Chemical Hazards and Poisons Report

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Contents

Editorial

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Centre for Radiation, Chemical and Environmental Hazards, Health Protection Agency

As the Health Protection Agency's (HPA) functions transferred to Public Health England (PHE) on 1 April 2013, this issue of the Chemical Hazards and Poisons Report celebrates the past 10 years within the HPA, highlighting our involvement with a wide range of chemical and environmental hazards, and the rich evidence base of health protection knowledge which has resulted from this. PHE represents an important opportunity to build on the experience and knowledge from across formerly separate public health groups. We hope to create healthier communities by supporting and enabling local government, the NHS and the public to protect and improve health and wellbeing and reduce inequalities, through the provision of professional advice, knowledge and evidence.

Complexity is the theme of this issue to highlight the environmental challenges faced by the wider public health community. Complexity means that the relationship between cause and effect is uncertain, and there may not even be agreement on the fundamental objectives of the investigations. A new report from the European Environment Agency cites complexity as vital when considering multiple effects and thresholds. Environmental health impacts are often not a result of a single hazard, but attempts to deal with interactions between multiple stressors soon create a level of complexity that is impossible to manage using traditional linear approaches. Using a systems approach is the only possible solution to these multifaceted issues, but this requires new ways of thinking.

For many, 2012 will be remembered for some amazing spectacles during the Olympic and Paralympic Games (the Games) but mass gatherings create environments where health hazards can be magnified if not carefully managed. The preparations for the Games within the Environmental Hazards and Emergencies Department are described, and the value of exercising scenarios demonstrated when there was a real large-scale fire in proximity to Games activities.

New materials and tools are constantly being developed to help deal with the complexity of environmental science and some of these are highlighted in this issue. Maritime transport of hazardous substances is an activity for which robust shoreline emergency response plans are critical to ensure the protection of public health. Cross-border issues can raise a wide range of challenges internationally and these have been reviewed to ensure emergency planning can cope with the potential spread of pollution to different countries, with areas of best practice highlighted.

Public health interventions that encourage behavioural change can have wide-reaching benefits. The consequential reduction in air pollution and increase in physical activity highlights the interaction between environmental hazards and wider public health improvements. The first Cold Weather Plan for England was published in 2011, and continues to improve as stakeholders identify lessons and build the evidence to support effective interventions. The complexity of emotional and subconscious reactions to environmental threats is also discussed.

Science strives to cut though complexity and provide simple solutions by understanding the complexity of how things work. New understanding will help to overcome real world challenges, and thereby the application of scientific developments will help create a better environment to live in. Public Health England will encourage this process.

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Incident Response

Holidaying with carbon monoxide: an unsuitable companion

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Introduction

Carbon monoxide (CO) poisoning is often associated in both public and professional opinion with faulty gas boilers in the home, occurring more frequently in the winter months when the heating is turned up high. Public interest stories and the media also often focus on gas boilers, for example, the recent storylines in *Eastenders*[1] and *Hollyoaks*[2], and a Christmas episode of *Coronation Street*[3]. For many years, the Gas Safe Register (previously Corgi until 2009) has campaigned to remind people to keep 'Gas Safe', advising the public to have their gas appliances checked annually by a qualified engineer. But recent research and tragic stories have shown that a popular focus on gas and boilers is not sufficient, and that people need to think more widely when it comes to protecting themselves from CO; in particular, when on holiday. This article describes sources of CO that should be considered when engaging in recreational activities and whilst on holiday.

Carbon monoxide from solid or liquid fuels

Carbon monoxide is formed when any carbon-based fuel is burned without sufficient oxygen. Some fuels, due to the nature of the way in which they are used, produce more CO than other fuels. For example, charcoal, when used in a barbeque (BBQ) for cooking purposes is burnt at a lower temperature, with smouldering embers being ideal for cooking purposes but producing high levels of CO; whereas higher temperatures would result in flames and the production of less CO. Other fuels which are required to burn at a higher temperature during their use, e.g. natural gas, produce very little CO in comparison. In order to prevent exposure to CO there are numerous safety features associated with appliances intended for indoor use and these include, for example, ones which remove or eliminate products of combustion from occupied areas, or ones that ensure fuels burn efficiently. Problems arise when such safety features do not work; this usually occurs when the appliance and/or its associated ventilation mechanism is not properly installed or maintained, or when equipment is not used according to the manufacturer's instructions.

In 2012, the Gas Safety Trust interviewed over 3000 members of the public on their approach to appliance safety[4]. Over half (52%) had checked their gas appliances in the last year, but only 17% and 30% of those with oil and solid fuel appliances, respectively, checked them annually.

In recognising the risk of CO poisoning associated with solid fuels, Part J of the Building Regulations in 2010 was updated to include the requirement for a CO alarm to be fitted where a new or replacement solid fuel appliance is installed in a dwelling[5]. This recognition came after a review, conducted on behalf of the Department for Communities and Local Government (DCLG), found that the rate of deaths associated with CO from solid fuels was far higher than the rate associated with gas appliances[6].

Having fun but staying safe

Outside the home environment, but inside dwellings such as hotels, holiday apartments, caravans, boats and tents, people are less likely to worry about protecting themselves from CO. Norms of behaviour are temporarily abandoned, particularly on holiday whilst in company-owned accommodation where the public rightly expect that health and safety rules have been obeyed. A study of campers by the Gas Safety

Case study 1: Camping and barbeques

During August 2011, Cornwall Fire and Rescue Service (CFRS) attended two serious incidents where families had been overcome and hospitalised by CO fumes produced by disposable barbeques (BBQs). On both occasions, the BBQs had been taken into their tented areas to provide extra warmth during inclement weather conditions.

CFRS conducted a series of tests using different types of disposable BBQs and tents. CFRS found that a small disposable BBQ with warm coals can produce lethal levels of CO within an enclosed, poorly ventilated area in a matter of minutes, even when the aluminium tray holding the charcoal is cold to touch. A BBQ was placed within the tented area with two different makes of gas monitor, and the tent sealed. Both monitors started to alarm with 30 seconds and continued to alarm for three minutes; on inspection the readings ranged from over 400 ppm (parts per million) to the highest recorded reading of 957 ppm, which would have led to a fatal dose for any occupants of the tent within one hour. Modern tent design has played an important part in contributing to such incidents as the improved waterproofing materials, integral ground sheets and zip design can inhibit a flow of air through the structure, allowing CO to build up quickly within the small space.

In response, CFRS currently runs a CO awareness register for all camping and caravan sites across Cornwall. Sites are provided with posters, leaflets and information cards for staff to use, helping to raise awareness on CO and the dangers of using disposable BBQs in enclosed spaces. CFRS also provides information on gas appliances such as lights and heating and encourages holiday makers to keep all camping equipment regularly serviced and well maintained.

Due to this local campaign's success, a national campaign was launched in 2012 with the charity CO Awareness and some of the leading holiday industry providers and supermarkets that sell disposable BBQs in the UK. This campaign was aired on BBC's *The One Show* in July 2012 and was covered by national radio and social media, helping to spread the awareness message to a wider section of the British holidaying public. CFRS is continuing to raise the awareness issue of CO poisoning across the UK.

More information on this campaign can be found at www.cornwall.gov.uk.

Case study 2: Near miss at New Year

On New Year's Day, emergency department staff at Frimley Park Hospital in Surrey treated an elderly couple who presented with flu-like symptoms and feeling faint. They had both begun to feel unwell that morning and called paramedics, who suspected CO poisoning. Upon arrival, their blood carboxyhaemoglobin levels were 20.6% and 22.2%, respectively. Hospital staff made enquiries and found that the couple did not have any gas appliances in their detached home; however, they did have an open coal fire in their living room, which they had been using that day. Upon further investigation, it was found that the chimney had become blocked with snow. This meant that the CO produced by the burning coal wasn't being extracted but was instead pouring into the room in which they were sitting.

Chimneys and flues should be swept from top to bottom at least once a year by a qualified sweep, which can be found from the **National Association of Chimney Sweeps** or **The Guild of Master Sweeps**. Regular sweeping would not have prevented these cases of poisoning, which was due to weather conditions, but a working CO alarm would have alerted the couple to the tasteless, odourless toxic gas. As is often the case, they had a smoke alarm but no CO monitor.

Battery-operated CO alarms should be in every room that contains a fuel-burning appliance; they cost less than one cup of coffee per year over their seven years of life, and until legislation is changed to ensure that domestic properties contain CO monitors, the public should be strongly encouraged to protect themselves by purchasing alarms.

Trust found that less than 4% of regular campers thought that CO was something to worry about[4]. According to the Gas Safe Register, in 2012 a number of campers lost their lives from CO poisoning in the UK, caused by bringing gas or charcoal BBQs into tents and associated enclosed spaces[7]. Case study 1 describes one such tragedy. The Gas Safety Trust research found that over a third of campers would use, or have used, a gas cooker inside their tent or caravan to protect themselves from rain or cold[4]. In 2012, new messages warning of the dangers of CO were proposed for the packaging of disposable BBQs and BBQ fuel; the suggested amendments to the British Standard EN 1806 are open for comment[8].

Over the winter and particularly during holiday periods, new situations may arise that increase the risk of CO exposure. People may begin using their open log fires without first having the chimney swept or infrequently used portable heating appliances may be dusted off in preparation for guests, without having had their annual servicing. Case study 2 describes a near-miss involving a blocked chimney on New Year's Day. Information on how to keep safe and warm over the winter period is provided by the Department of Health in its 'Keep Warm Keep Well' leaflets[9].

The HPA has previously reported on the risks of CO poisoning in association with shisha-pipe smoking, an increasingly common leisure pursuit involving the inhalation of smoke from burning tobacco, kept lit by smouldering charcoal[10], and a case of mass CO poisoning at a go-karting track[11].

Moving forward

The All-Party Parliamentary Carbon Monoxide Group (APPCOG) provides a forum for Parliamentarians, gas industry representatives and other key stakeholders to tackle CO poisoning from all fuels. APPCOG was until recently named the All-Party Parliamentary Gas Safety Group, but altered its name to reflect its new remit to prevent CO poisoning in a more holistic way: tackling the threat from all sources such as solid fuel fires, oil and BBQs, not just gas appliances.

APPCOG has undertaken much work on the threat of CO in the holiday industry. In December 2010, it held a roundtable entitled 'CO by the Seaside' on bottled gas safety and CO risks in caravans and boats. This meeting enabled progress on CO detectors becoming routinely fitted in new caravans, motorhomes, holiday homes and static caravans produced by manufacturers who are members of the National Caravan Council[12]; this was viewed by the caravan industry as best practice to help safeguard the consumer. Additionally in 2012, a number of CO alarms manufacturers put their products through further tests to gain BSI approval to withstand conditions within caravans and mobile homes.

In October 2011, APPCOG launched research led by Baroness Finlay, in order to improve detection and awareness of CO[13]. The research proposed 17 key recommendations to achieve this, with recommendation 10 referring specifically to CO and holidays[13]:

> *"Retailers selling camping and barbecue equipment, registered campsites and caravan sites should promote the dangers of carbon monoxide and the use of carbon monoxide alarms. The British Standards Institution should revise European Standard EN 1860 to include a requirement for a prominent warning about carbon monoxide poisoning as part of the information on appropriate usage."*

In 2012, APPCOG sought to drive forward progress on this recommendation, and held two events on CO safety in the holiday period. APPCOG heard how a range of organisations are carrying out valuable work around CO safety in camping, caravanning and boating:

- The Gas Safety Trust's research on campers revealed low awareness levels of the dangers of CO[4]. Consequently, the Gas Safe Register issued urgent safety advice to an estimated 3.7 million people who planned to go camping in the summer
- The charity CO Awareness ran the 'Cosy But Deadly' campaign, which warned people of the dangers of taking a BBQ into an enclosed space, and of the release of CO from a badly-adjusted camping light or stove. This campaign resulted in many supermarkets warning their customers of the dangers of using BBQs in enclosed spaces
- Cornwall Fire and Rescue Service spearheaded a CO register for all licensed campsites within Cornwall, forwarding on information on the dangers and how to raise awareness to campers
- The Boat Safety Scheme issued a leaflet about CO safety on boats[14]
- UKLPG, the trade association for the LPG industry, produced a leaflet entitled 'Camping Safely Using LPG', which was launched at an APPCOG reception in spring 2012. APPCOG also spread the holiday safety message online, and LPG supply members cascaded information through their supply chains.

Work was also carried by APPCOG and its supporters together with the British Standards Institution to improve the BS EN 1860-1 standard regarding appliances, solid fuels and firelighters for barbecuing. However, as a European standard, CEN, the European Committee for Standardisation, voted against changing the standard along the lines of the APPCOG recommendation. APPCOG is currently pursuing further avenues to improve the standard.

To further enable progress in CO safety, the Carbon Monoxide All Fuels Action Forum was launched in October 2012, which brings together key organisations and stakeholders committed to tackling CO poisoning in the UK. David Kidney, a former Energy Minister and current Head of Policy at the Chartered Institute of Environmental Health, was named as the first Chair of the new Forum.

The Forum promotes collaboration and knowledge-sharing between industry, charities and policymakers, as well as coordinating campaign activities across the sector. It is currently working on a number of initiatives for 2013, which includes looking again at holiday campaigns to ensure much of the work already undertaken in 2012 is coordinated and improved where necessary to bring down casualties.

Details of these events can be found on the APPCOG website at www.policyconnect.org.uk/appcog/.

Other initiatives include the European Commission's work towards a revision of the gas appliance product safety legislation. Here, the Department for Business, Innovation and Skills (BIS) is aiming to ensure that the proposal builds on the experiences gained from the current legislation. BIS continues to participate in UK and European activities to encourage understanding and compliance with the product safety legislation. On the European stage, Holiday TravelWatch campaigns on greater safety regarding CO, and collates data on deaths from CO poisoning that occur among holiday makers. Additionally, Linda McAvan MEP, who has long campaigned on hotel safety in Europe, is now campaigning for greater CO safety in Europe.

The Gas Safety Trust, in recognition of the lack of evidence about CO incidents relating to solid fuels, has agreed with OFTEC, the oil firing technical association, and HETAS, the solid fuel domestic heating association, to gather reports of CO poisoning from all fuel sources and recognises the need for awareness campaigns to be extended beyond gas[15].

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Olympic flames?

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Introduction

The summer of 2012 saw the London 2012 Olympic and Paralympic Games (the Games) come to London and the rest of the UK. This extraordinary event was the culmination of many years of preparation across a number of organisations, including all areas of the Health Protection Agency (HPA). The HPA's intensive preparations for the Games began in 2009 and, since then, colleagues across the agency prepared for Games time by enhancing surveillance and response systems and capacity to receive, rapidly analyse and react to health protection threats. Preparation and planning within the HPA Centre for Radiation, Chemical and Environmental Hazards (CRCE) included both enhancement of internal systems and response preparation, but also ensuring communications and response was coordinated with external partners and stakeholders.

To prepare for the heightened scrutiny during the Games, a series of national, multiagency exercises was undertaken with the exercise schedule culminating in Exercise Green Altius in April 2012.

Exercise Green Altius was a full-scale command-post exercise with exercise play up to COBR (Cabinet Office Briefing Room) level. The exercise scenario included a chemical release from a large fire at a fictional industrial works in Dagenham, which had the potential to impact on venues for the Games. During exercise play the smoke plume from the fire was directed toward Olympic venues (e.g. the North Greenwich Arena, Greenwich Village, Royal Artillery Barracks and Greenwich Park) to test the ability of the collective agencies to respond to the public health threat.

Many lessons were identified during the exercise programme and these were fed into the HPA planning for Games time. These lessons included the need for better multiagency communications and coordinated response, as well as internal communications improvements.

This article describes real incident response during the Games that had the potential to impact upon an Olympic venue. It also refers to lessons identified in Exercise Green Altius that were put in play during the incident.

Incident

After a successful Olympics, the Games' closing ceremony was planned for 21:00 hours on 12 August. This ceremony was held at Stratford featuring more than 4,100 performers, including 3,500 adult volunteers and 380 schoolchildren, in front of an audience of over 80,000 people, including heads of state and other VIPs. Also on 12 August was the final of the boxing events held in the ExCeL Centre, finishing at approximately 19:00, when up to 10,000 people vacated the building.

