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TECHNICAL UPDATE

Date: **01-17-2017**

To: [redacted]

SAMPLE(s): “SBR 1 ML”, “SBR 1 Foam”, “SBR 2 ML” and “SBR 2 Foam”
Received: 01/12/17
Analyzed: 01/12/17 – 01/13/17
Sample analyzed by Deborah Lee, Microbiologist, AQUAFIX

Problem(s): Identify cause of foam and make recommendations.

Microscopic Observations SBR ML

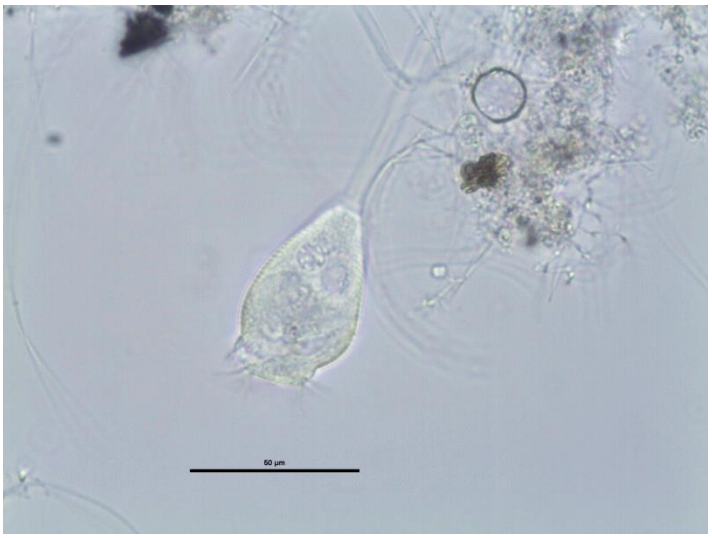

Figure 1-SBR 1 ML unstained and viewed with 100X magnification showing a stalked ciliate. There were medium amounts of stalked ciliates and crawling ciliates which contribute to a clear effluent.

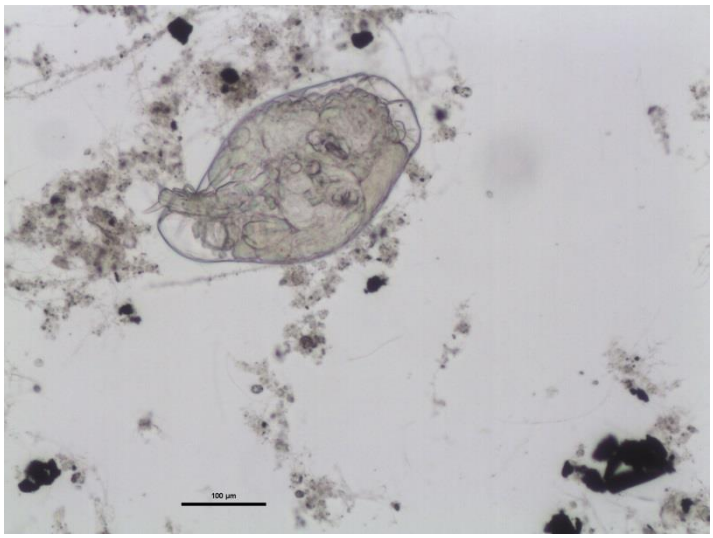

Figure 2-SBR 1 ML unstained and viewed with 100X magnification showing a rotifer. There were low amounts of rotifers which indicate no toxicity in the system.

