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Chemical Incident Report

Produced by the Chemical Incident Response Service of the Medical Toxicology Unit, Guy's and St Thomas' Hospital Trust

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Editorial

Dr Virginia Murray, Director, Chemical Incident Response Service

In this Chemical Incident Report the Chemical Incident Response Service (CIRS) highlights the following for public health professionals and staff working in accident and emergency departments:

- **Non-domestic fires** can be difficult to respond to with many requiring environmental sampling and effective clean up even if no acute adverse health effects are identified early (pages 2-5)
- **Chronic incidents** require careful review of all available information to provide risk assessment data to the local population (pages 9-11)
- **Air accidents** fortunately happen rarely but information on the Air Accident Investigation Branch and public health guidance will be helpful to all concerned (pages 16-23)
- CIRS has summarised some of the work it has been undertaking to support chemical incident response. Please make sure you have **access to CIRS information** that may useful to you in emergency planning, Accident and Emergency departments and public health (pages 6-8)

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NON-DOMESTIC FIRES INVOLVING RELEASE OF ASBESTOS CONTAINING MATERIALS

Introduction

Virginia Murray, CIRS

Over the years, many fires resulting in the release of asbestos containing material and presenting health protection issues have been reported to the Chemical Incident Response Service. In this Chemical Incident Report we include information on two incidents The first concerns a fire and the response by a local public health team. The second reflects the concern and management of issues by the local environmental health department. We are grateful for their collaboration.

A report on an international meeting on the toxicity of asbestos is included on page 15 of this CIR. Data on availability of the CIRS Checklists including the Non Domestic Fire Checklist and CIRS hazard information is summarised on page 6-8.

Asbestos roof fire

Alex Stewart, SpR, CDSC(NW), Paula MacDonald, CCDC, Chester Communicable Disease Unit.

Incident summary

On the night of Sunday 13 Jan 2002 there was a fire in a machine shop in a small industrial site in Burtonwood, Warrington, starting at 17.24 hours. The industrial site was hemmed in on three sides by houses. The roof of the building was a cement – asbestos composite, of which about 50 square metres were burnt. The night was damp and misty with little wind and the fire brigade had the fire under control within 1½ hours. No one was injured. The fire brigade had already contacted the Environment Agency, Environmental Health, Food Safety Agency, police and ambulance when we were contacted. We informed North Cheshire Health Authority, the regional epidemiologist and the Chemical Incident Response Service.

On inspection the following morning with the local EHO, chunks of asbestos, measuring up to about 30 cm by 10 cm, could be seen scattered within a radius of some 10 metres from the site. The ground was muddy, so there was no danger of airborne spread at that point. However, the question of how far asbestos powder and fibres had spread from the site of the fire was unanswerable. The type of asbestos could not be ascertained on site.

The machine shop staff were discouraged from removing machinery to their other building where they were intending to continue work. A specialist asbestos cleaning firm had already been contacted by the insurance agency; they cleaned the site on Monday afternoon.

Points to Ponder

A number of asbestos related issues were raised by this fire:

- the need for Public Health guidance when attending the aftermath of such a fire. In North Cheshire there are between five and ten asbestos fires each year, but in the past the CDU has rarely been consulted about them.

- the ability of Environmental Health Departments to carry out environmental sampling and swabbing for asbestos to help inform health advice

- the need for 24 hour laboratory analysis of asbestos swabs to help assess the health risk.

- there is a need for agreed advice for the public on minimising the risk of exposure. There is no safe lower limit for asbestos, and simple measures such as keeping pets and children indoors, specialist cleaning of clothes contaminated while outside on washing lines etc can reduce the risk. As these fires often occur on small industrial estates, the risk minimisation advice needs to cover industrial as well as domestic settings.

- there is also a need for agreed advice on what constitutes an effective clean-up

- availability/suitability of PPE for public health doctors attending site inspections, and for EHOs carrying out the site clean-up (this is sometimes done "in house").

- the question of the distance that asbestos spreads from a fire. A search of the Science Citation Index Expanded database [1981 onwards] of the Web of Science [http://tame.mimas.ac.uk] revealed no hits using asbestos with any of the following words fire, spread, atmosphere. The answer may lie in other literature.

Details of the fire and our response have been published in the CDSC(NW) newsletter.

