



## CUP 2 HydroFLOW Water Conditioning System Program Analysis



Kaiser Permanente Vallejo Medical Center  
Vallejo, CA

Analysis Period: July 2016 - July 2017

specializing in air and water safety



## **CUP 2 HydroFlow Water Conditioning System Program Analysis**

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some type of scale inhibitor. Although the reduction of the calcium in the condenser water due to the HydroFLOW system has greatly reduced the LSI, it is still within a condition that could leave to scale precipitation, especially in low flow, high heat flux areas. This should be monitored closely to ensure this is not occurring, (i.e. approach temperatures, kw/ton efficiency calculations, boroscope inspections or the chiller condenser tubes).

#### 4.6 Corrosion Coupon Analysis

##### Corrosion Coupon Monitoring

Prior to this study, corrosion rates were not monitored using a corrosion coupon rack assembly. Precept Environmental utilized an existing corrosion coupon rack assembly to insert coupons made of mild steel, and copper.

##### Condenser Water Corrosion Coupon Results

Kaiser Vallejo CUP 2 - Copper Corrosion Coupon Analysis			
System	Condenser Water		
Specimen Number	A39924		
Metal Type	Copper		
Initial Weight (g)	11.8825		
Final Weight (g)	11.8794		
Weight Loss (g)	0.0031		
Installation Date	7/11/16		
Removal Date	11/22/16		
Days of Exposure	134		
Corrosion Rate (mpy)	0.02		
		Type of Corrosion	General
		Status	Excellent

Kaiser Vallejo CUP 2 - Mild Steel Corrosion Coupon Analysis			
System	Condenser Water		
Specimen Number	D41499		
Metal Type	Mild Steel		
Initial Weight (g)	10.8164		
Final Weight (g)	10.7783		
Weight Loss (g)	0.0381		
Installation Date	7/11/16		
Removal Date	11/22/16		
Days of Exposure	134		
Corrosion Rate (mpy)	0.24		
		Type of Corrosion	General
		Status	Excellent

### Comments on Corrosion Coupon Monitoring

In general, during this study the corrosion rates observed for copper and mild steel within the condenser water system were considered to be "excellent" by industry standards. Given the LSI calculations from Section 4.4, it is expected that the corrosion rates are acceptable, as the chemistry of the water is not that of a corrosive condition.

### **4.7 Aerobic and Anaerobic Bacteria**

As shown below, aerobic bacteria levels in the condenser water were considered acceptable for all sampling done during this study, including the baseline sample collected prior to the changes in water treatment. The anaerobic bacteria levels were also acceptable before and during the implementation of the HydroFLOW system.