At 14:20 on Sunday 12 August 2012 the out-of-hours chemical on-call team for HPA CRCE received a call from the Hazardous Area Response Team (HART) of London Ambulance Service indicating that the team had been called to attend a very large fire at a waste recycling plant in Dagenham Docks (Figure 1). Initial reports from the scene suggested that the fire was generating a significant smoke plume that was being carried by a south easterly wind across central London. Discussions with London Fire Brigade (LFB) suggested that the fire had not been brought under control at that time and at least 12 fire appliances were in attendance.

Figure 1: Fire at the waste recycling depot, Dagenham, London (© London Fire Brigade 2012)

At 15:07 a CHEMET was requested from the Met Office. A CHEMET is a chemical meteorological output that shows the modelled distribution of an airborne release according to current weather conditions. The CHEMET indicated that the smoke plume was modelled to be carried to the north west from the site. Additionally further information was available from the scene, which indicated that the fire was in a building used to recycle waste materials. The building was approximately 5,000 m^2 in size and completely alight. HART was present at the scene and the LFB had committed 30 fire appliances to fight the fire. The fire was expected to burn for an extended period due to its scale and difficulty in accessing the seat of the fire.

Due to the size and nature of the fire it clearly had the potential to impact on public health. Exposure to the smoke from the plume could potentially lead to acute health effects in the local population and the location of the fire in east London led to immediate concerns about potential impacts on the ExCeL Centre and up to 10,000 spectators leaving the building at 19:00, as well as the closing ceremony of the Games scheduled for 21:00 that evening in the Olympic Stadium.

Public health risk assessment

Geographic Information Systems (GIS) were used by CRCE scientists to characterise the locality of the fire and identify any local sensitive receptors that could be adversely affected by the smoke plume. The fire was situated on an industrial estate in Dagenham Docks close to the River Thames. The industrial area is very large and extends more than 1 km from the location of the fire. The nearest residential properties were located approximately 1.4 km to the north of the site with the ExCeL Centre under 5 km away and the Olympic Stadium 6 km away to the west (see Figure 2).

During the incident, CRCE staff regularly reviewed the London Air Quality Network website[1] for any measured air quality impacts from the smoke plume. Run by King's College London, this is an extensive network of approximately 100 monitoring stations[2] across the capital that continuously measure pollutants such as particulate matter (PM), nitrogen dioxide and sulphur dioxide. The nearest fixed air quality monitoring station was located approximately 1 km from the seat of the fire. The data available did not indicate that air quality across east London was being adversely affected by smoke from the plume; all the sites recorded particulate matter (PM_{10}) levels in the 'low' banding[3]. Further to this, intelligence received from the scene and information available in the media suggested that the plume was buoyant and therefore not leading to air pollution at ground level.

A rapid public health risk assessment was carried out based on the available information. This assessment suggested that the expected impact on the local population was unlikely to be significant at that time, but changes to the plume conditions or other information from the scene could affect the risk.

Second to the public health risk to the local population was the potential impact that the plume could have on the closing ceremony of the Games and members of the public at the ExCeL Centre. Initial reports from the scene had suggested that the plume direction was to the west over central London. If this was the case the plume could have implications for the Olympic Park. However, using GIS it was possible to combine the CHEMET modelled output in a wider resolution (Figure 2), and this showed that the plume would not affect the Olympic Park. CRCE on-call staff considered the risk to public attending the closing ceremony to be insignificant.

CRCE briefed staff at North East and North Central Health Protection Unit and the HPA Olympics Coordination Centre, who acted as liaison with the Games organisers and the London Resilience Team regarding any impact from the fire.

By 17:00 the LFB response to the fire had escalated further with 40 fire appliances in attendance at what was at this stage being described in the media as 'the biggest fire for years'[4]. An updated CHEMET (Figure 3) was additionally released, which indicated that the wind was forecast to change slightly, to a south westerly direction, during the period from 17:00 until 23:00. This change would further reduce the risk of any plume affecting the Games' closing ceremony and did not change the risk to local residents. Again the limited data available did not indicate

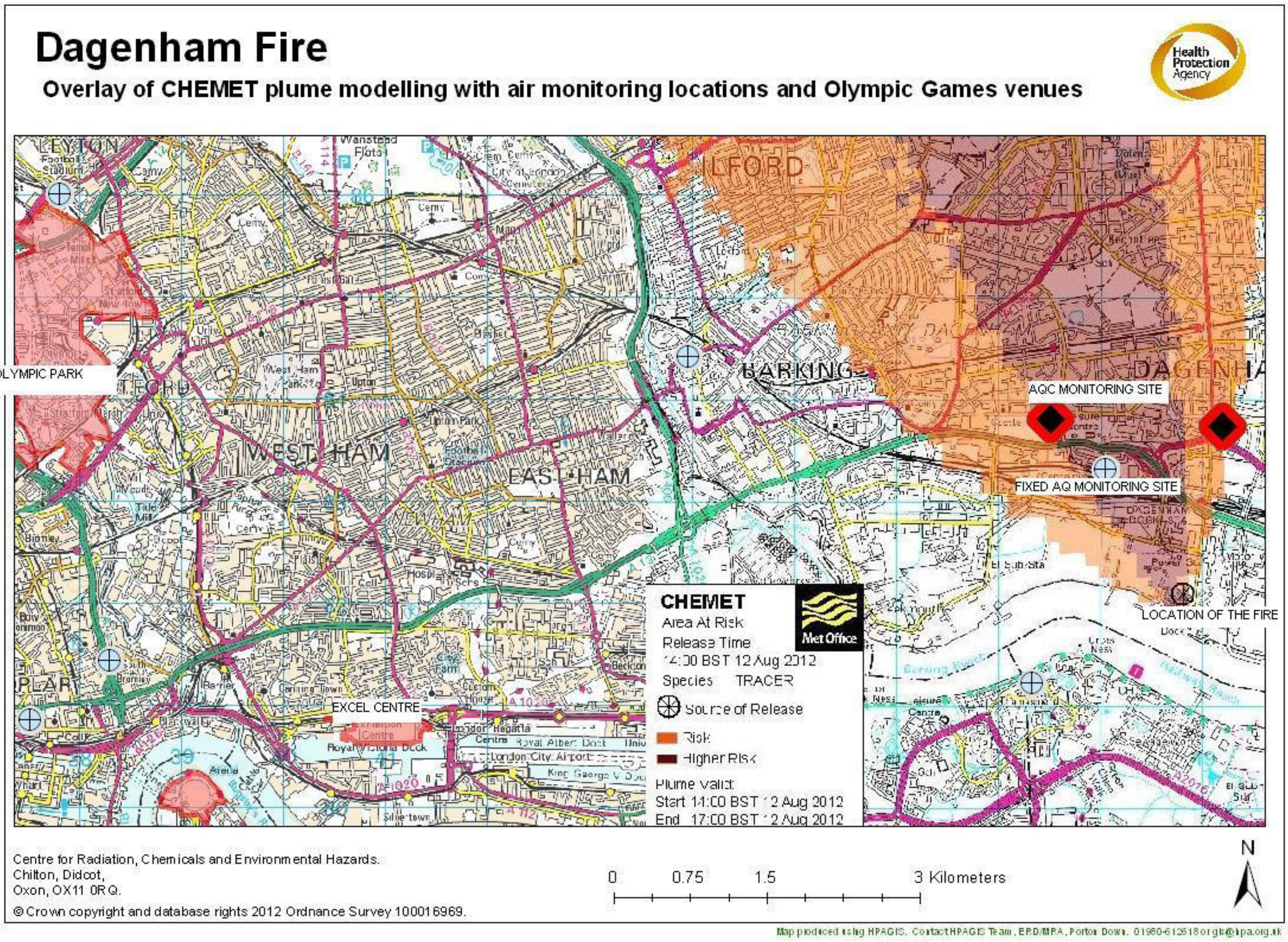

Figure 2: Position of the fire and plume direction (from 14:00 until 17:00 hours) in relation to the Olympic venues (pink), fixed air monitoring sites (blue dots) and AQC monitoring locations (red and black dots)

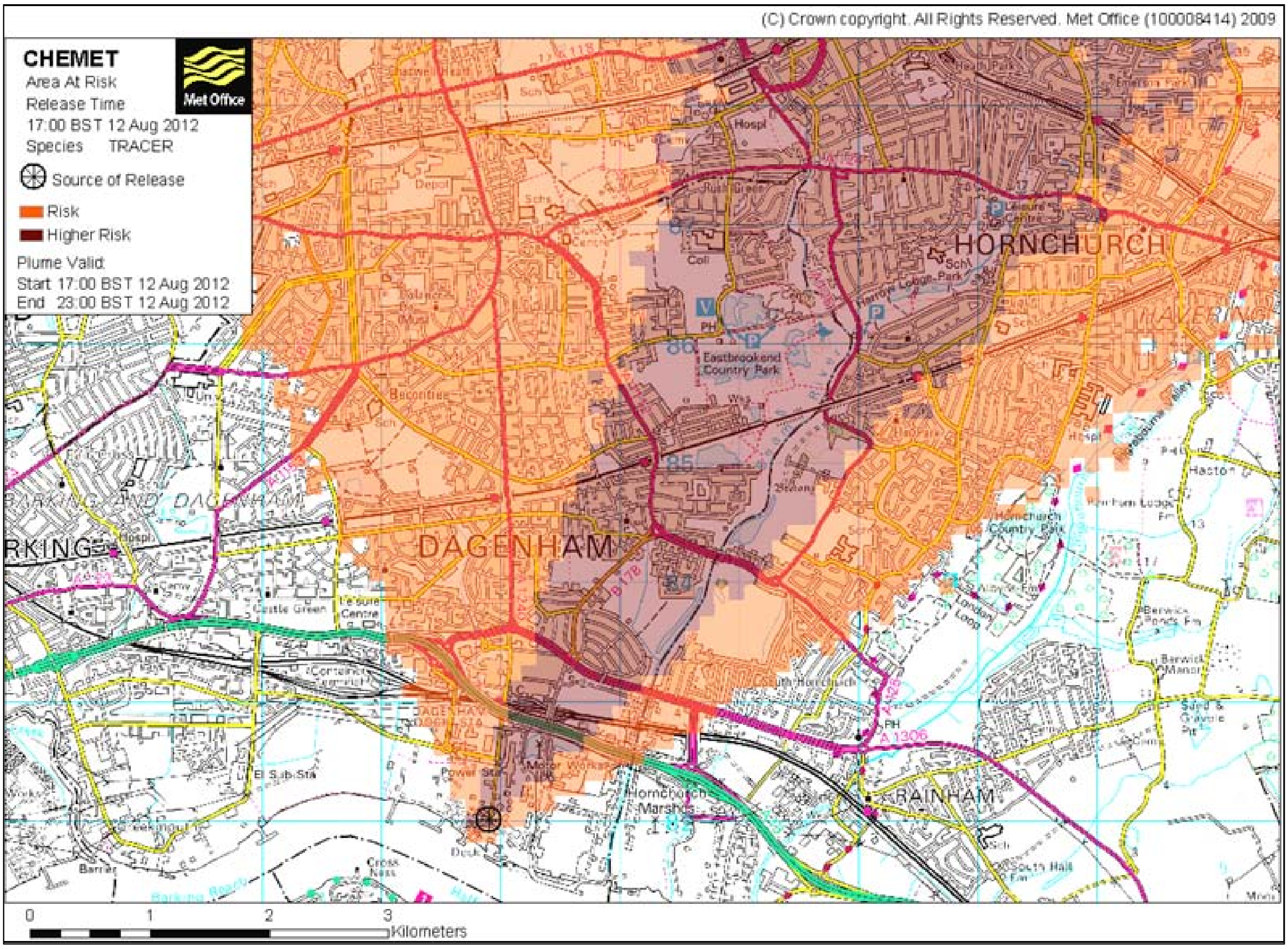

Figure 3: CHEMET showing the modelled plume direction from 17:00 until 23:00 hours

that air quality across east London was being adversely affected by smoke from the plume, and all the sites continued to record PM_{10} levels in the 'low' banding. Advice to continue to shelter from the plume in any affected areas was released by the London Resilience Team on the advice of the HPA.

Air quality cell

Shortly after 17:00 the HPA was contacted by the Environment Agency (EA) to request setting up of an air quality cell (AQC) due to local concerns. The AQC is a multiagency cell that is triggered in the event of an incident expected to significantly affect air quality[5]. Mobile teams deployed to site provide real-time air quality data, which are used to provide environmental and public health advice to strategic and tactical coordination groups.

The AQC conducted an initial teleconference at 18:00, which included CRCE, the EA and the Met Office. Notwithstanding the favourable public health risk assessment that had been undertaken and the plume direction being away from the Olympic Park and ExCeL Centre, two monitoring teams were deployed to residential areas close to the site and under the expected plume (as shown in Figure 2), to assess the impact on air quality and to ensure that the plume would not have the potential to have impact on public health. The monitoring teams were due to be in position from 20:30 with the first available data expected by 22:00.

Due to operational difficulty, the monitoring at the sites only began at 22:00. At this stage the fire was still generating a large plume but the LFB had brought the fire under control and the number of appliances had been significantly reduced. The first air quality data were received by the HPA at 23:50.

These data showed that the levels of PM_{10} were slightly elevated at the monitoring locations but the measured levels were an average of approximately 50 $\mu g/m^3$ in the 'moderate' range of air quality banding. Thus the levels of particulates were broadly comparable to pollution levels during a mild pollution episode, which are common in urban London, and as they were temporary, did not represent a significant risk to human health. Additionally the results highlighted the presence of sulphur dioxide at levels marginally above the UK air quality objectives but unlikely to lead to significant health effects in the sheltering local population.

The AQC stood down at 00:30. The fire was completely under control at this point and the LFB had reduced its presence on site to 10 appliances. There had been no reports of ill health and the closing ceremony of the Games and events at the ExCeL Centre had taken place without incident.

Discussion

The fire was among the largest that had been managed by LFB for some years. This fact, twinned with the unknown and mixed types of material being burned (Figure 4), led to immediate concerns over the impact of the plume on the local population and on the Olympic venues. However, the potential health impacts were quickly assessed to be smaller than initially feared due to the absence of a resident population within 1.4 km

Figure 4: Mixed waste types were present on site, Dagenham, London (© London Fire Brigade 2012)

of the seat of the fire, and no impact identified by the fixed air quality network across London. Information from Met Office modelling and emergency responders on scene showed the plume to be blowing away from the Olympic venues. The decision for additional air quality monitoring data to be obtained from mobile teams was taken due to the heightened concern regarding the Olympic Games. The certainty of air quality monitoring results from the AQC monitoring teams on scene allowed stronger conclusions to be drawn that the fire did not and would not have impacted upon the Games.

The fire was very similar to the industrial accident scenario for Exercise Green Altius, even being located on the same industrial estate, for which an AQC was also set up. Such recent exercising of the scenario meant that HPA staff were well prepared when it came to responding to this incident, as they were familiar with the area and implemented the learning points arising from the exercise. This highlights the importance multiagency exercises play in preparing and improving chemical incident response.

Planning and preparing for every eventuality is not always possible and is not usually appropriate given the impossibility of predicting the future. However, during the preparation for the Games, environmental public health scientists in the HPA developed a coordinated approach to planning and preparedness, utilising expert skills to provide a flexible, robust and resilient chemical incident response service.
Prior to the Games, CRCE staff assessed each Olympic venue for the potential to impact upon a large population in the event of a chemical or environmental incident during the Games (see page 37 for a full description of the risk assessments carried out). Fortunately the incident described in this report did not escalate but the use of the information gathered and prepared prior to the Games enabled on-call chemical staff to have all information about the location, the local population and other chemical facilities in the area, already prepared. This assisted in the HPA response, by allowing the setting up of timely communications, and rapid provision of background information.

The Games period passed without any significant chemical or environmental incidents. Although this was one of the biggest fires in London in recent times and, although it occurred while the world was watching London, its impact on the local population and international visitors was negligible.

