Moving Toward the Times

Treatment Plant Optimization

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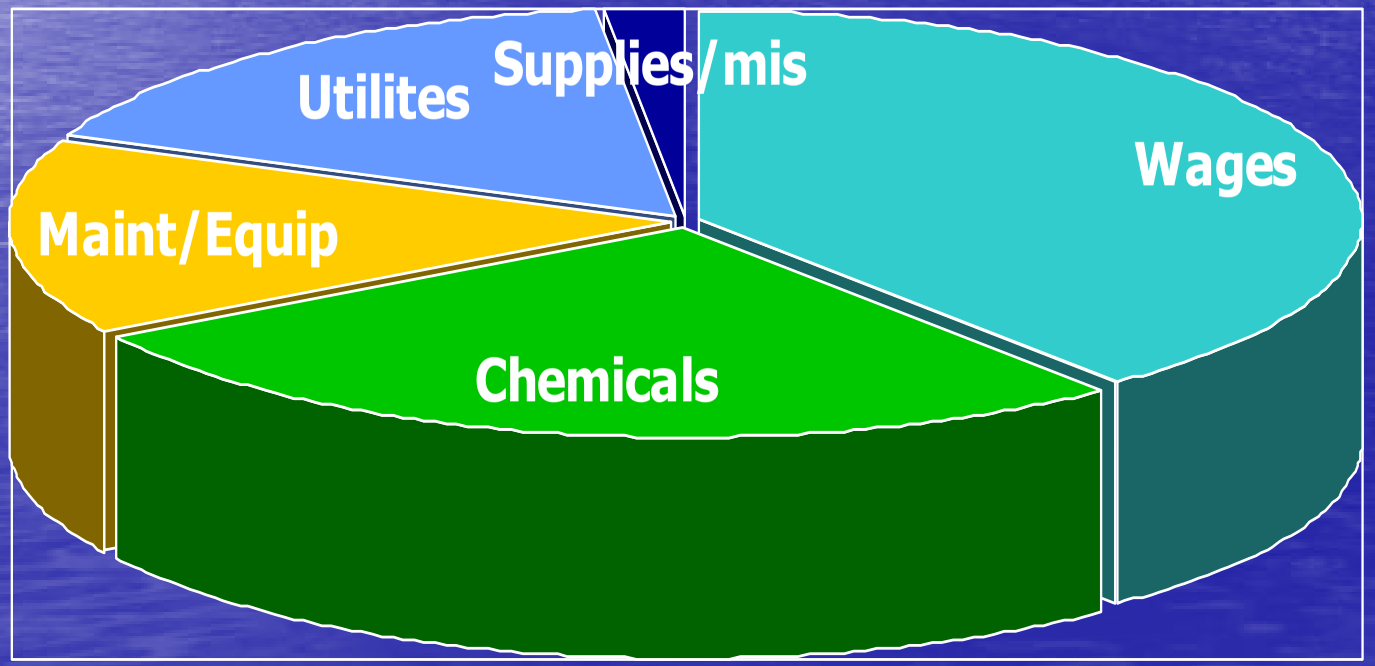
Goals of Plant Operation

- Production of a safe drinking water
- Production of an aesthetically pleasing drinking water
- Production of drinking water at a reasonable cost

Revenue – Water Sales

- 2007 - $5,620,000
- 2008 - $5,400,000
- 2009 – Projected to be - $5,380,000

Treatment Plant Budget Analysis



Where Do You Start?

- Rate Increase
  - Pass it on to the customers?
  - At this point it is not an option.
  - YET!
- Staffing
- Chemicals
- Utilities
- Maintenance & Equipment

Staffing

- Overtime
  - Calling in Maintenance for equipment failure
    - Redundancy
    - Use your best judgment
    - If your not sure CALL Your Supervisor
  - Water Main Breaks
    - Can it wait until normal business hours?
      - Small Leak?
  - Special Bacteria Testing
    - In house testing plan around Certified Personal

