

## **Statement of Work**

### **Chemical Treatment Program Monitoring**

#### **I. Scope**

The contractor shall provide services for monitoring the chemical treatment program at NASA/Goddard Space Flight Center. The Contractor shall furnish all labor and materials for the services covered by this contract. The Contractor shall regularly conduct water sampling and analysis, inspect chemical treatment equipment, review logs and service reports, synthesize findings into a report evaluating problem areas and recommending specific corrective action, and meet with all involved parties (the government and the chemical treatment contractor(s)) to discuss the state of the systems. The Contractor shall also carry out inspections of open equipment, and provide expertise for rectifying deficiencies or improving the quality of the chemical treatment program.

The water treatment program at GSFC, which the Contractor shall monitor, includes treatment of chillers, cooling towers, boilers, distribution systems, local closed heating/cooling loops, and auxiliary equipment.

#### **II. Requirements**

- a. This contract covers sampling, testing, analysis, evaluation and recommendations for the following:
  - i. The boiler plant chemical treatment program.
  - ii. The Building 24 and 31 chiller plants chemical treatment program.
  - iii. The site closed loops, testing three systems (from approximately 50) randomly selected by the Government per visit.
- b. The Contractor shall conduct periodic monitoring (zero to four times per year) for the above systems, following the requirements defined in Section III, Scope of Work, each to be followed by a summary meeting with the Government, the plant supervisors, and the chemical treatment contractor(s) to discuss findings. The Contractor shall provide six paper copies and one electronic copy of a summary report at each meeting showing all test results, discussion of all program deficiencies, progress in improving the programs, and recommendations for action. The Contractor shall provide the test results to the government in electronic spreadsheet format.

**Statement of Work**  
**Chemical Treatment Program Monitoring**

- c. The Contractor shall conduct inspections of chillers (zero to ten per year, selected by the Government) when they are opened up for annual cleaning. The inspection shall include direct visual inspection, borescope pictures, and analysis of wash water and any significant deposits. The Contractor shall prepare a report summarizing the findings, and discuss them at or before the next summary meeting.
- d. The Contractor shall conduct inspections of boilers (zero to five per year, selected by the government) when they are opened up for annual cleaning and permit inspection. The inspection shall include direct visual inspection, borescope pictures, and deposit analysis of any significant deposits. The Contractor shall prepare a report summarizing the findings, and discuss them at or before the next summary meeting.
- e. Contractor personnel shall sign in at the main entrance upon arrival to Building 24 or Building 31 and notify the plant supervisor or Government of their presence and which work is to be performed.
- f. The Contractor shall own and regularly operate, or contract with, laboratory facilities capable of performing a complete range of analytical work to assist with monitoring, control, and troubleshooting of the facilities water systems, including the parameters listed in Section III, Scope of Work.
- g. Contractor shall retain samples for a minimum of 3 months, with the ability to rework samples at no additional cost if results are questioned by the Government.

**III. Scope of Work**

("Full Standard Analysis" is defined for each parameter in the below table:

**Water Sources**

1.	Building 24 Well	Full Standard Analysis
2.	Building 31 Well	Full Standard Analysis
3.	City Water	Full Standard Analysis

**Boiler Plant System**

4.	Water to softener	Full Standard Analysis
5.	Softener effluent #1	Full Standard Analysis

**Statement of Work**  
**Chemical Treatment Program Monitoring**

6.	Softener effluent #2	Full Standard Analysis
7.	Softener effluent #3	Full Standard Analysis
8.	Combined Softener effluent	Full Standard Analysis
9.	North Condensate	Full Standard Analysis
10.	West Condensate	Full Standard Analysis
11.	South Condensate	Full Standard Analysis
12.	Condensate Tank	Full Standard Analysis
13.	Bag filter effluent / polisher influent	Full Standard Analysis, Particle Analysis
14.	Polisher #1 outlet	Full Standard Analysis, Particle Analysis
15.	Polisher #2 outlet	Full Standard Analysis, Particle Analysis
16.	Deaerator (on line)	Full Standard Analysis
17.	Feedwater	Full Standard Analysis
18.	Boiler 1	Full Standard Analysis
19.	Boiler 2	Full Standard Analysis
20.	Boiler 3	Full Standard Analysis
21.	Boiler 4	Full Standard Analysis
22.	Boiler 5	Full Standard Analysis
23.	Steam Quality Sample	Full Standard Analysis
24.	Blowdown Sump	Full Standard Analysis
25.	Building x Condensate Tank <sup>1</sup>	Full Standard Analysis
26.	Building y Condensate Tank <sup>1</sup>	Full Standard Analysis
27.	Building z Condensate Tank <sup>1</sup>	Full Standard Analysis

**Cooling Systems**

28.	Building 24 Cooling Tower A	Full Standard Analysis & Biological
29.	Building 24 Cooling Tower B	Full Standard Analysis & Biological

