

Twinsburg, Ohio

# *TREATING DIE CASTING WASTEWATER CASE HISTORY*



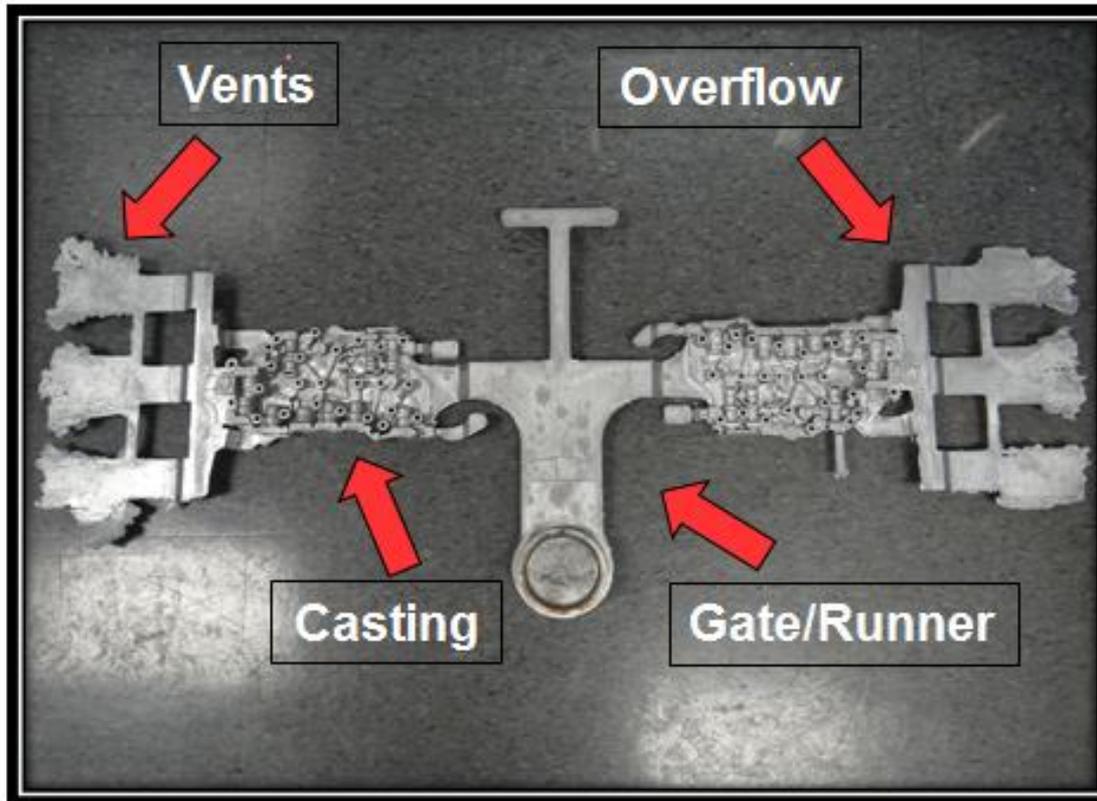
# Presentation Overview



- ✧ Twinsburg die casting facility
- ✧ Waste water treatment methods
- ✧ ZenoGem MBR
- ✧ Operation problems
- ✧ D.O.E. Project
- ✧ Koch S1UF
- ✧ Conclusions