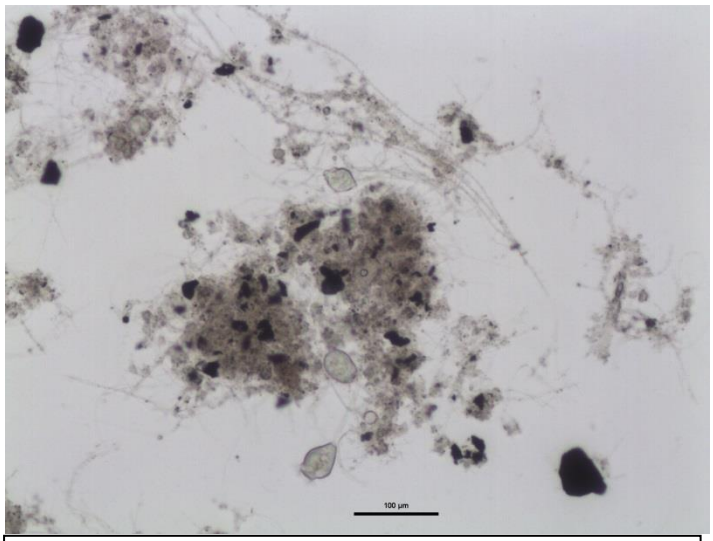

Figure 3-SBR 1 ML unstained and viewed with 100X magnification showing typically observed floc. There was large floc with open structure, high filaments, and septic particles / areas.

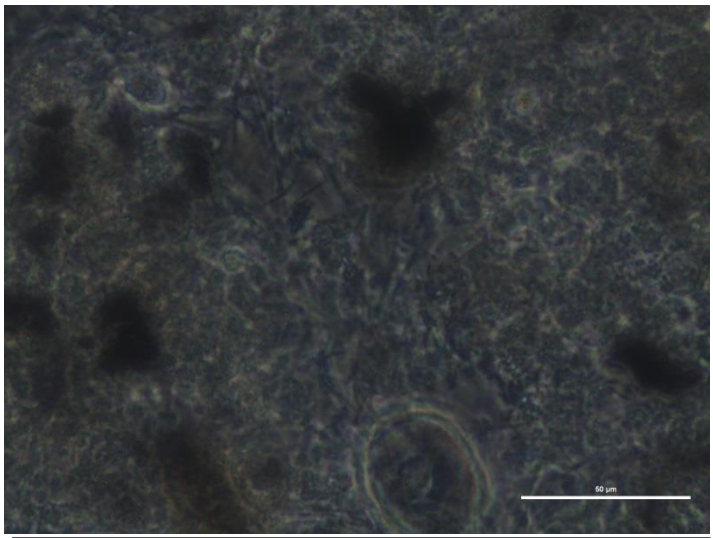

Figure 4-SBR 1 ML unstained and viewed with 400X magnification and phase contrast showing floc is mostly white with black spots. The black spots usually indicate septic particles but may be magnitite.

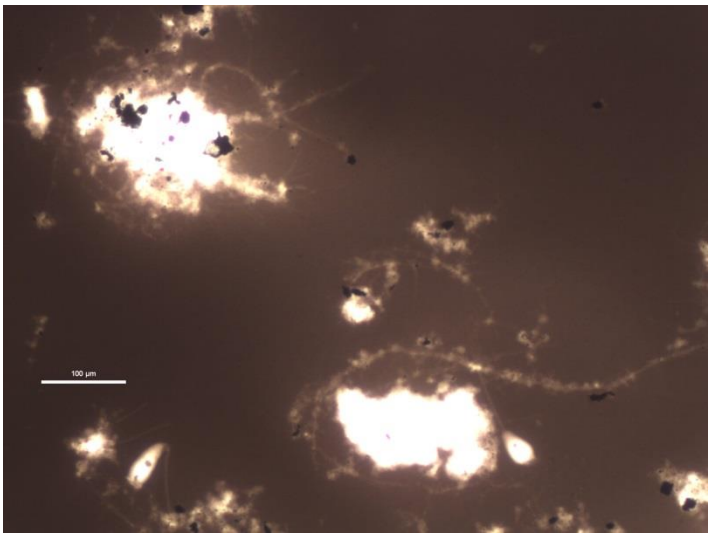

Figure 5-SBR 1 ML stained with India ink and viewed with 100X magnification showing floc exopolysaccharides (EPS) streaming into the bulk liquid. Strongly bound EPS is necessary for a good floc structure.

