Using Municipal Reclaimed Water for Cooling Water Applications:
Review of Two Case Studies

McIlvaine Company Hot Topic Hour on “Power Plant Cooling Towers and Cooling Water Issues”
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Agenda

- Background on reuse of municipal wastewater
- Typical Water Quality Concerns for Cooling Water Applications
- Case Studies
  - Denver Water Recycling Plant
  - Western Corridor Recycled Water System
Water Reuse is the Recycling of Treated Wastewater for Beneficial Use

Water Reclamation Plant

Non-Potable Reuse
- Agricultural Irrigation
- Landscape Irrigation
- Industrial Uses
- Recreational & Environmental Enhancement

Indirect Potable Reuse
- Drinking water source (reservoir, aquifer, etc.)

Wastewater Treatment Plant

Treatment Plant Effluent
Typical Water Quality Requirements for Cooling Water Applications

- Water quality requirements for cooling water applications vary depending on the metallurgy utilized at the power plant.
- Typical concerns when using reclaimed water:
  - Low ammonia (typically non-detect)
  - Low TDS, especially for boiler feed applications
  - Chloride less than 150 mg/L
  - Low phosphorus (<0.5 mg/L) to limit calcium phosphate scaling in heat exchangers.
Case Studies

• Denver Water Recycling Plant (Denver, Colorado)
  – Provides cooling water to the Cherokee Power Plant

• Western Corridor Recycled Water Project (Brisbane, Australia)
  – Provides cooling water to Swanbank and Tarong Power Stations
Denver Water Recycling Project

Background

• Integrated Resource Plan (1996)
  ▪ Additional water supply needed by 2013
  ▪ Supply to be provided by conservation, recycling, and misc. improvements

• Recycling water reduces potable water demands
  ▪ At buildout, potable demand reduced by the equivalent of 40,000 households

• Customers identified
  – Xcel Energy – 10 mgd cooling water
  – Parks
  – Golf courses
  – Zoo
  – Commercial and industrial users
**Water Quality Requirements**

- **Irrigation Use** (Colorado Regulation 84 for Category 3 unrestricted access areas):
  - E. Coli: none in 75% of samples and 126/100 ml max
  - Turbidity: < 3 NTU (monthly average)
  - Filtration and disinfection required

- **Power Plant Cooling Water:**
  - Phosphorus: < 0.6 mg/l to prevent calcium phosphate scaling
  - Ammonia: non-detectable to avoid stress corrosion cracking of admiralty metals
Denver Water Recycling Plant

- Treatment capacity = 30 MGD, non-potable reuse
- Cooling water = 10 MGD, supplied to Xcel Energy’s Cherokee Power Plant
Western Corridor Recycled Water Project - Background

• Southeast Queensland has had the worst drought on record from 2001 – 2008
- Three new AWTPs
- Nine storage tanks
- 12 pump stations
- 200 km of pipe
- 232 MLD (61 mgd) of purified recycled water supplies:
  - two power plants
  - Wivenhoe Dam (if required)
• Production capacity of 70 ML/d (18.5 mgd)
• Provide multi-barrier treatment process
• Very high quality water (low TDS and hardness) for power plant uses
• Meet all Australian drinking water guidelines
Luggage Point AWTP Site

- Chemical Building
- Membrane & UV Building
- Raw Water Storage
- Flocculation / Clarification
- Centrifuge Building
- Thickener
Luggage Point AWTP

Flocculation / Clarification

Microfiltration

Reverse Osmosis

UV / Advanced Oxidation
Summary

• Reclaimed municipal wastewater is a good candidate for power plant cooling water

• Water scarcity is increasing its use in this application

• Typical water quality concerns include TDS, chloride, ammonia, orthophosphate, bacteria— all can be addressed with proper treatment
Questions?

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