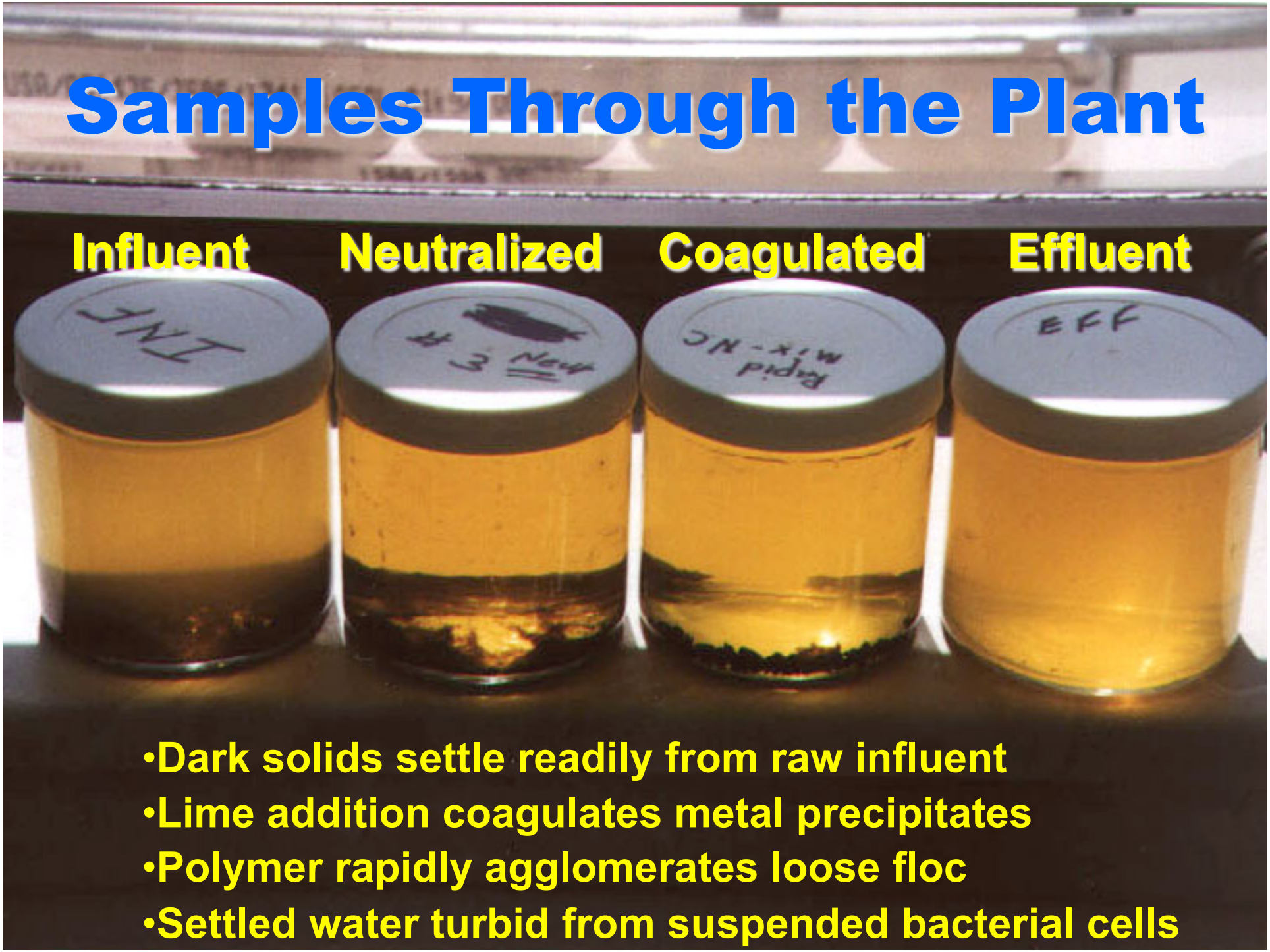
P-Chem Plant Process Performance

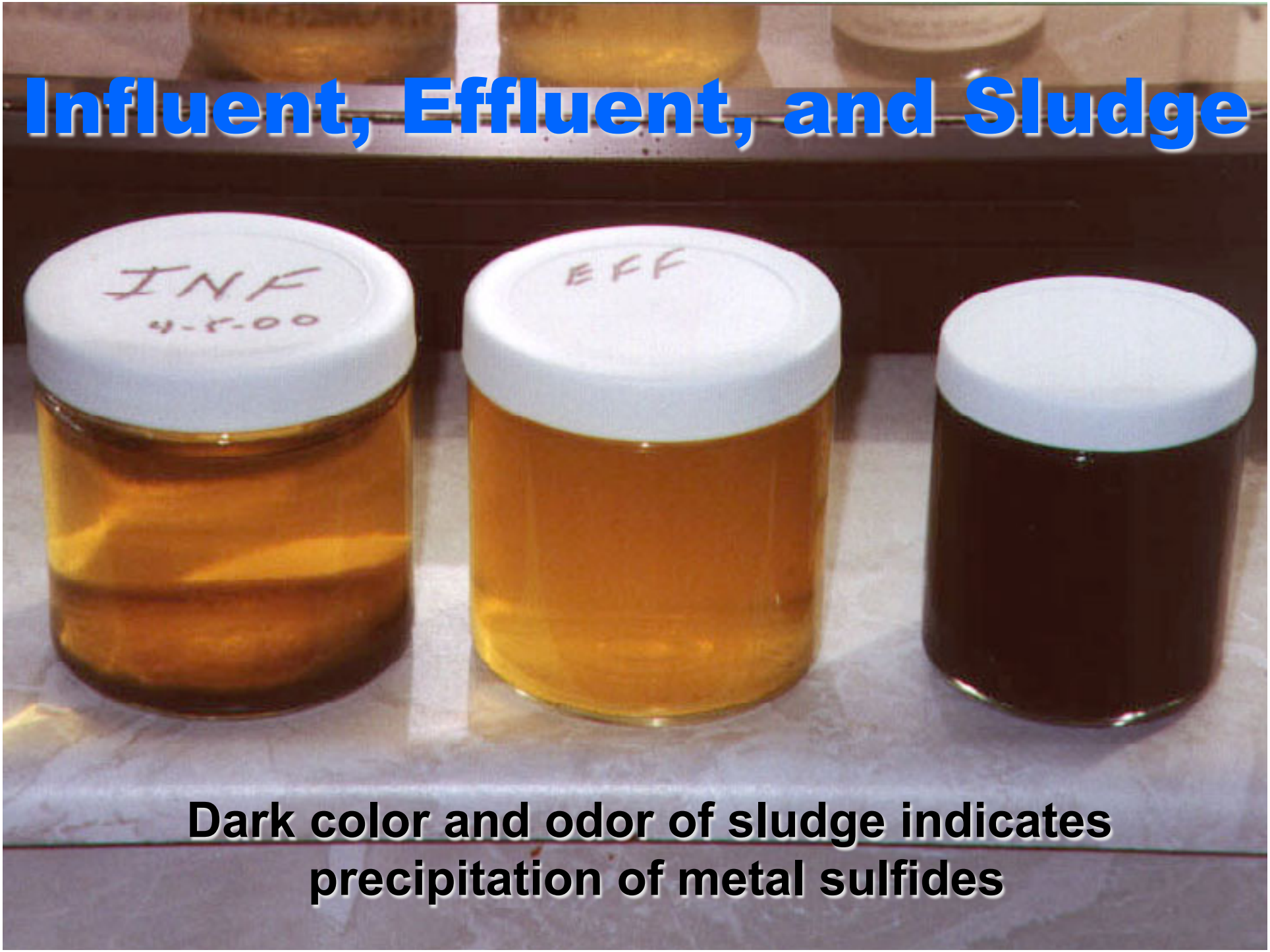
Dr. John T. O'Connor, PE

Samples Through the Plant



- Dark solids settle readily from raw influent
- Lime addition coagulates metal precipitates
- Polymer rapidly agglomerates loose floc
- Settled water turbid from suspended bacterial cells

Influent, Effluent, and Sludge



Dark color and odor of sludge indicates precipitation of metal sulfides

Operational Control

Effluent

- **Metals Analysis**
- **Suspended Solids**
- **pH**
- **Turbidity**

Sludge

- **Cadmium TCLP**

H2O C ENGINEERING

Dissolved Oxygen

H2O'C ENGINEERING

Alkalinity

H2O'C ENGINEERING

Copper

H2O'C ENGINEERING

Cadmium

North (Active) Clarifier
South (Inactive) Clarifier
Cadmium, mg/L
0
1
2
3
4
5
6
7
8
9
10
particulate
dissolved

Zinc

H2O'C ENGINEERING

P-Chem Plant

- Annual Average Flow: 4 - 8 mgd
- No Hydraulic or Process Overload
- Floc Break-up in Flume, Flocculator
- Low Flow, Idle Settling Tank, Anoxia
- Metals Increase in Inactive Tank
- Effluent Metal in Particulate Form
- Turbidity Poorly Related to Metals

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P-Chem Plant Effluent 5-Year Averages