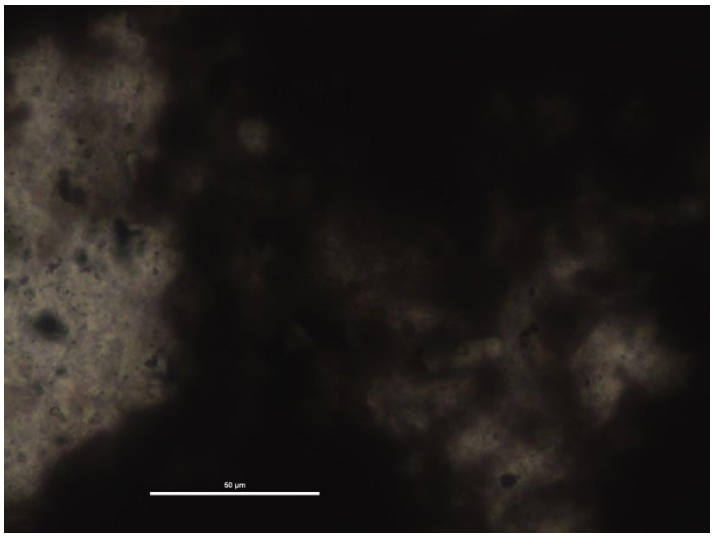

Figure 6-SBR 2 ML stained with India ink and viewed with 400X magnification showing remaining floc EPS is low. This is probably due to most of the EPS being weakly associated with the floc.

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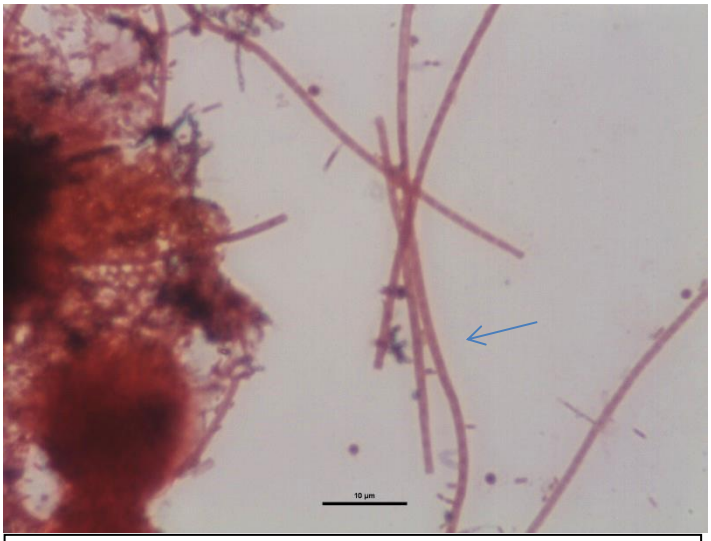

Figure 7-SBR 2 ML Gram stained and viewed with 1000X magnification showing filaments of Type 0092 (arrow)