Acknowledgements

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Mind the Hunmanby Gap! – millions of tiny white granules washed up on the beach

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Background and incident overview

On 28 April 2011 public health agencies in North Yorkshire were notified of millions of tiny white granules across a 4.5 km stretch of beach on the North Bay of Hunmanby Gap. The granules were described as a 3 m powdery white slick among strands of seaweed along the high tide mark. The initial description of the incident was reported as 'white and purple tablets' washed up on the beach, although this was quickly corrected to simply 'unidentified white granules'. As the nature of the granular material was unknown, North Yorkshire Fire and Rescue Service (NYFRS), the Maritime and Coastguard Agency (MCA) and North Yorkshire Police cordoned off the affected area to prevent potential exposure to members of the public until the material could be identified. As a consequence of the initial holding statement being too vague, there was heightened interest with many calls from national media.

Clear lines of responsibility were quickly established with North Yorkshire Police convening and chairing a Strategic Coordinating Group (Gold) meeting. The SCG was composed of representatives from NYFRS, Scarborough Borough Council, North Yorkshire County Council, the MCA, Environment Agency (EA), Primary Care Trust (PCT) and the Health Protection Agency (HPA). The main priorities of the SCG were to coordinate strategic actions to support Scarborough Borough Council, in its role as lead authority for the incident, in the implementation of an effective resolution and recovery interventions.

The impending May bank holiday weekend had the potential to attract greater numbers of visitors to the area, so rapid action was deemed essential to ensure the beach was safe for the public and business continuity for local tourism trades re-established.

Key strategic concerns related to:

- Rapid identification of the material to determine whether it posed a risk to public health and/or the environment
- Determination of whether the material had been lost from shipping. The MCA had no knowledge of containers that had recently been lost overboard and, as such, the loss of material could have taken place at some distance/time ago
- Tide heights were expected to gradually rise during the subsequent week which could result in further distribution of the pollutant along the coast
- Disposal: the EA would be able to provide support on the most appropriate method of disposal of the pollutant, although this would require positive identification of the material
- There had been reports of similar materials being washed ashore at Cayton Bay and a beach near Primrose Valley.

Identification of the white granules

Hazardous materials are encountered in many forms, which can present a broad scale of hazards and risks to the public and emergency responders. The Fire and Resilience Directorate, of the Department for Communities and Local Government, has provided a suite of Detection Identification and Monitoring (DIM) equipment to the Fire and Rescue Service (FRS). The DIM capabilities have been strategically distributed throughout England and Wales to ensure the best possible response and intervention to major centres of population. This capability is enabled and supported by DIM Advisers and teams of FRS operational personnel, usually HAZMAT officers, with the necessary background knowledge, skills and understanding in the use and operation of the DIM equipment. The DIM suite has been assembled to provide the DIM Advisers with a variety of equipment to attempt to detect, identify and monitor these substances and their associated hazards in all their respective states within the potentially hazardous area.

The white granules were described as 7 mm half spheres which were non-brittle, deformable with a consistency of 'Polyfilla'. They were all consistent in shape and size, with no evidence of swelling or fracture. Initial identification of the granules by the FRS proved to be inconclusive.

Analysis carried out by the NYFRS specialist DIM team using its Fourier transform infrared spectroscopy (FTIR) analytical equipment suggested the material to be a polythene-like hydrocarbon/paraffin wax composition, although the presence of seawater contamination prohibited a definitive identification. Where identification of substances using the DIM FTIR analytical equipment is inconclusive, the FRS has a 'Reachback' service to call up specialist support to help identify chemicals from the primary spectra data. Spectra data were sent via email to a 'Reachback' scientist in the United States to provide a more definite identification of the substance and to make corrections for the seawater contamination of the sample. This interpretation indicated the material was a long-chain alkylamine salt. However, the results were unable to confirm the polymeric/chain length and thus provide a conclusive identification. It was noted that a shorter chain alkylamine

would have physiochemical properties analogous to soap, exhibiting slow dissolution in water. Whilst a definitive identification was not possible on this occasion, the partial analysis results did allow the HPA to reassure the SCG meeting that the material was non-toxic with little risk to public health.

Recovery and media

The results of the analysis were able to inform a speedy recovery intervention to effect the beach clean-up. Cleansing teams supplied by Scarborough Borough Council subsequently combed the affected beaches and stockpiled the granules for removal. Following removal of the stockpiles it was agreed that the Hunmanby beach and nearby Primrose Valley beach would then be re-opened. It was also agreed that the council would lead the management of media communications, further analysis of the material to guide the disposal options and arrange a debrief.

Final media brief

The head of environmental services for Scarborough Borough Council said:

> ***"Cleansing staff have worked hard to remove as much of the product as possible at Hunmanby this afternoon. We're obviously pleased to have determined the product is nontoxic and we will continue to monitor the situation over the coming bank holiday weekend."***

Lessons identified

- The need to provide clear media messages at the inception of an incident. The initial holding statement in this case was too vague, leading to heightened media interest with many calls from national media
- The decision to coordinate the incident at an SCG level due to the impending bank holiday weekend worked well and facilitated a speedy resolution to the incident, mitigating any negative impacts on local tourism
- Timely, well-organised detection, identification and monitoring of hazardous substances at the scene of an incident greatly assists the incident response through confirmation of the appropriateness of existing cordons and the necessary safe systems of work. It supports rapid assessment of the risk to emergency responders, members of the public and the environment. It can also significantly reduce the time taken to successfully resolve such an incident, thus mitigating social and economic impacts, and assisting in re-establishing or maintaining business continuity. The agencies involved agreed that, in hindsight, a 24-hour response was still efficient considering the limitations of the immediate DIM analyses
- Recognising the limitations of the DIM equipment, the use of United Kingdom Accredited Services (UKAS) approved laboratories to support interpretation of analytical results, when required at short notice, could be explored
- It was recognised that there were difficulties in cordoning and securing such a large public area (a stretch of sea coast of over 4 km) where multiple access points were available for members of the public to gain access to the beach. Had the nature of the granules been toxic then this would have placed significant pressures on local emergency responders to isolate the area, implement recovery operations and have local social and economic impacts.

CRCE Dangerous Goods Safety Adviser (DGSA)

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Introduction

The majority of materials consigned for carriage pose no danger to those involved in transporting them, or to members of the public or the environment. However, large volumes of hazardous materials are transported using road, rail and sea networks (see page 18). These products' physicochemical and toxicological properties must be assessed to ascertain if the products meet the criteria to be classified as dangerous goods. Hazardous properties that can lead to a product being classified as dangerous goods include flammability, toxicity and corrosivity. Goods that pose a risk to people, property or the environment which are classified as dangerous goods are assigned to specific classes ranging from 1 to 9. A full list of the classes of dangerous goods for transport is presented in the table.

Goods that fall into these categories range from everyday products, such as paints, adhesives and cleaning products found in the home and at work, to those which may present specific hazards, such as explosives, fuming acids and highly flammable solvents. The controls placed on the transport of these goods are proportional to their hazard, i.e. the more hazardous a substance, the more restrictions are placed upon its transport. However, for all goods categorised as dangerous there is a requirement for them to be packaged and labelled correctly as defined in the various national and international regulations for each mode of transport. This allows dangerous goods to be safely transported in a manner which minimises the risk of an incident and labelled in such a way that they are easily recognisable by the emergency services and other parties should a problem occur during transportation.

Labelling is vital to ensure that the hazards presented by transported chemicals in packages or tanks are recognised. This information ensures an appropriate response if a problem arises during transportation, and can be used to inform public health risk assessments.

Identification of dangerous goods/vehicles carrying dangerous goods

The Health and Safety Executive's experience from roadside checks is that about one in three of those vehicles carrying dangerous goods and selected for inspection exhibit breaches of the regulations of some sort[1]. Correct identification of vehicles and information relating to the goods which they carry is extremely important. Identification of a vehicle that is carrying dangerous goods and the hazards that those goods may present is achieved by a system of placarding and marking that is prescribed in the regulations.

Hazard markings are required to be displayed on vehicles carrying significant amounts of dangerous goods to highlight the potential hazard associated with the transported materials. The markings may be presented in various ways, with or without identification numbers, depending on the nature of transport, but are all based on orange plates usually affixed to the front, back or sides of a transport vehicle as stipulated in the regulations. Examples of the markings are shown in Figure 1. The example on the left includes identification numbers to describe the chemical being carried by the vehicle.

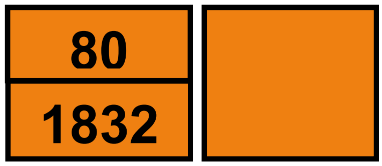


Figure 1: Example of hazard markings required on vehicles transporting dangerous goods. The two numbers on the left mark indicate that the vehicle would be carrying spent sulphuric acid (United Nations Number 1832) that presents a corrosive hazard (Hazard Identification Number 80)

In addition to the orange plate marking shown in Figure 1, tanks and containers are required to display placards identifying the hazard classes presented by the chemical carried. The placards for the different classes are presented in the table.

Where vehicles registered in Great Britain are carrying out journeys entirely within Great Britain, the markings on the vehicle are required to display a 'hazard warning panel' which is an integration of marking and placards. These will be familiar to users of the road network and are illustrated in Figure 2.

As a consequence of the large amount of goods transported by road, rail and sea there are frequent accidents involving vehicles carrying dangerous goods during which loss of containment often occurs to some extent[1]. The Health Protection Agency's Centre for Radiation, Chemical and Environmental Hazards (HPA CRCE) has been involved with a number of incidents directly resulting from the carriage of dangerous goods. Two recent incidents have highlighted the benefit to public health risk assessments gained from the use of these systems. In the first incident initial reports suggested that a 20 tonne railway tanker containing a flammable alcohol was at risk of fire and explosion. However, decryption of the UN number on the hazard warning panel indicated that the chemical was 2-(2-aminoethoxy) ethanol (UN 3055), which is a mildly corrosive liquid and is not flammable. This allowed the emergency responders to reduce the cordon around the tank, and actively fight the fire and ensured a prompt closure to the incident.

The second incident involved the release of up to 35,000 litres of 'biofuel'. It was unclear if the reference to 'biofuel' indicated that the spillage related to pure ethanol produced from biological digestion of plants or a fuel composed of a mixture of ethanol and fossil-fuel-derived petroleum products, as biofuel is a term often used to described both products. The impact on the environment and risk to human health

Table: Nine classes of dangerous goods for transport

Class	Hazard	Label/placard
1	Explosive substances and articles	
2	Gases	
3	Flammable liquids	
4.1	Flammable solids, self-reactive substances and solid desensitised explosives	
4.2	Substances liable to spontaneous combustion	
4.3	Substances which, in contact with water, emit flammable gases	
5.1	Oxidising substances	
5.2	Organic peroxides	
6.1	Toxic substances	
6.2	Infectious substances	
7	Radioactive material	
8	Corrosive substances	
9	Miscellaneous dangerous substances and articles	

would be very different depending on which substance was involved as the physicochemical properties and toxicological properties differ considerably. The hazard warning panels indicated that product was pure ethanol (UN 1170) which allowed CRCE staff to assess the risk to public health.

National regulations for the carriage of dangerous goods

The Secretary of State for Transport is responsible for the control of carriage of dangerous goods by all modes of transport – road, rail, air, inland waterways and sea – supported by the Health and Safety Executive (HSE) and by the Civil Aviation Authority (CAA). Within the Department for Transport (DfT), responsibility for maritime transport falls to the Maritime and Coastguard Agency (MCA)[2].

Transport by road and rail

When transporting dangerous goods by road, organisations must meet the requirements of the European Agreement Concerning the International Carriage of Dangerous Goods by Road (ADR), which are enacted in Great Britain through the Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2009 as amended (CDG09). CDG09 and ADR place many requirements on those involved in the carriage, loading, unloading or packaging of dangerous goods. One of these requirements is to appoint a Dangerous Goods Safety Adviser (DGSA).

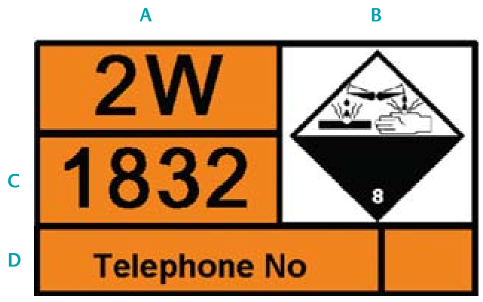
Dangerous Goods Safety Advisers

A DGSA is an expert in the dangerous goods transport regulations. They are employed by companies and organisations to advise on compliance with legislation and compliance with relevant undertakings to which they are appointed. These requirements are prompted by the EC directive (96/35/EC) and cover road, rail, and inland waterways. Since 1 January 2000, any company or other organisation that is involved in the transport of dangerous goods is required to have appointed a qualified Dangerous Goods Safety Adviser (DGSA)[2].

Among the tasks of the DGSA are the requirements to:

- Monitor their organisation's compliance with the regulations regarding transport of dangerous goods
- Advise on their organisation's carriage of dangerous goods
- Prepare an annual report to the organisation's management of the organisation's activities in relation to the transport of dangerous goods
- Monitor procedures and safety measures
- Investigate and compile reports on any accidents or emergencies
- Advise on the potential security aspects of transport.

In order to act as an appointed DGSA an adviser is required to hold a vocational qualification which is gained by passing a series of written examinations. In the UK, the examinations are currently set and administered by the Scottish Qualifications Authority (SQA) as the agent for the Department for Transport (DfT)[3]. To retain the DGSA qualification, the candidate must re-sit the three examinations every five years.



Hazard warning panels feature a number of pieces of key information essential for responding to a leak, fire or other emergency that requires knowledge of the load being carried:

- **A** The 'Emergency Action Code' (sometimes referred to as 'Hazchem code') for the substance carried. This provides information to the emergency services of the most appropriate way to fight a fire involving the load, the level of personal protective equipment needed, environmental considerations and if the load will present a public safety hazard. In this example the first character denotes the fire-fighting extinguishing media, in this case '2' indicates fine water spray and 'W' denotes that that liquid-tight chemical protective suits with breathing apparatus should be worn and the substance contained
- **B** The placard(s) illustrating the hazard(s) presented by the load. More than one placard may be required if the load has multiple hazards
- **C** The United Nations (UN) number – this number identifies the chemical or type of chemical being carried on the vehicle
- **D** A telephone number where specialist advice concerning the dangerous goods being transported may be obtained in the event of an emergency

Figure 2: Hazard warning panel

DGSAs within the Health Protection Agency

In 2004 it was identified that a small number of customers of the CRCE Radiation Protection Adviser (RPA) service, such as companies with radiographers, well loggers, portable gauge users and nuclear density gauge users, were required to appoint a DGSA under the dangerous goods transport regulations. Since then CRCE has trained four members of RPA staff to be DGSAs, who now act as both DGSA and RPA to companies requiring this service. They have also provided advice relating to the transport of dangerous goods when responding to transport emergencies.

In 2011 a further two CRCE staff members specialising in chemical hazards completed DGSA training and this now allows the HPA to provide a complete DGSA service across all classes of transport of dangerous goods.

The service contributes directly to raising radiation and chemical protection standards in practice and provides expert advice on the safe transport of dangerous substances. The regulations relating to the transport of dangerous goods are highly specialised, with many aspects being unique to the class of material being transported. The specialised nature of these regulations warrants a detailed understanding, not only of transport legislation but also of the goods themselves, and as such HPA DGSAs are specialists in their field.

More about the HPA DGSA services can be found at https://www.hpa-radiationservices.org.uk/dgsa.

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Incident Response Tools

Update on Health Protection Agency guidance: the UK Recovery Handbooks

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What are the UK Recovery Handbooks?

The Health Protection Agency (HPA), in collaboration with the Department for Environment, Food and Rural Affairs, Food Standards Agency, Home Office, Northern Ireland Environment Agency and Scottish Government, has now published the UK Recovery Handbook for Radiation Incidents (version 3, 2009)[1] and the UK Recovery Handbook for Chemical Incidents (version 1, 2012)[2].

