

## Report Summary

# Geophysical surveying techniques to characterise a site for a geological disposal facility: A review of recent developments and NDA's proposals

The Environment Agency's (EA) Nuclear Waste Assessment Team (NWAT) commissioned a review of the geophysical surveying techniques that could be used to understand the sub-surface characteristics of a candidate site for a geological disposal facility (GDF) in a range of geological environments in England and Wales. The work also looked at how the Nuclear Decommissioning Authority Radioactive Waste Management Directorate's (RWMD) is planning to use geophysical surveying techniques to assist in the characterisation of candidate sites for the disposal of higher activity radioactive waste.

Licensing a GDF will be a staged process and RWMD will need to apply to us for a permit before it starts intrusive investigations at a candidate site. RWMD's application, at that stage, will include an initial site evaluation which could be supported by information gathered using geophysical surveys. We will evaluate the evidence supporting RWMD's application and if satisfied that the proposals meet our regulatory requirements we will issue a permit. Thus, regulatory oversight will be established very early in the development of a GDF. This review will help us decide whether RWMD proposes to use appropriate techniques to gain the necessary and relevant understanding about the sub-surface characteristics of a candidate site before it disturbs the site. This is one aspect we will consider before we grant a permit to allow RWMD to commence intrusive investigations at a candidate site.

Geophysical surveying gathers subsurface data without disturbing a site. It can be used to develop an initial understanding of the sub-surface conditions, in order to define and focus subsequent (more disruptive) investigations. Seismic reflection is likely to be the main geophysical surveying technique used at the site scale. Other geophysical surveying techniques could yield valuable additional information at the regional and the site scales.

Geophysical survey techniques are evolving rapidly. Therefore we might need to update this report periodically, particularly once a site is selected and RWMD applies for a permit. We did not attempt to review any given technique in detail. Therefore once it becomes evident that RWMD is using, or should be using, a particular geophysical survey technique, we might need to investigate in detail, in the site-specific context, whether the technique can deliver the necessary information.

Several geophysical surveying techniques are currently being investigated and developed, by various organisations around the world, to improve data acquisition and interpretation. This should result in more accurate surveys and better use of integrated acquisition and interpretation strategies in future.

RWMD plans to use geophysical surveys in a similar manner to investigations undertaken for oil and gas. First it will survey the region at a relatively low resolution and then it will survey a specific and smaller area of interest in more detail.

RWMD also proposes to drill some boreholes in the early stages of the investigation. RWMD's plans need to be flexible enough to address the many challenges in characterising a site. In most circumstances we consider it is better to gather and interpret adequate geophysical data before drilling boreholes. We will expect RWMD explain how it will integrate and use information from interpreted geophysical data and borehole investigations.

RWMD recognises that developing a data management system and making it interact with visualisation and interpretation software is a considerable technical undertaking. RWMD will need to plan carefully how it will incorporate disparate geophysical data sets and interpretations with data and interpretations from other disciplines, and test them thoroughly under operational conditions.

As a result of this review we recommend that RWMD should:

1. consider how time-lapse geophysical surveys could be used to inform the development of a GDF. RWMD should identify any requirement for specific time-lapse geophysical surveys as early as possible once a candidate site, or sites, is selected, in order to plan and integrate each survey into the programme of site works.
2. build in as much flexibility as practically possible when they review the terms of the generic site characterisation programme or develop a site-specific programme.
3. programme geophysical surveys to precede and inform any borehole drilling, unless the technical requirements of a specific site dictate otherwise. The geophysical and borehole investigations should be fully integrated to optimise the detail, accuracy and coverage of the geological model.
4. develop and test its data management system and any visualisation and interpretation software in operational mode using typical data sets before they are used in a site characterisation project. This will test the functionality of the system and help to train operatives.
5. monitor the latest practical developments in geophysical techniques, and seek opportunities to incorporate relevant research and development into their programme.

We will continue to review RWMD's generic site investigation programmes and any subsequent proposals developed for a candidate site or sites. A regulatory review of any proposal from RWMD for site-specific characterisation will be more detailed, and might need to consider techniques that we have not addressed in this review of generic use of geophysical surveys.

**Full report:**

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This project was carried out by the Environment Agency's Nuclear Waste Assessment Team (NWAT). NWAT provides technical support to the Environment Agency on the management and disposal of radioactive waste in England and Wales, to ensure that wastes are disposed of in the most appropriate manner to protect the public and the wider environment, and to contribute to the UK's aim of sustainable development.

Further copies of this summary, and the full report, are available from:

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