



Water Treatment For South Bangkok Combined Cycle Power Plant Stage II

A Case Study

METITO has executed the complete WATER AND WASTE WATER TREATMENT SYSTEMS for the Electricity Generating Authority of Thailand (EGAT). These facilities were supplied on a turnkey basis for the 744 MW South Bangkok Combined Cycle Power Plant - stage II. The multi-million dollar contract was directly awarded by EGAT to METITO against international competition. The project demanded

the execution to the most stringent requirements laid down by EGAT and their consultants BLACK & VEATCH INTERNATIONAL Kansas City and Sindhu Pulsirivong Consultants, Bangkok. The complete plant works including the performance guarantee tests were executed within the jurisdiction of the ASME codes. METITO completed this most challenging task to the entire satisfaction of the authorities.

Scope Of Work:

This included the complete design, engineering, manufacture, supply, inspection and testing, site storage, fabrication, installation, commissioning, performance test and training of personnel. Civil design and construction of the super structure were also included in the scope of work.

Plant General Information:

The Water and Waste Water Treatment package comprises the following units:

- Circulating Water Makeup Treatment System utilizing Cyclone separators - 3780 m³/hr.
- Ion exchange Demineralization plant for Cycle make-up system - 147.6 m³/hr.
- Chemical Waste Collection and Treatment System - 600m³ Batch Treatment
- Sanitary Drainage and Treatment System - 90m³/day
- Auxiliary Water Supply units - 150 m³ /hr each
- Miscellaneous Mechanical and Architectural services along with HVAC, lighting, fire protection, Communication System, etc.



South Bangkok power plant

- DCIS based complete Control System for plant Operation.

PLANT TECHNICAL

CHARACTERISTICS

Circulating Water Treatment System:

The plant is designed to clarify water from the Chao Phya river where the level of suspended solids in the water varies widely due to strong tidal influences. The clarification system consists of four cyclone separators to accommodate these wide fluctuations in the incoming suspended solids level. The plant has a design flow capacity of 3780 m³/hr and utilizes three cyclone separators to treat this flow, one cyclone unit acting as a standby. The effluent quality must not exceed 100 mg/l of suspended solids. The complete operation of the cyclone separators is automatic and the blow down from the operating cyclones is automatically controlled based on a timed cycle.

Demineralization Plant for Boiler Makeup Water System:

This high purity water plant comprises a demineralizer stream consisting of two 50% duty activated carbon filters, a primary cation exchanger, forced draft degassifier, primary anion exchanger



Nest of pneumatically operated automatic valves

and a mixed bed exchanger along with regeneration equipment, chemical handling and storage facilities.

Carbon filters are provided upstream for residual chlorine reduction and organic removal in the water supply to the demineralizer.

The plant has the following design particulars.

Service Flow - 147.6m³/hr

Net output between two regenerations:

Cation, Anion	- 2,650m ³
Mixed Bed	- 18,600m ³

System design pressure - 8.6 bar

Influent water quality:

Total dissolved solids - 139mg/l as CaCO₃

Guaranteed effluent water quality:

Conductivity - 0.2micro S/cm

Silica as SiO₂ - 0.01 mg/l

Total dissolved solids- 0.025 mg/l

Chemicals used for regeneration:

- Hydrochloric acid or sulfuric acid for cation resins.
- Sodium Hydroxide for anion resins.

Resin quantity m³

Primary Cation exchanger - 10.3

Primary Anion exchanger - 9.6

MB(Cation/ Anion/ Inert) - 3.1/3.1/0.8

Exchanger size (mm)

Diameter x height

Primary Cation - 2900 x 3300

Primary Anion - 2800 x 3320

Mixed Bed - 2600 x 2670

Downflow service and upflow regeneration is employed for the primary Cation and Anion exchangers. The mixed bed is designed with simultaneous regeneration of cation and anion resin. The flow rates for service and regeneration had vastly different values. This required extremely careful selection of the underdrain system for the exchangers. Specially designed strainer elements are used for the under drain, the unique design of which provides the proper flow distribution patterns both during collection and distribution. Recycle rinse during



Cyclone separators



Demineralization plant

regeneration is employed to conserve the water consumption. Mandatory recycle of the ion exchange streams has been provided during the service cycle to ensure that any off-spec water does not flow from the plant.

For anion resin, the caustic dilution system is designed with on-line hot caustic regeneration. An important and very special feature of the regeneration system is that either hydrochloric or sulfuric acid can be used. These two chemicals have exceptionally different physical and chemical properties. This requires not only an extremely careful selection of materials of construction but also results in widely different operating parameters. Sulfuric acid regeneration for primary cation exchanger is carried out in three steps to eliminate the possibility of any sulfate precipitation. Thus the demineralization units with automatic operation and using two chemicals presented a very challenging task to the plant designers. The controls of the plant have been designed so that this complicated task is accomplished simply by the selection of a switch.

Continuous and trouble free operation is ensured by the excellent process and equipment design, coupled with rugged component and latest technology instrument selection.

The overall control of the plant is achieved through a state of the art Distributed Control & Information System (DCIS). DCIS is installed in a Control Room which is local to the plant and communicates on a high speed data highway with the power station DCIS, for monitoring and shutdown purposes. The DCIS system consists of two operating stations, marshalling cabinets and an Engineering Station. Three

Sequence of Event printers and one printer for screens and information printing are provided.

Operating stations are configured to perform the following functions:

- (a) Monitoring & control of overall plant
- (b) Alarm logging
- (c) Trends

The graphic screens on the operating stations are configured in such a fashion that the operator can monitor the overall plant and individual packages simultaneously and incorporate user friendly pop-up menus that guide the operator through different selections of operating modes.

To safeguard the plant operation against any accidental operation, three sensitivity levels are configured viz. Operator, Supervisor & Engineer. All these levels are protected by means of software locks.

The system is completely automatic. However, a facility for manual operation is provided to ensure the availability of the plant should any emergency situation arise.

Additionally, to provide complete flexibility in the operation, the operator may intervene the automatic sequence at any stage of the operation.

Chemical Waste Collection and Treatment System:

This comprises of a underground collection basin with HDPE lining,



Distributed control & information system room



Demineralization plant water storage tanks

self priming type recirculation-cum-disposal pumps and a double impeller mixer. The basin receives the chemical waste from the water treatment building drains together with ion exchange regeneration chemical wastes. The treatment system is operated on a batch basis

and is controlled from the DCIS. Each batch of treated effluent is transferred to a pond, from where it is discharged into the river.

Sanitary Drainage and Treatment System:

This is designed based on an extended

aeration system installed in the concrete basins and the plant comprises of two fifty percent capacity units. The treatment system has the capacity to handle a peak flow of 12 m³/hr, hydraulic load of 90m³/day and 20 kg/day of the organic load. The main components of the plant include sewage lift stations, screens, aeration blowers, coarse bubble air diffusers, clarifiers, equipment for sludge recycle, disposal and digestion and on-line chlorination.

Other facilities:

Include the complete works for the auxiliary service water supply units, building utilities including architectural, HVAC, communication, lighting, fire protection, plumbing, drainage etc.

The entire water treatment package for the defined scope of work was commissioned during the period from November 1997 to January 1998. Since that time the plant has been providing continuous trouble free service.



View of the demineralization plant building, sewage and waste treatment plant

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