University of Alaska Fairbanks Water Treatment Plant

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TVC Process Technology

Water Treatment & Process Tech Overview

Water Industry Segments

- Domestic Drinking Water
- Domestic Wastewater
- Process Water a.k.a Industrial Wastewater

Basic Information

- 1 MGD Facility
- Groundwater source
- Conventional Treatment
- Primarily treat for Fe and Mn
- 5000 people/day population
- 6 miles of pipe in distribution

The Process

- Aeration
- Oxidation
- ***Coagulation***
- ***Flocculation***
- ***Sedimentation***
- ***Filtration***
- Adsorption
- Corrosion Control
- Disinfection

Aeration

- 1 - Roots Blowers 1000 cfm
- 2 - Kaeser Air Blowers
- Ramco Air Turbine
- Saturates water with oxygen
- Volatize Organic compounds
- Vigorous mixing action

Oxidation

- Potassium Permanganate ($KMnO_4$)
- Converts Dissolved Fe and Mn to Suspended Fe and Mn.

Oxidation (cont.)

Oxidative Reactions

Aeration

$2Fe^{2+} + ½O_2 + 5H_2O \rightarrow 2Fe(OH)_3 + 4H^+$

Ferrous Iron **Ferric Hydroxide**

$Mn^{2+} + ½O_2 + H_2O \rightarrow MnO_2 + 2H^+$

Manganous Mn **Manganese dioxide**

Potassium Permanganate

$3Fe^{2+} + MnO_4^- + 7H_2O \rightarrow 3Fe(OH)_3 + MnO_2 + 5H^+$

Permanganate Ion

$3Mn^{2+} + 2MnO_4\text{-} + 2H_2O \rightarrow 5MnO_2 + 4H^+$

Coagulation/Flocculation

- Nalco 8185 Coagulant
- Lower mixing velocity

- Nalco 7768 Anionic Polymer
- Slow stirring

Sedimentation/Settling

- Allows solids to settle
- Tube Settlers
- Elimination of mixing velocity

Filtration

- Mixed media filters (Anthracite, sand, gravel)
- Removes remaining unsettled solids
- Turbidity-measure of water clarity

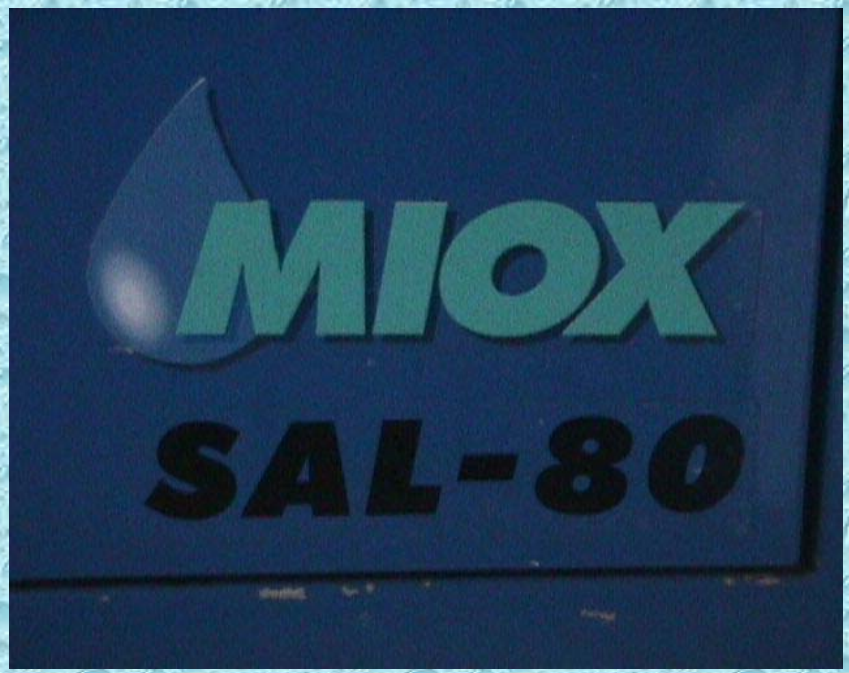
Adsorption

- Granular Activated Carbon (GAC)
- Removes any residual Organic Compounds, such as Benzene

