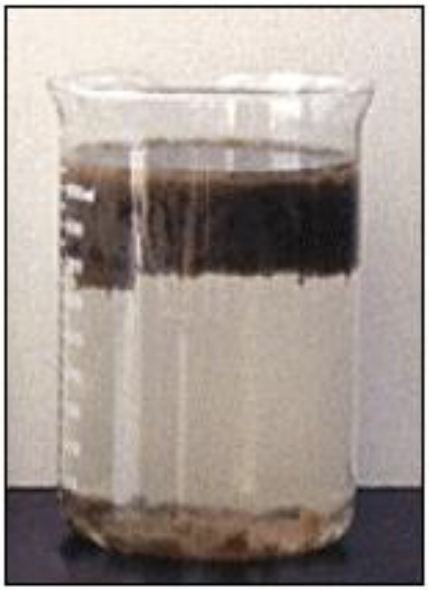
Environmental Conditions for Denitrification

- Denitrifying organisms present
- Zero or low dissolved oxygen
- Nitrate or nitrite present
- Organic carbon present

Denitrification



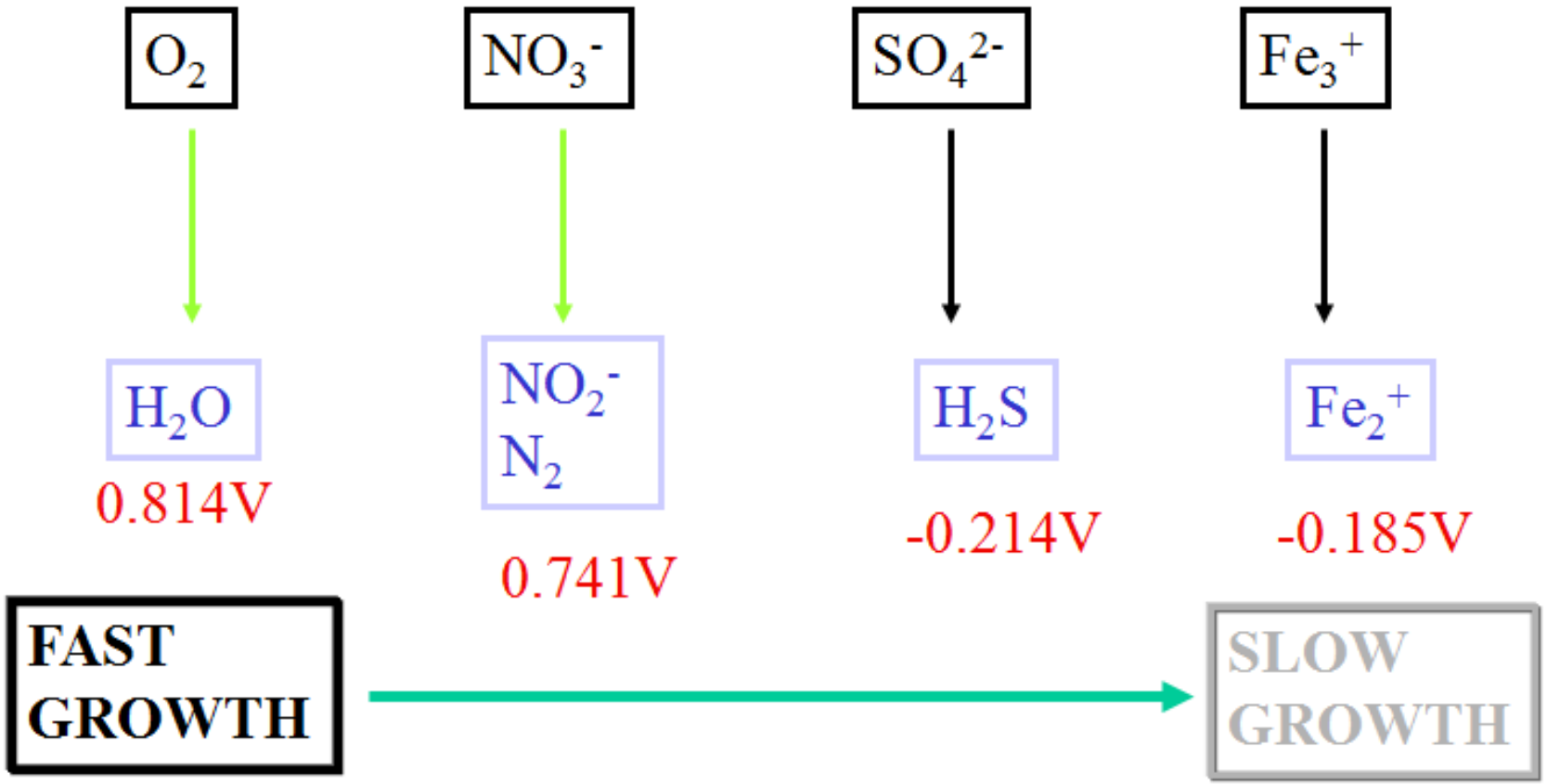
Reduction of nitrate to nitrogen gas

NO_3^- --> NO_2^- --> N_2

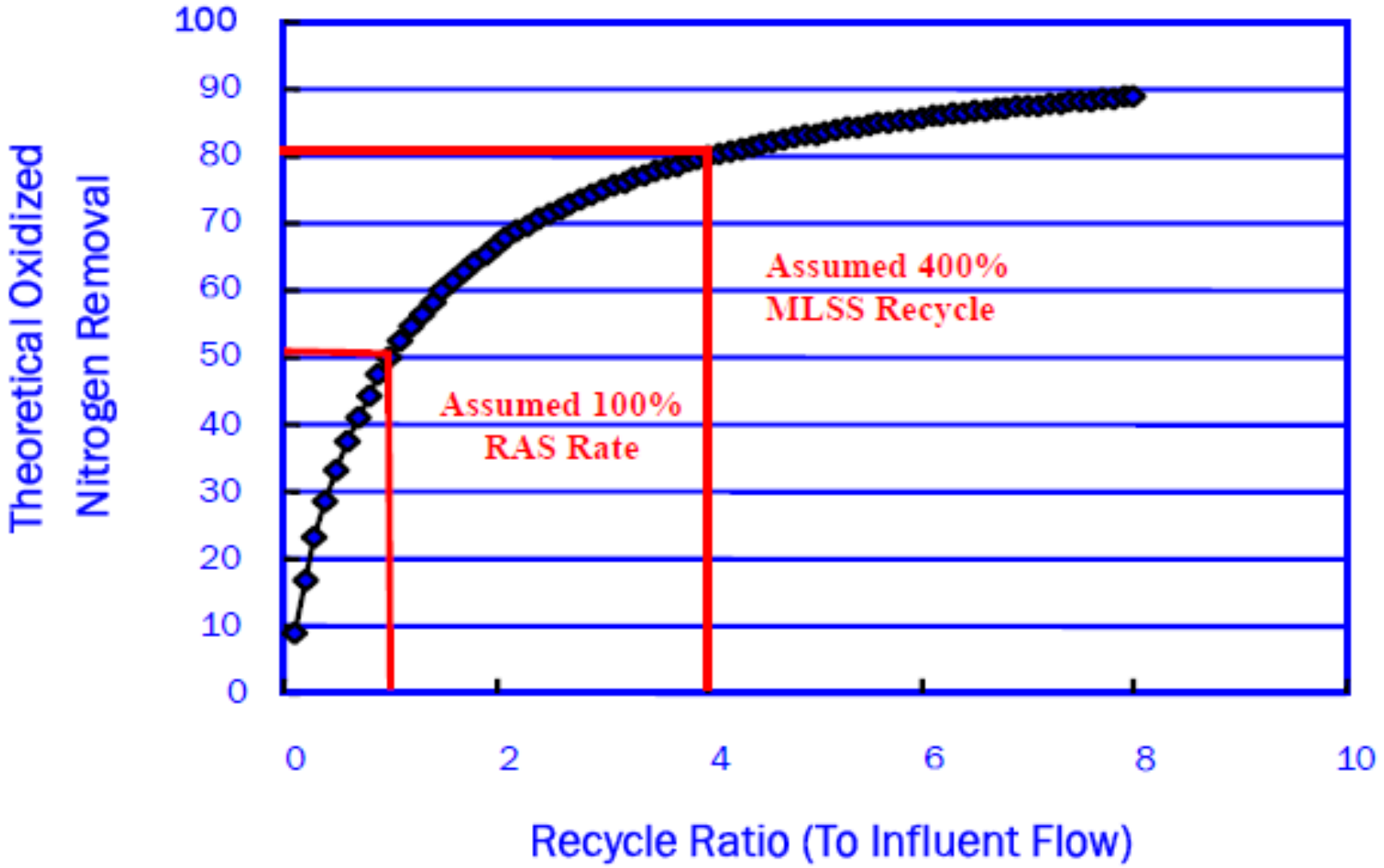
Nitrate **Nitrite** **Nitrogen Gas**

All within a single organism.

