

# **What's your water treatment carbon footprint?**

**May 2009 PNWS AWWA  
Salem, Oregon**

Mark Carlson & Paul Berg  
CH2M HILL

# Carbon equivalents

- Common unit is metric tons of CO<sub>2</sub>
- 100 gallons of gasoline use by a car represents 0.9 metric tons of CO<sub>2</sub>
- One year of driving a
  - Hybrid = 3 metric tons of CO<sub>2</sub>
  - Economy car = 5 metric tons CO<sub>2</sub>
  - Hummer = 13 metric tons CO<sub>2</sub>



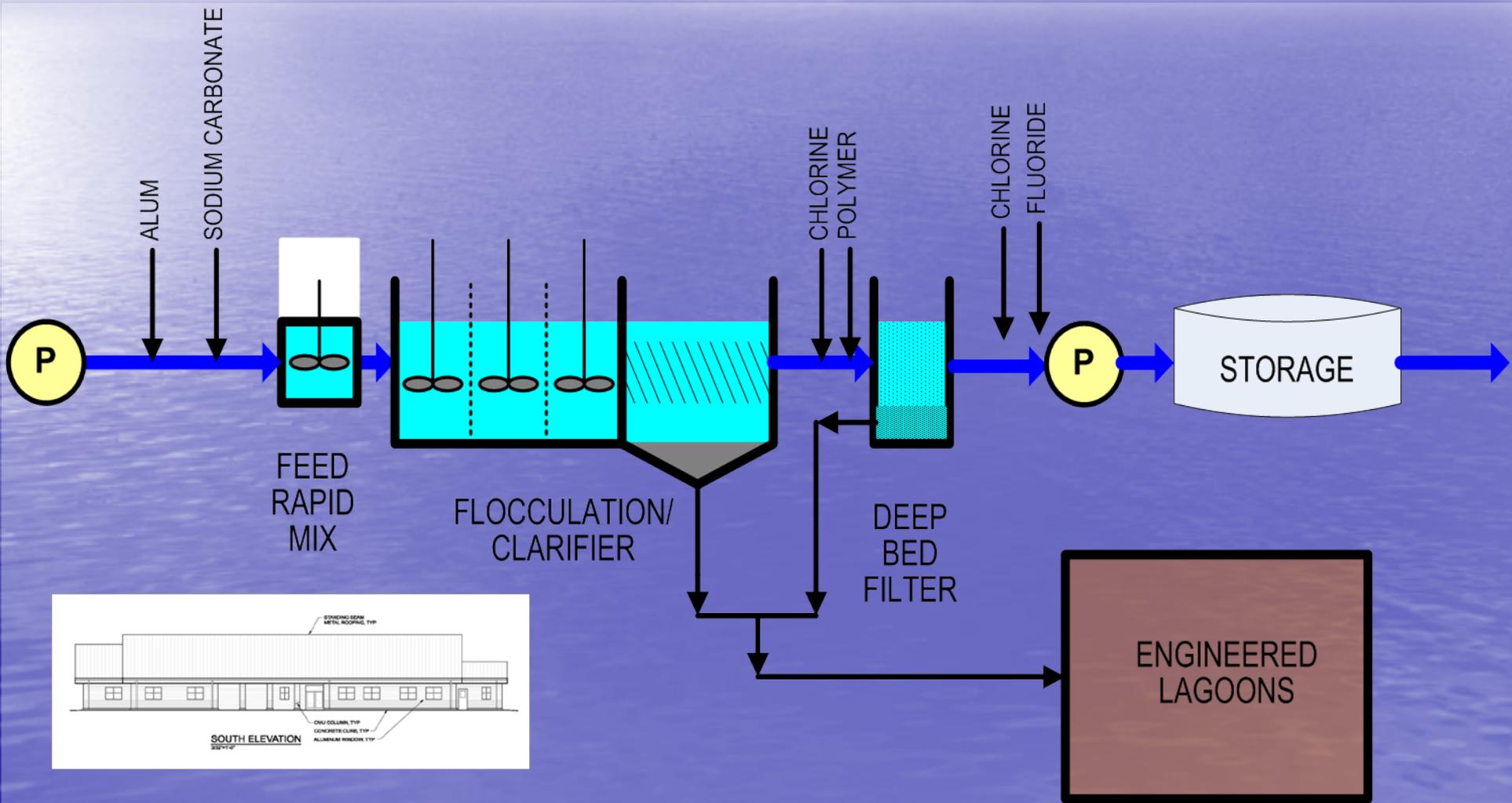
# Basic Assumptions

- 10 mgd capacity; 5 mgd average production
- Conventional media filtration alternative (alum coagulation, plate settlers)
- Pressure membrane filtration
- Ozone: 2 mg/L applied dose
- UV: 40 mJ/cm<sup>2</sup>
- Pumping: 70' source head, 200' finished
- 3 MG concrete clearwell

