

System Locations and Services Required

The Contractor must provide water treatment chemicals and services to the following locations:

A. McCormick Place **Complex Systems**

1. Closed Systems (2 tests per year on each system) – 21qty
 - North Building: Heating Water – 1qty
 - South Building: Heating Water – 1qty
 - Lakeside Center: Heating Water – 16qty
 - North Building and Lakeside Center: Chilled Water – 1qty
 - West Building: Heating Water – 1qty
 - West Building: Chilled Water – 1qty
 - Wintrust Arena – Heating Water – 1qty
 - Wintrust Arena – Chilled Water – 1qty

TypesofTest

- “P” Alkalinity
- Molybdate as MO4
- TDS (Total Dissolved Solids)
- Specific Gravity

2. Decorative Fountains (testing April through October – bi-monthly on 4 fountains; November through March – monthly on 2 fountains) – 4qty

TypesofTest

- Bromine
- Bacteria count (Dip Slide Test)

3. Boilers, plus Condensate System (bi-monthly testing on each) – 3qty a) West Building (125# operating pressure)

TypesofTest

- Sulfite level
- OH alkalinity
- Condensate pH

4. Cooling Towers (weekly testing on each) – 12qty cells: all 12 cells are winterized

TypesofTest

- Total hardness
- Bromine
- TDS

Laboratory Testing

Lab analysis shall determine the amount of all cations, anions and compounds in the sample. Lab analysis shall determine the alkalinity, TDS, hardness, pH, specific conductance, specific gravity and insoluble suspended solids. Microbiological activity shall be tested on an as needed basis, a minimum of once per year on all closed systems.

- North Building (Heating Water) 2 comprehensive laboratory analyses per year
- South Building (Heating Water) 2 comprehensive laboratory analyses per year
- Lakeside Center (Heating Water) 1 comprehensive laboratory analysis per year
- North Building and Lakeside Center (Chilled Water) 2 comprehensive laboratory analyses per year
- Laboratory analysis on decorative fountains shall be performed on an as needed basis

- West Building (Heating Water) 2 comprehensive laboratory analyses per year
- West Building (Chilled Water) 2 comprehensive laboratory analyses per year

- *Corrosion Coupon Testing*: System 1a, b, d, e, f and System 3 and 4 must receive quarterly corrosion coupon testing.

- *Annual Dissolved Oxygen Analysis for Deaerator*: (West Building Condensate)

- *Annual Softener Elution Study*: (West Building Boilers)

- *Annual Reverse Osmosis Output Analysis*: (West Building Boilers)

Legionella testing

The Contractor must provide Legionella testing for Cooling Towers and Decorative Fountains following

ISO 11731:1998 STANDARD to the following locations:

1. Cooling Towers (quarterly testing on each) – 12qty cells: all 12 cells are winterized
2. Decorative Fountains (testing every six weeks April through October –on 4 fountains; November through March – on 2 inside fountains) – 4qty

B. Energy Center Systems

1. Closed Systems (Quarterly analysis to include corrosion analysis, differential microbio analysis glycol concentration, concentration full mineral analysis, corrosion products: iron, copper, and/or other metals) – 8qty
 - Volume of North East loop: 225,000 Gal, 20% ethylene glycol, operating temperature

42°F

- Volume of South chilled loop: 100,000 Gal, 20% ethylene glycol, operating temperature 42°F
- Hyatt system volume: Unknown, 25% ethylene glycol, operating temperature for cooling and heating respectively 42, 160°F
- Corporate office Volume: Approximately 15,000 Gal, 25% ethylene glycol, operating temperature for cooling and heating respectively 42, 160°F
- Lakeside Technology Center: Approximately 20,000 Gal, 30% ethylene glycol, operating temperature for cooling and heating respectively 42, 160°F
- Make up to closed loops: very minimal
- Side stream Filtration
- Distribution system 1.75 Mile pipe 14"-30" diameter

