U. S. Steel Canada
Hamilton Works
Wastewater Treatment Plant

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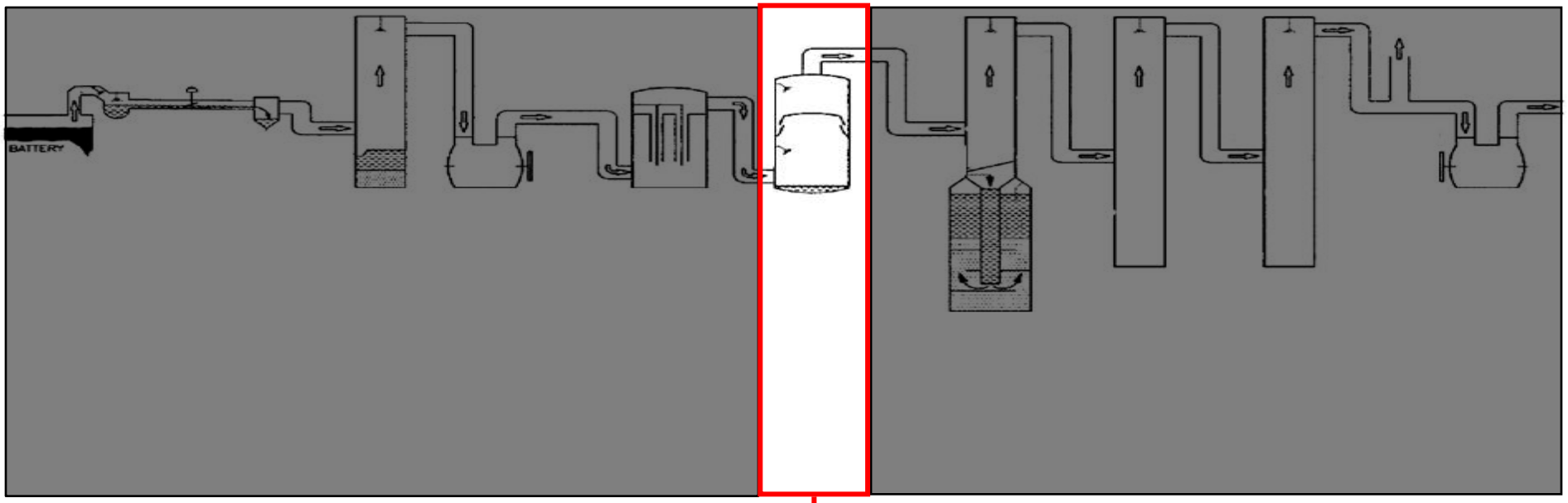
Waste Water Treatment