Role of electron acceptors; rate of biodegradation



N-Removal Depends on Nitrate Recycle

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Denitrification Summary

Benefits

- Removes nitrogen
- Removes organic carbon
- Produces alkalinity
- Serves as a selector

Environmental Conditions

- Presence of denitrifying organisms
- Presence of nitrates
- Presence of readily biodegradable organic carbon
- Absence of dissolved oxygen

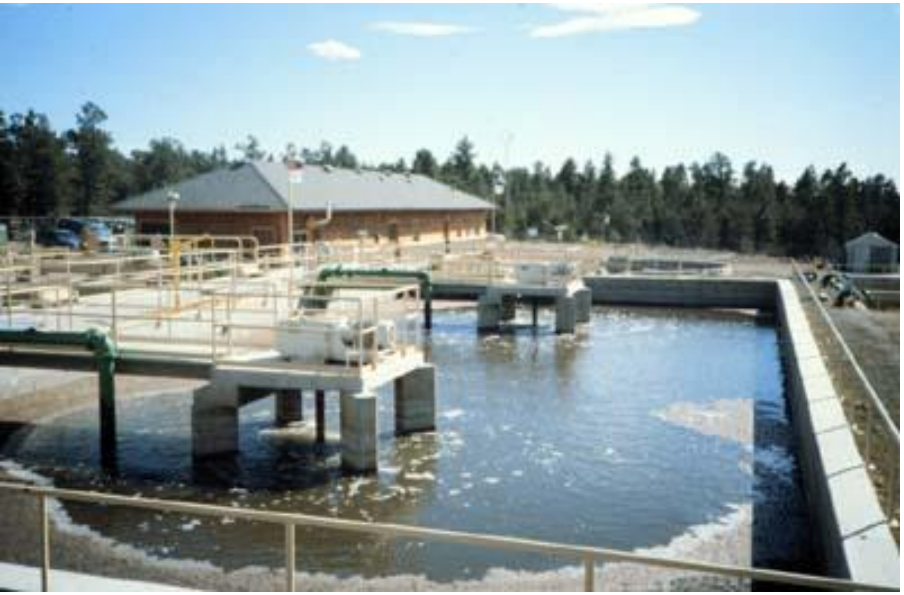

Aeration Tank
Oxic Tank
Overflow
Anoxic Tank

Figure 3.4 Surface aeration in activated sludge treatment plants creates aerosols which contain high amount of microorganisms. This poses a health risk to treatment plant employees and in some cases to neighbors (photo: D. Brdjanovic)

