



Palabora Asset Management Projects		Scope of Work	
Title:	Scope of Work for Underground section's permanent water treatment services for surface plants		
Division:	Underground		
Area:	Main Surface Fridge Plant, Head Gear Chiller Plant & Potable Water Booster Station		
Project No:	O.71382		
Designation:	Name:	Signature:	Date:
Project Leader:	R.P. Coetzee	Refer to page 8	Refer to page 8
Client:	F. Gono / S. Jenkins T.P. Mawela	Refer to page 8	Refer to page 8

1. General

Both the surface fridge plant and the headgear chiller plants have been operating without water treatment since 2015 resulting in substantial scale build-up and corrosion on the condenser coils, drift eliminators and induced draft fans. The scale build-up has caused the efficiencies of the chiller plants to decay from a COP of 5.3 to 3.4 resulting in unnecessary energy costs. Further to this, inefficient chiller operation results in cooling capacity constraints during the warmer summer months that affect the underground supply-air temperature as well as the winder operations, negatively.

Re-instatement of the water treatment program is therefore not only critical for cost control and operational purposes but is also a statutory compliance requirement from the DMR, MHSA Regulation 9.2 (2) (a) and (b), SANS 7243, OHSA Environmental Regulation for Workplaces 5. (1) and SAMHOP Part A Section 2.2.2(d).

An existing water treatment contract for Underground operations is in the process of being instated but does not include the surface fridge plant, headgear chiller plants nor the potable water booster station hence, the reason for this addition.



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2. Scope of Work

This document should be read supplementary to the *Scope of Work document for Water Treatment Related to the Underground Division (00230017-SOW-W-0076)* in order for it to be included under the same contract. The scope of work for this document is for the re-instatement of water treatment at the Main Fridge Plant, Head Gear Chiller Plant as well as the Potable Water Booster Station that involves the installation, operation and maintenance of the necessary equipment as well as the necessary chemicals to ultimately deliver satisfactory water treatment services to the surface plants.

3. Technical Specification – Main Fridge Plant Condenser System

a. System Overview

The main fridge plant provides cool water to the BAC units that are responsible for regulating the ambient air temperature & humidity underground. The condenser system of the main fridge plant consist of 3 forced draft cooling towers that cools hot ammonia gas through a set of tube bundles by means of a recirculating water spraying system. Water is pumped from the cooling tower sump (~332m³/chiller) to the top of the cooling tower at a rate of ~345L/s where a network of nozzles evenly distributes the water across 7 tube bundles (21 tube bundles for the entire plant). After absorbing the heat from tubes the cooling water, through the process of evaporative cooling, discharges the heat to atmosphere while it makes its way to the sump again. Raw water is used as make-up and the condenser is fitted with a sand filtration system.

b. System Metallurgy

- Galvanised steel
- 316 Stainless steel
- PVC pipes
- Polypropylene nozzles

c. Chemicals Required

- Corrosion inhibitor – Contractor to provide the recommended corrosion inhibitor for best water treatment practice and to maintain acceptable corrosion parameters



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- Scale inhibitor – Contractor to provide the recommended scale inhibitor for the best water treatment practice and to maintain acceptable corrosion parameters
- Primary biocide – Contractor to provide their recommended chemical or tablet for best water treatment practice
- Secondary biocide - Contractor to provide their recommended chemical to reduce slime layers in the system and for best water treatment practice

d. Equipment Required

Chemical control panel for bleed control and dosing of chemical is to meet the following minimum requirements:

- The Controller must be able to directly monitor and control both the addition of the corrosion inhibitor, scale inhibitor, the primary oxidizing biocide and the secondary biocide. It must also be able to measure the active polymer in the system.
- The controller must have the ability to monitor and control conductivity (bleed).
- The controller is to be equipped with an automatic system that detects and reacts to Biological Activity
- The controller must also be capable of monitoring and controlling the water's pH.
- The control system must have in-line mild steel and copper corrosion probes, and be capable of sending those readings to the controller for instantaneous corrosion rate measurements.
- The unit must be capable of measuring turbidity.
- The controller must have the ability for remote monitoring and control, either through a phone line, or a web based system. It must also be able to send Alarms via phones, and/or emails.
- The controller must be equipped with a Data Management program, capable of storing measured values for a one year period, and be able to generate graphs and reports on any or all of the variables.
- All necessary monitoring equipment to interface data with existing SCADA.



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e. Services

Daily service visits with weekly reports and recommendations to be submitted to PMC in written report format. All reports are to be maintained on site in binder format for the current contract year. Coupon analysis – 30, 60 and 90 day samples of copper and mild steel. Contractor to supply separate type written status reports for this analysis.

