Ideas in Motion
Georgian College Great Lakes International
Marine Training & Research Centre

NALCO

Essential Expertise
for Water, Energy and Air SM

Marine Sanitation Devices: Effective Control and Proper Maintenance

NALFLEET
MARINE CHEMICALS

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Owen Sound, Ontario
March 3rd, 2010

Lecture Objectives

1. Discuss regulation
2. Identify the two categories of MSDs
3. Recognize the importance of chemical, biological, and mechanical control of MSDs

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You Are A Problem Solver!

Knowledge gives you an opportunity to solve and prevent problems

- Improve efficiency
- Ensure environmental compliance
- Achieve internal environmental goals
- Provide solutions for improving the process

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IMO Regulation

- Typically cargo, naval and offshore vessels use small scale wastewater treatment plants called MSDs to treat sewage that is produced by 20 to 300 crewmembers.
- The International Maritime Organization (IMO), requires that all ships have approved sewage treatment systems fitted and operational as of September 27th, 2008.

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Standards of the Regulatory Bodies

Effluent must be monitored for the following:

- BOD
- TSS
- Fecal Coliform
- pH
- Chlorine

Standard	Units	USCG 33CFR PT1-300	IMO MEPC.2(vi)	USCG 33CFR 159 PT300-600 Alaska	EU Blue Flame Bathing Water
Test duration		10 days	10 days	30 days	Once every two weeks
Suspended solids	mg/l	150	50 (100 at sea)	30	Not required
BOD_5	mg/l	Not required	50	30	Not required
Faecal coliform	count/ 100ml	200	250	20	2000
ph		Not required	Not required	6.0 to 9.0	6.0 to 9.0
Chlorine	mg/l	Not required	As low as Practicable	10.0	Not required

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CSA 2001

Canada Shipping Act

Section: **Regulations for the Prevention of Pollution from Ships and for Dangerous Chemicals**

Division 4: SEWAGE, Subdivision 5: Operational Testing

130. The Board may require testing of effluent from a marine sanitation device to ensure that the effluent meets the following standards, as determined by Standard Methods:

a) in the case of a ship in an area other than a designated sewage area, the **fecal coliform** count of the samples of effluent is equal to or less than 250/100 mL;

b) in the case of a ship in a designated sewage area, the **fecal coliform** count of the samples of effluent is equal to or less than 14/100 mL;

c) the **total suspended solids** content of the samples of effluent is equal to or less than 50 mg/?L;

d) the 5-day **biochemical oxygen demand** of the samples of effluent is equal to or less than 50 mg/L; and

e) in the case of chlorine used as a disinfectant, the **total residual chlorine** content of the samples of effluent is equal to or less than 0.5 mg/L.

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Current/Future Regulation

Resolution MEPC.159(55)

- Revised guidelines Guidelines that apply to all MSDs installed on or after January 1, 2010
- Recommendations that the effluent from MSDs should be:
  - below 0.5ppm Total Chlorine
  - below 25ppm BOD
  - below 35ppm TSS

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System Overview

The majority of MSDs onboard offshore, cargo and naval vessels can be categorized in one of two varieties.

1. Biological Systems:
   - Activated Sludge, Aeration and Disinfection Systems
2. Physical Systems:
   - Maceration and Disinfection Systems