Chemicals

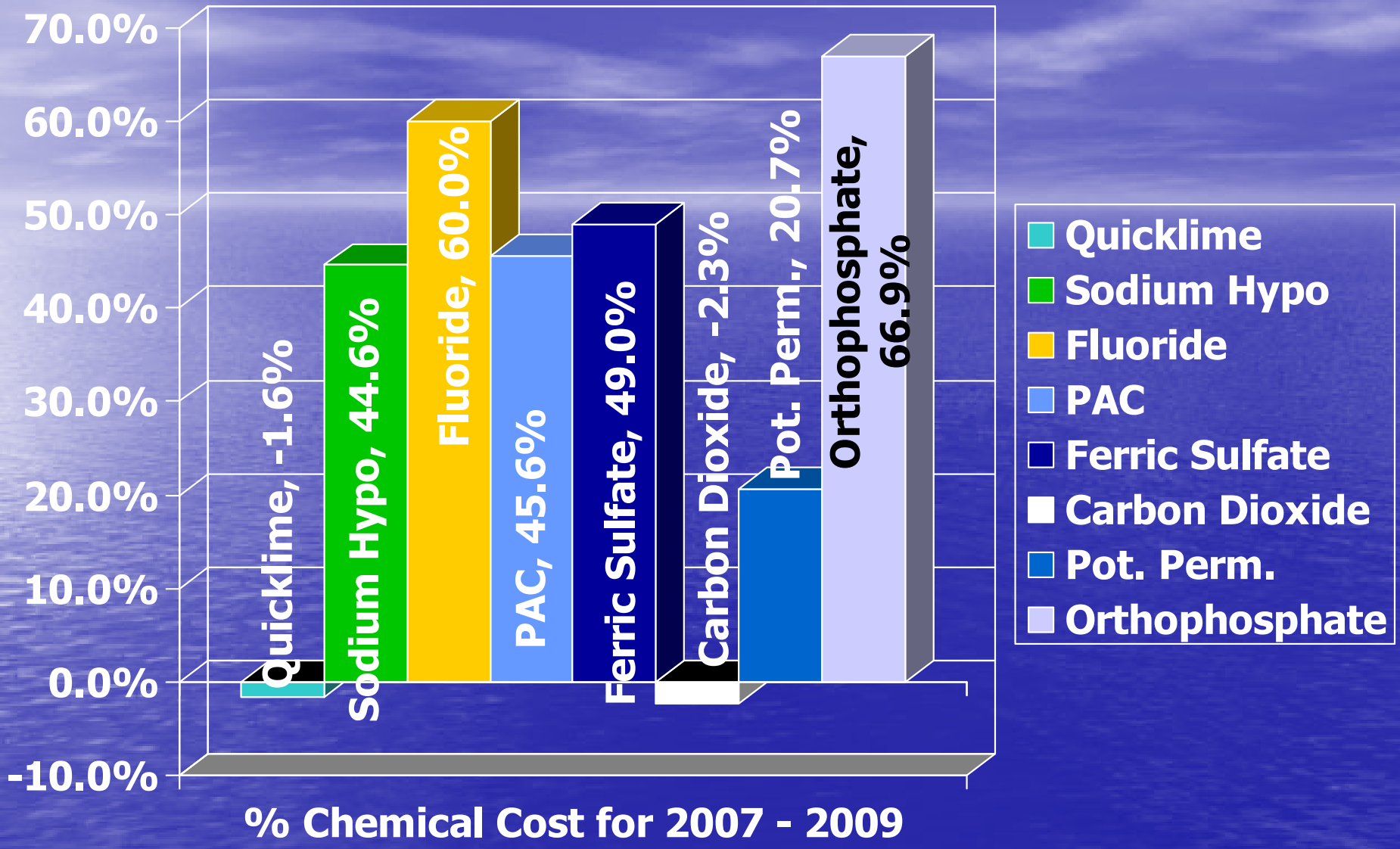
- Powdered Activated Carbon
- Potassium Permanganate
- Ferric Sulfate
- Quicklime
- Carbon dioxide
- Sodium Hypochlorite
- Orthophosphate
- Fluoride