Kaiser Vallejo CUP 2

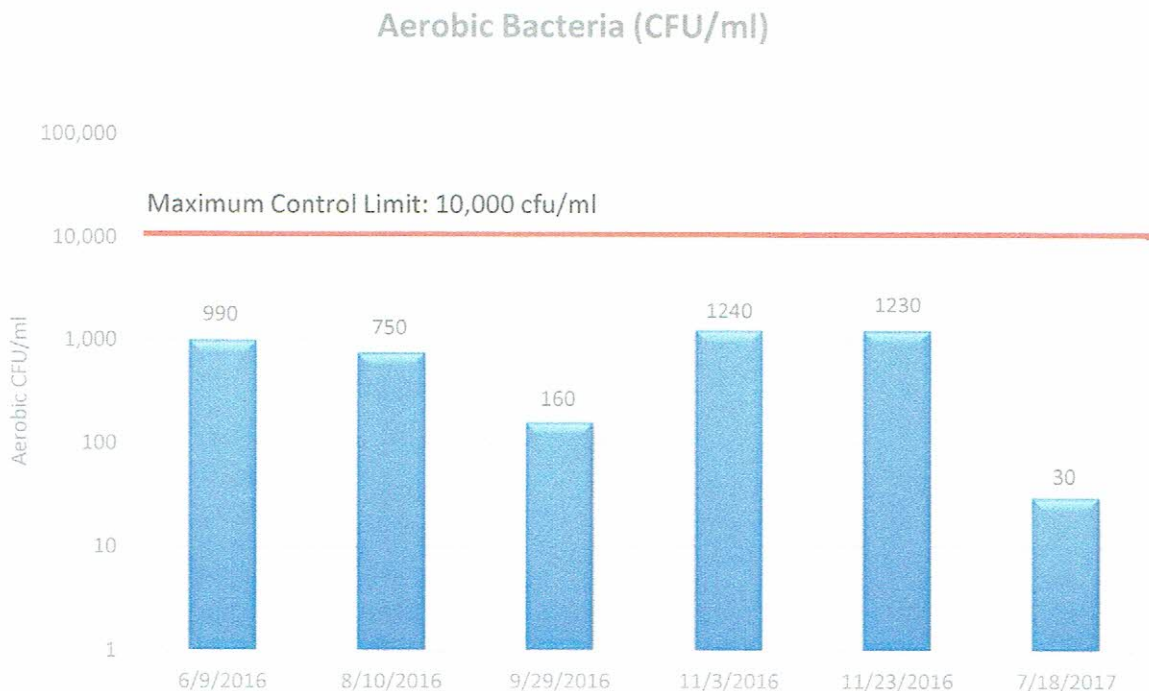
Project ID: KPV WTP Analysis

Sampled by: Jessica Bradbury, Precept

Sample Dates: 6/9/16, 8/10/16, 9/29/16, 11/3/16,  
11/22/16, 7/18/17

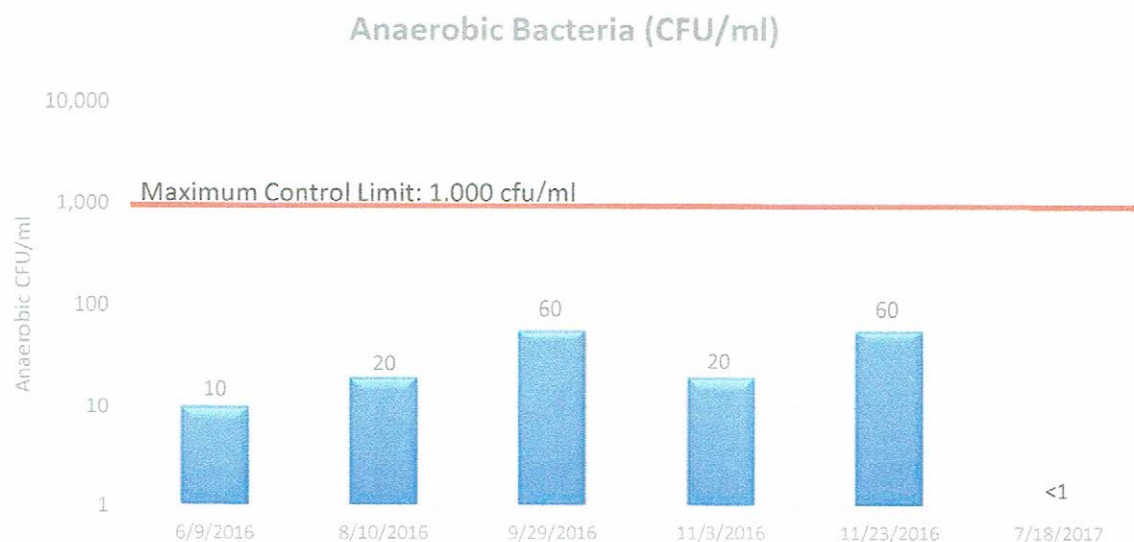
- Method References: SM9215 for total aerobic bacteria; COM ED.4 CH.6 for anaerobic bacteria.
- If detected, counts are provided for total aerobic and anaerobic bacteria species.

### **Condenser Water Aerobic Bacteria Results by Date (Goal is <10,000 cfu/ml)**





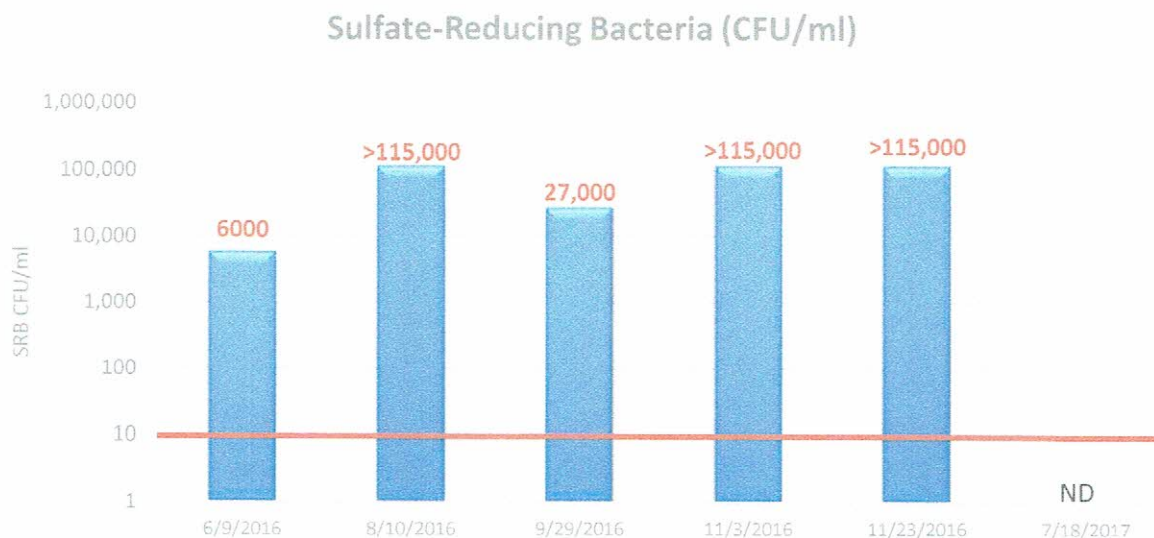
## Condenser Water Anaerobic Bacteria Results by Date (Goal is <1,000 cfu/ml)