The UK Recovery Handbooks include guidance and advice on the recovery and remediation of the environment in the post-accident (post-acute) phase and focus on environmental clean-up methods. The Handbooks aim to provide a framework for developing and selecting an effective recovery strategy following a chemical or radiation incident, and contain a compendium of practicable, evidence-based recovery options for inhabited areas, food production systems and water environments[1,2]. The Handbooks are suitable for use by a wide audience, but are specifically aimed at professionals in:

- Central government departments and agencies and inspectorates
- Emergency planning
- Health and environmental protection sectors
- Enforcement bodies (local authorities and public health agencies)
- Health authorities
- Emergency response professions (police force, ambulance service, and fire and rescue service)
- Water companies and distributors
- Agriculture, feed and food production sectors
- The Handbooks can also be used by others, including members of the public who may be affected or concerned, depending on the situation.

The UK Recovery Handbooks are technical guidance documents, containing well-focused and broadly applicable state-of-the-art information on scientific, technical and societal aspects relevant to recovery and remediation of contaminated environments. The Handbooks were developed to meet the following objectives:

- To provide up-to-date information on recovery options for reducing the consequences of contamination of inhabited areas, the food supply chain and water environments
- To illustrate how to select and combine recovery options to build a recovery strategy specific to the chemical or radiation incident being managed
- To outline the many factors that influence the implementation of recovery options
- To provide guidance on planning for recovery prior to an incident.

The UK Recovery Handbooks are also a tool that can be used to generate awareness amongst emergency planners and those who might deal with the aftermath of a chemical or radiation incident, and promote constructive dialogue between all stakeholders tasked with recovery following a chemical or radiation incident.

The UK Recovery Handbooks have been developed through a process of stakeholder participation, and are intended to be used or applied using a similar participatory approach to realise their full potential. Examples of the most likely applications of the Handbooks are:

- In the preparation and pre-planning phase, under non-crisis conditions, to engage stakeholders and to develop local, regional and national plans
- In the recovery phase of an incident by local and national stakeholders as part of the decision making process, e.g. recovery coordination group (RCG)
- For training purposes and contingency planning and in the preparation for and during emergency exercises.

What next?

Development of a UK Recovery Handbook for Biological Incidents

Microorganisms are ubiquitous in the environment and whilst the majority are harmless, a small number have the potential to cause disease and ill-health in humans, animals and plants. Outbreaks caused by these microorganisms can contaminate the surrounding environment, which leads to a risk of infection in the local population.

Remediation, recovery and environmental decontamination can help return the contaminated environment back to its original state, and reduce the chance of further outbreaks. As a result, the HPA is now developing a UK Recovery Handbook for Biological Incidents.

This Handbook is being developed as part of a three year project (2012–2015), as a guidance document to assist with recovery strategies following an outbreak. It will apply to areas or environments that have been contaminated by accidental or deliberate releases and environmental contamination. More information on the UK Recovery Handbook for Biological Incidents is available on the HPA website[3].

Development of a chemical and radiation recovery decision support tool

During the development of the UK Recovery Handbook for Chemical Incidents, feedback from users and other stakeholders was that the current formats of the chemical and radiation recovery handbooks (hardcopies and linked PDF documents) can be quite difficult to interpret, interrogate and navigate through by non-experts, especially if users are unfamiliar with the structure and content. This is particularly relevant during a response, where time is limited and situations pressured.

In particular, it is difficult for the user to keep track of where they are in the decision process; as the UK Recovery Handbooks have a number of steps involved in developing recovery strategies. Hence, the process of identifying and evaluating a recovery strategy could be made more user friendly by developing an online recovery decision support tool, to accompany the Handbooks. The recovery decision support tool will not replace current advice and guidance, and will help direct the user through the steps in developing a recovery strategy for the remediation of a chemical or radiation incident. The IT software (and platform) chosen to run the decision support tool will be suitable for use on computers or other web-enabled devices.

Whilst each chemical and radiation incident will be unique and require a site-specific assessment, the decision making processes for identifying and developing recovery strategies are quite similar. Therefore, it is envisaged that the recovery decision support tool will:

- Assist the user in navigating through the decision frameworks within the current UK Recovery Handbooks
- Assist the user in identifying suitable recovery options
- Provide a consistent methodology to compare remediation techniques by linking to the evidence base that will continue to be developed in parallel to the tool, and take account of lessons identified from recovery strategies applied after the chemical and radiation incidents
- Provide a framework that clearly documents all parameters, assumptions and data used to reach the decision
- Facilitate reproducible and transparent decision making with an auditable decision trail.

Conclusions

The UK Recovery Handbooks have been developed to ensure that guidance and advice is robust and practicable, based on an evaluation of the evidence base[4]. Knowledge gaps and issues to be taken forward through future research have also been identified (i.e. chemical and radiation recovery decision support tool).

It is envisaged that the UK Recovery Handbook for Biological Incidents will complete the suite of guidance published by the HPA for chemical, radiation and biological incidents. The UK Recovery Handbooks are designed to be user-friendly guidance documents to aid the decision making process for the implementation of a recovery strategy in the aftermath of a chemical, radiation or biological incident.

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A brief overview of work undertaken by CRCE Wales on the Arcopol Plus project

ARCOPOL PLUS

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Background and introduction

Data indicate that approximately 90% of European Union external trade is by sea, with estimates indicating up to 50,000 hazardous chemicals carried, and an annual bulk chemical trade of around 165 million tonnes and rising[1]. The next generation of container ships are also increasing in size. For example, the *MSC Napoli* (Figure 1), involved in the 2007 incident off the coast of Devon, carried 2,318 containers at 4,419 twenty-foot equivalent units (TEU) compared to newer, far larger vessel capacities of 12,000 TEU.

Whilst maritime shipping provides an efficient means for international transport of oils and chemicals, incidents from such activities have the potential to result in significant public health and environmental impact, as illustrated by such incidents as the *Sea Empress* in the UK, the *Exxon Valdez* and the *Prestige*[2,3].

Such impacts are primarily due to the large quantities and diversity of chemicals carried by modern ships, the duration and geographical dispersion of spills and leaks, and the range of receptors that can be affected. This last aspect is particularly relevant when considering that areas of high shipping activity, e.g. ports and terminals, are often in close proximity to coastal populations, fisheries, popular amenities and areas of natural beauty.

Human health impact can occur via many exposure routes, including direct contact from contaminated seawater, airborne migration of plumes and vapours and impact upon the food chain. The *MV Cason*, carrying 1,100 tonnes of mixed chemicals, caught fire and ran aground 100 m off the Galician coast of Spain in 1987, resulting in the death of several crew members and in 15,000 people being evacuated overnight from surrounding communities as a precaution against potential airborne exposure[2]. Similarly, a retrospective cohort study of coastal populations following the *Sea Empress* spill in West Wales identified exposure to be significantly associated with higher physical and psychological symptoms, such as headache, sore throat and eyes and anxiety[3].

As the potential for incidents cannot be completely prevented, it is essential to ensure suitable contingency plans exist, should such an event occur. In this respect many countries have implemented international conventions and guidance such as the International Convention for the Prevention of Pollution from Ships (MARPOL) and the Protocol on Preparedness, Response and Co-operation to Pollution Incidents by Hazardous and Noxious Substances, 2000 (OPRC-HNS Protocol)[4] and have also developed national and regional response procedures such as the Maritime National Contingency Plan in the UK[5].

Figure 1: ***MSC Napoli*** **(courtesy ARCOPOL)**

ARCOPOL Plus

As discussed, maritime incidents can have widespread effects, often involving international and transboundary response, and in this context, the Health Protection Agency's Centre for Radiation, Chemical and Environmental Hazards in Wales (CRCE Wales) is involved in a European-funded project to enhance shoreline response to maritime incidents, called ARCOPOL Plus[6].

ARCOPOL is the acronym given to the Atlantic Region Coastal Pollution Response project framed in the Atlantic Area Transnational Programme and focused on the preparedness, response to and mitigation of accidental marine pollution impacting on the shoreline. As indicated by the 'Plus', this project follows on from previous projects, namely ARCOPOL[6] and before this EROCIPS[6].

CRCE Wales was originally involved as a specialist subcontractor on the ARCOPOL project, tasked by Pembrokeshire County Council to develop a public health risk prioritisation methodology for hazardous and noxious substances (HNS) and the development of toxicological datasheets for use by emergency planners and responders (Figure 2).

As a result of this work, CRCE Wales was invited by the project coordinators to bid as a full partner on ARCOPOL Plus, with the aim to build upon the public health prioritisation works and incorporate these within a programme of training and educational materials for responders and wider stakeholders.

The ARCOPOL Plus project is aimed at European Atlantic regions and includes participation by Spain, Portugal, Ireland, France and the UK. Partners encompass a wide range of bodies including government agencies, regional authorities, maritime institutes such as the Centre for Environment, Fisheries and Aquaculture Science (CEFAS) in the UK and several universities. The project is overseen by members of several national coastguard agencies.

The project encompasses all aspects of maritime incident management over a series of seven discrete 'activities', ranging from laboratory studies on weathering and ecological fate of marine pollutants, development of monitoring and modelling technologies for spills, training and

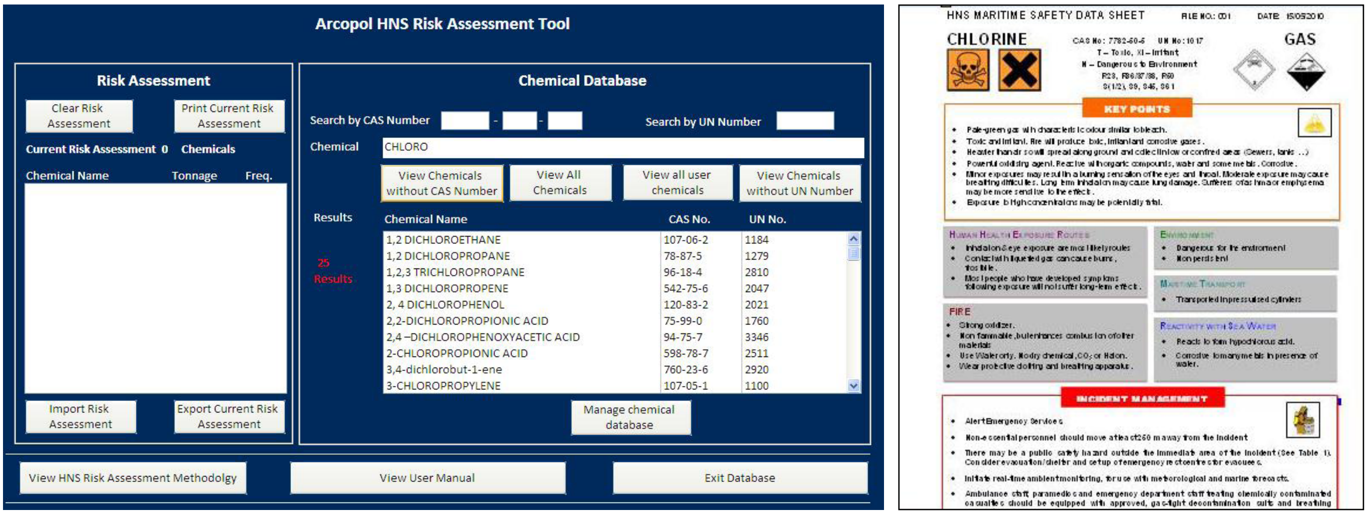

Figure 2: 'Screen-grabs' of prioritisation tool and example datasheet (P Harold, Arcopol)

educational materials for response, and financial compensation procedures. In addition, the project involves development of community engagement and dissemination processes including championing three coastal regions in Spain and Wales.

Specifically, the brief of CRCE Wales has been to develop written and e-learning training materials for maritime incident management, working in close partnership with colleagues in the HPA's Emergency Response Division, Public Health Wales and Pembrokeshire County Council, and to assist in delivering these materials via stakeholder engagement.

Outputs from the project

Materials under development by CRCE Wales include incident management checklists covering all aspects of planning, response and recovery; supporting case studies illustrating risk assessment, response and remediation in real incidents; and three off-the-shelf desk-top exercises encompassing detection and alerting, response and risk communication.

In addition, CRCE Wales, in conjunction with Public Health Wales, is producing a risk communications strategy document and frequently asked questions for use by public health planners and responders in the event of shoreline incidents. All of these materials are to be collated into a manual for responders and will form the basis for an e-learning programme.

The e-learning programme is to be developed in collaboration with a specialist academic partner and will include a series of web-based modules covering all aspects of shoreline incident management. In addition to written training materials and information sources, modules will contain supporting case studies, video footage, expert interviews and presentations, and a selection of self assessment quizzes and tests. The modules will also provide directed reading and options for accredited study through academic providers.

Finally, in partnership with Pembrokeshire County Council, CRCE Wales has assisted in the delivery of training and information to key stakeholders in West Wales via a workshop held in December 2012; a live exercise will be run over two days during the summer of 2013 and an international conference will be held in Cardiff later in 2013.

All materials produced will be freely available via the ARCOPOL website[6].

Funding and acknowledgements

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ATLANTIC AREA Transnational Programme

European Union

European Regional Development Fund

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Environmental Science and Toxicology

Only you can decide: facts and feelings are essential aspects of chemical risk assessment

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The Health Protection Agency is asked to provide advice on the health risks from hazardous substances to a wide range of audiences, including members of public, emergency responders and health professionals. In order to maximise the impact from our advice there needs to be an awareness of how perception of risk will influence the actions and response to our advice, where subtle changes in tone, emphasis and authority can be as influential as content. This article briefly describes how unconscious mental processes influence decision making in response to hazards, the potential consequences of a perception gap between actual and perceived risk, and some examples of how this knowledge can be applied to our routine work.

Risk perception: the 'affective risk response' and fear

The literature on risk communication includes some useful guidance[1,2,3,4], material on the HPA website[5], and is a key aspect of the UK Government Office for Science Blackett Review[6]. This article does not aim to duplicate these efforts, rather share some thoughts on how emotional and rational aspects of decision making contribute toward an evaluation of risk.

The system by which humans respond to risk includes a complex mix of neural messaging, biochemistry, instinct and fact-based reasoning which has evolved over hundreds of thousands of years. It therefore includes components that gave a competitive advantage in response to immediate and obvious threats that were prevalent in a pre-technological world. This response to fearful situations is still triggered by, but is not necessarily appropriate to, modern complex risks, and is often performed at a subconscious level. Modern neuroscience suggests unconscious neural processes make decisions before there is a conscious awareness of that decision[7]. Rational explanations of why a choice has been made will often be constructed after a decision has been taken, rather than the decision being a consequence of a rational process. It is useful to be aware that personal risk assessments are the result of conscious and unconscious neural processes, and feelings will often play an important role in influencing those decisions, sometimes in extremely subtle ways, and sometimes quite powerfully and directly. An improved understanding of the roots of our fears can therefore improve how we judge risks and help us make more informed, healthier and wiser choices for ourselves and society.

The overall risk perception system can be called an 'affective risk response'[8], which will simultaneously combine factual information and feeling about those facts to reach a judgement. In order to conceptualise these aspects it is convenient to separate them, but clearly they are not separate systems, but work simultaneously, are interwoven and are continuously evolving based on new experience and information. Crucially the way we feel about something will generate real physiological changes, which can themselves be associated with an increased health risk. It is possible that our fears about a risk will escalate our assessment and we will grossly overestimate the likely harm from a threat. It is also possible that a lack of awareness of the real dangers will cause us to underestimate the real risk from a threat. This perception gap can contribute to making choices that are more risky, increasing levels of unwarranted stress and influencing social policies that don't maximise public health protection due to a greater commitment to fearful hazards than those that cause the largest burden of disease. This is complicated by the way in which scientific understanding about health risks evolves, where evidence of harm sometimes evolves over a long period of time[9]. In addition, decision making is influenced by a wide range of external factors which are not always immediately obvious, e.g. historical, financial, political and ideological.

This isn't about being right or wrong, rational or irrational; this is more about 'perception is reality'. Knowing that everyone, including health professionals, emergency responders and members of the public *(and you)*, is making decisions based on facts and feelings is essential when providing advice, as providing only factual information will only do part of the job.

So what?

This balancing act between facts and feelings can be challenging, especially for scientists who are likely to be more comfortable talking about numbers and statistics than emotional well-being. The key to emotional aspects of communication is actively listening and making every effort to put your own world-view aside in an attempt to understand and respect the emotional validity of what people are really saying and feeling, even when their positions conflict with the evidence as you see it. Some further details about how empathic communication can increase effectiveness in general situations can be found in Stephen Covey's book[10].

