

Copper Corrosion & Agglomeration in APS Water Cooling System

Bijaya Adak

Prof. Philip Nash

Dr. Sushil Sharma

12th August '05

ARGONNE
NATIONAL LABORATORY



United States
Department of Energy

The University of Chicago

ENTRANCE

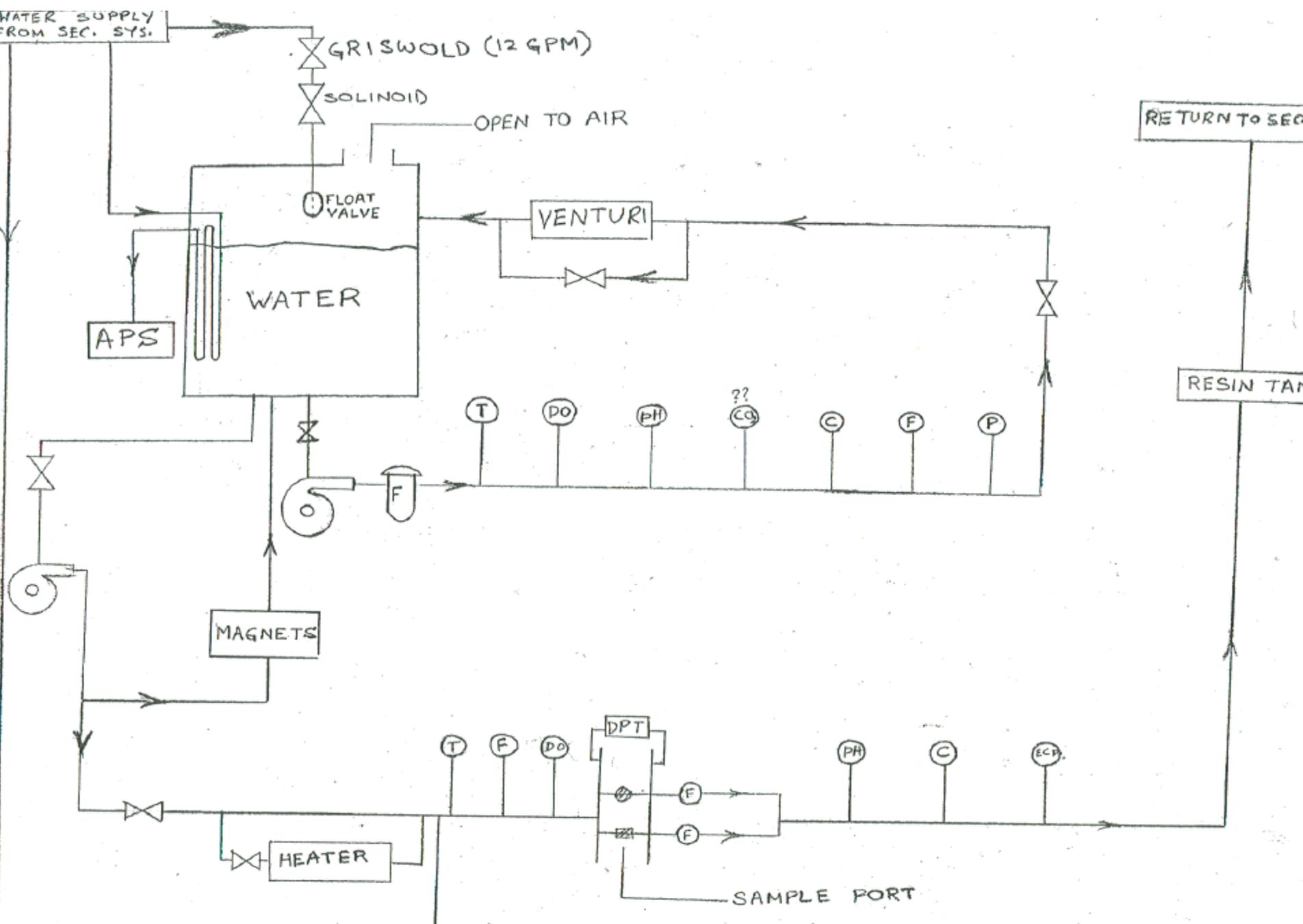
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Overview:

- **Venturi Aeration**
- **Water Chemistry**
- **Venturi**
 - *Principle and Functionality*
 - *Industries where it is used*

P&ID Diagram of the Experimental Set-Up:



Water Chemistry:

- **APS Water (Closed System, inside the ring) –**
 - pH: 6.3 ~ 6.5
 - Resistivity: 9 ~ 9.5 MΩ-cm
 - DO: 4 ~ 5 ppb

