£2.5m upgrade at four Yorkshire Incinerators

new effluent treatment plant satisfies latest EC legislation

Designed to treat contaminated scrubbing liquors from four upgraded gas cleaning systems, new effluent treatment plants are part of a Yorkshire Water initiative to ensure full compliance with the latest European Waste Incineration Directives by December 2005. When operational, the effluent treatment plants at Knostrop (Leeds), Esholt (Bradford), Blackburn Meadows (Sheffield) and Calder Valley (Huddersfield) will satisfy European legislation, EC2000/76 limits, with particular emphasis on the removal of solids and mercury.

New ACWA *Services* effluent treatment plant at one of four Yorkshire Incinerators to meet EC legislation *courtesy: ACWA Services & Yorkshire Water*

ACWA Services is currently working on a £2.5m contract to design, build and commission four Effluent Treatment Plants for gas cleaning systems at Yorkshire Water's four sewage sludge incineror sites. The order – placed by main contractor *Earth Tech Morrison* – includes the supply of all items of automated equipment, mechanical and electrical services, instrumentation and controls.

Removal of contaminants

At each of the four sites, ash particles will be removed from the fluidised bed incinerator flue gases by an electrostatic precipitator installed before the wet scrubbing system. Re-circulated liquor in the first stage acid quench scrubber will remove dust HCI and HF, Sulphur dioxide (SO_2) and the bulk of remaining dust and hydro halogens will be removed in the second stage packed column alkali scrubber.

To prevent any of the constituents adsorbed by the wash-water from increasing concentration to a level where it would interfere with the efficient operation of the scrubber, blow-down from each scrubber to the effluent treatment plant will be performed at a continuous rate of 4 m^3/hour.

Effluent treatment

The new *ACWA Services* Effluent Treatment Plants will be capable of operating round-the-clock 365 days a year, so as not to inhibit the continuous operation of the incinerators. Each plant will accept blow-down liquor from the scrubbing system, remove contaminants and provide secure discharge to the sewage works drainage system.

The various process steps will include effluent balancing, pH correction and precipitation, caustic soda dosing, up-flow

clarification, sand filtration, discharge temperature and flow measurement. Centrifuge dewatering of removed sludge, together with discharge to skip and the reception and safe storage of all treatment chemicals will be provided at each site.

The process
At the start of the effluent treatment process, blow-down liquors from two scrubbing systems will be pumped to 22m^3 and 38 m^3 capacity polypropylene balance/storage tanks installed at the inlet.

Both tanks will incorporate agitators to maintain fluidity of the effluent and prevent the settlement of solids, whilst monitors indicate liquid levels and control forward feed pumps. Both tanks will normally operate at a low level to provide four hours storage capacity and effluent will be monitored for pH before being pumped through a common transfer line to the neutralisation tank.

Neutralisation
Within the polypropylene neutralisation/reactor tank, process liquors will be monitored for pH and temperature and dosed with a Caustic Soda (Sodium Hydroxide) solution through activated valves. The process will be installed with a high energy mixing unit, sized to ensure full chemical reaction – allowing effluent pH to increase to optimum levels before gravitating to the precipitation tank.

Precipitation
In the precipitation tank, the pH will be further adjusted to 8.5 by the addition of sodium hydroxide solution to precipitate the metals. TMT15, Ferric Chloride and a polymer will also be dosed into the precipitation tank.The effluent will react with TMT 15 to precipitate the heavy metals and with Ferric Chloride and a polymer to flocculate the precipitant and other solids. A slow speed agitator will be installed to flocculate solids in suspension.

Chemical storage & dosing
The alkali to be used for neutralisation of the effluent is a solution of Sodium Hydroxide. Activated valves will be used to dose 47% solution from an existing extended ring main, according to pH levels, in the neutralisation and precipitation tanks.

To provide the correct dilution and make-up of the selected polymer, ACWA Services will install an automated polymer preparation system and two sets of dosing pumps to provide dosing to the precipitation tank and the centrifuge.

Ferric Chloride solution will be stored in a 1.5m^3 'minibulk' system from which it will be dosed to the precipitation tank by dosing pumps. TMT15 solution will be delivered in IBC's and pumped by the dosing pump into the precipitation tank.

Clarification & sand filtration
For the removal of solids, flocculated effluent from the precipitation tank will gravitate to a settlement tank which, to improve efficiency, will be fitted with a fixed bridge scraper. This tank will allow clarified liquor to overflow to the sand filter feed tank whilst settled sludge is pumped to a sludge storage tank. From the sand filter tank, clarified liquor will be pumped to a continuous sand filtration system.

Cleaning of the sand filter media will be achieved by a compressed air lift, from which back-wash water gravitates to the settlement tank prior to being reprocessed through the system.

Filtered water will gravitate to the discharge monitoring point where it is monitored for pH, temperature and flow. An auto sampler will take either a flow proportional or time proportional sample.

Sludge handling
Process sludge is to be stored in a purpose built tank installed with a thickener/stirrer and a level monitor to control the operation of the centrifuge feed pumps. The sludge tanks will incorporate decant facilities to reduce the volume of sludge discharged to the centrifuge. The sludge will then be pumped to a centrifugal decanter where a polymer solution dosed into the feed pipe facilitates the dewatering process. The sludge cake will be discharged to skip for off-site disposal and all centrate will flow to a storage tank before being pumped back to the alkali balance tank.

On the selection of *ACWA Services* as effluent treatment sub-contractor, *Earth Tech Morrison's* Project Manager stated: "ACWa was awarded the contract on its ability to provide references to a number of similar projects successfully completed for incineration sites in various parts of the UK and Scandinavia. The Company submitted a comprehensive and competitive bid for the effluent treatment project and in the early stages of process proposal and design submissions exhibited a sound knowledge of gas cleaning requirements and a proactive approach to contracting."

The fifth incinerator plant at Knostrop will be converted from a single pass process to a circulating flow system for connection to the new *ACWA* effluent treatment ■

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