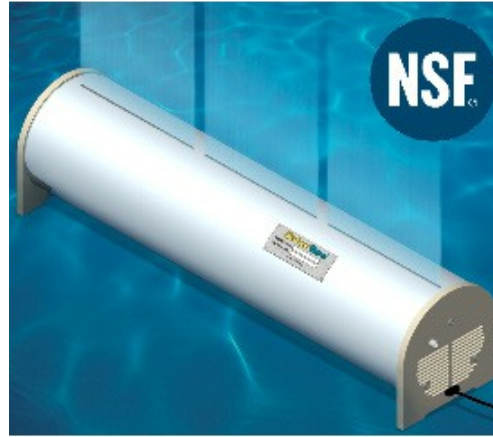


Medora Corporation

Partially Buried & Underground Tanks

USMAPW-LOC828.001-3

Topics: potable, stratification/water age, short-circuiting, chlorine



Aerial view of the partially buried tank, the GS-12 submersible mixer, & an aerial view of the underground tank.

Customer:

Information is available upon request from Medora Corporation. 866-437-8076 info@medoraco.com

Overview: The underground tank is a concrete rectangular structure (226' long, 166 wide, 21 ft high) built in 1968. Divided in the center, each side has a 2.5 MG storage capacity. The partially buried conical bowl tank (115' diameter, 20' high) with a geodome roof built in 1908 and refurbished in 1975, also with a 2.5 MG storage capacity. Both tanks have common inlet / outlet structures, and both tanks use free chlorine as the disinfectant.

Conditions / Objectives: Both tanks experienced significant thermal stratification from inadequate circulation resulting in short-circuiting, inconsistent water age and water quality.

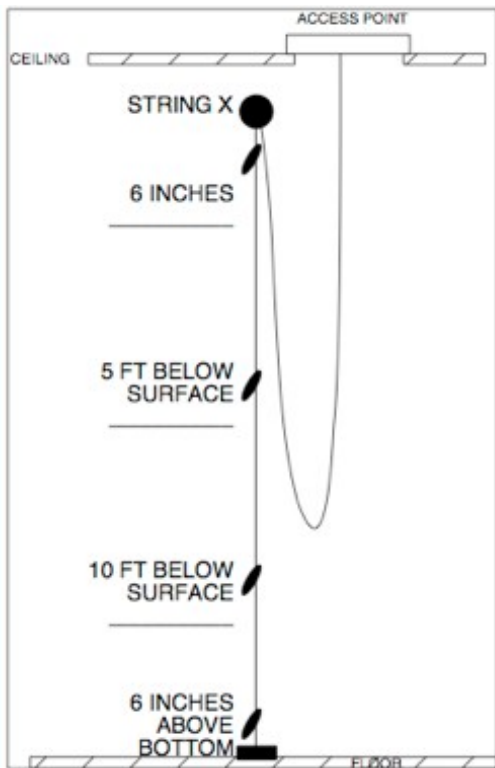
Solution: June 2011, installed two (2) GridBee® GS-12 mixers in the underground tank (one on each side of the partition), and one (1) GridBee® GS-12 mixer in the partially buried tank. Three strings of digital temperature probes were also installed in each tank to monitor vertical thermal profiles. Each string measured water temperatures at 6 inches, 5 feet, and

10 feet below the surface, as well as 6 inches above the tank bottom (see illustration on page 2).

Results: The vertical profile temperature data are presented graphically below. The data clearly indicate that the GS-12 mixers performed very well in both tanks. Prior to the startup, water in the underground tank had 5°C stratification from bottom to the surface, while the partially buried and had 3°C stratification. Within 24 hours of starting up the GS-12s, water column temperatures converged to within 0.5°C. In both tanks, fill cycles were detectable by observing how bottom temperatures dipped lower than surface waters due to cooler influent water. For several hours following each fill, the GS-12 mixer converged the temperatures, rapidly mixing in the new colder water that entered during the fill cycle. As part of the study, an intentional off/on cycle of the GS-12 mixer in underground tank showed that temperatures began to stratify soon after the mixer was turned off, but again quickly converged when the mixer was turned back on. Furthermore, measurements from the three separate test locations within each tank indicate that water temperatures were uniform both vertically and horizontally, from one end of the tank to the other.

