Project Omega Sludge Disposal Solution

second stream sludge incinerator at Duncrue Street WwTW

by
Robin J Smith

Project Omega is a Public Private Partnership (PPP) project between Northern Ireland Water and Glen Water (a joint venture company incorporating Laing O'Rourke and Veolia Environmental Services) to provide, extend and improve wastewater treatment and sludge and incineration facilities. This Sludge Disposal element of the Omega project requires the construction and operation of sludge disposal facilities for all of the sludges generated by Northern Ireland's wastewater treatment facilities. It includes the provision of a second fluidised bed sewage sludge incinerator at Duncrue Street (Belfast) WwTW to process an annual sludge volume of 46,000 m^3 per annum at 24% dry solids, designed and constructed in accordance with EC Directive 2000/76/EC - Waste Incineration Directive (WID). As a result of the legal requirement to end the disposal of sewage sludge at sea, a fluid bed incinerator was constructed and commissioned in 1998 by Northern Ireland Water's predecessor, the Department for Regional Development (NI) Water Service. Now with increasing pressure to limit the disposal of sewage sludge to agricultural land due to the perceived risk of contamination, further incineration plant is being constructed.

New incinerator at dawn partially constructed with process equipment on foundations *courtesy Les Page, Project Manager, Laing O'Rourke*

Best site

Duncrue Street WwTW was identified as the best site in Northern Ireland because of a range of factors including adjacent land uses, transport links, planning policy and environmental issues (including the effect on humans, ecology, land, water, atmosphere and cultural heritage).

The Second Stream Sewage Sludge incinerator builds on the success of the existing incinerator and has been developed using the latest technology and to the highest environmental standards. It employs Best Available Techniques (BAT) and reflects the Best Practical Environmental Option (BPEO) following a detailed review by Ferguson McIlveen in 2002.

