



SEVERN TRENT WATER Scrubber Effluent Treatment (SET) PLANTS

CUSTOMER:

**SEVERN TRENT
WATER**

MAIN CONTRACTOR:

EARTH TECH

SECTOR:

EFFLUENT TREATMENT

**DATE OF CONTRACT
AWARD:**

2004

CONTRACT VALUE:

£ 730,000

ACWA CONTRACT NO:

4643



INTRODUCTION:

ACWA Services Ltd. was awarded a contract to design, build and commission a scrubber effluent treatment (SET) Plant at Coleshill Sludge Incineration Plant for Severn Trent Water Ltd. The SET Plant has been designed to treat the effluent from the Incineration Plant to a standard that meets the Waste Incinerator Directive (EC2000/76) and suitable for discharge to the adjacent sewage treatment works drainage system.

PROCESS DESCRIPTION:

Pre-SET Plant

The purge liquors from the first stage acid scrubber and second stage alkali scrubber are presently combined in a recovery tank from both incinerator streams at Coleshill Sludge Incinerator Plant. The combined flow is pumped to a pre-neutralisation tank where the pH is raised to 6.5 – 7.0 pH using sodium hydroxide. This pre-neutralised effluent overflows by gravity to a neutralisation tank, here the pH is raised to 7.0 – 7.5 using sodium hydroxide.

Effluent Collection and Transfer

The neutralised effluent from the incinerator plant flows by gravity to the SET Plant feed pumping station located adjacent to the SET Plant. PH and temperature monitoring occurs at this point. Duty/standby pumps transfer the effluent to the balance tank at a set flowrate of 20 m³/hour.

Balancing and Chemical Addition

The balance tank receives the neutralised effluent and the centrate liquors, and provides 4 hours storage under normal operation. The tank is equipped with a mixer, to prevent settlement of solids, and pH/temperature monitor. Sodium hydroxide is added, controlled on a pH PID loop, to increase the pH to 8.5. This is the optimum pH for the removal of mercury and other heavy metals using TMT15.

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TMT15 is a proprietary additive, specifically used for the removal of mercury and heavy metals, for example, nickel, lead and copper. TMT15 is dosed, at a fixed rate, to the suction side of the forward feed pumps, for the removal of mercury and metals in solution. This addition point ensures efficient contact and facilitates the precipitation of the TMT15 and heavy metals present in solution.

Ferric chloride is added to the discharge side of the forward feed pumps. Ferric chloride is added to the effluent to facilitate flocculation of the TMT15/heavy metal precipitate.

Precipitation

The effluent is transferred from the balance tank to the precipitation tank. The tank is equipped with a mixer and pH monitor. Polyelectrolyte is added to the precipitation tank at fixed dose rate to assist with flocculation and settlement of the TMT15/metal precipitate and other solids.

For operational flexibility dosing lines for TMT15, ferric chloride and sodium hydroxide have also been installed.

Clarification and Filtration

The effluent from the precipitation tank flows by gravity to a settlement tank. The flocculated solids and metals settle to the base of the settlement tank, from where they are removed to a sludge storage tank. The clarified effluent overflows to a collection tank, and transferred to a sand filter for further treatment.

A continuously operating upward flow sand filter is used to remove the remaining traces of fine solids and metal precipitate to ensure the discharge consent is met. The filtered effluent gravitates to the acid-mixing tank.

The backwash water containing the removed solids particles is returned to the settlement tank.

Acid Mixing Tank

The filtered effluent gravitates to the acid-mixing tank. The tank is equipped with a mixer and pH/temperature monitor. Hydrochloric acid is added to the effluent, controlled on a pH PID loop, to reduce the pH to 7.0 before discharge. This is to protect the sewage work drainage system.

The neutral effluent is transferred to the discharge point by duty/standby pumps via a discharge monitoring station for pH, temperature and flow. An autosampler takes a representative sample for laboratory analysis.

Sludge Treatment

Settled solids from the settlement tank are pumped to a sludge storage tank. The storage tank is equipped with a picket fence thickener and decant tree to promote consolidation before thickening.

Sludge from the storage tank is pumped to a centrifuge, with polyelectrolyte added to the centrifuge feed to assist the dewatering process. Sludge cake, with dry solids content in excess of 25% is produced, and disposed of off-site. The centrate liquors are returned to the balance tank for reprocessing through the system.

Chemical Storage and Dosing

The sodium hydroxide and hydrochloric acid required for pH correction are stored in bulk tanks. The hydrochloric acid storage system has also been supplied with a fume scrubber system. Addition of the sodium hydroxide and hydrochloric acid is by duty/standby variable speed dosing pumps, controlled on a pH set-point PID loop from pH meters located with the balance tank and acid-mixing tank respectively.

TMT15 and ferric chloride are stored in bulk tanks. Duty/standby dosing pumps deliver the chemical at a fixed rate to the suction and discharge sides of the forward feed transfer pumps respectively.

A liquid polymer preparation system provides diluted polyelectrolyte, at the required concentration, to the precipitation tank for settlement purposes, and to the centrifuge to aid dewatering. Polyelectrolyte is added, at a fixed rate, using a dedicated duty/standby dosing set for each process.

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Influent and Effluent Characteristics

	Influent	Treated Effluent
Flow (m ³ /hour)	20 m ³ /hr	
pH	7.5 – 8.0	7.0 – 7.5
Temperature (°C)	30 – 35°C	
Suspended solids (mg/l)	1,000	30
Mercury (mg/l)	4.0	0.03
Cadmium (mg/l)	0.5	0.05
Lead (mg/l)	0.6	0.2
Copper (mg/l)	2.0	0.5
Nickel (mg/l)	2.0	0.5
Zinc (mg/l)	4.0	1.5