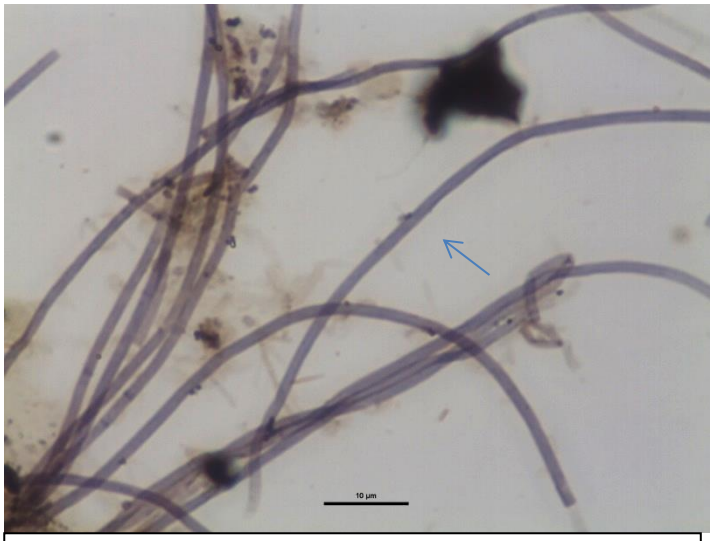

Figure 8-SBR 2 ML Neisser stained and viewed with 1000X magnification showing Neisser positive sheaths of type 0092 (arrow).

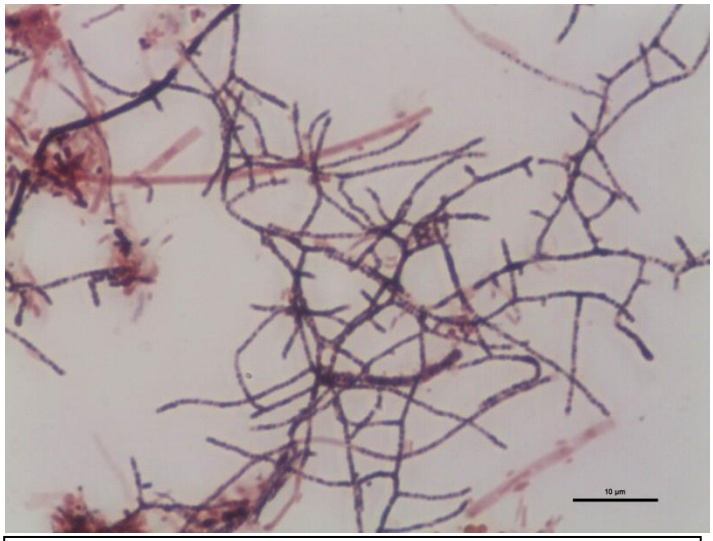

Figure 9-SBR 2 ML Gram stained and viewed with 1000X magnification showing branched Gram positive filaments of Nocardioforms (purple)

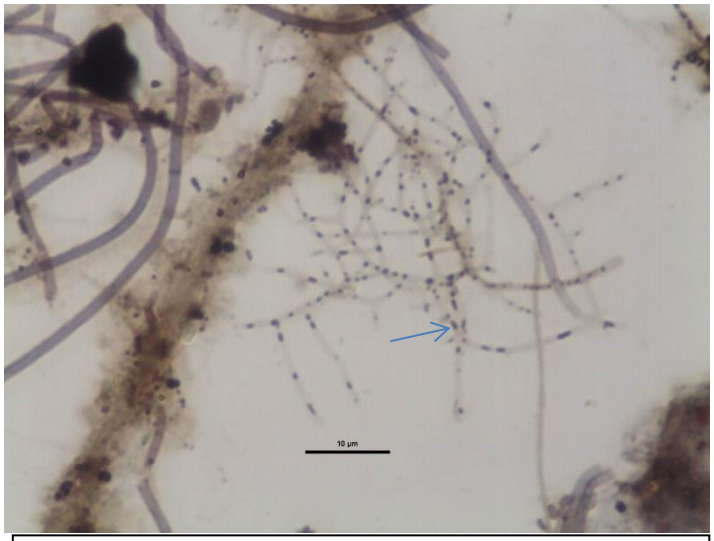

Figure 10-SBR 1 ML Neisser stained and viewed with 1000X magnification showing Neisser positive granules in Nocardioform filaments (arrow).