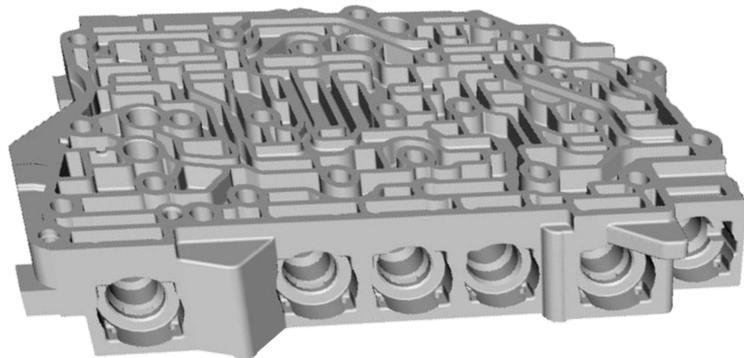
# Twinsburg Die Casting Facility

- Forced molten aluminum into a steel die under 3000 psi

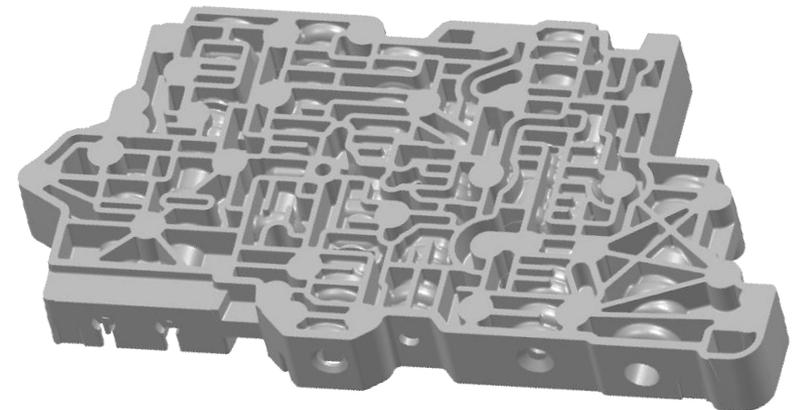


○ **Lester: segmented die**

**Solenoid Body: Die Cast &  
Finish Machined**



**Valve Body: Die  
Cast & Semi-Finish  
Machined**



# Twinsburg Die Casting Facility

- **1992- First fully automated die casting facility**
- **Specifically for valve bodies**



# Wastewater Treatment



## ○ Physical-Chemical

- ✧ Waste water : 80% die lube, 10% trim lube, 9% washwater, 1% glycol
- ✧ COD: 15000 die lube, 12000 trim lube, 1000 washwater, 1,000,000 glycol
- ✧ Firm when out of business, hired the foreman to operate system
- ✧ Batch mode problems
- ✧ Could not remove glycol
- ✧ 126 violations in 6 months for COD, BOD, O&G, Phenols, Zinc, Copper, Lead
- ✧ COD limit = 10,000 mg/l

# Zenon (GE Water)



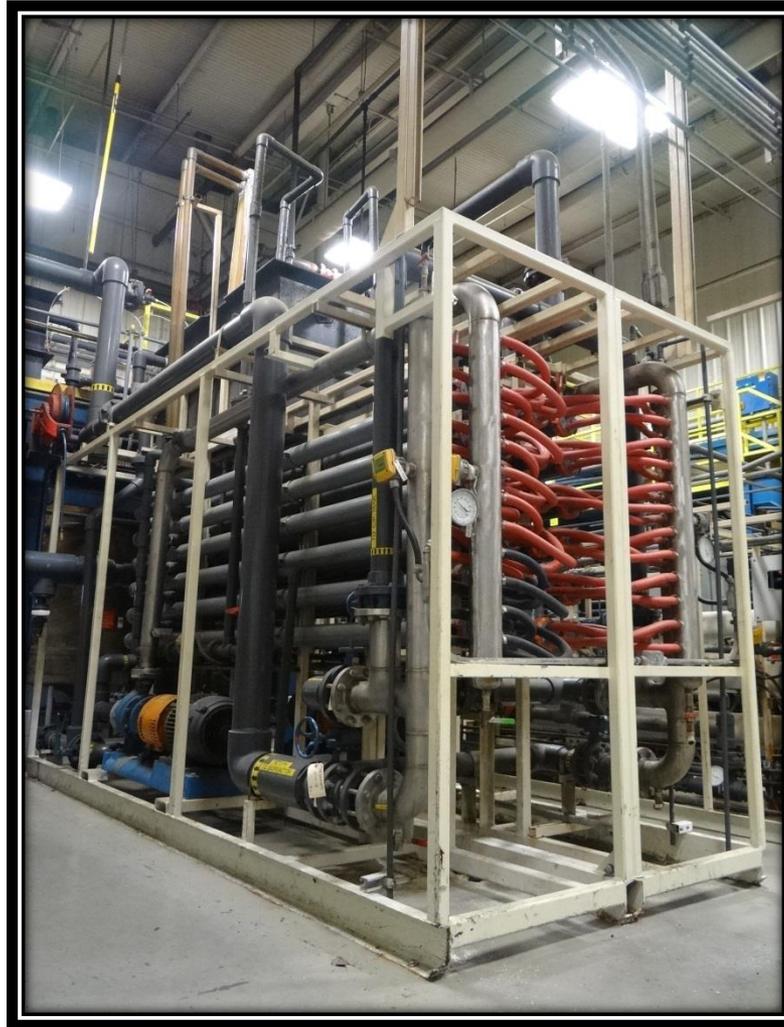
- Hire environment consultant
- Recommended Zeno-Gem MBR with Reverse Osmosis (RO)
- Zero discharge
- Hired Nov. 1994 to manage the install and operate
- Consulting firm quit
- Started new system 30 days ahead of compliance schedule