4. Technical Specification – Head Gear Chiller Condenser System

a. System Overview

Two headgear ammonia chillers ensure that there are sufficient cool air for the production winder motors and headgear by supplying cool water to these areas. They also assist with the cooling of the brake and tipping hydraulic oil power packs. The chiller plant is cooled by means of two ATC 486B EVAPCO, evaporative condensers. Cooling water is circulated from the condenser sump (5.4m³) to the spray nozzles at the top of the cooling tower at a rate of ~30L/s. Raw water is used as make-up.

b. System Metallurgy

- Galvanised steel
- 316 Stainless steel

c. Chemicals Required

- Corrosion inhibitor – Contractor to provide the recommended corrosion inhibitor for best water treatment practice and to maintain acceptable corrosion parameters
- Scale inhibitor – Contractor to provide the recommended scale inhibitor for the best water treatment practice and to maintain acceptable corrosion parameters
- Primary biocide – Contractor to provide their recommended chemical or tablet for best water treatment practice
- Secondary biocide - Contractor to provide their recommended chemical to reduce slime layers in the system and for best water treatment practice



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d. Equipment Required

Chemical control panel for bleed control and dosing of chemical is to meet the following minimum requirements:

- The Controller must be able to directly monitor and control both the addition of the corrosion inhibitor, scale inhibitor, the primary oxidizing biocide and the secondary biocide. It must also be able to measure the active polymer in the system.
- The controller must have the ability to monitor and control conductivity (bleed).
- The controller is to be equipped with an automatic system that detects and reacts to Biological Activity
- The controller must also be capable of monitoring and controlling the water's pH.
- The control system must have in-line mild steel and copper corrosion probes, and be capable of sending those readings to the controller for instantaneous corrosion rate measurements.
- The unit must be capable of measuring turbidity.
- The controller must have the ability for remote monitoring and control, either through a phone line, or a web based system. It must also be able to send Alarms via phones, and/or emails.
- The controller must be equipped with a Data Management program, capable of storing measured values for a one year period, and be able to generate graphs and reports on any or all of the variables.
- All necessary monitoring equipment to interface data with existing SCADA.

e. Services

Daily service visits with weekly reports and recommendations to be submitted to PMC in written report format. All reports are to be maintained on site in binder format for the current contract year. Coupon analysis – 30, 60 and 90 day samples of copper and mild steel. Contractor to supply separate type written status reports for this analysis.



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5. Technical Specification – Potable Water Booster Station

a. System Overview

The underground potable water booster station is located on surface next to the gantry conveyors. This station provides potable water to the entire Underground section at a rate of ~1000kL/day.

b. System Metallurgy

- Galvanised steel
- Brass
- Copper

c. Chemicals Required

- Primary Biocide - Contractor to provide their recommended tablet for water treatment

d. Equipment Required

Brominators

e. Services

Daily service visits with weekly reports and recommendations to be submitted to PMC in a professional type written manner. All reports are to be maintained on site in binder format for the current contract year.

6. Service Responsibility

Contractor shall have a qualified service technician conduct or provide the following:

- On-site water analysis to include establishing and maintaining water treatment parameters.
- Establish and maintain water treatment program with PMC's on-site personnel.
- Inspection of chemical feed systems and inventory control.
- Functioning as consultant to PMC for water treatment and water related problems.
- Inform PMC about any changes in treatment program.
- Prepare/update operating manuals.
- Supply all MSDS's sheets for chemicals supplied for water treatment covered in the specification. Updates to be submitted quarterly.
- Supply and analyze corrosion coupons.



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- Train PMC's employees on the use of the dosing systems.
- Train PMC's employees on new chemical feed system.
- Supply all chemicals to maintain set points and adequate stock of reagents to perform necessary testing for the duration of contract.

7. Emergency Services

Emergency service/clean-up will be available on a 24-hours a day, 7 days a week basis at no additional cost to PMC.

8. Substitution of products/new technologies

Substitute of product must first be explained and product MSDS sheet supplied to PMC for final review and acceptance.

9. Training Program

Contractor shall, at no additional cost, provide the following training to PMC's personnel at the Plant twice annually:

- Basic explanation of water treatment program for Plant.
- Introduction to new treatments/technology.
- Training in test procedures.
- Control limits/system setups (i.e. times, feed rates, frequencies, test results, recording).

Safety seminar to include:

- Safety in handling procedures
- MSDS's sheets
- Protective clothing necessary
- Compliance with new laws



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- Emergency first aid procedures
- Controller operations
- General maintenance of Dosing and control systems

Upon the request of PMC additional training/seminars shall be provided by Contractor as they become available.

10. Reports

Contractor shall provide to the PMC the following reports:

- All inspection, Service and Tests conducted per visit shall be noted in a log provided by Contractor at a location selected by PMC.
- Field Service Reports showing work performed, labour hours, problems found, work remaining, and signature of PMC acknowledging work performed.

All reports shall be neat, legible, and filled in completely.