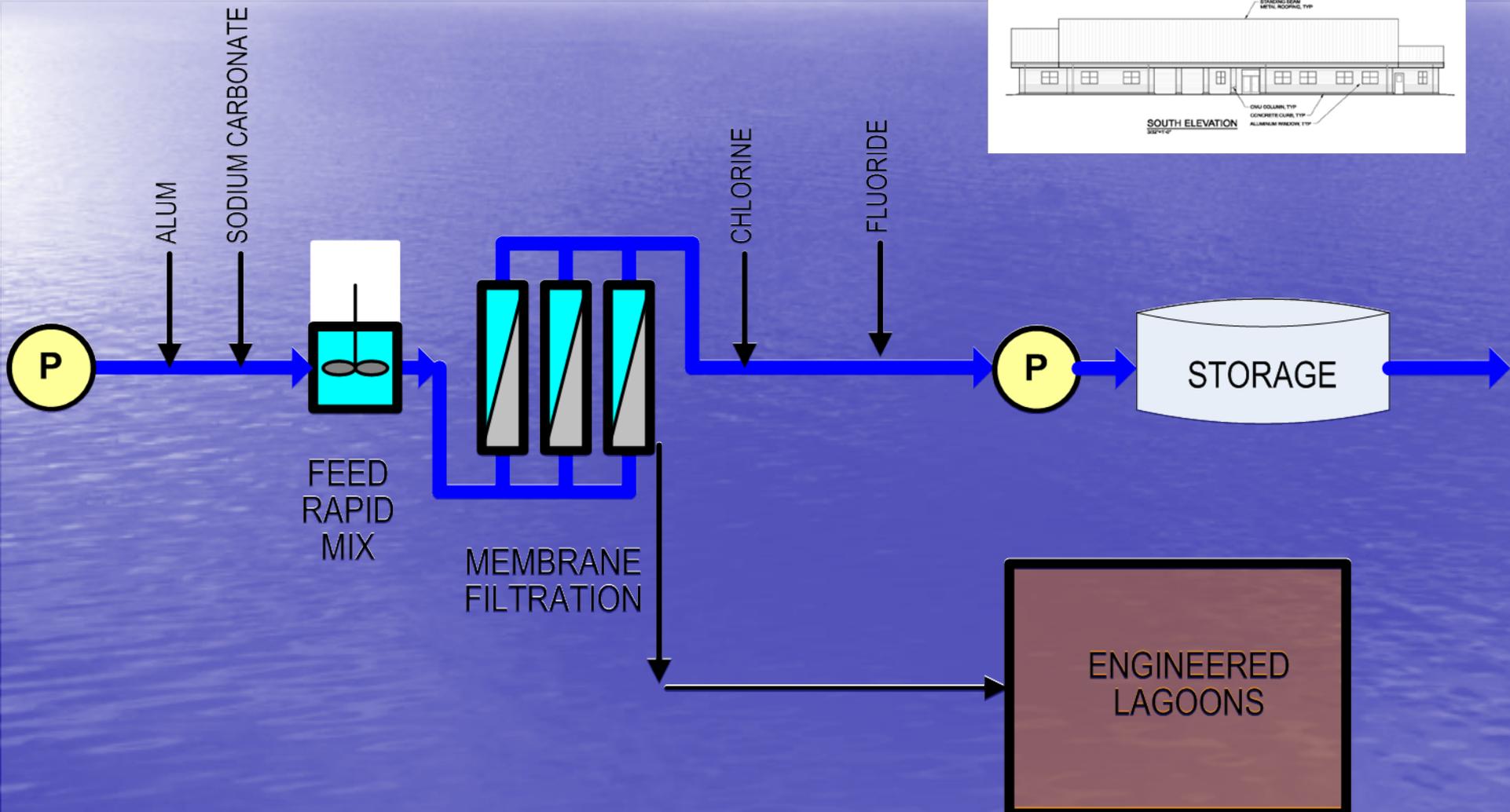
# What Was Included?

