



Environmental Microbiology Laboratory Report

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Sample Identifiers

Location: BSR Cable Park, Waco, TX

Description: Environmental sampling during on-site assessment of the water bodies associated with a confirmed case of primary amebic meningoencephalitis caused by *Naegleria fowleri*

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Report Issue Date: October 11, 2018

Sample Collection Date: September 27, 2018

Sample Receipt Date(s) and Notes: September 28, 2018

Summary of Findings:

The environmental sample results, including physical and chemical water quality and biological test results, are described in Table 1. *Naegleria fowleri* was detected in the large-volume ultrafiltration water sample and sediment sample collected at the Cable Park where the drain from the Lil' Bro enters the Cable Park pond. Viable thermophilic ameba were detected in samples collected from the reservoir, Surf Resort, Royal Flush, and Cable Park, and are pending analyses for identification. A free chlorine residual was not detectable in the reportedly treated Surf Resort or Lazy River. The turbidity of the Surf Resort, Lazy River, Royal Flush, and reservoir were 558, 20.6, 5.31, and 2.36 NTU, respectively (as reference, the EPA drinking water treatment standard is 0.5 NTU). Total coliform and enterococci were detected in the reportedly treated reservoir water (as reference, the EPA drinking water treatment standard is <1 total coliform MPN/100 ml). Total coliforms were detected in the Royal Flush and Lazy River water, and enterococci were detected in the Surf Resort water.

The presence of fecal indicator organisms (total coliforms, enterococci), viable thermophilic ameba, and high turbidity indicate a treatment failure, and when the water is warm, would create conditions amenable to *Naegleria fowleri* growth. Detection of *Naegleria fowleri* on the property indicates the potential for the ameba to enter other surface water bodies on the property through various routes (i.e., soil, run-off, person transfer, etc.). The unprotected surface water reservoir supplying the water bodies is susceptible to soil intrusion and warm water through radiant heating. Moreover, the reservoir is supplied by ground water; studies have shown ground water can contain *Naegleria fowleri* (Bright and Gerba 2017)*.

Report authorized by: _____ **Date:** _____
 [Signatures may be handwritten or electronic]

*Bright, K.R. & Gerba, C.P. Hydrogeol J (2017) 25: 953. <https://doi.org/10.1007/s10040-017-1582-4>

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Table 1. Environmental sample results including physical and chemical water quality and biological test results.

Water Body Description	Sample Types Collected at Water Body ¹	Physical Water Quality Parameters	Total Coliforms ² (MPN/100 ml)	<i>E. coli</i> ² (MPN/100 ml)	Enterococci ² (MPN/100 ml)	Ameba Culture Results ³	<i>Naegleria fowleri</i> Results ³
Reservoir GPS: N31.627822, W97.006836	Ultrafiltration Grab Sediment	Total Chlorine = 0.03 mg/L Free Chlorine = 0.05 mg/L Temperature = 27.6 °C pH = 9.15 Turbidity = 2.36 NTU Conductivity = 1219 µS/cm Total Dissolved Solids = 868 ppm	686.7	<1	2.0	Detected in sediment	Non-detect
Surf Resort GPS: N31.621139, W97.003853	Ultrafiltration Grab Sediment ⁴ Surface Swab ⁴	Total Chlorine = 1.03 mg/L Free Chlorine = <0.02 mg/L Temperature = 24.7 °C pH = 9.31 Turbidity = 558 NTU Conductivity = 1644 µS/cm Total Dissolved Solids = 1170 ppm	<1	<1	2.0	Detected in ultrafiltered water and sediment opposite cement wall center	Non-detect
Royal Flush GPS: N31.619690, W97.004617	Ultrafiltration Grab Sediment ⁵ Surface Swab	Total Chlorine = >2.20 mg/L Free Chlorine = 1.77 mg/L Temperature = 25.3 °C pH = 8.79 Turbidity = 5.31 NTU Conductivity = 1610 µS/cm Total Dissolved Solids = 1140 ppm	1.0	<1	<1	Detected in sediment	Non-detect
Lazy River GPS: N31.619915, W97.003425	Ultrafiltration Grab Surface Swab	Total Chlorine = 0.25 mg/L Free Chlorine = <0.02 mg/L Temperature = 27.0 °C pH = 8.98 Turbidity = 20.6 NTU Conductivity = 355 µS/cm Total Dissolved Solids = 267 ppm	1.0	<1	<1	Non-detect	Non-detect
Cable Park GPS: N31.618805, W97.003442	Ultrafiltration Grab Sediment ⁶ Surface Swab ⁶	Total Chlorine = <0.02 mg/L Free Chlorine = <0.02 mg/L Temperature = 29.0 °C pH = 8.83 Turbidity = 45.0 NTU Conductivity = 1252 µS/cm Total Dissolved Solids = 891 ppm	1732.9	1.0	101.4	Detected in sediment, ultrafiltered water, and swab	Detected in sediment and ultrafiltered water

¹Ultrafiltration samples were 50 L volumes, except at Surf Resort where only 10 L filtered due to clogging.

²Measured using EPA standard methods, IDEXX Colilert-18 or Enterolert, on 100 ml grab samples. MPN: most probable number

³*Naegleria fowleri* was tested for using both direct Real Time Polymerase Chain Reaction molecular assays (PCR) and culture-based assays followed by PCR confirmation of presumptive positive cultures by epi-fluorescence microscope. Non-*Naegleria fowleri* viable thermophilic detected are pending identification via 18S rDNA amplicon sequencing.

⁴Sediment was collected at two sites in the Surf Resort: 1) beach opposite center of cement wall (GPS coordinates given); and 2) adjacent to south end of cement wall. Surface swabs of cement wall were collect at two sites in the Surf Resort: 1) center of cement wall; and 2) at intersection of sand and PVC lining on north end of cement wall.

⁵Sediment at Royal Flush was collected from sand 'beach' adjacent to slide.

⁶Sediment at Cable Park was collected within Cable Park pond adjacent to Lil' Bro pond input. Surface swab at Cable Park collected from pebble/cement wall drain from Lil' Bro pond,