Fire resulting in the distribution of asbestos: an example of good practice

David Packard, Sefton Local Authority and Fiona Welch, Research Engineer Air, CIRS

Background

On January 15 1998 a fire in a large warehouse with an asbestos cement roof caused a major asbestos release in the Borough of Sefton, Merseyside.

A fire in the 300m warehouse containing 5000 tonnes of paper products quickly took hold and the intense heat caused the asbestos cement sheet roof to disintegrate and be carried off with smoke and ash in the strong convection currents. Approximately 100 tonnes of delaminated asbestos material was deposited on the neighbouring Council housing estate and primary school, with some pieces being carried up to 3 miles downwind of the fire (photograph 1).

Sequence of Events

A call from the Fire Brigade requesting assistance from the Environmental Protection Department was received around 13.00 hours and an officer was at the scene by 13.20 hours. The Commanding Fire Officer's briefing was short and concise stating that the fire was primarily paper and that the suspected asbestos roof had broken up and been carried downwind. With that he pointed to the adjacent housing estate.

The Environmental Health Officer (EHO) quickly made his way to the housing estate to be greeted with the site of extensive deposition of what appeared to be penny sized delaminated asbestos pieces on roadways, pavements, gardens and property roofs – in some places it looked as if it had started to snow! The seriousness of the problem was clear. The long term health effects of exposure to asbestos fibres are well documented. For fibres to pose a risk they must enter the lungs. Those longer than 100 µm or with a diameter greater than 3 µm are not respirable. Those smaller than 0.01 µm are not retained in the lungs. The fibres considered to be the most hazardous are between 5 and 100 µm long with a diameter of less than 1.5-2 µm and with an length:diameter ratio of more than 5:1 (this is known as the aspect ratio). These fibres are not visible to the human eye. There was a risk both from free-fibre released directly from the fire and from crushing of larger pieces of deposited material which could cause a secondary source of fibres.

The Council invoked its Major Emergency Plan and assembled its Emergency Management Team, made up of key Senior Officers from the Council. In view of the potential risks to public health and obvious concern with dealing with the emotive subject of asbestos, the Director of Public Health and Consultant in Communicable Disease Control (CCDC) were called in to form a sub-group of the Major Emergency Management Team. The CCDC in turn contacted the Chemical Incident Response Service for expert advice on the health risks associated with asbestos and incident management.

The Council contacted the HSE for advice on how to clean up the material and was given the names of asbestos specialists. Environmental health contacted a commercial organisation who were asked to assist by providing expertise for the clean up operation by way of a faxed open ended contract, based on the Federation of Civil Engineering Contractors rates. They confirmed they would be on site as soon as possible.

Photograph 1: Proximity ot warehouse to housing estate and primary school © Fiona Welch, CIRS

Environmental health benefits from an in-house UKAS accredited labo-

Photograph 2: Locked skip © Fiona Welch, CIRS

ratory that has specialist expertise in asbestos identification and monitoring. Staff were quickly deployed wearing basic protective clothing to undertake ambient air sampling in and around the estate and in residents homes. The laboratory staff quickly confirmed that the deposited material was white asbestos.

The commercial organisation arrived at 16.00 hours and assessed the situation. Resources from the Council's Cleansing DSO, who had been placed on standby, were deployed and began to sweep roadways using wet mechanical brush equipment with special filters.

Communication

Police with loudhailers advised the public to stay indoors with doors and windows shut. Local TV and national radio picked up on the story.

As the fire was being brought under control media attention turned quickly from the scene of the fire to the asbestos exposure issue and the 'is it safe?' frenzy of speculation. The Director of Environmental Protection and Director of Public Health issued joint statements, and following confirmation that initial ambient air samples taken over hourly periods were free from asbestos fibres, were able to bring the situation and media speculation of risk under control. The council obligated itself publicly to clear up all the deposited material. A community-briefing note was created, signed by both Directors and delivered to each property in the affected area that day. A help-line for concerned residents was also set up to advise worried residents on the situation and what to do should any of the material have found its way into their properties, through open windows etc. The advice given was to "wet it, bag it and bin it" using rubber gloves and a dust mask if available.