<b>OPERATION</b>	<b>CHEMICALS</b>	<b>CONSTRUCTION</b>
Pumping	Chemical Production	Diesel Consumption
Building Operation (heating and cooling)	Transportation Emissions - $\text{CO}_2$ , $\text{CH}_4$ & $\text{N}_2\text{O}$	Concrete, Earthwork, Steel & Iron
Sludge Handling and Disposal		

# Conventional Treatment



# Membrane Treatment



# Annual Emissions Dwarf Construction

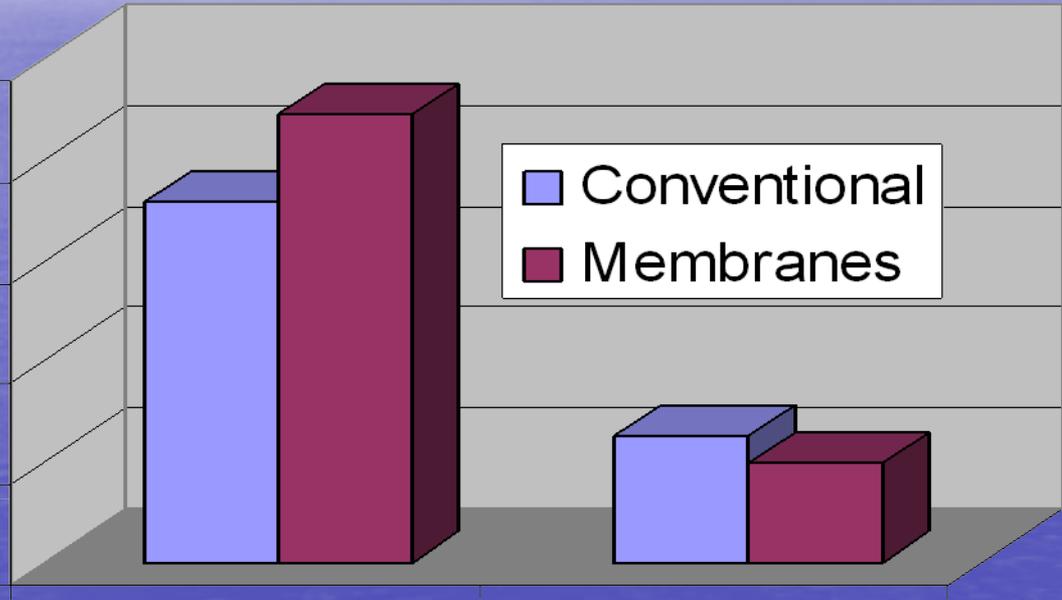
CO<sub>2</sub> Equiv  
(Metric  
Tons)