- **APS Water (Open to air) –**
 - pH: 5.9, 5.6
 - In this time we modified our system several times (addition of heat exchanger, piping etc.). During this phase pH reading fluctuated a lot and not very consistent.
 - Resistivity: 1.01 MΩ-cm
 - DO: 7 ~ 7.5 ppm

Venturi Aeration:

- **Advantages of using a venturi:**

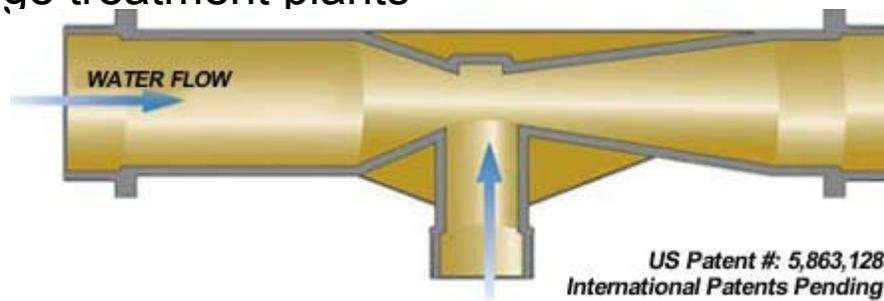
- Oxygen enrichment
- Stripping of carbon dioxide from water

- **Chemistry:**

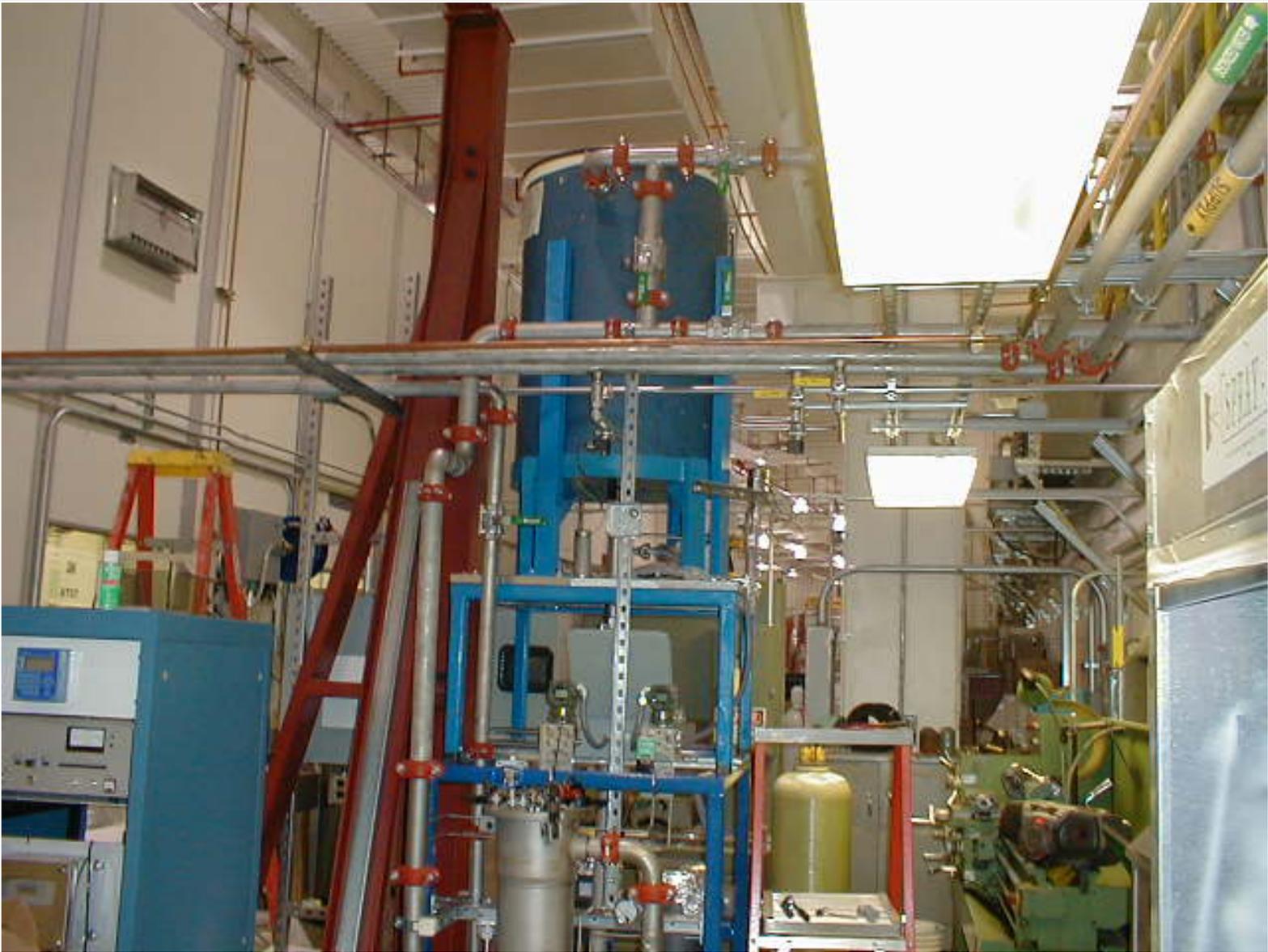
- La Chetalier's Principal: $2\text{H}_2\text{O} \leftrightarrow 4\text{H}^+ + \text{O}_2 + 4\text{e}^-$
- Carbonic acid: $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{H}_2\text{CO}_3 \leftrightarrow \text{H}^+ + \text{HCO}_3^-$

