

Gasification Demonstration Plant Design Study Northumbrian Water

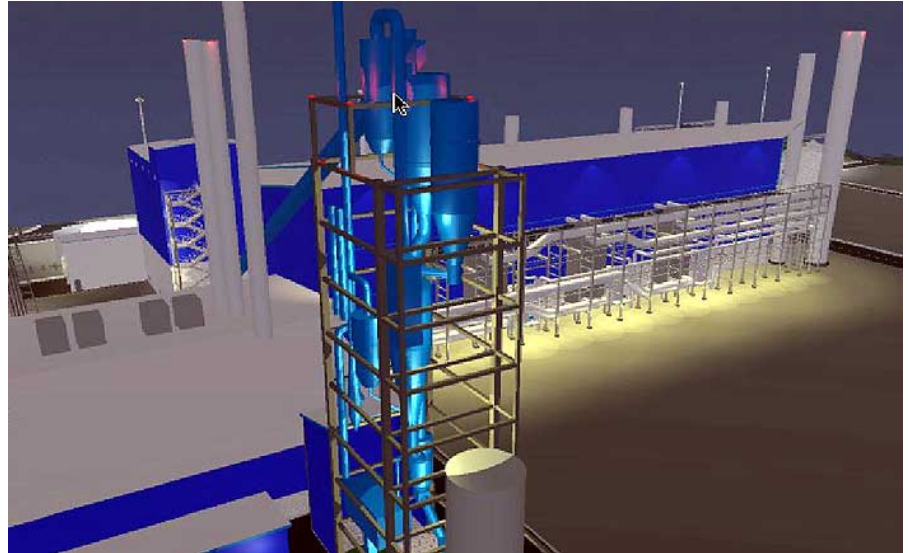
The gasification demonstration plant (GDP) was one of several dried sludge re-use options and technologies investigated by Northumbrian Water Ltd (NWL) and Entec for the Bran Sands site on Teesside, during the production of the sludge disposal strategy.

The gasification technology finally chosen for a full design study was the Lurgi Ruhrgas (LR) process. As well as the gasifier, to be designed and supplied by Lurgi UK, the GDP comprised two other main components; a compressor, to be supplied by Howden Donkin Blowers of Chesterfield, and a gas turbine, to be supplied by Dale Gas Power of Filey.

The three main contractors signed contracts split into three phases; design, construction and demonstration. The design phase was further divided into two parts; part one - conceptual design, and part two - detailed design. Such a structure minimised risk to NWL by permitting close scrutiny of the conceptual design to ensure that a technically feasible design solution was available prior to the commencement of detailed design work. Furthermore, on completion of the detailed design and receipt of confirmed lump sum prices for phase 2, NWL would be allowed to terminate the contract if they chose not to proceed.

The key elements of the conceptual design addressed were as follows:

- Optimum thermal capacity of the gasifier (on a cleaned gas basis) was to be 21MW. Thermal capacity was derived from a model developed within Entec based on a whole life cost assessment for the overall plant inclusive of gasifier equipment and gas turbine;
- Development of the environmental framework for the process, working alongside the IPC methodology to limit emissions within those anticipated to be set by the EA in the future authorisation for the plant;
- Justification that a three stage reciprocating compressor was suitable to meet the duty required, to compress partially cleaned raw gas from close to atmospheric pressure to 16 barg;
- Confirmation that final fuel gas composition to Solar Gas Turbines and that the proposed engine, a Taurus 60, would successfully burn the cleaned



- process gas to give satisfactory long term operation; and
- Reduction of project operating costs for treatment of aqueous effluent by initiating a wastewater design study involving recycling of aqueous liquors within the process.

Entec was appointed by NWL to manage the design study of the proposed gasification demonstration plant and to provide technical and design services. The four key elements covered in this appointment comprised:

Gasifier Island

- Provision of sludge design brief and monitoring of sludge testing programme;
- Assessment of contract deliverables against final payment;
- Programme delivery;
- Value engineering of final design;
- Resolution of gas composition thermodynamic model across compressor inter-stages; and
- Review of existing contract and redrafting of changes to reflect NWL requirements on process guarantees.

Compressor

- Review of alternative compressor types;
- Assessment of contract deliverables against final payment; and

- Programme delivery.

Power Island

- Development of a model that optimised plant size in relation to gas turbine performance;
- Calculation of fuel gas demand for turbine against ambient air temperature range;
- Assessment of contract deliverables against final payment; and
- Programme delivery.

Balance of Plant

- Supervision of accuracy and smooth flow of interface information to and from the main contractors;
- Resolve integration issues with the contractors packages;
- Addressing of environmental and planning issues;
- Design of emergency relief venting and flare system;
- Preparation of overall plant control philosophy;
- Design of materials handling systems and balance of plant;
- Hazard assessment and availability reliability and maintainability; and
- HV and LV design.

