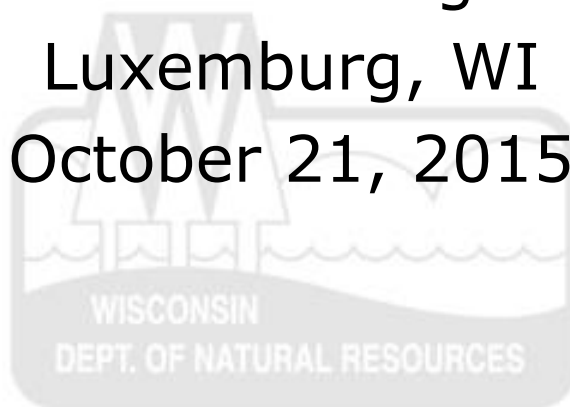


Wastewater 101: A Brief Overview

WDNR Sensitive Areas and Management
Practices Workgroup

Luxemburg, WI

October 21, 2015





STEPS OF TREATMENT

1. Preliminary Treatment
 - Bar Screens & Grit Chambers
2. Primary Treatment
 - Settling/Clarification
3. Secondary Treatment
 - Aeration & Sedimentation (Activated Sludge)
4. Tertiary/Advanced Treatment
 - Filtration
5. Disinfection
 - Chlorine, UV, ozone
6. Solids Handling



STEPS OF TREATMENT

1. Preliminary Treatment

- Remove large debris & grit

2. Primary Treatment

- Removes solids that float/settle; ~50% removal

3. Secondary Treatment

- Aeration tanks use air bubbles to suspend microorganisms to break down waste materials
- Microorganisms biologically convert dissolved solids into suspended solids that can settle out
- Final products are clean water, CO_2 , more microorganisms, settled solids
- ~85-90% waste removal from water flow



STEPS OF TREATMENT

- Suspended growth, fixed growth, membrane bioreactors, aerated basins/lagoons.

4. Advanced Treatment

- Removal of suspended solids and nutrients.
 - Phosphorus & Nitrogen
- Chemical addition, biological phosphorus removal, nitrification.
- Filtration & ultrafiltration.

5. Disinfection

- Significantly reduces pathogens (bacteria, viruses)
- Chlorination most popular but use of UV and ozone increasing



STEPS OF TREATMENT

6. Solids Handling & Processing

- Sludge conditioning
 - Chemicals & heat for water removal
- Sludge thickening
 - Gravity, flotation, chemicals for solids separation
- Sludge stabilization
 - Reduce odors & pathogens
 - Aerobic/anaerobic digestion
 - Chemicals/lime to raise pH (odor)



STEPS OF TREATMENT

- Sludge dewatering
 - Mechanical dewatering
 - Filters, centrifuges, presses, drying beds to remove excess water
 - Beneficial reuse through:
 - Land application
 - Composted for use as a soil conditioner
 - Incinerated for thermal or energy recovery
 - Placed in landfills (burial or cover)



Your House
Water from your pipes enters the sewer



Bar Screens
Catch large debris like branches or rocks.



Grit Chambers
Gravity pulls the larger particles to the bottom of the tank.



Trickling Filters
Water runs over beds of rocks for aeration.



Settling Tanks
Large particles separated from water and sent on for biosolids processing.



Activated Sludge
Chemicals added to the water cause aeration.



