Water Re-Use System for Industrial Discharger

Timothy J. St. Germain, P.E.
Senior Vice President
Outline

I. Site Background
II. Process Flow Diagram
III. The Problem
IV. The Solution
V. The Process
VI. Results
VII. Transformative Decision
VIII. Questions/Discussion
UTC-Aerospace Systems (division of UTC)
Windsor Locks, Connecticut

Manufacturer of Commercial and Military aircraft components

Site Development = 1950s
Mfg Space = 2.2M SF
Land Area = 300 Acres
Employees = 4,000

Industrial Wastewater Flows = 30K to 40K GPD

Windsor Locks, CT Campus
**Process Flow Diagram**

**Groundwater Treatment System (GTS) Flow Map**
- Flow from 22 extraction wells
- Equalization
- VOC Removal
- Ion Exchange
- pH adjustment
- GTS Discharge

**Industrial Wastewater Treatment System Flow Map**
- Flow from SEEP collection system
- pH adjustment
- Combined Groundwater and Industrial Wastewater Discharge
- Surface Water (River)

**Influent Sources**
- Metal Finishing Wastewater
- General Factory Flow
- Containerized Waste
- FPI Waste

**Pre-treatment Systems**
- Chrome Reduction
- Acid/Alkaline Wastewater
- Microfiltration (Alkaline Cleaner)
- Ultrafiltration (FPI Wastewater)
- pH Adjustment
- Equalization
- Advanced Treatment (Metal Hydroxide Precipitation and Multi-Media Filtration)
- Industrial Wastewater Discharge
Site Background

Wastewater Treatment Facility
The Problem

Corporate goal is to reduce or eliminate environmental risks

• Corporate EHS staff have concluded that NPDES permit/surface water discharges represent significant environmental compliance risk and ongoing environmental liability
  – Cost of maintaining compliance
  – Risk of permit violation/impact to environment

• Determine that relocating discharge to local sanitary sewer authority may provide some risk reduction but not adequate
The Solution

Eliminate industrial discharges from the site

• Implement water conservation measures
  – Extensive water audits
  – Process controls
    o Flow metering
    o Flow restriction
    o Conductivity-driven rinsewater use
    o Counterflow rinses
    o In-process/side stream treatment (I/X, filtration)
    o Point-of-use recycling (LPI, aqueous cleaning)
  – Operator training

• Upgrades to existing treatment processes

• Wastewater recycling and reuse
Treatment System Upgrades

- Chromium Pretreatment
- Equalization
- Groundwater Remediation
- Multi-Media Filtration
The Process

Feasibility Study

- Gather data (develop understanding of current operations and water usage)
- Evaluate options (water conservation, treatment, recycling)
- Assess needs, recycle water opportunities & potential costs

Pilot Study

- On-site, side stream operation
- Gather design criteria (flow rates, treatment efficiency)
- Assess maintenance requirements

Design

- Primary recycling equipment
- Supporting utilities (steam, electricity, cooling water)
- Other infrastructure (building, distribution system)
Recycled Water System

Clean-in-Place

Carbon Filtration

Reverse Osmosis

Water Softening

Reject

City Water

Distillate

Evaporator

Municipal Water

RWS

Wastewater Treatment Facility

Metal Finishing

Other Factory Flow

Powerhouse Co-Gen

Groundwater Remediation
Water Reuse System

5 Major Treatment Skid-Mounted Components

(Carbon Polishing, Water Softening, Reverse Osmosis, Vacuum Distillation and Clean-In-Place)
Carbon Polishing

**Purpose** – Remove organics to protect RO membranes

**Key Feature** - Redundancy
Water Softening

Purpose – To protect RO membranes
Key Feature - Redundancy
Reverse Osmosis

Purpose – Primary recycling (85-90% permeate)
Key Features – 100% Redundancy (dual trains); 75 GPM
Vacuum Distillation

Purpose – Enhanced recycling (98%+ recycle)
Key Features – Vacuum distillation and dual effect (900 GPH)
The Infrastructure

- New building to house processes
- New utilities (steam, compressed air, electricity, cooling water)
- Upgraded process controls (instrumentation, SCADA)
Water Reuse - Distribution

- 10,000 Gallon Storage Tank (Recycled Water)
- Recycle Water Distribution Network
- Two (2) – 30,000 Gallon Storage Tanks
Facility Water Balance

- **WATER REUSE SYSTEM**
- **PRIMARY TREATMENT**
  - Metal Hydroxide
  - Precipitation
  - Clarification
  - Multi-Media Filtration
- **PRE-TREATMENT**
  - Microfiltration
  - Chrome Reduction
  - Ultrafiltration
  - Neutralization

- **FACTORY METAL FINISHING POWERHOUSE**
- **WASTEWATER GENERATION**
Results

Completion in 2011

- Close-loop industrial wastewater
- Excellent and consistent water quality
- 30,000 to 40,000 GPD (average) reduction in discharges (approximately 13 to 14 MGY)

Revocation of NPDES Permit to the river

Pretreatment Permit for discharge to local POTW

- Regulatory coverage
- Emergency discharge option
- No discharge has occurred since system start-up (approximately 4.5 years)
Transformative Decision

The company is evaluating zero discharge throughout its entire organization

- 150 manufacturing facilities world-wide

The outcome has been viewed as an overwhelming success

- Reduces corporate-wide environmental risk
- Promotes corporate goals for sustainability
- Improves business continuity
Acknowledgement

UTC Aerospace Systems:

Erich Uhlan, Global EHS Compliance Program Manager
Roland Babin, Manager - Wastewater Treatment Facility

Primary Equipment Manufacturer:

Kontek Ecology Systems Inc.
Burlington, Ontario, Canada
Questions/Discussion
Water Reuse System
Wastewater Evaporative Recovery System

1. **Feed water** flows into the FIRST EFFECT evaporator and is heated in the Heat Exchanger.
2. The water vapor is then cooled in the Cooling Water Exchanger and sent to the 2-Stage Mist Eliminator.
3. The concentrate is directed to the BRINE FOR OFF-SITE DISPOSAL and the distillate is recycled.

4. The SECOND EFFECT evaporator receives the feed water and heat from the Heat Exchanger.
5. The water vapor is cooled in the Cooling Water Exchanger and sent to the 2-Stage Mist Eliminator.
6. The concentrate is directed to the CONCENTRATE FOR OFF-SITE DISPOSAL and the distillate is recycled.

**Additional Components:**
- **Vacuum Line:** Connects the evaporators to the vacuum system.
- **Cooling Tower:** For water vapor discharge to atmosphere.
- **Vacuum System:** Includes Eductor Pump and TANK.
- **Powerhouse Boiler:** Provides steam for the evaporators.
- **Eductor:** Used to enhance the vacuum process.