### 4.8 Sulfate-Reducing and Iron-Reducing Bacteria

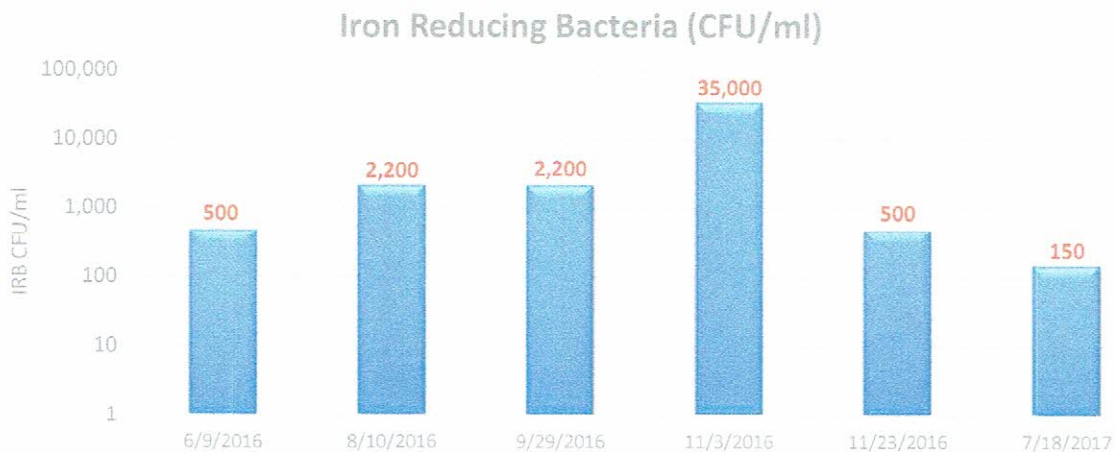
The results below show that condenser water has tested for unacceptable levels of sulfate reducing bacteria on all but one date sampled.

## Condenser Water Sulfate-Reducing Bacteria by Date



The results below show that condenser water showed acceptable levels of iron reducing bacteria after the November 3<sup>rd</sup> sampling date.

#### Condenser Water Iron Reducing Bacteria by Date



#### Comments on Sulfate-Reducing Bacteria and Iron-Reducing Bacteria

There has been a high level of Sulfate-Reducing Bacteria in the condenser water system. Sulfate-Reducing Bacteria (SRB) are typically found under deposits or foulants that collect on metal surfaces, or in areas where there is low flow (such as offline chiller tubes). These bacteria can create very corrosive condition because the anaerobic environment in which they live produces hydrogen sulfide and ferrous sulfide, which together form a malodorous (smelly) black slime. Under this slime, aggressive under-deposit corrosion will occur that can cause metallurgical failures.

Iron-Reducing Bacteria were also found at high levels while analyzed during the HydroFLOW trial. While Iron-Reducing bacteria have been associated with microbial induced corrosion (MIC) in some research, other studies have shown that IRBs can actually inhibit corrosion of mild steel surfaces in certain cases. Sulfate-reducing bacteria are typically the more aggressive of these two types of bacteria that can cause MIC.

Based on the first 6 months of the analysis, it appears that the HydroFLOW did NOT destroy neither Sulfate-Reducing or Iron-Reducing Bacteria. Further analysis should be conducted to monitor these levels to ensure that their presence does not lead to microbial Induced corrosion cells throughout the low flow areas of the condenser water system (cooling tower basins, offline chillers, offline recirculation pumps).