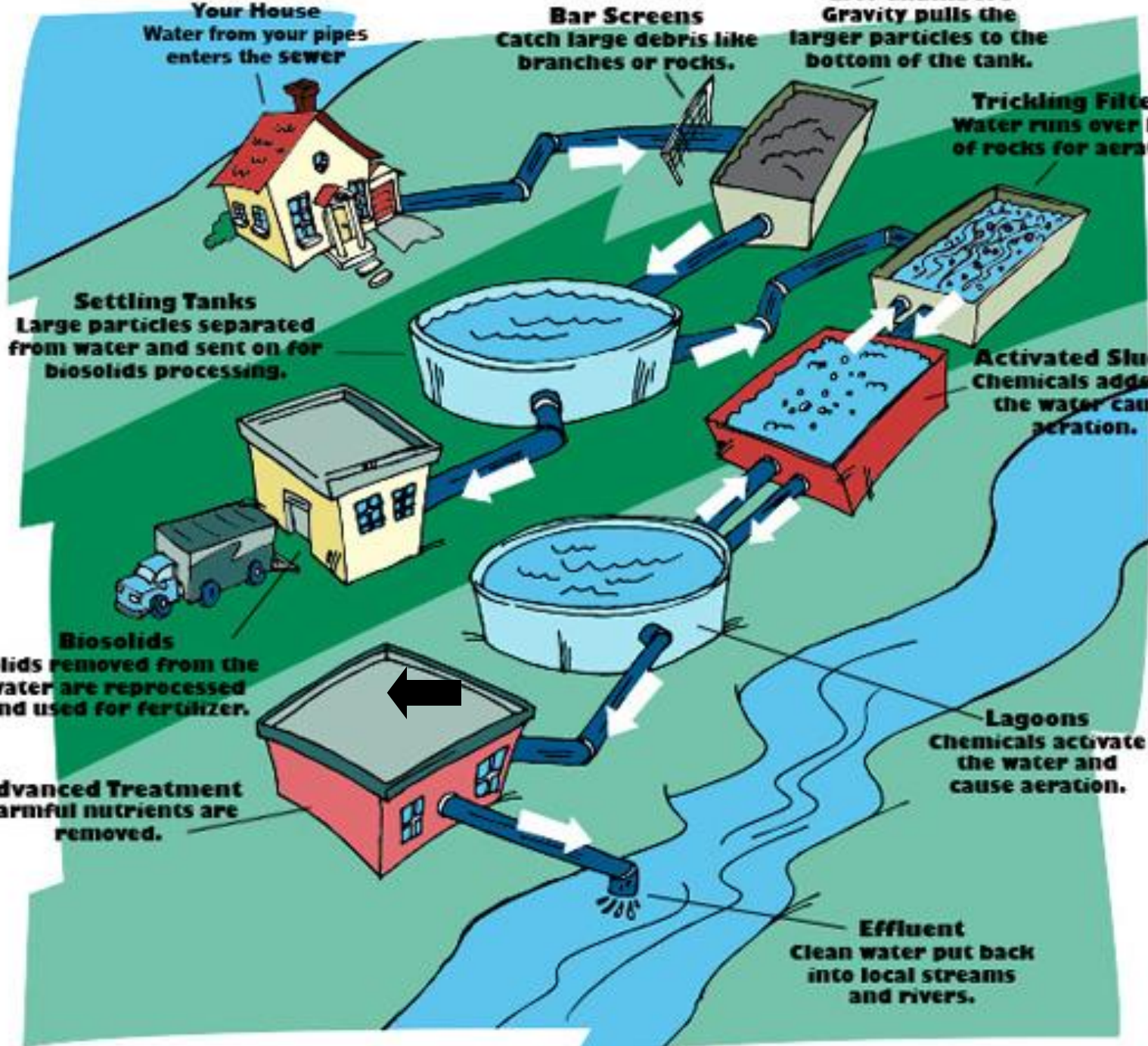
Biosolids
Solids removed from the water are reprocessed and used for fertilizer.

Advanced Treatment
Harmful nutrients are removed.



Lagoons
Chemicals activate the water and cause aeration.

Effluent
Clean water put back into local streams and rivers.



Wastewater Treatment Plant



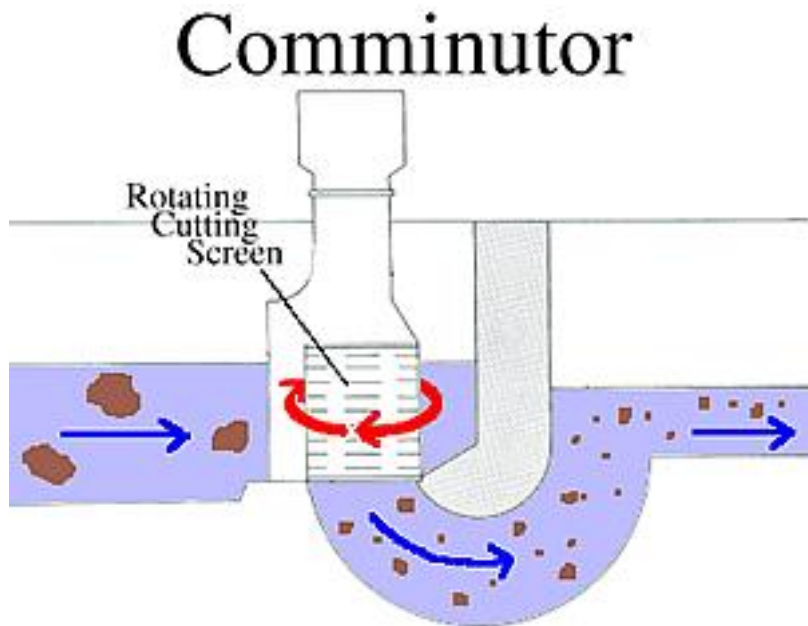
PRELIMINARY TREATMENT

MANUALLY CLEANED BAR SCREEN



PRELIMINARY TREATMENT

Comminutor (Sewage Grinder)



