

SCIENTIFIC ADVISORY GROUP FOR EMERGENCIES (SAGE)

VOLCANIC ASH DISRUPTIONS

**MINUTES of a Meeting held in 35 Great Smith Street
on 21 April 2010 at 14:00**

PRESENT

Professor John Beddington
Government's Chief Scientific Officer
and SAGE Chair

Professor Julia Slingo	Met Office
Dr David Thomson	Met Office
Professor Stephen Mobbs	Natural Environment Research Council (NERC)
Professor Stephen Belcher	University of Reading
Professor Hugh Coe	University of Manchester
Professor Adrian Simmons	European Centre for Medium-Range Weather Forecasts (ECMWF)
Dr Willy Aspinall	University of Bristol
Dr Jennie Gilbert	University of Lancaster
Professor Alex Halliday	University of Oxford
Dr David Kerridge	British Geological Survey
Dr Sue Loughlin	British Geological Survey
Professor Steve Sparks	University of Bristol
Professor Marge Wilson	University of Leeds
Dr Matt Watson	University Bristol
Professor David Spiegelhalter	University of Cambridge
Professor Brian Collins	Department for Transport and Department for Business, Innovation and Skills
Professor Mark Welland	Ministry of Defence
Professor Bob Watson	Department for the Environment, Food and Rural Affairs

OBSERVERS

Susan Hamilton	Department for Transport
Chris Bradley	Foreign and Commonwealth Office
Ian Williams	Home Office
Dr Jordan Gillings	Department for Transport
Dr Penny Bevan	Department for Health
Dr Miles Parker	Department for the Environment, Food and Rural Affairs
David Warrilow	Department for Energy and Climate Change
Jeremy Clayton	Government Office For Science

BY TELEPHONE

Bob Maynard	Health Protection Agency
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SECRETARIAT

Judy Britton (GO-Science)
Miles Elsdon (GO-Science)
Chris McFee (GO-Science)
Catherine McCloskey (GO-Science)
Felicity Oswald (Cabinet Office)
Anita Friend (Cabinet Office)

INTRODUCTION

Professor Beddington welcomed Committee Members and thanked them for finding the time to attend the meeting at very short notice.

1. AGENDA ITEM 2 – Confidentiality Agreement and Terms Of Reference

Professor Beddington outlined the Terms of Reference for the group (**SAGE (10)(04)(02)**). These were agreed by the group.

Professor Beddington outlined the importance of ensuring that all discussions within SAGE remained confidential, and asked members to sign the confidentiality agreement (**SAGE (10)(04)(03)**), and inform the Secretariat of any potential conflicts of interest.

ACTION 1: ALL SAGE NON-GOVERNMENT MEMBERS to sign Code of Conduct agreement, return to secretariat at the end of the meeting, and notify secretariat of any potential conflicts of interest immediately.

2. AGENDA ITEM 3 - UPDATE ON CURRENT SITUATION IN EYJAFJALLAJÖKULL (GCSA/Geology subgroup)

Dr Sue Loughlin (British Geological Survey) updated the group on current activity at Eyjafjallajökull. Current activity had decreased significantly, and 20% of the crater ice had melted and there had been no water accrual in the caldera. Although there were small eruptions through the ice, new vents would be needed for more explosive activity. This meant that the vertical column of material ejected from volcano was now lower (3km). Plume height from the volcano source was no longer rising so high, which had led to a decreased amount of ash over UK airspace. Continued seismic activity at the volcano indicated that activity was likely to continue, but predictions beyond this were impossible.

There had been no new ash composition results since the 14 April. These indicated that the plume was 58% silicate. There was no information on the particle size distribution in the plume but initial data indicated that there were a lot of fine particles below 2 microns in the plume. Some Scanning Electron Microscope images had been taken of particles collected from the ground, and particle size distribution could also be estimated from satellite data – although this was not a trivial measurement. However, it was noted that there was some uncertainty relating to the proportion of the ash that was made up of very fine particles.

The group noted that the probable change in weather patterns would push the plume away from UK airspace, but the plume would still be present and would start to affect North American airspace.

The group discussed the implications of the newly imposed restrictions on the amount of ash which could be present in the plume before a no-fly zone would be put in place. The group noted that the initial interpretation on safe levels had been described by a particle concentration level of 0.2 mg per cubic metre of air but this level had now

been increased to a particle concentration level of 2 mg per cubic metre of air on the advice of air engine manufacturers. The group noted that it was not clear whether these figures took account of the cumulative effect of transitions through a low concentration plume. They also noted that it appeared that these concentrations were independent of particle size. The Met Office told that group that the Civil Aviation Authority (CAA) were holding regular daily meetings with airframe and engine manufacturers, and Professor Steve Mobbs (Natural Environment Research Council) confirmed they are also participating in these meetings to offer advice.