Types of Test

- TDS
 - pH
 - Dissolved Iron
 - Scale/Corrosion Control agent
 - Bacteria Level
 - Specific Gravity
2. Cooling Tower System (weekly tests) – 1qty
- Evaporative condensers Makeup water (2005): 13,410 K Gal
 - Operating Temperature: 180°F
 - Water holding: 2,090 Gal, 1,670 GPM
 - Number of evaporative condensers: 6 units, galvanized steel
 - Capacity of each evaporative condenser at design conditions: 15,333MNH, R-717, 92/74 Deg F.
 - Chillers Capacity: 3 screw Ammonia chillers 2,200 nominal tons each
 - Total tons produced in 2005: 12,205.9 Mton-hr
 - Thermal Energy storage: 124,000 Ton-hr, 8,500,000 Gal, 92.5% water, 7.5% solution
Sodium Nitrite-Sodium Nitrate, Ph 9.35

Types of Tests

- TDS
 - Molybdate as MO4
 - Bacteria Level
 - Calcium Hardness (mineral balance verification)
3. Boilers and Condensate System (weekly tests) – 3qty
- One Heat recovery steam generator: O-style water tube with economizer, 80,000 lbs/hr@150 psig
 - Two package Boilers: D-style water tube with economizer, 80,000 lbs/hr@150psig
 - Feed Water Deaerator: Horizontal Dish head, 8,300 gal (62,200 lbs)
 - Total Steam generation in 2005: 178,000 MIbs
 - Feed water makeup: 670 Kgal
 - Condensate Line: 0.90 Miles, 4”- 6” Diameter
 - Steam Line: 0.85 Miles, 6” - 14” Diameter

Types of Test

- Conductivity
 - Sulfite
 - Condensate Return pH
 - Feedwater Hardness
 - Feedwater Dissolved Iron
 - Condensate Dissolved Iron
 - Scale/Corrosion Control Agent
 - OH Alkalinity
4. Brine System (Quarterly testing to be performed on Brine system) – 4 qty

Laboratory Testing

Lab analysis shall determine the amount of all cations, anions and compounds in the sample. Lab analysis shall determine the alkalinity, TDS, hardness, pH, specific conductance, specific gravity and insoluble suspended solids. Microbiological activity shall be tested on an as needed basis.

□ Laboratory testing shall be conducted twice a year on all systems.

A representative of the contractor is to participate in all scheduled inspections of the treated equipment for the Energy Center. The results of inspection must be submitted electronically.

Corrosion Coupon Testing: shall be conducted twice a year on all systems. *Annual Dissolved Oxygen Analysis for Deaerator:* (Energy Center Condensate) *Annual Softener Elution Study:* (Energy Center Boilers) *Annual Boroscope Inspection:*

(Energy Center Boilers)

5. **Energy Center Product Specifications**

The steam boiler scale/corrosion inhibitor must contain acrylate polymers, dispersants, scale inhibitors, and **cannot contain chelants**. The steam boiler oxygen scavenger must contain a cobalt catalyst. Condensate treatment must be a blend of cyclohexylamine, morpholine and DEAE.

The cooling tower scale/corrosion inhibitor must contain no heavy metals (e.g. molybdate, chromate, zinc, etc.) It will contain dispersants, and tolytriazole. The cooling tower biocide program will consist of two biocides, an oxidizing and a non-oxidizing type. Chlorine, bleach, and hydrogen peroxide are not acceptable. Due to the alkaline tendencies of the cooling tower water the oxidizing biocide must be a bromine product. The non-oxidizing biocide can be isothiazoline, gluteraldehyde, or DBNPA as a 98% active solid.

The bromine will be shock fed daily to achieve a 1.0 – 2.0 PPM residual one hour after the automated feed. The non-oxidizer will be fed at a dosage consistent with label instruction. In either case the final determination as to the biocide program dosages will be based upon bacteria level testing.