# ZenoGem MBR + RO

- **Ultra Filter**

- ✦ Tubular



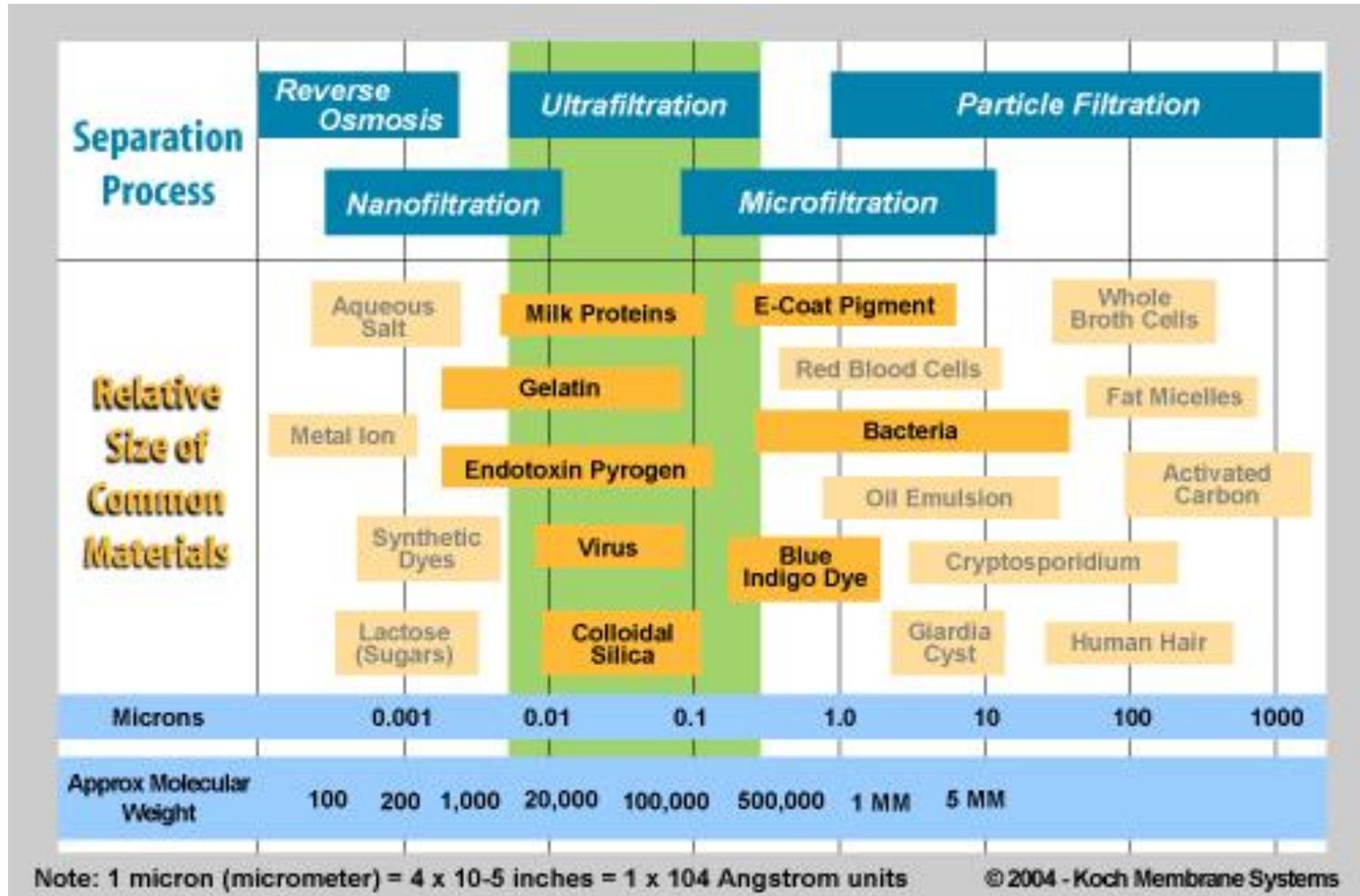
# ZenoGem MBR + RO

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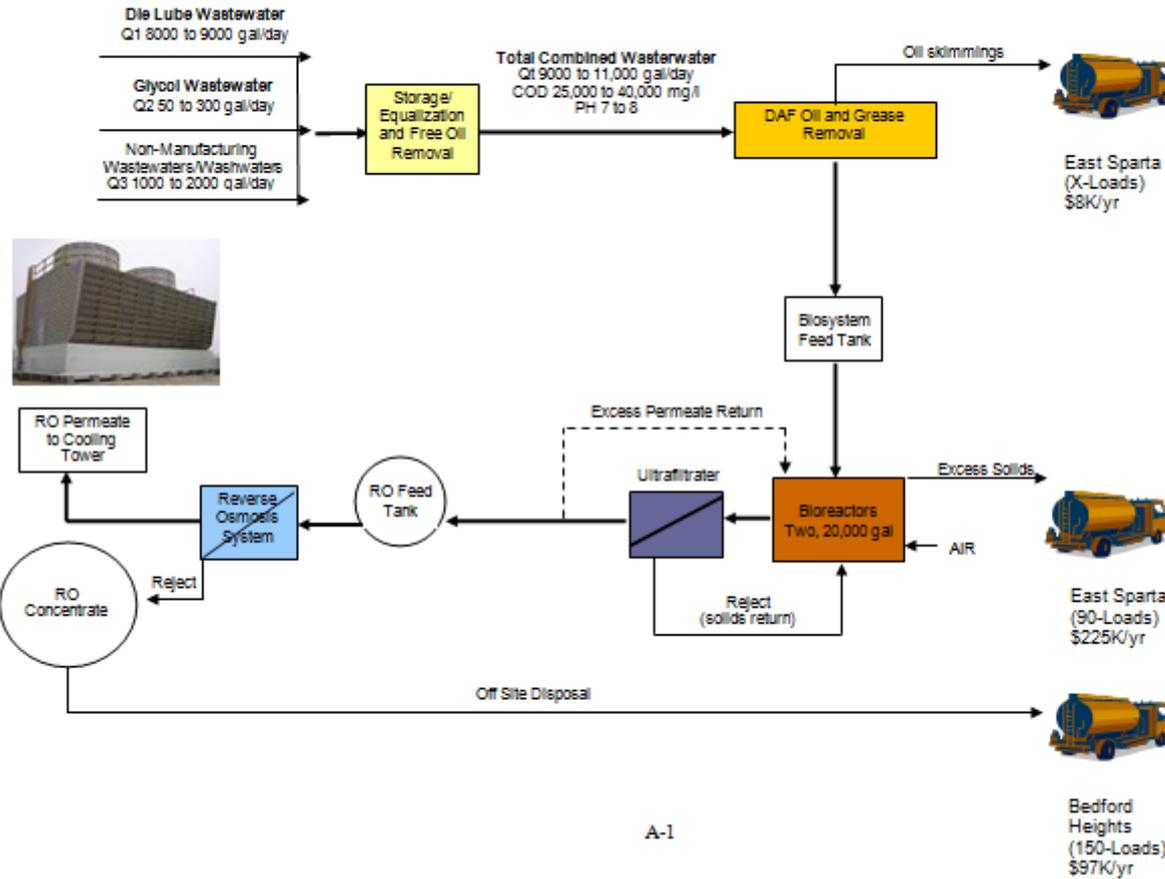


# ZenoGem MBR + RO



# ZenoGem MBR + RO

**METALDYNE TWINSBURG: WASTEWATER TREATMENT PROCESS FLOW DIAGRAM**



A-1

# ZenoGem MBR + RO

## ○ Issues & Problems (Opportunity's for Improvement)

- ✧ FOAMOVER!!
- ✧ Defoam
- ✧ Installed conductance probes
- ✧ Installed Ultra sound probes
- ✧ EPA spill
- ✧ Hired people to sit and watch 24/7
- ✧ Built containment room 400+ foamovers



- **Temperature**

- ✦ Uncontrolled temperature from 90 to 140 degree F
  - Installed heat exchangers to maintain temp @ 90 F

- **Dissolved Oxygen**

- ✦ Unable to maintain and control Dissolved Oxygen (DO)
  - Installed Variable speed drives on Blowers control by DO level

