Science

Ammonia (NH₃) is converted to Nitrate (NO₃) in oxygen-rich, **BOD-poor conditions**

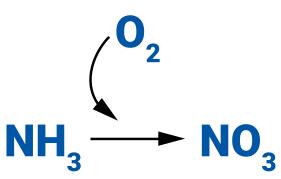
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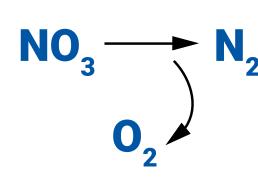
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Nitrate (NO₃) is converted to Nitrogen Gas (N_2) in oxygen-poor, BOD-rich conditions.



Volatile Fatty Acids (VFAs) are created in septic conditions.



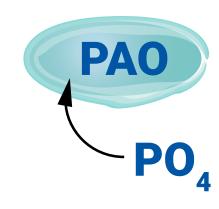
As Phosphate Accumulating Organisms (PAOs) feed on VFAs in septic conditions, they release Phosphorus as Orthophosphate (PO_4).

PAO



As PAOs multiply in aerobic conditions, they take in Phosphorus (PO₄).



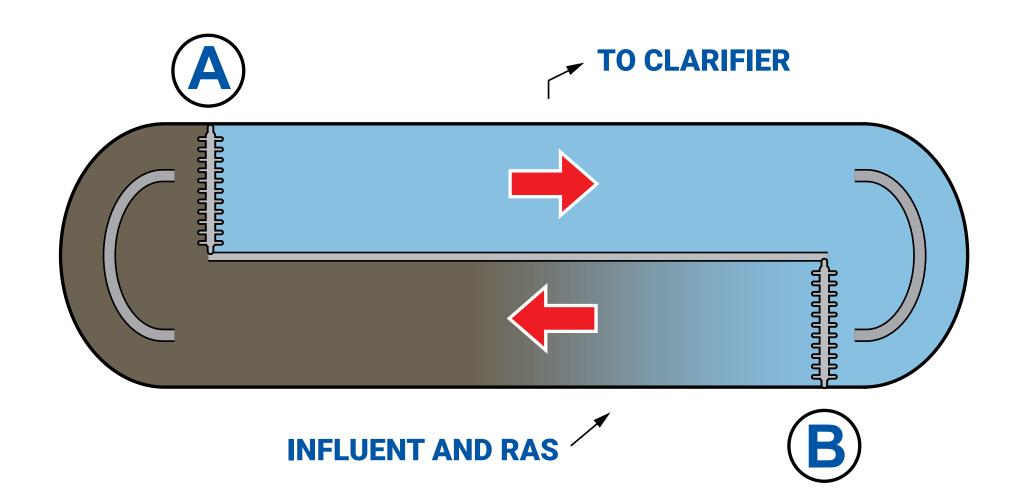


Optimization Strategies

Oxygen-Rich & Oxygen-Poor Zones

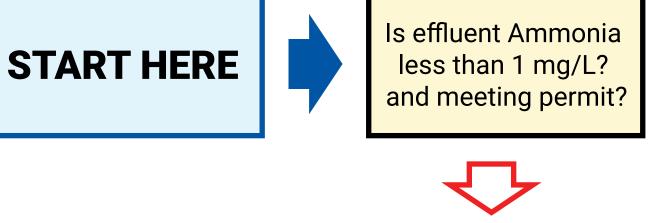
Maintain enough aeration so that a portion of the Oxidation Ditch remains oxygen-rich enough to remove Ammonia while limiting aeration such that another portion of the Oxidation Ditch becomes oxygen-poor enough to remove Nitrate.

Example: Operate aeration rotor A in the illustration below to maintain an ORP of +150 mV in the blue shaded area and -100 mV in the settled solids in the brown shaded area while operating rotor B only once daily to resuspend solids.



Cycle Aeration Equipment On & Off

Turn aeration equipment on and off to make the entire Oxygen Ditch switch back and forth between oxygen-rich and oxygen-starved.



Turn OFF all aeration equipment for one hour in AM and one hour in PM.