The closed loop cold water system scale/corrosion inhibitor will be a molybdate-based product and will contain no silica. Closed loop cooling systems must be maintained at a dosage capable of achieving the stated corrosion rates. Glycol percentage will be maintained at 20% by volume. The closed loop systems will be maintained at a pH between 8.5 to 9.0.

The closed loop hot water system scale/corrosion inhibitor will be a molybdate-based product and will contain no silica. Closed loop hot water systems must be maintained at a dosage capable of achieving the stated corrosion rates.

6. ServiceCallRequirementsforALLSites/Systems

Service calls include, but are not limited to the following:

- an on-site chemical analysis on all water systems;
- making adjustments as indicated by analytical results;
- trouble shooting chemical pumps, distribution lines, water meters, by-pass feeders, filter vessels;
- changing chemical drums, inspecting operational equipment and calibrating field testing apparatus;
- recording water and chemical consumption information;
- submitting written reports on all findings, adjustments and discussing repair procedures for each site to McCormick Place | SMG's Chief Engineer or its designate (please include a sample analysis report with Proposal);

- review of the water testing logs with McCormick Place | SMG's Chief Engineer or its designate, noting and identifying reasons for out-of-range parameters, trends and prescribing corrective procedures;
- submitting samples to laboratories per requirements;
- installing and removing corrosion coupons;
- inventorying chemicals and reagents at each location as outlined herein.

GROUP A - Water Treatment Chemical Formulas

The following requirements must be met for all formulations supplied by Contractor. Chemical pricing is based on the treatment of a unit of water (1000 gallons). The annual cost will be based upon a range of estimated water use.

- All pricing for chemicals, testing equipment, supplies and reagents is based on a full delivered price. McCormick Place | SMG shall not pay deposits for any drums or containers.
- All chemicals must be deliverable in the sizes listed; all containers must be made of polyethylene.
- All biocides must be pre-registered with the EPA. The exact EPA number must be submitted with the Proposal.
- A complete SDS shall be provided for each chemical offered.
- Proposer shall provide a formulary for each formula offered.
- Acids are not an approved alternate for scale inhibition for cooling tower treatment.
- A sample of any compound offered may be requested for analysis by an independent laboratory.

<u>FORMULA 1: Non-Oxidizing Biocide #1 (all Cooling Towers and Fountains)</u>
Typical Properties:
□ Poly (oxyethelene-dimethylimino) ethylene-(dimethylimino) ethylene dichloride 15%
□ Density: 8.67 lbs/gal
□ S.G. (Specific Gravity)=1.03523
□ Solubility - Complete
Packaging:
□ 5 Gallon polyethylene pail
□ 30 Gallon polyethylene drum
<u>FORMULA 2: Non-Oxidizing Biocide #2 (all Cooling Towers)</u>
Typical Properties:
□ 5-chloro-2-methyl-4-isothiazolin-3-one 1.15%, 2-Methyl-4-isothiazolin-3-one .35%
□ Density: 8.50 lbs/gal

☐ S.G.=1.032
☐ Solubility - Complete
Packaging:
☐ 5 Gallon polyethylene pail
☐ 30 Gallon polyethylene drum
<u>FORMULA 3: Oxidizing Biocide #1 (East and South Building Fountains)</u>
Typical Properties:
☐ Liquid: stabilized bromine (Bromine chloride 11%), available Br ₂ 15%, available Cl ₂ 7%, sodium hydroxide 10%
☐ Density: 10.9 – 11.4 lbs/gal
☐ S.G.=1.224
Packaging:
☐ Bulk delivery: as requested
☐ 55 Gallon polyethylene drum
☐ 30 Gallon polyethylene drum
☐ 5 Gallon polyethylene pail
<u>FORMULA 4: Oxidizing Biocide #2 (West Building)</u>