2007

- Quicklime – $223,200
- Hypochlorite – $30,444
- Fluoride – $14,500
- PAC – $79,680
- Ferric Sulfate - $108,637
- Carbon Dioxide - $19,800
- Permanganate - $14,400
- Phosphate - $14,900

2009

- Quicklime – $219,600
- Hypochlorite – $54,926
- Fluoride – $36,200
- PAC - $146,560
- Ferric Sulfate - $212,857
- Carbon Dioxide - $19,350
- Permanganate - $18,150
- Phosphate - $44,950


70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
-10.0%
Quicklime, -1.6%
Sodium Hypo, 44.6%
Fluoride, 60.0%
PAC, 45.6%
Ferric Sulfate, 49.0%
Carbon Dioxide, -2.3%
Pot. Perm., 20.7%
Orthophosphate, 66.9%
Quicklime
Sodium Hypo
Fluoride
PAC
Ferric Sulfate
Carbon Dioxide
Pot. Perm.
Orthophosphate
% Chemical Cost for 2007 - 2009

Re-Think Treatment

- Where can we make adjustment?
  - Fluoride
    - The optimal level is 1.0mg/l
    - The low end is 0.8mg/l
  - The source water has a level of 0.2mg/l
  - With the feed rate at 0.8mg/l
  - Made a feed rate adjustment to .65mg/l
- How can 0.15mg/l make a difference?
  - Lets Break it down

Fluoride

$$\frac{(0.8\text{mg/l})\ (7.3\text{MGD})\ (100)}{(23\%)\ (0.79\text{wt.F})\ (24\text{hrs})\ (1.18\text{SG})} = 1.13\text{gal/hr}$$

$$\frac{(0.65\text{mg/l})\ (7.3\text{MGD})\ (100)}{(23\%)\ (0.79\text{wt.F})\ (24\text{hrs})\ (1.18\text{SG})} = 0.92\text{gal/hr}$$

Fluoride - cont.

1.13 gal/hr

\- 0.92 gal/hr

= 0.21 gal/hr (24hr/day) = 5.10 gal/day

(365days/yr) = 1860.1 gal/yr

(1860.10 gallons/year) ($3.62 per gallon)

Savings of =$6,733.57/year

Ferric Sulfate

- Back to the Basics
  - Jar Testing
    - Not sure how?
      - Take a Class, Perhaps OTCO?
    - Dosages in 2007
      - Winter – 15mg/l
      - Summer – 10mg/l
  - After jar testing
    - Dosages in 2008
      - Winter – 7mg/l
      - Summer – 5mg/l

Ferric Sulfate – Winter Nov-April

$$\frac{(15\text{mg/l})\ (9.3\text{MGD})\ (100)}{(45\%)\ (1.55\ \text{S.G.})\ (24\text{hrs})} = 8.33\ \text{gal/hr}$$

$$\frac{(7.0\text{mg/l})\ (9.3\text{MGD})\ (100)}{(45\%)\ (1.55\ \text{S.G.})\ (24\text{hrs})} = 3.89\ \text{gal/hr}$$

Ferric – Winter is based on 181days

8.33 gal/hr
- 3.89 gal/hr
= 4.44 gal/hr

(24hr/day) = 106.67 gal/day

(181days/Bi-yr) = 19,307 gal/bi-yr

(19,307gal/bi-yr) (8.34Lbs/gal) (1.55S.G.) (12%) = 29,949 lbs

(29,949Lbs 12% Fe/year) ($1.53 per lb of 12% Fe)

Savings of = $45,822.39/Biannually

Ferric Sulfate – Summer May-Oct

$$\frac{(10\text{mg/l})\ (9.3\text{MGD})\ (100)}{(45\%)\ (1.55\ \text{S.G.})\ (24\text{hrs})} = 5.56\ \text{gal/hr}$$

$$\frac{(5.0\text{mg/l})\ (9.3\text{MGD})\ (100)}{(45\%)\ (1.55\ \text{S.G.})\ (24\text{hrs})} = 2.78\ \text{gal/hr}$$