Improve Ammonia removal and go back to START

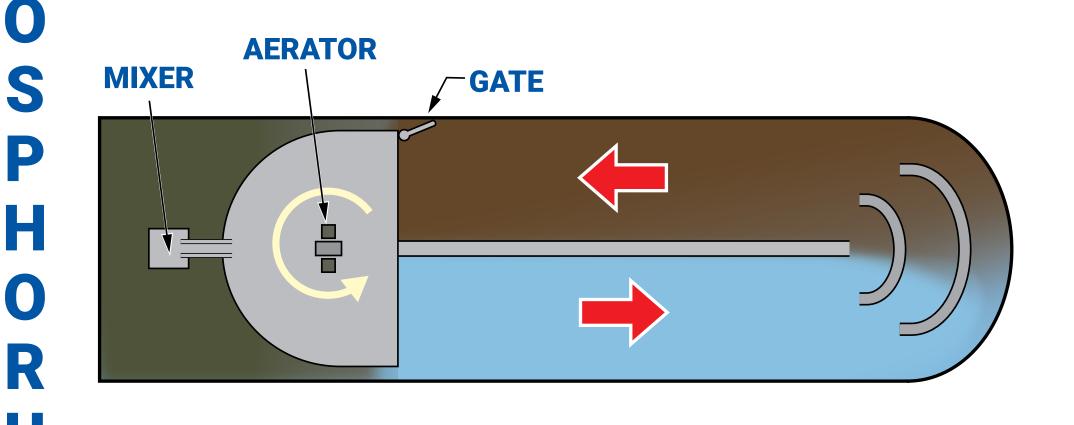
Add additional air-ON / air-OFF cycles until optimal total-Nitrogen removal is realized. Example: four cycles daily of 4 hours air-ON and 2 hours of air-OFF.



Provided effluent Ammonia is meeting permit and less than 1 mg/L, extend air-OFF time to two hours in AM and two hours in PM. If Ammonia is high, go back to **START**

Make VFAs and Energize PAOs by **Making Anoxic Basin Septic**

Turn off Anoxic mixers and close the gate between the Oxidation Ditch and the Anoxic Zone to make the ORP in the sludge blanket -200 mV and the Orthophosphate concentration leaving the Anoxic Zone to be three times the concentration entering the Anoxic Zone. Operate mixer(s) daily to resuspend solids.



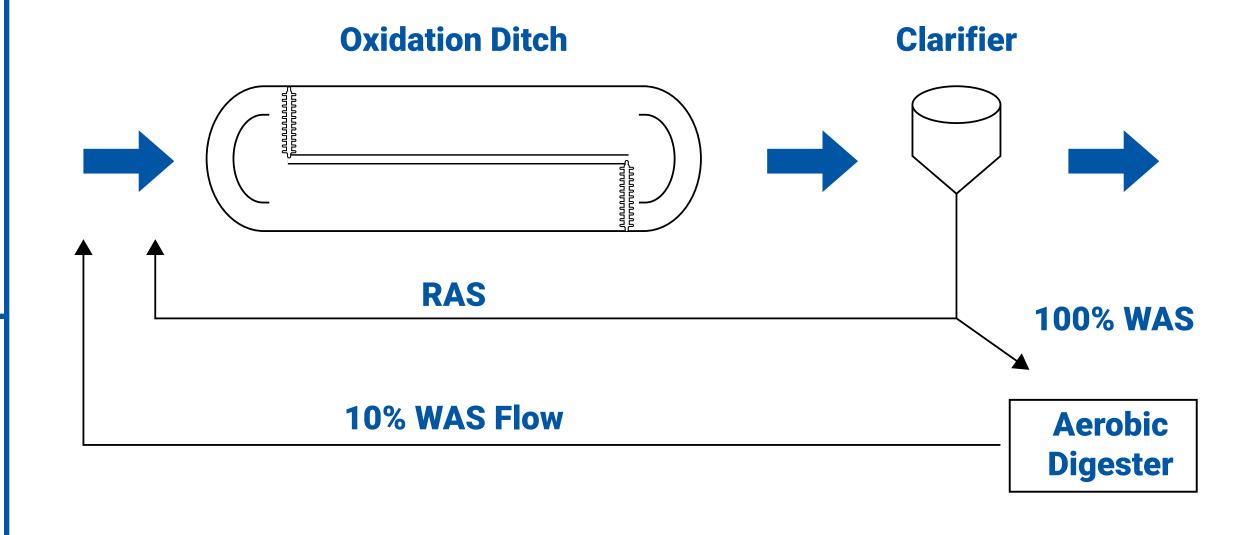
Make VFAs and Energize PAOs by Creating **Septic Sludge Blanket in Oxidation Ditch**

Minimize mixing to allow mixed liquor suspended solids to settle into sludge blankets with ORP of -200 mV. Resuspend daily.

Make VFAs and Energize PAOs by Using Aerobic **Digester as both Digester and Fermenter**

Daily stop aerating, stop mixing the Aerobic Digester for at least six consecutive hours to drop ORP to -200 mV. While aerating the Aerobic Digester daily for at least 1 hour, send a volume of PAO-rich digested sludge equal to 10% of the Waste Activated Sludge (WAS) volume back into the Oxidation Ditch.

The Orthophosphate (PO₄) concentration in a filtered Digester sample should be 15-30 mg/L as P. If less than 15, more air-off time is needed. If more than 30, more air-on time is needed.







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