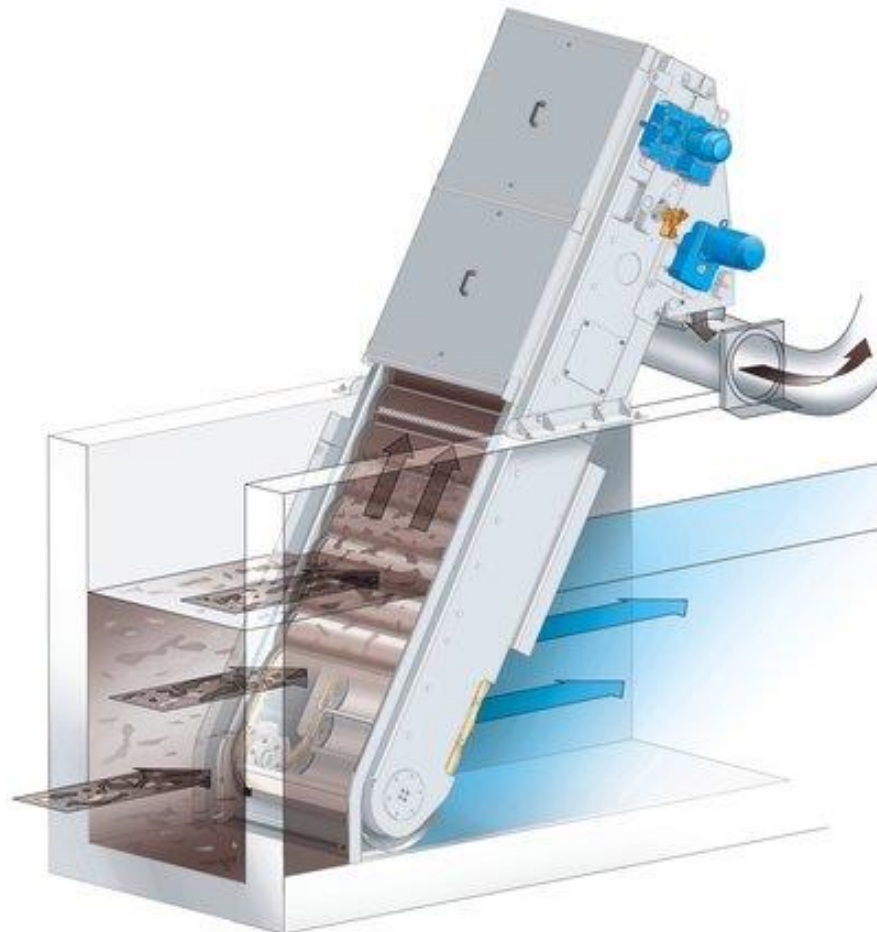
PRELIMINARY TREATMENT

Muffin Monster (Sewage Grinder)