Typical Properties:
☐ Liquid: stabilized bromine, sodium hypochlorite 10.70%, sodium bromide 14.77%, sodium hydroxide
☐ Density: 12-12.2 lbs/gal
☐ S.G.=1.47 – 1.50
Packaging:
☐ 55 Gallon polyethylene drum
☐ 30 Gallon polyethylene drum
☐ 5 Gallon polyethylene pail
<u>FORMULA 5: Oxidizing Biocide #4 (Energy Center Fountains)</u>
Typical Properties:
☐ Tablets: 1-Bromo-3-Chloro-5, 5-Dimethylhydantoin 92.5%
Packaging:
☐ 50 lb pails
<u>FORMULA 6: Cooling Tower Corrosion Inhibitor #2 (West Building)</u>
Typical Properties:
☐ Liquid: polymer stabilized phosphonate, sodium molydate 2.1%, tolytriazole, two polymeric dispersants, potassium hydroxide 11.7%
☐ Density: 10.4 lbs/gal
☐ S.G.=1.242

Packaging:
☐ Bulk delivery: as requested
☐ 5 Gallon polyethylene pail
☐ 30 Gallon polyethylene drum
☐ 55 Gallon polyethylene drum
<u>FORMULA 7: Cooling Tower Corrosion Inhibitor #3 (Energy Center)</u>
Typical Properties:
☐ HEDP, PMA, tolytriazole and dispersant 29% active
Packaging:
☐ Bulk delivery
☐ 5 Gallon polyethylene pail
☐ 30 Gallon polyethylene drum
☐ 55 Gallon polyethylene drum

FORMULA 8: High Pressure Boiler Treatment #1 (West Building)

Typical Properties:

- ☐ All in one liquid: sulfite, phosphonate, synthetic polymers, antifoam, cobalt catalyst and **no**
- ☐ Density: 10.5 lbs/gal
- ☐ S.G.=1.260

Packaging:

- ☐ 30 Gallon polyethylene drum
- ☐ 55 Gallon polyethylene drum

FORMULA 9: High Pressure Boiler treatment #2 (Energy Center)

Typical Properties:

- ☐ Liquid: sodium hexametaphosphate 5%, sulfite, antifoam, acrylate polymers and **no**

Packaging:

- ☐ 30 Gallon polyethylene drum
- ☐ 55 Gallon polyethylene drum

FORMULA 10: Boiler Oxygen Scavenger (Energy Center)

Typical Properties:

- ☐ 25% sodium bi-sulfite neutralized to a minimum pH of 8.0, cobalt catalyst

Packaging:

- ☐ 30 Gallon polyethylene drum
- ☐ 55 Gallon polyethylene drum

FORMULA 11: Condensate Treatment #1 (West Building)

Typical Properties:

- ☐ Liquid: cyclohexamine 12% + morpholine 12% + Diethylaminoethanol(DEAE) 16%
- ☐ Density: 8.00 lbs/gal

Packaging:

- ☐ 5 Gallon polyethylene pail
- ☐ 30 Gallon polyethylene drum
- ☐ 55 Gallon polyethylene drum

FORMULA 12: Condensate Treatment #2 (Energy Center)

Typical Properties:

☐ Liquid: cyclohexylamine 13% + morpholine 13% + Diethylaminoethanol (DEAE) 13%

Packaging:

- ☐ Bulk delivery: as requested
- ☐ 5 Gallon polyethylene pail
- ☐ 30 Gallon polyethylene drum
- ☐ 55 Gallon polyethylene drum

FORMULA 13: Closed System Inhibitor #1 (West Building)

Typical Properties:

- ☐ Liquid: Sodium Nitrite (anhydrous) 15.0%, Sodium Tetraborate, sodium Hydroxide, polyphosphates, Tolytriazole, sodium silicate
- ☐ Density: 9.82 lbs/gal
- ☐ S.G.=1.177
- ☐ Solubility - Complete

Packaging:

- ☐ 5 Gallon polyethylene pail
- ☐ 30 Gallon polyethylene drum
- ☐ 55 Gallon polyethylene drum

