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Study of Cooling Water Use at a Large Pulp and Paper Mill

NCASI West Coast Regional Meeting – September 2016

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Introduction

Agenda

- Background information.
- Evaluation approach.
- Cooling water users.
- Results.

Background

Cooling Water Intake Structure Rule – 316(b)

- Effective on October 14, 2014.
- Section 316(b) of the Clean Water Act requires EPA to identify “best technology available for minimizing adverse environmental impact” for cooling water intake structures operated by sources with technology-based effluent limits implemented through NPDES permits.

Background

Cooling Water Intake Structure Rule – 316(b)

- Facilities that meet the criteria will be required to comply with the federal requirements for their intake structures.
- 40 CFR 125.91 contains the applicability criteria for existing facilities:
  - The facility is a point source.
  - The facility is designed to draw more than 2 MGD from waters of the US.
  - ≥25% of the water the facility withdraws on actual intake flow basis is used exclusively for cooling purposes.

Background

Cooling Water Intake Structure Rule – 316(b)

40 CFR 125.92(e)

Cooling water means water used for contact or non-contact cooling, including water used for equipment cooling, evaporative cooling tower makeup, and dilution of effluent heat content. The intended use of the cooling water is to absorb waste heat rejected from the process or processes used, or from auxiliary operations on the facility's premises.

Cooling water obtained from a public water system, reclaimed water from wastewater treatment facilities or desalination plants, treated effluent from a manufacturing facility, or cooling water that is used in a manufacturing process either before or after it is used for cooling as process water, is not considered cooling water for the purposes of calculating the percentage of a facility's intake flow that is used for cooling purposes in §125.91(a)(3).