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Test Setup



6 HOBO STRINGS (3 PER TANK BASIN)
SET TO BEGIN 5 MIN TEMP SAMPLES ON 6/17/2011, 6:00 AM EASTERN

**UNDERGROUND TANK (RECTANGULAR BASIN):
STRINGS 1 THROUGH 3**

LOCATION	STRING 1	STRING 2	STRING 3
6 IN BELOW SURFACE	9947109	9947104	9947099
5 FT BELOW SURFACE	9947110	9947106	9947100
10 FT BELOW SURFACE	9947111	9947107	9947101
6 IN ABOVE BOTTOM	9947112	9947108	9947102

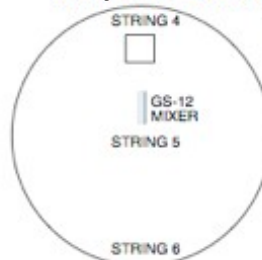
**PARTIALLY BURIED TANK (CIRCULAR BASIN):
STRINGS 4 THROUGH 6**

LOCATION	STRING 4	STRING 5	STRING 6
6 IN BELOW SURFACE	9947095	9947103	2028445
5 FT BELOW SURFACE	9947096	9923850	2028436
10 FT BELOW SURFACE	9947097	9933293	2028431
6 IN ABOVE BOTTOM	9947098	2419909	2028451

Underground Tank Rectangular, Underground, Concrete 2.5 MG Basin, 115ft X 85ft X 20ft Height

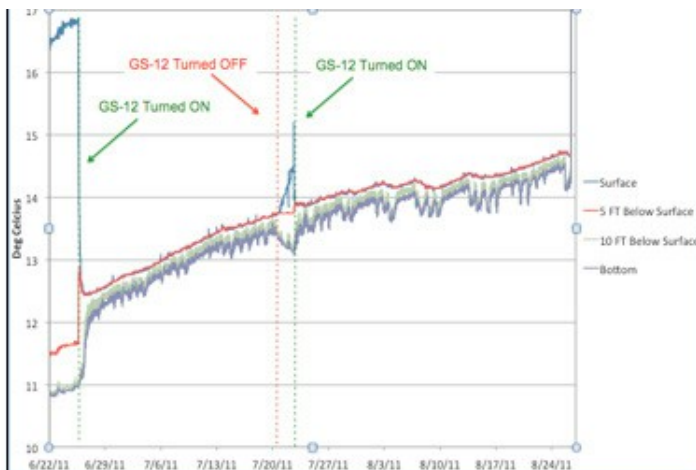


Partially Buried Tank Cylindrical, Partially Buried, Concrete 2.5 MG Tank, 115ft Dia X 20ft Height

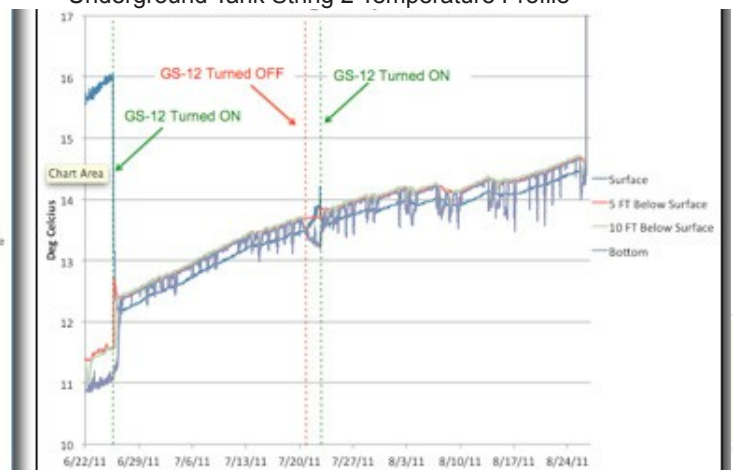


Test Data

Underground Tank String 1 Temperature Profile



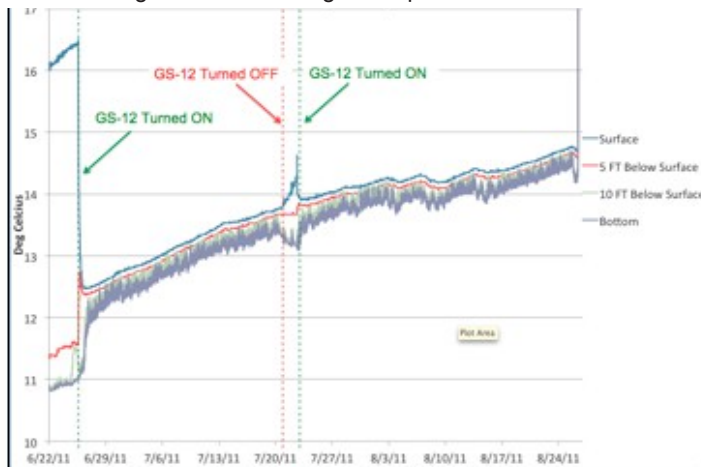
Underground Tank String 2 Temperature Profile