- **Weekend Upsets**

- ✦ One day Influent tanks
- ✦ Run out of Biofeed water = foam

# Die Lube



## ○ Switched Die Lube

- ✧ Fouling & irreversible UF membranes
- ✧ Frequent cleaning
- ✧ Golden oil
- ✧ Replacing 3 weeks to 3 months
- ✧ Slime in UFP



- **Switched Die Lube**

- ✦ High COD in RO permeate
- ✦ Fouling RO membranes
- ✦ Frequent cleaning

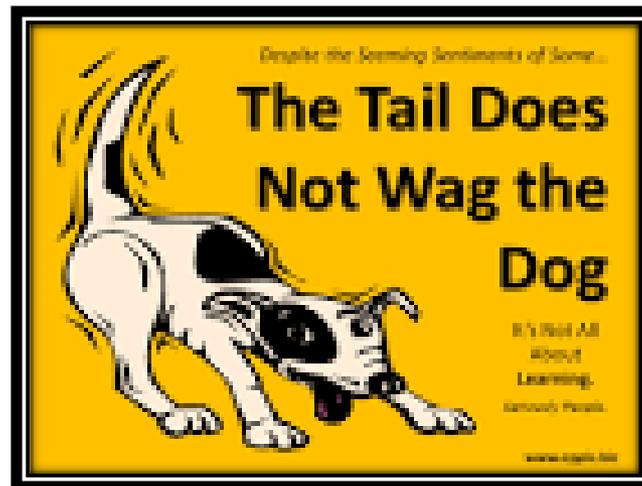


- **Switched Die Lube**
  - ✦ Poor tower make-up
    - Tower cleanings
    - Problematic treatment
  - ✦ Uncontrolled wasting of Bioreactor
    - Non-homogeneous biomass
    - Bio-balls
  - ✦ Increased Foaming



# New vs. Old (Die Lube)

- 50 /50 study
- New lube worked 40% better in production with Silicone Oil
- Management instructed to find a way to treat new die lube



# MBR Pretreatment Options



- **Phys/Chem- polymers, clay**
- **Evaporator**
- **Thermal Oxidizer**
- **Centrifuge**
- **UF polymer and ceramic**
- **26 companies & 3 consulting firms in 10 years**