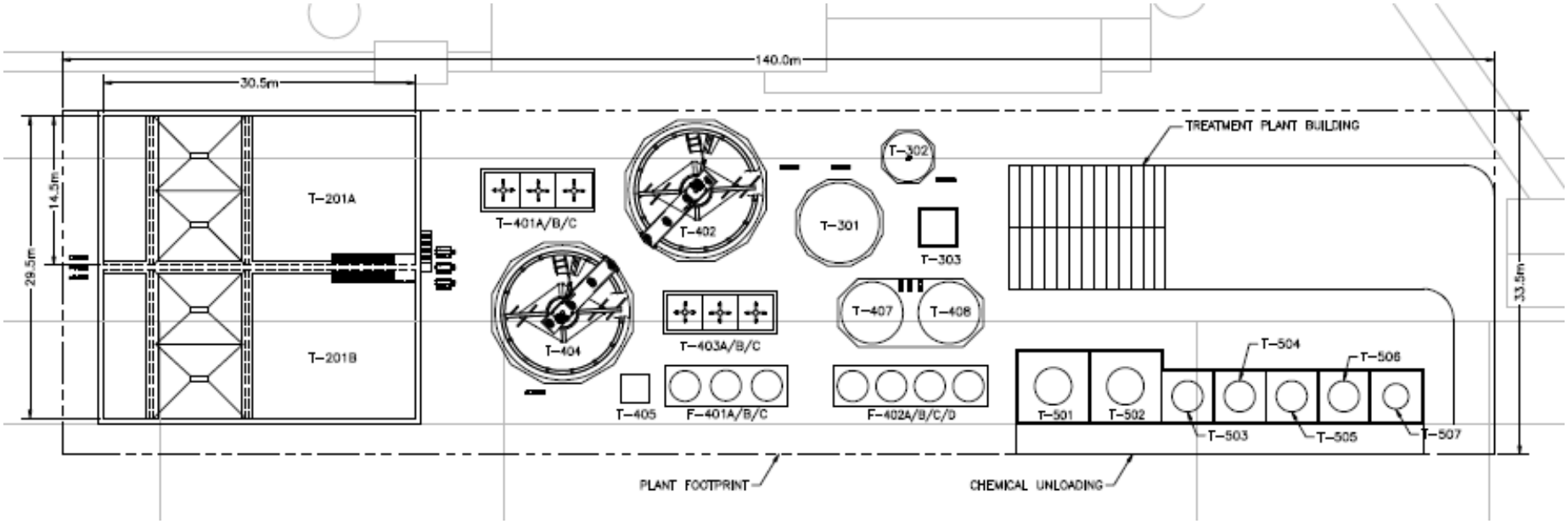
Ammonia Plant



Install new Waste Water Treatment Plant for water from Ammonia Plant

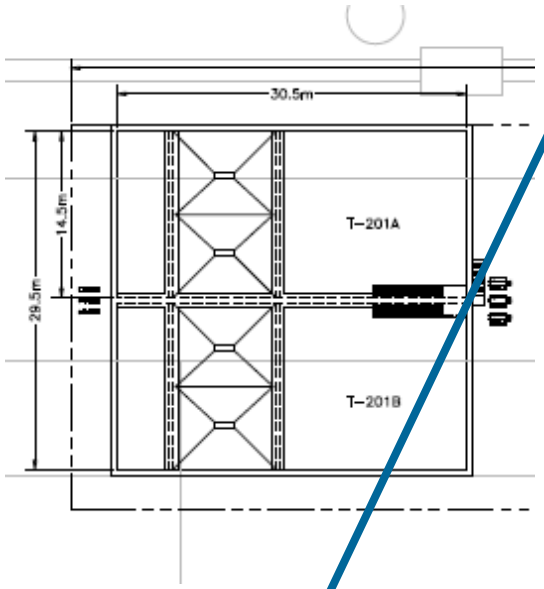
U. S. Steel Canada Waste Water Treatment: Our Process

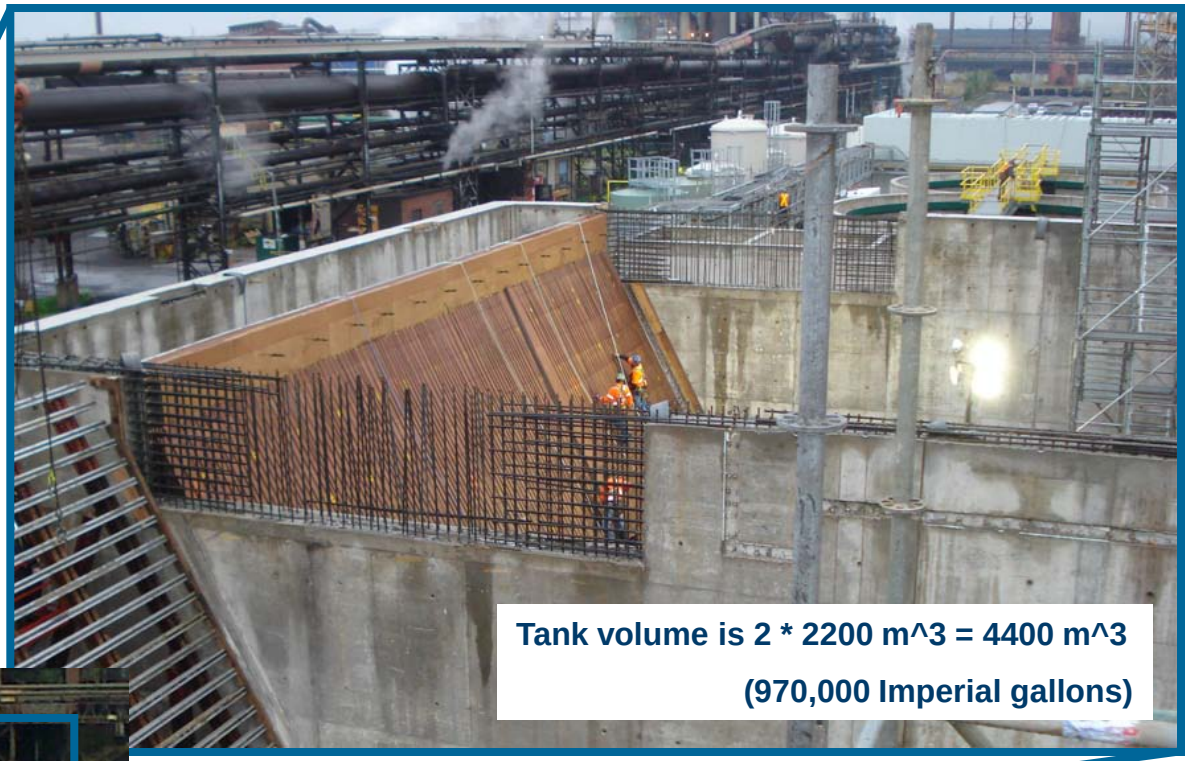
Biological Treatment → **Cyanide Treatment** → **Fluoride Treatment** → **Filtration**