**Statement of Work  
Chemical Treatment Program Monitoring**

30.	Building 31 Cooling Tower 1	Full Standard Analysis & Biological
31.	Building 31 Cooling Tower 2	Full Standard Analysis & Biological
32.	Building 31 Cooling Tower 3	Full Standard Analysis & Biological
33.	Building 31 Cooling Tower 4	Full Standard Analysis & Biological
34.	Building 31 Cooling Tower Blowdown	Full Standard Analysis

**Closed System Sampling**

35.	East Chilled Water System	Full Standard Analysis & Biological
36.	West Chilled Water System	Full Standard Analysis & Biological
37.	Hot Water System x <sup>1</sup>	Full Standard Analysis
38.	Hot Water System y <sup>1</sup>	Full Standard Analysis
39.	Hot Water System z <sup>1</sup>	Full Standard Analysis

Note 1. Systems to be selected by Government at time of sampling.

**Definition of Full Standard Analysis**

Lab Test	City/Well Water	Cooling Tower	Chilled Water	Closed Loop/Hot Loop	Softened Water	Boiler Feedwater	Condensate Polishers	Steam Boiler; Blowdown Sump	Steam Condensate
pH	✓	✓	✓	✓	✓	✓	✓	✓	✓
Conductivity	✓	✓	✓	✓	✓	✓	✓	✓	✓
Turbidity	✓	✓	✓	✓	✓	✓	✓	✓	✓
Free Halogen		✓							
Calcium	✓	✓	✓	✓	✓	✓	✓	✓	✓
Magnesium	✓	✓	✓	✓	✓	✓	✓	✓	✓
Molybdenum		✓	✓	✓		✓	✓	✓	✓
Zinc	✓	✓	✓	✓	✓	✓	✓	✓	✓
Total Iron	✓	✓	✓	✓	✓	✓	✓	✓	✓
Manganese	✓	✓	✓	✓	✓	✓	✓	✓	✓
Total Copper (ppb)	✓	✓	✓	✓	✓	✓	✓	✓	✓
Aluminum	✓	✓	✓	✓	✓	✓	✓	✓	✓

## Statement of Work

### Chemical Treatment Program Monitoring

Lab Test	City/Well Water	Cooling Tower	Chilled Water	Closed Loop/Hot Loop	Softened Water	Boiler Feedwater	Condensate Polishers	Steam Boiler, Blowdown Sump	Steam Condensate
Silica	✓	✓	✓	✓	✓	✓	✓	✓	✓
Nickel	✓	✓	✓	✓	✓	✓	✓	✓	✓
Vanadium	✓	✓	✓	✓	✓	✓	✓	✓	✓
Sodium	✓	✓	✓	✓	✓	✓	✓	✓	✓
Potassium	✓	✓	✓	✓	✓	✓	✓	✓	✓
Total Phosphate	✓	✓	✓	✓	✓	✓	✓	✓	✓
AEC		✓							
Ortho Phosphate	✓	✓	✓	✓	✓	✓	✓	✓	✓
Phosphonate		✓							
Ammonia			✓	✓					
M-Alkalinity	✓	✓			✓	✓		✓	
P-Alkalinity						✓		✓	
OH Alkalinities						✓		✓	
Sulfite - Field						✓		✓	
Sulfite - Lab						✓		✓	
Sulfite						✓		✓	
Free Chelant								✓	
Total Chelant								✓	
Chloride	✓	✓	✓	✓	✓	✓	✓	✓	✓
Nitrite			✓	✓					
Bromide	✓	✓	✓	✓	✓	✓	✓	✓	✓
Nitrate	✓	✓	✓	✓	✓	✓	✓	✓	✓
IC-ORTHO	✓	✓	✓	✓	✓	✓	✓	✓	✓
Sulfate	✓	✓	✓	✓	✓	✓	✓	✓	✓
IC Ammonia			✓	✓					
Morpholine						✓			✓
DEAE						✓			✓
Cyclohexylamine						✓			✓
Total Azole		✓	✓	✓					✓
Benzotriazole (BZT)		✓	✓	✓					
Tolytriazole (TTA)		✓	✓	✓					
Mercaptobenzotriazole (MBT)		✓	✓	✓					
Halogen Resistant Azole		✓	✓	✓					
Chlorite			✓						
Bromate			✓						
Chlorate			✓						
Glycol									
IC Propylene Glycol									
IC Ethylene Glycol									
HEDP		✓							

## Statement of Work Chemical Treatment Program Monitoring

Lab Test	City/Well Water	Cooling Tower	Chilled Water	Closed Loop/Hot Loop	Softened Water	Boiler Feedwater	Condensate Polishers	Steam Boiler, Blowdown Sump	Steam Condensate
PBTC		✓							
PMA		✓							
AMP		✓							
PSO		✓							
IC Mass Spec HPA		✓							
Aerobic Bacteria		✓	✓						
Primary Organism		✓	✓						
Secondary Organism		✓	✓						
Boiler Polymer								✓	

### IV. Facility Information

GSFC has one Steam Plant and two Chiller Plants. All three plants operate 24/7/365, and have operators on duty at all times. They supply steam and chilled water to GSFC, more than 3 million square feet of offices, shops, labs, communications centers, and clean rooms. Because of the critical work done by GSFC personnel, reliability is the most important consideration for central plant configuration and operation.