Post-fire incident management

The following day teams of DSO operatives, under the guidance of the commercial organisation, began the painstaking task of hand brushing and picking the material, firstly from hard areas such as pavements and walkways, and then from grassed areas. For the health and safety of the workforce they were deployed in white disposable suits and dust masks to carry out their tasks. This action was very emotive and it was hard to give credibility to the message that there was no immediate risk to the public and have the cleansing staff dressed up in what must have looked like space suits. (The clothing was subsequently changed to blue disposable suits for the duration of the 20-day clean up).

The Merseyside Emergency Planning Unit's forward command vehicle was deployed in the heart of the affected community to act as an advice centre for worried residents whilst the clean-up operation was taking place.

The council used air pollution modelling equipment to plot the likely distribution of deposited material and Council staff were deployed as spotters to determine the extent of deposition. Commercial premises were contacted by letter and advised to inspect their property and remove the material by use of specialist contractor or by following some basic health and safety procedures.

All the material collected was treated as special waste and bulked up in a lockable skip at the on-site operational centre at the local school (photograph 2). Material on property roofs was a problem, as the material would be blown down to re-contaminate cleared ground. Cherry pickers and water hoses were used to wash the material into gutters for collection (photograph 3). Some 100 roofs were treated in this way.

Ambient air sampling continued throughout the first week, with over 80 samples being taken using HSE method MDHS 37/4 Asbestos Fibres in Air. Not one sample indicated airborne asbestos contamination above the HSE clearance standard of 0.010 fibres per millilitre of air. The gathering of this information was crucial to be able to allay fears of contamination and exposure to interested parties, which by the end of the event included not just the residents, but Council, Police, Fire Brigade staff and respective unions, the support group for victims of asbestos and the solicitors acting on behalf of opportunist residents seeking compensation!

Discussion

The clean-up, essential for removing a public health hazard, commenced quickly and efficiently. There was no doubt that the Council had a moral duty to undertake its role of protector of the community and secure the removal of the hazard as quickly as possible, irrespective of liability. By decisive action the clean-up had begun just 3 hours after the initial call.

The partnership working between medical and environmental health experts, supported by an open and responsive communication approach, helped alleviate much of the stress that could have ensued from media speculation of possible exposure and long term medical effects. The availability of local asbestos monitoring expertise and facilities, which gave reliable and fast feedback, was core to the success of the early part of the response.

South Sefton Health Authority set up a long term health effects monitoring information system to record any respiratory disorder arising in the affected population, or those involved in the response via GP surgeries and local hospitals.

Two years after the event a dispute over liability between the building owners, the former tenant and insurance companies is still ongoing. The cost of the clean-up and associated activities procured by Sefton Council totalled £73,000.

In retrospect, the Council was fortunate that none of the air samples indicated asbestos exposure. Should any of them have been positive, the situation and response would have been very different. Different again would have been the initial response if the fire had happened four weeks earlier when the warehouse was allegedly full of tyres! Although Council emergency plans are not these days written to cover every eventuality, access to medical experts and credible analytical facilities are essential parts of any comprehensive emergency response arrangements.

Key points and lessons learnt

- the Emergency Management Team should include representatives from the Health Authority to agree health risk assessment strategies and communications
- ready access to monitoring and clean-up services was invaluable
- keep the local community well informed throughout the whole process. Ensure they know how get in touch if they have any concerns
- stay in touch with ancillary groups – e.g. GPs, community clinics, Accident and Emergency departments and NHSDirect where appropriate. They can be a useful source of information for the public, plus can identify and report back any specific concerns.

Photograph 3: "Cherry Pickers" removing contamination from the house roofs © Fiona Welch, CIRS

Further information

Hoskins JA, Brown RC. Contamination of the air with mineral fibres following the explosive destruction of buildings and fire. Drug Metabolism Reviews 1994(26):663-673

Doll R, Peto J. Asbestos: Effects on Health of Exposure to Asbestos. London: HMSO, 1985

HSE information on asbestos: www.hse.gov.uk/pubns/asbindex.htm Or telephone your local area office.