# MBR + RO Performance



- **RO Permeate Poor Quality**

- ✧ Poor MBR performance

- ✧ Glycol

- **Very Poor Tower Make-Up**

- ✧ Sludge in basin

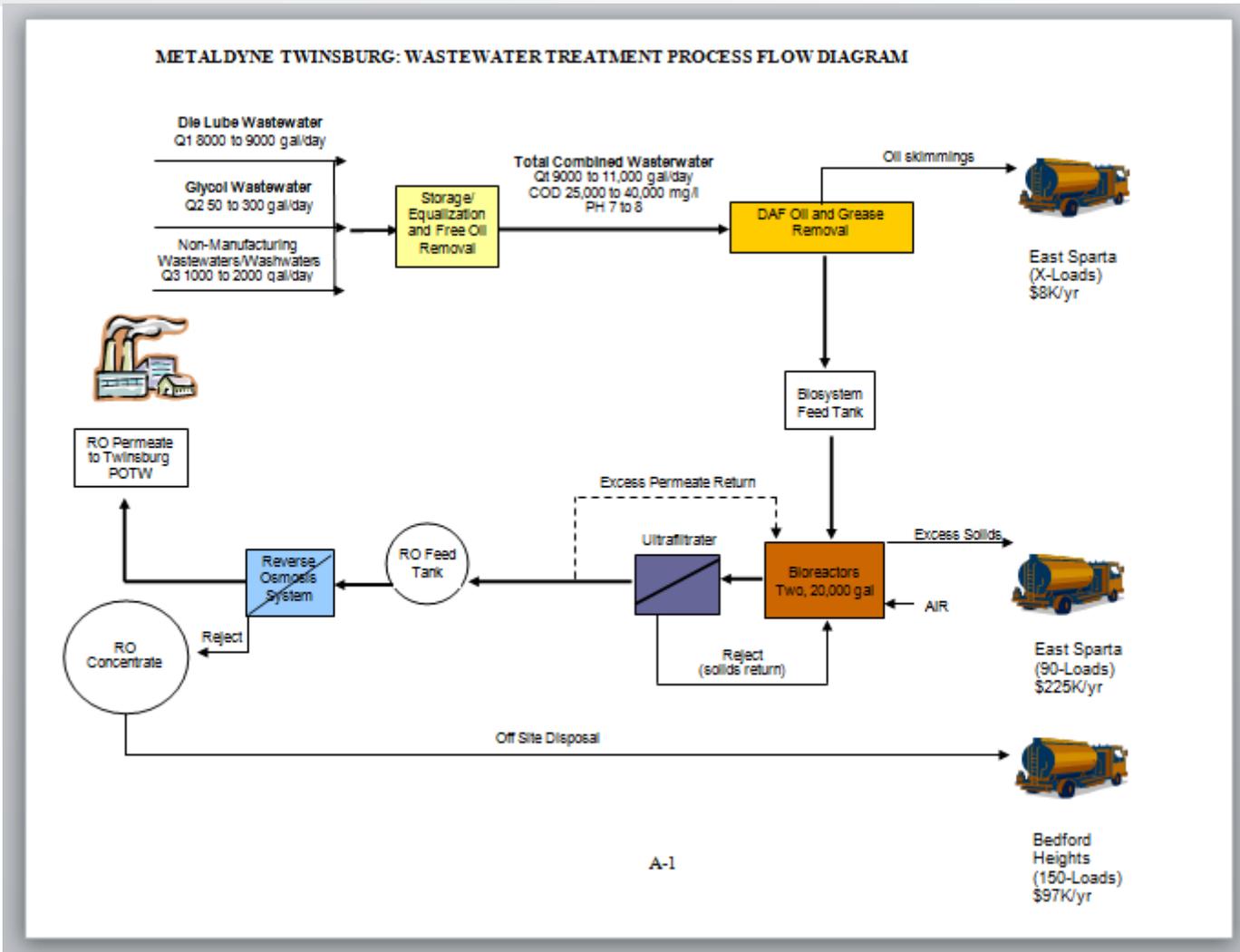
- ✧ Poor treatment control

- ✧ Added \$

- ✧ ROC hauling cost increased

- **Applied for Discharge Permit**
  - ✧ RO Permeate suitable for discharge
  - ✧ Cod limit 1000 mg/l
    - Surcharge over 500 mg/l
  - ✧ Foam in POTW outfall into park
    - COD limit lowered to 500 mg/l

# MBR + RO Performance







# Department of Energy



## ○ Office of Industrial Technologies

- ✦ Production employed 8 technology's they helped develop
- ✦ Facility Showcase
- ✦ \$250 k grant for WW



## ○ Idaho National Engineering and Environmental Laboratory (INEEL)

- ✦ Dr. Eric S. Peterson
- ✦ Researched different technologies

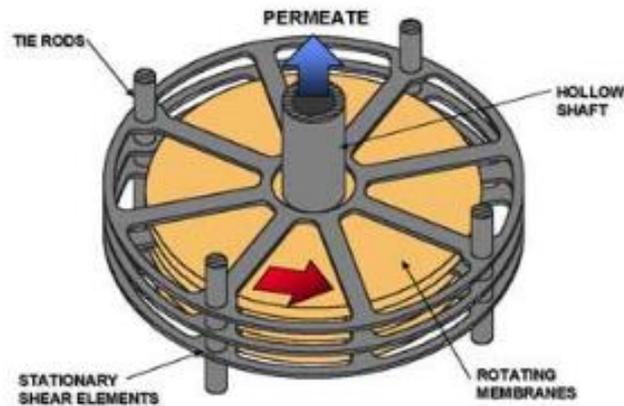


## ○ SpinTek Filtration, LLC

- ✦ Awarded grant to R&D possible solution



## ○ ST-11 Speedy Rotary Membrane System



## ○ **ST-11 Speedy Rotary Membrane System**

- ✧ Employs centrifugal force
- ✧ Tried polymeric and ceramic membranes at different pore sizes
- ✧ Concentrated from 20X to 50X. Target 25X optimal performance
- ✧ Die lube reuse
  - Infra-Red fingerprinting
  - 50/50 mix
  - 30 day trail, over 10,000 castings

## ○ **Conclusions of SpinTek Project**

- ✧ SpinTek was primarily R&D
- ✧ Labor intense, hard to manage, hire 3 operators
- ✧ Possibly jeopardize quality
- ✧ Electric cost
- ✧ Not economical or practicable

- **Ultra filtration for MBR pretreatment**

- ✧ Dr. Paul Sutton- Retry Koch UF
- ✧ Pilot tested several membranes
- ✧ Run to failure; then clean
- ✧ S1UF