Mechanical Aerators

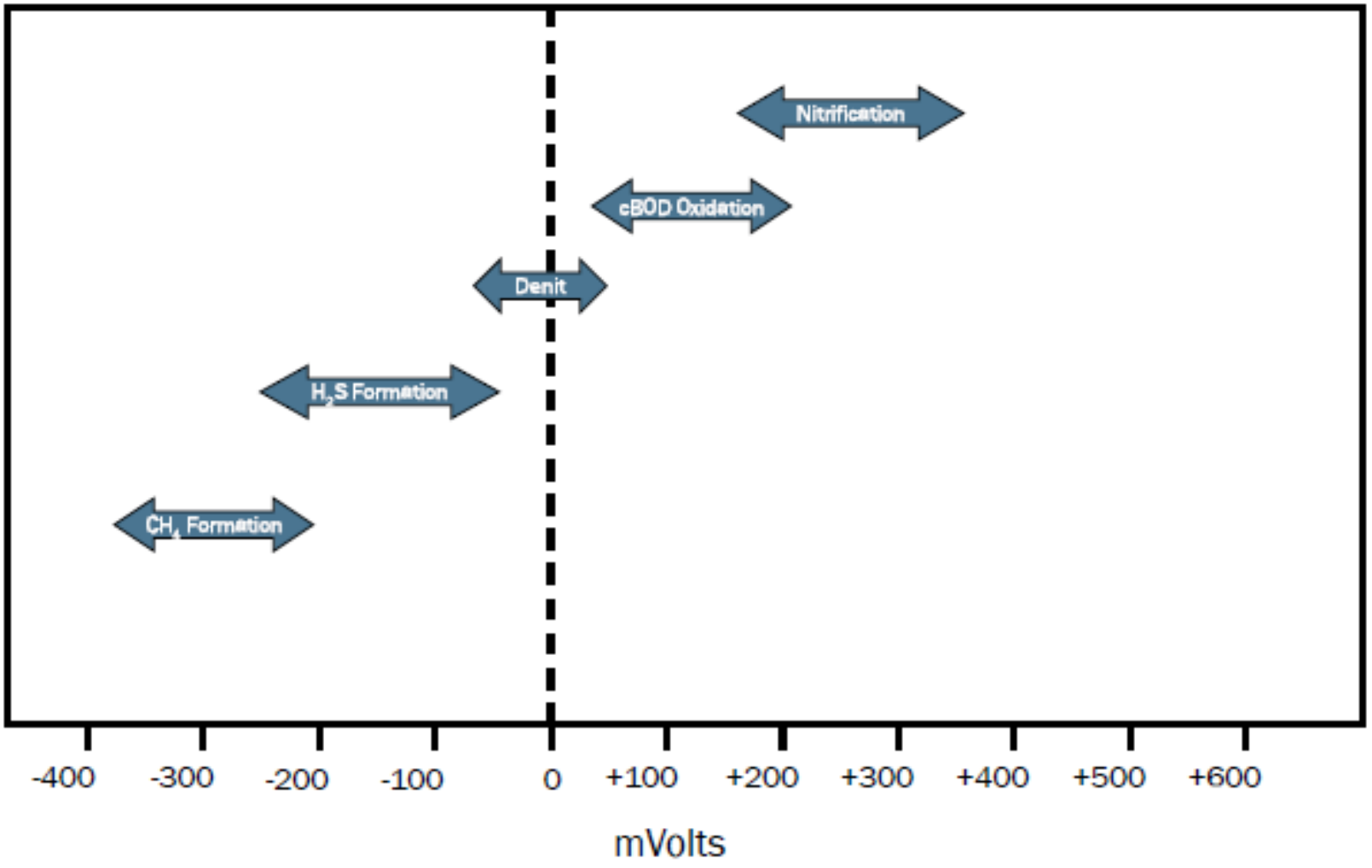
Fixed aerator

Floating aerator



Turbine aerator

Biological impacts on ORP



ORP Control

(Goronzy, 1992)

