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TO: Guy Bertelli, Accents in Water, Inc.
FROM: Mark Hernandez, PhD, PE, Principal Investigator

RE: RESULTS SUMMARY FOR COMPARING SANIGARD EFFECTS ON ORGANIC CARBON SEQUESTRATION AND MICROBIAL COLONIZATION OF ACCENTS IN WATER FEATURES UNDER REALISTIC OPERATING CONDITIONS

OVERVIEW: Over a several month period, experiments were performed by monitoring the culturable bacteria content, as well as the organic carbon retained by 8' x 4' stainless steel ACCENTS IN WATER features that were otherwise identical except for the application of the antifouling agent ***SANIGARD***. The features were placed side-by-side in a relatively high pedestrian traffic area of the University of Colorado's Engineering Center, where they were operated continuously during the 2008 fall semester.

OPERATIONAL CHALLENGE: Organic carbon measurements, and standard heterotrophic plate counts commonly used to judge the quality of drinking water, were used as performance indices to isolate and judge the effect of a sole process variable: the pre-application of SANIGARD. We used heterotrophic plate counts for these trials because they are widely accepted as a surrogate indicator for the survival potential for pathogenic microorganism in drinking water. We also monitored both total and dissolved organic carbon content as indirect evidence of airborne particulate matter partitioning into the operating water features to link the following biophysical responses: (i) that the partitioning of particulate matter from the indoor atmosphere is a likely source of carbonaceous substrates for microbial growth in water features, and (ii) that SANIGARD applications may affect microbial growth in operationally significant time frames.

SETTING and FACILITIES: One of the busiest buildings on the University of Colorado's flagship campus is its engineering center, which is the academic home to thousands of students. The lobby of this facility was designed with and HVAC system providing a nominal air exchange rate between 2 and 3 air changes per hour (ACH), and has relatively high occupancy and pedestrian activity during normal business hours. This facility has relatively stringent control of environmental factors (temperature and humidity), for human comfort. We installed stainless ACCENTS WATER FEATURES each with an approximate surface area of 32 ft^2, side-by-side within this lobby, and monitored their operations continuously using a remote, internet-based camera.

RESULTS SUMMARY: Immediately prior to operations, the features were carefully cleaned with ethanol, and filled with sterile, particle free water. Airborne particulate matter from the indoor atmosphere partitioned into the water recirculating in the features; some of which contained organic carbon (TOC = Total Organic Carbon), and subsequently dissolved (DOC = Dissolved Organic Carbon).