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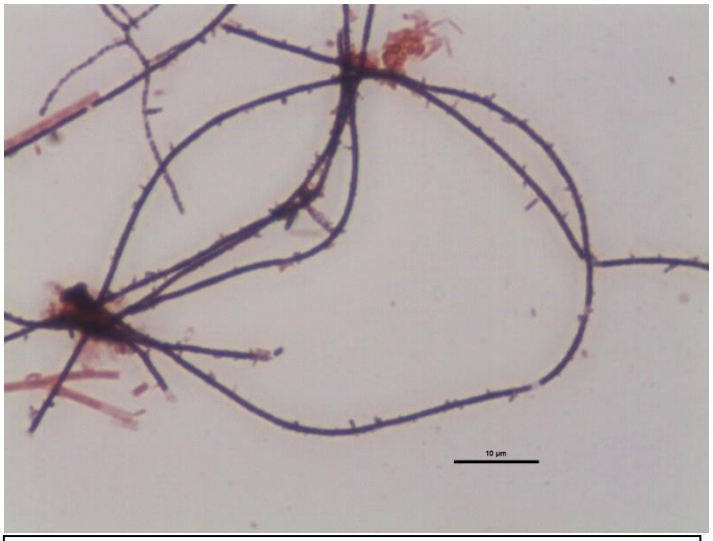

Figure 11-SBR 2 ML Gram stained and viewed with 1000X magnification showing Gram positive, unbranched filaments of *Microthrix parvicella* (purple filaments in center).

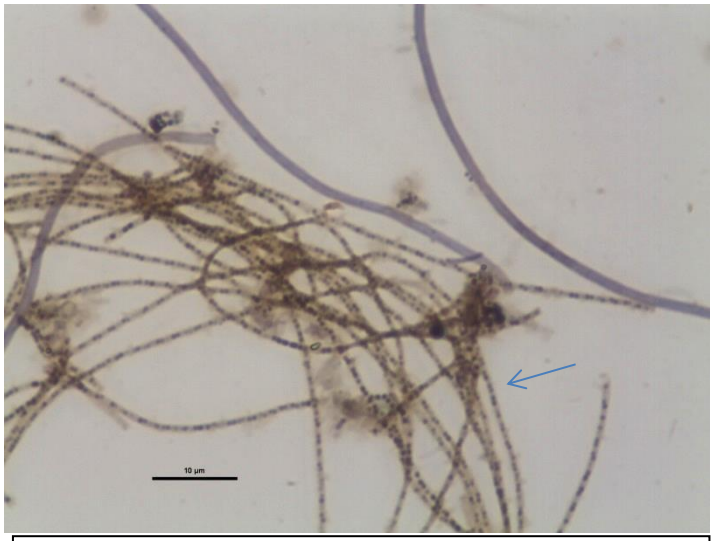

Figure 12-SBR 1 ML Neisser stained and viewed with 1000X magnification showing Neisser positive granules in *M. parvicella* filaments (arrow).

Summary:

- SBR 1 ML and SBR 2 ML were similar in composition. Both SBR's contained medium amounts of stalked ciliates and crawling ciliates with low amounts of rotifers. The presence of these types of ciliates should lead to a clear effluent and the presence of rotifers indicates that there are no toxins in these SBRs. The floc were about 200-300um in diameter and consisted of condensed areas with black spots as well as very open areas due to filamentous microorganisms extending from inside the floc structure. These floc may be breaking apart due to filament extension. The flocs were white in color with black spots when observed under phase contrast. This indicates that most of the floc is getting adequate dissolved oxygen but there are areas that are getting no oxygen. These areas may be particles of magnetite from the magnetite system getting into the return. Although the floc showed only low amounts of exopolysaccharides (EPS), much of the EPS was observed easily pulled off the floc structure and into the bulk liquid. This indicates that they structure of the floc EPS may be too weak to hold the floc together. This is sometimes caused by some form of nutrient deficiency.
- The SBR ML sample contained high amounts of filaments observed both inside and outside of the floc.