List of UKAS accredited laboratories: www.ukas.co.uk/new_docs/accredit.htm. These have not been put into categories, so includes all type of analysis Or telephone 020 917 8400(9-5, Monday to Friday) Or email: info@ukas.com

Information Available for Chemical Incident Response

Henrietta Harrison, Senior Toxicology Information Scientist, Chemical Incident Response Service

Table 1 lists all the current **CIRS chemical hazard handouts** that have been produced by CIRS and are available for chemical incident response, either electronically or by fax. Many of these chemicals have extensive lists of chemical synonyms which are not included in this list. Many of these are available in The **Chemical Incident Management Handbook**[1] but it is important to remember that they are reviewed and updated on a regular basis. Any new relevant information is then added to the handouts and standards and guidance levels are updated. For instance, the HSE publish new **Occupational Exposure Standards**[2] annually.

CIRS also produces **checklists to assist with chemical incident response.** This is an area that we are currently looking at and expanding to assist with chemical incident response. Table 2 lists the current checklists and documents that are available to assist with incident management. Figure 1 identifies some of the most useful checklists to refer to for specific types of chemical incident (page 8). These are also available electronically and in faxable format

The aim of the checklists is to provide a logical progression through the incident management process for different types of incidents. They are not meant to provide an exhaustive list of actions but a practical tool that will help ensure complete, appropriate investigation and successful management.

The checklists serve mainly as an aide-memoire of the major actions needed at each stage of the incident management. They can also be used to record progress and information about a particular event. A well-documented list of actions taken by each agency responding to the incident is invaluable at incident control meetings and at subsequent incident debriefings where management procedures are reviewed.

If you are dealing with an incident and there is no information listed below it does not mean that we do not have information. CIRS will always do its utmost to assist with information for chemical incident response!

References

1. Farrow C, Wheeler H, Bates N and Murray V (eds). *The Chemical Incident Management Handbook.* The Stationery Office, London, 2000
2. Health & Safety Executive. *EH40/2002 Occupational Exposure Limits 2002*. Stationery Office, London, 2002

Table 1: Chemical hazard handouts available from CIRS

Chemical Name	Date last reviewed or written
Acetic acid	March 2002
Acetone	April 2002
Acetonitrile	April 2002
Acrylonitrile	February 2002
Aluminium & aluminium compounds	April 2002
Ammonia	April 2002
Ammonia nitrate	July 2001
Aniline	February 2002
Arsenic and arsenic compounds	March 2002
Arsine	April 2002
Asbestos	Available, under review
Benzene	April 2002
Blue green algae	Available, under review
Bromates	July 2001
Bromides	Written April 2002
Bromine	February 2002
Butane	February 2002
Cadmium	February 2002
Calcium peroxide	February 2002
Carbamates	March 2002
Carbon dioxide	March 2002
Carbon disulphide	February 2002
Carbon monoxide	April 2002
Cellulose nitrate	July 2001
Chloramines	Written April 2002
Chlorine	April 2002
Chlorofluorocarbons	March 2002
Chloroform	March 2002
Chloropicrin	February 2002
Ciguatera	July 2001
Copper	March 2002
Copper sulphate	March 2002

Chemical Name	Date last reviewed or written
Cresols	Available, under review
Crowd control agents	March 2002
Depleted uranium	Written April 2002
1,2-Dibromoethane	March 2002
1,2-Dichloroethane	March 2002
Dichloromethane	March 2002
Diesel	Summer 2002
Dioxins	March 2002
Ethanol	April 2002
Ethylene glycol	March 2002
Ethylene oxide	March 2002
Fibre-reinforced polymer composites	Written October 2001
Formaldehyde	April 2002
Formic acid	March 2002
Glutaraldehyde	March 2002
n-Hexane	March 2002
Hydrazine	March 2002
Hydrochloric acid	March 2002
Hydrofluoric acid	March 2002
Hydrogen cyanide and cyanide salts	March 2002
Hydrogen peroxide	March 2002
Hydrogen sulphide	March 2002
Isopropanol	March 2002
Kerosene	March 2002
Lead and lead compounds	March 2002
Lindane	March 2002
Liquid paint	July 2001
Magnesium	March 2002
Manganese and manganese compounds	March 2002
Man-made mineral fibres	Written October 2001
Mercaptans	March 2002
Mercury (elemental)	March 2002
Methane	March 2002
Methyl bromide	March 2002