Corrosion Control

- Nalco 7390
- Phosphoric Acid, Zinc Sulphate
- Coats the interior of the pipe without buildup or scaling
- Reduces lead and copper leaching and rust

Disinfection

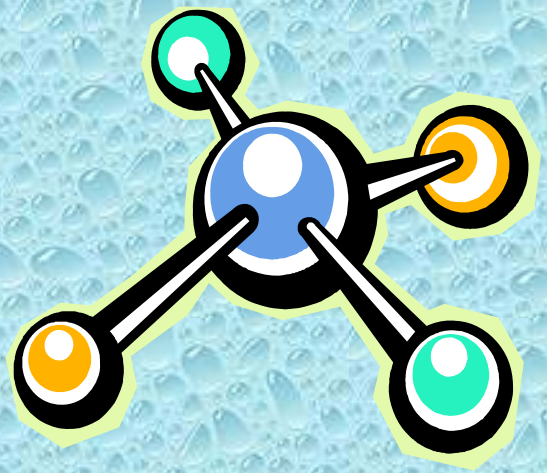


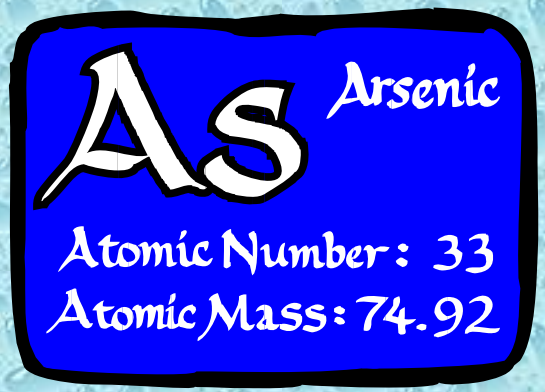
- MIOX or Mixed Oxidants solution provides disinfection
- Main Ingredient: Sodium Hypochlorite
- Hypochlorous acid (HOCl)
- $Cl_2 + H_2O \longrightarrow HOCl + HCl$
- $HOCl \longleftrightarrow H^+ + OCl^-$

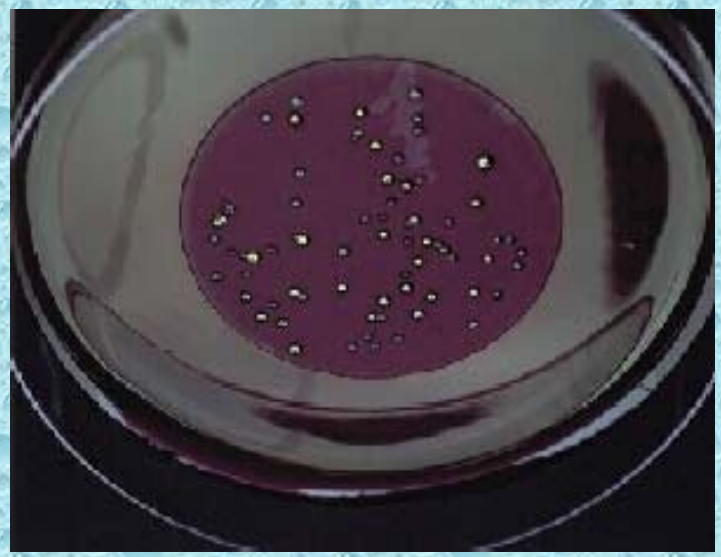
HOCl is roughly a ***80*** times more effective in killing power than OCl-, largely because the uncharged HOCl is more effective in penetrating cell walls.

What's in the water?

