

# Regeneration of previously developed land

## The Greenwich Peninsula: contamination remediation

### Background

The Millennium Village site is a former gasworks on the Greenwich Peninsula. The site had significant ground contamination related to gas works, tar distillation and a benzene plant. Due to the risks to human health and to controlled waters, the Environment Agency carried out remedial actions based on a series of risk assessments. The remedial actions included the removal of a 7 million litre tar well at the site of the Millennium Dome, washing 30 000 m<sup>3</sup> of soil, treating 66 000 m<sup>3</sup> of contaminated groundwater and effluent, and recycling 245 000 m<sup>3</sup> natural and engineering materials for backfill.

### Funding

The operations cost £21.5 million and were carried out over a period of 14 months.

### Objectives

The main objective was to remove the risk to human receptors and controlled waters through removal of key contamination, including volatile organic compounds (VOCs), cyanides, heavy metals, sulphur compounds and ammonia. The development would provide the venue for the Millennium Experience site, with the principal features being the Millennium Dome (a 26 000 capacity arena), sports, leisure and retail outlets, over 3800 affordable dwellings, over 10 000 new homes (including student and special-needs housing), over 3000 m<sup>2</sup> of office space, a new business park, community uses including new schools and health provision, 194 200 m<sup>2</sup> (19.5 ha) of open space, 300- and 500-bedroom hotels, 25 000 jobs in commercial and retail enterprises.

### Materials and Methods

#### Method

The statutory remediation was carried out first. This involved the removal or treatment of the most significant long-term sources of pollution, including removal of the tar well and an effluent pond associated with chemical works, off-site disposal of wastes to landfill, in-situ remediation of volatile hydrocarbons using soil vapour extraction, and on-site treatment of contaminated groundwater.

The development remediation was then carried out, and involved isolating the residual contamination through the construction of barrier systems to prevent gas and vapour accumulation beneath future buildings.

## Results

During the process of remediation a number of validation tests were carried out in order to detail the extent of the residual contamination. The validation results demonstrated that all the significant pollutant linkages identified in the risk assessment process had been addressed by partial or complete removal of the source, or modification of the pathways. The level of human risk associated with the residual gases, such as carbon dioxide and benzene, was shown to be acceptably low, although gas control measures were incorporated into the floor of the Millennium Dome as a precaution and in order to carry out ongoing monitoring of gas evolution.

## Discussion

Cost-effectiveness was a key consideration throughout the remedial process, and the timescale was restricted to 14 months. However, despite these restrictions the remedial objectives were dependent on ensuring that the residual levels of risk were acceptably low for humans and controlled waters. Construction methods have therefore been employed to minimise the movement of contaminated groundwater to areas that have already been remediated.

## Reference

Barry, D.L. (1999). The Millennium Dome (Greenwich Millennium Experience site) Contamination Remediation. *Land contamination & reclamation* **7**, 177-190.