Memorandum submitted by the British Geophysical Association

Our recommendation is that, before any proposed geoengineering project proceeds, evidence-based geophysical modelling of its effects should be carried out and must demonstrate that, with appropriate hazard mitigation measures, relevant risks are low and proportionate to the benefits that will be obtained.

Geophysics is the application of physics to the study of the Earth and planetary systems. It includes the understanding of atmospheric dynamics and atmosphere-Earth-Sun interactions crucial to the prediction of climate and weather, and the rock-fluid-gas interactions crucial to secure carbon dioxide (CO_2) sequestration. Much of this understanding has come from computer modelling; with the sophistication of these models increasing as computing power has increased. Where such modelling is isolated from real evidence, there is a danger that it can become unrealistic. By evidence-based modelling we mean that the computer models used to test the effects of a geoengineering intervention in the Earth's system have themselves been proved against observations. Such observations depend on steady funding and in some cases, a legal obligation to deposit them with a government agency and hence are endangered by legal or financial neglect.

A variety of observations can be used to test Earth system models. Laboratory experiments on real or artificial rocks under pressure and permeated with fluid or gas, and downhole and remotely-sensed (e.g. seismic) observations of gas flow through rocks, have been used for many years by the oil industry in enhancing production of subterranean oil and gas. The storage and curation of records from these experiments is needed to ensure that they are available for future proving of geoengineering-related models.

The British Geological Survey, for instance, has recently announced plans to integrate its "library" of borehole cores and logging records from onshore and offshore UK into a single modern facility within the National Geoscience Data Centre. The evidence against which to gauge weather and climate models includes centuries-long unbroken weather records.

Continuing to add to and preserve records such as these incurs a regular cost that is prone to be cut when short-sighted cost savings are made, because the economic benefit is not immediate. Further back than the purposeful records, historical, archaeological, palaeontological and geological evidence can all be gained by research. Such research is expensive, painstaking and frequently unglamorous, as exemplified, for instance, by the drilling of many boreholes in the seafloor and careful identification and counting of microfossils in the borehole cores by experienced palaeontologists. The Integrated Ocean Drilling Program, to which the UK subscribes through NERC and the EC, carries out such work. A commitment to continuous support of this programme is essential to secure the evidence of past climates and climate change that is necessary to predict the likely effects of geoengineering.

Key to both the modelling and the testing against evidence is the education of the next generation of geoscientists. A strong maths and science background at school is required for a geophysics degree. A 2006 report on university geophysics education in the UK, commissioned by the BGA, found that a poor appreciation of subjects such as geophysics

and of their societal impact leads many students to make ill-advised choices at entry to Key Stage 4 that leave them unable to begin such a degree. The Institute of Physics and especially the School Seismology Project (based at the British Geological Survey) runs teacher professional development courses that try to address this ignorance, but teachers are finding it difficult to get time off work to attend such courses. This contributes to a global deficit of geophysicists, already noted by the oil industry. Unless addressed through improved science and technology education at secondary school level, the lack of good geoscience graduates will sap our national capability to evaluate geoengineering projects rigorously.

The BGA represents UK geophysicists, particularly in the fields of solid Earth and geomagnetic studies, and is a joint association of the Royal Astronomical Society and the Geological Society. Geophysics, the application of physics to the study of the Earth and planetary bodies and their surroundings, is crucial to the prediction of the effects of geoengineering.

We recommend that as well as incorporating the attached submission into your final report you seek oral evidence from leading geophysicists in the fields of Earth systems observation and modelling.

Sheila Peacock
Secretary, British Geophysical Association
December 2009