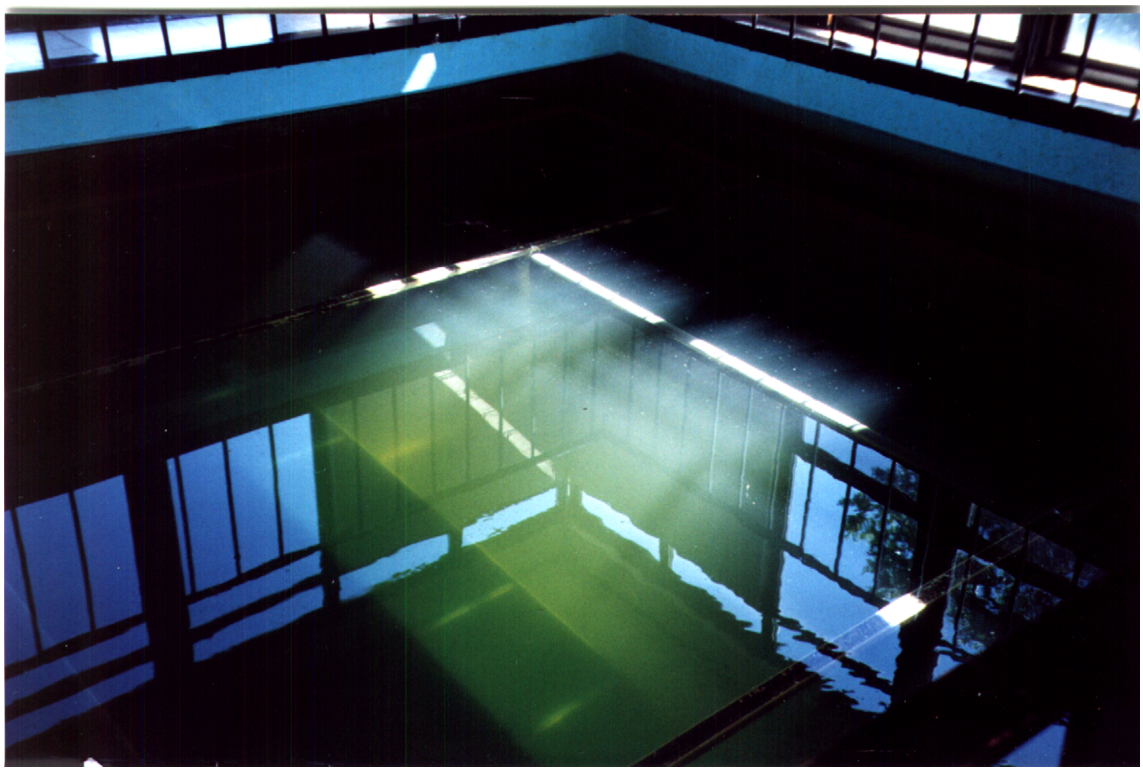
Gladstone, Missouri

Identification of Accumulations
on High Service Pumps



submitted

September 27. 2005

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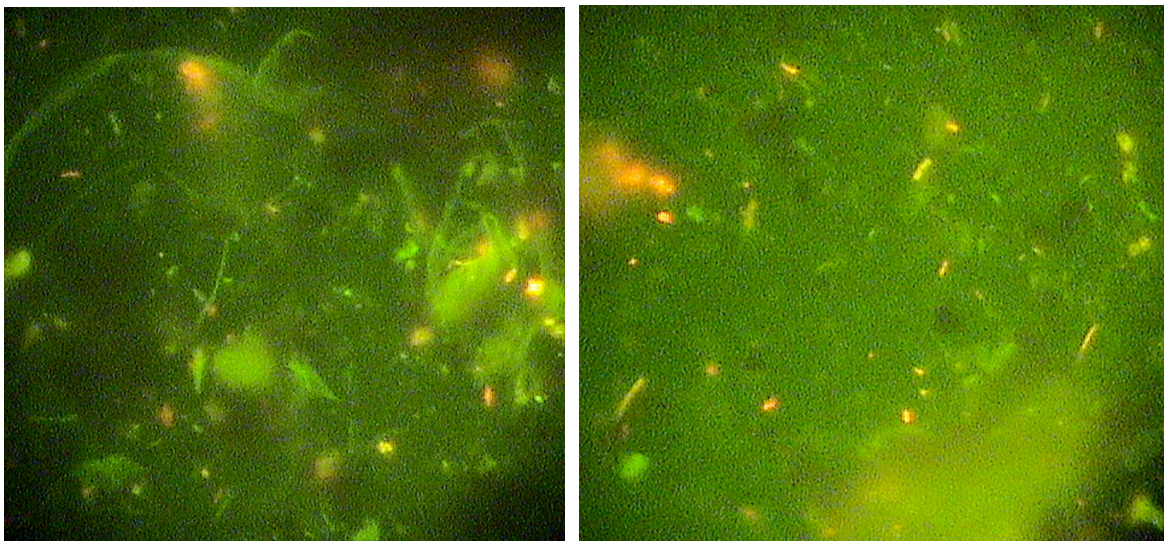
Identification of Accumulations

