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Training Progress Report

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PILOT RURAL DESALINATION PLANT USING RENEWABLE POWER AND MEMBRANE TECHNOLOGY AT GRÜNAU WATER SUPPLY SCHEME, //KARAS REGION

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1 Introduction

This document was compiled to provide NamWater with a brief description of each of the training activities that was completed with the operator/s at the water treatment plant in Grünau, namely, Ester, Morne, Shikatu, Onesmus, Jeremiah, Anne and Tresia.

Each of the plant manuals was explained in detail and demonstrated physically on the plant. The training also entailed going through each of the instrumentation and controls, both Hybrid and Water Treatment plant in detail.

2 RO Plant Operator/s

The following daily activities were explained as mentioned as part of the operator requirements:

- Daily operational procedures as per plant requirements
- Daily water quality sampling and operational water quality analyses and reporting of the same
- Daily plant and process optimisation based on operational data (pH, NTU, etc.)
- Daily maintenance of the plant diary relating to operational and site events
- Daily calibration tasks
- Daily maintenance tasks
- General cleaning of the plant and site
- Other general tasks as per the norm for NamWater operational requirements.

To ensure that the plant runs at a maximum of 18hrs per day, a shift roster was introduced of process controlling staff will be required to attend 16 hours per day and 7 days per week initially during the commissioning stages. A major concern during the training period is the lack of raw water available to effectively run the plant and deliver the anticipated yield.

However, despite this challenge, the operators have conducted their learnt skills well and have ensure that the plant always runs smoothly and optimally.

3 Introduction to the WTP

The first of the training covered the overall view, the various operations, and goals of the Grunua Water Treatment Plant. They were taken through the plant P&ID drawing to show in detail what equipment and instrumentation is used, the respective pumps and tanks as well as the HMI.

The following topics were covered in detail:

- **General Plant Description**
- **Raw Water Supply**
- **Chemical Dosing**
- **Flocculation**
- **Sand Filtration**
- **Reverse Osmosis**
- **Ground Water Reservoir Pumps**
- **Chlorination**
- **Sampling and Analysis**

- **Laboratory setup and usage**
- **SDI Methodology and demonstration**
- **Hybrid Plant – operation, monitoring and maintenance**

In addition to the above-mentioned modules listed, the operating crew were also shown in detail the working and operation of the HMI interface, the Weather station and its sensors, the Wind turbine and security equipment on site.

4 The Water Treatment Plant (WTP)

The following aspects of the Grünau WTP has been demonstrated and explained in detail:

- **Plant Start-up and Shutdown procedures, including checks to be performed prior to the respective procedures**
- **Plant operation and monitoring – inspection and duties to be performed prior, during and after plant operation**
- **Set points of the various inter operations**
- **Detailed analysis of plant performance and monitoring of plant input and output**
- **Monitoring of the plant instrumentation and equipment**
- **Correctly interpreting readings and trouble shooting during faults/events**
- **Water Contaminants Overview**
- **Semipermeable RO Membranes -**
- **Reverse Osmosis - detailed operation, interpretation of the sensor readings and applying adjustments accordingly**
- **RO Vessels and Membrane Elements – Installation, Removal, and inspection of the elements**

4.1 Monitoring

The following topics pertaining to the monitoring process of the Grünau WTP was covered in detail:

- **Turbidity – reading and interpreting the effects of turbidity on the RO process**
- **pH – reading and interpreting the effects of the water pH relative to temperature on the RO membranes**
- **Conductivity – understanding the electrical conductivity and how to adjust accordingly**
- **Fluoride – using the laboratory equipment to measure the water fluoride levels**
- **Chlorine – how to adjust the Chlorine water quality after sampling the potable water**
- **Daily Monitoring – monitoring of the plant operations and recording them physically on a logsheet at set time intervals**

4.2 Chemical Dosing (Pre- and Post-treatment)

4.2.1 Flocculation

The following was demonstrated and explained to the operators:

- **Chemical to dose (Ferric Chloride (42.5 %))**
- **How to dilute the chemical and at what concentration**
- **How much to dose depending on the turbidity and SDI before and after the pressure filters using the information obtained from the data recorded**

- Show how to adjust dosing pump rate

4.2.2 pH Adjustment Dosing Pre-Treatment to RO Plant

The following was demonstrated and explained to the operators:

- Chemical to dose (Hydrochloric Acid (38 %) / Sodium Hydroxide (46 %))
- How to dilute the chemical and at what concentration
- How much to dose depending on the pH before the RO process from the information obtained from the data recorded
- Show how to adjust dosing pump rate

4.2.3 Anti-Scaling

The following was demonstrated and explained to the operators:

- Chemical to dose (Sodium Hexametaphosphate (100 %))
- How to dilute the chemical and at what concentration
- How much to dose depending on potential scaling from the information obtained from the data recorded
- Show how to adjust dosing pump rate

4.2.4 Biocide Dosing

The following was demonstrated and explained to the operators:

- Chemical to dose (Sodium Metabisulfite (98 %))
- How to dilute the chemical and at what concentration
- How much to dose depending on biological fouling potential from the information obtained from the data recorded
- Show how to adjust dosing pump rate

4.2.5 Remineralisation

The operators were shown the operation and inspection of the Remineralisation tanks and the effect it has on the potable water.

4.2.6 pH Adjustment after Remineralisation

The following was demonstrated and explained to the operators:

- Chemical to dose (Hydrochloric Acid (38 %))
- How to dilute the chemical and at what concentration
- How much to dose depending on the pH before the remineralisation from the information obtained from the data recorded
- Show how to adjust dosing pump rate

4.2.7 Inline Calcium Hypochlorite Dosing

The following was demonstrated and explained to the operators:

5 Cleaning and Sanitization

5.1 CIP

The operators were taught the concept behind a cleaning in place (CIP) procedure as well as demonstrated as to how to perform these tasks and when it is applicable: which chemical to use (Low pH to remove inorganic precipitates and high pH cleaning to remove organic fouling)

- Mixing procedure
- Heating the solution
- Low flow pumping
- High flow pumping
- Recycling
- Soaking
- Flushing
- Importance of pH levels during the cleaning phase and how to measure it using the equipment

5.2 Sanitizing RO Membrane Systems

The sanitization of RO membrane systems is the application of biocidally effective solutions or hot water to the membranes while the system is offline, i.e., not in production mode. This was demonstrated and explained to them in detail.

6 Handling, Preservation and Storage

The operators were taught the importance of proper care and maintenance of the Membranes and how to strategically perform these operations without compromising the membrane elements. In addition, a manual was drawn up to show these steps in detail while adhering to the guidelines of the manufacturer.

7 Replacement of Cartridge Filters

The operators were shown how crucial the cartridge filters play a role in preserving the elements upstream. They were also demonstrated as to when these filters must be replaced.

8 Trouble Shooting

A major part of the training was showing the operators how to do trouble shooting with the help of the WTP manuals. However, training plays a crucial role in ensuring that the operator is competent and has a background knowledge of the equipment, instrumentation and layout of the plant.

The following elements were explained in detail:

Visual Inspection – Using the instrumentation, HMI and testing apparatus to determine the problem at hand.

Profiling -how to profile the event and log the fault/problem accordingly.

Probing – physically examining and determining the exact problem and following the solution to rectify the problem.

9 Conclusion

The training was conducted as best as possible to ensure that both the students and Namwater operators are well trained and prepared to operate, to maintain and to ensure that plant always runs optimally.

In addition to the training, the reliability run itself has provided training for the operators, to make them aware and pick up trends in the operation of the plant, allowing them to distinguish more comfortably between the various operations of the plant and detect any deviations that do not conform to the norm or expected values.

In summary, the training has equipped the students, Shikatu Nestor Lipuleni, Onesmus Tuyenikela, Jeremiah Chitoti, Anne Handuba and Tresia Haihambo, as well as the Namwater operators, Ester Petrus and Morne Beukes, with the following skills:

- **The ability to pilot a Hybrid powered water treatment plant successfully while adhering to Water quality standards and effectively maintain the plant in good operational status**
- **Diagnose, troubleshoot and apply solutions in accordance to the guidelines of the manuals and improvise solutions**
- **Analyse, record and extract data of the plant performance and operation**
- **Perform daily inspection of all equipment, maintenance on plant equipment and chemical refills necessary for the potable water production and to provide maximum life in the interest of the plant**
- **Management of low raw water levels to sustain the flow of water to the town**
- **Repeated execution of operator duties to ensure successful operation of the plant and maintaining a professional level of performance**

The above is hereby declared Approved and Accepted as per the Authorised representatives involved.

NEC

Site Manager

Signature

Date

CMB

Consultant

Signature

Date