Chemical Name	Date last reviewed or written
Methyl ethyl ketone	March 2002
Methyl ethyl ketone peroxide	March 2002
Methyl isobutyl ketone	March 2002
Methyl methacrylate	March 2002
Mustard gas	September 2001
Naphthalene	Written July 2001
Nerve agents	Written September 2001
Nickel and nickel compounds	March 2002
Nitrates	January 2002
Nitric acid	March 2002
Nitrobenzene	Written July 2001
Nitrogen	March 2002
Non-biological particles	Written April 2002
Odours	Summer 2002
Organophosphates	February 2002
Oxides of nitrogen	March 2002
Paraquat	February 2002
Petrol	July 2001
Phenol	April 2002
Phosgene	February 2002
Phosphine	February 2002
Phosphoric acid	February 2002
Picric acid	Written November 2000
Polychlorinated biphenyls	Summer 2002
Polynuclear aromatic hydrocarbons	March 2002
Potassium permanganate	February 2002
Products of combustion	Available, under review
Propane	February 2002
Pyrethroid and permethrin insecticides	February 2002
Pyridine	February 2002
Ricin	Written September 2001
Sarin	February 2002

Chemical Name	Date last reviewed or written
Scrombrotoxin	Available, under review
Sodium chlorate	February 2002
Sodium dichromate and hexavalent chromium salts	February 2002
Sodium fluoride and fluoride salts	February 2002
Sodium hydroxide	February 2002
Sodium hypochlorite	February 2002
Strychnine	February 2002
Styrene	February 2002
Sulphur dioxide	February 2002
Sulphuric acid	February 2002
Sulphur trioxide	February 2002
Tetrachloroethylene	February 2002
Thallium	February 2002
Thionyl chloride	Written January 2002
Titanium tetrachloride	February 2002
Toluene	February 2002
Toluene diisocyanates	February 2002
Tributyl phosphate	Written March 2002
Trichloroethylene	February 2002
Uranium hexafluoride	Written April 2002
Vinyl chloride	February 2002
Xylene	February 2002
Zinc and zinc oxide	February 2002
Zinc chloride	February 2002

Table 2: Checklists and additional information available from CIRS

- Acute Chemical Incident Checklist
- Non-Domestic Fire Checklist
- Shelter or evacuate in a chemical incident
- Water related chemical incident Checklist
- Land contamination incident Checklist
- Fuel incident Checklist
- Flooding Checklist
- The role of health surveillance in chemical incident management -Checklist
- WHO Guideline and UK prescribed concentrations or values for drinking water
- Interpreting CHEMET Forecasts

