Written evidence prepared for:

The Business, Energy and Industrial Strategy Committee's inquiry on Draft National Policy Statement for Geological Disposal Infrastructure

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I hold the Chair in Radioactive Waste Management at the University of Sheffield, and am Head of the Department of Materials Science & Engineering, where I lead the largest academic research team in the UK working on radioactive waste management and disposal. My research has focused on the conditioning of higher activity wastes and fissile materials and the performance of waste packages in storage and disposal. I have served as a technical expert for the International Atomic Energy Agency and provided advice and guidance to radioactive waste management organisations in the UK and overseas.

Declared interests: Fellow of the Royal Society of Chemistry; current research grants sponsored by the Nuclear Decommissioning Authority, EPSRC, European Commission and US Department of Energy, and others; member of Nuclear Innovation Research Advisory Board (2013-20).

This is an individual submission and I will address aspects of those questions raised by the inquiry, relevant to my expertise. Geological disposal is the best available approach for radioactive wastes arising from historic and planned future nuclear fuel cycle activities. The Draft National Policy Statement NPS) creates an essential framework for evidence based decision making on development consent for Geological Disposal Infrastructure. Therefore, I welcome the Draft NPS, earlier Government consultation and this inquiry by the Business, Energy and Industrial Strategy Committee.

Are the draft National Policy Statement's Assessment Principles and Impacts, including the requirement to take the Environmental Impact Assessment and the Habitats Regulation Assessment into account, adequate and comprehensive enough to inform development consent decisions? If not, how could they be improved?

1. Overall, the draft NPS Assessment Principles and Impacts are comprehensive and constitute a transparent framework for evidence based decision making on development consent. I suggest two areas for consideration and improvement below.
2. The Infrastructure covered by the Draft NPS includes the Geological Disposal Facility itself and the boreholes necessary to determine the suitability of a site to host the facility. However, the Draft NPS does not include provision for an Underground Research Facility (URF), which has proven pivotal in almost all advanced programmes for geological disposal of radioactive waste. The purpose of a URF is to: extensively characterise the host rock, hydrogeology and geochemistry; conduct in situ experiments of radionuclide migration and sorption; and to undertake full scale demonstration of technology to construct the facility, emplace / retrieve wastes, and backfill and seal the deposition zone. URFs have

also proven effective in building public trust in the development of geological disposal infrastructure. It is likely that a URF will also be essential enabler for successful realisation of UK Geological Disposal Facility, and, therefore, consideration should be given to its provision, by the developer, within the Draft NPS.

3. The impact of the radioactive waste inventory on the infrastructure requirements and impact assessment of the geological disposal facility are not well considered in the Draft NPS. The required underground footprint will be determined primarily by the volume of heat generating spent nuclear fuel and high level waste to be emplaced and is thus sensitive to:

    - The extent to which the UK plutonium stockpile can be reused as mixed oxide (MOX) fuel in light water reactors, per Government policy (with due regard to burnup and cooling time).
    - The spent nuclear fuel inventory from new build nuclear power stations, for which geological disposal is required (per Section 5.5.2)

    The underground footprint of the Geological Disposal Facility, in terms of construction, operation, and waste generation, is a key driver of the environmental impacts identified in the Appraisal of Sustainability Report (e.g. air quality, noise, human health). The Draft NPS, and the Assessment of the Examining Authority and Secretary of State, should consider the extent to which bounding scenario assumptions on the waste inventory, particularly concerning spent MOX fuel and spent fuel from new build, affect the infrastructure requirement and impact assessment.

What priority should each of the Assessment Principles and Impacts have or should equal weight be given to each of them?

4. Notwithstanding the overriding requirement that the application must demonstrate, at the time of submission, that the envisaged infrastructure fulfils the essential safety requirements of a Geological Disposal Facility, the Assessment Principles are clear and appropriate.
5. With regard to weighting the proposed Assessment Principles, a hierarchy of consideration may be more effective, as outlined below, to avoid over-performance in one part of the assessment unduly compensating for under-performance in another.
6. Of the stated Assessment Principles, good design, safety and security may be considered as primary requirements. If these requirements cannot be adequately demonstrated, in terms of best available technological approach, then it is inconceivable that the impact of the infrastructure on health and the environment (pollution and nuisance) could be justified.
7. Assuming that good design, safety and security can be demonstrated, the test should then be whether regulatory compliance is achieved and the health and environmental impacts of the development have been avoided, reduced, or mitigated, as far as reasonably practicable.
8. Climate change adaptation presents a unique challenge in the context of the ca. 150 year operational timescale of the infrastructure development and it should

certainly be considered in the assessment. The Draft NPS provides some requirements for the application in this respect, in consideration of 10%, 50% and 90% probability ranges of the high CO_2 emissions scenario of the UK Climate Change Risk Assessment for safety critical elements of the infrastructure, so as to make a risk-averse evaluation. This is a reasonable and practical approach. However, given the very negative consequences of high impact scenarios, it would be worth eliciting expert advice as to whether additional considerations would be appropriate.

Additional comment: impact of exiting the European Union

9. I draw the attention of the Committee to the following impacts of exiting the European Union, insofar as they relate to geological disposal of radioactive wastes in the UK.
10. Ensuring the long term safety of radioactive waste disposal is evidently a scientifically challenging proposition and demands expensive engineered infrastructure. Our participation, hitherto, in the relevant Euratom Framework and Horizon 2020 research programmes has proven extraordinarily beneficial and value for money, given that the UK has the largest radioactive waste inventory in Europe.
11. Likewise, access to transnational infrastructure, such as the EC Joint Research Centre at Karlsrhue, provides unique facilities, not available in the UK, for working with highly radioactive materials, to answer fundamental research questions relating to the safe disposal of radioactive wastes.
12. Government should now, as a matter of urgency, put in place the measures and resources, and articulate the necessary assurance, to maintain participation in European research programmes, and access to facilities, relevant to geological disposal of radioactive wastes, such that the safety of the proposed infrastructure is underpinned by the latest research of the highest quality, through cost-sharing with European partners.