Knowing that different people will rely more or less on rational and emotional information to inform their judgement about risk can be invaluable when attempting to understand and thereby influence their decisions. When people approach the HPA for advice on the health risks from hazards in the environment it is obviously critical that we have a high degree of technical competence, but it is at least equally important that we can build an emotional connection to ensure our advice is heeded. In order to do this we must employ excellent listening skills, without judgement or pre-conceptions so that we can fully understand the nature of the questions being asked of us. Here the two-way aspect of communication becomes critical, not only in gaining sufficient factual information to evaluate public health risk, but also in considering the emotional aspects for those dealing with a potentially unusual and fearful experience. Remaining calm in high pressured situations, being aware of our own and others' emotional resilience and being able to deliver highly technical information succinctly are key attributes of a good response.

Achieving good communication in respect of emotional and rational factors should also be a consideration when using relatively new media such as social networking. Though the challenge can seem great due to the increased complexity, the rewards can be vast in terms of delivering a message to, and being able to receive feedback from, many people in a very short period of time. Similar principles will apply as those described in this article, and guidance must consider how new technologies can be used to improve risk communication.

Examples

Some situations which we are contacted about have the potential to raise levels of fear, and therefore increase the importance of responding to emotional aspects of the situation. Common examples include where people have died or are severely affected following an exposure to a chemical, where substances are released that have a high profile as being dangerous, or where there is particular sensitivity related to an event such as the Olympic Games or a specific site such as a waste site.

Disposal of waste creates concerns about exposure to hazardous emissions, and innate fears related to engagement, uncertainty and trust[11]. The response to all these challenges involves some form of genuine and empathic listening, such as actively involving local people, striving to understand the basis for their concerns and recognising that scientific uncertainty is open to misinterpretation. Broader issues would also benefit from research into why science is often not trusted, how to convey outputs from complex risk assessments more effectively and public understanding about scientific evidence. Popular news articles sometimes promote simplistic relationships between cause and effect. However, environmental chemicals are rarely a simple case of an individual agent being sufficient alone to cause illness but this complexity can be difficult to convey using traditional deterministic tools[12].

Where there are cases of childhood cancer within a small geographical area there will often be a strong desire to identify the cause, so that others can be protected in the future. In such circumstances a local industry might be a vulnerable target, and the HPA will be asked to provide impartial advice on the health risks from site activities. When providing this advice to communities the role of the HPA is not to convince the community that our advice is 'right'. Rather there is a responsibility to strive to understand the perception of those suffering by providing a space to listen to their thoughts and feelings. There is also a responsibility to act on the information provided to ensure health is protected.

Summary

An awareness of the role of emotion and reason in decision making can improve the impact of our advice. This requires strength in listening skills as well as technical knowledge about the health risks from chemicals in the environment.

When feelings influence actions they are likely to contribute towards negative outcomes, and modern humans have evolved the ability to respond to fear (other than freezing, fighting or taking flight). This fourth option is to calmly face your fear, being aware of your emotional state, and choosing a response which fits with the facts and feelings. Ultimately the subjective nature of reality and risk mean that *only you* can decide what your best option is, but we hope we can provide facts and context that will help make that as informed a decision as possible.

Acknowledgement

Many thanks to David Ropeik for his help in reviewing this article, which has used some of the concepts from his book[8].

The biggest surprise

When asked what surprised him most about the world:

> *"Man ... Because he sacrifices his health in order to make money. Then he sacrifices money to recuperate his health. And then he is so anxious about the future that he does not enjoy the present; the result being that he does not live in the present or the future; he lives as if he is never going to die, and then dies having never really lived."*

Dalai Lama (born in 1935)

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Actions to cut local air pollution can deliver additional public health benefits and save money

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Abstract

Air pollution is responsible for up to 9% of deaths in some areas of our cities according to government figures. Local actions to reduce air pollution can often save money and have substantial additional public health benefits over and above those from the air pollution reductions themselves. These include encouraging walking and cycling, high quality insulation of buildings, in particular the homes of the most vulnerable, and use of modern, efficient heating systems. Taken together, the measures can form the basis of local strategic plans to significantly improve public health while reducing air pollution and costs, all of increasing importance given the growing role of directors of public health in local strategy setting.

General background

A recent analysis for the Department of Health's public health outcomes framework suggests some 5.6% of mortality across England in 2010 may have been due to man-made particulate air pollution, rising to 9% in the City of London[1]. These estimates followed work by the Committee on the Medical Effects on Air Pollutants[2], which estimated the burden of particulate air pollution in the UK in 2008 to be an effect equivalent to nearly 29,000 deaths at typical ages, with an associated loss to the population of 340,000 years of life. These figures come as no surprise to air quality experts, but have shocked many less familiar with this hazard. Since the 1950s efforts to improve air pollution have focused on technological solutions at power plants and in vehicle motor and exhaust designs[3], but a review of local measures applied in the UK and elsewhere[4] shows considerable scope to reduce toxic air pollution emissions through low cost or cost-reducing local actions, many of which have substantial additional public health benefits.

The main toxic air pollutants come from common activities involving combustion, such as heating and driving, so many of the effective local solutions involve changing people's behaviours and choices. In urban landscapes the proximity of upwind air pollution sources to populations increases their impact[5] and air pollution sources such as busy roads are often close to low cost housing and thus disadvantaged communities[6]. Taken together, these factors mean that action to reduce local air pollution sources in city centres can have disproportionate health benefits. The government's public health outcomes framework[1] specifically lists particulate air pollution as an indicator; directors of public health will help set local strategic priorities for councils to work towards improving air quality and reducing health inequalities.

This article summarises work undertaken on behalf of Central London councils to identify cost-effective measures to reduce air pollution at the local level, and are applicable across the UK.

Method

To identify beneficial local actions a long list of 94 actions tackling the main local pollution sources was drafted from 40 interviews with officials and experts in London, San Francisco, Sydney and New York, with additional enquiries in Barcelona, Seville, Amsterdam, Copenhagen, Rome and in Sweden. Using information from about 400 official reports, peer-reviewed publications and databases, these were screened for air pollution, carbon, cost and noise benefits, and for practical achievability and alignment with other policies by a panel of local government experts. A final list of 23 actions was studied in detail using the Department for Transport's transport analysis guidance (TAG) method[7], using metrics for air pollution, carbon, cost and noise. The air pollution, carbon and financial metrics were monetised using Defra's damage cost methodology[8]. This roughly estimates the public health benefits of the resulting air pollution reduction, allowing comparison with the costs of implementation and the calculation of an overall benefits-costs ratio (BCR). Of the 23 actions, those with a BCR significantly less than two were rejected, as recommended in TAG. The resulting list of actions with a BCR of around two or greater include actions to promote active travel, improve building energy efficiency, some simple technical modifications to the most polluting vehicles and public information programmes.

Results: cost-effective, local measures to reduce air pollution

Actions promoting active travel

Encouraging frequent commuting by bike

The health benefits of cycling are well documented – for example, by the National Institute for Health and Clinical Excellence[9], but the direct financial benefits are often forgotten. A cyclist in London commuting up to 30 minutes each way by bike three days per week is estimated to save about £700 per annum in fare costs. Workplaces can help by promoting cycle-to-work tax incentive schemes and organising cycle 'taster' days in workplaces, while local councils can help by installing cycle-friendly road and parking infrastructure. It is estimated that in London the financial benefits of cycling outweigh the cost of the infrastructure required by more than 2-to-1[4], while the public health benefits outweigh the infrastructure costs by a factor of over 20-to-1[9]. Air pollution emissions in Central London could be reduced by 10% through a tripling of the current low levels of cycling[4].

Eliminating short taxi journeys

In many UK cities taxis are some of the most polluting vehicles on the road, but are widely used for short journeys during the working day. This practice can be eliminated by employers not refunding expenses for short taxi journeys that can be walked in 10–15 minutes. In trials in the City of London, firms saved as much as £3,000 per week while reducing demand for polluting taxis.

Encouraging car clubs

Most households joining car clubs get rid of one household car, reduce their car use and walk and cycle more[10,11], giving active travel benefits. Car club vehicles are newer and cleaner than average, giving an additional reduction in air pollution, and car club membership and hire are much cheaper than the annual cost of car ownership.

Zero and low emission procurement

In Central London 11 companies provide office services such as lunch deliveries, using zero emission methods such as walking, cycling and electric vehicles[12], and similar firms exist in most UK cities. A trial by the City of London Corporation of using only zero emission couriers and office suppliers has increased active travel, reduced local air pollution and local parking pressure[13], and all at no extra cost.

Improvements to building energy efficiency

Insulating homes, particularly of vulnerable households

Well-insulated homes reduce the cost of heating so people are more likely to heat their homes adequately with consequent public health benefits[14,15], particularly for those who are vulnerable. Indeed, Liddel[15] estimates that each pound spent on insulation for vulnerable households saves 42p for the NHS. Building insulation reduces gas heating demand and fuel waste, can pay for itself in months, and reduces heating pollution, which causes up to half the nitrogen oxides (NO*x*) emissions in urban centres[16]. As 80% of the UK's 3.5 million vulnerable households are living in fuel poverty[17], and about £0.5 billion per annum of grants are available to pay for insulation of their homes, there is significant scope through good insulation to improve public health, reduce costs for the vulnerable and reduce air pollution. Using Liddel's analysis this would result in savings to the NHS of about £200 million a year.

Cyclical replacement of boilers with ultra-low NOx models

Ultra-low NO*x* boilers are designed to emit up to 90% less NO*x* than other boilers, but are as efficient and cost no more than conventional boilers[18,19]. Suitable for commercial or domestic use, if installed every time an old boiler wears out they would reduce London NO*x* emissions by 600 tonnes a year, or about 2% of the total[16].

Technical modifications to the most polluting vehicles

Vertical exhausts on large diesel engine vehicles

Vertical exhausts (as opposed to horizontal, low level exhausts) can be retrofitted to heavy goods vehicles at low cost, reducing exposure to exhaust pollutants by 50–90% by preventing recirculation at ground level[20,21]. They are standard practice in the US, Australia and elsewhere, including on buses, and bus retrofitting has occurred in a number of locations[22]. However bus retrofit kits are not currently available in the UK.

Exhaust particle filters on older diesel taxis

Diesel taxis that pre-date 2005 have relatively high particulate emissions but still do high mileage. Their emissions can be reduced by about 99% using diesel particulate filters, at a cost of about £1,700 per vehicle (G van Aaken, HJS UK, personal communication).

Public engagement for behaviour change

San Francisco's 'Spare The Air' campaigns have succeeded in delivering behaviour changes during air pollution episodes – for example, reducing car use typically by 9%[4,23] over the 20 years that the programmes have been running. These encourage people to cycle, walk or take public transport to work instead of the car (with consequent active travel benefits), but also help public engagement in and understanding of the causes of local air pollution.

The results are summarised in the table, including BCR, cost, etc, which can be ordered according to the local priorities of the authority in question.

Conclusions

The measures described here can deliver significant local air quality improvements without recourse to national or international coordinated action and so can readily be delivered by local governments, in some cases very quickly. Public health officials – for example, directors of public health – can cite the evident benefits of these actions both for air pollution, public health and cost saving to encourage local transport and sustainability officers to deliver local improvements more quickly. The greatest impact can be expected from combining a selection of these actions to create a local strategic plan, involving key interested parties – local government, transport operators, energy companies, etc – to achieve multiple goals through a suite of individual and coordinated actions. Indeed exactly this approach is currently being developed in Leicester and other UK cities, to tackle their significant local air pollution and public health problems.

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Table: Cost-effective measures, with estimated timescale for impact, air pollutant reduction and cost saving. All figures given are approximate, based on the evidence available. BCR: benefits-costs ratio; tpa: tonnes per annum

Measure	Impact timescale from policy decision	Ratio of total benefits to total costs	Benefits (net present value in 2012)	NOx reduction (tpa)	PM_{10} reduction (tpa)	CO_2 reduction (tpa)	Noise improvement
Replacement of old boilers with ultra-low NOx devices	Years–decades	Infinite (as zero cost)	£1.8M	566.00	8.00	Not estimated	0
Business engagement (ongoing for six years)	Months	22.11	£4.6M	0.07	0.01	34.92	+1
Car clubs expansion programme	Months	13.58	£7.6M	28.53	1.40	26,915.65	+1
Cycle to work schemes expansion	Months	6.22	£4.6M	3.54	0.33	2,171.49	+1
Ecodriving training for taxi drivers	Months	5.75	£7.7M	4.14	0.36	2,023.22	+1
Zero emission vehicle last mile deliveries	Weeks–months	5.05	£4,046 per major customer	0.02	0.00	20.46	+3
Taxi rank idling wardens	Months–years	4.12	£0.5M	0.96	0.35	1,490.54	0
Cycle infrastructure and promotion using low cost cycle tracks	Years	2.49	£210M	249.48	18.59	150,685.92	+3
Euro V requirement for Central London buses and Euro IV engine reprogramming	Months	2.41	£2M	204.71	1.34	0	0
Fitting diesel particle filters on taxis	Months–years	2.01	£28M	0.00	15.28	0	0
Campaign days	Days	2	£2.5M	15.00	2.40	20,000.00	+1
Vertical exhausts at roof level on heavy goods vehicles	Months	2	£4M	1,596	15	0	0
Totals (unweighted average for BCR)		**6.16**	**£273M**	**2,668.45 tpa NOx**	**63.06 tpa PM_{10}**	**203,342.2 tpa CO_2**	**+1=some +2=significant +3=substantial**

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Cross-border Exposure Characterisation for Risk Assessment in Chemical Incidents

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Introduction

Chemical incidents do not respect national borders and can affect communities a significant distance from the incident site. An accurate and timely assessment of risks to human health is a cornerstone of an effective response strategy. The aims of the Cross-border Exposure Characterisation for Risk Assessment in Chemical Incidents (CERACI) project are to strengthen the public health risk assessment for the acute phase of a chemical incident by assessing the response to chemical incidents in European (EU) Member States, focusing in particular on the interoperability of exposure assessment guidelines, tools and practices.

CERACI has addressed the following questions:

- How have Member States organised exposure assessment for health risk assessment during acute chemical incidents?
- Which Member States have organised collaboration and interoperability on exposure assessment, nationally and across borders?
- Which good practices – technical or organisational – can be (further) developed?
- Will harmonisation and collaboration improve Member States' capabilities and capacities to respond to acute chemical incidents?

The partners in the project are the Netherlands National Institute for Public Health, and the Environment (RIVM), the Polish Nofer Institute of Occupational Medicine (NIOM) and the UK Health Protection Agency (HPA). Project collaborators included public health organisations in the Netherlands, an international advisory board and experts from across Europe who informed the information gathering and compilation of good practices at the workshops. CERACI is co-funded by the EU Civil Protection Financial Instrument.

