

PAM in a Man-Made Water Attraction

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What is PAM?

- PAM stands for Primary Amebic Meningoencephalitis
- Caused by a free-living, thermophilic microscopic ameba known as *Naegleria fowleri*
- The ameba is usually found in warm freshwater (Rivers, Lakes, creeks, hot springs) and soil.
- Enters the body through the nose and travels to the brain causing PAM.
- Infection usually occurs through swimming or diving in freshwater sources.

Of course it happened on a Friday afternoon

- On 9/21/18 Waco-McLennan County Public Health District (WMCPHD) Epidemiology program received an email from The Texas Department of State Health Services (DSHS) informing us of a positive Primary Amebic Meningoencephalitis (PAM) linked to a facility in Waco.
- Case information:
 - 29 year old male
 - Visited water attraction on 9/8/18
 - Exposure was surf park
 - Symptom onset 9/14/18
 - Hospitalized on 9/17/18

So what do we do now?

- Internal communication between departments within the health district
 - Epi, PHEP, Nursing, PIO, LHA and Director
- Calls between CDC, DSHS, and WMCPHD
- Contacted Facility
 - Notified the owner of the positive PAM case linked to his facility and discussed next steps.
 - Owner agreed to have our team visit the following Monday afternoon.
 - Team Consisted of:
 - Lead Epi - Vaidehi Shah
 - Infectious Disease Epi - Lacey Sanders
 - Environmental Health Program Manager - David Litke

What we know (or thought we knew) about the facility





Next steps

- After many calls and emails, it was agreed that CDC would send a team for testing at the facility.
- Notified Owner
- Testing Team consisted of:
 - CDC team
 - Local Epi's
 - State Epi's
 - LHA
 - State/Regional Environmental Health







What we found when the CDC came to play

- Multiple issues at the facility.
- As a result of the numerous issues noted, WMCPHD and the Local Health Authority (LHA) asked the owner to close the facility (not to include cable park)
- Facility closed on 9/30/2018
- Internal discussions
 - Private property
 - Limit of LHA
 - Pool rules versus Swimming lagoon....where is the regulation?

Then the media found out





U.S. Department of Health and Human Services
National Center for Emerging and Zoonotic Infectious Diseases
Division of Foodborne, Waterborne, and Environmental Diseases
Waterborne Disease Prevention Branch



Centers for Disease Control
and Prevention
1600 Clifton Rd, MS E-10
Atlanta, GA 30333
(404)639-8120

Environmental Microbiology Laboratory Report

| | |
|-------------------|---|
| Lab Contact Name: | Mia Mattioli, PhD, Environmental Engineer |
| Telephone Number: | 404-718-5643 |
| Email: | kuk9@cdc.gov |

Sample Identifiers

Location: ~~██████████~~

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

Local Contact: Vaidehi Shah, Waco-McLennan County Public Health District, 254-750-5775, VaidehiS@wacotx.gov

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]

CDC Environmental Microbiology Laboratory Report

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 |

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

² Measured 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.

⁴ Sediment 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 collected 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.

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

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



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City of Bellmead

City of Beverly Hills

City of Bruceville-Eddy

City of Crawford

City of Gholson

City of Goliad

City of Hallsburg

City of Hewitt

City of Lacy-Lakeview

City of Leroy

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City of McGregor

City of Moody

City of Riesel

City of Robinson

City of Ross

City of Waco

City of West

City of Woodway

McLennan County

Hand delivered to [REDACTED] and via email

October 12, 2018

Subject: Primary Amebic Meningoencephalitis (PAM) Investigation

Dear [REDACTED]

We appreciate the opportunity to meet with you to discuss plans to ensure the safest possible environment for visitors and employees of the [REDACTED]. The Waco-McLennan County Public Health District ("WMCPhD") has recently been provided with the Environmental Microbiology Laboratory Report that includes lab results and findings from an on-site assessment of [REDACTED]. The on-site assessment was conducted as a result of a confirmed case of PAM caused by *Naegleria fowleri* with possible exposure at [REDACTED].