2,500  
2,000  
1,500  
1,000  
500  
0

Conventional  
Membranes

Annual

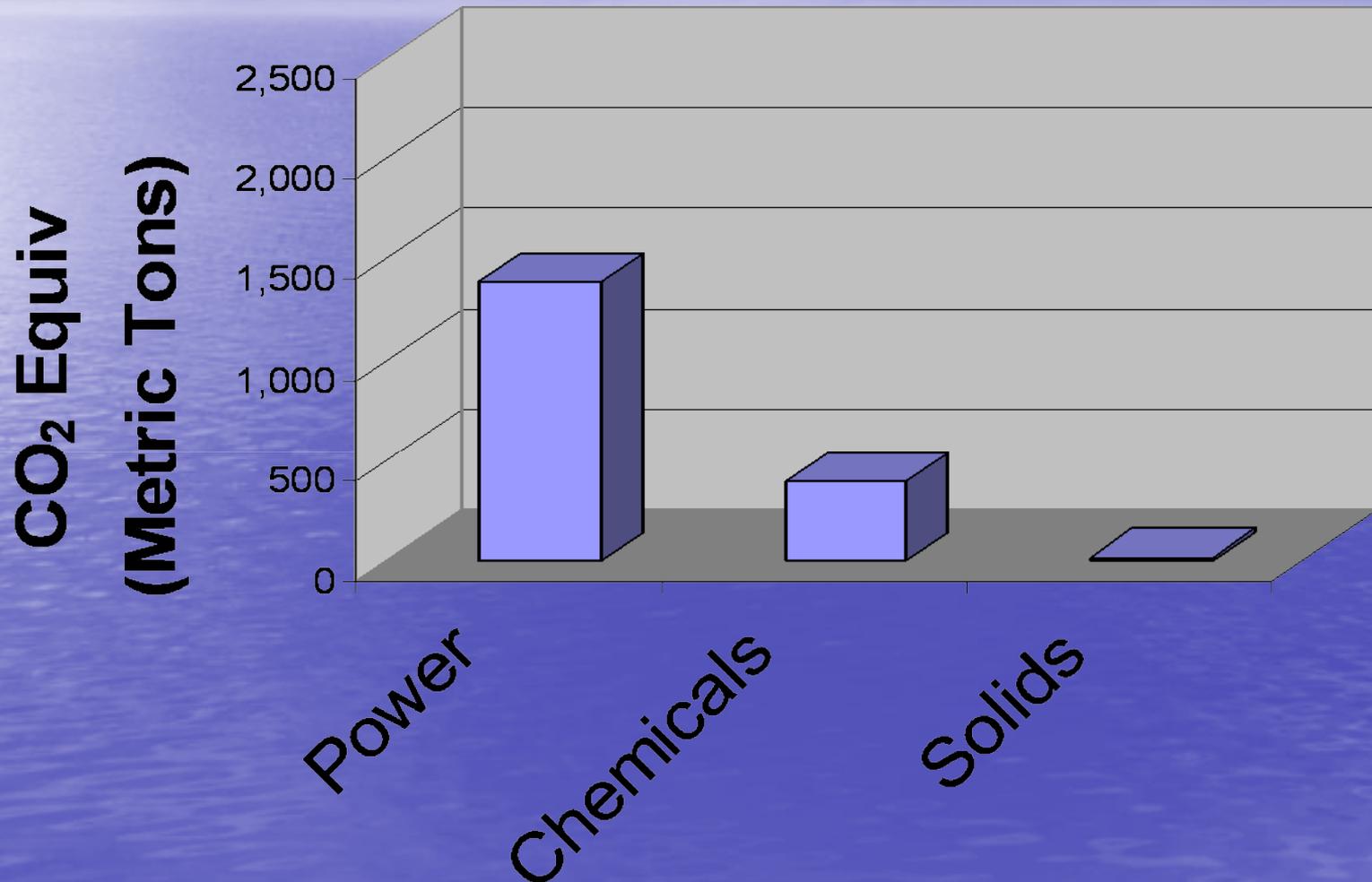
Construction



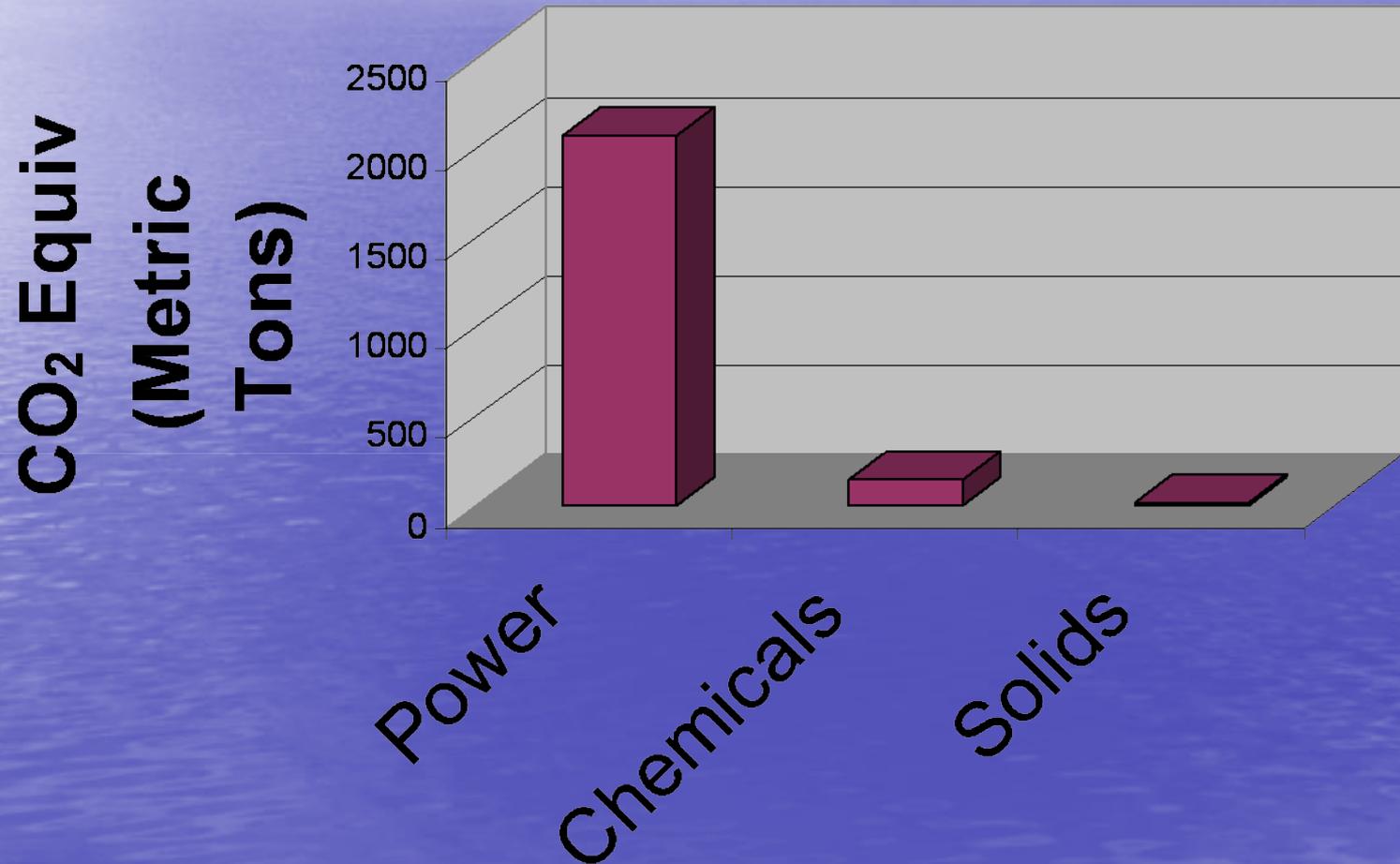
# Annual Operating Emissions

- Greater than Construction
- Small footprint on per person basis about 0.05 metric tons annually (vs. 5 for a car)
- Membrane vs Conventional
  - Membrane: greater annual emissions
  - Conventional: greater construction emissions