Method

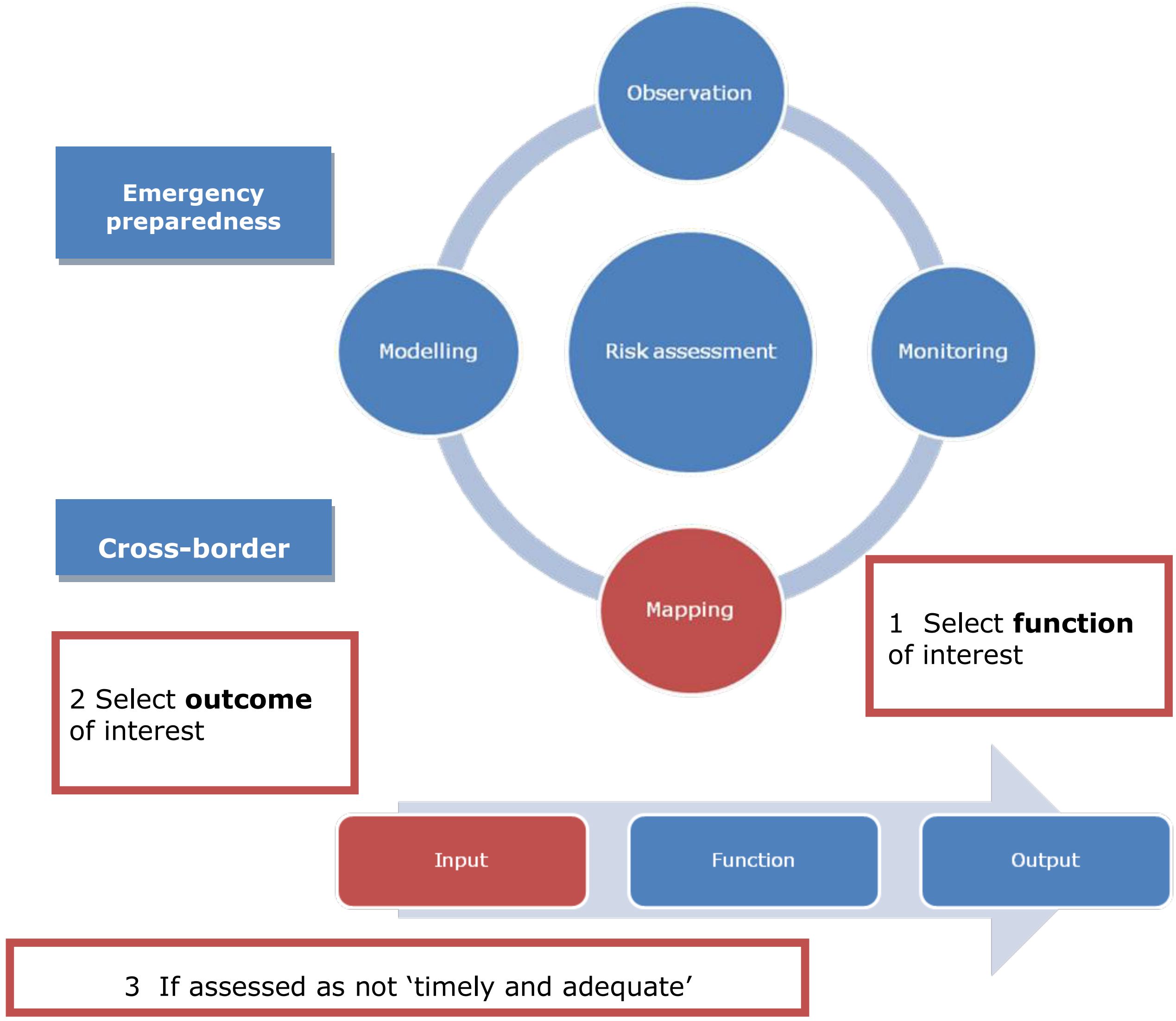
Through a literature and project review, the chemical incident response capacity, organisation and exposure assessment capability in EU Member States was investigated. More detailed information about individual Member States was gathered and analysed through a web-based survey and telephone interviews of individuals involved in exposure assessment during the acute phase of a chemical incident. The findings were tested by delegates at two international workshops. This paper discusses some of the findings of the project. Full project reports and references can be found on the project website: http://www.rivm.nl/ceraci.

Discussion

The project has confirmed a wide diversity in organisation, good practices and capability across Member States. A good practice in one Member State may be an unmet need in another; however, it is clear that there are potentially many means (good practices) by which a particular Member State may achieve the capability level required. Therefore the more generic term 'unmet need' is used by the CERACI project for evaluating the important criteria for each capability. Where criteria are not met, the good practices found by the CERACI project are noted as a means to achieve the capability. For example, a Member State which has an unmet need for adequate and timely dispersion modelling may achieve this capability by several means according to the sophistication (from visual observation upwards) required and organisational structures in place. The sophistication required is set by each individual Member State according to its needs and priorities.

The full project reports have compiled, categorised and verified good practices in exposure assessment across Member States. These have been developed into guidelines for exposure assessment organisation and practice, along with a self-assessment methodology to identify gaps in a Member State's capability. These are designed to be used by a risk assessor for their own country in the first instance, and then to be evaluated on a cross-border basis – for example, bilaterally or multilaterally across borders or regions. For an incident with cross-border impacts the coordination of communication, response, decision making and communication to the public offer great challenges. The project outputs offer a means of evaluating and targeting improvements in preparedness for cross-border incidents.

Through following the CERACI proposed methodology a risk assessor in one Member State or region would evaluate their own capability first and then look at the gaps introduced for a cross-border incident. For example, would the monitoring data be shared in a timely manner, would the rationale and nuances of the data gathering be understood, or would the use of different acute exposure reference value systems on both sides of the border cause disagreement in messages to the public, etc? The evaluation should then be completed by risk assessors on both sides of the border and unmet needs identified. Some unmet needs may be accepted, while others may be met by bespoke or CERACI identified good practices. The evaluation should be tested by means of suitable exercises with cross-border participation/injects. The figure shows how an evaluation tool might guide assessors using CERACI identified needs and good practices through each risk assessment function and associated good practices.



Mapping input good practices	Practice used?	Resolved issue?
Mappers use central sources of data (e.g. Czech central data warehouse)	Yes / No	Yes / No
Mappers have access to multiple receptor layers (e.g. land use, population size, population type and vulnerable zones)	Yes / No	Yes / No
Data layers are shared between responding organisations	Yes / No	Yes / No
To assess generic emergency preparedness good practices: http://www.rivm.nl/en/RIVM/What_RIVM_does/International_activities/International_projects/CERACI To assess generic emergency response good practices: http://www.rivm.nl/en/RIVM/What_RIVM_does/International_activities/International_projects/CERACI		

Figure: Example of one step of CERACI self-assessment methodology

Even where capabilities exist on both sides of a border and responders understand the requirement to share information and cooperate, it can be worthwhile for Member States or individual agencies to formally agree and document mutual support and alerting by means of treaties, conventions or memorandums of understanding. This can be particularly relevant where capability is provided very differently across borders, e.g. military versus commercial, or where there are political difficulties or a culture not to alert until a Member State is absolutely sure of cross-border impacts. The CERACI project has identified examples of treaties and agreements for collaboration, cross-border working and mutual aid good practices.

The key good practices in emergency preparedness were identified as:

- Interagency training and exercises across borders
- Shared preparedness materials and response plans, having agreed approaches before incidents occur
- Focal points and defined points of contact
- Bilateral or multilateral agreements, underpinned by detailed local and regional arrangements
- Harmonised procedures and resources to facilitate collaboration
- Agreed consistent approaches for risk management and communication
- Debriefing after incidents and sharing of databases and information.

The project has identified international and regional examples of collaboration which improve Member State capabilities and capacities to respond to acute chemical incidents. Although differences in response structures and, for example, the use of differing acute exposure reference value systems exist, collaboration increases cross-border learning and adoption of good practices, while minimising conflicting communication and misunderstanding. The CERACI project identified that existing alerting requirements and the availability of mutual aid – for example, requirements for action under national agreement to WHO International Health Regulations (IHR)[1], EU Civil Protection[2] Mechanism Monitoring and Information Centre (MIC)[3] or the United Nations Economic Committee for Europe (UNECE) Convention on the transboundary effects of industrial accidents[4] – were not recognised at all risk assessor levels.

It is important that a holistic approach to emergency preparedness for chemical incidents is adopted. Preparedness plans should consider impacts outside the Member State country or region and, where necessary, include alerting and response information developed in consultation with emergency planners in each neighbouring Member State. This concept should include plans made under the requirements of the Seveso Directive and other major industry emergency preparedness plans, using a worst case rather than foreseeable incident approach when deciding on the inclusion of alerting and response information from other regions/Member States.

CERACI's work is directly relevant to international, national and local chemical incident emergency preparedness. CERACI's priority recommendations are:

- Develop and implement national and local programmes to improve emergency preparedness and response, using self-assessment to prioritise and target work
- Use and develop legal and institutional frameworks that help Member States and responders deal with threats to public health from chemical incidents
- Adopt a common multidisciplinary, multisectorial European and national approach to preparedness and response for chemical incidents
- Establish/maintain a multidisciplinary, multisectorial European forum of exposure and risk assessors, linking to national forums and networks of experts
- Develop, propagate and coordinate self-assessment using the methodology developed by CERACI
- Support and implement shared harmonisation and cross-border initiatives, training, exercises and research
- Facilitate the exchange of good practices and lessons learnt from cross-border chemical incidents and joint training and exercises
- Collate and signpost relevant international and Member State resources, guidance and training materials.

Conclusions

The CERACI project has summarised response structures across Member States for health risk assessment during acute chemical incidents. The project has compiled, categorised and verified good practices in exposure assessment across Member States. These have been developed into guidelines for exposure assessment, organisation and practice along with a self-assessment methodology to identify gaps in capability. The compilation of this and other CERACI outputs minimises duplication of efforts by Member States, allows for the comprehensive assessment, and sharing, of solutions to unmet needs and enhances understanding of cross-border differences and issues for acute chemical incident responses.

The project outputs may be equally applied to a single region or Europe wide. The self-assessment outputs could be developed into a software tool or website which would continue to share and gather good practices between users.

The project highlights the need for further research. A network of experts and national focal points to champion cross-border good practices, and to facilitate collaboration and harmonisation, would raise awareness and inform policy making.

Acknowledgements

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Extreme Events and Climate Change

The European heat wave 2006 – a case study

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Background

In July 2006 Europe experienced a heat wave[1], during which the highest recorded temperature in the UK of 36.5 C was recorded at Wisley[2], Surrey – the month was the warmest on record, and a number of regional weather records were broken.

Heat can have severe health implications, in the 2003 European heat wave there were many fatalities attributed to excessive heat[3], 14,800 in France, approximately 2,000 in Portugal, 1,500 in the Netherlands, 140 in Spain, 300 in Germany and approximately 2,000 in the UK. The elderly are particularly affected, although very young children, those who are chronically sick or overweight, or taking certain prescription medicines that affect the body's ability to dissipate heat, are also vulnerable. It is believed that as the impacts of climate change increase, the incidence of heat waves will also increase. This case study outlines some of the factors that will adversely affect living conditions during a heat wave, to help illustrate the role that housing plays in health protection.

The dwelling

The house was built in the 1960s, located in suburbia, on the western edge of London, and would be affected by the urban heat island effect. The house is semi-detached, with unshaded south and west facing elevations, and cavity walls.

The house had optimal insulation – cavity wall insulation, 270 mm of loft insulation and draft proofing – installed free of charge under a 'HeatStreets[4]' scheme, an initiative to reduce carbon emissions – and fuel poverty.

Being of 1960s construction, the inner leaf of the cavity wall and the internal partitions are likely to be of brick construction, rather than lightweight insulating concrete blocks that would be used in more modern construction. This dense brick would have significant thermal mass, absorbing heat during the day – this would give a buffering effect, the room would take longer to warm up, but take longer to cool down in the evening[5].

The original, timber, side-hung casement windows were installed; however, they had been augmented with a system of sliding double-glazed units at some time in the past. There had been burglaries and so supplementary security devices, including key-operated window locks, had been installed.

The event

The occupier was in her late 80s, lived alone, and had limited mobility, though not registered as disabled. Reaching the windows to open them would have been difficult for her, and she lacked the dexterity to unlock

the windows, so opening them to increase ventilation would have been almost impossible. At about 8 pm, one evening during the heat wave, she phoned her neighbours to request assistance – the first and only time that she did this. She reported having trouble with a dressing on one of her legs and, when visited, her legs were noticeably swollen – it was later thought that she might have been suffering oedema, brought on by the high temperature.

On arriving at her home, it was realised that the house was still extremely – uncomfortably – warm. Unfortunately no data on indoor temperature was gathered at the time, so precise information is not available. However, the indoor temperature was considerably in excess of the outdoor air temperature, as there had been high solar gain during the daytime through the south and west facing windows, and this heat had been stored in the building's thermal mass. The very good thermal insulation of the building, coupled with the absence of ventilation (the windows were all tight shut and had been all day), prevented the stored heat from being lost.

Assistance – increasing ventilation, giving cooling drinks and the loan of an electric fan – was provided and then she recovered. The neighbours were not medically qualified and, with hindsight, it might have been appropriate to contact, for instance, NHS Direct for advice, or perhaps even the ambulance service.

Legal considerations

The first legislation controlling the quality of dwellings was the Public Health Act 1875. More specifically, there has been legislation regarding a dwelling being 'fit for human habitation' under the various housing acts dating back to the 1930s. The factors that were taken into account when considering fitness were defined, and ventilation was specifically mentioned (as were stability, disrepair, dampness, water supply, heating, lighting, sanitary accommodation, food preparation facilities and drainage), and Part F of the Building Regulations requires ventilation. But until the Housing Act 2004 became operational, there was no provision that related to the way in which the building protects the occupiers against excessive heat. The Housing Act 2004 introduced the 'Housing Health and Safety Rating System'[6] (the HHSRS), which includes 'Excess Heat' amongst 29 hazards that can be considered and enables improvements to be required in some cases.

The HHSRS requires assessment to be undertaken where a hazard exists, or is likely to exist within a 12-month period, and where a dwelling is recognised as being 'worse than average' with regard to that hazard. Assessment under the 'excess heat' category would not often be undertaken on inspection, as there is likely not to be an incident within any 12-month period, and the 'average' is not well defined – this house would almost certainly be seen as 'average'.

Although the assessment factors in 'vulnerable groups' – in the guidance for the 'excess heat' hazard, this is defined as 'the most vulnerable age group is all persons aged 65 years or over' – no allowance is made for the special needs of any specific occupier – and disability is specifically excluded. Before the HHSRS, nuisance legislation within the public health and environmental protection acts were used to consider these types of hazards, where case law set precedents that nuisance was assessed in respect of an average citizen rather than someone with exceptional needs. Thereby the exclusion of disability is directed in the operating guidance.

The 'excess heat' hazard is not well understood, nor is there much experience in dealing with it – the HHSRS operating guidance states 'data to allow quantifiable attribution to dwelling condition is weak', 'there is a weak evidence base' and accepts it is based on assumptions and expectations. Apocryphally, in a 35-year career in environmental health, in five local authorities, the author can only recall a handful of cases where complaints of 'too hot' were made, and typically these were where units of accommodation were adjacent to boiler plant rooms in housing developments with a communal heating scheme. There seems to be little expectation that a dwelling will protect against excessive heat in the event of a heat wave.

Conclusions

On first sight it would not appear that this particular property would have been any different from any of the neighbouring properties – and in many ways it was not – however, factors combined to lead to a potentially hazardous situation for the occupier, including:

- The difficulty in opening the windows, a consequence of the occupier's limited mobility, coupled with the presence of secondary glazing that obstructed access to casements, and the presence of security locks
- The very high standard of insulation, to both the walls and roof, and the presence of double glazing, all of which prevented heat from being lost
- The method of construction with internal walls and the inner leaf of the cavity wall being from dense brick with a high thermal mass
- The occupier lived alone and independently – there was no one there to help – opening windows or putting fans on
- The absence of air conditioning.

For the majority of the time, excess heat is not a hazard; however, during heat waves it can be devastating – as seen in France in 2003. A person's home is their refuge and protection against the elements – cold, wind, rain and, during heat waves, from heat. With climate change there is likely to be an increasing need for housing to provide effective protection from more extreme weather patterns.

Other actions that may help to reduce the incidence of harm include:

- Early alerting under the Heatwave Plan for England[7] where it is now established practice to issue extreme weather warnings in connection with heat waves
- Media campaigns can explain appropriate actions to take
- The use of NHS Direct to provide clinical advice
- Awareness raising for health care professionals when a heat wave is more likely and how this will alter health risks
- Support for vulnerable people by friends, relatives or the community care organisations to help them weather the heat. In France, for example, the most vulnerable, who tend to be in full-time care, were less affected than those less vulnerable so living independently, for whom support was not so readily available.

In the UK, dwellings have not been designed with heat waves in mind, and modifications that are typically made to them (to improve thermal efficiency and security) may reduce their performance in the event of a heat wave. Some adaptations to improve performance in a heat wave are possible, e.g. in continental Europe, external shutters and blinds shade windows and doors. Other measures, such as air conditioning, light, reflective finishes on external walls and training vegetation up walls so as to give a shadowing effect might have some benefit, but may not be seen as necessary or cost effective in view of the infrequency with which such events happen in the UK. With climate change this might need to be reviewed.

