The Role of Science & Scientists in UK’s Emergency Response Policy

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29th June 2017
Within the FCO, the Chief Scientific Adviser & Prosperity Directorate are the S&I focal points

- The CSA looks across the full range of FCO policy.
- Ensures that foreign policy is informed by the best available science & has access to appropriate science networks.
- Provides advice to the Foreign Secretary and Ministers.
A network of Chief Scientific Advisers

Prof Sir Mark Walport GCSA
Prof Dame Sally Davies CMO
Prof Vernon Gibson MOD
Prof Ian Boyd Defra
Prof Chris Whitty DH
Prof Tim Dafforn BIS
Prof Robin Grimes FCO

Prof Phil Blythe DfT
Prof Charlotte Watts DFID
Prof Bernard Silverman Home Office
Dr Tim Leung DfE
Osama Rahman MoJ
Prof Anthony Finkelstein National Security
Prof John Loughead DECC

Prof Stephen Belcher Met Office
Prof Andrew Curran HSE
Prof Peter Freer Smith Forestry C.
Stephane Aldridge (interim) CLG
Prof Sheila Rowan Scotland
Prof Julie Williams Wales
Prof Bernadette Hannigan (interim) Northern Ireland
Problems 1990-2010

- Kings Cross Fire
- Hillsborough Stadium
- Potters Bar
- Port Talbot Blast Furnace
- Buncefield Oil Storage Depot
- Liverpool Crane Incident
- Grayrigg Rail Incident
Some principals of Engineering Design Safety

• Failures in engineering systems can occur as a consequence of: i) component failure, ii) human error & iii) external events.

• Defence in depth: consists of multiple independent protections against the occurrence and propagation of accidents.

  • If one component fails, another component is present whose failure is independent of the operation of the first.

  • No single point failure mechanisms.

• DID should prevent accident scenarios but also provide sufficient protection that should the initial system fail it would prevent the escalation of failures and mitigate the risks from accidents.
Some principals of Engineering Design Safety

- DID compensates for weaknesses in the ability to evaluate the risks and protects against common cause failures (CCFs).
- DID is implemented through the engineered mechanisms of:
  
  i) Redundancy,
  
  ii) Diversity,
  
  iii) Segregation

- The DID design must withstand the consequences of postulated (most severe) accidents, including the loss of systems, structures and components that assure health and safety. These are known as design basis accidents (DBA).

- Accidents due to human error can be DBA but can lead to circumstances which are beyond design basis accidents.
Definitions

Hazard: something that poses a threat to life, health, property, or the environment.

A hazard is any biological, chemical, mechanical, environmental or physical agent that is reasonably likely to cause harm or damage to humans, other organisms, or the environment in the absence of its control.

Identification of hazards is the first step in performing a risk assessment.

Risk: the probability that exposure to a hazard will lead to a negative consequence

\[
\text{Risk} = \text{Hazard} \times \text{Dose (Exposure)}
\]

So, a hazard poses no risk if there is not exposure to that hazard
Perception of risk varies depending on circumstances

• Risk
• Hazard
• Uncertainty
• Vulnerability
• Randomness
There are different facets to disaster risk response

Prevent

Mitigate

Manage

Clear-Up
Many risks have common consequences:
This determines the National Planning Assumptions
Different departments are involved in both mitigation & response

- Mass Fatalities
- Mass Casualties
- Biological Release
- Radiological Release
- Chemical Release
- Debris / Rubble
- People requiring evacuation & shelter
  - Influx of British Nationals
  - Disrupt. to Water Supply
  - Disrupt. to Transport
  - Disrupt. to Oil & Fuel
  - Disrupt. to Gas
  - Disrupt. to Electricity
  - Disrupt. to Telecoms
  - Disrupt. to Health
  - Disrupt. to Financial Services

Terrorist attack

Major industrial accident
How the UK prepares for the common consequences of risks

Assess the risks

Pull out the common consequences of risks

Build capability to deal with those common consequences

6 month Forward Look: Provides departments with an indication of the relative likelihood and impact of unfolding or emerging civil domestic risks. It is produced every quarter.
The National Risk Register

[Diagram showing a risk matrix with various risks such as Non-Pandemic Human Disease, Coastal Flooding, Effusive Volcanic eruption, and Disruptive Industrial Action, plotted on a Relative Likelihood and Relative Impact axis.]
In the UK the Natural Hazards Partnership brings together expertise from across the UK's leading public sector agencies with the aim of drawing upon scientific advice in the preparation, response and review of natural hazards.
Our ability to respond to disaster risk relies on a scientific value chain.
Scientific Advisory Group for Emergencies (SAGE)