Waste Water Treatment Plant: Overview

Waste Water Treatment Plant: Biological Treatment



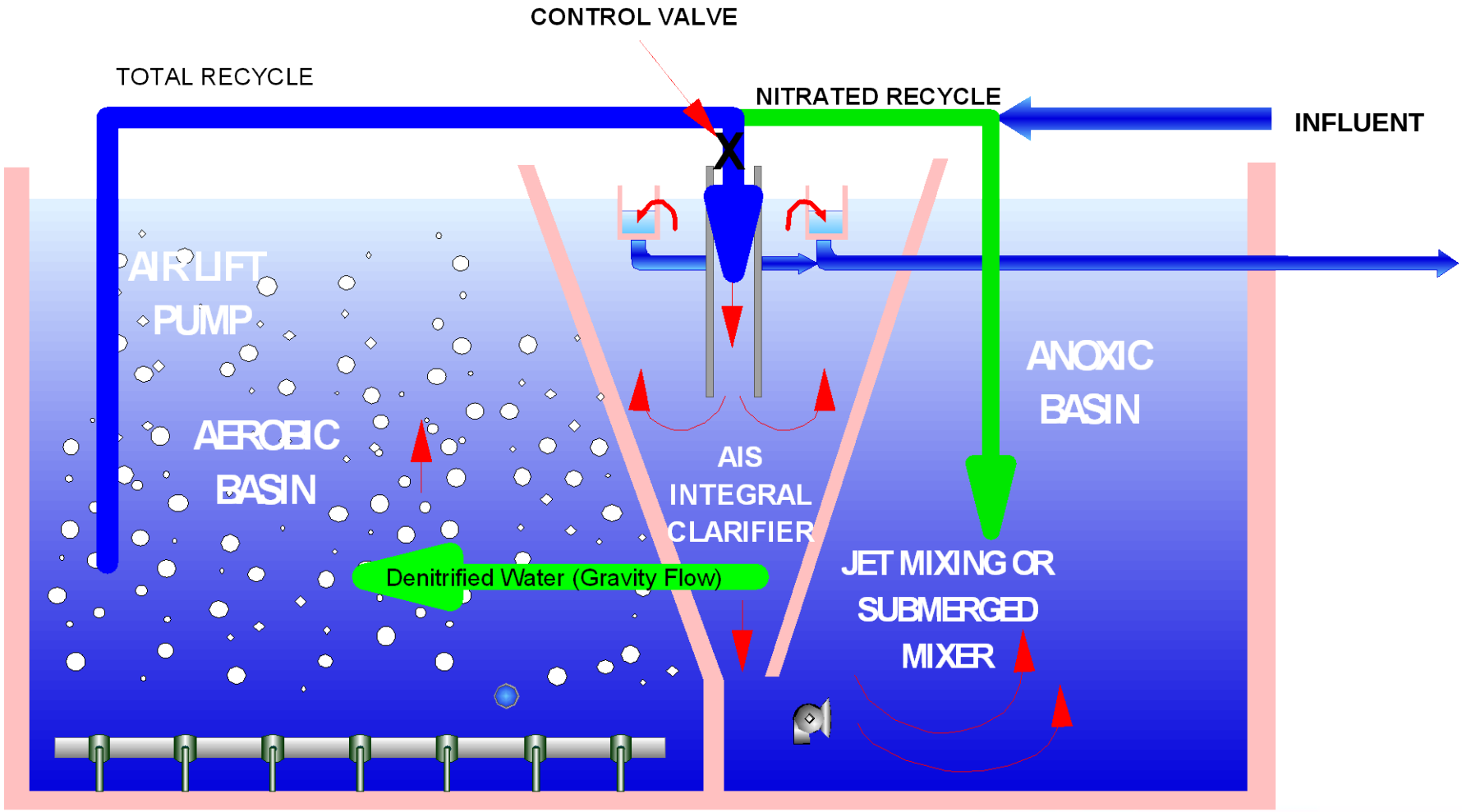


Tank volume is 2 * 2200 m^3 = 4400 m^3

(970,000 Imperial gallons)

Bioreactors contain ‘bugs’ – simple bacteria / single celled organisms that breakdown or ‘eat’ nitrogen compounds (TKN) and organic compounds such as phenol.