# Wastewater Upgrade Project

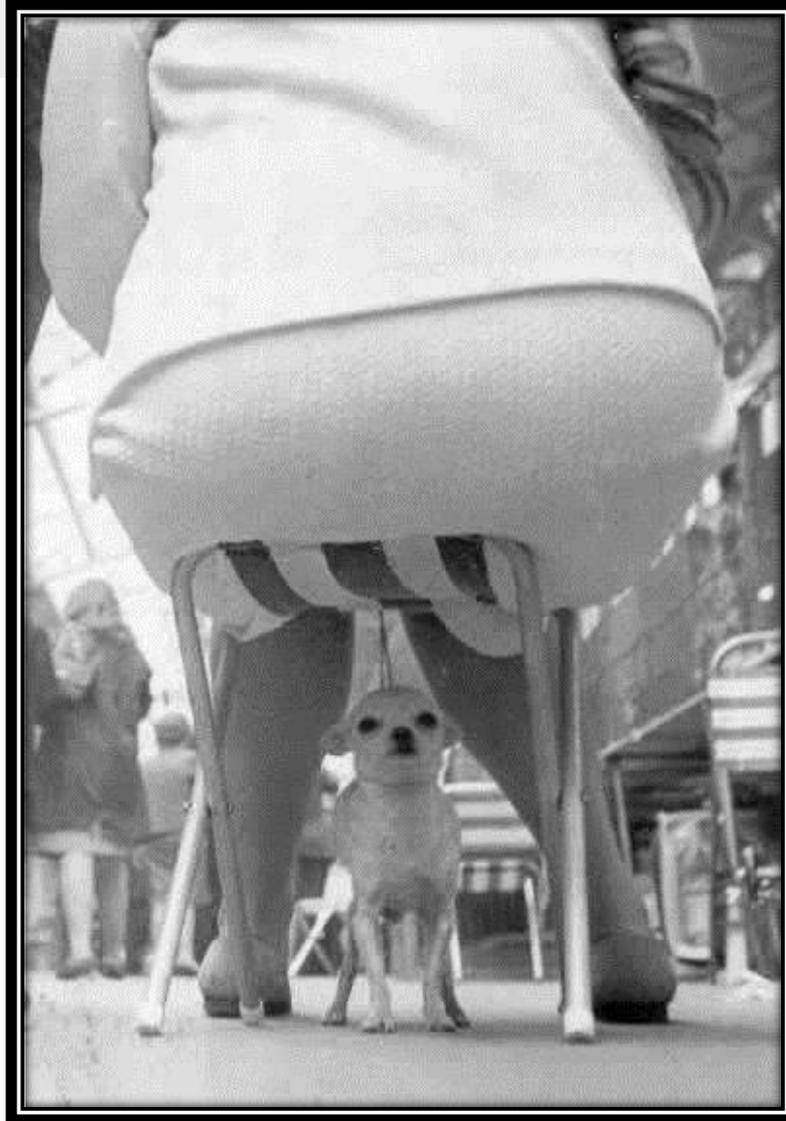
- Koch Konsolidator 150



# Wastewater Upgrade Project

- Koch Konsolidator 150
- Add 3 days Equalization tanks
- S1UF in weekly modified batch mode
- MBR reaction unknown