Given the presence of some flights in the ash plume, the group agreed that getting more information on this was important, particularly as this information would be important in modelling the transition from a 'no-fly' zone to a 'fly at your own risk' zone where airlines could fly into areas at their own risk.

Professor Beddington introduced a draft letter (**SAGE (10)(04)(6)**). He said that it was his intention to send the letter to the Icelandic Authorities formally requesting a range of information about the volcanic eruption. The group agreed to provide comments on this draft following the meeting.

ACTION 2: BRITISH GEOLOGICAL SURVEY, with the SAGE **SECRETARIAT** to finalise letter to Icelandic Authorities requesting certain information.

ACTION 3: DR MATT WATSON to talk to contacts at the Science and Technology Facilities Council about modelling the agglomeration of volcanic ash particles, and to communicate results to SAGE. If successful, Met Office to consider possibility for incorporation into the plume dispersion model.

ACTION 4: MET OFFICE to form a sub-group to investigate better definitions of particle size distribution and mass at source, and over UK.

The group discussed whether it was possible to make longer term predictions on the likely eruptive pattern from Eyjafjallajökull. BGS reported that Global Positioning System (GPS) deformation indicated that the volcano surface was deflating and that

since 14 April it had been recorded that significantly more of the earthquakes in the area surrounding the volcano had originated at shallow depths. This was thought to indicate that the volcano's eruptive power was decreasing. However, given the complexity of plume structure and composition, it would be very difficult to provide any level of certainty and the group agreed that it would not be possible to provide specific advice on likely future behaviour of the volcano.

ACTION 5: BRITISH GEOLOGICAL SURVEY and MET OFFICE to work with **CIVIL CONTINGENCIES SECRETARIAT** and the **GOVERNMENT OFFICE FOR SCIENCE** to investigate lower probability, higher impact Icelandic volcano risks, as part of the National Risk Assessment process.

**3. AGENDA ITEM 4 - Update on meteorological situation.
(GCSA/meteorology subgroup)**

Professor Julia Slingo and Dr David Thompson discussed the model used by the Met Office and reported that the inputs to their ash dispersal model were the greatest uncertainties. In particular there were uncertainties in the size and distribution of material from the volcano. The model itself had been calibrated against other models and surveillance data and was considered relatively robust. The model currently assumed that material from the plume entered the atmosphere uniformly at different column heights. This assumption was considered reasonable.

Professor Steve Mobbs described the two research aircraft used by the Natural Environment Research Council (NERC) to obtain data from the plume. He said that work was being undertaken to sample the plume, as the changing weather patterns meant that there was about a 3 day opportunity before the changed weather patterns pushed the plume outside of UK airspace. Some work was also being undertaken with an aircraft manufacturer, who would fly through the plume, whilst the NERC plane will look at the concentrations of the plume. After the flight, the manufacturer would strip the engines and inspect for damage. The group agreed that it was important to focus limited resources in this area.

The group discussed Katla and the probability of an eruption following the eruption at Eyjafjallajökul as three eruptions on Katla have appeared in the same years as an eruption occurred on Eyjafjallajökul. It was known that the two volcanoes did not share a magma chamber but historic evidence suggested the two were connected in some way. The group discussed whether it was possible to make longer term predictions on the likely eruptive pattern from Eyjafjallajökull. GPS measurements indicated that the volcano's magma chamber had deflated since the 14th of April. Some volcanoes displayed an exponential decline in activity over a period of weeks to months. Although at present Eyjafjallajökull was following this pattern (as indicated by shallower seismic activity), the unpredictability of volcanoes meant it was impossible to say whether this trend would continue. However on previous occasions Eyjafjallajökull had not followed this exponential decline pattern and the plausible possibility of new fissures opening meant that activity could increase again.

BGS reported that they were encouraged that no major changes had been noted at Katla, but noted that there had been a change in the nature of low frequency tremors over the last 7 years or so and this could indicate that there had been a change in material around the volcano. The group agreed that the probability of a major eruption on Katla should be factored into the [REDACTED].

The group discussed how different any Katla eruption might be from the current eruption with Eyjafjallajökull. It was noted that the ice cap on Katla was thicker (between 500-750 metres thick) than that at Eyjafjallajökull. This difference would probably lead to much higher plumes being thrown up into the atmosphere at Katla, if it erupted. A major eruption of Katla could be up to 100-1000 times the material ejected than in the current, Eyjafjallajökull, eruption and there would be significant problems with high levels of Sulphur Dioxide (SO₂) and silicates which can cause major health problems. The probability of a very major eruption was considered to be relatively low, but the impact would be very high.

