METITO

Commitment to a Cleaner Environment

A Case Study

Water And Waste Water Treatment Plants for Nubaria
1500 Megawatt Power Plant - Egypt

Introduction

The Egyptian economy experienced a massive growth in the early part of 2003, resulting in a parallel increase in demand for electric power. As part of its utilities expansion plan, the government decided to construct a new power station at Nubaria, a township located 120 km North West of Cairo. The plant was designed to utilize Egypt's abundant natural gas resources along with high efficiency turbines that are characterized by low carbon dioxide emissions, thereby playing an important role in the efforts to reduce global warming.

Under the Nubaria project, Metito constructed several water and waste water treatment units to cover the entire scope of water treatment requirements for the site.

Scope of Work

The complete water and waste water treatment plant package included the following:

- Nile River intake chlorination package
- Raw water pre-treatment system
- Potable water system
- Ion exchange demineralization Plant
- Chemical waste water neutralization
- Waste water treatment package
- Oil separation package
- Sewage treatment package
- Sludge dewatering system
- Chemical injection systems for steam turbine unit
- Turbine steam and water analysis systems
- Fully automated SCADA work stations

Plant Technical Characteristics

The technical characteristics of each package are as follows:

Nile River intake chlorination package

Raw water pumped to the plant is subjected to a shock dose of Sodium Hypochlorite which acts as a disinfectant. This process ensures the elimination of algal or bacteriological growth in the plant intake structure.

Raw water pre-treatment system

This system is designed to treat Nile water for process use as well as for potable purposes. It has a design flow of 225 m^3/h for process water and 40 m^3/h for potable drinking needs.

In this process, raw water is passed through three solid contact type clarifiers that reduce the suspended solids

content to less than 7 ppm and turbidity to less than 5 NTU.

Potable water system

Filtered water is put to potable use by passing it through two activated carbon filters, each rated at 20 m^3/h. Water is then disinfected and pumped to storage tanks for onward distribution.

Ion exchange demineralization plant

The process water treatment plant consists of three streams of demineralizers each comprising of an activated carbon polishing filter, a cation exchanger, a degasser tower, an anion exchanger and a mixed bed vessel.

The units are all skid mounted, pre-assembled, pre-wired and pre-tested. Each stream is designed to provide 1500 m^3/day flow based on a 20 hour daily operation with a product water conductivity of less than 0.1 µmho/cm at 25°C, and a total silica content of less than 0.01 mg/l. The cation and anion exchangers used in the process are counter-current regenerated and stratified bed design types.

The reliability of operation is insured by the application of innovative design techniques coupled with rugged instrument selection. The complete plant operation is controlled by a full hot true redundant and data highway system, which comes complete with an operator work station. This station provides the operator with full visualization, monitoring and control of the plant, right from the time the raw water enters the system all the way to the final stage of storage.

Historical trends and monitoring data are archived in the computer system and provide immediate assistance to process engineers during any trouble shooting scenario.

Chemical waste water neutralization

A chemical waste collection and neutralization system receives the waste water from the exchanger regeneration process and neutralizes it on a batch process control basis.

Waste water treatment package

The plant is designed to treat waste water at a flow rate of 120 m^3/h. Treatment is achieved in three steps:Clarification, Filtration (in gravity type filters) and Neutralization in the pH adjustment tank.

Waste water collected from the plant is treated for irrigation purposes to produce an effluent that contains no more than a total of 1 mg/l of heavy metals, 60 mg/l BOD, 50 mg/l COD, 10 mg/l oil & grease , 2000 mg/l TDS and 5000 mg/l TSS at a pH value of 6-9. Excess water, which meets the local environmental regulations, is discharged back into the river.

Oil separation package

The plant is designed to cater for 100 m^3/h of oily water separation. Oily water is collected in a sump from where it is discharged to the API separator. Oil from the separator is then collected in a tank for disposal, while the effluent flows

to a flash mixing tank for coagulation followed by flocculation in a dedicated tank.

The effluent then flows to the dissolved air floatation unit (DAF) where the flocculated particles are removed.

Effluent from the DAF unit is dumped to the waste water main collection basin where it is further treated in the waste water treatment plant.

Sludge from the API and DAF systems is pumped to sludge thickeners.

Sewage treatment package

The Sewage Treatment Plant (STP) is designed to treat incoming sewage in a twin stream scheme where each stream is capable of handling 50% of the average daily flow of 400 m^3.

This design allows an approximate retention and aeration time of 24 hours, long enough to obtain an effluent with less than 30 mg/l BOD and 30 mg/l TSS.

Raw sewage is collected in an equalization tank from where it is pumped to the aeration tanks.

Aerated sewage then flows to the clarifiers, from where the clarified effluent gravitates to the chlorine contact tank where it meets a controlled dose of sodium hypochlorite solution for disinfection purposes.

Sludge dewatering system

Sludge from the plant is pumped into two sludge thickeners, where the solids settle and the supernatant overflows to the waste water main collection basin.

The settled sludge from the thickeners is then pumped into two filter presses where it is compressed and dewatered.

The supernatant from the filter presses is drained to the waste water main collection basin while sludge cakes are carried away for disposal.