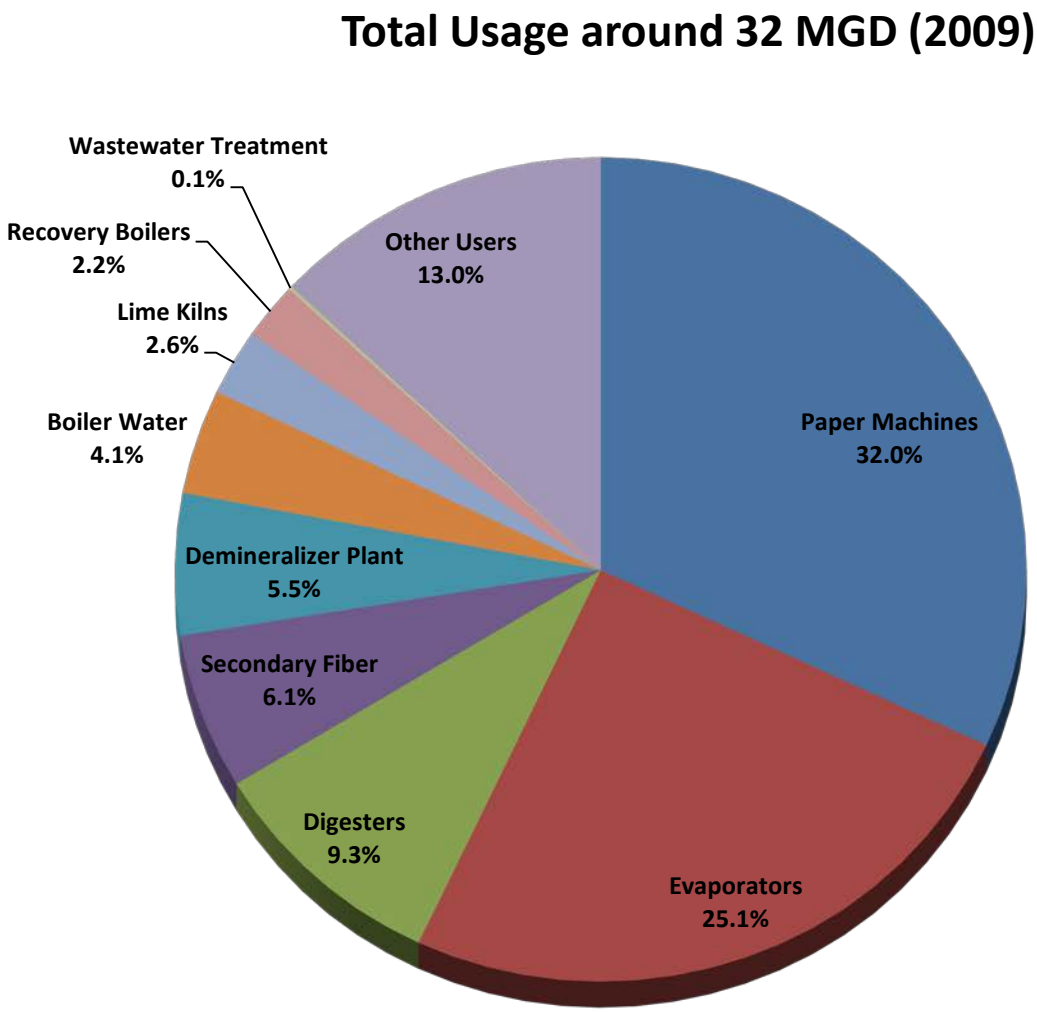
Evaluation Approach

Methodology

- Determining overall water users.
- Understanding mill water systems.
- Identifying systems that utilize cooling water.
- Determining what cooling water uses meet the definition of 40 CFR 125.92(e).
- Identifying key systems that can be used to simplify evaluation.
- Determining measurement and estimation approaches.

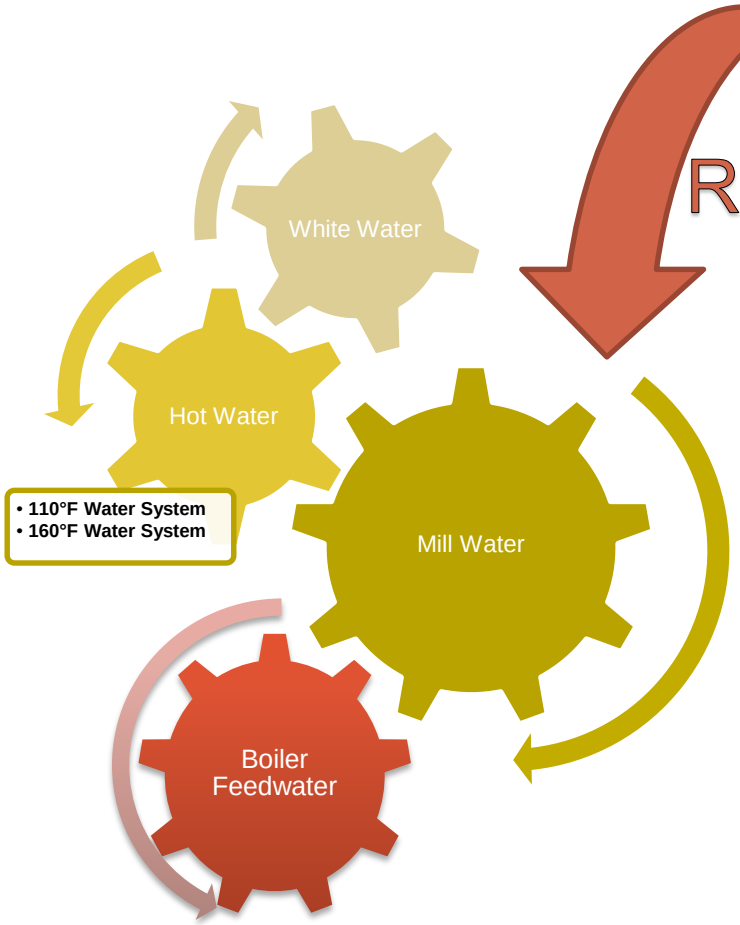
Mill's Water Users

Total Mill Water Use Survey



Mill Water Systems

Facility Water Systems and Connections



- Multiple water systems
- Each system defined based on use, temperature
- Mill water used for cooling, hot water systems receive waters used for cooling
- Wasted hot water must be accounted for

Cooling Water

Pulp and Paper Mill Cooling Water Users

Typical systems that might use cooling water:

- Heat exchangers.
- Processes where temperature control is necessary.
- Equipment cooling.
- Oil coolers.
- Cooling towers.
- Air conditioners.
- Wastewater treatment.

Cooling Water

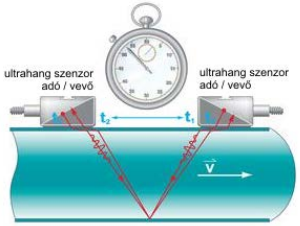
Measurements

- Continuously recorded flow meters

  Data limited to where meters are installed

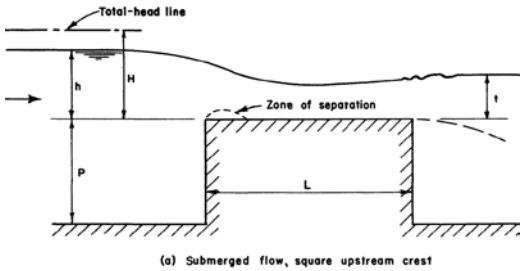
- Temporary flow meters

  Limited amount of data collected
  Not suitable for all locations and pipes (pipe material, flow disruption, etc.)



