

OPTIMIZATION OF FILTERS

Presented By
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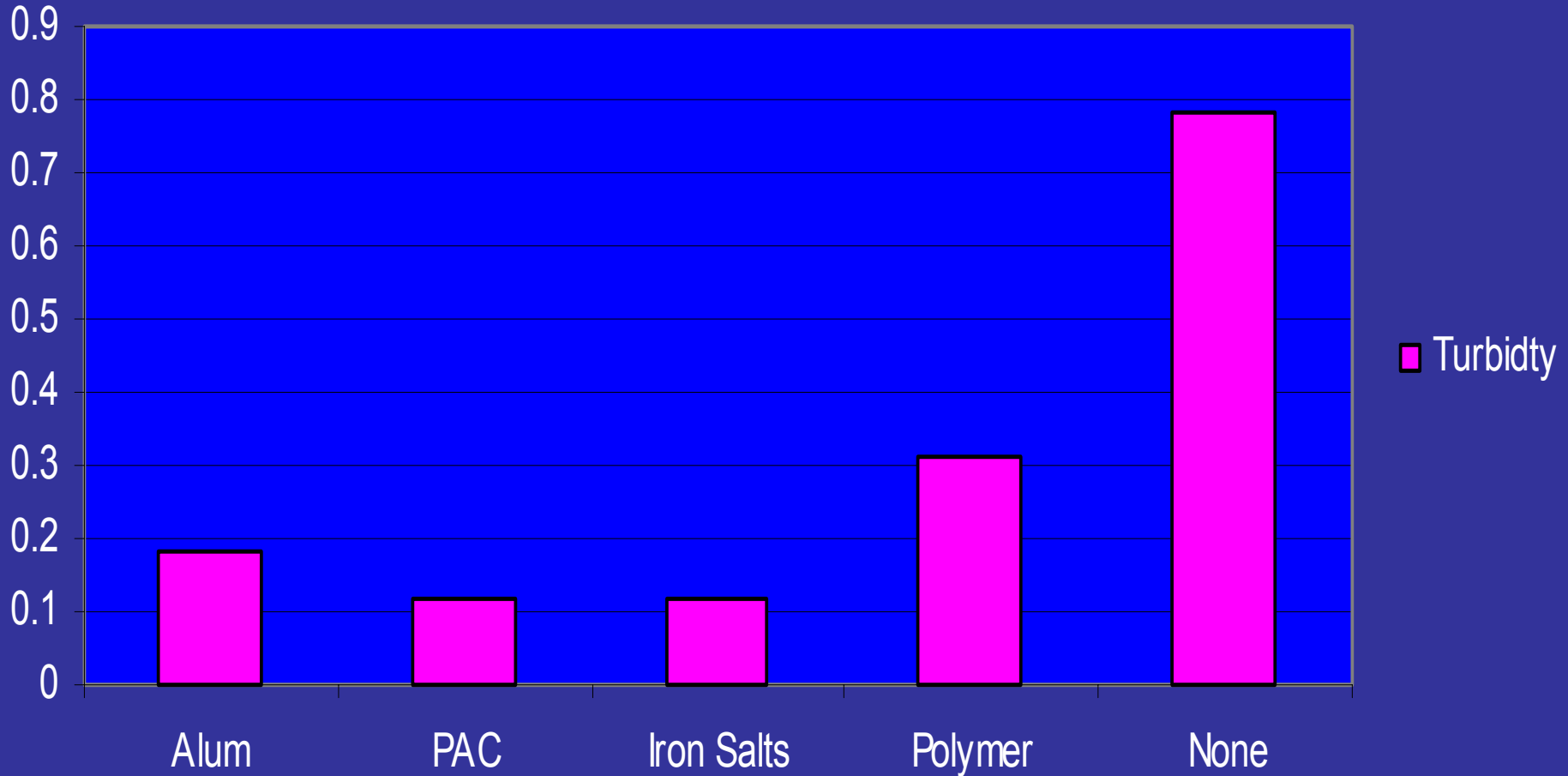
4 MAJOR FACTORS AFFECTING FILTER PERFORMANCE

