House of Commons Select Committee on Science and Technology: Inquiry into scientific advice and evidence in emergencies

Submission from the British Geophysical Association

1. The British Geophysical Association (BGA) is a Joint Association of the Geological Society of London and the Royal Astronomical Society (RAS).

2. The aims of the BGA are to promote the subject of geophysics, and particularly to strengthen the relationship between geology and geophysics in the UK, by holding meetings and courses, by encouraging the publication of the results of research, and by such other means as are deemed appropriate to an Association by the parent Societies.

3. Geophysics is the application of physics to the study of the Earth and planetary systems, including planetary interiors, atmospheres and interactions with the Sun. It thus embraces two of the four topics being investigated by the Select Committee: the volcanic ash crisis and solar storms. The following submission refers to the Icelandic ash cloud: BGA input on solar storms was incorporated into the Royal Astronomical Society's submission. Some of the recommendations below are based on those from a European Space Agency workshop in Frascati, Italy, on 26-27 May 2010, in which UK experts participated.

   What are the potential hazards and risks and how were they identified? How prepared was the Government for the emergency? How does / did the Government use scientific advice and evidence to identify, prepare for and react to an emergency? What are the obstacles to obtaining reliable, timely scientific advice and evidence to inform policy decisions in emergencies? Did the Government have sufficient powers and resources to overcome the obstacles? Was there sufficient and timely evidence to inform policy decisions?

4. The modelling of natural processes, in this case ash eruption and dispersion shaped the assessment of the emergency and decisions that were made. These needed to be more firmly based on observations and wherever possible validated against datasets of observations from past similar events.

5. Relevant observations include satellite and ground measurements of the distribution and optical properties of the ash; meteorological measurements, geophysical measurements on the ground both proximal and distal, such as continuous monitoring of earthquake occurrence and position, temperature, gravity and geodetic (shape) measurements of both the volcano and its ice cover, and quantifying emission rates of gas and ash from the vent.

6. The prediction of ash dispersion, based on the UK Meteorological Office modelling, required a number of assumptions to be made in the absence of direct observation, such as the volume and speed of mass ejection and using *a priori* optical properties of the fine ash

particles. However, given the then present level of knowledge, it is unlikely that air space could have been opened earlier without unacceptable risk.

7. The BGA notes that many of these essential measurements require a long lead-in with diligent data collection when there is no obvious threat. A good example is satellites which may take around 20 years from conception to launch and operation. Better risk awareness demands 'baseline' geodetic and seismological measurements that long precede major volcanic activity. Continual calibration of models on a fine spatial scale, from ground and airborne meteorological stations is required to improve modelling of weather patterns and hence atmospheric dispersion of ash. (We also note that effective emergency preparedness for a major explosion involving radioactive material presents similar requirements for atmospheric modelling and an additional requirement for baseline measurements of environmental radioactivity).

8. More basic research on volcanic eruptions of this type is vital, because the geological evidence is that other volcanoes on Iceland and elsewhere erupt from beneath ice caps. In particular, the fine grain size of ash was highly unusual in modern observations but should be included in risk assessments of future volcanic activity (see paragraphs 4 and 5). The BGA urges the Government to provide the resources necessary for this research to be pursued with vigour, so that the UK can have both time-critical advice and the means to verify it.

9. One long-running issue is the major shortage of qualified geophysicists. If this deficit is not addressed it will hinder future research in this area. Geophysical skills required for both measurement and modelling depend on a solid maths and physics background at school level. The BGA report 'Geophysics Education in the UK' (Khan 2006, from http://www.ras.org.uk/images/stories/ras_pdfs/Geophysics%20Education%20in%20the%20UK%20(12b).pdf) showed that school students were hindered in proceeding to study geophysics at university by the lack of both sound careers advice and the general shortage of teachers with a qualification in physics.

10. Crises such as the Icelandic ash cloud spark a short term interest in geophysics, but the maintenance of UK capability for future events depends on the continuous support of geophysical education and research careers. The BGA therefore recommends that the Department for Education work closely with the geophysics community to better promote careers in this area.

    How effective is the strategic coordination between Government departments, public bodies, private bodies, sources of scientific advice and the research base in preparing for and reacting to emergencies?

11. One critical issue is that the operational community lags behind the scientific research community in its use of modelling algorithms by as much as decades. The BGA recommends that cooperation between these two groups is greatly improved on an

ongoing basis, rather than just being triggered by emergencies. Both communities need to be sensitive to the changing needs of the Government as the end user and be given the resources to adapt to provide advice in a useable form, in particular probabilities or yes / no thresholds for closing airspace as required.

How important is international co-ordination and how could it be strengthened?

12. The Icelandic ash cloud affected a large part of Europe and eventually North America, making international co-ordination an essential part of the response.

13. A large body of evidence and data relevant to eruptions already exists. The BGA recommends that its value is maintained by being kept up to date and readily available to the international scientific community. Observations need to be assembled from where they are dispersed across European countries and institutions in different formats and accessibility. Resources for making these data available need to be pinpointed and the effort required to make them readily available rewarded.

14. The American Geophysical Union (AGU, Eos Transactions 91/34, August 2010) has recently commented on the need for better citation practices and peer review of data (rather than scientific papers based on the data) to encourage greater recognition and more critical use of data. We commend to the Committee the AGU's 'position statement' on geophysical data (see http://www.agu.org/sci_pol/positions/geodata.shtml) that applies directly to the Icelandic ash crisis.