PRELIMINARY TREATMENT

Mechanically Cleaned Bar Screen



PRELIMINARY TREATMENT

ROTARY FINE SCREEN



Courtesy of ROTAMAT

PRELIMINARY TREATMENT

Rotary Fine Screens



PRELIMINARY TREATMENT

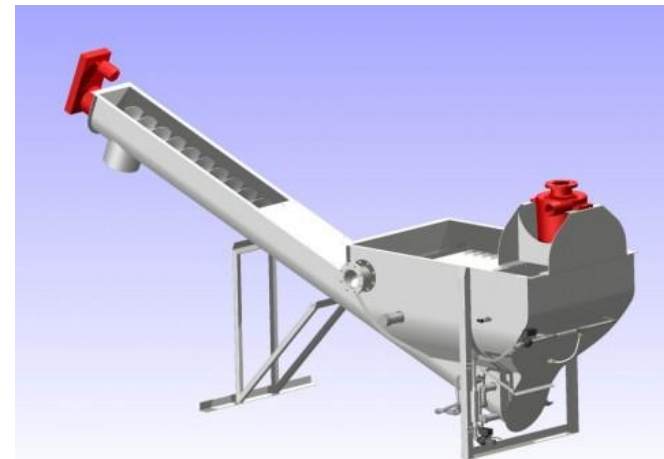
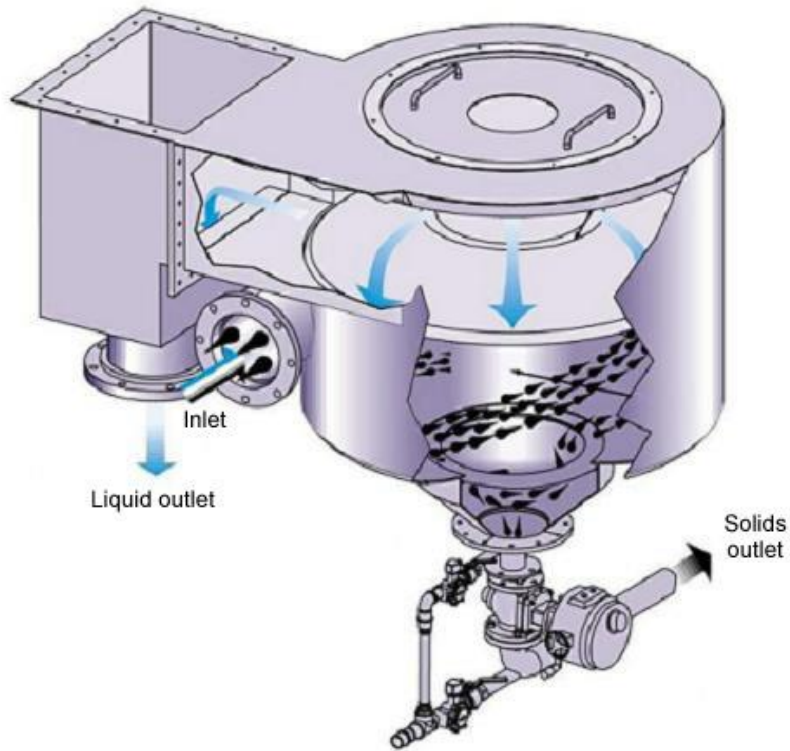
Grit Removal Channels



PRELIMINARY TREATMENT

Grit Removal

VORTEX TYPE GRIT SYSTEM



PRELIMINARY TREATMENT

Aerated Grit Removal



PRIMARY TREATMENT

Rectangular Primary Clarifiers



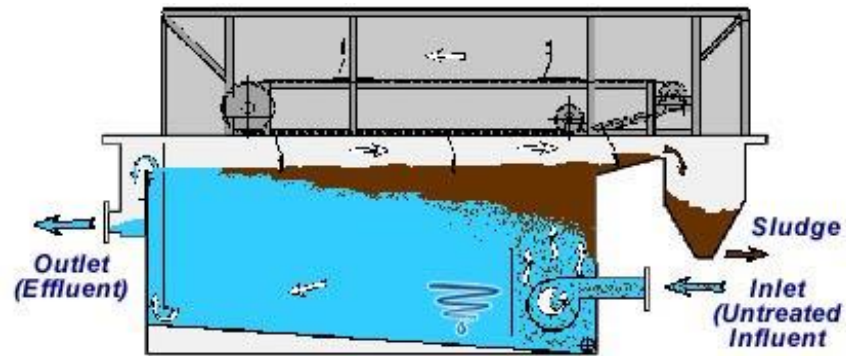
PRIMARY TREATMENT

Circular Primary Clarifiers



PRIMARY TREATMENT

Dissolved Air Flotation (DAF)



SECONDARY BIOLOGICAL TREATMENT

Activated Sludge (Oxidation Ditch)