- Operational
- Mechanical
- Physical
- Chemical

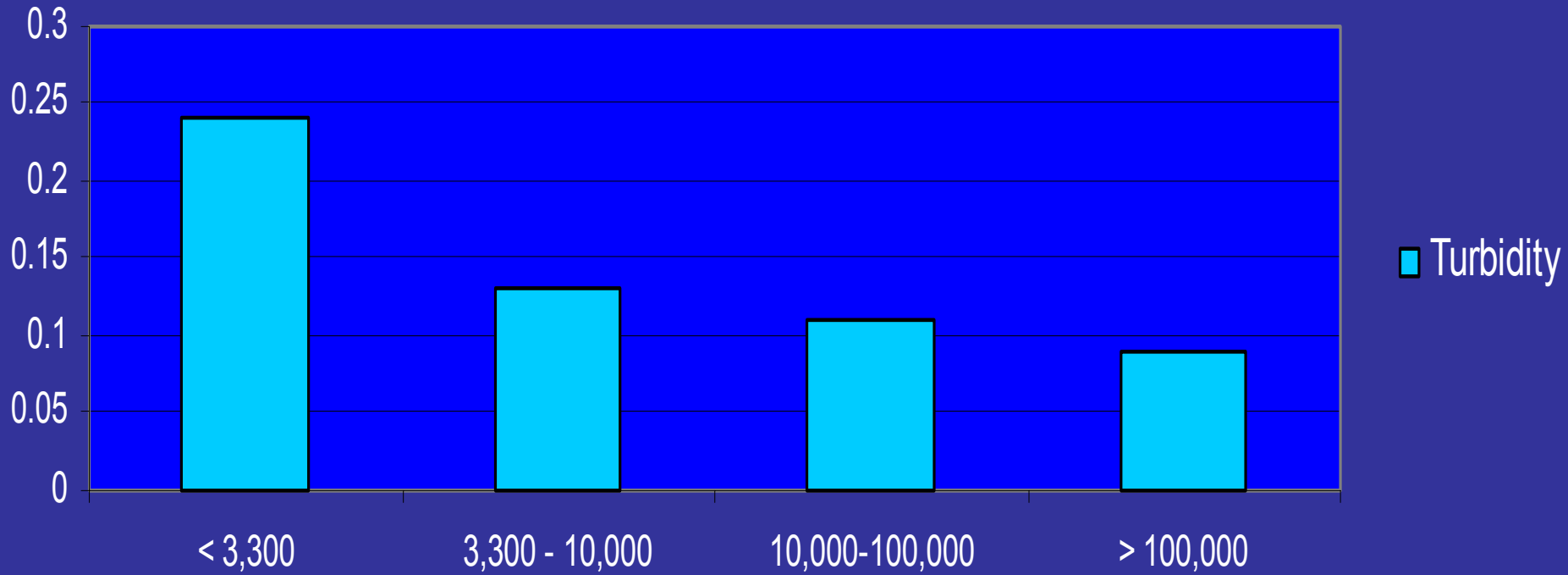
OPERATIONAL

- Study conducted in Pennsylvania in late 90's at 75 water plants regarding filtered water turbidity. Evaluated plant size, plant age, chemical treatment, type of process equipment, type of filter media, filtration rates and operation.
- Single most important factor was the attentiveness of the operators