- **Industries where ventureries are used:**

- Fishing
- Agriculture
- Domestic water system
- Sewage treatment plants



Work Station:



Venturi:

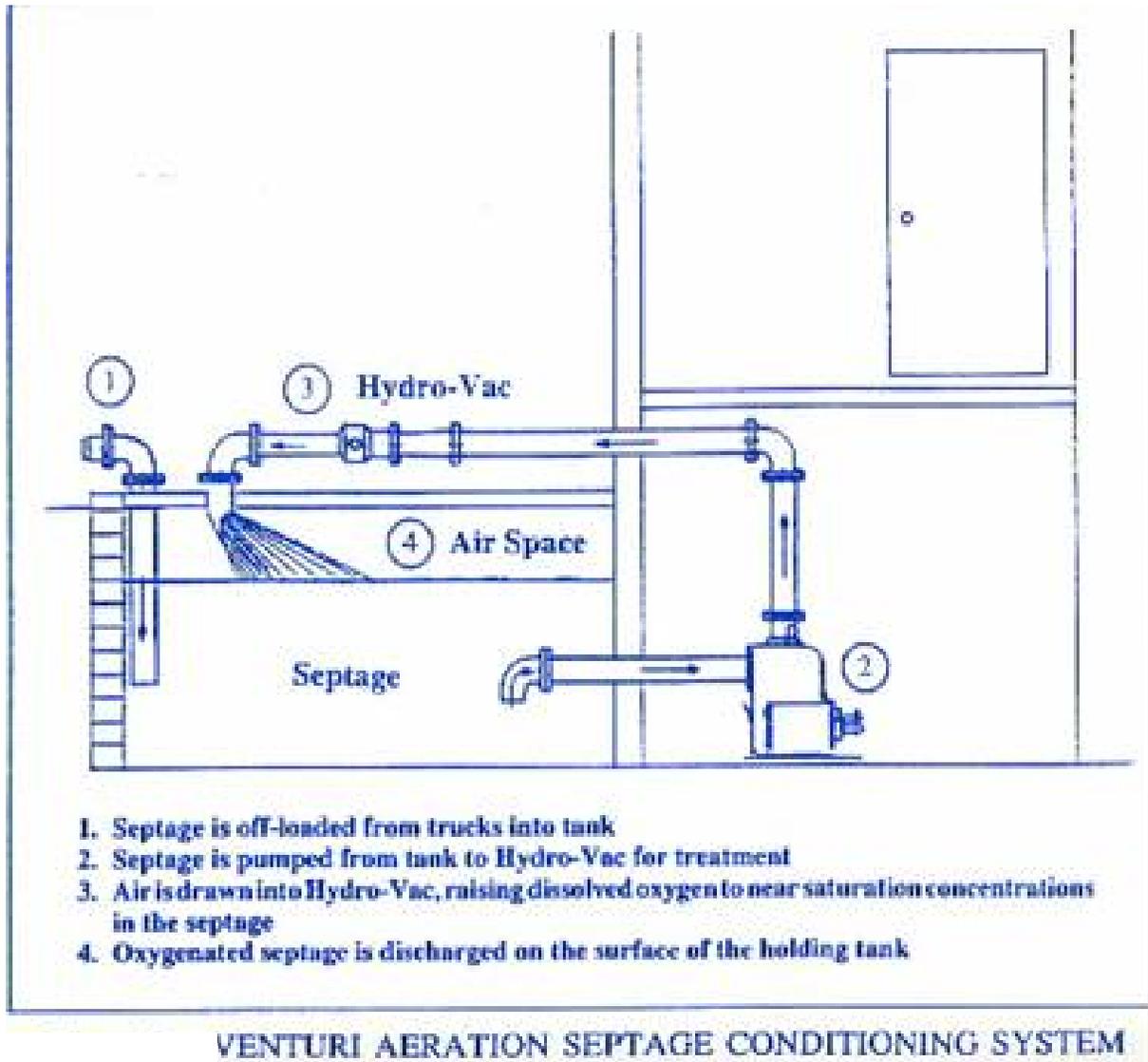


Water Chemistry before and after venturi:

- **APS Water (Open to Air, before operating Venturi) –**
 - pH: 5.9, 5.6
 - In this time we modified our system several times (addition of heat exchanger, piping etc.). During this phase pH reading fluctuated a lot and not very consistent.
 - Resistivity: 1.01 MΩ-cm
 - DO: 7 ~ 7.5 ppm

- **APS Water (Open to Air, after operating Venturi) –**
 - pH: 5.8
 - Very consistent data for four days.
 - Resistivity: 1.01 MΩ-cm
 - DO: 7.5 ~ 8.8 ppm

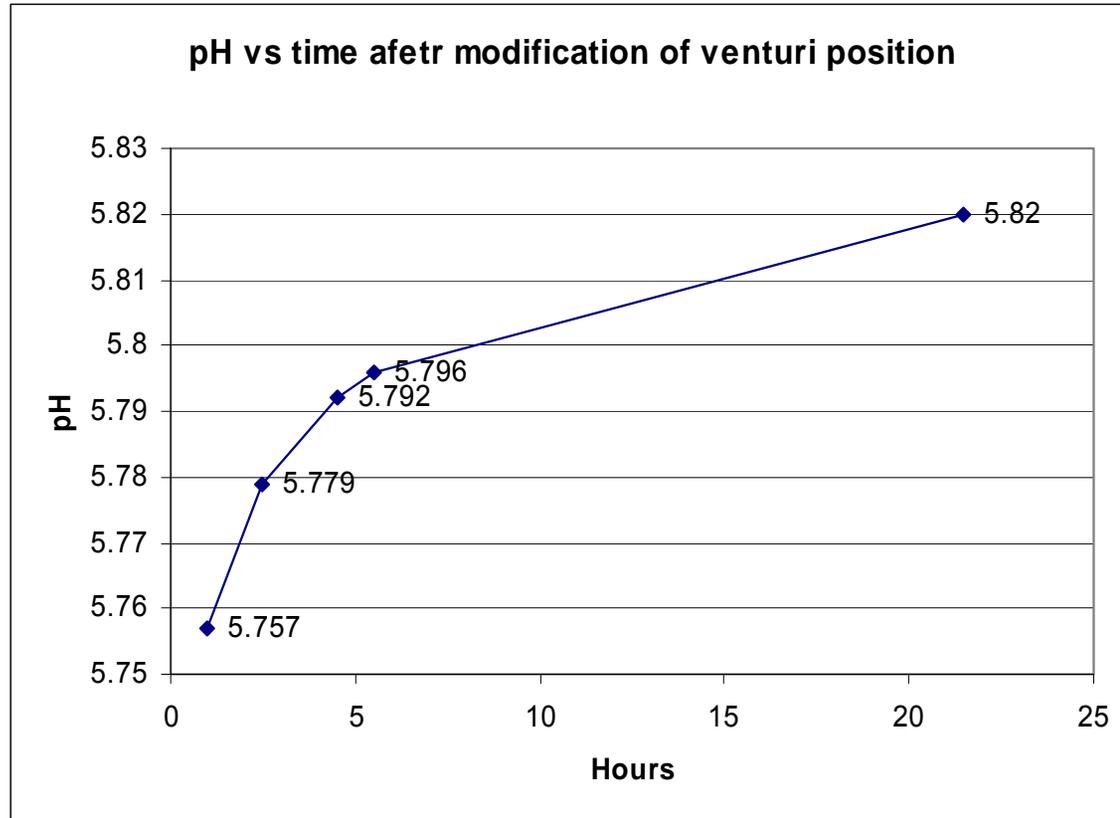
Modification in Installation:



Ref: "Hydro-vac treatment of septage for odor elimination and increased revenue" , Joseph E. O'brien et. al ,
Journal of the new England Water Environment Associatin, V 28, Issue 2, 1994

Water Chemistry after Modifying Venturi Position:

- pH:



- Resistivity: 1.01 M Ω -cm
- DO: ~ 8 ppm