Ferric – Summer based on 184 days

5.56 gal/hr
- 2.78 gal/hr
= 2.78 gal/hr

(24hr/day) = 66.67 gal/day

(184days/Bi-yr) = 12,067 gal/bi-yr

(12,067gal/bi-yr) (8.34Lbs/gal) (1.55S.G.) (12%) = 18,718 lbs

(18,718Lbs 12% Fe/year) ($1.53 per lb of 12% Fe)

Savings of = $28,638.99/Biannually

Total Ferric Cost Savings

- Winter – $45,822.39
- Summer – $28,638.99

- Total Yearly savings = $74,461.38

Powdered Activated Carbon & Potassium Permanganate

- Why are we feeding these chemicals?
- Is one single treatment process applicable to all taste and odor problems?

Why are we feeding Chemicals?

- Taste & Odors are the most common and difficult problems that confront water operators
- Biological Growth in Source Water
  - Geosmin
    - A natural chemical by-product of various species of blue-green algae
      - (earthy odor)
  - Filamentous Bacterial Growth
    - Grows in sediments, water, and aquatic plant life.
      - (earthy-musty taste & odor)

Is one single treatment process applicable to all taste and odor problems?

- Because both chemicals have a different function an evaluation of the source water should be done.
- Just a couple of things to look at before making adjustments?
  - TOC levels
  - Atrazine levels

Taste & Odor Control

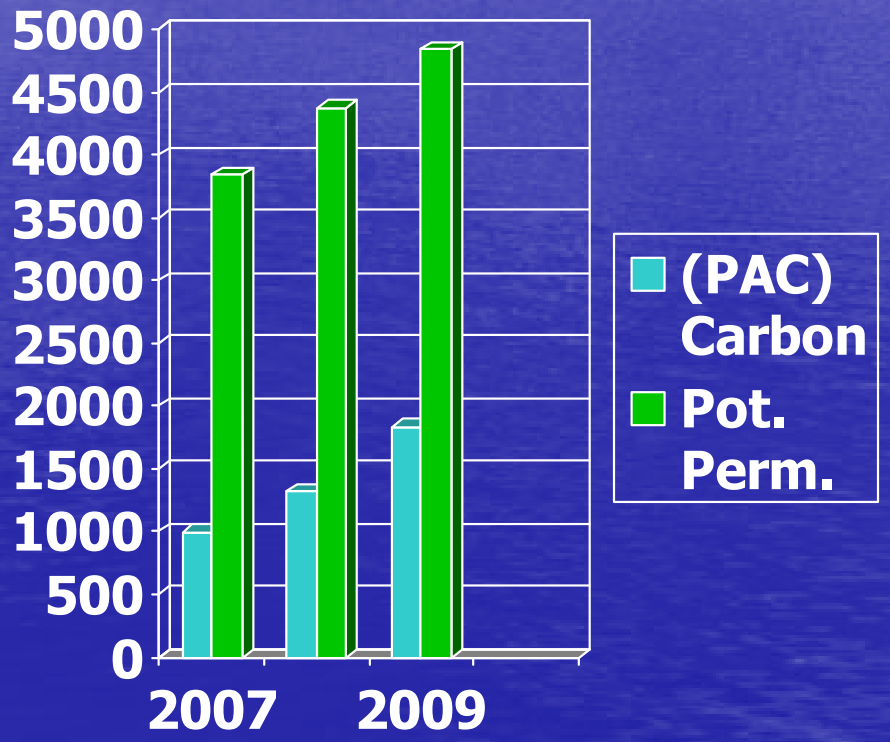
- Powdered Activated Carbon
  - Adsorption
  - Most common technique used
  - Wood, Coal, Coconut shells, or Bones