35 mg / l Suspended Solids (55% Volatile)

140 mg O / l Biochemical Oxygen Demand

0.43 mg Zn / l	0.01 mg Cr / l
0.23 mg Fe / l	0.01 mg Cd / l
0.09 mg Cu / l	0.00 mg Pb / l
0.04 mg Ni / l	1.70 mg Phenol / l

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Metal Excursions

Particulate Form – Retained on Membrane

Evaluate Effluent Polishing

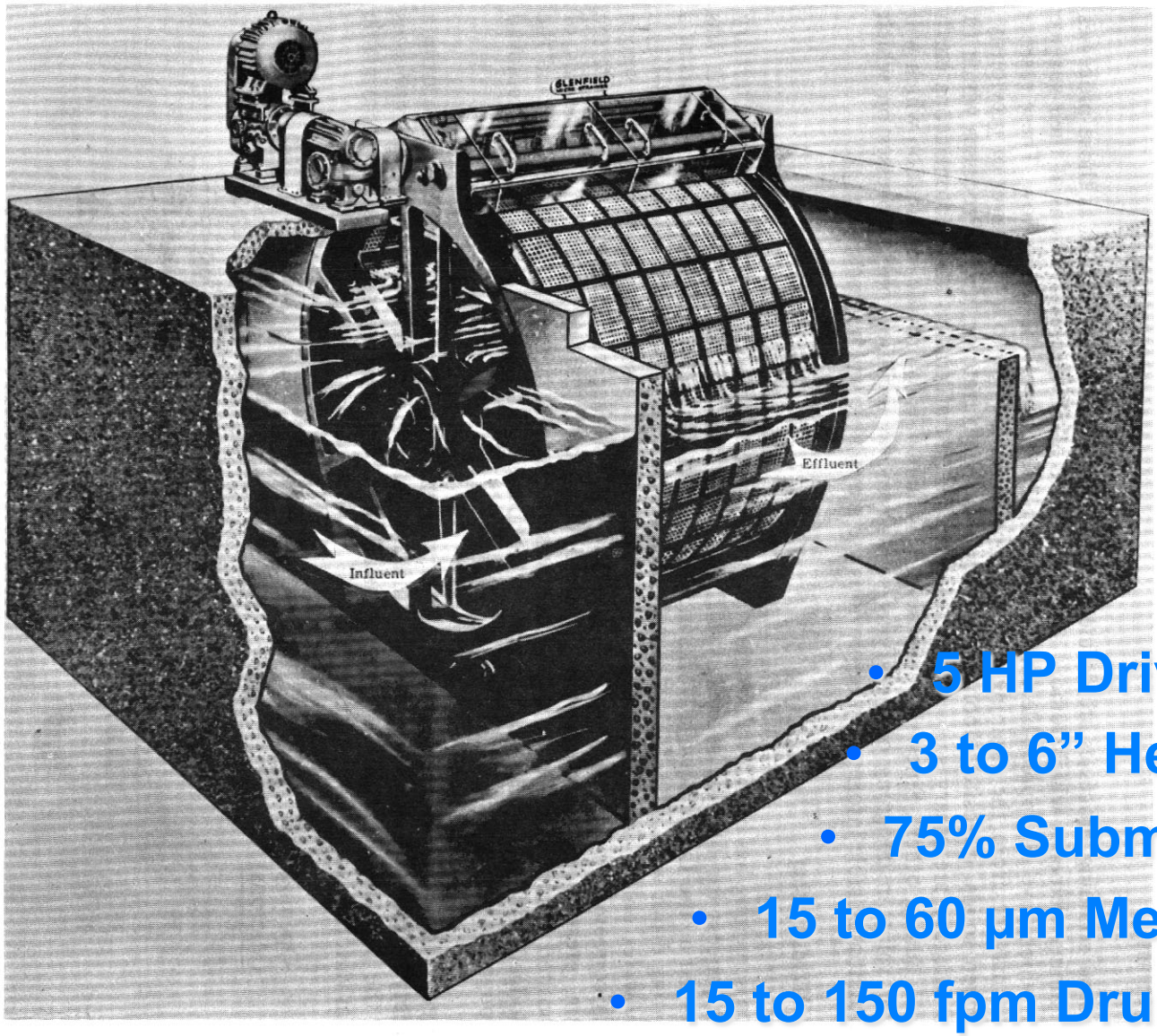
- Tube Settlers at Effluent Launders
- Microscreens in Effluent Channel