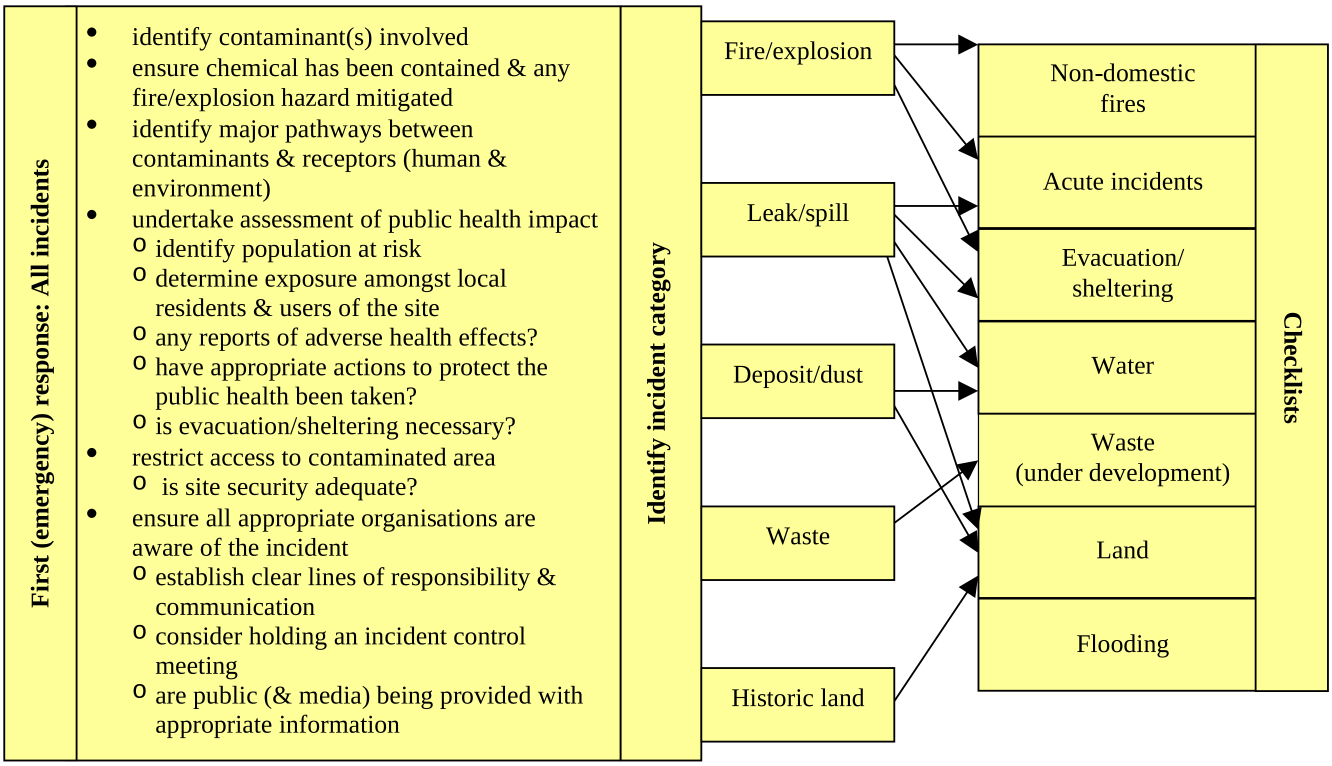

Figure 1: Identifying the most useful checklists for different types of chemical incident

CHRONIC INCIDENT RESPONSE ASSOCIATED WITH CANCER CLUSTERS

Commentary

Virginia Murray, CIRS

Investigation of chronic incidents associated with cancer clusters is difficult and time consuming. Two such events are reported below; the first reviews the investigation undertaken for complaints associated with an old hospital incinerator and a reported cancer cluster, and the second reviews the investigation undertaken for complaints associated with odours and a reported cancer cluster in the vicinity of an iron foundry.

Odours have proven an increasing source of concern to members of the public and present a difficult area for CIRS to collaborate on response. Henrietta Harrison summarises some of the work undertaken at CIRS in preparing a review for the odours investigation information sheet (page 12). As hydrogen sulphide at low doses has presented a specific odour issue, a review by Oliver Morgan is included on page 13. Asbestos remains an issue of considerable concern. Dr Desiree Elkabir has written a conference report on a recent international meeting held at the London School of Hygiene and Tropical Medicine (page 15).

Report on the possible increase in cancer cluster cases in North Liverpool and potential links to the site of the former incinerator

Dr Kate Ardern, Director of Public Health, South Liverpool Primary Care Trust, formerly Consultant in Public Health, Liverpool Health Authority

In the summer of 2000, as a result of concerns expressed to Liverpool City Council by residents of Fazakerley and Gilmoss area, the City Council requested Liverpool Health Authority to conduct a study into the incidence of cancer in those areas.

The particular concern was that a number of cancer deaths since 1974 could have been linked to emissions from the former incinerator at Fazakerley Hospital. The incinerator was closed in 1995, the plant demolished in 1996, and the chimney stack demolished in February 2000. When the incinerator closed it met or was better that the air quality standards that were in place at the time. The review of the limited environmental data available from the incinerator and reports from the Liverpool City Council's Environmental Health Departments concluded that even with a worst case scenario, the maximum level of pollutants showed that the incinerator was operating well within the standards established by Environmental legislation of the early 1990s.

A project team was set up to study the following four key areas:

- to establish whether the cancer deaths in Fazakerley and Gillmoss were more than could be expected in these populations over a 26 year period;
- to compare cancer rates in Fazakerley and Gilmoss with the rest of Liverpool;
- to establish as far as possible the risk factors for cancer in these neighbourhoods that might affect the number of cancer cases. These included socio-economic deprivation, occupational exposure and environmental factors including the incinerator;
- to establish whether there was any relationship between the distance of residence from the incinerator and the risk of cancer.

The study involved commissioning an in depth review of cancer cases by the Merseyside and Cheshire Cancer Registry, which investigated the neighbourhoods that were covered by the emissions from the incinerator. National and local experts in the field of incinerators and their impact on health were involved in the study and there was an independent review of the study findings.