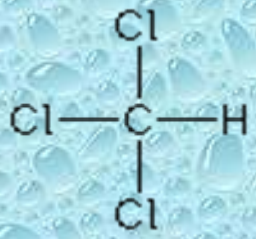
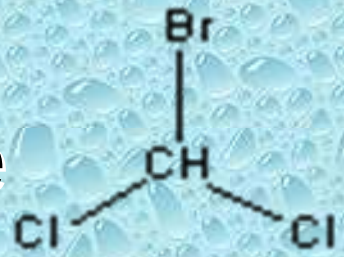
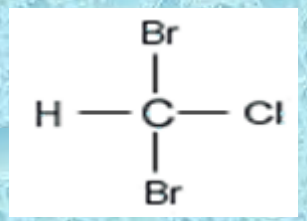
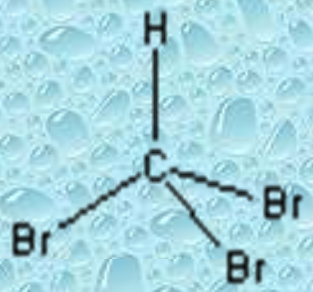
- You can still expect a certain amount of contaminants to remain after the treatment process.
- Contaminants of Concern
  - Total Trihalomethanes (TTHM's)
  - Arsenic
  - Bacteria





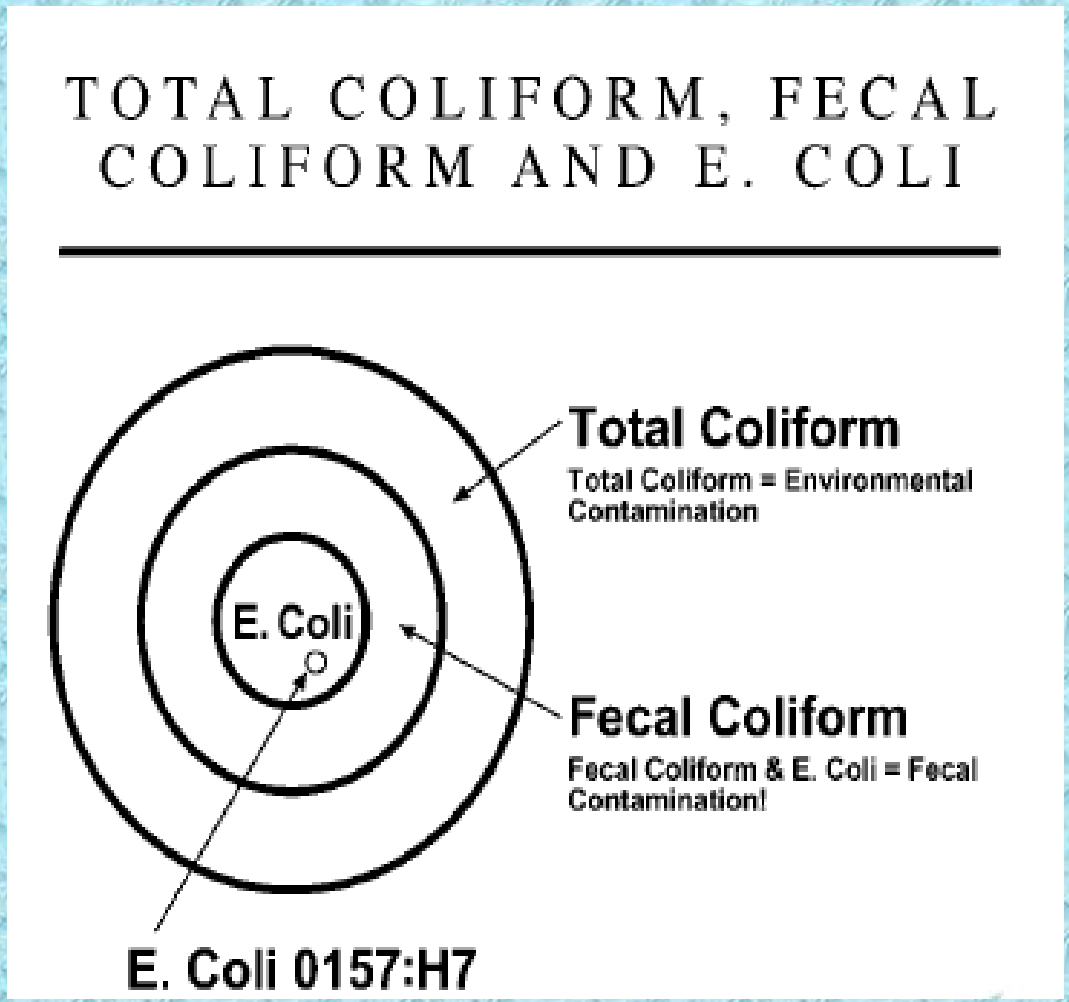


Total Trihalomethanes

- Trihalomethanes
  - Chloroform 
  - Bromodichloromethane 
  - Dibromochloromethane 
  - Bromoform 