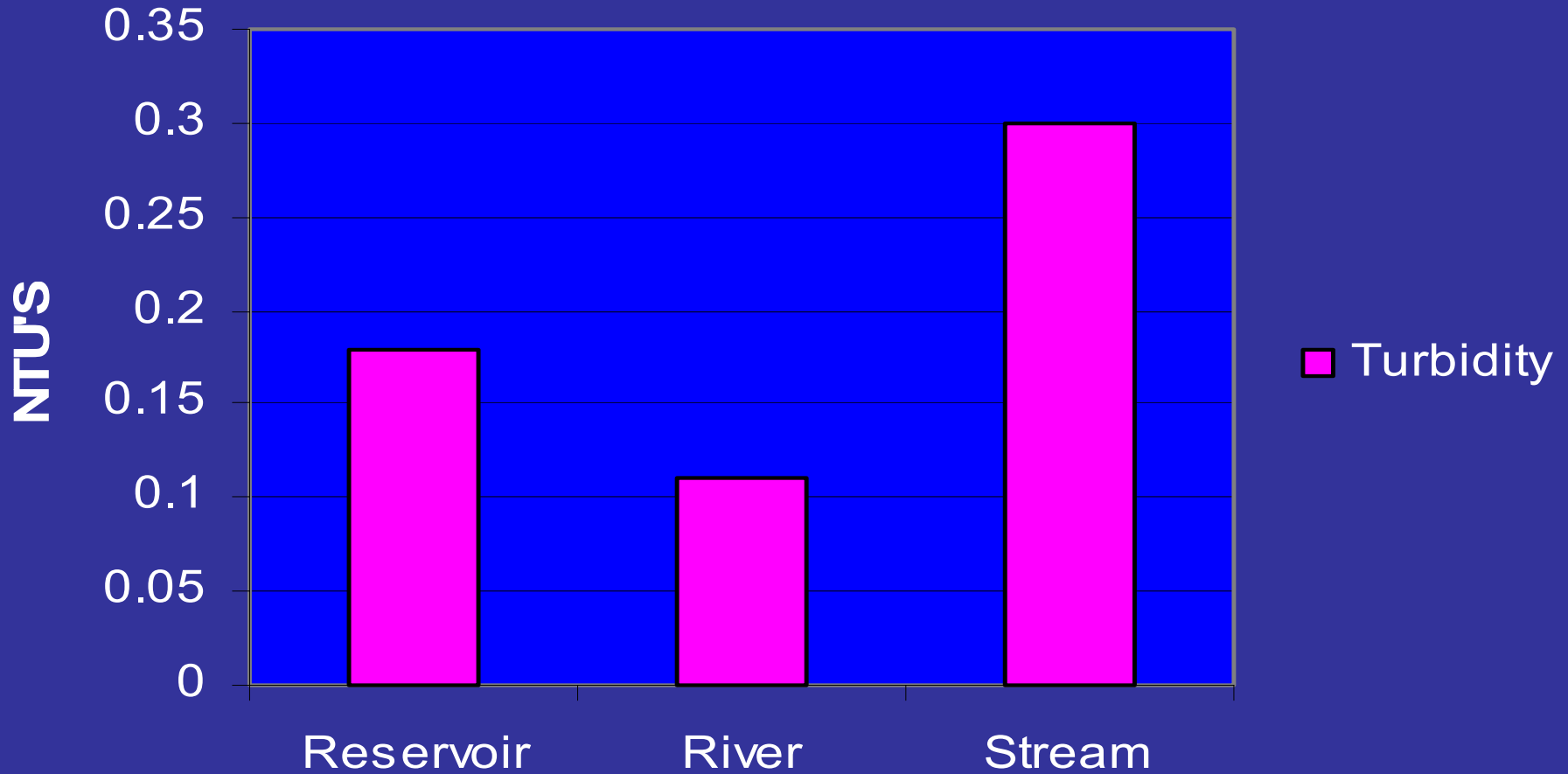
CHEMICAL TREATMENT



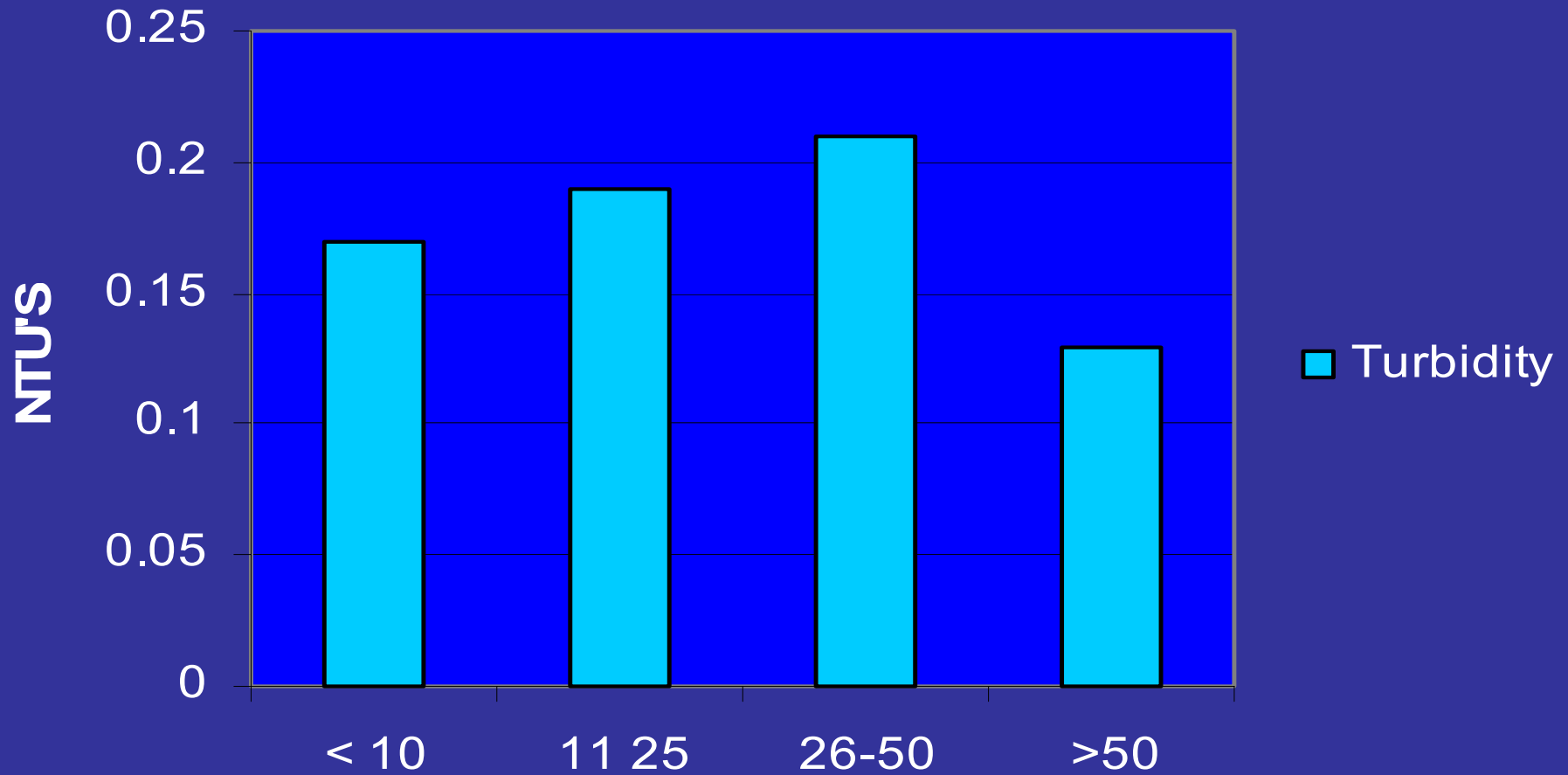
POPULATION



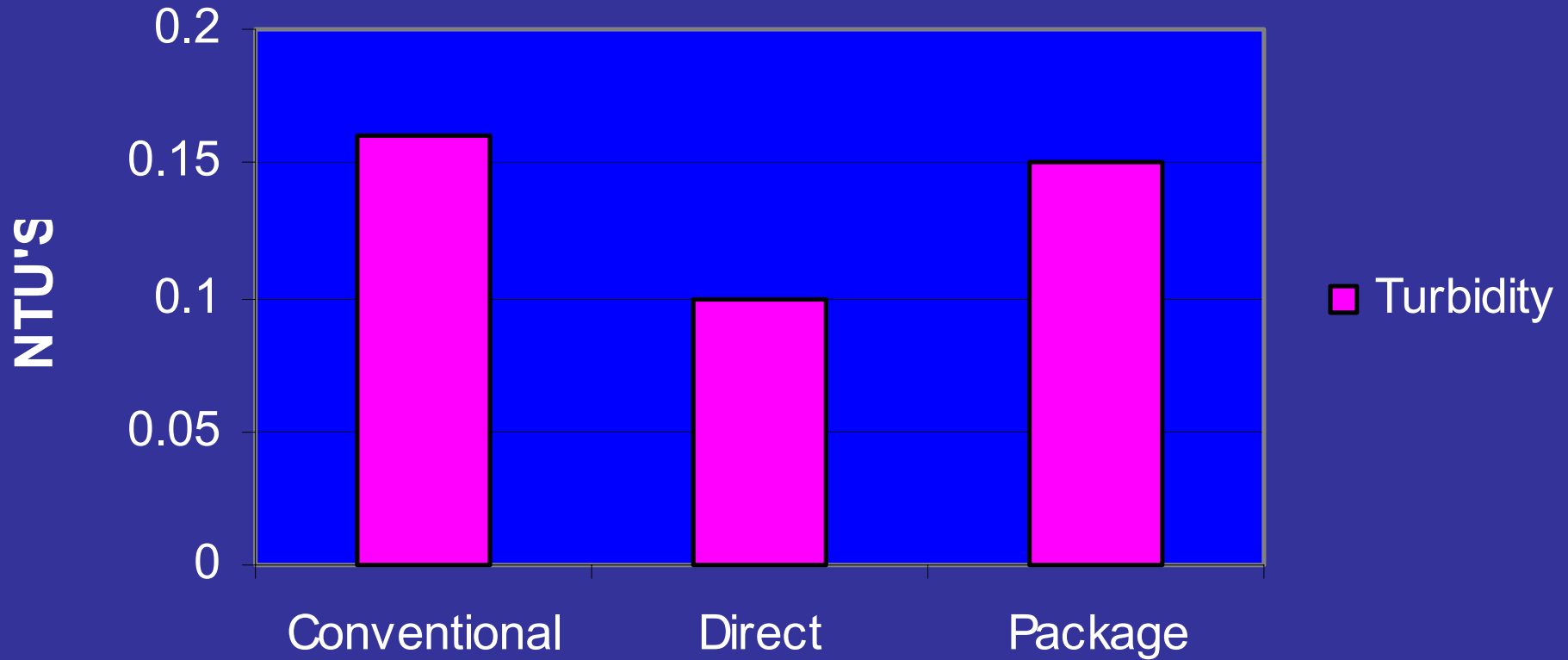
WATER SOURCE



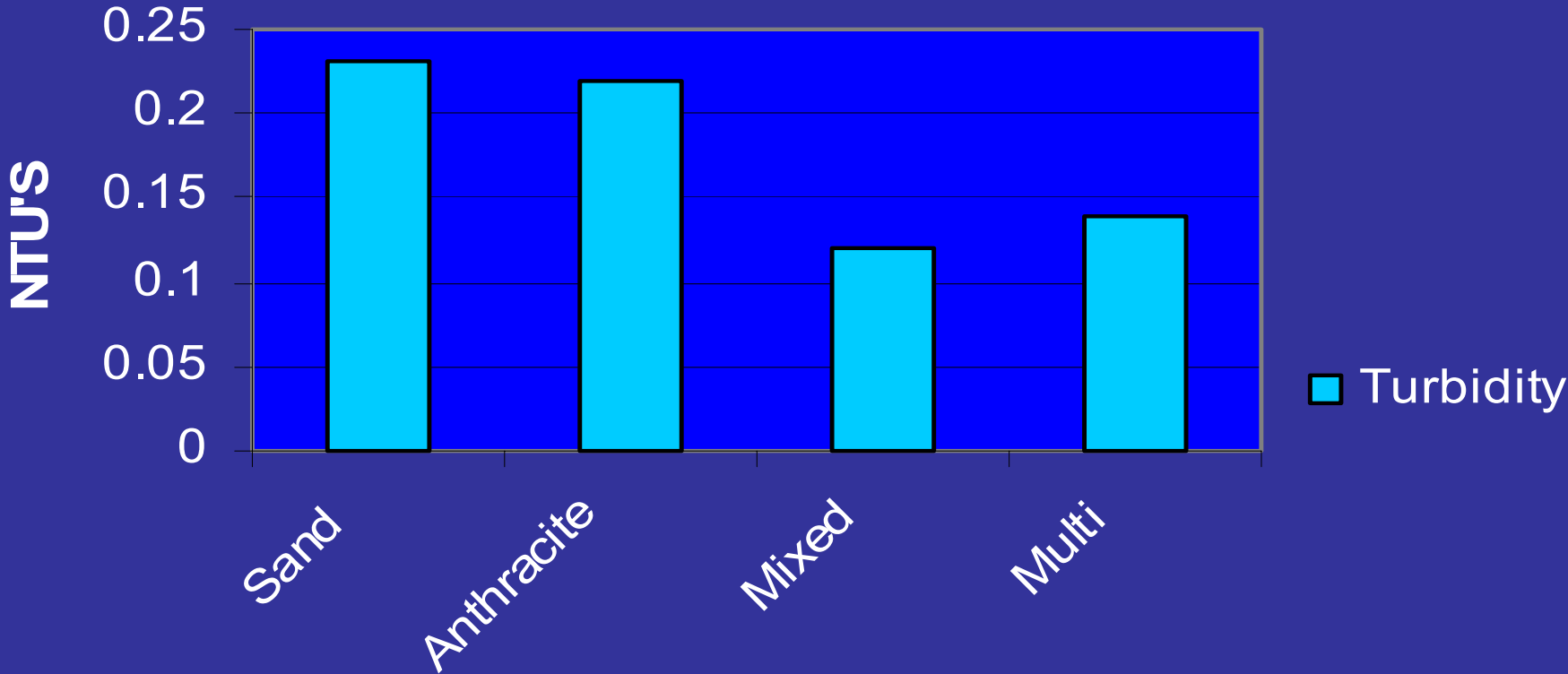
Plant Age



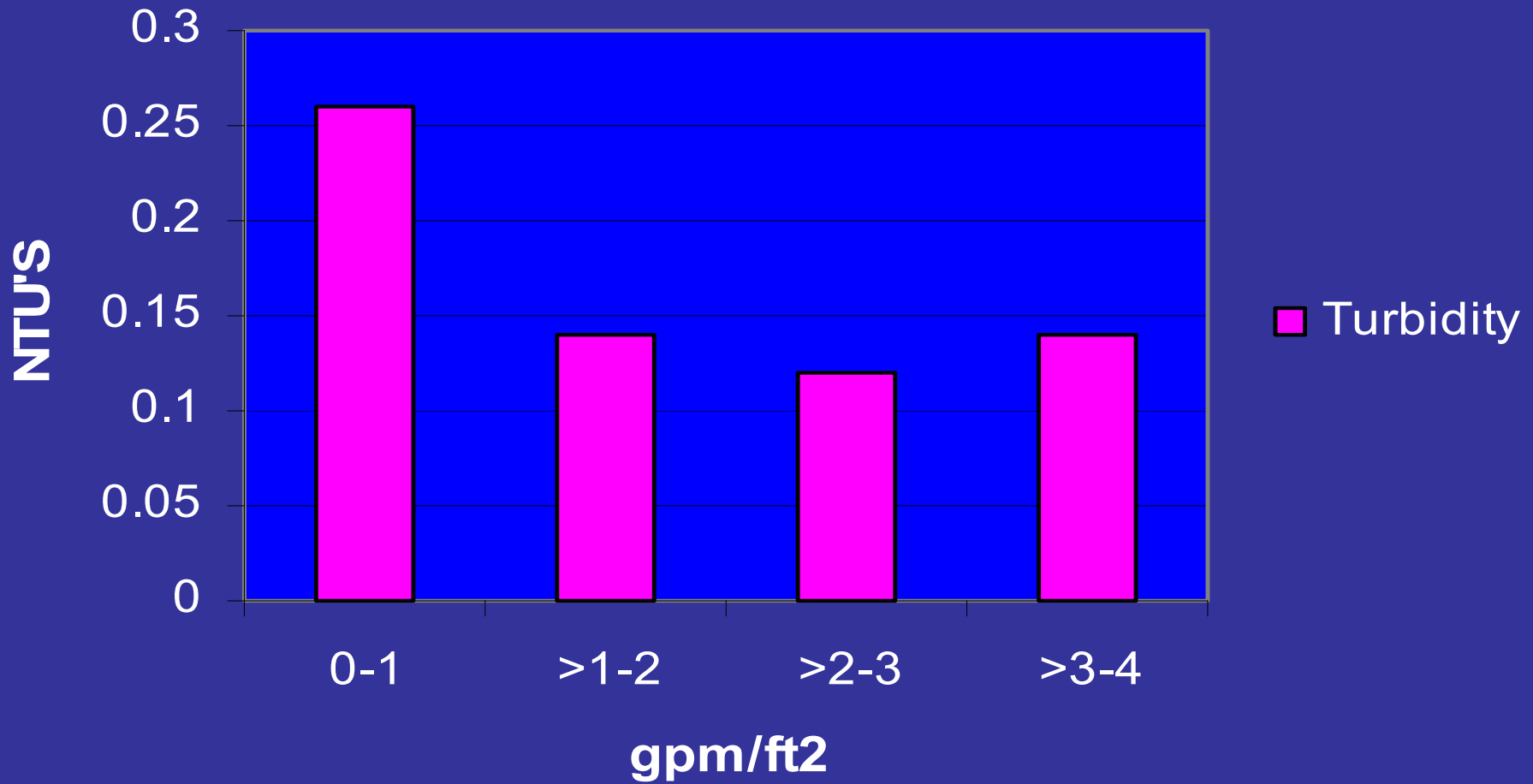
PLANT TYPE



MEDIA TYPE



FILTRATION RATE



OPERATIONAL MONITORING

- Head Loss
- Throughput
- Turbidities
 - Run Time
 - After Backwash
 - With Increased Head Loss
 - At Breakthrough

OPERATIONAL MONITORING

- Backwash Changes
- Physical Appearance
- Filter Media Depth
 - Indentations
 - Mounds
 - Holes