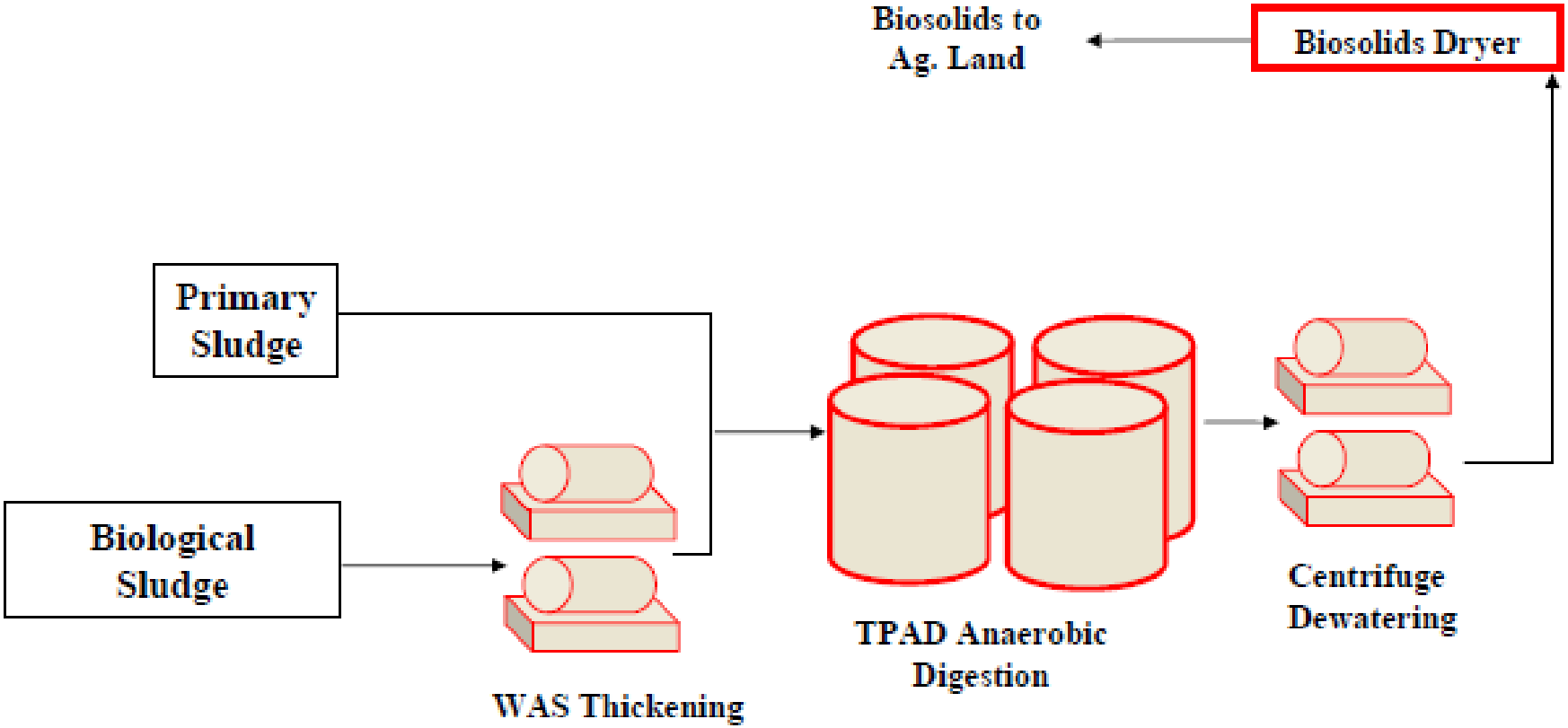
Process	Range, mV	e^- Acceptor
cBOD oxidation	+50 to +200	O_2
Poly-P production	+40 to +250	O_2
Nitrification	+150 to +350	O_2
Denitrification	-50 to +50	NO_3^-
Poly-P breakdown	-40 to -175	NO_3^-, $SO_4^=$
Sulfide formation	-50 to -250	$SO_4^=$
Acid formation	-40 to –200	Organics
Methane formation	-200 to -350	Organics