#### a. Steam Plant

The Steam Plant, located in Building 24, includes five package boilers, "D"-type Nebraska Model NS.C/S.46 (Boilers 024-BLR001, 002, 004, and 005) and Model NS.C/S.43 (Boiler 024-BLR003). Each boiler is rated to produce 40,000 lb/hr steam at 100 psig.

The Steam Plant produces 100-psig steam for distribution to 34 campus buildings, where the pressure is reduced to provide steam for process heating, space conditioning, and direct humidification. Condensate is collected in building vented condensate tanks, and returned (pumped and gravity) to the main plant condensate tanks, 024-CRT101 and 024-CRT102.

Makeup to the system is well water, with city water provided by WSSC as backup. Water from the well has significantly less carbonates and hardness than city water. Well water is treated with caustic to raise the pH and provide OH alkalinity. Makeup water is pre-treated with a three-tank resin ion exchange water softener, 024-WAS001, 002 & 003, with capacity of 80 gpm continuous flow (per tank), and 90 gpm peak.

## Statement of Work Chemical Treatment Program Monitoring

Makeup water is fed to maintain level in the condensate tank. Condensate mixed with makeup water is pumped into one of two deaerators, 024-DAT001 and 002, where it is scrubbed with 7-psig steam and heated to saturation. Sulfite is continuously fed to the on-line deaerator tank.

Three feedwater pumps, 024-FWP001, 002 and 003, each rated for 280 gpm at 400 ft TDH, take suction from the deaerator tanks and supply feedwater to the boilers through two resin exchange feedwater polishers, 024-WAS004 and 005.

Feedwater is treated with neutralizing amines and Nalco NexGuard 22310 polymer at a common point before the boilers.

Boiler blowdown is cooled to 130F and discharged through storm drains to a pond on the west campus, which drains into a local creek. The outfall of the pond is monitored under a NPDES permit. The most pertinent limits at this outfall are copper, pH, and chlorine.

### b. West Chiller Plant

The West Chiller Plant is located in Building 24 and contains six electric centrifugal chillers with 14,000 tons of cooling capacity.

<b>West Chiller Plant</b>		
<b>North Chiller Room</b>		
Chiller 024-REU003	1500 Tons	York YK-MAXE
Chiller 024-RBU004	1500 tons	York YK-MAXE
Cooling Tower A	3000 Tons	
<b>South Chiller Room</b>		
Chiller 024-REU005	3000 Tons	York Turbomaster OM3000
Chiller 024-REU006	3000 Tons	York Turbomaster OM3000
Chiller 024-REU007	2000 Tons	York Turbomaster OM2000
Chiller 024-REU008	3000 Tons	York Turbomaster OM3000
Cooling Tower B	11,000 Tons	

Two plate and frame heat exchangers (024-HEX101 and 102) are installed in the North Chiller Room, for winter free cooling.

Cooling Towers A and B primarily use well water for makeup, with WSSC water as backup. Blowdown from the towers is directed through storm drains to the same pond on the west campus, which drains into a local creek. The outfall of the pond is monitored under a NPDES permit. The most pertinent limits at this outfall are copper, pH, and chlorine.

## Statement of Work Chemical Treatment Program Monitoring

### c. East Chiller Plant

The East Chiller Plant is located in Building 31, and includes four 1200-ton York centrifugal chillers. Each chiller is connected to a cooling tower. During the winter, free cooling is supplied by four plate and frame heat exchangers, one per chiller system.

<b>East Chiller Plant</b>		
Chilled Water Volume	144,000 Gallons	
Chilled Water Makeup	Minimal	
Condenser Water Volume	10,000 Gallons	Each chiller system
2003 Cooling Tower Makeup	10,760,800Gallons	
Chiller 031-REU101	1200 Tons	York YK Codepak
Chiller 031-REU201	1200 Tons	York YK Codepak
Chiller 031-REU301	1200 Tons	York YK Codepak
Chiller 031-REU401	1200 Tons	York YK Codepak
Cooling Tower 031-CWT100, 200, 300, and 400.	1200 Tons	

The cooling towers normally use well water for makeup, with city water as backup. When using well water, blowdown from the towers is filtered and then directed through storm drains to a pond on the east campus, which drains into a local creek. The outfall of the pond is monitored under a NPDES permit. The most pertinent limits at this outfall are copper, pH, and chlorine.