The study did not identify a causal link between the incidence of cancer cases in the vicinity of the incinerator. A full copy of the report was published on 7 February 2002 and is available on www.nwpho.org.uk/documents. Figure 1 shows the front cover of this report

Figure 1: Front cover of report on the possible increase in cancer cluster cases in North Liverpool and potential links to the site of the former incinerator

Planning permission for housing adjacent to an iron foundry – 30 years of complaints

Dr. Gill Lewendon, SpR in Public Health, South and West Devon Health Protection Unit, currently on secondment to Chemical Incident Response Service

Site Description

The immediate area around the foundry is relatively flat with residential accommodation adjacent to the site. Most of the housing is small bungalows but there is also a low rise block of flats situated 50 yards from the foundry smelter (figure 1).

Photograph 1: Cupula from foundry site ©CIRS

Site History

Originally the Iron Foundry was sited in the centre of a seaside town in South Devon but after the Second World War, was re-sited in what was then a Greenfield site (used for farmland pre-1948) outside the town. The adjacent fields were intended for industrial use but land usage was altered in the late 1960's and planning permission was given for this to become residential. The Foundry is now surrounded by a housing estate, much of which is occupied by elderly people who have moved into the area to retire.

There have been intermittent long-standing complaints over the past 30 years. These have been mainly concerned with nuisance value rather than health effects. The main concern was from airborne pollutants arising from the foundry processes.
In addition to odours there have also been complaints about the soot fallout on domestic properties and on clean washing hanging out to dry. A local Councillor alleged that the Foundry was 'causing' cancer on the basis of five people thought to have cancer who were living in one nearby residential street.

Site Investigation

Emissions from the Foundry had been closely monitored by the local Environmental Health Department over the years and the Foundry's owners had been compliant with suggested measures to reduce nuisance to local residents. For example, the cupula stack was raised to minimise particulates falling on local houses and it was agreed that firing would be carried out only once a day, at midday, on weekdays only.

The population of the PCT, in which the Foundry is situated, is older than average (22% of the population are aged 65 years and over). The nature of the housing, which includes a large number of retirement bungalows, means that the area round the Foundry is relatively representative of the population of the Primary Care Trust (PCT) as a whole.

The Environmental Health Department requested the help of the Health Authority in assessing the risk of any long term health effects from the Foundry emis-

Figure 1: map of site in relation to local housing

sions. A site visit was undertaken by members of the Health Authority's public health team, the Environmental Health department and CIRS (photographs 1-2). Following this plans for further investigation were agreed.

1. Complaints from members of the public that had been received in the preceding three years were mapped. Complainants all lived within four hundred yards of the foundry. Air pollution can exacerbate existing respiratory problems, in particular asthma. Although no complaints had been received about this it was decided initially to look for an increase in respiratory problems in people living in the vicinity of the foundry.
2. A telephone survey of local GPs in the three practices in the town enquiring about the prevalence of respiratory problems in people living near the foundry was undertaken. They were also asked whether any adverse effects that could be linked to the site had been notified to them. No problems were reported.
3. Prescribing data were examined. Inhaled steroids were specifically looked at as these were thought to be a good indicator of cases of severe asthma and chronic obstructive airways disease (COAD) in a particular practice. Data from the three local practices were compared with prescribing data from the rest of the Primary Care Trust (PCT) and all were found to be below average in the amount of inhaled steroids prescribed.[1]
4. Asthma admissions by practice in the PCT for the year 2000/2001 were examined (information from S&WDHA). The crude admission rate for each of the local practices (2.4, 2.5, 2.6/1000 patients) compared favourably with the admission rate for the PCT as a whole (3.8/1000 patients).
5. There were no details about the alleged five cases of cancer. The possibility of identifying clusters of cancers was discussed with the South West Cancer Intelligence Unit (CIU) in Bristol. Without identification of the type of cancer (or even able to confirm whether or not these five people actually had cancer) meant that it would be impossible to investigate this as a potential cluster. CIU sent a detailed report of the incidence counts and rates of all cancers for residents in each of the four PCTs in South and West Devon for 1997 (the most recent figures available at the time). The PCT in which the Foundry and neighbouring town was a part had the lowest age standardised rate of cancers when compared with the other three PCTs in the district.[2]
6. The death certificates of people who had been living in the Foundry town for the previous five years were scrutinised. Deaths from respiratory problems or from cancer were not over represented in this sample