Drying

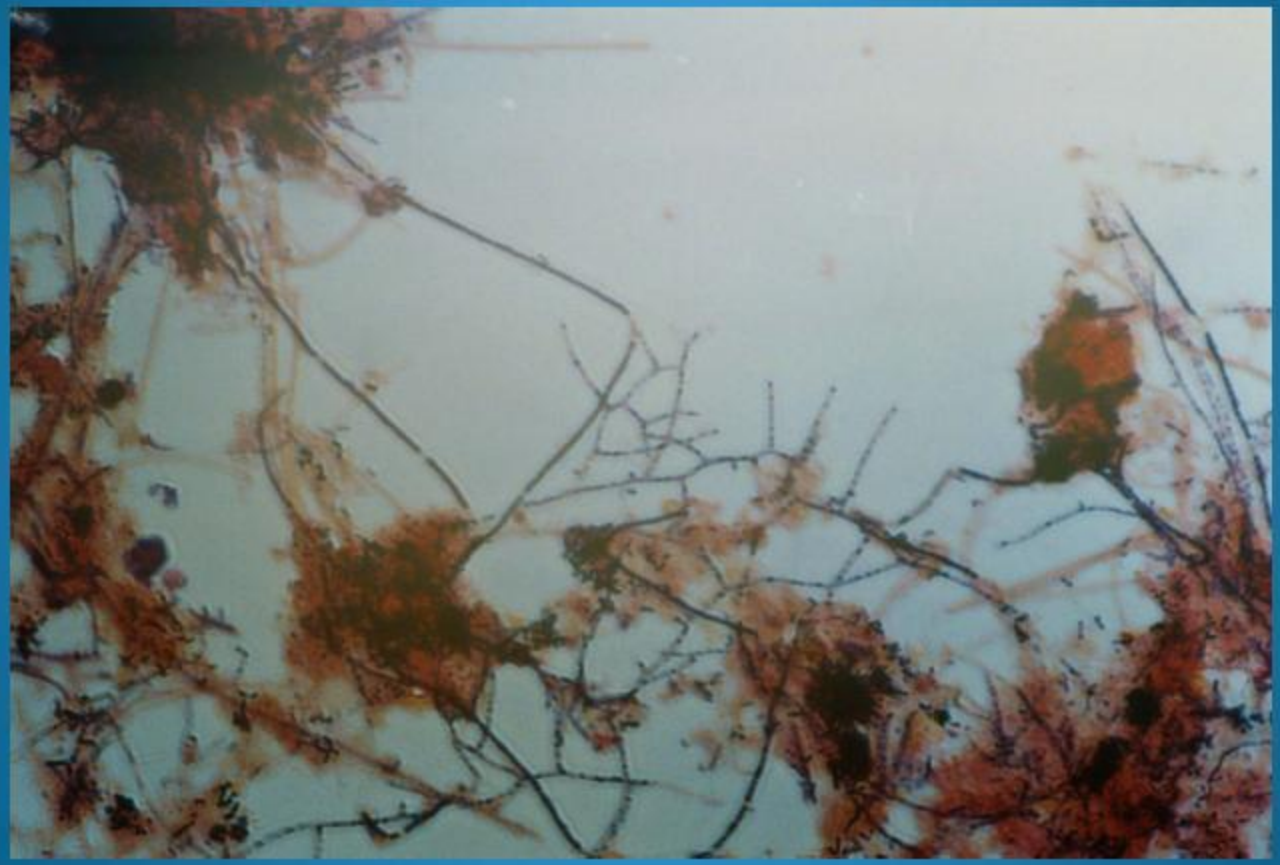
- %18 %90


Drying Sludge Means Big Volume Reduction
Before-
120 Pounds Wet
After-
20 Pounds Dry

Thermal Dryer


Biosolids to
Ag. Land
Biosolids Dryer
Primary
Sludge
Biological
Sludge
WAS Thickening
TPAD Anaerobic
Digestion
Centrifuge
Dewatering