Rank	Filament	Abundance	Cause
1	Type 0092	High	Low F:M, high simple organic acids.
2	Nocardioforms	High	FOG, long MCRT
3	*Microthrix*	Medium	FOG, cold temperature
4	Type 0675/0041	Low	Low F:M

Microscopic Observations SBR Foam

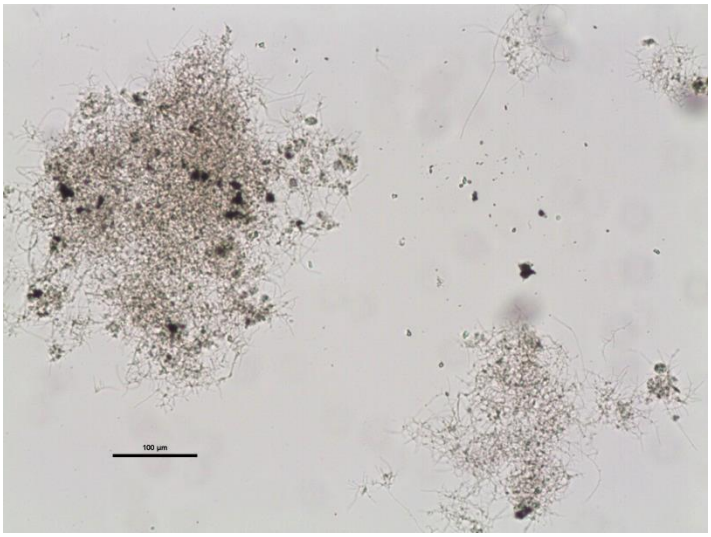

Figure 13-SBR 1 Foam unstained and viewed with 100X magnification showing clumps of branched filaments and trapped fine particles including septic particles.

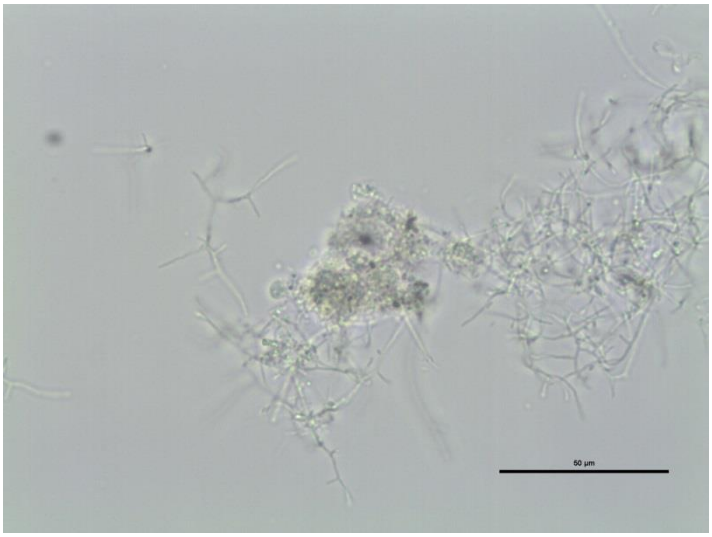

Figure 14-SBR 1 Foam unstained and viewed with 400X magnification showing clusters of branched filaments making a raft-like structure.

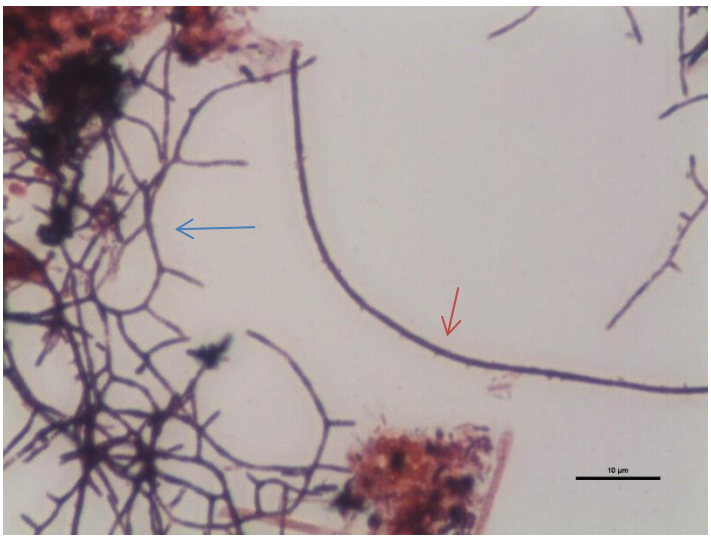

Figure 15-SBR 1 Foam Gram stained and viewed with 1000X magnification showing Nocardioforms (blue arrow) and *M. parvicella* (red arrow).