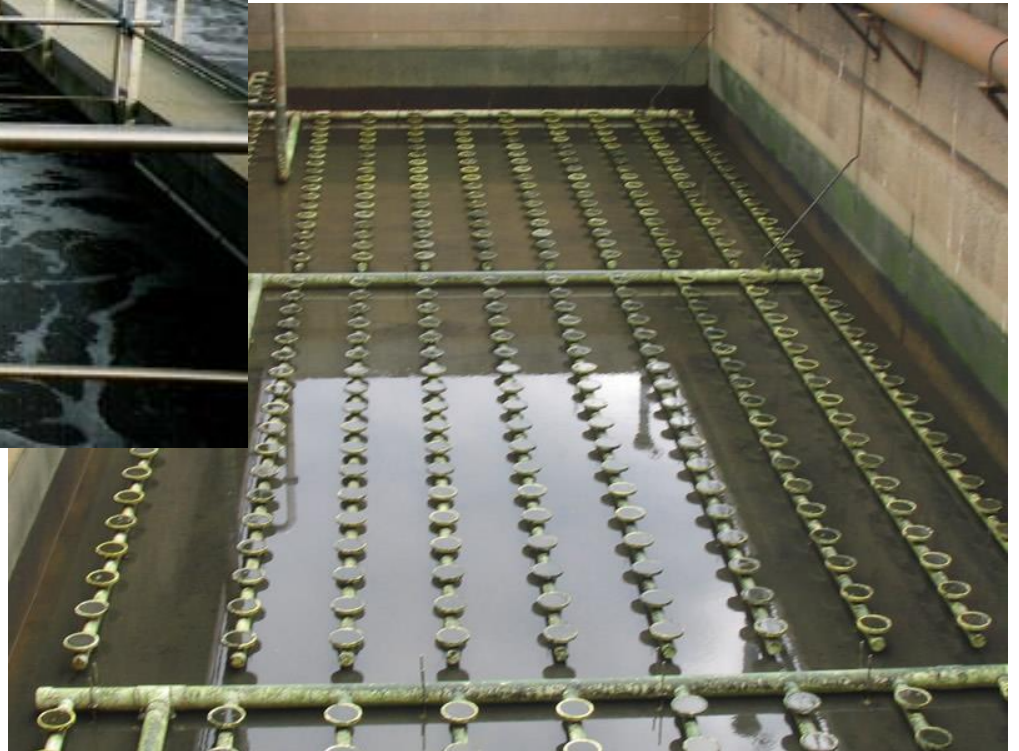
SECONDARY BIOLOGICAL TREATMENT

Activated Sludge



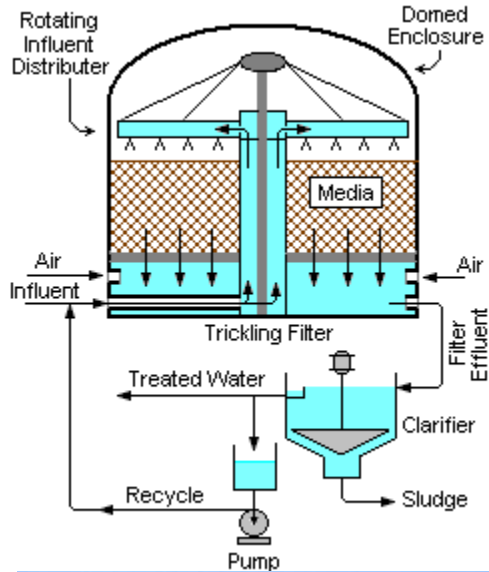
SECONDARY BIOLOGICAL TREATMENT

Activated Sludge

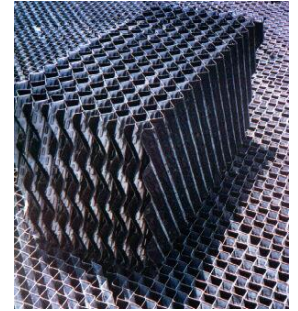
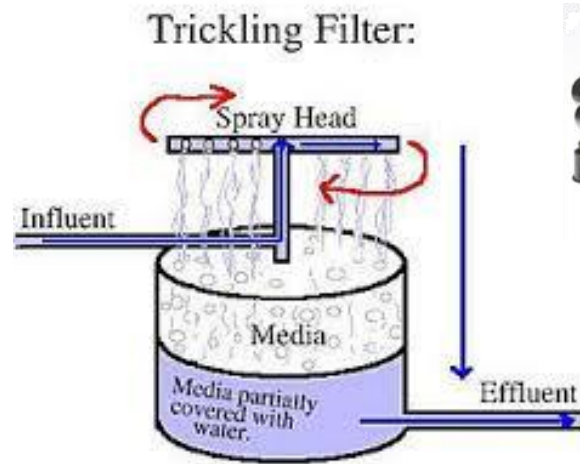