Chemical injection systems for steam turbine units

Five chemical injection skids are supplied for the purpose of biological growth control and water conditioning for the condensate system, de-areator, heat recovery boiler drums and circulating water.

Oxygen scavenger and ammonium hydroxide are dosed to control the oxygen, pH and carbon dioxide, while phosphate solution is injected in the heat recovery drums for the control of solids. Each skid consists of two dosing pumps automatically controlled from the client's Distributed Control System (DCS).

Turbine steam and water analysis systems

Metito supplied two air conditioned metal cladding weather proof analyzer shelters, one to serve each module of the power station. The analyzer shelters house steam and water analysis systems and are complete with the necessary sample conditioning equipment, instrumentation, probes, analyzers, racks and cabinets.

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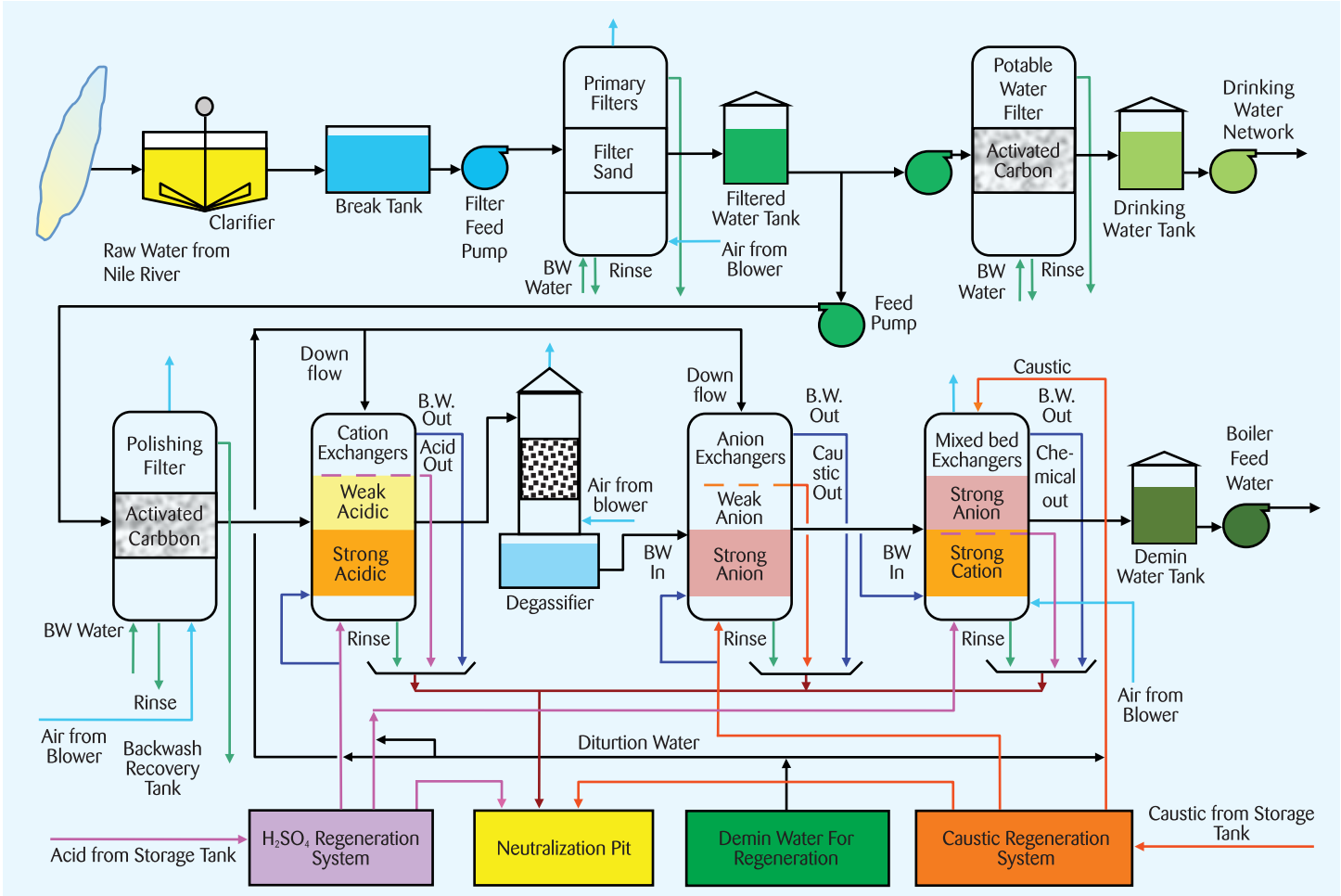
The total of 21 samples cover various parameters at different locations within the turbine; these parameters are pH, conductivity, dissolved oxygen, silica and sodium. All readings are monitored locally at the shelter as well as remotely at the power plant main control room DCS.

Conclusion

Metito delivered the water treatment facility on time and within budget. Metito also accomplished this challenging task while meeting the stringent requirements laid down by the owner, WDEPC, a wholly owned subsidiary of the Egyptian Electricity Holding Company and PGESCO/BECHTEL, the project manager for the Nubaria power plant. More importantly, Metito's technologies utilized in this project contributed to the environment by providing low carbon emission equipment resulting in a low carbon footprint.



Schematic Flow Diagram

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