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Sun, sea and rain: wet and warm summers in the UK and increased flooding risk

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Why a warmer Atlantic means wetter summers in the UK

The global scientific consensus is that climate change is unequivocal and that human activity has warmed the planet since 1750. Climate is influenced by many factors at differing geographical and temporal scales. There are subtle effects on the Earth's climate that are modulated in the short term by 'pulses', which either accelerate or slow down warming effects. Oscillations in the climate systems are varied, both in magnitude and frequency. A well-known oscillation is the El Niño Southern Oscillation (ENSO), which occurs in the tropical Pacific, although its effect can be felt in many parts of the world. An oscillation closer to home is the Atlantic Multidecadal Oscillation (AMO), which describes changes in the sea surface temperature of the Atlantic Ocean. It was first identified in 1994 by Schlesinger[1]. The AMO results in a difference of about ±0.5 C in sea surface temperature from the long-term average. The duration between peaks and troughs is from 20 to 40 years, taking several decades (65–70 years) to complete a cycle[2]. Regionally, decadal climate variability can be as large as, or even larger than, global climate change predicted between now and 2030. Figure 1 shows the variation in sea surface temperature of the Atlantic since the 1800s, currently in a positive (warm) AMO phase.

Recent research by Sutton and Dong[4] has identified a link between the positive phase of AMO and increased summer rainfall over Northern Europe, similar to that experienced in the UK during 2012. The exact mechanism by which the temperature of the sea surface affects weather systems is still to be discovered, but it is thought that changes in pressure influence the path of the jet stream. Regions to the north of the jet stream, as Britain was for much of the summer of 2012, tend to receive more rain storms.

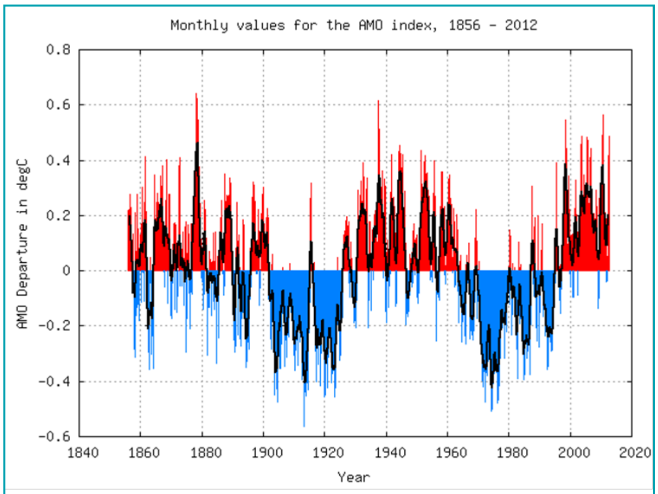

Figure 1: AMO time series with a 12-month moving average (black), 1856–2012 (original data from NOAA[3])

Three periods of the AMO cycle were compared: a positive phase from 1931–60; a negative phase (cool period) from 1961–90 and the most recent positive phase starting in 1990 and continuing to the present day. Sutton and Dong noted that conditions in the last positive phase in the Atlantic are broadly similar to those observed in the current period. The study compared weather conditions in Europe during the two positive Atlantic phases with those experienced in the negative phase. Sutton and Dong concluded that a warmer-than-usual Atlantic "favours a mild spring (especially April), summer and autumn, in England and across Europe". Another finding, of greater relevance to the search for a cause of rainy summers, is that a warmer ocean tends to result in a wetter northern and central Europe. By contrast, southern Europe, from Portugal to Turkey, receives far less rain than normal. This pattern was observed during the summer of 2012. Figure 2 shows the changes to summer rainfall over Europe during the positive AMO phase, when the North Atlantic is warm. The marked divide between a wetter northern Europe (blue) and a drier southern Europe (red and orange) is clearly visible. Further afield, the AMO affects other weather phenomena. For example, during the positive phase, twice as many major hurricanes form in the Atlantic basin[5].

While the latest UK climate projections (UKCP09[6]) suggest that in the long term the majority of the UK will see drier and warmer summers, in the short term the positive phase of the AMO may result in milder, wetter summers. We are not yet capable of predicting exactly when the AMO will switch. Computer models are far from being able to do this; however, it is possible at present to calculate the probability

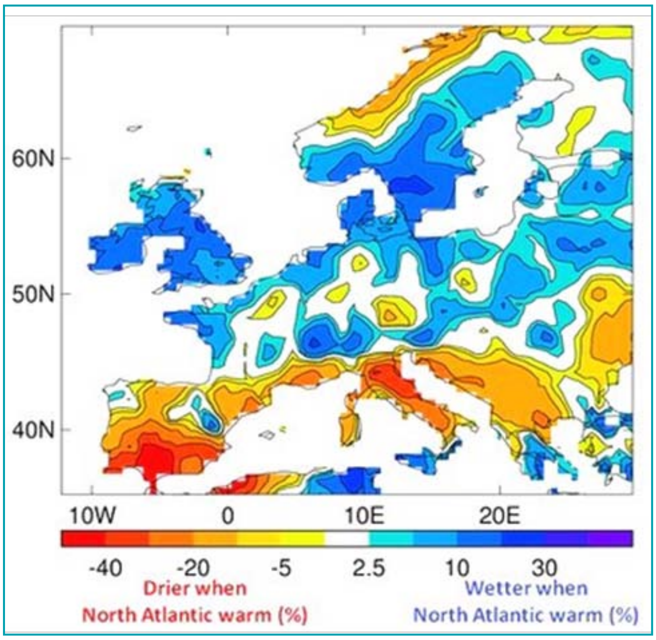

Figure 2: Changes to summer rainfall over Europe when the North Atlantic is warm (from Sutton and Dong, with permission)

that a change in the AMO will occur within a given future time frame. Probabilistic projections of this kind may prove to be useful for long-term planning in climate-sensitive applications, such as water management. Wetter summers increase the risk of flooding and so while the AMO is in a positive phase it is imperative that emergency services and members of the public remain prepared to respond effectively.

Public health implications

The consequences of flooding can be severe and wide ranging in relation to public health. The positive phase of the AMO has been shown to increase rainfall during the summer, which can result in increased flooding, and can result in flooding in areas not usually considered to be at risk. Sensitive locations to flooding, that might release a chemical hazard[7], include large industrial sites, such as Control of Major Accident Hazards (COMAH) installations and land which has historic contamination. Flooding can also hamper the emergency response to acute chemical incidents. After the floodwaters recede there can be concerns about hazardous residues during clean-up operations, and there have been tragic cases where inappropriate use of portable generators has resulted in carbon monoxide poisoning.

In addition to direct impacts within flooded areas, the presence of sensitive receptors such as schools and hospitals, and the impact of flooding on densely populated areas and on transport routes, power and water supplies, can create wider health challenges. Examples include issues associated with the evacuation of vulnerable groups such as the elderly, lack of clean drinking water supplies and power loss. Unusual cases can also occur – for example, the Health Protection Agency was contacted by the National Blood Service for advice after a serious flooding incident affected its blood bank in Summer 2012. There was an urgent requirement for clean up of flood-damaged areas so blood supplies would be available. Tailored advice, much of which was extracted from the HPA flooding webpage[8] and the UK Recovery Handbook[9], was provided. This was based upon the specific context of the situation to inform a local risk assessment which assisted with cleaning up the site.

The Health Effects of Climate Change in the UK 2012 highlights the impact of flooding on public health, identifying vulnerable regions, groups and the potential impact on mental health[10]. Cross-government working is required to effectively manage many natural hazards, of which flooding is one example, which is why the Natural Hazards Partnership has been created to improve emergency preparedness and response[11].

Conclusions

Climate variability, caused by oscillations in the Earth's climate system, can enhance or diminish climate change trends over timescales of months to decades. The recently established link between the warm Atlantic Ocean state, positive AMO, and wetter north-European summers will last until the AMO transitions into a negative phase, which could be a decade or more away. The precise timing of the switch is currently difficult to predict. We should therefore expect further wet summers in the UK, and be prepared for the associated increased risk of flooding and public health impacts, over the short to medium term.

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Conferences and Workshop Updates

Cold Weather Plan for England: seminar 2012

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Background

In his 2009 annual report, the former Chief Medical Officer Liam Donaldson highlighted the public health issue of excess seasonal mortality[1]. Each year in the UK there are around 25,000 excess winter deaths, with colder countries such as Finland having around half this figure[2]. The CMO called for a national Cold Weather Plan (CWP) to be developed to address this important public health issue.

The Cold Weather Plan for England was developed by the Department of Health (DH), Health Protection Agency (HPA) and the Met Office and was first published in November 2011[3]. The Plan aims to reduce avoidable winter mortality and morbidity and, by doing so, alleviate pressures on the health and social care system. It does this through a system of Met Office generated alerts with associated actions for those in contact with vulnerable groups. The associated Warm Homes Healthy People (WHHP) fund was created with the aim of aiding local authorities to help protect vulnerable people against the adverse health effects of cold weather and thus help to achieve the aims and objectives of the Cold Weather Plan. In total, 157 projects across 135 local authorities were successful in bidding for a share of this £20 million fund and a range of innovative projects was carried out over Winter 2011/12.

As part of an HPA-led evaluation of the Plan, a one-day seminar was organised with 150 delegates from a variety of backgrounds (see the figure). The day comprised a number of presentations and discussion sessions. Four stalls showcasing local level projects were organised to offer the opportunity to share advice, practice and ideas. We were also pleased to welcome the former Secretary of State for Health, Andrew Lansley, to deliver the closing speech of the seminar on the work achieved.

Aims

The overall aim of the seminar was to gather feedback from a wide range of stakeholders who have implemented the Plan over the last year. The objective of the morning session was to review the Plan and garner commentary on how it could be improved so that it maximises its potential to reach frontline personnel and have a positive impact on those vulnerable to the effects of cold weather. The afternoon session was dedicated to the Warm Homes Healthy People fund and the sharing of information, ideas and best practice between local authorities.

Methods

The various presentations, workshops and discussion sessions gathered feedback from those who had used the Plan during its first year of implementation. The morning session began with a series of presentations from the DH, Met Office and HPA on the first year of the Plan, a summary of the weather and the evaluation. This was followed by a presentation by the North West Strategic Health Authority on its experience of using the Plan.

Topics for the breakout workshops were developed from the themes arising from the online survey which was conducted as part of the evaluation prior to the seminar[4]. All discussions within the groups and during the plenary sessions were documented, analysed and developed into action based recommendations on how best to revise the Plan ahead of its re-launch for Winter 2012/13.

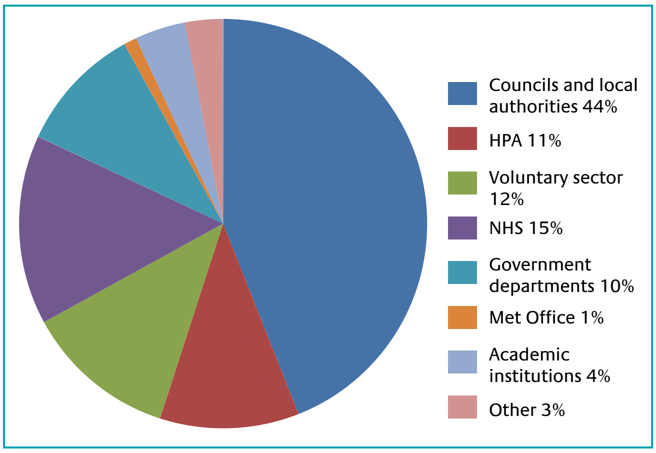

Figure: Breakdown of seminar delegates by type of organisation (rounded)[4]

Results

Overall, the Cold Weather Plan and the Warm Homes Healthy People fund were warmly welcomed by all in attendance and thought to be useful and beneficial additions to existing winter weather preparedness tools. Recommendations included how to improve the content of the Plan, how to improve its implementation to frontline staff, what could be done to enhance communication of cold weather messages and which WHHP fund projects worked particularly well.

Examples of some specific recommendations are summarised below:

- Data sharing – actively engage with existing information sharing platforms that will support ongoing information exchange so that local areas can learn about what worked well and what did not
- Partnership working – the Plan should be embedded in the Joint Strategic Needs Assessments of each local authority and should also engage GPs and Clinical Commissioning Groups (CCGs). Including boxes of 'good practice' would help local areas to see what has been done to overcome barriers to implementation
- Early publication of the Plan – the earlier the Plan can be published, the better. This would allow local areas to plan more effectively

- Evaluation – Evaluation of the Plan is very important and also incredibly challenging. However, DH should aim for an output evaluation to establish if the Plan has had any impact on winter-related morbidity and mortality
- Primary care engagement – to actively engage with the National Institute for Health and Clinical Excellence (NICE) to encourage the development of cold-weather-related guidance within its public health work programme.

A full report detailing the results of the seminar has been written and was presented to DH which includes the recommendations made by delegates[4].

Conclusions

The day was well attended and there was a great deal of enthusiasm for the Cold Weather Plan and suggestions on how it could be improved so it could be better implemented by frontline staff. Mr Lansley praised the work of those who had developed projects aimed at protecting vulnerable groups from cold weather and highlighted the importance of the actions, aims and recommendations of the Cold Weather Plan for England.

The Cold Weather Plan for England 2012 was re-launched on 26 October 2012 following this workshop and the evaluation undertaken by the HPA Extreme Events and Health Protection team[1,4].

Acknowledgements

On behalf of the HPA and the DH, we would like to thank all those who attended the seminar, presented their work and offered their feedback on the current Cold Weather Plan and Warm Homes Healthy People fund. Thanks also to all those who ran stalls and facilitated and co-facilitated the individual breakout sessions on the day. In particular, we would also like to thank the HPA Events Team and Joanne Gritton (HPA), Claire Williams (DH) and Dee Garnett (DH).

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Evaluation Design for Complex Interventions – Barcelona, November 2012: course summary

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Introduction

Each year, the Johns Hopkins Bloomberg School of Public Health (Department of Health Policy and Management), Baltimore, organises a week-long 'Fall Institute in Health Policy and Management' alongside the Agencia de Salut Publica de Barcelona (the Public Health Agency of Barcelona) with the collaboration of the Universitat Pompeu Fabra. The week consists of a number of seminars which comprise intensive courses lasting between two and five days on a range of public health topics for postgraduate students, academics and public health professionals. One of the courses offered and summarised here is entitled 'Evaluation Design for Complex Interventions'[1].

This course is of particular interest to the work of the Extreme Events and Health Protection Section (EEHPS) of the Health Protection Agency because of its focus on the Cold Weather and Heatwave Plans for England[2,3]. These are both public health plans on which EEHPS is working closely with the Department of Health and Met Office to develop and evaluate. Both these plans use a Met Office generated alert system to advise the public and professionals of periods of extreme cold or heat. The plans outline a number of actions and recommendations based on these alerts that individuals, communities and professionals can take to protect people from extremes of temperature, the aim of the plans being to reduce avoidable morbidity and mortality from the impact of extreme heat and cold. Alongside annual stakeholder seminars to gain frontline feedback on the plans, EEHPS recently published a process evaluation on the Cold Weather Plan for England[4]. Given the complexities surrounding the plans and the challenges in assessing their effectiveness, this course offered the opportunity to explore additional ways in which EEHPS could undertake future evaluations.

An extensive pre-course reading list was provided on the evaluation of complex public health interventions including papers on learning from evidence in a complex world and on the necessary steps to take to improve evaluation of public health policies and programmes. The course leaders began by explaining that evaluation of public health policies and programmes is intended to assess and improve existing performance, and to identify new ways to deliver programmes alongside policy makers. The course then proceeded, through interactive teaching sessions and group work, to explore the barriers, challenges, points for consideration and deadly sins of conducting evaluations. A series of highlights from the course is summarised in the tables below. However, the tables do not attempt to fully show the extensive nature of topics discussed throughout the course.

Key learning points on planning evaluation of public health policies and programmes

Some of the key learning points to consider prior to embarking on an evaluation are summarised in Table 1.

Internal and external validity

Internal validity refers to the consideration of factors that could offer an alternative explanation for the change (positive or negative) in the outcomes measured as part of the evaluation. Points to consider are summarised in Table 2. External validity is concerned with the ability to generalise the results. Some examples of external validity are summarised in Table 3.