SECONDARY BIOLOGICAL TREATMENT

Activated Sludge

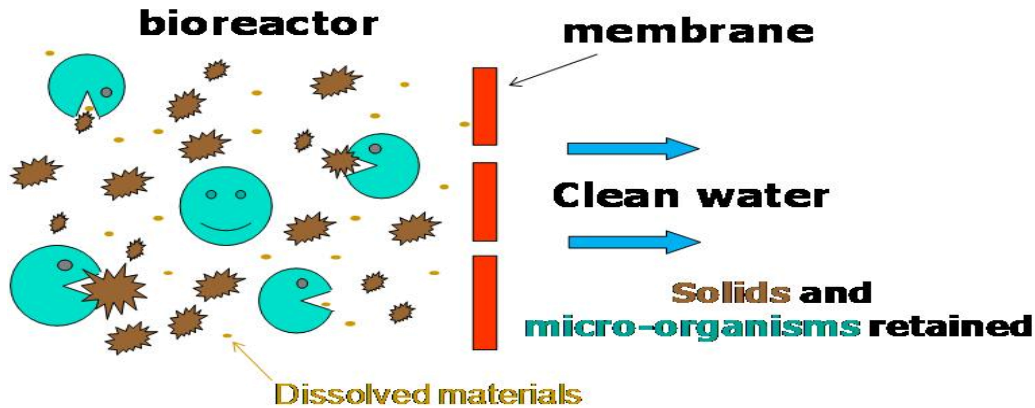


Trickling Filter:



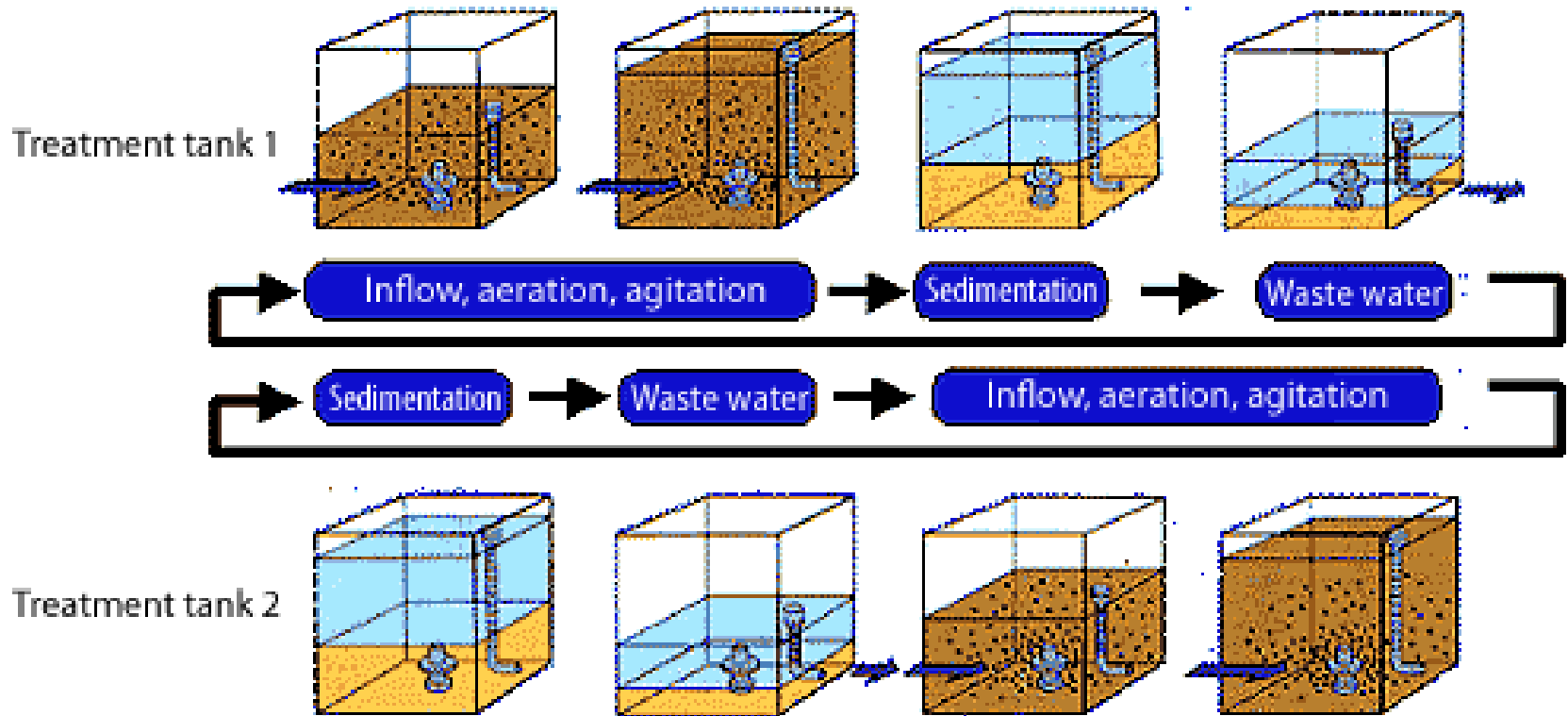
SECONDARY BIOLOGICAL TREATMENT

Activated Sludge



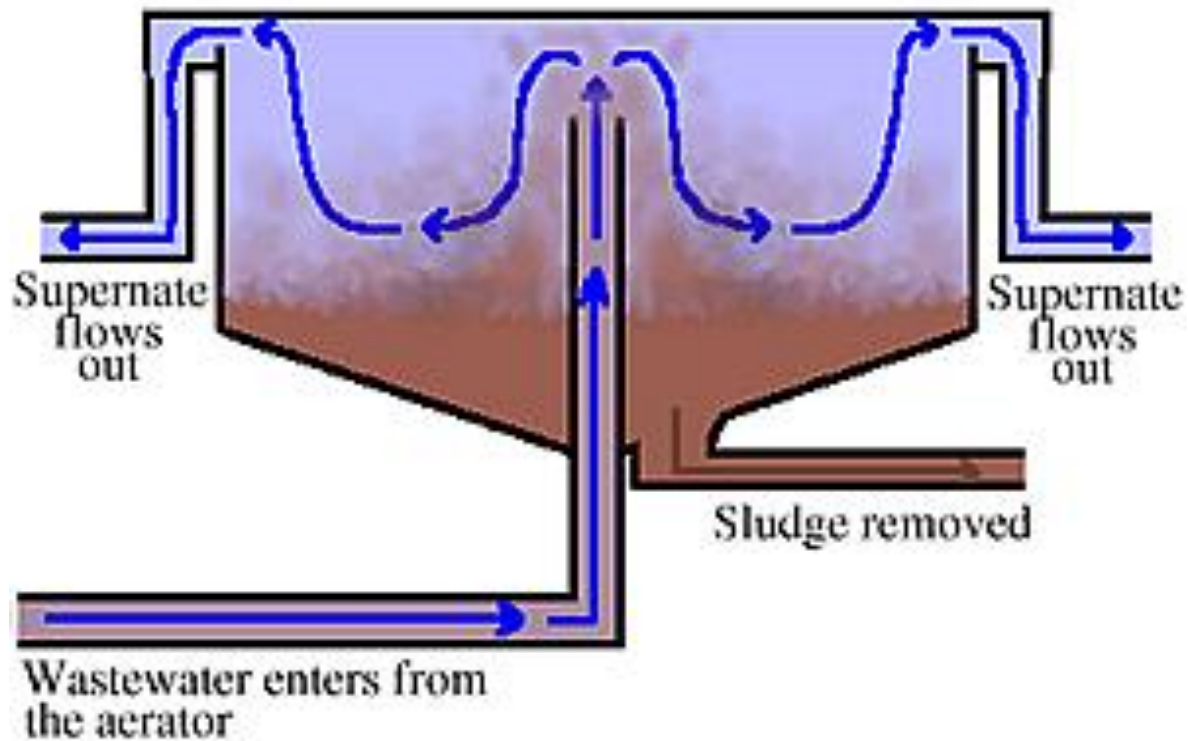
SECONDARY BIOLOGICAL TREATMENT

Activated Sludge (Sequencing Batch Reactors)



FINAL CLARIFICATION

Clarifier



FINAL CLARIFICATION



DISINFECTION

Ultraviolet Radiation



POST AERATION



POST AERATION



Discharge to River per WPDES Permit



SOLIDS HANDLING & PROCESSING





04/09/2012



04/09/2012



04/09/2012



04/09/2012

MUNICIPAL
50056
WISCONSIN



LOUISVILLE

SBU
STURGEON BAY UTILITIES

U.S. DOT. 566633 IN

04/09/2012

Overdue



03/16/2009



03/16/



03/16/2009



624H
HIGH LIFT

DEERE

03/16/2009



SEPTAGE TREATMENT

– Two methods of treatment/discharge:

