



WATER & WASTE WATER TREATMENT FOR NATIONAL FERTILIZER PUBLIC CO. THAILAND

A Case Study

National Fertilizer Public Company Ltd. of Thailand (NFC) installed modern NPK fertilizer plant including a phosphoric acid manufacturing unit within the complex. This resulted in wastewater having abnormally high content of various highly toxic pollutants like phosphoric acid and fluorides coupled with sulfates. The characteristics of the wastewater, the amount of waste to be treated coupled with the strict environmental discharge regulations, required special treatment process. This classified the wastewater treatment plant among one of few of its kind in the world. METITO was entrusted to execute the WASTEWATER TREATMENT PLANT and other WATER TREATMENT FACILITIES through HYUNDAI ENGINEERING AND CONSTRUCTION CO. LTD. The multi-million dollar contract was awarded to METITO against international competition. METITO accomplished the challenging task meeting the most stringent requirements laid down by NFC and their consultants FOSTER WHEELER.

Scope of Work:

This included the complete design, engineering, manufacture, inspection, testing and supply on FOB basis, supervision of installation & commissioning, start-up, performance test and training of personnel at site.



METITO EXPERTISE FOR INDUSTRIAL WATER TREATMENT PLANTS

General Information:

The complete package comprises the following units.

- Process Wastewater Treatment system.
- Water Pretreatment system
- Ion exchange Demineralization plant.
- Ion Exchange Plant Chemical Waste Collection and Treatment System.
- Sanitary Drainage and Treatment System.

Technical Characteristics: Process Wastewater Treatment System:

The treatment plant has a design capacity to treat 150 m³/hr of wastewater from different process units with vastly different concentrations. In addition five different sources of the raw materials are used for the production. All these conditions lead to numerable combinations of the influent water characteristic having a wide range of

variations both in concentration and flows. The design influent and effluent water characteristics are as follows.

Influent

Flow rate (m ³ /hr.)	25 - 150
Sulfates (mg/l):	0 - 5000
Fluorides as F (mg/l):	8000 - 83400
Phosphates as P (mg/l):	0 - 13300
Calcium Oxide (mg/l):	300 - 5000
pH:	0.6

Effluent

Fluorides as F (mg/l):	20
Phosphates as P (mg/l):	70
Suspended solids (mg/l):	30
pH	6.5 - 8.5
Sludge solids content (%):	25

Acidic Water Equalization Basin:

The waste water from different sources is collected into 1200 m³ lined concrete basin. Highly toxic and hot acidic process waste from one of the streams is cooled through a plate heat exchanger before its entry into the collection basin. The wetted parts of the heat exchanger are made of hastelloy-C. An air grid is provided with coarse bubble air diffusers for mixing the incoming contents. Rotary air blowers supply the mixing air.

Neutralization And Clarification:

The wide fluctuations both in flow and concentration of the influent wastewater called for most effective means to control the process which involves treatment by



CLARIFIER CUM THICKENER FOR WASTE WATER TREATMENT

precipitation. Taking into account the operating cost and other considerations, lime was the obvious choice as main chemical for precipitation. For complete flexibility in operation and optimization of the process conditions two stage precipitation is employed. First stage precipitation is designed with neutralization to a pH value of 2 - 3 for precipitation of fluorides as calcium fluorides. Phosphates are precipitated as calcium phosphate in the second stage neutralization and clarification at pH range of 8 - 9. This demands a very fine, effective and reliable control of lime injection. An innovative dosing arrangement is employed to automatically control the addition of lime

solution in the neutralization tanks of the two stages. Lime dosage is controlled from merely a few kgs./hr to 7000 kgs./hr. The pH control is attained in the two neutralization tanks. Pre-contact tanks are provided before the neutralization tanks. Partial re-circulation of sludge through pre-contact tanks promotes solids contact for effective precipitation reactions. The precipitation is achieved in the clarifier-cum thickeners. The treated water overflows from the clarifiers to the Effluent water storage tanks. Both first and second stage clarifiers are 15 m in diameter and are of concrete construction. The severity of the quality of the water being treated desired careful consideration for materials of construction. The concrete tanks and basins are protected with special coating. The internal mechanism is specially made of rubber coated steel.

