CASE STUDY

Site investigation services at Hinkley Point

STRUCTURAL SOILS LTD

Background

The UK government has identified nuclear power as a key ingredient in the country's future energy mix. If given planning permission, Hinkley Point C could become the first of the UK's third-generation power stations and produce more than 6% of the country's total energy demand.

Hinkley Point headland is already home to Hinkley Point A (now being decommissioned) and B (currently producing 2% of the UK's power) nuclear power stations. However, as this is the first new build station in over 20 years, developer EDF Energy (EDF) wanted to ensure that it had extensive knowledge of the surrounding geology to help it make a successful application for planning permission to the Infrastructure Planning Committee (IPC).

Structural Soils Limited (an RSK company) was therefore commissioned by EDF to undertake an intrusive ground investigation worth over £3 million at Hinkley Point.

The site was located immediately to the west of Hinkley Point B, approximately 8 km to the north of Bridgwater, Somerset.

Project description

The purpose of the work was to investigate ground conditions and provide information for the design of foundations for the power station's two European pressurised reactors (EPR) and associated structures.

The work involved a total of 4000 m of rotary drilling with each borehole reaching depths of up to 140m. In addition, approximately 140 geotechnical and environmental trial pits and window samples were carried out. The main objective of the work was to investigate the integrity, structure and geotechnical properties and characteristics of the geological strata on which the reactors and associated structures are to be founded. To study the nature of specific geological anomalies, identified by a surface geophysical survey, some of the rotary boreholes were inclined at angles between 30° and 45° from the vertical.

Services

Geotechnical investigation

A considerable array of in situ geophysical survey techniques were carried out including surface seismic refraction and resistivity tomography surveys; cross-hole, up-hole and down-hole seismic testing; and down-hole optical televiewer logging and geologging to identify the in situ physical properties of the geology.

In addition, physical in situ tests including static cone penetrometer tests, hydraulic fracture testing, Menard pressuremeter tests, high-pressure rock dilatometer tests and packer permeability tests were undertaken and formed a large part of the investigation. A large-scale pumping test was also undertaken.

An experienced team of more than 10 engineers supported by additional office-based contingent supervised the site work. All site staff were trained to handle visitors to the site from different backgrounds and levels including the general public, local authority officials and representatives and EDF officials. The health and safety management on site was under constant review, with daily briefings to all staff and daily meetings with the client, the site owner and operator and CDM coordinator team.

Our well-equipped and UKAS-accredited laboratory undertook extensive laboratory core testing, while our advanced gINT geotechnical borehole logging software produced and populated all of the laboratory data and helped to characterise the geotechnical properties of the different lithological units.

Ecology

RSK has provided a detailed ecological survey, as well as an experienced ecologist to monitor work throughout the project.

Radiological services
Fourty percent of the Hinkley Point C site is on the nuclear licensed site and therefore, the whole site has the potential for contamination. RSK's Radiological business unit, a joint venture between RSK and US partner Radiation Safety & Control Services (RSCS), has provided health physics technicians, method statements for radiological protection and additional HSE and behavioural training for RSK employees new to a nuclear site.

Laboratory testing
Envirolab, RSK's wholly owned analytical testing laboratory, has provided additional chemical testing of samples.

Challenges

Testing
In an effort to achieve best practice levels on a global scale, EDF asked Structural Soils to carry out several testing methods that are rarely used in UK site investigations, when compared to other European countries.

These included Menard pressuremeter testing, high-pressure rock dilatometer testing and hydraulic fracture testing.

Structural Soils' solution was to bring in top specialist contractors from around Europe to ensure that these tests were performed accurately, efficiently and in compliance with the stringent requirements of the consultant.

Borehole drilling
It is common practice in the UK to form aquifer protection seals within exploratory boreholes at relatively shallow depths to protect underlying aquifers or bodies of groundwater from shallow contamination in the ground.

As a significant portion of the site had potential for the presence of contamination in the ground, radioactive or otherwise, EDF was particularly vigilant and concerned as to the possibility of forming vertical preferential pathways for contaminants by the drilling of boreholes. It was therefore agreed that a second tier of aquifer protection measures be installed on certain areas of the site at the base of the most permeable strata at 20 m depth.

Water supply
No supply of fresh water was available on site to carry out the investigation and subsequently all water used had to be brought to site by road tanker. Typically, 1000–2000 litres of potable water was required for every 1 m core drilled. With up to 10 drill crews operating at any one time, and 3 teams carrying out packer permeability tests, water demand was often in excess of 100,000 litres per day.

Transporting this amount of water across a 1.76 km² site created significant logistical problems for Structural Soils.

To add to this, EDF's environmental management plan stipulated that no drilling flush was to go to ground.

The solution was to create a large network of surface water supply pipes across the site, charged by water pumped under considerable pressure from 30,000 litre tankers, and an army of 1800 intermediate bulk containers (IBCs) to collect the used drilling flush for testing and subsequent disposal.

Result

At any one time RSK has had up to 60 staff on site, with up to 10 drill crews operating at any one time. Around 200 boreholes were drilled over a 9-month period, making it probably the largest site investigation in the UK at the time.

The data gained from the investigation will be submitted to the IPC and it is hoped that planning permission will be granted in 2011.

Moreover, the knowledge gained on this project has given Structural Soils the experience required to bid for other investigations of this size and scope in the future, including those on nuclear licensed sites and specifically for new nuclear build projects.

For further information, please contact:

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