# Annual Emissions from Conventional Treatment



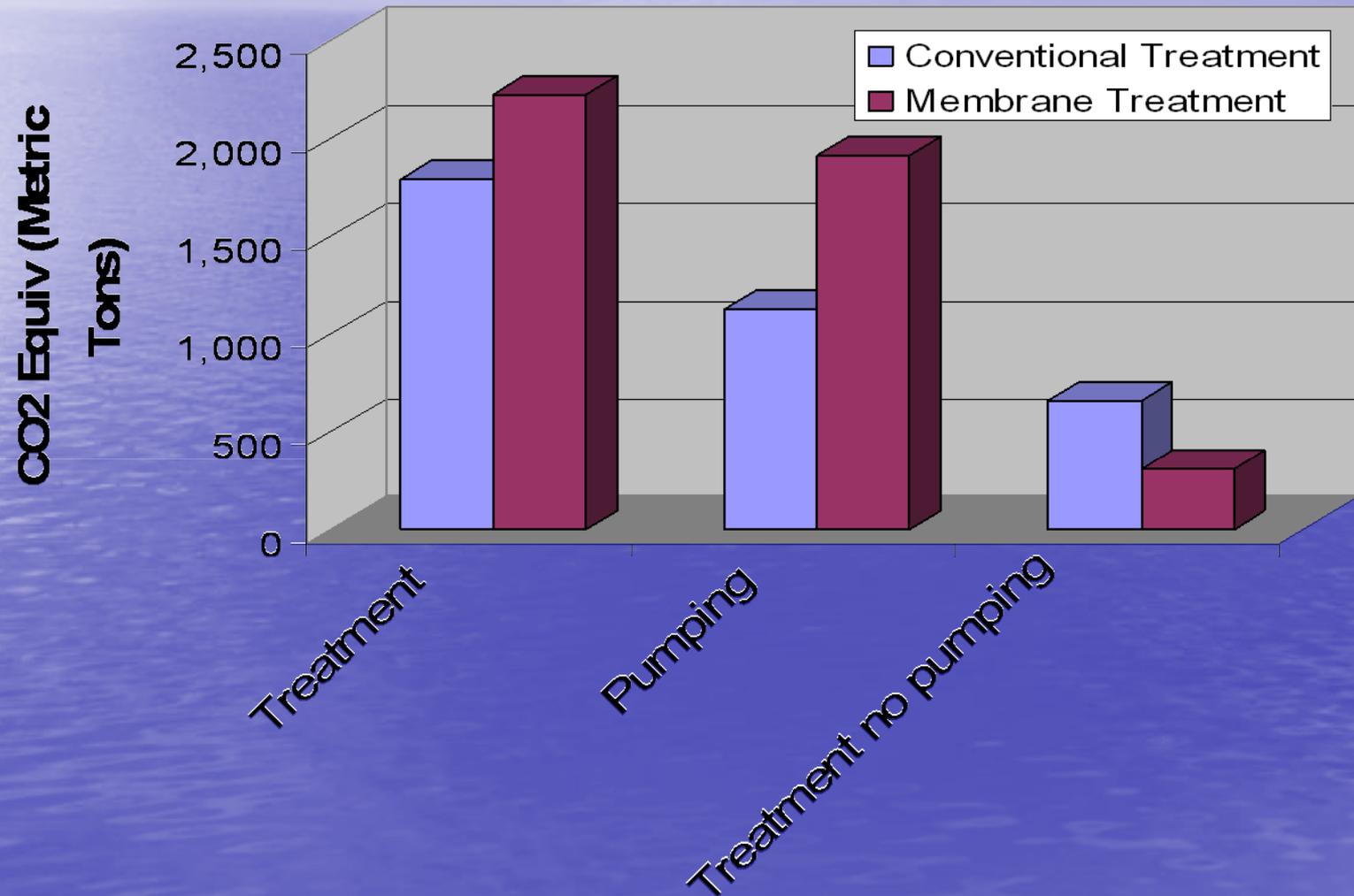
# Annual Emissions from Membrane Treatment



# Contributions to Annual Emissions

- Power is greatest source for both Membranes and Conventional
- Power is greater for Membranes – increased pumping requirements
- Chemicals greater for Conventional
- Solids handling minor source
- Pumping deserves a closer look