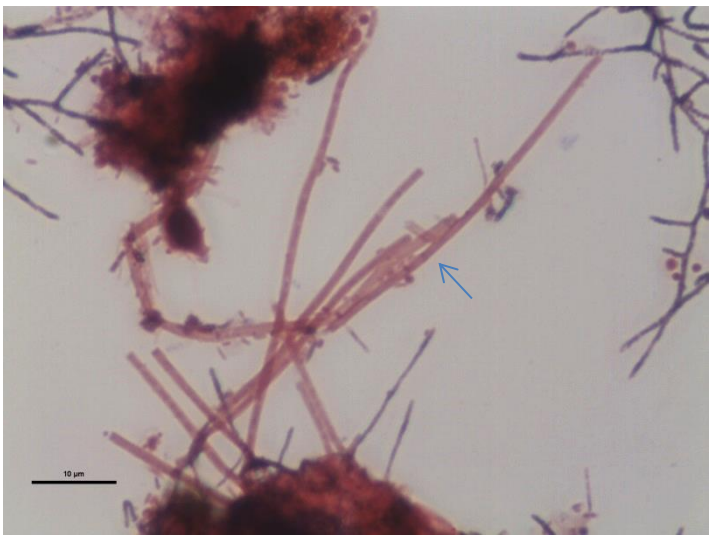

Figure 16-SBR 2 Foam Gram stained and viewed with 1000X magnification showing Type 0092 (arrow).

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Summary:

- The SBR Foam samples did contain low amounts of metazoan. The floc in this sample was composed of filamentous microorganisms but at first appeared more condensed than the floc observed in the SBR ML sample. There were also high amounts of free and clean clumps of branched filaments. This indicates that fine solids are rising to the surface and becoming trapped in the network of filamentous organisms floating on the surface. The foam is due to the abundance of filamentous microorganisms present in the system. The types of filaments and abundance in the foam were similar to those found in the SBR ML sample.

Rank	Filament	Abundance	Cause
1	Nocardioforms	High	FOG, long MCRT
2	Type 0092	Medium	Low F:M, high simple organic acids.
3	*Microthrix*	Low	FOG, cold temperature

The foam appears to be caused by high amounts of Nocardioforms and medium amounts of Type 0092. Nocardioforms can be present in abundance if there are high amounts of fats, oils, and greases (FOG), or if the sludge age gets too old. Sometimes there is a combination even in winter with incoming FOG that builds up due to low temperatures combined with keeping a larger volume of mixed liquor (decreased wasting) compared to summer that seems to let Nocardioforms proliferate. It seems that this plant is receiving high amounts of incoming FOG that may also be building up in the lift stations upstream. This influx of FOG should be decreased in the anoxic/anaerobic selector. However, it seems that this is not occurring and that may be due to one or a combination of factors such as very high FOG load, short time in the selector, low temperature, or other factors.

Recommend:

- Add a Bug On A Rope into upstream lift stations to decrease grease buildup.
- Add Qwik-Zyme L into the anoxic/anaerobic selector and directly into the SBRs to reduce the amount of FOG that has built up or may be incoming.
- Physically remove the foam from the basins and do not allow it to recirculate back into the system. Heavy wasting will help to reduce the foam and flocs composed of filamentous microorganisms.
- Add Foam Buster and VitaStim Low F:M to the SBR(s) to increase the population of floc-forming bacteria.