Naegleria fowleri is the free-living amoeba (single-celled organism) that causes PAM, a rare and devastating brain infection with a fatality rate of over 97%. Infection occurs when contaminated water enters the body through the nose and the amoeba travels to the brain. *N. fowleri* infections most often occur when people engage in recreational activities like diving and swimming in warm freshwaters (e.g., lakes, rivers, ponds, and hot springs). Infections have occurred after exposure to artificially created freshwater recreational facilities. Infection does not occur by drinking contaminated water. Even though *N. fowleri* infections are rare, the organism is ubiquitous in warm freshwater making the risk of infection always present.

An environmental assessment along with environmental sampling was conducted on September 27, 2018 by Centers for Disease Control and Prevention (CDC) in conjunction with the WMCPhD and the Texas Department of State Health Services. We noted that there is a

single source of water for the Surf Resort, the Lazy River and the Royal Flush ([REDACTED]) which is a surface water reservoir that draws from a deep well. While the original source of water is protected ground water, the storage reservoir is considered surface water that is open to the environment, surrounded by a sandy beach that contains construction sediment, and can reach high temperatures conducive to free-living amoeba and other microbial growth. We noted that there is no routine chemical treatment, monitoring, scrubbing of wetted [REDACTED] venues' surfaces, filtering, or record keeping to document water quality and treatment for the [REDACTED] venues open to the public. We also noted that the [REDACTED] venues contain sand, which can create an environment that protects microbes from chemical disinfectants used to treat [REDACTED] water. Additionally, limited information was available on the chemical dye, reportedly an algaecide, and water disinfection products (e.g., chlorine) during the onsite visit.

Based on our observations during the on-site visit, the findings in the lab report, and the known public health risks associated with inadequately treated recreational waters, the overall recommendation is that the facility will require application of best practices related to water management of a recreational water facility open to the public.

In order to address this situation and ensure the safety and well-being of your employees, visitors, and family members, the WMCPhD supports the plan to hire [REDACTED] who met with Health District staff on October 9, 2018 to briefly discuss their intention to develop a water quality management plan to evaluate and remediate the [REDACTED] venues. [REDACTED] worked with Mecklenburg County in North Carolina in 2016 to address and remediate their *N. fowleri* concerns. As a result of this meeting and the above mentioned findings, WMCPhD understands that:

- [REDACTED] will work with you to draw up an initial plan, which will be shared with the WMCPhD for review.
- The [REDACTED] venues will not re-open without consultation with the WMCPhD and not before all health and safety issues have been addressed and mitigated appropriately.
- We will provide additional recommendations based on the evaluations made by the third party engineer/consultant and other subject matter experts, as well as current regulatory requirements, including Chapter 341.064 of the Texas Health and Safety Code.

Our mission is to ensure the health and well-being of the citizens and visitors of the county. We will not deter from taking stringent actions including legal actions to fulfill our responsibility. Based on our October 9, 2018 meeting, we believe that you want to work with the WMCPhD to resolve this matter without legal action. We look forward to working with you in resolving this matter.

Where are we at today?

- Handed investigation over to Environmental Health in October 2018
- Facility opened to public in April with all completed renovations done for the surf park and lazy river.
 - New automatic chlorination system
 - New Filtration System
 - Ozone treatment
 - Most importantly a staff that is trained in water treatment and water regulations.

BEFORE PUBLIC HEALTH INTERVENTION



AFTER PUBLIC HEALTH INTERVENTION



BEFORE PUBLIC HEALTH INTERVENTION



AFTER PUBLIC HEALTH INTERVENTION



And that's all Folks

Any Questions or Comments

**Diarrhea and swimming
don't mix!**



If you wouldn't
do this...

...then why
would you
do THIS?

**Don't swim or let your kids swim
if sick with diarrhea!**

Learn more at www.cdc.gov/healthyswimming