Integral Clarifier & Nitrification/Denitrification Approach



Integral Clarifier & Nitrification/Denitrification Approach

Anoxic Section

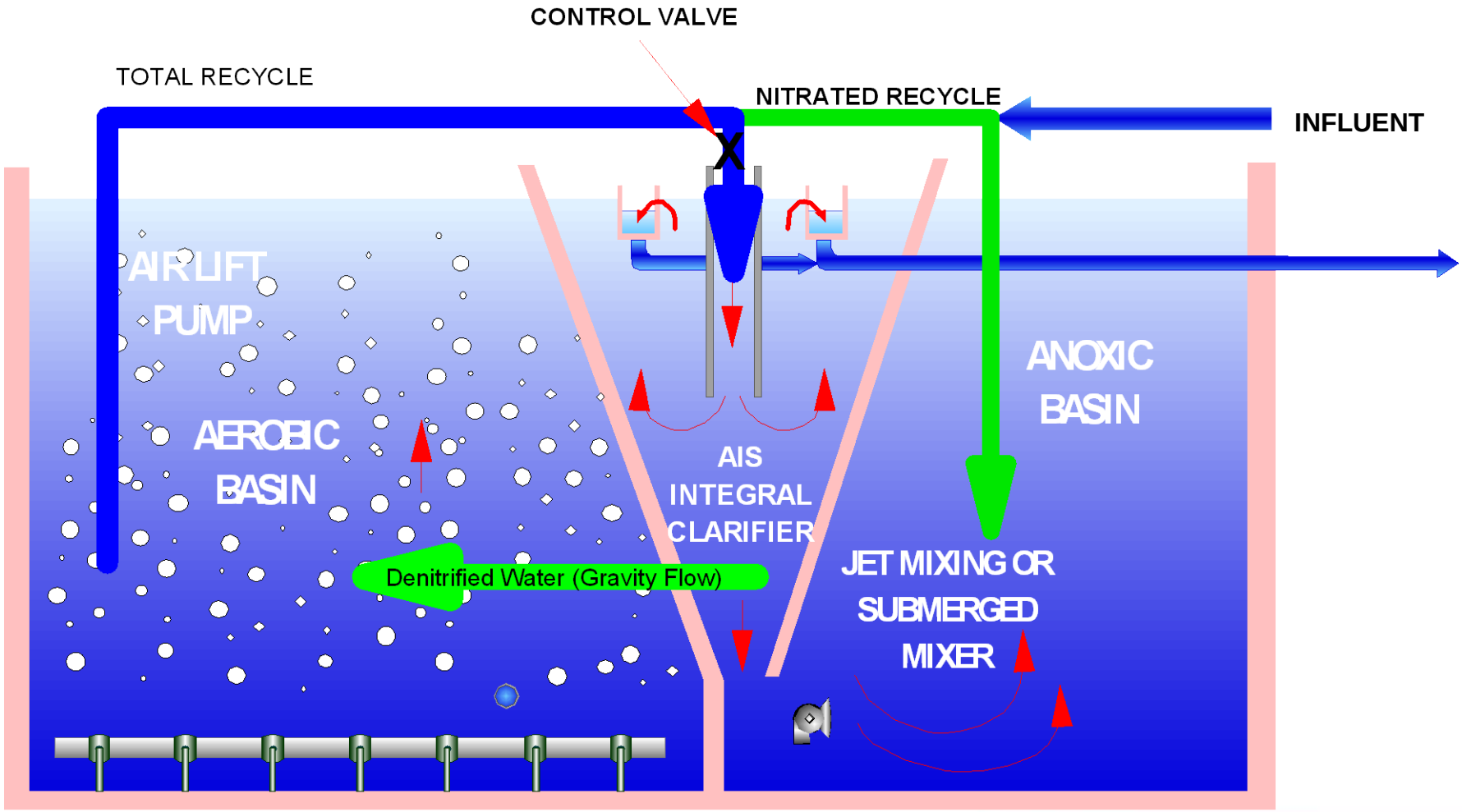
- Denitrification

  NO_3 + organics → N_2 (gas) + CO_2 (gas) + H_2O

- facultative microorganisms use chemically bound oxygen in the form of nitrates to break down organics (eg. Phenol)

- dissolved oxygen concentration must be <0.1 mg/L but not anaerobic.

