



Engineering Group of the Geological Society



One Day Seminar

Date/time: 09.30am Wednesday 14 January 2009

Venue: The Geological Society Burlington House, London

ENGINEERING HYDROGEOLOGY PREDICTIONS, MANAGEMENT, DEWATERING AND LEGISLATION

SESSION ABSTRACTS

GROUNDWATER PREDICTION SESSION

Predicting the Effects of Civil Engineering Projects on the Groundwater Environment: Choosing the Right Tool for the Job

Mike Streetly, ESI Ltd

Civil engineering projects may impact the groundwater environment in a range of ways. In the past, most of the focus was on the effect on groundwater levels (and to some extent flows). However, more recently, concerns about the potential risk of chemical and thermal pollution have increased. This means that the range of predictive tools that needs to be considered is now wider. This talk will review some of the approaches that can be considered, illustrated by appropriate examples. First a tiered approach for flow/level modelling will be discussed: moving from analytical and spreadsheet based tools to more complex 2D and 3D modelling. Then new approaches to predicting thermal and chemical impacts will be discussed. The importance of monitoring data and an appropriate conceptual model will be emphasised.

GROUNDWATER MANAGEMENT SESSION

Karst Hydrogeology in South Africa

David Whitaker, Arup

A new high speed rail link is being built in South Africa. The alignment crosses a 2 billion year old karst aquifer which supplies the metropolitan area north of Johannesburg. CRD (Cumulative Rainfall Departure) analysis has been used to separate abstraction-related changes in groundwater level from fluctuations due to varying inputs from recharge. A heavily abstracted catchment in the Malmani dolomites is compared with one in which groundwater development is based upon utilisation of natural spring flows. The long term effects of spring capture upon water levels are assessed.

Management of Ground and Groundwater Contamination at Sellafield

John McCord, Senior Hydrogeologist/Project Manager Sellafield Ltd

Sellafield Site is a compact and complex site which since the 1940s has been home to a range of facilities associated with the production and reprocessing of fissile material. Spent fuel reprocessing is still undertaken on site; however waste management and decommissioning activities are of increasing importance. These include the emptying and removal of fragile ponds and silos containing significant radioactive inventories, the decommissioning of reactors (including the world's first commercial reactor for power generation and the Windscale Piles, the site of a reactor fire in the late 1950s) and the construction of a new generation of vitrification and encapsulation plants.

Leaks, spills and on-site disposals during the site's industrial lifetime have resulted in a legacy of fission products and other radionuclides in the ground and groundwater. Volumes of contaminated



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ground have been estimated as being as much as 18 million m³. These have all occurred within close proximity to a range of receptors including farm land and the sea.

The cramped nature of the facilities on site, overlapping source terms and ongoing decommissioning, waste management and operating activities all raise significant challenges in the management and remediation of contaminated land and groundwater. The strategy to address these challenges includes:

1. Data collection, management and interpretation.

The congested nature of the site and the age of some of the monitoring facilities has resulted in particular difficulties. For example the design of a new characterisation project has had to be constantly reworked to ensure fragile plants, site services, current operations and decommissioning projects are not impacted.

2. Assessment of Risk to the public and workforce.

Risks need to be assessed for the short, medium and long term. The main pathways to receptors are through groundwater or excavations. Risks to the public are complicated through the proximity of the site to major receptors such as the sea and a near-by dairy farms. As entry to the site is controlled, excavations into contaminated ground are only possible by members of the workforce whose activities are managed to minimise any risk. This is through a system of excavation permits and authorisations for disposal of excavated material which can add significant time and cost to construction projects on site.

3. Prioritisation of remediation.

Large volumes of impacted ground and groundwater sit beneath fragile buildings with significant inventories. With current decommissioning schedules wholesale remediation of ground and groundwater near or under key buildings cannot commence for at least another 40 plus years. Early remediation and/or containment of groundwater further away from the source terms and remediation of smaller accessible areas of contamination are being considered and will be assessed through a comprehensive optioneering process. Long term clean-up strategies run into the early part of the 22nd Century, making any predictions as to the end-use of the site and therefore clean-up criteria for current projects difficult to determine.

DEWATERING SESSION

Assessment of Impacts from Groundwater Control Projects

Martin Preene, Technical Development Director Golder Associates (UK) Ltd

Groundwater control encompasses the range of techniques used to allow construction projects such as tunnels or basement excavations to be carried out in dry and stable conditions. Two principal approaches can be used: groundwater control by pumping (commonly known as dewatering), which lowers groundwater levels in the vicinity of an excavation; or groundwater control by exclusion, which relies on low permeability cut-off walls around the excavation. One of the challenges for the future of groundwater control methods will be the need to better predict, monitor and mitigate the impacts on the groundwater environment. This presentation will use examples from case studies to illustrate the wide range of potential impacts that can result from dewatering and groundwater control activities, and to highlight potential mitigation and monitoring measures.



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The Influence of Large Scale Inhomogeneities on a Construction Dewatering System in Chalk Dr Toby Roberts, Managing Director WJ Groundwater Ltd

Large scale inhomogeneities are a known feature of chalk aquifers which can significantly affect the performance of a construction dewatering system. A groundwater model for a tunnel approach structure has been used to show that the observed performance of the dewatering system cannot be adequately explained unless such features are incorporated. The monitoring records and model have been used to assess the physical scale and hydro-geological characteristics of the inhomogeneities encountered in this case. Accurate prediction and assessment of such features is often not feasible or inadequate from the site investigation information available for design of the dewatering system. Anisotropic conditions are particularly hard to identify primarily because they have most significance once a horizontal flow barrier is in place, which is generally not the case during the site investigation. The model results provide some insight into the scale of variations that are potentially significant and must be looked for in a site investigation.