Sludge handling:

The high inflow coupled with high concentration produces a heavy solids load of 10,000 kg/hr. This high rate of solids slurry is drawn from the bottom of first and second stage of clarifiers into a common 100m³ sludge storage tank. To keep the solids in suspension provision is made for continuous air mixing. Three Gravity Belt Presses are provided to thicken the sludge to a minimum requirement of 25% concentration. The thickened sludge is discharged into a 25-tone storage hopper. The storage hopper is elevated and located in a manner so that the sludge can be collected in the carry away trucks parked below the hopper. The approach is designed so that,



PRE TREATMENT RAW WATER STORAGE TANKS



TOWERING LIME SILOS HOUSING LIME SLAKING & SOLUTION TANKS

under full load conditions, the trucks can operate in merry-go-round manner. Polymer flocculent is used to promote the dewatering. Wash pumps provide the water required for washing of the filter presses. The wash water thus produced is recovered through a plate settler.

Lime Storage And Handling:

The peak lime consumption for the process treatment is 7000kg/hr. The lime system is designed to handle powdered dry lime. Storage facilities consists of two numbers of huge lime silos each measuring 6.5m diameter, 31 m height having a storage volume of 800 cubic meters. The silos are complete with lime filling facility, vent filter, Bin activators, Volumetric feeders, Slakers, Slurry tanks with mixers and lime feed pumps. The lime preparation and feeding system is fully automatic and functions practically without any operator.

Other Chemical Handling Facilities:

Treatment process also involves the use of other chemicals. Acid and caustic is used for final pH correction, and polymer solution for sludge conditioning. Facilities are provided

for storage, solution preparation to required concentration and feeding of these chemicals to required dosage. The chemicals are injected through positive displacement pumps whose rate is automatically controlled.

The wastewater treatment design practically achieves 'zero discharge' principle.

Operation:

The whole plant operation is controlled automatically through a modern PLC based control station.

Water Pre-Treatment System:

The plant is meant to treat the raw water for the process use. The plant has design flow capacity of 310 m³/hr and utilizes Solids Contact Type Clarifier to treat this flow. The effluent quality is not to exceed 30

mg/l of suspended solids under entire range of inlet concentrations. Two gravity type concrete basin filters produce filtered water with turbidity less than 2 NTU. Chemical preparation and dosing equipment are

provided to dose chemicals required for flocculation and pH control. Treated water is stored in underground filtered water storage tank. The filters are located above this tank to conserve the plant space. Dedicated pumps and blowers are provided for back washing and air scouring of the filters. The underflow from the clarifier is sent for recovery to the waste treatment plant described above. The complete operation of the water pre-treatment system is controlled automatically through remote located central DCS control panel.

Demineralization Plant:

The plant comprise two streams of demineralizer each consisting of a primary cation exchanger and a primary anion exchanger. Regeneration equipment and chemical handling and storage facilities are common to both the streams. The ion exchange equipment are having skid mounted design. All the skids are supplied as completely pre-assembled, pre-wired and pre-tested units.

The plant has the design flow rate of 20 m³/hr. Net output between two regenerations for both cation and anion is 250 m³. The demineralizer unit is designed to produce the water having Conductivity of 10 micro S/cm and TDS value less than 2 mg/l. The primary cation and anion exchangers are co-current regeneration. The latest techniques adopted for equipment design coupled with rugged component and



GENERAL VIEW OF WATER PRE TREATMENT UNITS



FULLY AUTOMATIC DEMINERALIZATION & WATER PRE TREATMENT PLANTS

instrument selection ensures the reliability of operation.

The complete operation of the Demineralization Plant is controlled automatically through remote located central DCS (Digital Control System). The control system allows completely automatic or

manual operation of the plant. The software is designed in manner that provides the plant operator proper operation of the control interface and control systems.

