Replacement Groundwater Plant at UKAEA Harwell

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Jason Allen reports on Bilfinger Berger Environmental Ltd's project to design and build a groundwater containment plant for the UKAEA.

Chemical contamination of groundwater at Harwell was first identified in the late 1980s. This contamination, principally by chlorinated organic chemicals, was subsequently linked to the historic disposal of waste chemicals in unlined chalk pits at Harwell. UKAEA subsequently undertook a major programme of work to investigate and deal with the contamination.

In the early 1990s a groundwater containment system was commissioned at the Western Storage Area, one of the major sources of the contamination. This was done as an emergency response to prevent further escape of contaminated groundwater from the site.

Replacement of the Groundwater Plant

UKAEA is committed to the continued operation of a groundwater containment plant as an essential component of the groundwater clean-up programme. The current assumption is that a containment plant will need to be operational until 2025, and this would be well beyond the design life of the original plant. To meet this requirement, UKAEA awarded a contract in October 2005 to Bilfinger Berger Environmental for the Design and Build of a replacement groundwater plant, to be operational from April 2007.

Following a detailed appraisal of all the possible solutions by Bilfinger Berger Environmental Ltd (BBE), a plant utilising liquid-phase Granular Activated Carbon (GAC) was selected as the preferred design.

The design offered several innovative features over the existing plant, some of which had never before been used in the UK, such as the use of mobile filter units (MFU) of granular activated carbon

Bilfinger Berger Umwelt, the German parent company of BBE, had successfully tested MFU in a large groundwater treatment project at Bitterfeld, Germany, with capacity to treat up to 250m^3 per hour. The Bitterfeld site is a typical example of an "industrial mega site", characterized by multi-source, multi-component contamination dominated by chlorinated hydrocarbons. The performance and logistics of MFU have proven to be very successful and effluent quality met stringent German standards for groundwater infiltration.

The new plant at Harwell offers significant environmental, health and safety, operational and cost benefits over the existing and common traditionally designed plants. These include:-

- Operational benefits
- Stainless steel construction for improved durability for the design life of 20 years.
- Significant reduction in energy consumption compared to the system it replaces in that it negates the need for an air stripping system.
- Significant reduction in operator manhours to run it and therefore costs.

- Significant reduction of the pollution burden rather than transferring it.
- Compliance with Health and Safety
- No exchange of carbon takes place on site improving H & S implications and costs.
- Removal of the need for confined space personnel-entry operations to remove the spent GAC.
- Replaces the need for working at height.
- Removes possible exposure to contaminated GAC dust.
- Reduced vapour emissions.
- Quieter operation.

The GAC exchange trucks are equipped with an entirely self-supporting loading and unloading system, thus removing any handling and lifting operations.

Considerations of sustainability

The plant has been designed to operate more efficiently than the existing plant and has less energy requirements. The regeneration of the carbon is more sustainable than the disposal route. Emissions are reduced as the carbon in the vessels is effectively enclosed and emissions are minimal. A regeneration route has also been identified for the spent GAC, reducing the waste generated by the plant.

Conclusion

BBE believe that this system is the first Groundwater Plant of its type ever built in the UK to use the 15m^3 GAC vessels. The installation contains the largest quantity of onsite carbon for chlorinated solvent/hydrocarbon removal in the UK with 90m^3 or 45 tonnes of activated carbon available. The system operates the highest flow rates of any chlorinated solvent/hydrocarbon groundwater plant in the UK to date.