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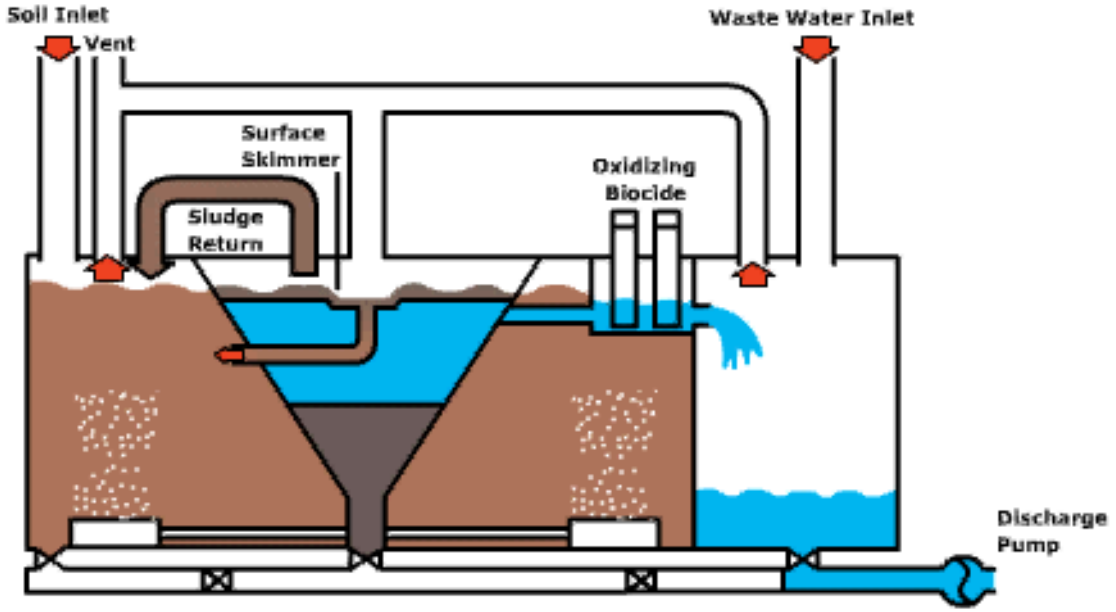
Activated Sludge, Aeration and Disinfection Systems

Three stage approach.

1. The aerobic chamber
2. The clarification chamber
3. The disinfection chamber



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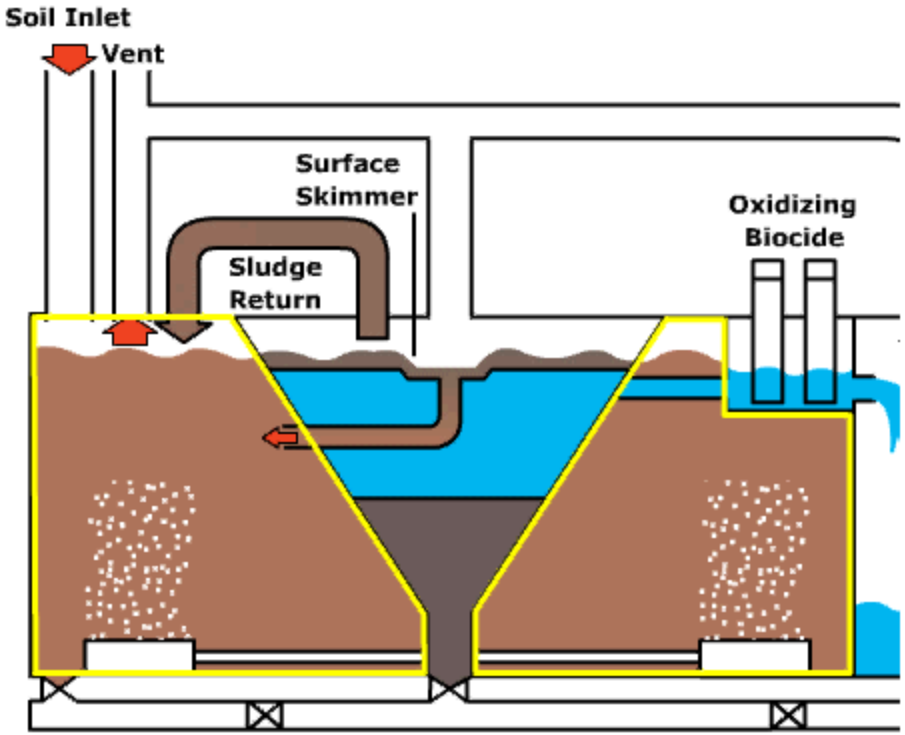
Activated Sludge, Aeration and Disinfection Systems - Aerobic Chamber

In the aerobic chamber the following processes occur:

- Wastewater organics are consumed
- Solids are broken down
- BOD is reduced
- Some settling occurs



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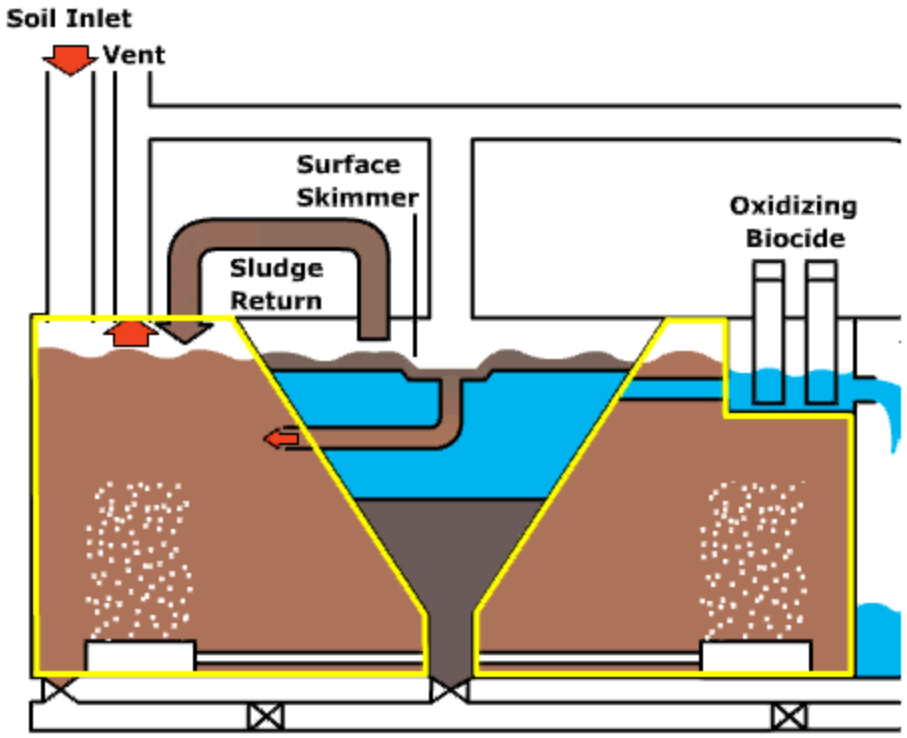
Activated Sludge, Aeration and Disinfection Systems - Aerobic Chamber

Aerobic chamber issues:

MAINTAIN THE BIOMASS!!

1. Flow rate
2. No Toxic Substances (Cleaners)
3. Proper Oxygen Level
4. Good Circulation



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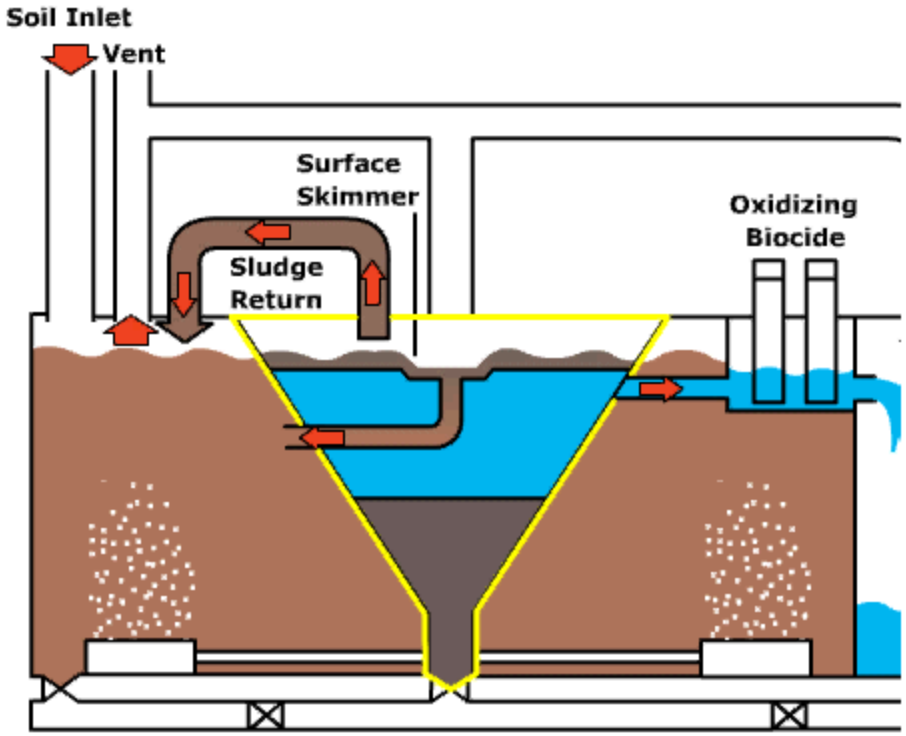
Activated Sludge, Aeration and Disinfection Systems - Clarification Chamber