 - Cracks

OPERATIONAL MONITORING

- Observe Backwashes
 - How fast do the filters cleanup?
 - Are you over backwashing?
 - Are you under backwashing?
 - Does the media bed lift uniformly?
 - Are you achieving proper bed expansion?
 - Is there entrained air when backwashing?

PHYSICAL MONITORING

- What condition is your media in?
 - Core Sampling
 - Sieve Analysis
 - Microscopic Examination
 - Chemical Analysis for Foulants

PHYSICAL MONITORING

- Mud Balls

PHYSICAL MONITORING

- What causes mud ball formation?
 - In almost all cases mud ball formation is caused from inadequate backwash
 - Not enough water volume
 - Plugged nozzles
 - Hardening of media due to calcium carbonate buildup

PHYSICAL MONITORING

- How do you get rid of mud balls?
 - Best way is prevention
 - May have some success in trying to physically breakup the mud balls
 - We are presently trying an NSF approved surfactant
 - Replace the media

PHYSICAL MONITORING

- How do you determine if you have inorganic fouling of your media?
 - Core sample the media and have it analyzed
 - If you are a lime softening plant there is a good chance you will have some calcium carbonate fouling taking place
 - Calcium phosphate fouling should not occur unless you would be feeding an orthophosphate to a higher pH environment, > 8.5

PHYSICAL MONITORING

- Is your media fouled with
 - Calcium carbonate?
 - Calcium phosphate?
 - Potassium permanganate?
 - Iron?
 - Aluminum?
 - Biological?

PHYSICAL MONITORING

- CALCIUM CARBONATE/PHOSPHATE PRECIPITATION
 - Time
 - Temperature
 - Residuals of calcium, alkalinity, phosphate
 - pH

CALCIUM PHOSPHATE STUDY

Lime softening plant that we were concerned about calcium phosphate precipitation. Evaluated phosphate drop out.