How science supports the UK’s emergency response
COBR - The decision making process

- Facilitates rapid co-ordination of the central government response and effective decision-making.
Calling COBR

Escalation of the Central Response

- **National Coverage**
  - **Significant – Level 1**
    - LGD led central response, COBR not involved
  - **Serious – Level 2**
    - Co-ordinated central response led by LGD from COBR
- **Cross-Region**
- **Regional Coverage**
- **Cross-Force**
- **Single Scene**
  - Local response only

Impact
SAGE’s purpose

- COBR must decide whether it is necessary to call SAGE
- The aim of SAGE is to “ensure that coordinated, timely scientific and/or technical advice is made available to decision makers to support UK cross-government decisions in COBR”

Practice, practice, practice…what’s missing?

http://www.publications.parliament.uk/pa/cm201011/cmselect/cmsctech/498/49809.htm
Where does CSAs advice fit during a crisis?

- SAGE Chair
- SAGE
- CSAs
- SHED
- UKCDS
- RHEG
- Other government advisory and regulatory bodies e.g. Met office
- STAC Chair
- STAC
- COBR
STACs and SAGE:
1. Local v Cross-government

STACs should support local decision making, whilst the focus of SAGE should be to support UK cross-government strategic decision making.”

STAC - Science and Technical Advice Cell within the multi-agency Strategic Co-ordination Centre (SCC)
STACs and SAGE:
2. Known v Uncertain

**STACs will focus on “pre-prepared known”** whilst **SAGE will focus on more uncertain advice where there are knowledge gaps.**

*Enhanced SAGE Guidance*
Where does CSAs advice fit during a crisis?

- COBR
- SAGE Chair
- SAGE
- CSAs
- UKCDS
- RHEG
- STAC Chair
- STAC
- Other government advisory and regulatory bodies e.g. Met office
SAGE in action: Recent challenges that led to international collaboration action

- 2009 – Pandemic Flu
- 2010 – Volcanic Ash
- 2011 – Fukushima
- 2014 – UK Floods
- 2014 – Ebola
- 2015 - Zika
Science in Humanitarian Emergencies and Disasters

How science supports the UK’s emergency preparedness and response overseas
A similar approach is being taken for international natural hazards

Humanitarian Emergency Response Review:

“If we are to meet the challenges ahead, we have to be ‘ahead of the curve’...preparing for disasters, as well as reacting to them”

“improve our use of science in both predicting and preparing for disasters, drawing on the Chief Scientific Advisors network across government.”
Science in Humanitarian Emergencies and Disasters Project

The Use of Science in Humanitarian Emergencies and Disasters

June 2012

Anticipating natural hazards

Established a Risk and Horizon Scanning Expert Group (RHEG) to provide advice to DFID, FCO and MOD on what natural hazard events may occur over the next 6 months that have the potential to cause disasters.

Responding to disasters

Provision of rapid scientific and technical advice in response to natural disasters. Option to established a Humanitarian Emergency Expert Group (HEEG), which is similar to SAGE.
Risk and Horizon Scanning Expert Group
Responding to international emergencies

- Acts as a **coordinating body** and a "one-stop-shop" for S&T advice in emergencies when COBR not called.

- Coordinates the provision of **timely S&T advice** to support the UK Government response to overseas emergencies.

- **Facilitate interaction** between policy makers / crisis management teams and scientists.

- **Multi-disciplinary and multi-hazard approach.**
Typhoon Haiyan
Typhoon Haiyan – the SHED response

8 November
10:00GMT – request from DFID for S&T advice to support the UK’s response.

10:15 – SHED Secretariat contacts the International Landslide Centre and UK Met Office.

10:32 – Initial advice on landslide risk provided.

13:39 – Detailed weather forecast provided by UK Met Office.

9-18 November
• Brought together a wide range of experts from Met Office, BGS, PHE & the International Landslide Centre

• Coordinated the provision of rapid coherent advice data & information on:
  • Daily forecast information including risk of low cloud and the expected sea state, which could hamper aid operations.
  • Expected frequency of further rainfall and thunderstorms.
  • Risk of flash floods.
  • Areas most at risk of landslides.
  • Health impacts.
Haiyan - What impact did SHED have?

- Advice assisted DFID and their partners in-country with the response.
- Helped inform where to send two British Royal Navy ships.
- Advice on health impacts made available open access to everyone the Philippines through Evidence Aid.
- Review found that the “SHED process did achieve its aim in streamlining and synergising the UK’s scientific capacity to advise key actors in disaster anticipation and mitigation.”
Case Study: Nuclear response
UK Approach to Safety Regulation

All regulators aim to ensure operators properly control nuclear hazards and manage risk.

