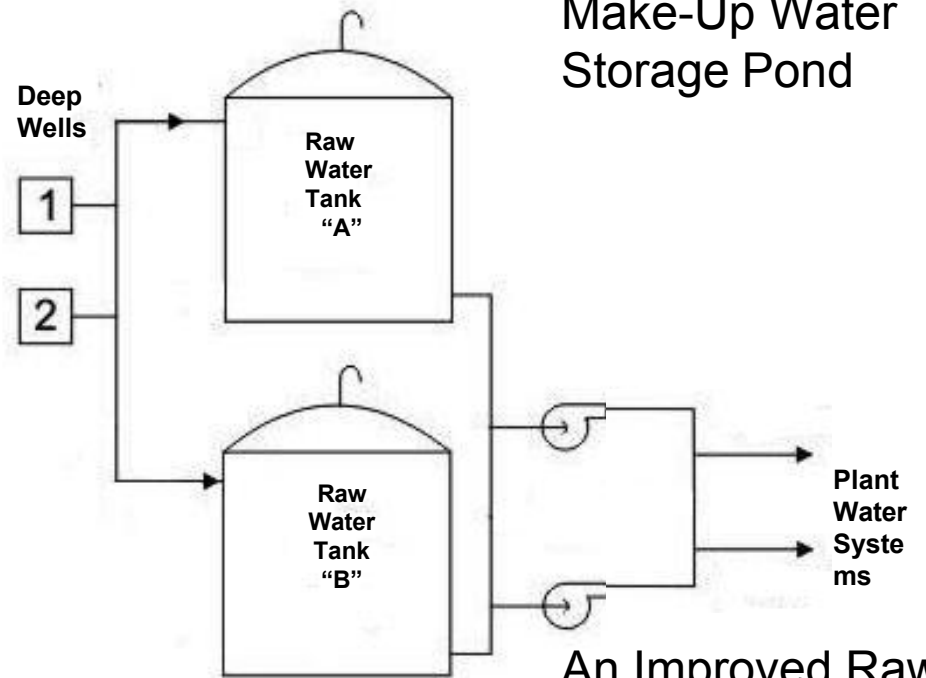
Make-Up (Raw) Water Systems



A Basic Raw Water System



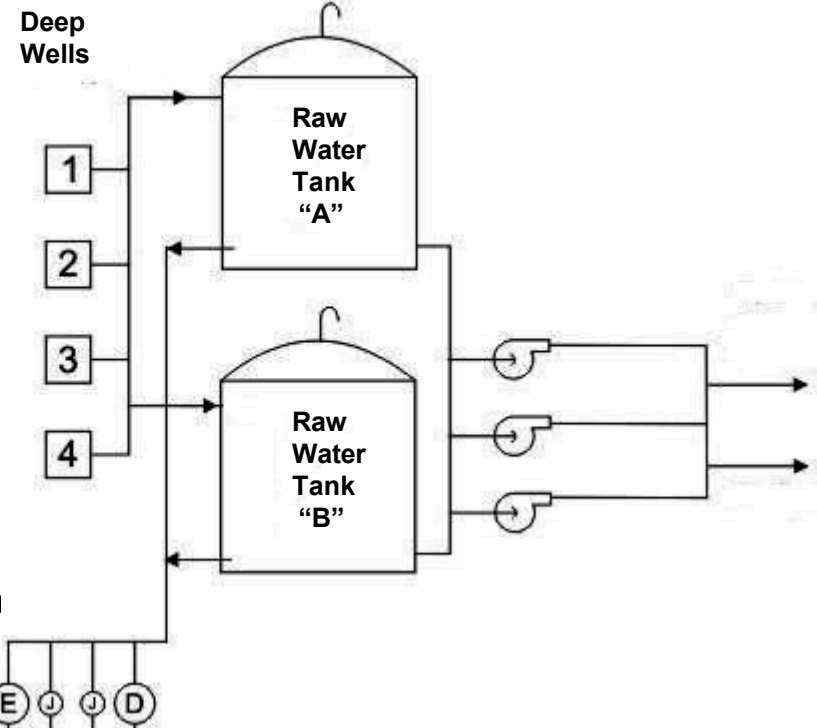
Make-Up Water Storage Tank



Make-Up Water Storage Pond

An Improved Raw Water System

Fire Water System



Fire Water Pumps

D = Diesel Fire Pump
 E = Electric Fire Pump
 J = Jockey Pumps



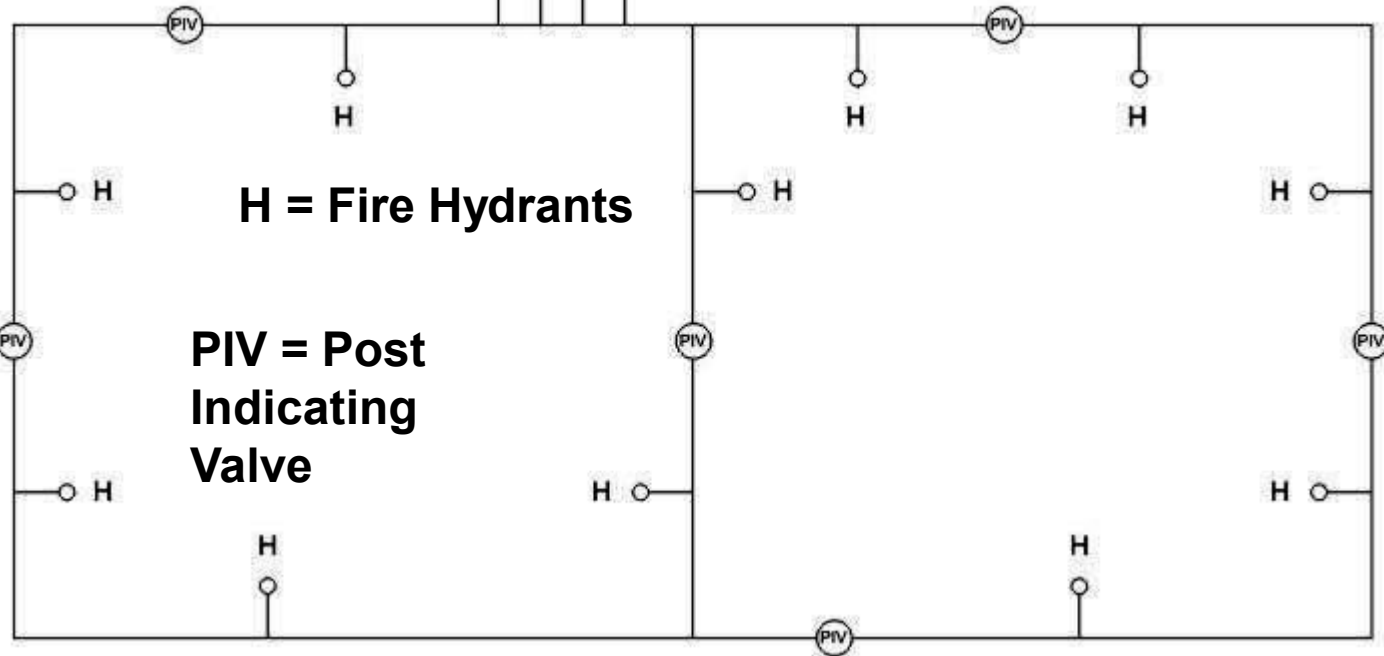
Plant Water Systems Jockey Pump



Motor Driven (Electric) Fire Pump



Engine Driven (Diesel) Fire Pump



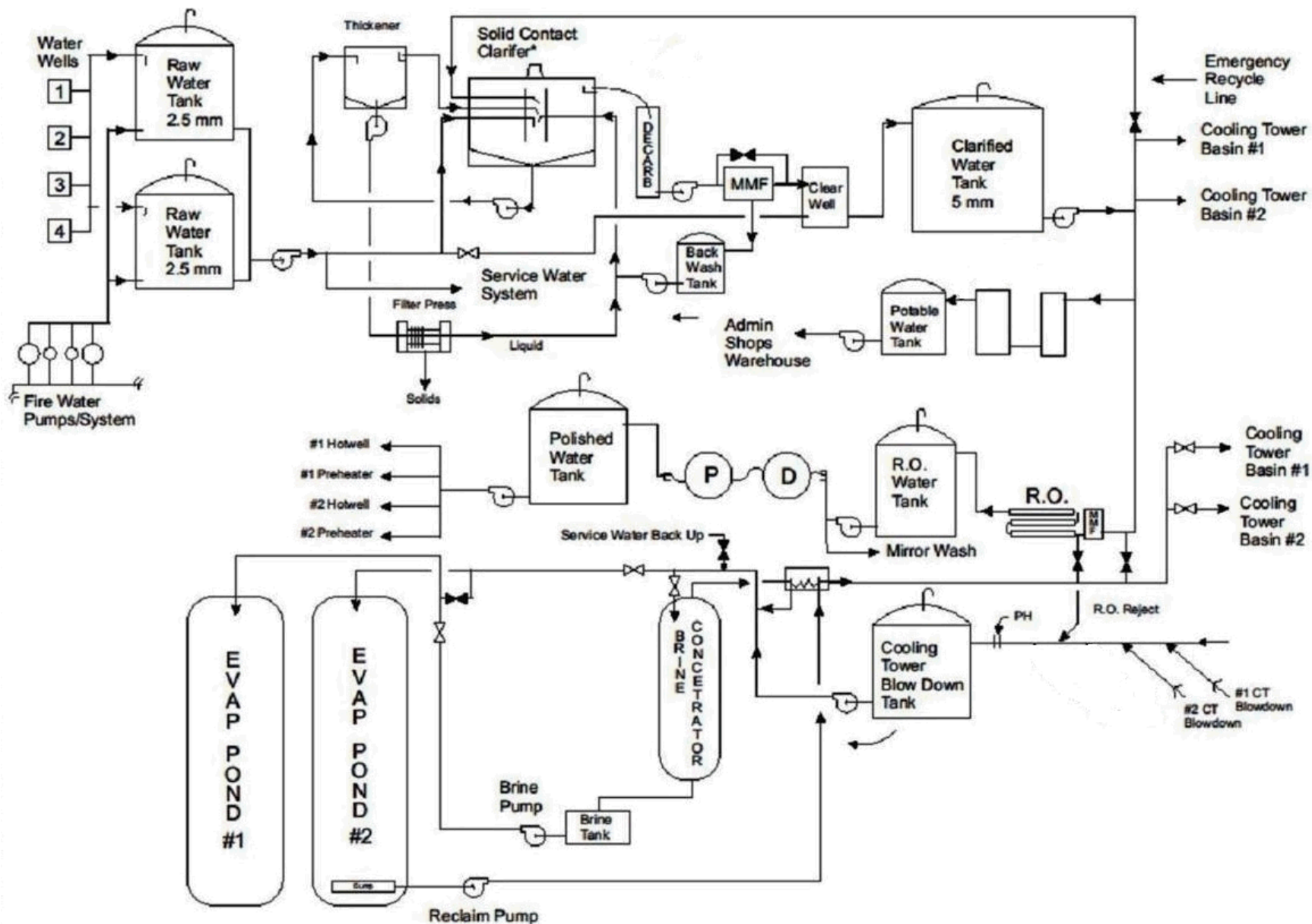
H = Fire Hydrants

PIV = Post Indicating Valve

Water Treatment Equipment

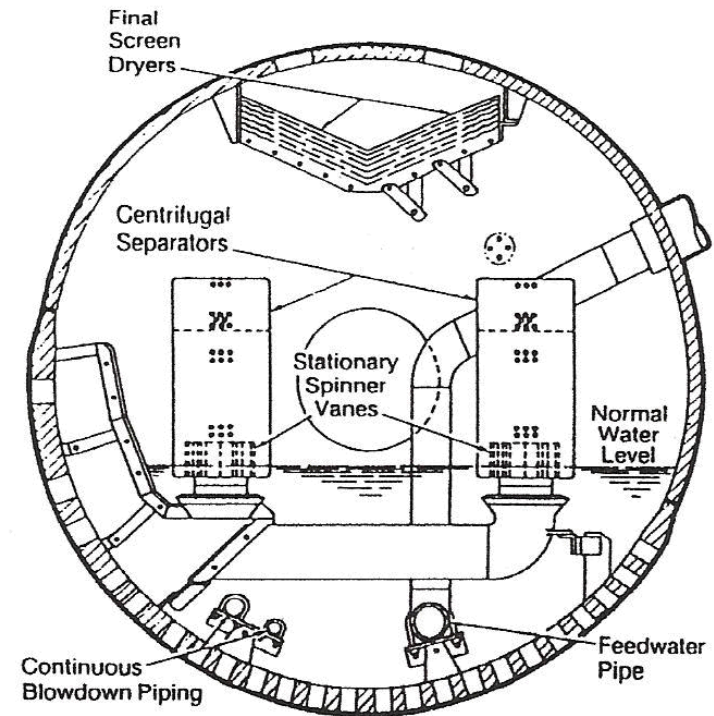


Water Treatment System



Blowdown

- During the boiling process in the receiver, solids are left behind in the steam drum
- Accumulate in bottom of drum, unless removed
- To remove, a fraction of the boiler water is blown down to remove the solids (1-2% of feedwater flow)
- During startup blowdown valve is closed to prevent the drum from draining while the receiver is building pressure. The intermittent blow down is used to clear solids.
- Blow down water is sent to the cooling tower basin or the evaporation ponds



**Steam Drum With
Centrifugal Separators**

Water Chemistry for Boiler

- Receiver manufacturer may specify the water chemistry requirement
- Because of the cyclic nature of the receiver (routine pressurization and depressurization), controlling the water chemistry is critical for reducing corrosion of the receiver material
- Chemical injection of oxygen scavengers may be required into the feedwater going into the drum
- Since direct steam receivers may have attemperators between the primary and secondary superheaters, the chemical injection is done down stream of the take off for the attemperator water.
- When the receiver is depressurized, nitrogen is back filled to displace air (oxygen) and reduce corrosion