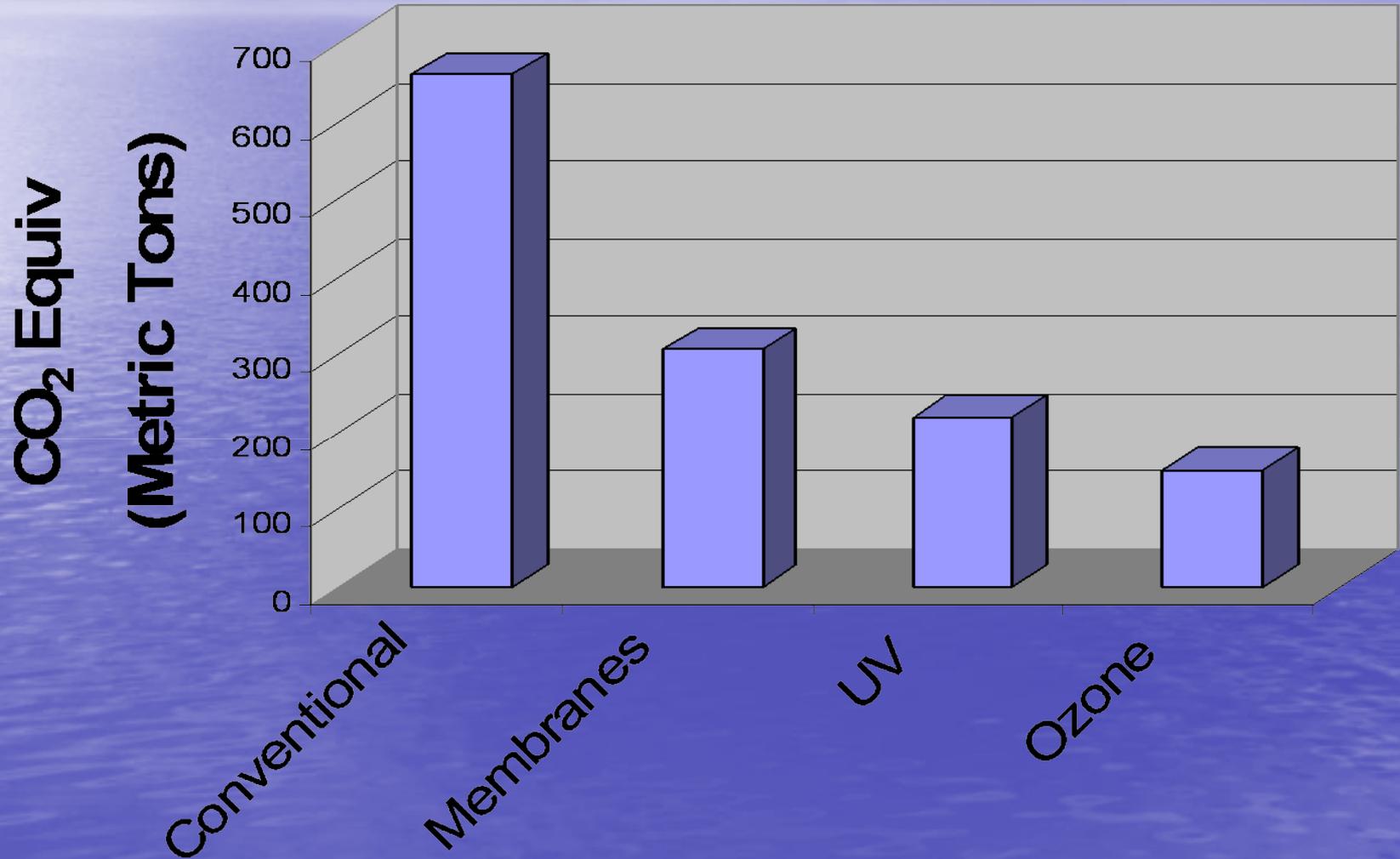
# What is Pumping Contribution?



# Role of Pumping in Annual Emissions

- Pumping a key contributor
- Pump emissions greater for Membrane treatment
- Avoiding need to pump is key
  - Typically utilities have little control over source elevation
- Without pumping membranes have smaller carbon footprint
- Pumping difficult to avoid, look at other sources

