

From Tim Atkinson,
Principal Research Associate &
Honorary Professor of Environmental Geoscience,
Department of Earth Sciences,
University College London,
Gower Street, London WC1E 6BT.

National Geological Screening Consultation,
Radioactive Waste Management,
Building 587,
Curie Avenue,
Harwell,
Didcot OX11 0RH

16 December 2015

National Geological Screening Consultation

I attended the Consultation Meeting in Ipswich some weeks ago. I am sorry that I have missed the deadline for reply to the formal consultation document, but I hope it is not too late to send comment by letter.

Broadly speaking I was happy about the level and scope of information that it is proposed to provide, and the regionalised approach to providing it. Communities that are thinking seriously about starting the volunteering process may want more detailed information related to their specific territories, but presumably there will be a mechanism for providing this on further enquiry.

One area which is not covered very well by the consultation documents, although it was touched upon in the discussions at Ipswich, is the communication of uncertainties surrounding our current knowledge of geologic conditions at the depths relevant to a repository, and therefore the degree of current uncertainty about the suitability of any particular location (or region) as a potential site. By uncertainty I mean the degree to which our current knowledge is tentative, and also the scope of what we do not know, whether tentatively or at all. For example in the East Anglian region we may say that we are "fairly certain" of the depth to basement rocks beneath the sedimentary cover of Cretaceous and Jurassic strata, on the basis of evidence from geophysical surveys as well as a few deep boreholes. However, our knowledge of what rocks make up the basement is known only from a few boreholes that have provided samples, and none of these penetrate far into the basement. Although these borehole rocks are broadly similar to the Palaeozoic sedimentary rocks found in the Welsh Marches and the West Midlands, and there is evidence that some parts not actually penetrated by boreholes may be underlain by igneous rocks, our knowledge of the geological structure is so incomplete that it would be very difficult to predict what the nature of the basement rocks might be at locations between boreholes. Thus our knowledge of the suitability of the basement for housing a repository has a "high degree of uncertainty" for any given location in the region, except where there are boreholes.

A related issue in East Anglia concerns the degree to which the basement and cover rocks are connected hydraulically. There is "almost complete uncertainty" regarding the direction of the vertical

hydraulic gradient, as there are no head measurements at all in the basement rocks. The only indication of the possible direction of this gradient comes from the geothermal gradient, which is relatively high in East Anglia and might possibly reflect an upward flow of warm groundwater from depth, driven by heads beneath high ground in the southern Pennines. (This was a speculative interpretation made by Downing and others in the 1970s as part of their assessment of geothermal resources in the UK.) Boreholes provide indications of the presence or absence of low permeability strata interposed between the basement and the overlying sedimentary aquifers. You mentioned the Gault Clay in this regard. It is very thin in the western part of East Anglia, and without looking up borehole records myself I am unsure of how it may thicken eastwards.

It may be useful to have a standardised, formally defined vocabulary for communicating uncertainty in this sense, as the IPCC has for climate change issues.

The communication of uncertainty leads naturally on to a second area which is not covered by the consultation documents. This is the identification of the major unknowns in each region, and what the first steps would have to be to investigate them. (By major unknowns I mean those that would be critical for a repository.) In the East Anglian region one might list these, following the above, as:

- (a) the lithology, local geological structure and permeability of the basement rocks, as these would have to house any repository;
- (b) the direction of vertical hydraulic gradients between them and the overlying aquifer strata in the Chalk and the Lower Cretaceous sandstones, as this would determine the direction of transport of material leaving the repository;
- (c) the presence of any low permeability strata that could impede groundwater flow between the level of a repository and the overlying aquifers, as this might provide a natural barrier to migration of material from the repository.

It needs to be made clear that because of the current uncertainty surrounding these issues, any expression of interest would have to be followed by assessment and possible site investigation, probably involving the drilling of a borehole, to decide whether any of them present reasons that would eliminate the site from further consideration. As the framework provides for either side to leave for any reason during the early stages, this would provide a clear view of the limited commitment that both sides would be contemplating at such an early stage. Only if investigation revealed no 'game-changer' on any of the three issues above, might RWM wish to proceed to the next stage if the community were willing also.

It's my belief that without a road-map as to how uncertainty will be dealt with, communities may be reluctant to volunteer. With such a map in hand, however, it would be clear that risks arising from proceeding to the first step would be low relative to possible advantages to be gained from the engagement process (although this would depend on what those advantages were in terms of remuneration or community development).

(end)