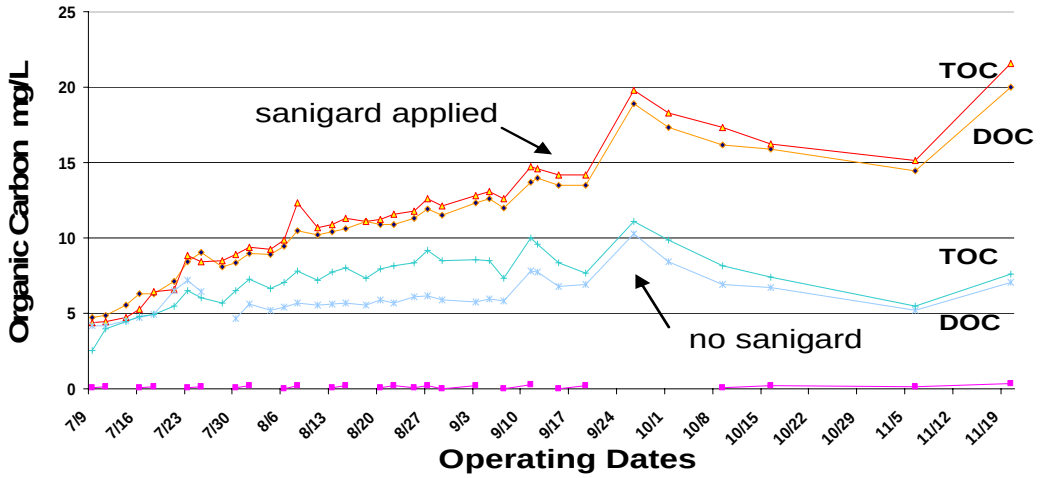

Figure 1. After more than 4 months of continuous operation, water features experienced marked increases in the amount of organic carbon sequestered from indoor air. In all cases, most of the organic carbon presented as a dissolved faction. Organic carbon was markedly higher in the water feature treated with the microbial anti-fouling compound SANIGARD (-▲-), than an otherwise identically constructed and operated unit not treated with SANIGARD (-▲-). Analytical TOC "blanks" are shown (-▲-).

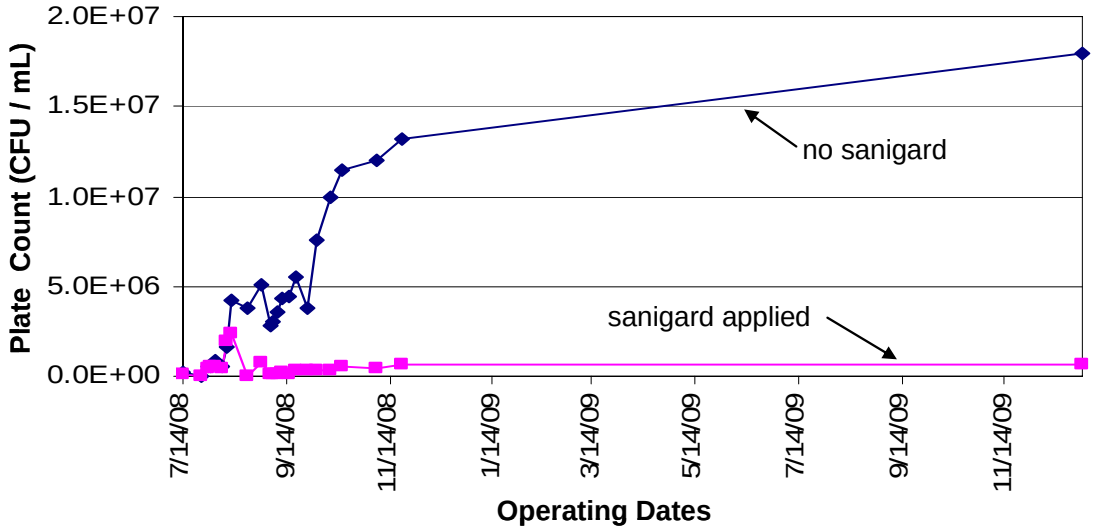

Figure 2. As judged by standard heterotrophic plate counts on broad spectrum bacterial media (R2A agar), the feature constructed of virgin stainless steel (-▲-)hosted more than 3 orders of magnitude higher heterotrophic colony forming units that an otherwise identical unit with steel surfaces covered with the antifouling compound SANIGARD (-▲-) during a 4 month period.

CONCLUSIONS and SIGNIFICANCE: These results suggest that the thin water films recirculating on the faces of these water features can sequester and retain airborne particulate matter from indoor environments with relatively high occupancy. This particulate matter has significant organic carbon content, which may be available as microbial substrates. This is consistent with increasing TOC/DOC content of the water feature reservoir in the absence of any clear indications of photosynthetic activity (chlorophyll A) or other significant autotrophic activity.

Given that the units were initiated with identical aliquots of sterilized, particle free drinking water, patterns of TOC/DOC increases and culturable heterotrophic microorganisms recovered from the water features' reservoirs, suggest that SANIGARD pretreatment had a significant inhibitory effect on the growth potential of attached and planktonic microorganisms. This performance is consistent in isolating this process variable, where the water features were identical in every engineering respect except for SANIGARD application.