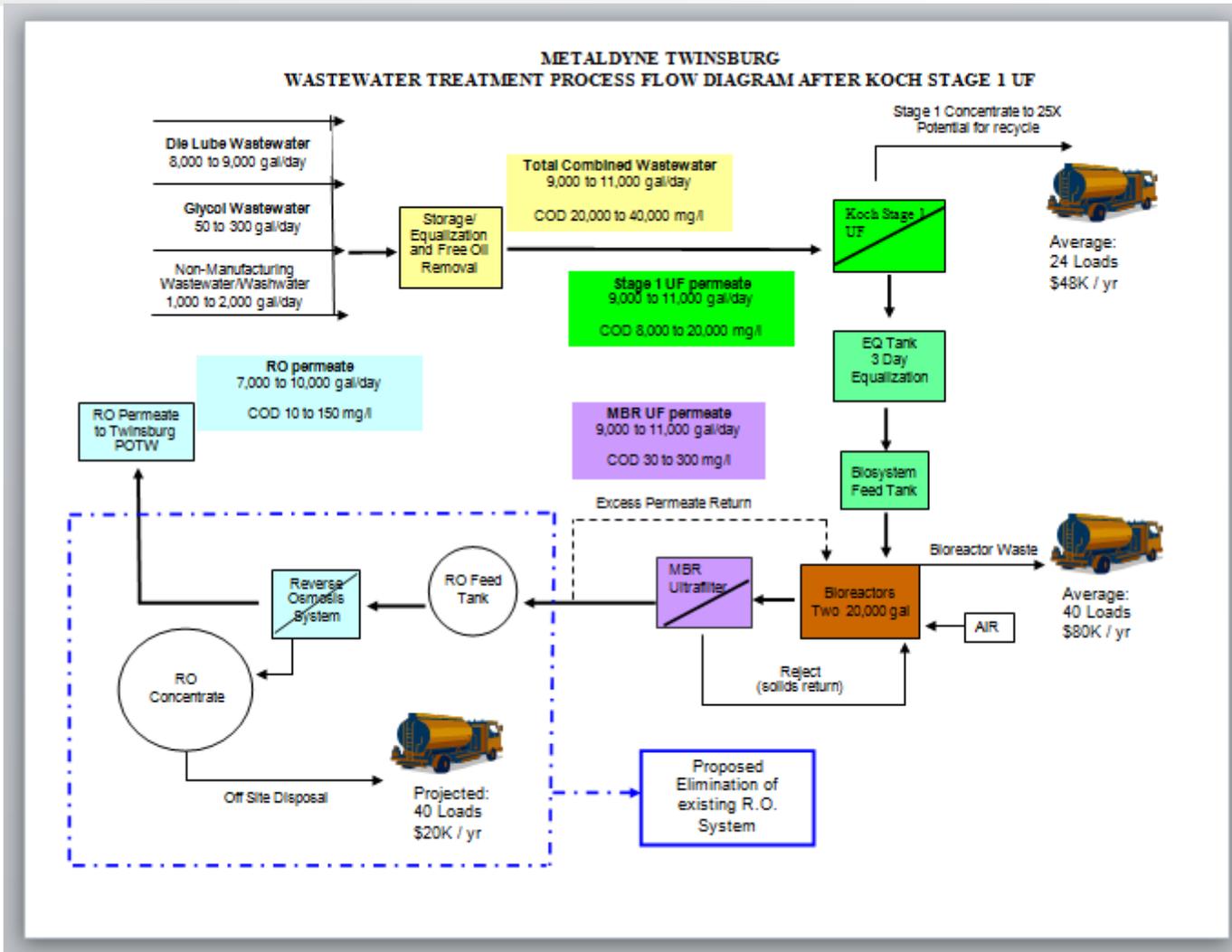




## ○ **Reaction to S1UF**

- ✧ No TSS in Biofeed water
- ✧ Reduced loading
- ✧ Reduced wasting
- ✧ COD continuous decline from 500- 2000 range to >100
- ✧ DO and Temp easily maintained
- ✧ Foam changed to light and bubbly; continuous decline
- ✧ Defoam effective
- ✧ Membrane fouling and cleaning continuous decline
- ✧ Slime disappeared
- ✧ RO Shutdown

# MBR Performance



## ○ Cost Reductions

- ✧ Biomass wasting: \$240K to \$80K
- ✧ ROC: \$90K to \$0
- ✧ RO Chemicals: \$5K to \$0
- ✧ RO membrane replacement: \$12K to \$)
- ✧ UF membrane replacement: \$140K to \$8K
- ✧ Total \$400K
- ✧ Addition S1UF cost: UFC \$50K
- ✧ Addition S1UF membrane: \$10K

○ **Total Savings = \$340K per year**



# MBR Performance



- **MLSS Unchanged**
- **No Wasting for 8 Months**
- **Biomass Became Jelly-Like**
- **Poor Flux**
- **Poor Pump Performance**
- **Timed Drip Test to Determine Wasting Frequency**

## ○ Koch S1Uf Effective Pretreatment for MBR

- ✧ S1Uf reliable 98%- bad batch- emulsion break liberates oils
- ✧ No issues with discharge- COD >100
- ✧ Controlled wasting
- ✧ Recycle UFC
- ✧ RO shutdown
- ✧ Foam 98% gone
- ✧ MBR membranes life 8 Yrs; cleaning twice per year
- ✧ S1UF membrane life 4 yrs





# Questions