Clarification Chamber

- Designed to remove more solids before entering the disinfection chamber.
- Solids are recirculated to the aerobic chamber.



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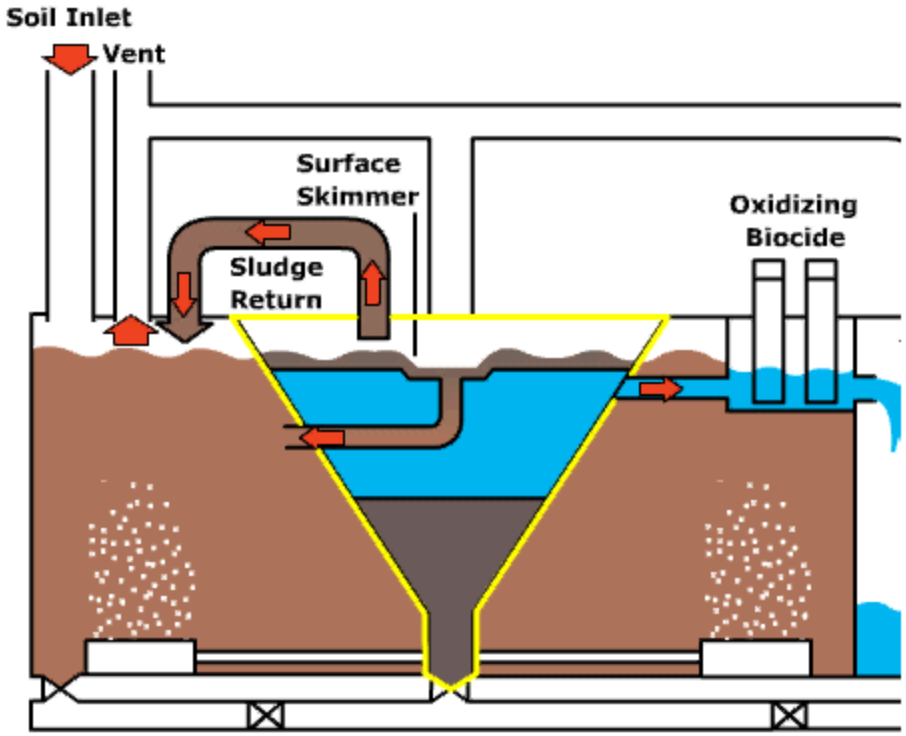
Activated Sludge, Aeration and Disinfection Systems - Clarification Chamber

Clarification chamber issues:

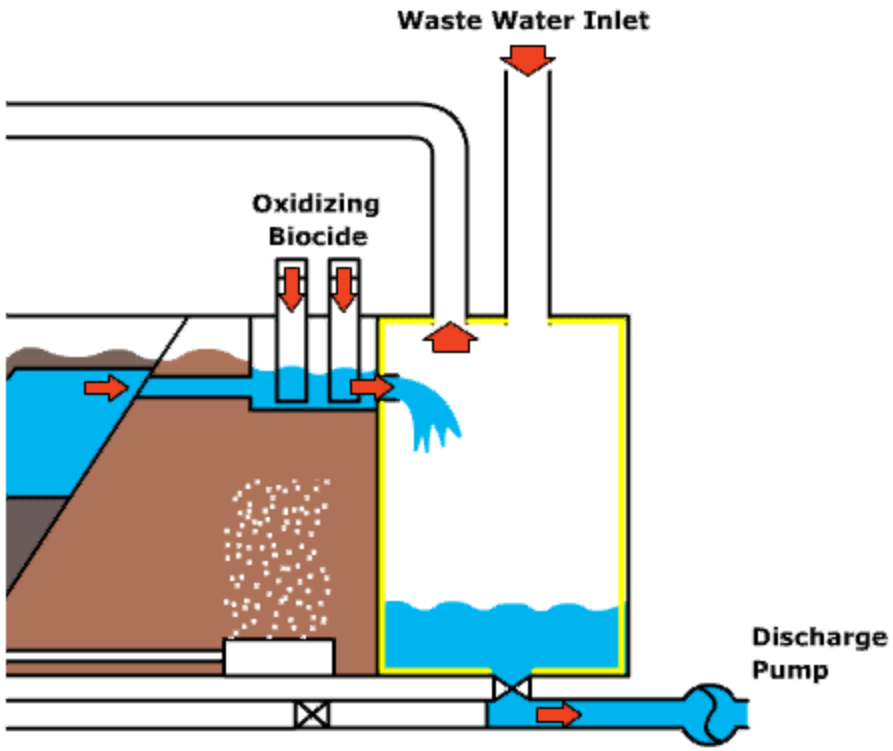
1. Good circulation
2. Excessive foaming



Activated Sludge, Aeration and Disinfection Systems - Disinfection Chamber

Oxidizing biocide:

1. Bromine
2. Chlorine
3. Chlorine Dioxide



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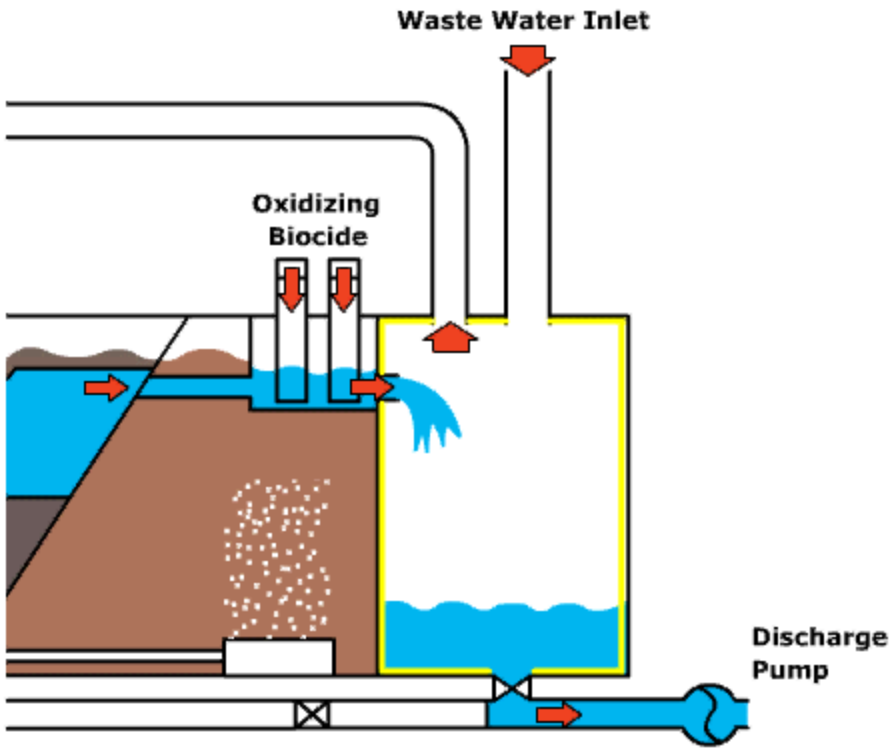
Activated Sludge, Aeration and Disinfection Systems - Disinfection Chamber