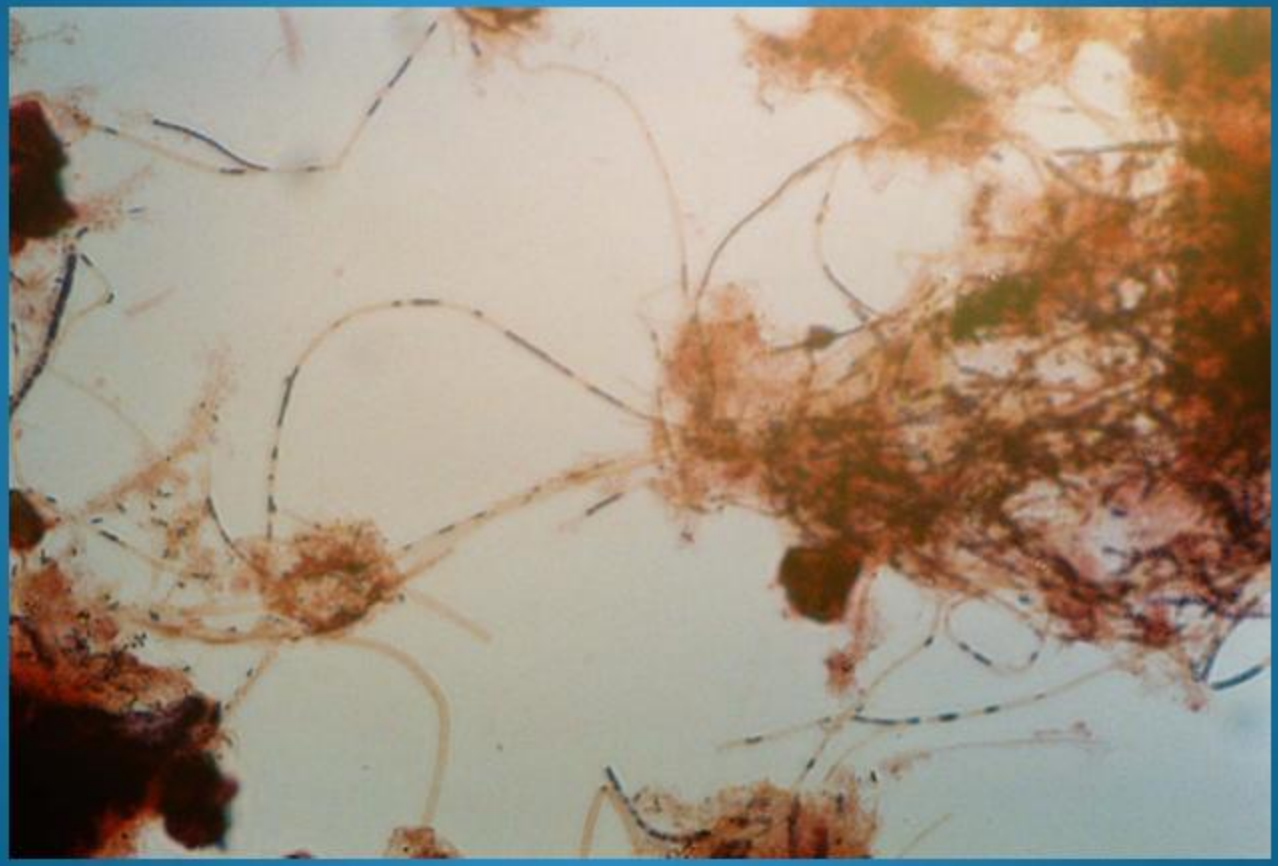
Nocardia



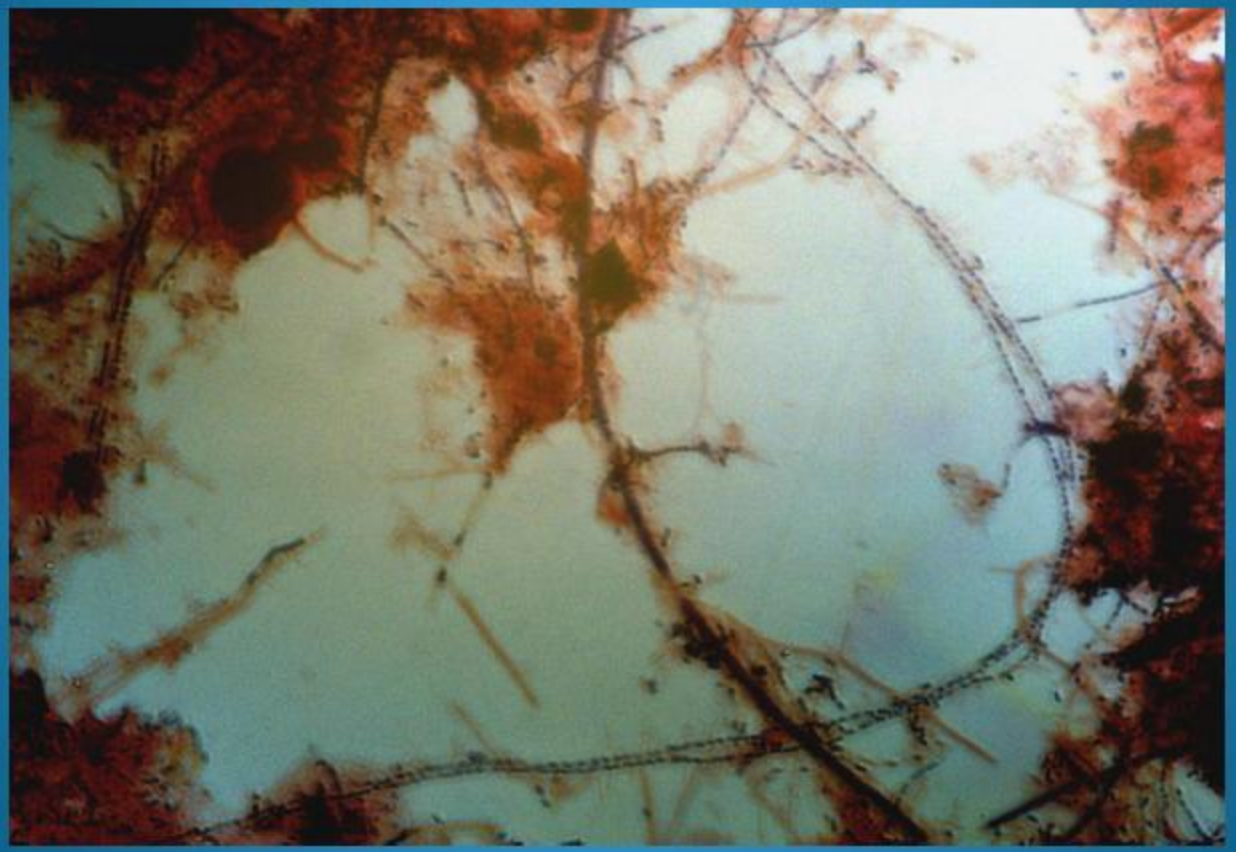

Young Sludge Foam

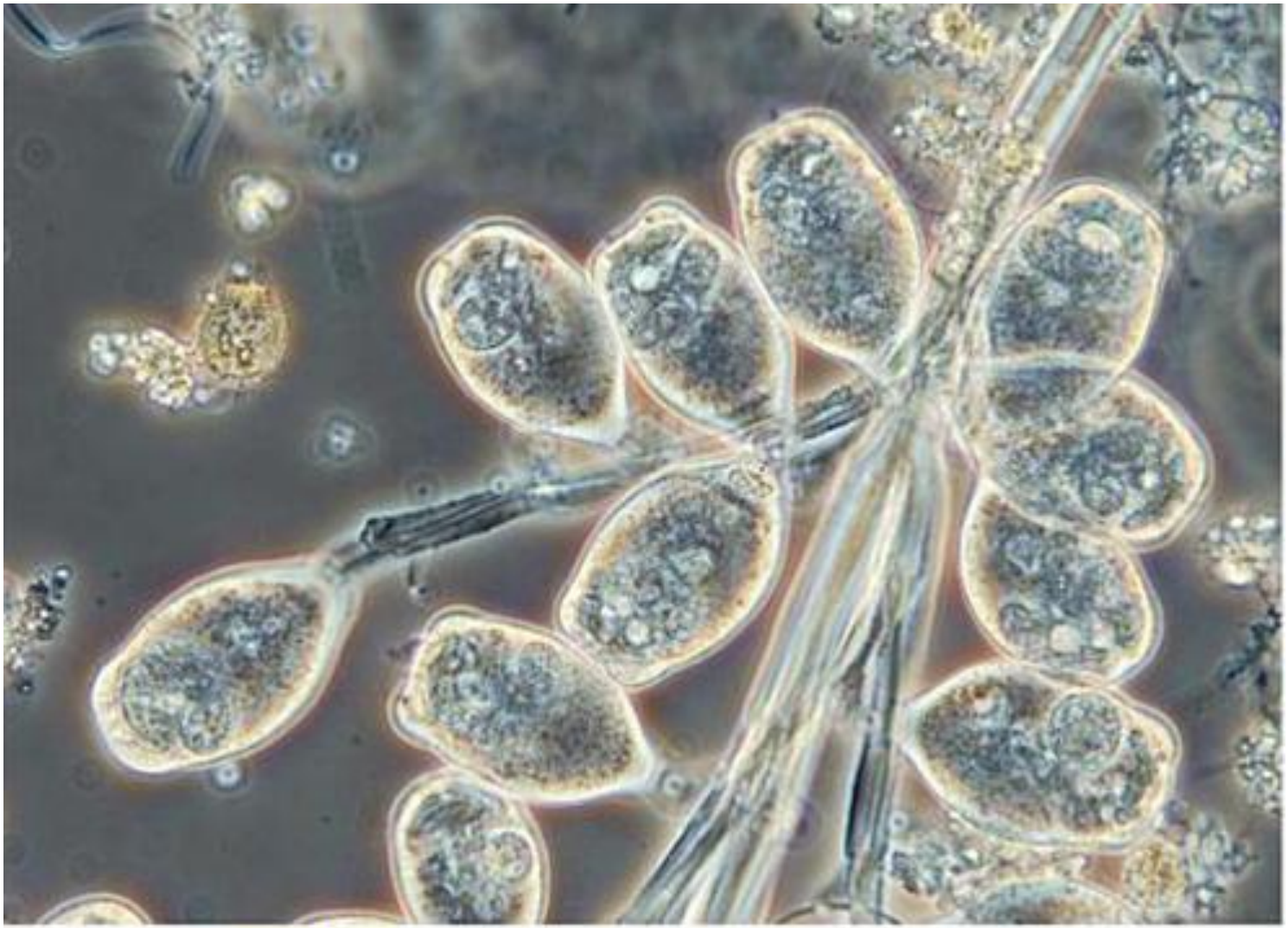
Figure 3-3 Detergents in high concentrations create problems to a wastewater treatment plant operator (photo: M. Henze)

Microthrix parvicella



Filaments 1851 and 0041





Colony of protozoa in an activated sludge ecosystem: (photo: D. Birdjanovic)