Regular digester foaming coincided with implementation of EBPR in 1996.
Very predictable — effluent crossing 16°C threshold apparently triggers transition.
Seasonal — foaming season is approximately mid-Nov through mid-May.
Forces reduction in mixing and SRT for digestion.
Microthrix is believed to be the culprit.
Dig 4-7% mixer run by month for the last three years

- **08-09** Parallel Feed, Meso
- **09-10** Mod Stockholm, Meso
- **10-11** Mod Stockholm, Meso

WAS is being bypassed to metrogro and defoamant used in 10-11
Attempted solutions

- TPAD
- Acid-Phase Digestion
- Reduction of WAS loading
- “Split” digestion of WAS and primary
- Chemical defoamants
- Attacking symptoms
10th addition project implemented temperature-phased anaerobic digestion, better known as TPAD.

Bench scale pre-design research suggested TPAD as effective in addressing foam.

Research was not conducted with MMSD sludge.

Our full scale experience did not agree with the bench scale results.
Modified TPAD system to run a designated digester as an acid-phase digester.

Appeared effective for periods, but eventually process crashed due to establishment of methanogens.

The acid-phase digester was adapted from TPAD batch sizing and was not designed for acid digestion—test not conclusive.
Reduction of WAS load to digesters has been a regular — and effective — solution for every foam season except 2009-10.

A portion of the WAS is thickened and directed to storage without digestion.

By hauling season it is suitable for land application.

Not a designed solution, nor a long-term solution to the issue.
Informally dubbed “Stockholm Process”. 
100% thickened primary and 40% thickened WAS digested in east complex where higher gas production occurs.
45% of this digested flow is combined with remaining 60% of thickened WAS and digested in west complex, where there is more Microthrix but lower gas production.
The east complex still foams, the west has been relatively foam free—jury still out.
Spot use of a defoamant during 2009-10 foaming season.

2010-11 foaming season significant use of defoamant chemical -- $35,000 so far.

Chemical defoamant has an effect, but dosage is higher than anticipated and overall cost is high.

Foam is present even with chemical defoamant, simply holding in check.
Attempted solution-symptom mitigation measures

- Reducing mixing time—four digesters with “bubble guns” are mixed less frequently when foaming is nearing a critical point.
- Reduction of sludge level—creates more head space to house foam; only effective in containing foam.
- Not effective in eliminating, only in surviving the foam season.
Moving forward

11th Addition is being designed

- Implementing acid-phase digestion by adding two designed acid-phase digesters.
- Will utilize steam injection into WAS for process heating.
- Possible option for split digestion.
- Removing gas mixers and converting to internal draft tube mixers.
- Adding digester #8.
- Improve gas draw-off and foam separation.
- Adding provisions for defoamant addition.