Disinfection Chamber issues:

- Test and monitor the biocide
- Monitor flowrate
- Monitor the chemical feed
  - Liquid - observe the chemical feed pumps for proper operation
  - Tablets - check the sounding tubes for clogs



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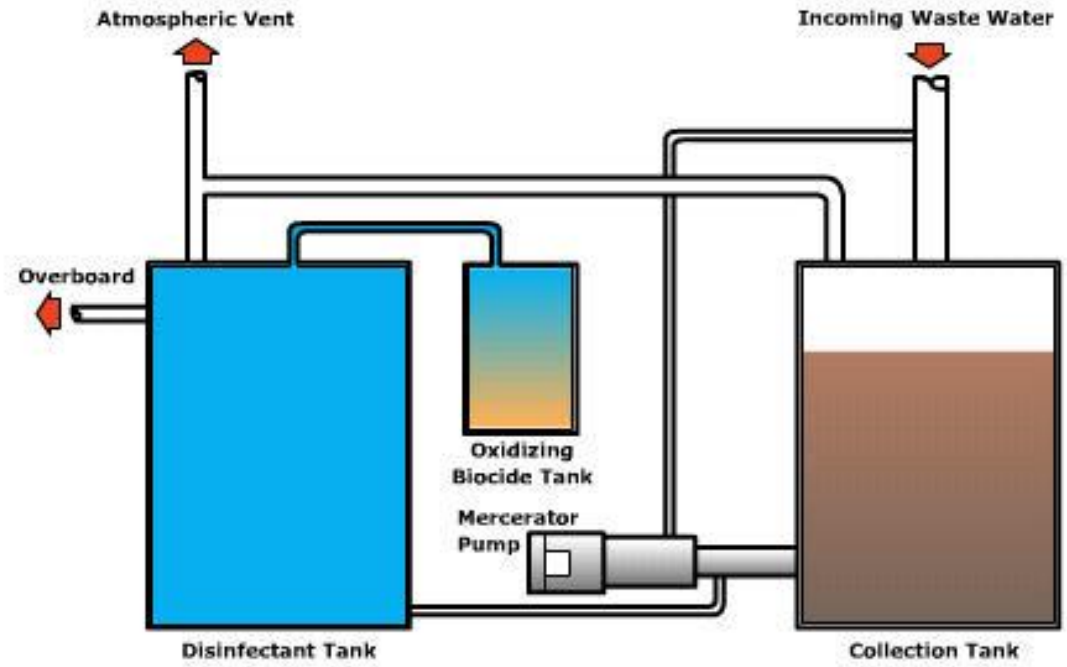
Maceration and Disinfection Systems

1. Collection
2. Maceration
3. Disinfection



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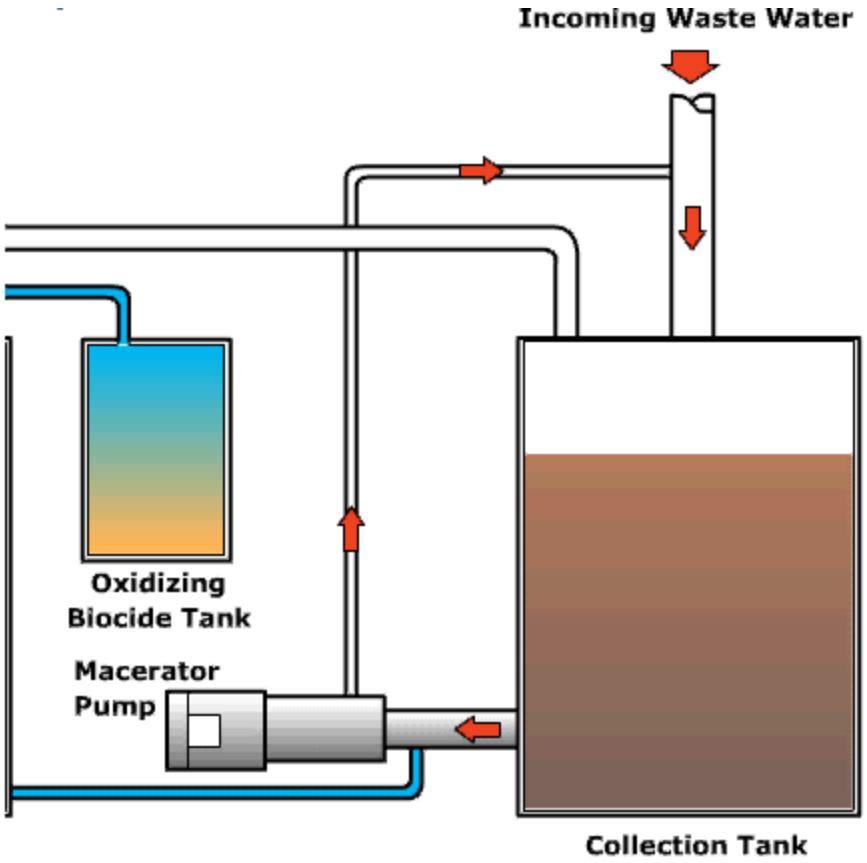
Maceration and Disinfection System - Collection

