Comments on: National Geological Screening Guidance – Providing Information on Geology

I generally agree with your approach to site selection, however, I think that you need to be more careful as to precisely how you refer to geological matters. As you are no doubt aware, it is very easy to be criticised for making statements that are not completely scientifically correct. I thought it would be useful to send you some comments now, so that you could perhaps take such matters into account when you have your public meetings.

Figure 3 – this is supposed to be an example of a possible GDF and is described as 'an artist's impression'. However, the figure includes very specific dimensions in the horizontal plane. These dimensions are, of course, only relevant to a specific GDF design and also to a specific type of disposal environment. The separation of disposal tunnels, the size of the tunnels or galleries, etc. in different host rocks will vary considerably. What would be best would be to show perhaps three different designs, relevant to different disposal environments, or, if you only wish to have a single illustration then, at a minimum, you need to remove the specific dimensions. Also, in addition to mentioning that the surface facilities are likely to have an area of approximately 1 km^2, it would be useful to contrast this with the expected range of possible areas required for the underground facilities, i.e. perhaps 10 - 12 km^2 approx.

You also need to discuss somewhere that the likely depth for a GDF will vary depending on the potential host rock and the geological environment in which it is located. For example, it is unlikely that it will be possible to locate a GDF in lower strength sedimentary rocks at a depth in excess of approximately 600 m, due to their limited strength, whereas it would be possible in higher strength rocks and also, possibly, in evaporites – although in these latter rocks a very different type of GDF operational phase would be necessary.

Para 3.15 – You state: "Higher strength rocks, which may be igneous, metamorphic or older sedimentary rocks, have a low matrix porosity and low permeability, with the majority of any groundwater movement confined to fractures within the rock mass." You need to add volcanic rocks to this description, especially as the BVG in Cumbria is such a rock type. I know you have been told this previously, but for some reason you seem reluctant to change your description.

Para 3.15 – When discussing the properties of potentially suitable host rocks I think it would be helpful to mention that the properties presented are those applicable to disposal depths, e.g. low permeability for higher strength rocks. As you well know, the permeability of such rocks in the uppermost, say 100 m and possibly more, will be substantially higher than at potential disposal depths and rocks at these depths could not be described as having 'low permeabilities'.

When discussing evaporite rocks you need to be careful about how you describe their properties. You state that: "They are weak and creep easily so that open cracks cannot be sustained." The majority of evaporites do have such properties, in particular halite, however some evaporites, such as anhydrite, for example, are quite brittle and can sustain open fractures, even at quite considerable depths and for very considerable periods of time. They can also be associated with zones of

pressurised groundwater and also possibly gas – although this is more likely to occur in salt domes rather than in bedded evaporites. It is for this reason that in safety cases which consider evaporite sequences, e.g. Gorleben, WIPP, etc., radioactive waste is not placed close to such types of evaporites.

Para 3.16 – You need to state here that only rocks units which have thicknesses in excess of (some value to be stated by you) will be identified. Although you do mention thickness in para 3.18, although in rather vague terms, I think this factor needs to be more clearly stated. The absolute minimum thickness for any potential host rock is most likely to be associated with the lower strength sedimentary rocks, where it is probable that the minimum acceptable thickness is 50 m – a greater thickness is very likely to be preferable, unless the host rock is itself confined by other low permeability sediments. There is good evidence on this subject from the current work by Andra and Nagra.

Pare 3.21 – You state: "Major faults and fracture zones that would provide effective limits to any rock volume being considered for siting a GDF". This is not necessarily the case – it depends what you mean by the term 'major'. If such features are those shown on the large-scale BGS maps referred to, then I agree with your statement, however there are many smaller faults and fracture zones which could be considered in this category (and could be referred as major, at least on the scale of a site investigation for a GDF) but which are not shown on these maps. Such features would, of course, control where waste would be emplaced in a GDF, but all such features would not necessarily provide the outer limits of a GDF – just look at the way that fracture zones control the design of the proposed GDF at Olkiluoto, for example. Some of these fracture zones in Finland are quite substantial.

Para 3.27 – Are you going to show here the extent of the last two glaciations (and will these two glaciations be distinguished in some way?) or perhaps the potential extent of earlier glaciations, evidence for which is far more limited?

Table 3 – It is stated in Table 3 (and also see Table 2) "Explanation of the nature of the structures within the region that are relevant to safety. These will be major faults and fault zones and areas of folded rocks with complex properties." There are likely to several structural features that are very relevant to safety that are not 'major fracture zones' – especially as your description of such zones makes reference to the large-scale BGS maps (see para 3.21). If you look at the safety cases for Olkiluoto, Forsmark, Benken, etc. you will see that there are several such structural features that could not be described as being 'major' and also, as commented on with reference to para 3.21, some of which could be described as being major, but which are unlikely to be featured on the BGS maps. It might be useful when discussing this subject with audiences to show them images of such features from the various radwaste programmes which have considered them, and then explain why and how their presence, and their possible properties, need to be taken into account.

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