FORMULA 14: Closed System Inhibitor #2 (East, North, South, Arena & Energy Center)

Typical Properties:

- ☐ Liquid: Sodium Molybdate Dihydrate 15.0%, Sodium Tetraborate, polymeric dispersant, Tolytriazole, surfactant
- ☐ Density: 8.95 lbs/gal
- ☐ S.G.=1.075

Packaging:

- ☐ 5 Gallon polyethylene pail
- ☐ 30 Gallon polyethylene drum
- ☐ 55 Gallon polyethylene drum

FORMULA 15: Closed System pH Buffer (all Closed Systems)

Typical Properties:

- ☐ Liquid: Potassium Hydroxide, Sodium Tetraborate 25%, Tolytriazole
- ☐ Density: 11.5 lbs/gal
- ☐ S.G.=1.376
- ☐ Solubility - Complete

Packaging:

- ☐ 5 Gallon polyethylene pail
- ☐ 30 Gallon polyethylene drum
- ☐ 55 Gallon polyethylene drum

FORMULA 16: Inhibited Glycol #1 (West Building)

Typical Properties:

- ☐ Liquid: 94.8% virgin, industrial grade ethylene glycol, diethylene glycol 0.5% maximum, sodium nitrite, tolytriazole, sodium tetraborate
- ☐ Density: 11.5 lbs/gal
- ☐ S.G.=1.108

Packaging:

- ☐ Bulk delivery: as requested
- ☐ 5 Gallon polyethylene pail
- ☐ 30 Gallon polyethylene drum
- ☐ 55 Gallon polyethylene drum

FORMULA 17: Inhibited Glycol #2 (East, North, South & Energy Center)

Typical Properties:

- ☐ Liquid: 94.8% virgin, industrial grade ethylene glycol, diethylene glycol 0.5% maximum, sodium molybdate, tolytriazole, sodium tetraborate
- ☐ Density: 11.5 lbs/gal
- ☐ S.G.=1.108

Packaging:

- Bulk delivery: as requested
- 5 Gallon polyethylene pail
- 30 Gallon polyethylene drum
- 55 Gallon polyethylene drum

FORMULA 18: Fountain Anti-Foam (East & South Fountains)

Typical Properties:

- ☐ Liquid: Diol Family Surfactant containing Dipropylene glycol & Tetramethyl-6-dodecyne-5, 8-
- ☐ S.G.=.99

Packaging:

- ☐ 1 quart polyethylene jug
- ☐ 1 gallon polyethylene jug
- ☐ 5 gallon polyethylene pail

FORMULA 19: Closed System Cleaner (All Buildings)

Typical Properties:

- ☐ Liquid: Potassium hydroxide, tetra-potassium pyrophosphate, sodium metasilicate, surfactants, chelating agents, wetting agents

- ☐ S.G.=1.216

Packaging:

- ☐ 5 Gallon polyethylene pail
- ☐ 30 Gallon polyethylene drum
- ☐ 55 Gallon polyethylene drum

<u>Group B - Testing Chemicals</u>
☐ Molybdenum Indicator Powder
☐ Can solution, dB
☐ Ferroion Indicator
☐ pH Buffer, 4.0
☐ pH Buffer, 7.0
☐ Conductivity Standard, 30 PPM
☐ Conductivity Standard, 300 PPM
☐ Phenolphthalein Indicator
☐ Sulfuric Acid Solution
☐ Total Alkalinity Indicator
☐ pH Indicator
☐ N/50 Sulfuric Acid
☐ DPD Free Chlorine Powder for 10ml sample
☐ Bromine Tabs
☐ Hardness Buffer Solution
☐ Hardness Indicator Power
☐ Hardness Titrating Reagent (N/50, EDTA)
☐ Potassium Iodide Crystals
☐ Starch Indicator Solution
☐ PAO Reagent Cartridge (w/40)
☐ Sani-Check B Dip Slides

Water Treatment Testing Equipment and Chemical Supplies – Group B & C

Contractor must furnish all supplies and equipment necessary to ensure that all systems are being properly operated within the established chemical control limits. The following is a representative listing of equipment and chemical supplies which have been used or are currently in use.