- Grey and black water are first collected in the collection tank.
- Periodically check the collection tank for good circulation.



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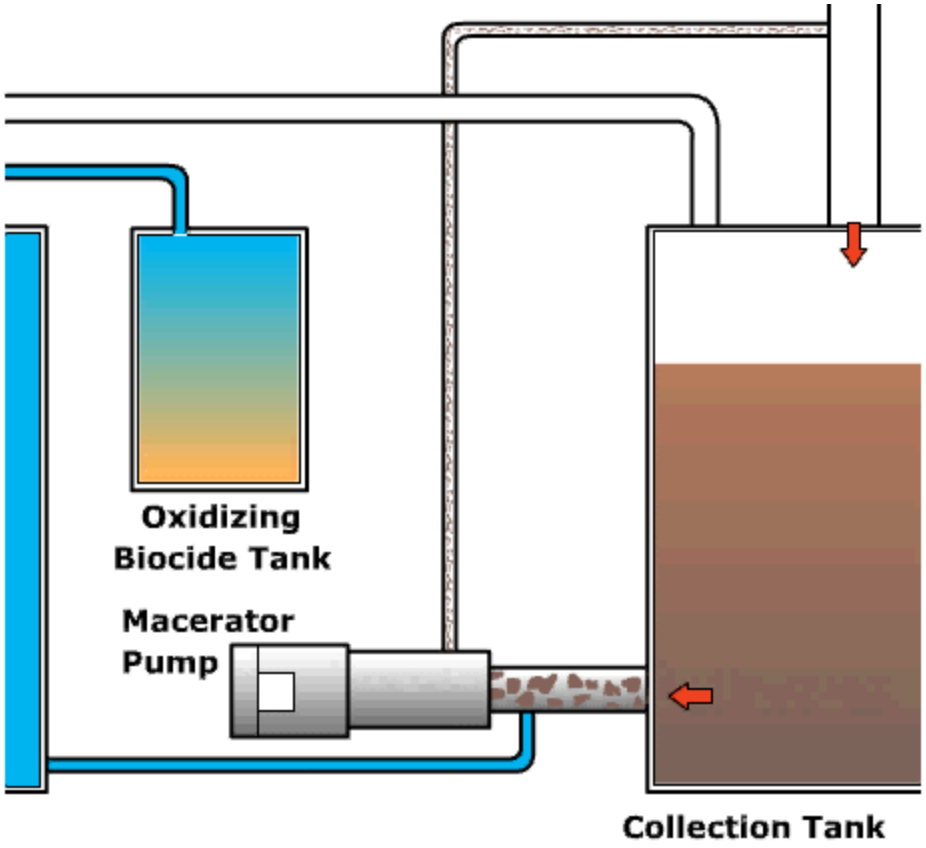
Maceration and Disinfection System - Maceration

- The macerator pump grinds the solids down to a small particle size.
- A portion of the macerated waste is returned.