Bacteria in the Water

- Total coliform bacteria are usually not harmful to humans
- TC's are used as indicators of a potential problem
- E. coli is proof of human or animal waste contamination



Process Technology

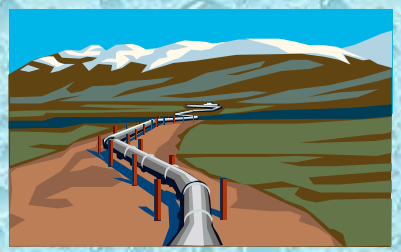
- APICC
  - Alaska Process Industries Career Consortium
  - Formed to “create, connect and enhance the quality of training & educational programs to help prepare Alaskans for good jobs.”
- Mission
  - *To define workforce needs from an employer perspective, to create statewide skill standards for jobs, to develop standardized curricula that meet industry needs, and to promote careers in the industry for Alaskans.*

APICC
Alaska
Process Industry
Careers Consortium

Process Technology

- The process technology program prepares students for employment as operations technicians in the process industry, which includes oil and gas production, mining and milling, transportation and refining, chemical manufacturing, power generation, utilities, wastewater treatment facilities maintenance, and food processing.

- This A.A.S. degree program incorporates technical and academic courses covering topics such as pumps and turbines, instrumentation, safety and quality control. Summer internships give students valuable practical experience and exposure to the true nature of process technology careers.

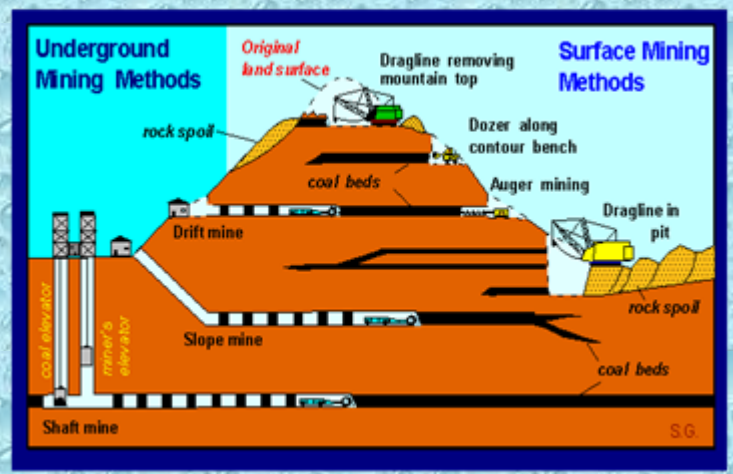


It all begins with PRT101!

- The Introduction to Process Technology course is a lecture course about the *basics* of the Process Industry.
- Course objectives include
  - Define a Process Industry.
  - Describe the roles, responsibilities and expectations of the Process Technician.
  - Describe worker & workplace safety.
  - Solve basic mathematical problems that process technicians and operators encounter in their jobs.

PRT 101

- Throughout the semester, 101 students learn the basics of eight different industries.
- Discuss team dynamics.
- Learn to identify hazardous conditions in the workplace.
- Discuss the operation theory behind 14 equipment categories.
- Review of basic Physics and Chemistry



Mining

What is mining?

- Extraction of valuable minerals or other geological materials from the earth.

What are minerals?

- Naturally occurring, inorganic substances, which have a definite chemical composition and a characteristic crystalline structure.

How can you help?

- Things I look for as an instructor…
  - Guest speakers
  - Literature
  - Hands on models
  - Video or DVD of actual process operations

- Things the Process Tech Program is looking for…
  - Industry partners
  - Internship Opportunities
  - Used equipment (working or not)
  - Adjunct Instructors

More info…

For more information about the Process Technology Program, please contact

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