Table 1: Key points to consider before embarking on an evaluation

Has someone done it before?	Evaluations have been undertaken on a wide range of policies and programmes that may fall outside your sector of work. Think about how you may transfer the methodology of these studies to your own evaluation. For instance, an evaluation of education may have important methods that could be used in the health setting. Don't reinvent the wheel!
You're not solely a critic	Although critical analysis is important, the aim of evaluation is to work with policy makers, and those who implement the programme, to improve it
How will findings be best used?	A bad habit often seen is of organisations conducting evaluations because they have to. This can result in the evaluation outcome being documented but not acted upon
External influences	You need to consider the external influences that may affect the outcomes of your policy or programme. Consider those of a historical context and/or cultural nature during the evaluation when reflecting on a programme, and the community it is intended to impact on
Be specific	Look at key questions when developing an evaluation. An evaluation that tries to look at everything will usually answer nothing
Don't overcomplicate	When considering the evaluation ask yourself how you would explain the intentions and programme theory (how the programme's actions or interventions are intended to achieve the measured outcomes) to a lay person in simple, everyday language
Length of time for a result	Consider how long will it take for the programme to bring about an impact (some intervention programmes take many years before a change in the outcomes is measured). There are many trajectories of change so the shape of the timeline is important. An evaluation too early may not see an impact (or may even see a negative impact). Later, however, the effect may be seen. Think about the likely time to achieve an impact in relation to the context of the community and the programme itself, as programmes evolve over time and are influenced by people

Table 2: Considering internal validity

Factor	Explanation
Temporal ambiguity	Did the outcome begin to change ***before*** the initiation of the programme?
Selection	Did people self select themselves for the programme? What is the risk of bias?
History	Did something major happen to influence shifts in behaviour that was nothing to do with the programme (e.g. civil war)?
Maturation	Change will happen naturally irrespective of policies and programmes, due to natural growth. It should be demonstrated that the results of a programme are beyond what would normally be expected
Regression to the mean	The outcomes may improve due to the extremely poor situation at the beginning of the programme. Therefore the intervention is not driving the change
Attrition	A change in the treatment or control group due to people dropping out and being lost to follow up
Instruments	Difficulty and timing of tests and using inaccurate instruments
Testing	If you do the same test and repeat it with subject groups then this will probably lead to some improvement as they have seen the test before

Table 3: Considering external validity

Interaction of causal relationship with	Example
Units	Interventions on white males being generalised to other populations – cultural context or specific area
Treatment variation	A reduction in class size might improve educational achievement if it is accompanied with substantial funding to build new classrooms and hire skilled teachers, i.e. other influencing factors are happening simultaneously
Outcomes	Programmes and their associated interventions might have a different impact on quality of life and on survival times – multiple outcome measures are important
Settings	A programme may work in rural areas but not in urban areas

Ways to find solutions to external validity

- Compare and contrast results found from other similar evaluations on the same topic
- Apply the policy or programme in multiple populations/settings/contexts
- Be explicit about what the programme aims to achieve
- Collect data on multiple outcomes
- Collect process/context information as the context will often be dynamic and changing.

It is almost impossible to eliminate all threats to external validity but they must be considered during the evaluation process.

Design

The 'seven deadly sins' of evaluation reminded participants what to consider when designing an evaluation[1,5].

1. **Not evaluating** – don't keep a programme going without evaluating it; a non-effective programme will be a waste of resources. There may be a negative impact that needs to be known about
2. **Starting evaluation late** – it is important that baseline measurements have been collected from before the programme's initiation (otherwise, how will you know if it has made an impact?). What happened before and what are your bases of comparison?
3. **Evaluate results without evaluating the process** – programme coverage and quality are key to interpreting evaluation of results. Did the intervention(s) contained within the programme get implemented as intended?
4. **Using inadequate methodology** – evaluation design must be suitable for the objective, using carefully selected indicators
5. **Not involving stakeholders** – include those involved in plan development and those responsible for making policy decisions
6. **Ignoring context** – programmes may work in one place or situation and not in another
7. **Not evaluating inequalities** – what is the effect of the intervention(s) contained in a programme in different social groups? Does the programme reach those it is intended to?

Conclusions

As public health in England moves into local authorities and Public Health England (PHE) takes shape there will be an ever-present requirement to show value for money and positive gains to health from new and existing policies and programmes and their associated interventions. The importance of evaluation and subsequent enhancement of existing public health programmes is therefore essential. Not only is there a need to show what works in practice but also what is not working and what can be done to improve it.

This course covered a wide range of learning points that public health professionals should be aware of prior to embarking on evaluations of complex public health programmes. Only a brief summary of the seminars and discussions have been covered in this paper due to the wide scope and depth of the topics discussed. This course, and others taught during the Fall Institute, would be of value to those within the HPA and PHE whose work depends on conducting rigorous evaluations of complex public health programmes and their associated interventions.

Links for further information

Course brochure with details. Available at http://www.jhsph.edu/departments/health-policy-and-management/institutes/fall-institute/_pdf/Fall_Institute_Brochure_2012.pdf

The Ninth Annual Johns Hopkins Fall Institute in Health Policy and Management November 12–30, 2012. Available at http://www.jhsph.edu/departments/health-policy-and-management/institutes/fall-institute/

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HPA Updates

Risk assessments: preparation for the London 2012 Olympic and Paralympic Games

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Introduction

Planning and preparing for every eventuality is not always possible, and not usually appropriate given the impossibility of predicting the future. However, during the preparation for the London 2012 Olympic and Paralympic Games (the Games), environmental public health scientists in the HPA developed a coordinated approach to planning and preparedness, utilising the expert skills of both disciplines to provide a flexible, robust and resilient chemical incident response service.

In this article the public health risk assessments carried out prior to the Games and the subsequent preparation are described. The importance of working with stakeholders and agreeing prepared information is highlighted.

Risk assessments and planning for the Games

In the run up to the Games, two main risks were identified:

- Air quality during the Games time
- Emergency preparedness in terms of acute incident response.

Air quality

In the lead up to, and during, the Games, the HPA produced a daily public health report (situation report) for the Olympic Games Chief Medical Officer (CMO) and other key partners. This included information on public health threats, incidents and patterns of disease that might impact upon Games training grounds and venues across the UK, and any significant international emergency of public health significance. Assurance was provided that the appropriate public health response was being undertaken to protect all those taking part in and visiting the Games.

Prior to the Games, concerns were raised by a number of media reports that air quality in London was not meeting European Union targets and should this pattern continue up to and including the Games, there would be adverse effects on athletes' health and performance, as well as potential impacts on residents and visitors to London. Air quality has improved significantly in London over the last decade, but in common with many UK and European cities, additional steps are required to continue this trend and it is predicted that all of London will comply with most EU pollution targets in 2012.

The HPA established a multiagency air quality coordination group which aimed to contribute to a safe and healthy Games by ensuring that concerns relating to air quality and its impacts on health were identified and adequately addressed or effectively managed.

As part of this process a risk register was developed to identify the key risks to air quality during the Games and to ensure that adequate controls and measures were in place to predict and respond to such threats.

The overall aim was to ensure that information and guidance on air quality was available within the main public health briefings and that the same information was available to all the relevant government departments.

Specific prepared information was compiled by the air quality coordination group. This information included agreed lines on:

- General information if air quality reaches very high bands of air pollution, including:
  - ◊ if ozone is elevated
  - ◊ different weather conditions – i.e. heavy rain, wind, dry hot weather and effects on ozone etc
- Different incident scenarios, including:
  - ◊ elevated particulate matter (PM_{10} and $PM_{2.5}$)
  - ◊ air quality monitoring during incidents
  - ◊ information for fires
  - ◊ information for volcanic events.

Emergency preparedness in terms of acute incident response

Prior to the Games, the HPA Centre for Radiation, Chemical and Environmental Hazards (CRCE) identified that due to the number of venues around the country and the large attendance expected at the venues, the implications of an incident at any of these sites had the potential to impact upon a large population including those attending, athletes and the surrounding communities, as well as generating interest from the world's media.

A risk assessment was carried out on each of the 32 venues to be used for the Games. Some of these risk assessments included the additional risk of chemicals being brought to the venue by each of the countries competing. A prime example of this was in Weymouth and Portland Harbour, Dorset, where chemicals for boat maintenance were brought in by each competing country and stored in designated areas.

CRCE maintains an out-of-hours system with chemical specialists available 24 hours a day to assist with the response to chemical and environmental incidents. This is a national on-call service, so out-of-hours staff may be based anywhere in the country. During the Games it was imperative that all chemical on-call staff (regardless of location) had access to as much information as possible about each venue, to assist with any incident response if required. Olympic initial reference sheets (IRS) were completed for each of the 32 locations identified on the risk register.

Table: Contents of Games initial reference sheets and the importance of the information for CRCE chemical staff out of hours

Contents	Relevance to CRCE on-call staff
Address of venue with postcode	Ability to locate venue quickly on HPA GIS or other mapping systems
Event description and dates of when venue is in use	Sporting discipline, special requirements, and when events being held at venue
Capacity of venue	Approximate number of spectators
Nominating receiving hospital and backup	In event of a mass causality event, CRCE assists with mass decontamination advice
Nearby receptors	Quick description with links to maps (see Figures 1 and 2)
Where appropriate: chemicals stored on site and amounts	Summary chemical and toxicology information for quick reference in an incident
Local command and control structure on site and key contacts	Vital in an emergency to be able to establish quick, timely and robust communications

Figure 1: Storage area for chemicals at Weymouth and Portland Harbour
(Note: more detailed maps of the storage area were also available but are not shown here)

The table outlines the contents of each sheet and also shows the information relevant for on-call staff who may not have had any previous knowledge of the location or surrounding communities.

A number of key maps for each location were also generated, using the HPA GIS system. These could provide CRCE staff vital quick visual aids which can be use to assist in early emergency response. See Figures 1 and 2 for examples.

Discussion

During the Games, there were three episodes where air quality in the South East of England was poor with ozone levels moderate to high, due to the warm and sunny weather. The prepared information sources and agreed key messages enabled the HPA to inform the Olympic Games CMO and the London Organising Committee of the Olympic and Paralympic Games (LOCOG) in a timely and consistent manner, as well as assist with additional questions that the episodes generated.

There was one major incident during the Games that had the potential to affect spectators leaving the venue and athletes, as well as the health of the local community (see page 7). Fortunately the incident did not escalate but the use of the Games IRS enabled on-call chemical staff to have all information about the location, the local population and other chemical facilities in the area, already prepared. This assisted in the HPA response, by allowing the setting up of timely communications, and rapid provision of background information.

An improved understanding of the complexities of public health and working relationships across the health community will be one of the significant legacies of the 2012 Games. The multiagency air quality group established prior to the Games included representatives from many different backgrounds, and the emergency preparation work included liaison with not only those in public health but also others involved with emergency preparedness and response. The Games have helped to raise the profile and understanding of public health across government departments through multiagency preparedness and planning.

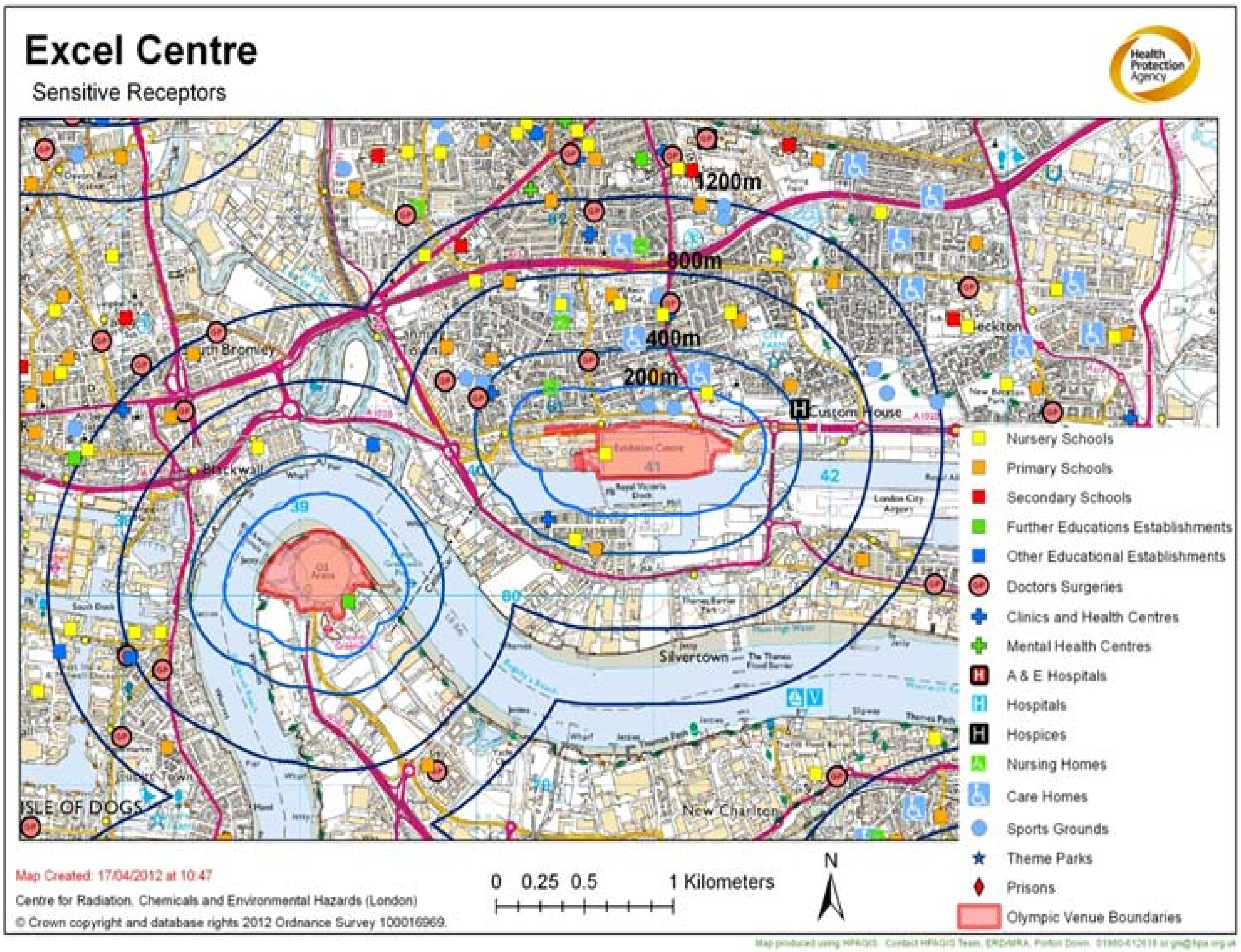

Figure 2: Location of sensitive public health receptors close to the ExCeL Centre, London

Training

Health Protection Academy Training Courses

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(on behalf of the Health Protection Academy Forum)

The Health Protection Academy is a service created to provide a one-stop-shop for the entire catalogue of specialist learning and development activities offered by the Health Protection Agency (HPA). Courses may be aimed at NHS employees, the emergency services and environmental health practitioners as well as HPA employees.

The Health Protection Academy website offers a diverse range of specialist health protection learning activities on various topics including:

- Emergency preparedness and planning
- Radiation and chemical hazards
- Public health and epidemiology
- Microbiology
- Communications
- Research and development
- Clinical governance and knowledge management.

Courses that may be of particular interest to readers of this report include:

- **Strategic Leadership in a Crisis**
  This one-day course designed by the Department of Health and HPA aims to prepare attendees to lead their trust or local authority through an emergency, whilst supporting a strategic coordinating group. It covers how to manage local and regional issues, the challenges involved in creating situational awareness and the recording of strategic decisions.
- **RADSAFE Awareness Course**
  RADSAFE was developed based on the requirements of emergency services and draws on the principles of the national Chemsafe plan. This course is intended for those professionals whose duties may encompass planning for, or responding to, transport radiation emergencies.
- **Essentials of Environmental Science – Level 3**
  This course focuses on the health impacts of air, water and land pollution. Environmental sampling and environmental legislation are also covered.

To find more information about these courses or other learning activities offered by the Health Protection Academy visit **www.hpa.org.uk/academy**.

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