Taste & Odor Control

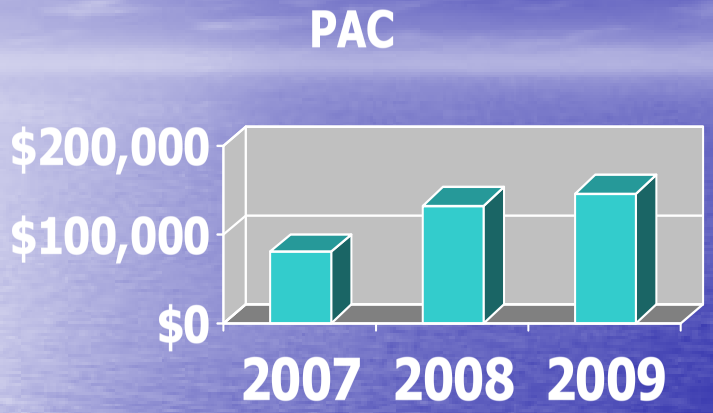
- Potassium Permanganate ($KMnO_4$)
  - Strong Oxidizer
  - Destroys many organic compounds
    - Natural and manufactured
  - Commonly used to oxidize iron and manganese

2007 – 2009 Review

- Powdered Activated Carbon Increase by 45.6%
- Potassium Permanganate Increase by 20.7%



Total Estimated Chemical Cost/Yr.



- Powdered Activated Carbon (2007) - $79,680
- Powdered Activated Carbon (2009) – $146,560

- Potassium Permanganate (2007) - $14,400
- Potassium Permanganate (2009) – $18,150

No-Brainer

- Shut off the Carbon
- Potassium injected at the beginning of the Pre oxidation basin feed rate 0.7mg/l

PAC – Winter Nov-April

$$\frac{(5\text{mg/l})\ (7.6\ \text{MGD})\ (100)}{(10.7\%)\ (24\text{hrs})} = 14.8\ \text{gal/hr}$$

$$\frac{(0.0\text{mg/l})\ (7.6\ \text{MGD})\ (100)}{(45\%)\ (24\text{hrs})} = 0.00\ \text{gal/hr}$$

PAC – Based on 181days

14.80 gal/hr

\- 0.00 gal/hr

= 14.80 gal/hr

(24hr/day) = 355.14 gal/day

(181 days) = 64,280 gal/biannually

(64,280 gal/biannually) ($0.916 per lbs)

1 lb = 1 gallon (10.7%)

Savings of =$58,880.82/biannually

Orthophosphate

$$\frac{(1.0\text{mg/l})\ (7.3\text{MGD})\ (100)}{(36\%)\ (1.24\text{SG})\ (24\text{hrs})} = 0.68\text{gal/hr}$$

$$\frac{(0.5\text{mg/l})\ (7.3\text{MGD})\ (100)}{(36\%)\ (1.24\text{SG})\ (24\text{hrs})} = 0.34\text{gal/hr}$$

Orthophosphate

0.68 gal/hr

\- 0.34 gal/hr

= 0.34 gal/hr

(24hr/day) = 8.18 gal/day

(365days/yr) = 2,984.43 gal/yr

(2,984.43 gallons/year) ($2.98 per gallon)

Savings of = $26,830.03/year

Weighed the benefits

- Fluoride = $ 6,733.57
- Ferric Sulfate = $74,461.38
- PAC = $58,880.82
- Ortho = $26,830.03

- Total Yearly Savings = $166905.80

Utilities – Electricity

- Motion sensors for lighting through out Plant
- More energy efficient light bulbs
- Heating / Cooling system updates

Power Factor Correction Device

- Raw Water pumps
  - Before PFC device 78% efficient
  - After PFC device 94% efficient
- Carbon Mixer 40 Hp motor
  - Before PFC device 35% efficient
  - After PFC device 97% efficient
- Hot Water 7.5 Hp motor
  - Before PFC device 81%
  - After PFC device 98%

Plant Maintenance

- Maintenance Program
  - Planning & Scheduling
  - Records Management
  - Spare Parts Management
  - Cost and Budget Control
  - Emergency Repair Procedures
  - Training Program

Supplies

- Laboratory & Equipment Parts
  - Let the supplier stock it for you
    - Order what you Need
  - Delivery time
- Janitorial
  - Do you need it?
  - Shop around
- Office
  - Paper/Toner or Ink
    - Print ONLY what you need
- Do your part & Recycle ☺