Foam calls

By Paul LaLiberte

If you've never received a "foam call" then you either haven't worked for the Water Program for very long or you are very good at dodging public inquiries. Even though calls reporting foam on waterbodies are frequently made, it is not a subject that is easily researched.

The readily available textbooks have insufficient information to satisfy a caller convinced that the river has been turned into a cauldron of soap, beer, fertilizer, pesticides, or whatever else comes to mind. I thought I would take this opportunity to share some of the information that I have accumulated over the years on this subject. So before you take your first (next) "foam call" and run off to fill bottles, take pictures and prod the waterbody with various probes, sondes, meters, etc., please consider the following: Tom Sheffy compiled a summary of useful information on the subject dated Jan. 11, 1994.

Another useful document is the report of an investigation of foam on the Fox River in the spring of 1993, put together by Scott Szymanski. Some additional relevant external publications are referenced below.

The "age old answer" as given by Sheffy (who else to give an age-old answer?) is that foaming is caused by an increase in nutrients and/or organic material in the surface microlayer. This enrichment decreases surface tension so that any aeration, such as winds, riffles, dams, waterfalls, etc., produces foam.

The color can vary from brilliant white to dirty brown and the quantity of foam can be truly astounding. Doug Knauer (another source of age-old information) reports foam six feet high on a pool below the Tahquamon Falls in the Michigan UP. Rafts of dirty brown foam the size of a VW Beetle have been spotted floating down the Mississippi below a dredging operation (the source of both the organic matter and the aeration). I've also received a report of foam below a dam on the Eau Galle River flowing up over the river bank and covering picnic tables in a riverfront park.

Dark water streams stained with humic and fulvic acids seem to be prone to foaming. While inorganic nutrients are capable of lowering surface water tension and causing foaming, the most common cause in freshwater systems are glycoprotein or proteoglycan polymers of biological origin. This includes organic material associated with plants or plankton production.

From the above, you can see that freshwater foams can occur widely and naturally. You can also see how society can cause foaming indirectly. For example, cultural eutrophication spurs plankton production, which, in turn, can cause foaming.

I've noticed that foaming in dark water streams seems to be a cool water phenomenon and that the "foam call" season does not include the winter or summer. I am interested in observations that others may have on the seasonal nature of "foam calls."

If you want to target the origin of your foam, the literature suggests a diagnosis based on analysis of nitrogen, phosphorus, and carbon. When collecting foam for analysis be sure to anticipate the volume reduction associated with the loss of bubbles (also known as the Lawrence Welk Effect) lest you come up short on sample volume. How much foam must one collect to get a 50 ml liquid sample?

I have no idea. Maybe Scott can help. But C/N rations of about three suggest

proteinaceous matter. Higher C/N ratios suggest organic acids. High phosphorus could indicate this inorganic nutrient as a culprit.

A word of warning! Foam has a much higher content of lipids, suspended solids and colloidal matter than the underlying water. Since all these materials have an affinity for at least one class of pollutants, foam has the nasty property of concentrating inorganic and organic contaminants. While a good head of foam is desirable on your glass of beer, it may be a cause for concern on your sample bottle.

When looking for the source of the foaming agents, it's important to realize that the foam rarely accumulates where it is generated, so look upstream. Usually, the point of origin is a dam or natural source of aeration.

Occasionally, it may unnatural. My most memorable find was a 12-foot wall of foam rising out of a municipal WWTP and flowing through a chain link fence into the stream.

So now you're prepared to respond to your "foam calls." The age-old answer is still most likely to be the correct one. However, your 12-foot wall of killer foam may still be waiting out there for you. Just bring your camera and watch out for sudden wind gusts.

The following are helpful documents to use in familiarizing yourself with foam:

Eisenreich, S. et al, 1978. Enrichment of micronutrients, heavy metals and chlorinated hydrocarbons in wind-generated lake foam. Environ. Sci. & Tech. 12(4) 413-417.

Elzerman, A. & D. Armstrong. 1979. Enrichment of Zn, Cd, Pb and Cu in surface microlayer of Lakes Michigan, Ontario and Mendota. Limnol. Oceanogr. 24(1) 133-144.

Elzerman, A. et. al. 1979. Particulate Zn, Cd, Pb, and Cu in the surface microlayer of Southern Lake Michigan. Environ. Sci. & Tech. 13(6) 720-725.

Napolitano, G. & J. Richmond. 1995. Enrichment of biogenic lipids, hydrocarbons and PCBs in stream-surface foams.