ACTION 6: DR WILLY ASPINALL to form a sub-group to investigate the likelihood of a Katla eruption as a result of the current volcanic activity, and likely magnitude of this. A paper will be presented at the next meeting of SAGE.

ACTION 7: MET OFFICE, CIVIL CONTINGENCIES SECRETARIAT, GOVERNMENT OFFICE FOR SCIENCE AND THE BRITISH GEOLOGICAL SURVEY, on behalf of SAGE, to develop a range of indicative scenarios considering plausible short- and longer-term impacts.

The availability of measurement assets in the UK was discussed. More LIDARS would be able to provide a more consistent ground-based monitoring of plumes across the UK, and it could be useful for the UK to have a dedicated aircraft which could be flown through the Ash cloud. Professor Slingo said that the World Meteorological Organization (WMO) were also very keen to develop broader measurement coverage across the world. The Met Office reported that it was working closely with European colleagues to maximise use of all potential measurement capabilities, although it was not thought to be possible to fit the measurement technology onto commercial aircraft.

ACTION 8: NATURAL ENVIRONMENT RESEARCH COUNCIL (NERC) and DEPARTMENT FOR TRANSPORT to discuss the timing of the scheduled refurbishment of the NERC research aircraft, and the associated implications on surveillance.

ACTION 9: MET OFFICE and the NERC to explore options for developing the UK's monitoring capability for volcanic ash and other airborne particulates, and also ways of widening coverage beyond UK borders

ACTION 10: NATURAL ENVIRONMENT RESEARCH COUNCIL to liaise with Defence Science and Technology Laboratory (Dstl), through the **MINISTRY OF DEFENCE** Chief Scientific Adviser's office, to organise the chemical analysis of NERC's airborne particulate samples.

3. ANY OTHER BUSINESS

The group then discussed potential health and environmental effects. Professor Bob Watson (Defra) said that Defra had established an expert group looking at issues

around water and air quality and fluorine levels in herbage and were holding teleconferences with this group every day. Analysis of environmental samples has, so far, returned no indication of environmental effects from the plume. Professor Julia Slingo noted that once the weather patterns changed it was likely that there would be some rain, and any particulate matter would then be washed out – and some collected by rain gauges. This material would be collected and sent for measurement.

Dr Penny Bevan (Department of Health) reported that guidance had been produced in terms of air quality. There was a small potential for some problems with eye or skin irritation, but a comprehensive system of reporting was established across England to collate reports from general practitioners, and to monitor calls to NHS Direct to identify any significant increases in respiratory problems. No significant increases in respiratory problems had been reported at the time of the meeting. However, it was cautioned that the UK was entering the ‘hay fever’ season, when respiratory problems would be expected to rise.

The group considered potential health effects on passengers flying on commercial planes. It was thought that around 60-80% of air in an aircraft is recycled at any point and so the passengers were probably not exposed to too much material from the plume. Following discussion, the group agreed it was unlikely that there were significant numbers of nano-sized particles and that it was very unlikely that there would be any health risks associated with these nanoparticles.

ACTION 11: NATURAL ENVIRONMENT RESEARCH COUNCIL to consider possible safety precautions that may be needed to protect research staff from the health impacts of flying through the plume in unpressurized aircraft.

David Warrilow (Department of Energy and Climate Change) said that it was very unlikely that this eruption would have any measurable effect on climate. The CHAIR said that at a recent meeting of [REDACTED], the issue of the potential for damage to power cables was raised. He asked DECC to take this action forward and report back to the group.

ACTION 12: DEPARTMENT OF ENERGY AND CLIMATE CHANGE to explore the potential for damage to power cables caused by wet ash and the associated impacts. BRITISH GEOLOGICAL SURVEY or STEVE SPARKS to provide contact details for Dr David Johnson, working on this issue in New Zealand.

Felicity Oswald (Cabinet Office) tabled a paper (**SAGE(10)(04)(11)**). This was a draft impact matrix which considered the consequences of the volcanic eruption for key sections of the UK National Infrastructure and economy.

ACTION 13: ALL to read and comment on Impact Matrix document, sending comments to [REDACTED] **ideally by close of play 22 April** but comments would be welcome after this date.

Professor Beddington thanked all SAGE members for attending at short notice. In summary, he said that two sub-groups of SAGE had already been formed prior to this meeting, and that a third group would be useful to consider science and engineering issue around the effect of the plume on airframes and air engines.

ACTION 14: DEPARTMENT FOR TRANSPORT to establish an aviation science and engineering subgroup to SAGE to consider volcanic ash effects on aircraft.

4. DATE OF NEXT MEETING

Professor Beddington noted that the date of the next meeting would be in approximately two weeks time, but that the secretariat would confirm the exact details. .

SAGE

29th April 2010