Point of addition – 3.80 ppm of ortho

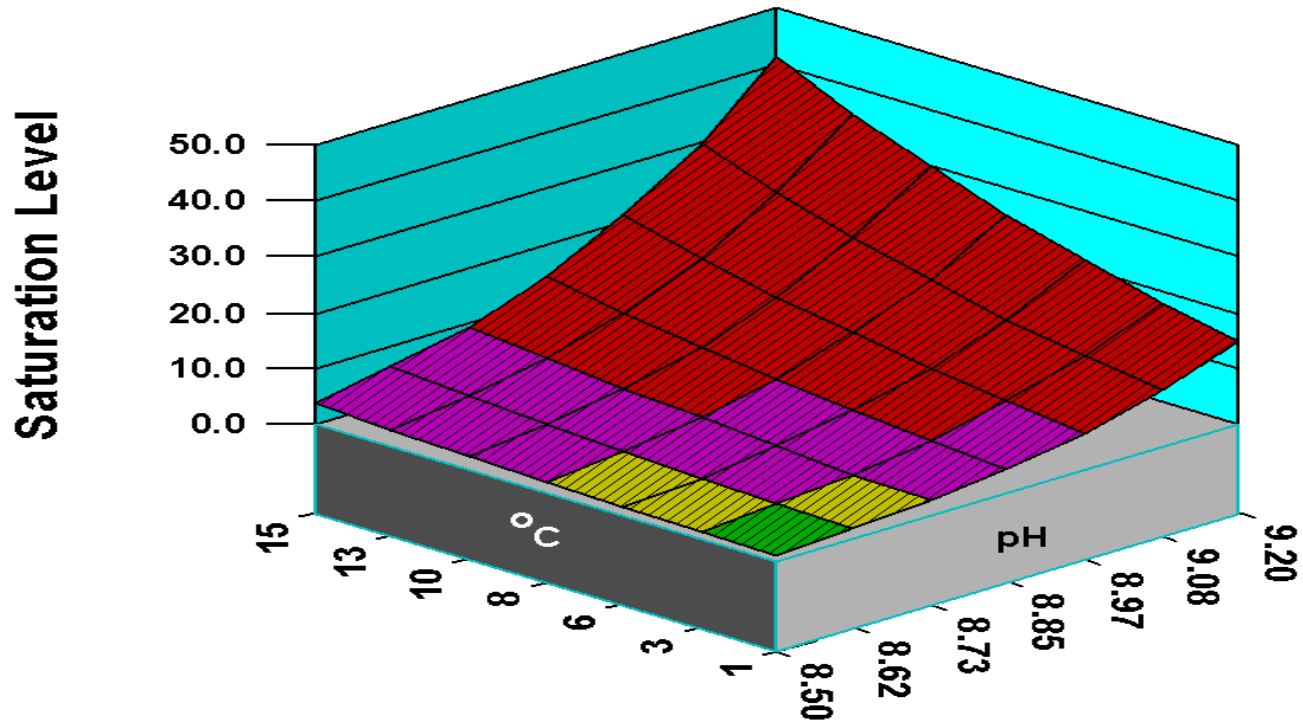
Top of filters – 3.62 ppm of ortho

Bottom of filters – 3.26 ppm of ortho

Clearwell – 3.18 ppm of ortho

CALCIUM PHOSPHATE SATURATION

Calcium Phosphate Saturation

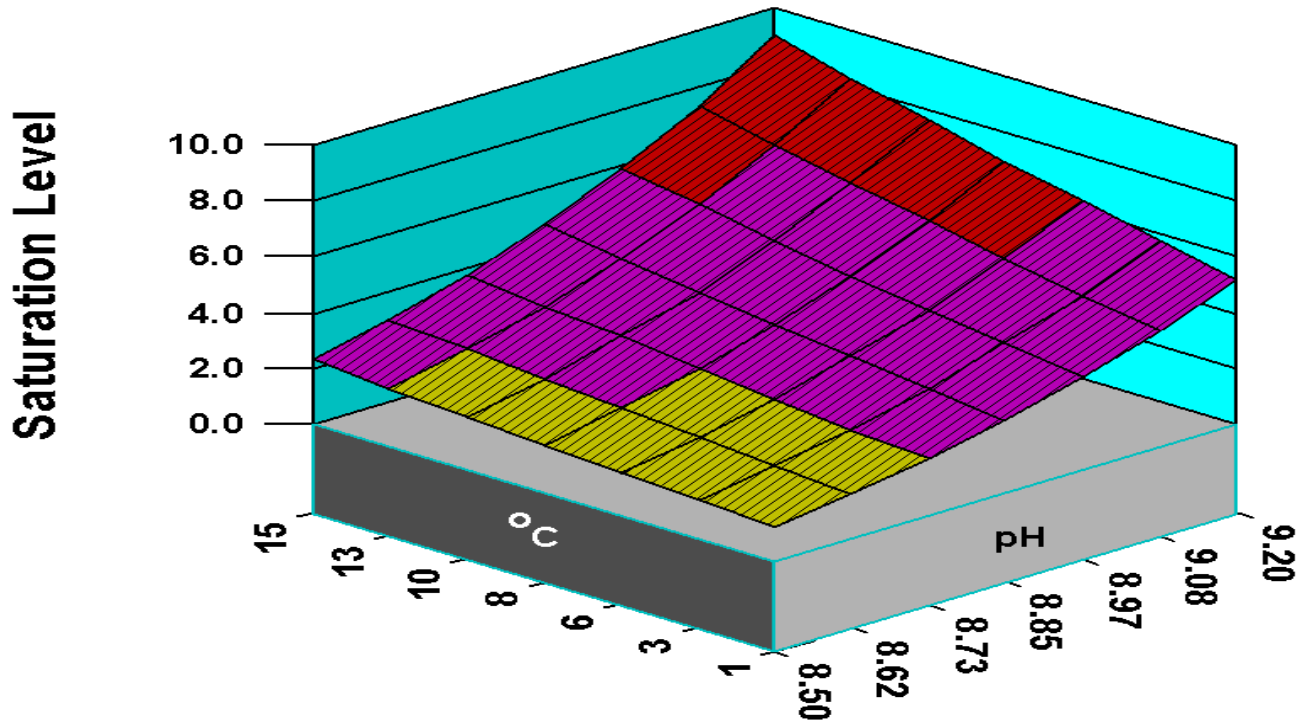


CALCIUM CARBONATE

- Most common problem associated with calcium carbonate fouling is overfeed of lime.
- Generally occurs when raw water quality changes without operators catching it.
- Have had numerous plants call about white water running to filters, filter runs only a couple of hours