Monitoring

- Total Zinc or Zinc Retained on Membrane
- Total Sulfides
- Color of Membrane

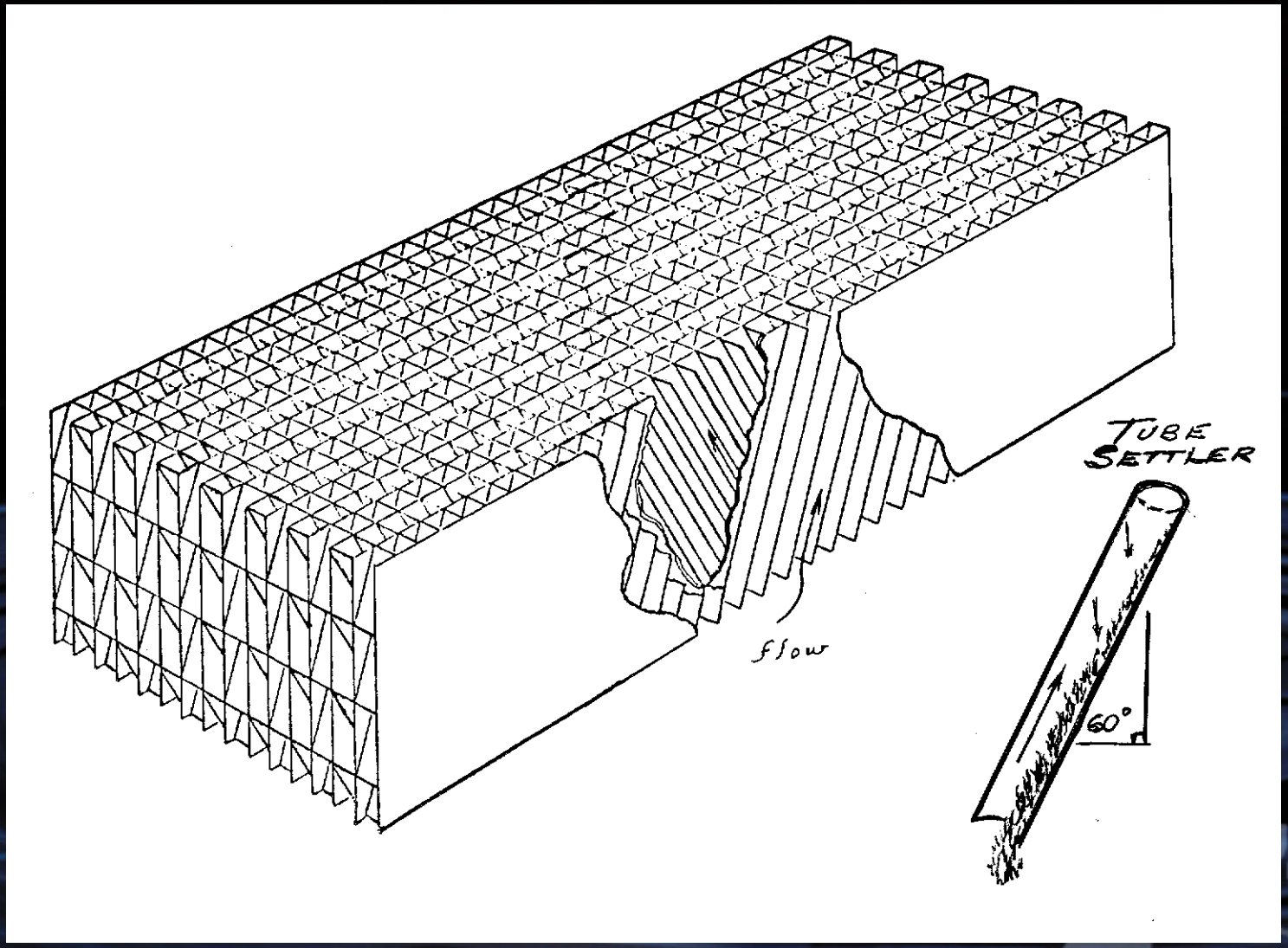
H2O'C ENGINEERING

Microscreens



- 5 HP Drive Motor
- 3 to 6” Head Loss
- 75% Submergence
- 15 to 60 µm Mesh Sizes
- 15 to 150 fpm Drum Speed
- 10’ Diameter for 3 to 10 mgd
- 5% Backwash Flow @ 15 psi

Tube Settler Module



Metabolism-Generated Alkalinity and Ammonia

- **Protein & Organic Acid Degradation**

  $RCH\text{-}NH_2\text{-}COOH + 2\ H_2O \longrightarrow NH_4^+ + HCO_3^-$

- **Sulfate Reduction**

  $CH_3COO^- + SO_4^{2-} \longrightarrow 2\ HCO_3^- + HS^-$

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