- Weir discharge equations

  Limited to very few locations



(a) Submerged flow, square upstream crest

- Bucket and stopwatch

  Limited to very few locations and low volumes

Cooling Water

Estimations

- Targeted sampling and statistical correlation with process data
  - Paper machine production rates during normal operation correlates with total mill water use.
  - Some data used to estimate flow rates of substantially similar equipment.
- Design flow rates
  - Equipment ratings and other engineering information used to estimate maximum flow.
- Seasonal factors
  - Multiple air conditioners use mill water for cooling.
  - Correction needed to adjust for weather conditions.

Cooling Water Use Evaluations

Paper Machines

Cooling Water Use Evaluations

Paper Machines

List of potential cooling water uses:

- Oil cooling systems.
- Calendar cooling system.
- Gearbox coolers.
- Bearing coolers.
- Vacuum pump condensers.
- Other various equipment.

Cooling Water Use Evaluations

Paper Machines

Coolant Use	Flow Rate (GPM)
Main Machine Oil Cooling System Water	150
New Machine Oil Cooling System Water	85
Other Non-Contact Cooling Water Overage	235
Calendar Air and Oil Cooling Water	15
Repulper Gearbox Coolant	90
2nd Level Air Pump Water Flow	100
Total	675

Cooling Water Use Evaluations

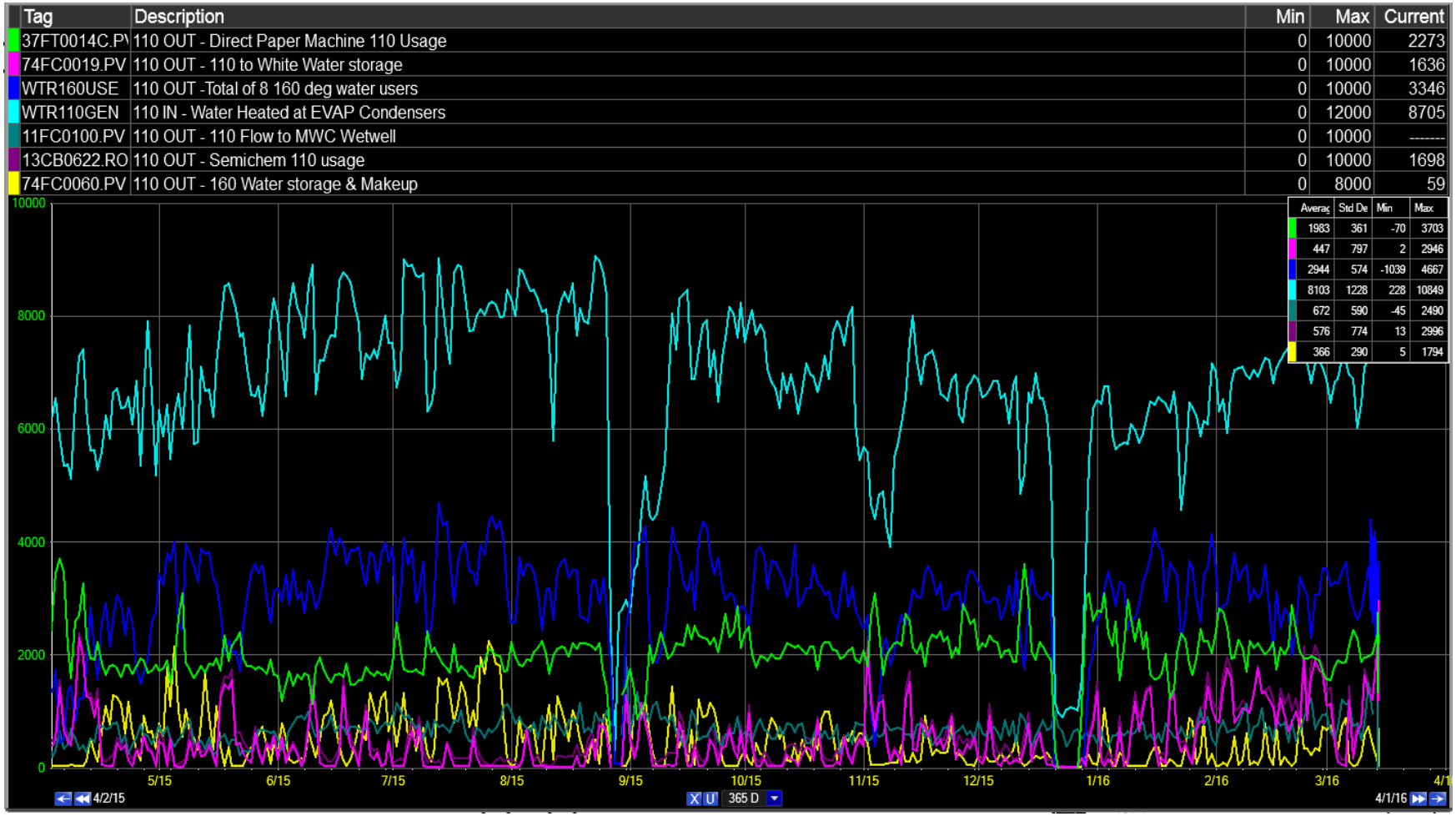
Evaporator Condensers

Things to consider with evaporator condenser water:

- Collection system.
- Users.
- Storage capacity.
- Seasonal demand.