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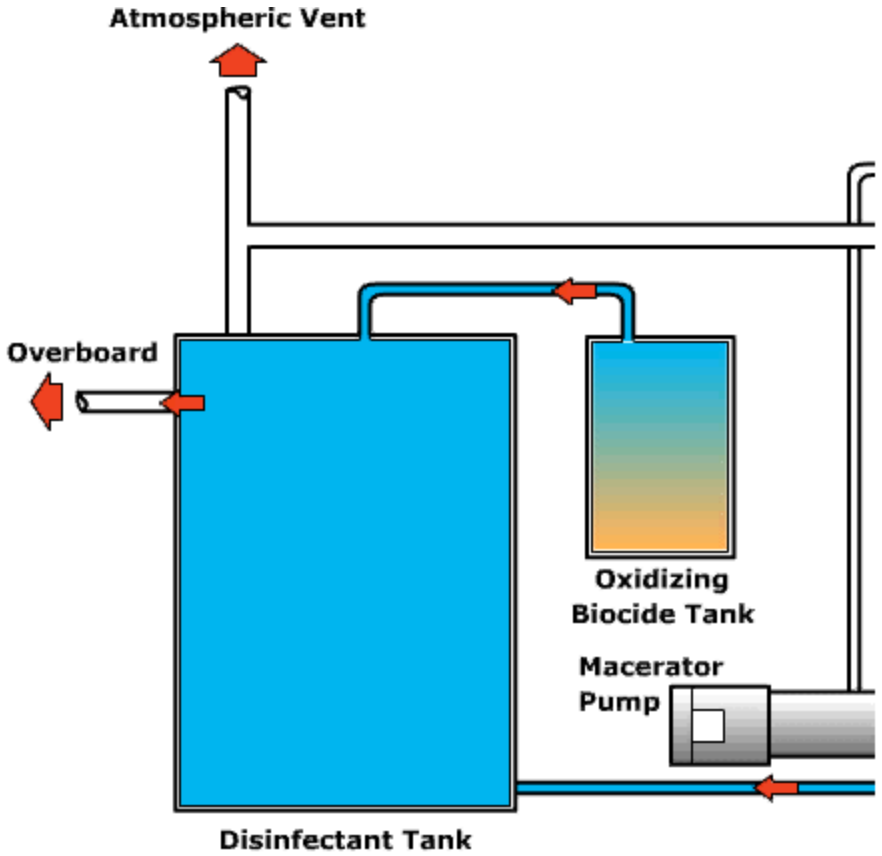
Maceration and Disinfection System - Disinfection

- The macerated wastewater enters the disinfection tank where an oxidizing biocide is introduced. The effluent from the system is sent overboard.



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Total System Approach

You must monitor the chemical, biological, and mechanical operation of an MSD. The following should be carefully considered:

- Toilet, sink, and drain cleaners
- Bioaugmentation
- Antifoams
- Proper mechanical operation
- Disinfectant

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Total System Approach
Cleaning and Maintenance Products

Strong general detergents or solvents will disrupt and kill the biomass,

- resulting in poor digestion and filtration or plant shutdown
- this will result in regulatory discharge violations.
- If the plant shuts down, it must be drained and refilled and the biomass must be re-established.

To prevent the upset, only use cleaners and maintenance products that are pH neutral.

Sea Shield
CLEANING & MAINTENANCE PRODUCTS

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Total System Approach
Bioaugmentation

- A Bioaugmentation Culture that is specifically designed for use in MSDs should be used.
- The Bioaugmentation Culture will rapidly establish a healthy biomass in aerobic wastewater treatment systems.

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Total System Approach
Antifoam

- To control foaming, an antifoam specifically designed for a marine sanitation device should be used.
- It is good practice to keep antifoam on hand in the event of excessive foaming.

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Total System Approach Mechanical

- A preventative maintenance program will monitor:

1. Flowrates
2. Circulation
3. Wastestream
4. Air compressors
5. Pumps

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