<u>Group B - Testing Equipment</u>
☐ Test tubes 10 ml, glass
☐ Spoon, 0.05g., plastic
☐ Distilled Water Ampoule
☐ Pipettes, 1.0 ml, w/20 mm screw cap
☐ Molybdenum Comparator (2-20 PPM MO)
☐ Sample tube, Calibrated 5 ml plastic
☐ 10ml Self- Leveling Burette Assembly
☐ Erlenmeyer Flask, 250ml
☐ Graduated Cylinder, 50 ml
☐ Casserole, 140 ml
☐ Plastic Stirring Rod
☐ Funnel
☐ Filter Paper #5, one box
☐ Digital Titrator and Red Delivery Tube
☐ Measuring dipper, 2GM (Plastic)

Group C - Sidestream Filter Cartridges
The filter cartridges to be provided are as follows:
☐ Filter rating: 10 micron
☐ Filtering media: continuous thread polypropylene
☐ Cartridge Core: tinned steel
☐ Inside diameter: nominal 1"
☐ Outside diameter: nominal 2¼"
☐ Maximum temperature: 200°F
☐ Length: various, 9¾", 10", 30" and 40"

Operational Parameters

1) MPEA requires the following operational parameters for McCormick Place systems:

SYSTEM	CORROSION RATES	ADDITIONA
Cooling Towers	Steel 1-2 mpy general , <3 mpy pitting Copper .1-.2 mpy general, <.15 mpy pitting	No visible algae growth in wet areas, < 10,000 CFU's limit of bacteria growth, 1.0-2.0 ppm residual one hour after oxidizing biocide dosage
South & East Fountains	No coupon stations	No visible algae growth in wet areas, < 1,000 CFU's limit of bacteria growth, 0.2-0.5 mg/L free bromine residual
Closed Systems	Steel <.5 mpy general , <3 mpy pitting Copper <.1 mpy general, <.15 mpy pitting	Soluble iron <.80 ppm, Soluble copper <.20 ppm, suspended solids <10 ppm, < 1,000 CFU's limit of bacteria growth; Glycol levels to be maintained at a minimum of 20% by volume
Boilers and Condensate System	Steel 1-2 mpy general , <3 mpy pitting Copper .1-.2 mpy general, <.15 mpy pitting	No calcium carbonate or other inorganic scale formation is allowed

2) MPEA requires the following operational parameters for its systems at the Energy Center:

Steam boiler make-up water quality is softened by Lake Michigan water.

Boiler water operating parameters:	
Sulfite	20 – 40 PPM
Total Hardness	<.1 PPM
"P"	300 – 700 PPM
"M"	800 PPM max
"OH"	200 PPM min
Phosphate	20 – 40 PPM

Iron	0.0 – 0.5 PPM
Condensate return:	
pH	7.8 – 8.2
Iron	0.1 – 0.5

Cooling tower operating parameters:	
Mmho's	1200 – 1350
O.P.	5 – 7 PPM
Ca	450 – 550 PPM
Bromine	1.0 – 2.0 one hour after feed
Aerobic	<10 x 3
Legionella	<10 CFU's
Tolytriazole	3PPM
Closed Loop parameters:	
Mo	80 – 100 PPM
pH	8.0 – 9.5
Iron	< 0.8 PPM
Copper	< 0.2 PPM
Tolytriazole	10 PPM or Greater
Bacteria	< 1,000 CFU's

Standard of Performance

All Services required must be performed with that degree of skill, care, and diligence normally shown by a professional performing work of comparable scope, purpose and magnitude in the Chicagoland area.

Intent

It is the intent of these specifications that the chemicals and technical services are provided by one company so that the responsibility will be assured.