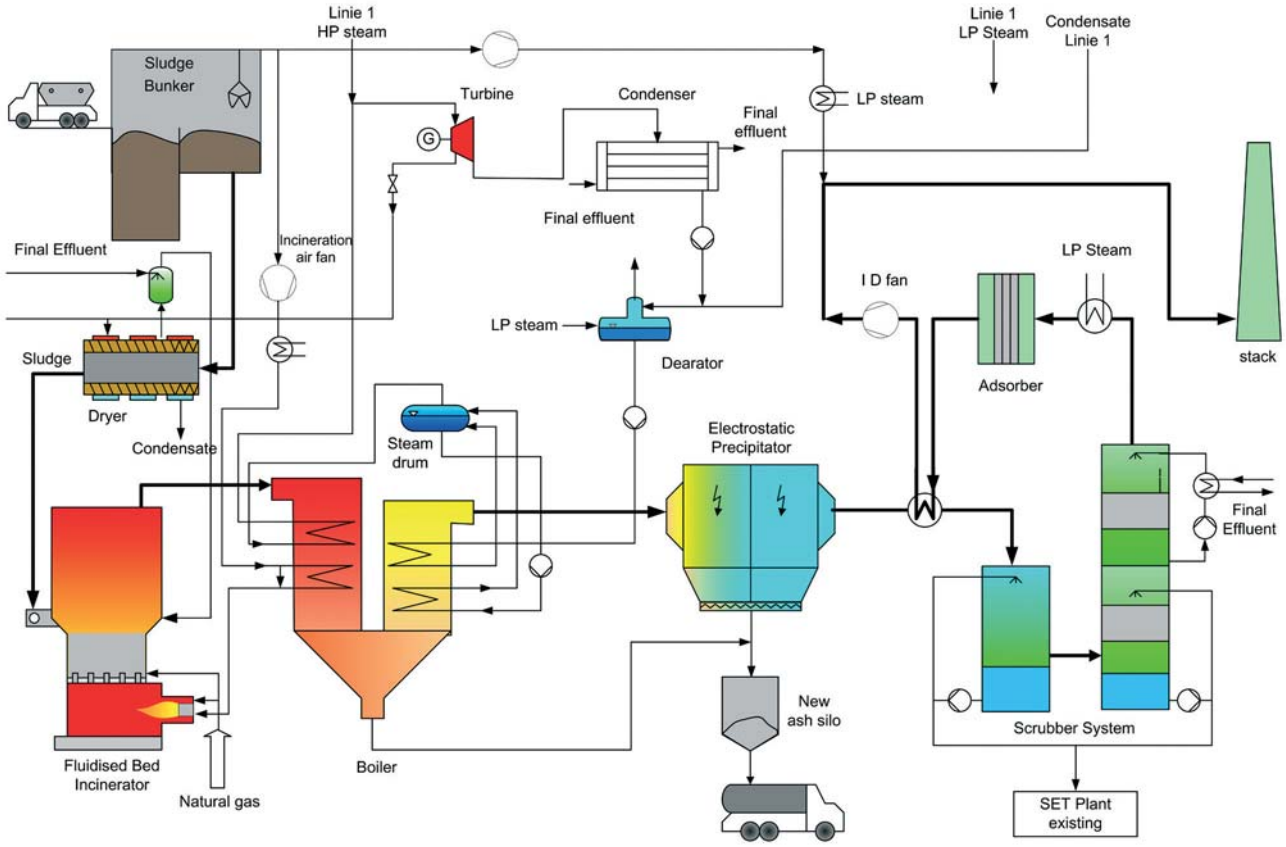
New design

The new Second Stream Sewage Sludge Incinerator building has been designed to mirror the shape and form of the original incinerator building structure, reflecting the maritime location of the plant and the backdrop of the adjacent industries. The building has 10 degree sloping sides clad in smooth silver aluminium set off with an overhanging roof and latticework architectural detail that compliments the "Belfast Industrial Skyline".

The new incinerator building is located some 17 metres to the west of the Existing Incinerator building. This location place the new building roughly equidistant between the Existing Incinerator building and the final settlement tanks of Duncrue Street WwTW. The new and existing incinerator buildings will be linked by a bridge that will permit services to cross between the two buildings, thus maximising the flexibility for operation of both plants either independently or together.

Optimisation of the existing incinerator is being carried out to ensure that the maximum throughput of 24,000 tonnes dry solids per annum is achieved. The new stream is rated for 24,000 tonnes dry solids per annum and when combined the two streams, together have a nominal capacity of 46,000 tonnes dry solids per annum.

Imported sludge for the second stream is delivered to the site from within the province by road at around 25% dry solids. It is tipped into



Schematic diagram of fluidised bed incineration process *courtesy of Bamag GmbH*

Basic Process Parameters	
Sludge input	24,000 Tonnes dry solids per annum (tds/a) at 24% Dry Solids
Drier output	2.1 to 3.0 Tonnes dry solids per hour (tds/hr) at 33% Dry Solids
Preheat temperature	260 – 400 °C
Combustion temperature	850 – 950 °C
Steam	11.8 to 16t/hr, 58Bar, 400 °C
Steam turbine/generator MCR	3420kW, 11kV, 50Hz
Emissions	To EC Directive 2000/76/EC - Waste Incineration Directive

a sludge storage bunker serviced by two fully automatic overhead cranes fitted with grab buckets to homogenise and decant the sludge into the process.

Stones and any ferrous metals are removed before the sludge enters the sludge drier. The drier reduces the water content to around 33% dry solids before being fed to the fluidised bed incinerator at around 2.1 to 3.0 tds/hr. At 33% dry solids the sludge becomes autothermic thus minimising the quantity of support fuel (natural gas) required for general operation. The normal operating temperature of the incinerator is in the range of 850-950°C, The 4 second residence time ensures complete oxidation of all the organic matter to CO_2. NOx is controlled by an SNCR (Selective Non Catalytic Reaction Process.

The hot gases pass through a two pass waste heat boiler generating superheated steam at 58bar 400°C which is used to preheat the combustion air for the incinerator, provide heat for the drier unit, drive the steam turbine/generator and to heat the exhaust gases before they exit the stack. The operation of the heat recovery boilers, the turbines and the condensate systems for both the first and second stream incineration plants is integrated, in order to optimise electrical power production for the site.

After the boiler the hot gases pass through a gas clean up facility to reduce the airborne contaminants to below levels required by the Waste Incineration Directive. This comprises an electrostatic precipitator (for particulate removal), a quench scrubber (for removal of HCI, HF, $HgCI_2$ and heavy metals), a packed tower scrubber/subcooler (for SO_2 removal), reheater and carbon adsorber (for mercury removal) before passing up the 70m high stainless steel stack. Ash is removed from the system and stored on site in 3 silos for onward transportation to landfill. The ash represents around 4% of the sludge load, thus significantly reducing the volume of waste to land fill. All ancillary systems such as compressed air, water, chemical storage and dosing are duplicated or extended from line 1.

At the time of writing construction is well underway with the building erection nearly complete and all process plant delivered and installed. Commissioning of the new incinerator is due to start in September 2008 with both incinerators entering formal service no later than May 2009. Parties involved in the process are as follows:
Main Contractor is Laing O'Rourke. Civil and Structural Design was carried out by Hyder Consulting (UK) and the Process Design and Process Contractor is Bamag GmBH.

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