Integral Clarifier & Nitrification/Denitrification Approach



Integral Clarifier & Nitrification/Denitrification Approach

Aerobic Section

- Nitrification (TKN, Ammonia nitrogen)

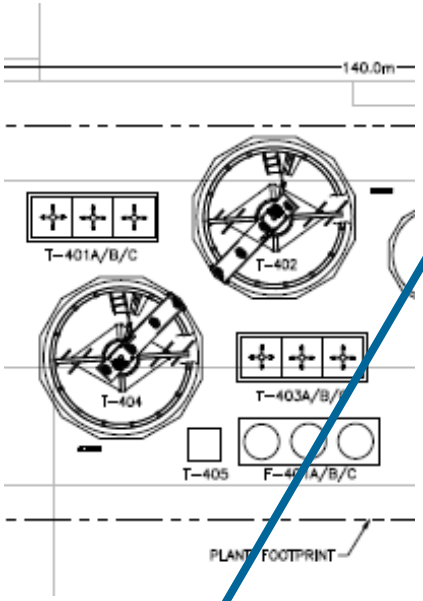
$$NH_4 + 1.5O_2 \rightarrow NO_2 + H_2O + 2H$$

$$NO_2 + 0.5O_2 \rightarrow NO_3$$

- Nitrosomonas – convert ammonia to nitrite
- Nitrobacter – convert nitrite to nitrate

- dissolved oxygen concentration must be >2.0 mg/L.

Waste Water Treatment Plant: Cyanide and Fluoride Treatment



Treatment tanks for cyanide and fluoride, and clarifiers for the initial separation of solids in the effluent.

Cyanide and Fluoride Removal

Cyanide

- Addition of $FeSO_4$ and acid to precipitate cyanide
- precise pH and temperature control
- flocculation to drop out solids

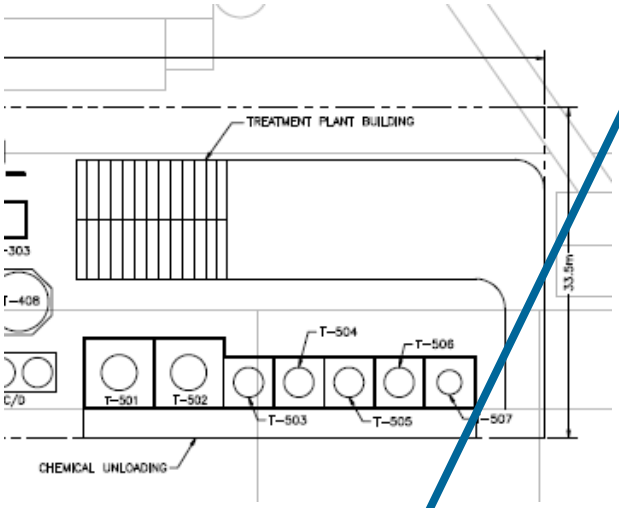
Fluoride

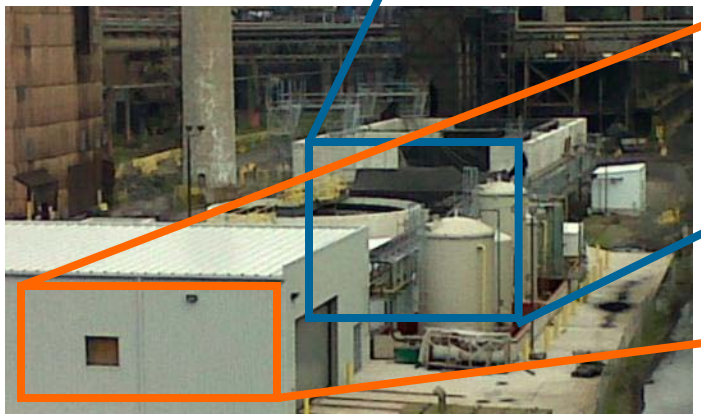
- $CaCl_2$ and $Al_2(SO_4)_3$ is added to precipitate fluoride
- precise pH and temperature control
- flocculation to drop out solids

Phosphorus & PAHs

- phosphorus precipitation & removal of PAHs

Waste Water Treatment Plant: Reagent Storage and Filtration





Pressure filters remove the suspended solids in the effluent from the clarifiers after cyanide and fluoride treatment.

Results

Reduction in:

- Phenol 99.9%
- Phosphorus treatable ($FeSO_4$)
- TKN 98%
- PAHs 99%
- Cyanide 82%
- Fluoride 78%

- Reduced contaminant discharge to the City of Hamilton's Wastewater Treatment Plant – easier to achieve RAP targets for BUI on eutrophication.

Questions?