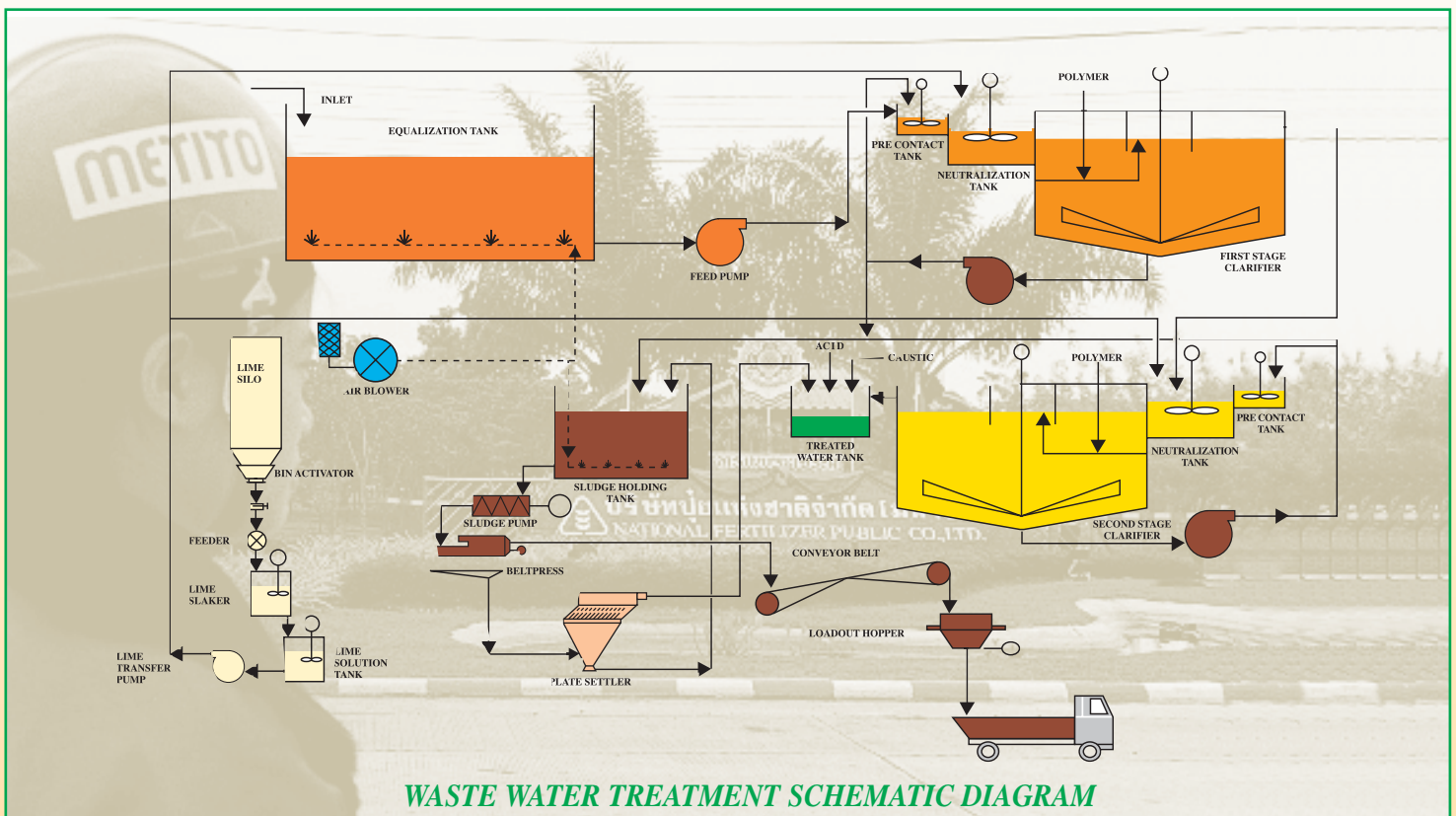
Chemical Waste Collection and Treatment System receives the chemical waste from ion exchange regeneration. The treatment system

is operated on batch basis and is controlled from DCS.

Sanitary Drainage and Treatment System:

Sanitary treatment system is designed based on extended aeration system installed in the Glass lined tanks. The treatment system has the capacity to handle a flow of 7 m³/hr, hydraulic load of 168 m³/day and 80 kg/day organic load. The main components of the plant comprise sewage lift station, reduction and screening of sewage solids, aeration blowers, diffused aeration supply equipment, final clarification, on-line chlorination, sludge recycle and Sludge holding tank. The stored sludge is pumped to the wastewater treatment plant for recovery. The plant is operated automatically through a local control panel.

The entire water treatment package for the defined scope works was commissioned in June/November'1997. The plant is providing continuous trouble free service since then.



WASTE WATER TREATMENT SCHEMATIC DIAGRAM

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