Water Efficiency in the Automotive Sector

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Area’s Largest Manufacturing Facility
Largest Mfg. Facility in Volvo Family
OVERVIEW

- Examine a decade plus of water savings benefits
- Review two projects
- Review water savings versus energy savings
Overall, water use efficiency improved 41% since the baseline year of 2003.
Cab Leak Test Water Recycling

- Baseline water use for cab leak testing - 1100 gallons per truck
- System installed to clean and recycle the water used for cab leak testing.
- Investment was $520,000
- The benefit of recycling this water for reuse
  - Water use savings of 700 gallons per truck
- This represented a plant-wide reduction for water use of 22%
Process Wastewater Treatment Method

The reuse system consists of the following components:

- **Un-treated Wastewater**
- **Waste Water Storage**
- **To Plant Processes**
- **WWT**
- **UF Feed Storage**
- **Cartridge Filter**
- **Ultra-Filtration**
- **Reuse Water Storage**
- **High Pressure Reverse Osmosis**
- **HPRO Feed Storage**
- **UV Light**
- **Reused Water**
Process Wastewater Reuse Drivers

Environmental Issues

- Surfactant issues at the regional authority / foaming
- Molybdenum contamination of land-applied sludge
- Volvo was proactive to identify its contribution to a potential issue

Volvo Environmental Requirements

- Wanted Position: To install water recycling processes with low water usage and preferably with chemical recycling in closed loop processes
Process Wastewater Reuse Incentives

Environmental Sustainability

- Average incoming water from processes = 12M gal
- Average reuse water to processes = 7.4M gal
- Average annual reuse rate is 62% for process water

Environmental Liability / Risk Mgmt.

- Capital funds invested for recycling water instead of meeting increasingly stringent environmental regulations. $1.5 MUSD vs 1.1 MUSD
Process WWTP Specifications

1. Average daily flow from WWTP
   - 36,307 gallons per day
2. Maximum treated flow (WWT) = 500 gpm
3. Storage capacity of untreated wastewater
   - 274,000 Gallons
4. Conventional precipitation system.
   Treats Nickel and Zinc (0.099 mg/L limit for Ni and 0.6 mg/l limit for Zn)
Usage Points With a Focus on Process Opportunities

- E-coat high-purity water (HPW) system required replacement
  - Ran 3-4 months of water testing to baseline system to verify performance before incorporating process needs
  - Advantage:
    - Avoid additional capital expense and incorporated e-coat into reuse system instead
  - Disadvantages:
    - Drives reuse water requirement to lower conductivity
    - More frequent discharge events due to more stringent water quality requirements
Usage Points

- **PROCESS**
  - E-coat System: 15,000 to 20,000 gpd

- **NON-PROCESS**
  - Humidification: 500 to 1,000 gpd
  - Parts Wash: 12,000 gpd
  - Cooling Tower: 4,000 to 6,000 gpd
System Upgrade in 2015

- UltraFilter and High Pressure Reverse Osmosis replaced NF/RO
  - When NF permeate conductivity > 2000 µohms/cm, the RO permeate conductivity will exceed 30 µohms for processes.
    - Resulting in a discharge event
      - Install UF and HPRO operating at 800 – 1000 psi allowing treatment of conductivities of 45,000 µohms/cm
  - Upstream of WWTP, reduce solids content of wastewater to minimize impact and loading on UF and HPRO
    - Install filter system to remove E-coat solids and other solids
- Improve Water Balance between production and non-production periods
  - Added two 17,000 gallon tanks to store clean water for reuse
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- UV Light
- HPRO Feed Storage
- To Plant Processes
Design Specifications and Installation

Ultraviolet Light (254nm)  Cartridge Filtration
Design Specifications and Installation

Ultra-Filtration

High Pressure RO
Process Improvement - 2015

- Installed solids removal equipment for E-coat discharge to reduce impact of process on conductivity/TDS & TSS.
Process Improvement - 2015

- Expand the storage capacity for reuse water to address losses associated with shutdown periods by addition of two 17,000 gallon pure water storage tanks.
Process Improvement - 2015

- High pressure RO system will address lower conductivity requirement for E-coat, but allow improved system reuse (provide up to 93% recovery of process water)
  - Operating at membrane pressures from 800 to 1,000 psi will allow for treatment of waters with conductivities approaching 45,000 μohms/cm.
Reference: EPRI- 2013 - Electricity Use and Management in the Municipal Water Supply and Wastewater Industries

- Public Water Supply Average w/o CEC data = 1,903 kWh/MG
  - Community Surface Source = 1,600 kWh/MG
  - Community Groundwater Source = 2,100 kWh/MG

- Municipal Wastewater/Secondary Treatment = 2,080 kWh/MG
  - Greater than Secondary Treatment = 2,690 kWh/MG

- For this analysis:
  \[ 1,903 + 2,080 = 3,983 \text{ kWh/MG or } 3.983 \text{ kWh/1000 gallons} \]
Impact of Reduction in Water Use

- Plant-wide Baseline Water Use is 62M gal
- Water Use Average from 2004 to Present is 39M gal
- Average Annual Reduction in Water Use is 23M gal
- Plant-wide Average Cost Savings is $216,230 per yr

WWTP reuse system savings in 2015 is ~$69,000
Increased Energy Use for WWTP reuse system is 136,320 KWH on average or $18,135/year
WWTP reuse system net cost savings is ~$51,000 in 2015
Nominal Benefit to the County

- County Energy Savings Based on plant water savings
  - 926 KWH per Year average
- At 7.5 cents/KWH, Average County Cost Avoidance
  - $69.46 per year
- Overall, nominal energy savings or cost benefit for the County
Overall Benefits for Wastewater Recycling and Reuse

- Additional energy cost to operate reuse systems is outweighed ~ 4:1 by the savings from reduced water use at county rates
- Improved feed water quality and water balance for processes
- Reduced chemical usage for non-process requirements
- Partial Fulfillment of the Volvo Environmental Goal
- Reduced environmental liability and risk with fewer discharges to POTW
Thank You
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