CALCIUM CARBONATE

Calcite Saturation Level



CALCIUM CARBONATE/PHOSPHATE

- If your filters are plugged with calcium salts how do you go about cleaning them up?
 - You can try sequestering the calcium with a polyphosphate. Slower process requiring time to cleanup the filters
 - Acidize the filters. Rapid but health risks associated with it. Can create problems if not done appropriately
 - Change out the media

CALCIUM CARBONATE/PHOSPHATE

- Why are we concerned about calcium salts fouling our media?
 - Media fouling changes the porosity of the media and the filter. Particularly true with anthracite and granular activated carbon
 - Severe fouling can create channeling in a filter bed
 - Fouling affects the density of the media

CHEMICAL MONITORING

- Insure that you are supplying properly treated water to the filters
- Good water to a filter usually results in excellent water out of a filter
- Poorly treated water to a filter usually results in fair water out of a filter

CHEMICAL MONITORING

- Ways to evaluate and improve chemical performance
 - Jar studies
 - Pilot filters
 - Pilot studies
 - In plant trials
 - Equipment
 - Streaming current monitors
 - pH meters for lime feed control

PILOT FILTERS

WEB WATERPLANT P LOT FILTER PROJECT



P LOT FILTERS STUDY FOR GAG FILTER MEDIA

CHEMICAL MONITORING

- Ways to utilize chemicals to enhance turbidity removal
 - Hydroxyl components of metals enhance the overall performance for turbidity removal. This is true for aluminum, magnesium and iron.
 - Filter aids have proven to be very effective in reducing finished water turbidities. Applied during normal run times or in backwash waters

CHEMICAL MONITORING

- Ways to utilize chemicals to enhance turbidity removal, (cont.)
 - Acrylamide use in the treatment process have lowered turbidities to the filters and after the filters
 - Inorganic/organic combinations have proven to be more effective when used together than when used separately
 - Utilizing polyphosphate in lime softening applications to maintain the integrity of the media

CASE HISTORY

- Lime Softening Plant with Pretreatment
 - Problem:
 - Exceeding finished water turbidities, >1.5 NTU's
 - Cause:
 - Extremely fine suspended colloidal clay
 - Solution:
 - Increased lime feed to utilize as much magnesium hydroxide for removing the clay material
 - Result:
 - Turbidity was back below 0.5 NTU's in less than 2 hrs and below 0.1 NTU's in 8 hrs.

CASE HISTORY

- Lime Softening Plant with Pretreatment
 - Problem:
 - Exceeding finished water turbidities, >1.0 NTU's
 - Cause:
 - Overfeed of alum
 - Solution:
 - Decreased alum feed, added organic polymer, went through extensive backwashes to clean up fouled media beds
 - Result:
 - Turbidity was back below 0.5 NTU's in less than 4 hrs and below 0.3 NTU's in 8 hrs.

CASE HISTORY

- Lime Softening Plant with Pretreatment
 - Problem:
 - Excessive white water running to filters, short filter runs, < 3hours
 - Cause:
 - Spring runoff, extremely soft water, overfeed of lime compounded by recommendation to increase alum feed
 - Solution:
 - Decreased lime feed, decreased alum dose, ran extended backwashes
 - Result:
 - Filter runs went back to normal times, finished water turbidities dropped substantially within the day

CASE HISTORY

- Clarification Plant
 - Problem:
 - Turbidity spikes during backwash, adjacent filter would spike up to 0.15 to 0.30 NTU's
 - Cause:
 - Doubling of velocity through the adjacent filter, elimination of potassium permanganate
 - Solution:
 - Applied an acrylamide polymer at a low dose, 0.05 ppm during normal operation
 - Result:
 - Turbidity spikes disappeared, and actually improved over time after the elimination of potassium permanganate

CASE HISTORY

- Lime Softening Plant with Pretreatment
 - Problem:
 - Excessive carryover from softening basin, resulting in higher finished water turbidities and shorter filter runs
 - Cause:
 - Extremely cold dense river water and increased flow rates due to one of three basins taken out of service for annual maintenance
 - Solution:
 - Fed an acrylamide polymer to the softening basin
 - Result:
 - Carryover was eliminated, filter runs exceeded times prior to basin taken out of service, sludge blow offs were reduced by 67% and finished water turbidities are the best they have ever been. Decided to feed acrylamide year around.

THANK YOU FOR YOUR TIME!!!!