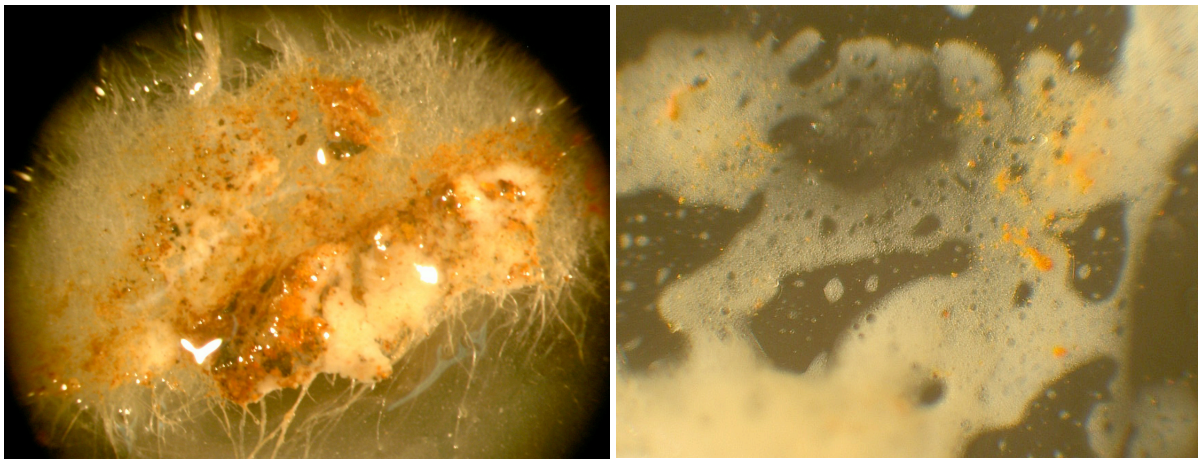
During maintenance of their high services pumps, Gladstone plant personnel noted the presence of a white, slimy accumulation. On September 9, 2005, they forwarded a sample of this accumulation to H_2O'C Engineering for identification and evaluation.

Based on its slimy consistency, the accumulation was initially thought to be largely bacterial cell mass. However, while bacterial cells and filaments were observed using epifluorescence microscopy, as shown below, the numbers of cells observed did not indicate the large populations associated with microbial slime.



Micrographs (1000x) indicate modest populations of bacterial rods and filaments embedded in slime.

Subsequent micrographs of the slime, taken with a Zeiss stereo microscope, indicated that much of the material is a froth or very fine foam. The orange particles appear to be embedded iron oxide precipitates which are commonly found in water treatment plant effluents.



Implications of Presence of Foaming Materials

The presence of dissolved organic carbon (DOC) compounds in the finished water is indicated by the formation of foam or froth. Most naturally-occurring organic compounds lower the surface tension of water and allow a stable accumulation of bubbles to form. In this particular instance, the bubbles formed are extremely small and do not readily coalesce.

The presence of dissolved organic carbon in Gladstone's finished water indicates the potential for bacterial regrowth during distribution. For this reason, both dissolved organic carbon and ammonia nitrogen should be monitored in each well water and in the plant's filter effluents.

A portion of the dissolved organic matter may also react with disinfectant residuals to form disinfection by-products during distribution. An analysis of all available historical data on disinfection by-products in Gladstone's distributed water should reveal any long-term trends in DBP formation.

Initial Distribution System Evaluation

An examination of trends in Gladstone's DBP formation is consistent with a pending major component of the *USEPA Stage 2 Disinfectants and Disinfection Byproducts Rule.* This rule, to be promulgated early in January 2006, requires utilities to *"identify areas in the distribution system with representative high DBP concentrations."*

Gladstone is prepared to readily meet this new regulatory requirement since H_2O'C Engineering has already prepared its distribution system hydraulic model (See *The Gladstone, Missouri Water Distribution System,* January, 2003). An update of this model to incorporate the system changes made since 2003 will provide the basis for selecting Gladstone's compliance monitoring sites.

Proposed Water System Evaluation

Based on perceived water source and system needs plus pending regulations, H_2O'C Engineering proposes to conduct the following evaluation of the Gladstone water system:

- evaluate the formation and persistence of disinfectant residuals (free chlorine, monochloramine) in the distribution system,
- determine the removal or conversion of ammonium ion to nitrite and nitrate during treatment and distribution,
- look for evidence of dissolved oxygen depletion during filtration and distribution,
- consult regarding Well #5 and the formation of the white slime (foam),
- update the distribution system hydraulic model and use the revised model to satisfy the MDNR requirements for the IDSE.