Cooling Water Use Evaluations

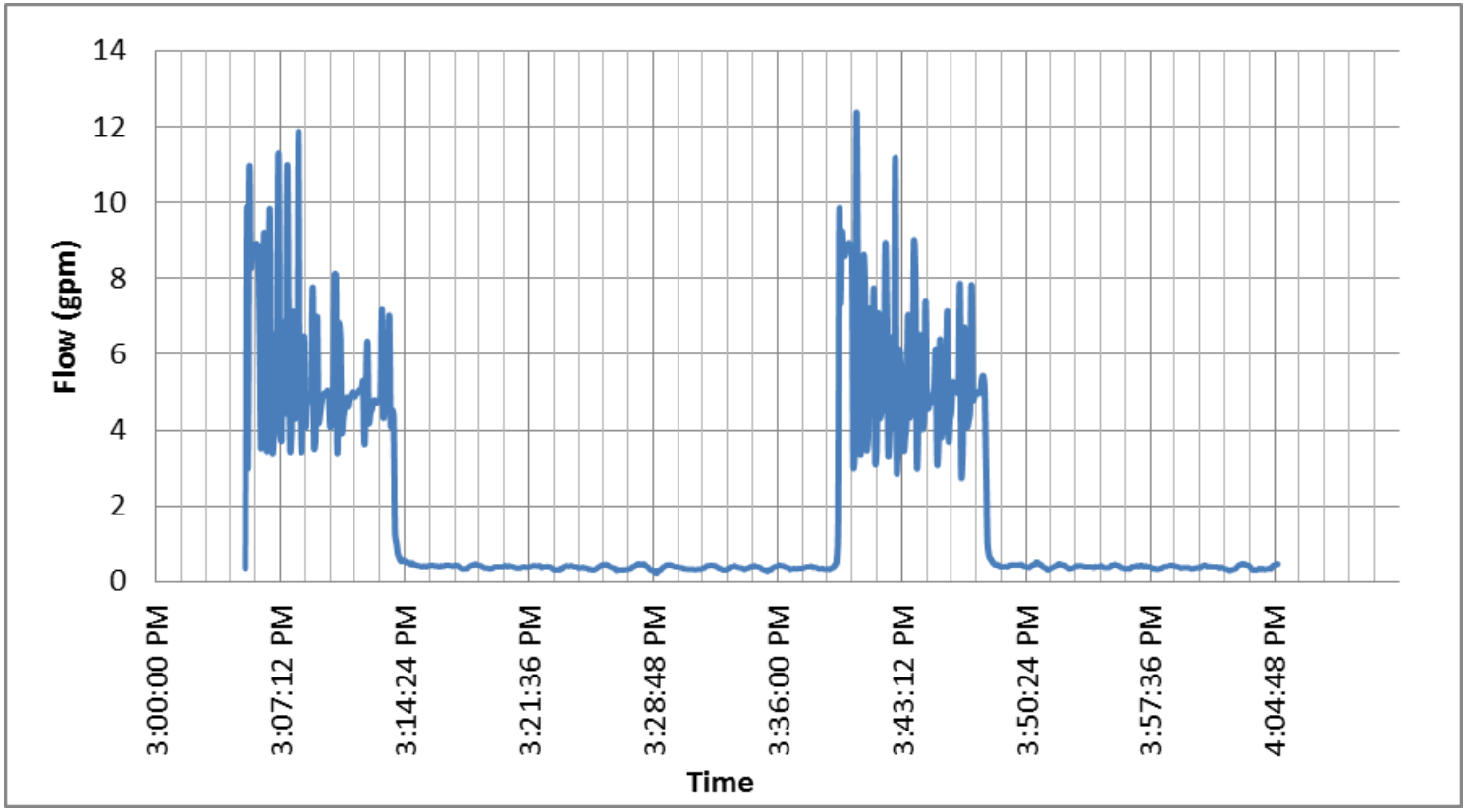
Evaporator Condensers



Cooling Water Use Evaluations

Air Conditioners

Air conditioner refrigerant condensers



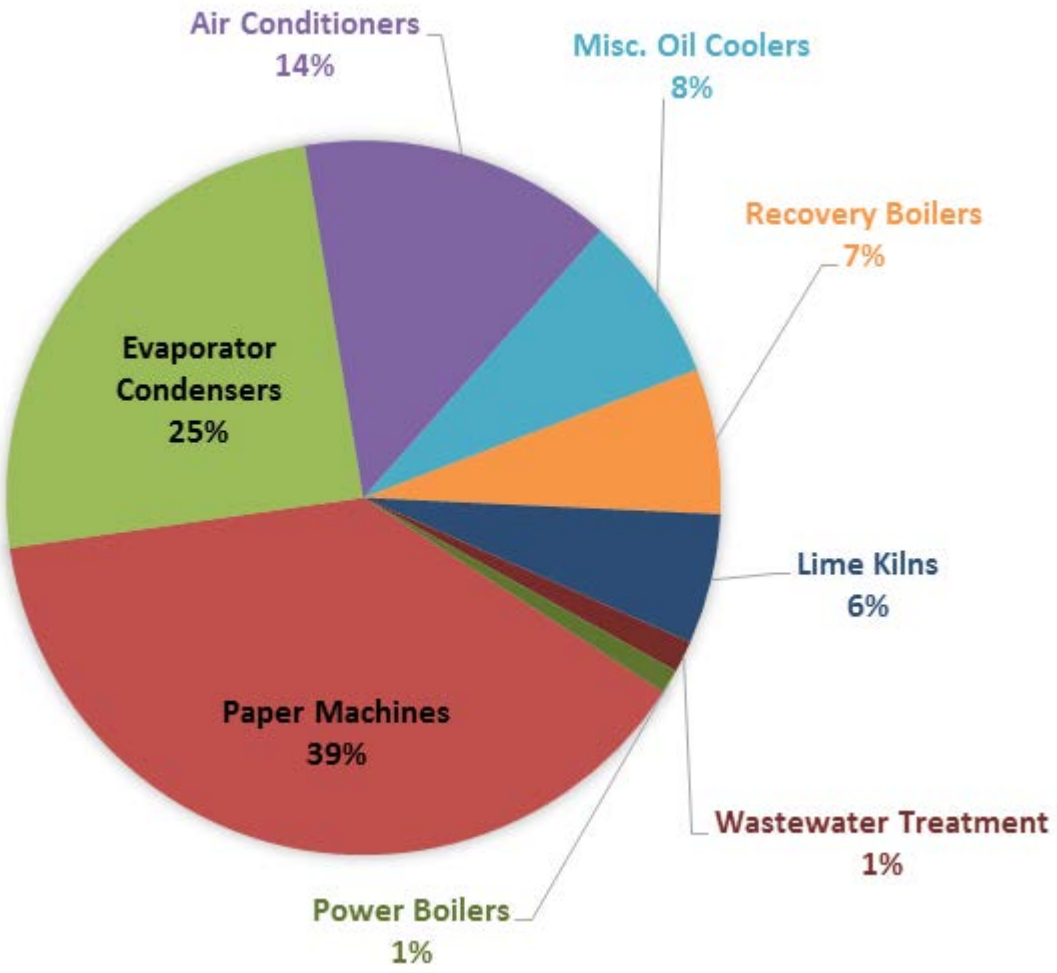
Cooling Water Use Evaluations

Other Water Cooling Uses

- Vacuum pump condensers.
- Lime Kiln trunnions.
- ID/FD Fan cooling systems.
- Bearings and gearbox coolers.
- Various oil cooling systems.
- Wastewater treatment cooling.

Cooling Water

Results Summary



Questions?

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Thank You