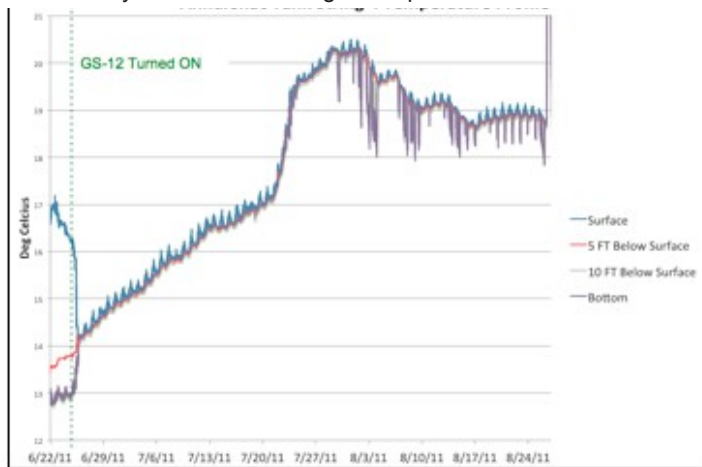
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Test Data Continued

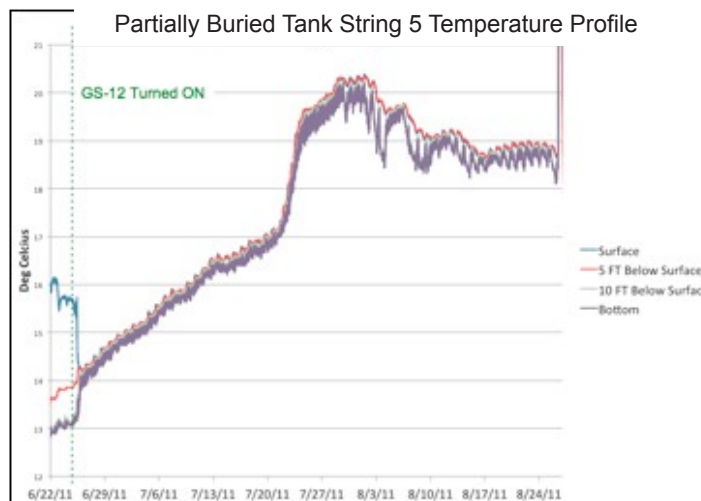
Underground Tank String 3 Temperature Profile



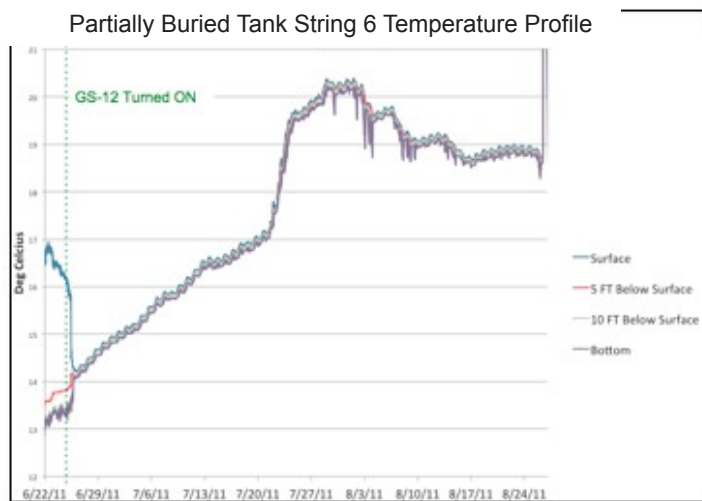
Partially Buried Tank String 4 Temperature Profile



Partially Buried Tank String 5 Temperature Profile



Partially Buried Tank String 6 Temperature Profile



Further notes on the observed data:

1. The surface temperature probe for the 2.5MG the underground tank String 2 appears to have an offset of several tenths of a degree below actual temperature.
2. The temperature rise in week 7/27/2011 the partially buried tank can be explained by a) a switch in source water from ground water to a combination of ground and surface water, and b) a heat wave occurring that week.

The comprehensive testing with multiple temperature probes clearly demonstrated the rapidity and completeness of mixing with the GS-12. With thermal stratification, and associated short-circuiting and inconsistent water age no longer a management issue, water quality is now both improved and more consistent. The town is very pleased with the performance and water quality benefits the GS-12 mixers have provided in each of their 2.5 MG potable water tanks.

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