1. WWTF

- Septage hauler does not need to do anything besides follow rules at each WWTF
- Waste is treated through the WWTF system prior to discharge to the environment

2. Land application

- Surface application – requires stabilization with lime
- Incorporation – must occur within 6 hours of application
 - Lime stabilization required only if residential setbacks are further reduced
- Injection – must occur within 6 hours of application



PATHOGENS

–Municipal Waste

- Surface water discharge:
 - Limits depend on designated use of receiving water
 - ⇒NR 102, Water Quality Standards for Wisconsin Surface Waters
 - ⇒*Recreational Use*. All surface waters shall be suitable for supporting recreational use and shall meet the criteria specified in sub. (6). A sanitary survey or evaluation, or both to assure protection from fecal contamination is the chief criterion for determining the suitability of a water for recreational use. [NR 102.04(5)]



PATHOGENS

⇒ *Criteria for Recreational Use.* As bacteriological guidelines, the membrane filter fecal coliform count may not exceed 200 colonies per 100 ml as a geometric mean and may not exceed 400 colonies per 100 ml in more than 10% of all samples during any month. Samples shall be required at least 5 times per month. [NR102.04(6)]

- Land application of sludge/biosolids:
 - Limits are defined in federal regulations – 40 CFR Part 503, Standards for the Use or Disposal of Sewage Sludge.
 - ⇒ Requirements specified in NR 204.

Class A

Parameter	Unit	Limit
Fecal Coliform	MPN/g TS	1000
or		
Salmonella	MPN/4g TS	3

AND, ONE OF THE FOLLOWING PROCESS OPTIONS

Temp/Time based on % Solids	Alkaline Treatment
Prior test for Enteric Virus/Viable Helminth Ova	Post test for Enteric Virus/Viable Helminth Ova
Composting	Heat Drying
Heat Treatment	Thermophilic Aerobic Digestion
Beta Ray Irradiation	Gamma Ray Irradiation
Pasteurization	PFRP Equivalent Process

- WWTFs must also meet vector attraction reduction requirements by implementing one or more treatment processes or land application methods.
- These methods and associated requirements are listed in NR 204.

Class B

Parameter	Unit	Limit
Fecal Coliform	MPN or CFU/g TS	2,000,000

OR ONE OF THE FOLLOWING PROCESS OPTIONS

Aerobic Digestion	Air Drying
Anaerobic Digestion	Composting
Alkaline Stabilization	PSRP Equivalent

**Tables from NR 204.07*



PATHOGENS

– Industrial Wastes

- Pathogens are not a typical component of industrial wastes
- Pathogen monitoring, limits, and treatment requirements can be added to industrial WPDES permits to address pathogens if waste characterization shows levels of concern
 - Treatment could include a wastewater treatment facility, any combination of available technologies, alkali stabilization, etc...as long as permit requirements are met



PATHOGENS

– Septage Waste

- Pathogen control & vector attraction reduction requirements in NR 113
 - Pathogen control (PC):
 1. Crop harvesting/grazing restrictions
 2. Alkali stabilization with lime addition
 - Vector attraction reduction (VAR):
 1. Alkali stabilization with lime addition for surface application
 2. Incorporation within 6 hours of application
 3. Injection

****One method is required for each category****



WASTE STORAGE

- Municipal waste/biosolids
 - NR 204 allows it but requirements are very strict and difficult to meet → very rare/does not occur
- Industrial waste
 - 10% exemption for manure pits only allowed for liquid wastewater
 - Manure pit must have been built to NRCS 313 standards
 - Facility samples/monitors wastewater prior to disposal
 - Waste mixture is considered animal waste as long as <10% is industrial waste at the time of removal for land application
 - All other industrial wastes require structural approval under NR 213 and approval is for 100% industrial waste storage (no mixing)



WASTE STORAGE

- Septage waste
 - NR 113 allows 3 different types of septage storage:
 - Capacity of <25,000 gallons
 - Capacity of >25,000 gallons
 - Other (includes manure pits)
 - NR 108/110/113 standards
 - Requires a PE review to certify
 - Manure pits >25,000 gallons of septage/year or >10% septage in mixture
 - NRCS 313 standards
 - Manure pits <25,000 gallons of septage/year or <10% septage in mixture



QUESTIONS



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