Many regulators set out rules telling operators how to do this – a ‘prescriptive’ approach.

UK instead has a ‘goal-setting’ approach, which makes it a legal duty to meet the safety goals, but does not set out in detail how operators should meet this duty, e.g. “reduce the risk to workers and the public so far as is reasonably practicable.”
UK Nuclear Emergency Preparedness & Response

- UK Legislation
- Emergency Planning Requirements
- ONRs Role:
  - Regulator
  - Independent Source of Advice
The national radiation monitoring network and emergency response system (RIMNET)

- Following Chernobyl, the UK Government developed a **National Response Plan** to ensure that any future similar emergency could be effectively managed. It is a multi-departmental and agency plan, DECC led.

- RIMNET is both a multi-purpose response tool and a platform for the effective coordination of emergency response. It supports the UK response to any radiological event and has the potential to be used in non-radiological events. It is managed by the Met Office.

- RIMNET has a network of 94 fixed gamma dose rate monitoring sites across the UK, automatically measuring, analysing and informing on background radiation levels 24/7. All measurement and reference data is stored in the UK National Nuclear Database.
Aim: Delivery & ongoing development of inter-agency collaboration and capability to provide timely expert data and advice to the UK Government through SAGE to support the response to a radiological emergency.
Existing operational framework

- Current UK operational response includes:
  - Operators emergency response plans
  - Local and national emergency response plans
  - Local & regional model predictions based on unit source term
  - Local and national monitoring
  - Local ‘most likely scenario’ impact assessment
- All JAM partners are represented within current local and national response
- JAM builds on this with a focus on:
  - Better integration across agencies, contingency planning through ‘what if’ scenarios, greater exploitation of science
Timeline

- Threat of an incident
- Incident
- Off-site nuclear emergency declared
- JAM agencies notified

Time (hours):
- < 0 for JAM purposes

Joint Agency Modelling
Timeline

Joint Agency Modelling

**Key**
- Model or observation data
- Discussion / analysis

**STAC**

**SAGE → COBR**

- MetO model for local area
- MetO model for regional area
- Agencies make contact & discuss situation
- Written Summary

**Source terms**
- Source term library
- Real time source term data

**Agencies discuss**

**Agencies notified**

**Timeline**

0  | 0.5  | 1  | 2  | 3  | 4
---|------|----|----|----|---

- As required by SAGE
- As required by SAGE

**JAM**

- Agencies make contact & discuss situation
- **Monitoring data**
- **Written Summary**

**Discussion / analysis**

**Model or observation data**
Timeline

Joint Agency Modelling

Key
Model or observation data
Discussion / analysis

STAC

SAGE → COBR

Agencies discuss
JAM model runs
Agencies analyse
Updated real time source data
Agencies discuss

JAM model runs

Agencies analyse

Monitoring data
Real time source term data
Source term library

Source term

Time (hours)
5 6 7
JAM inputs to SAGE

- Briefing documents (most likely and reasonable worst case scenarios)
- Extra data (images / maps / figures) from models (e.g. sensitivity analysis) and measurements as available
- Consensual expert interpretation of data
- Quality assured science and data
- Integrated expertise
- All the agencies believe JAM contributes significantly to the UK capability and will improve the information available to SAGE/STAC for the response
OECD GSF report 2015

- Motivated by Fukushima and L’Aquila
- Focuses mainly on deliberative processes

Includes:
- A review of national science advisory (eco-) systems
- An analysis of the different steps in an advisory process
- An analysis of legal responsibilities
- Special challenges in crisis situations
- Perspectives on public interest/engagement
Two main aims:
• To analyse national mechanisms for obtaining science advice in ‘international’ crisis situations.
• To explore the challenges and barriers to information and data sharing during ‘international’ crises.

Specific activities:
• A survey of (OECD member) countries to capture information on national responsibilities and processes for providing scientific and technical advice during crises.
• Building on the results of the survey, a workshop on information and data sharing during transnational crises.
• April, 2018: Final report to GSF
International collaboration is the way to solve international problems

Many 21st century challenges require scientific collaboration

- Climate change
- Poverty reduction
- Food security
- Nuclear disarmament

Collaboration is essential for our domestic science

- Strength of research base
- Creativity of innovation ecosystem
- Knowledge economy
- More export potential!
Fin

Muchas gracias