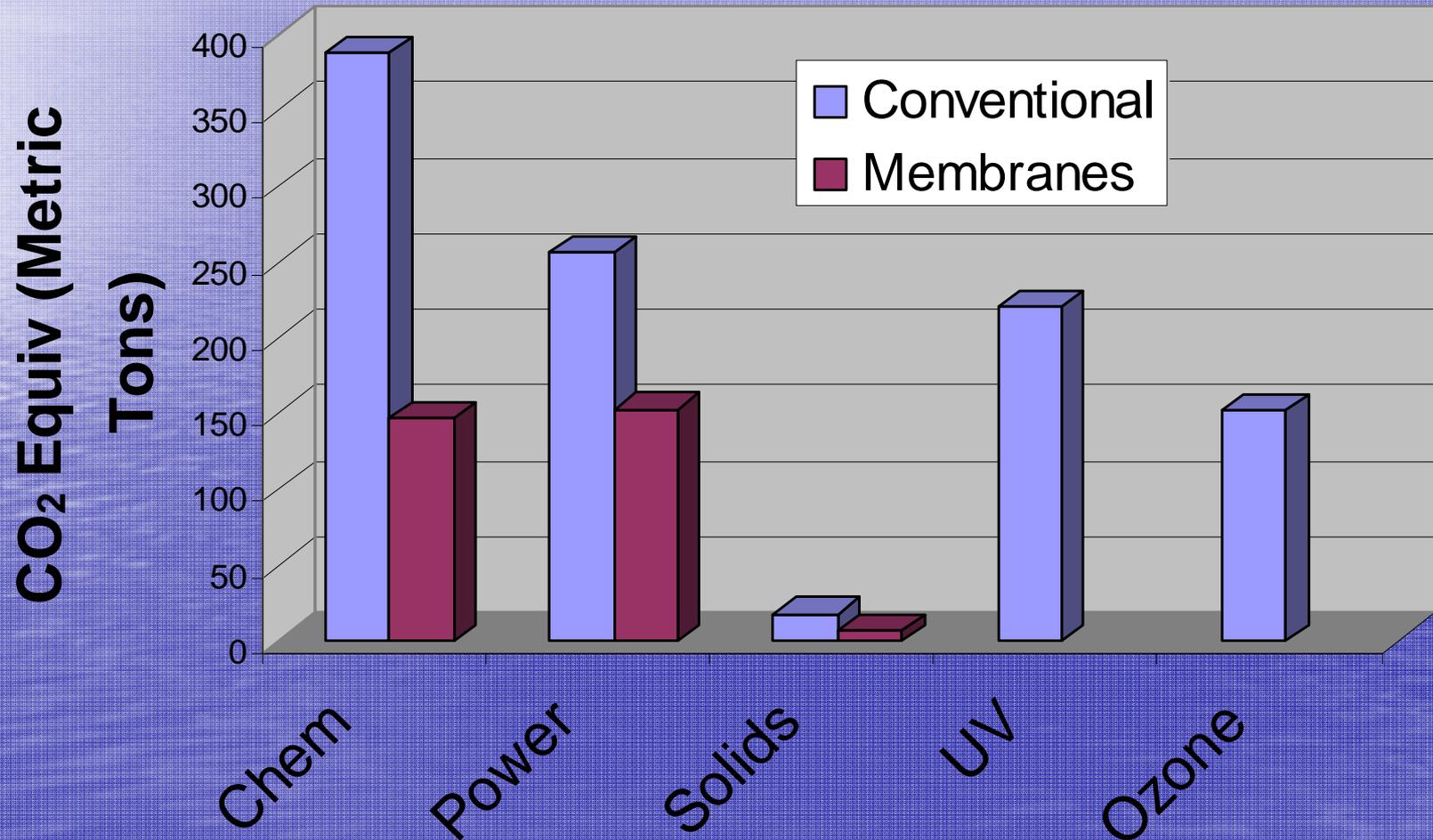
# Process Comparison (No Pumping)



# Process Comparison

- When pumping is omitted, conventional treatment has largest carbon footprint.
- Adding ozone, and especially UV would add significant contribution
- Source of emissions of interest

# GHG Contributions Outside Pumping



# GHG Contributions Outside Pumping

- Generally these items more easily controlled than pumping
- Conventional
  - Chemical production and delivery
  - Process and Building power next largest
- Membrane system
  - smaller carbon footprint than conventional
  - even split between chemicals and power

# What Can you Do?

- Limit pumping when possible
- Conserve building energy
- Use chemicals judiciously
- Encourage water conservation
- Choose chemical suppliers close by
- Look for ways to limit number of deliveries
- Consider Carbon Offsets (Typically \$15/ton of offset)

# Cost of Carbon Offsets

	Annual Metric Tons	Annual Cost
Conventional	1,791	\$ 26,862
Membranes	2224	\$ 33,367
Pumping Conventional	1129	\$ 16,928
Pumping Membranes	1917	\$ 28,754

# Conclusions

- Water Treatment Plants have significant carbon footprints (but small in scheme of things)
- Annual operation dwarfs construction
- Pumping requirements represent the largest portion followed by chemicals and other power
- Ignoring pumping – conventional has larger footprint than membranes
- Reducing energy use decreases costs and carbon footprint

The background is a blue gradient. At the top, there are wispy white clouds. On the left side, there is a bright sun that creates a shimmering reflection on the surface below, which appears to be water. The overall color palette is various shades of blue, from light to dark.

Questions?

# What's your water treatment carbon footprint?

May 2009 PNWS AWWA  
Salem, Oregon

Mark Carlson ([mark.carlson@ch2m.com](mailto:mark.carlson@ch2m.com))

& Paul Berg ([paul.berg@ch2m.com](mailto:paul.berg@ch2m.com))

CH2M HILL