Photograph 2: Cupula proximity to local housing ©CIRS

Lessons leaned

Local epidemiology provides no evidence at present to suggest that emissions from the foundry are causing adverse physical health effects. Given the levels measured, adverse health effects would not be expected. However the issue of the possible mental stress caused by the nuisance effects of the foundry (smell, noise and dirt) was not taken into consideration when planning permission was given for use of the land for residential accommodation. In future the integrated pollution prevention control regulations should ensure that this important aspect is not overlooked.[3]

References

1. Personal communication. Primary Care Comparative Prescribing Information Oct 99-Sept 00. Prescribing team South and West Devon Health Authority, S&WDHA

1. Personal communication. South West Cancer Intelligence Unit. 1992-1997

2. Part 1 Environment Protection Act 1990, Intergrated Pollution Prevention and Control. 1 Aug 2000

Odour Investigation Information

Henrietta Harrison, Senior Toxicology Information Scientist, Chemical Incident Response Service

Introduction

CIRS has been receiving more and more enquiries about odour investigations, either from known origin or, more often than not, from an unknown source. To assist with the investigation, an **Odour Investigation Information Sheet** has been put together. The following is a summary of this information.

Understanding odours

Odours that are pleasant or acceptable to one person's nose can be offensive to another. Some of these offensive odours can be detected when the odorant is present in very low concentrations. For example, the odours of new-mown hay or honeysuckle and roses are generally acceptable odours at normal concentrations to most but not all people.

However, obnoxious odours may be unacceptable at much lower concentrations to more people and become acceptable only at very low concentrations. Even normally acceptable perfumes can be unacceptable at high intensities.

In the main document information is given about odour legislation, odour descriptions and their relevant chemicals, and also odour threshold concentrations.

Human toxicity

Public perception of malodours may lead to concerns about adverse health effects, environmental concern and stress within the community.

It is impossible to describe the generic adverse health effects from odour exposure; all odours have their own characteristics and individuals have different susceptibility. Dislike of bad smells is a defence mechanism found throughout most civilisations; the human nose can detect some chemicals at very low concentrations in the atmosphere. Odour detection generally precedes sensory irritation, on an ascending concentration scale with exposure to the majority of chemicals; however, some chemicals (e.g. methyl isothiocyanate) are mucous irritants at sub-odour concentrations.[1]

Odour Investigation

The first task in odour investigation is to attempt to identify the individual sources and establish those factors influencing the rate and type of emission. An investigation should be carried out to assess health effects reported with regards to the odour:

- How many individuals are complaining of the odour?
- Is it a specific group of vulnerable people (children/elderly)?
- Are there general complaints within the community?
- How frequent are the complaints?
- How widespread are they compared to the alleged source?
- Are there people with pre-existing conditions (asthma, pregnancy) who may suffer more significant acute effects then the general population?
- Are there other plausible explanations other than environmental matters (change in industrial practice or process; occupational exposures)? Is the odour noticed at any particular time of day or day of the week?

Case studies

The unpleasant smell of hydrogen sulphide from a petroleum refinery lead to complaints and reported symptoms of headache and nausea. Investigations showed the hydrogen sulphide concentrations to be as little, on occasions, as that produced by a single boiled egg (distance from source unspecified).[1]

Odours have been reported to play a part in some episodes of "mass psychogenic illness". Headache, nausea, shortness of breath and dizziness were reported among 80 students and 19 staff in a school. The index case reported smelling a "gasoline-like smell"; symptoms spread quickly to the occupants in other rooms as fire alarms went off and the school was evacuated. Subsequent environmental and medical investigation failed to identify a responsible toxic agent.[2]

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Chronic Effects of Hydrogen Sulphide Exposure: A brief review

Oliver Morgan, Public Health Specialist, Kensington and Chelsea Primary Care Trust, on secondment to CIRS January—March 2002

Introduction

Odour and nuisance problems due to hydrogen sulphide have been studied in relation to sewerage, sewage treatment works and odours[1]. However, evidence about health effects due to chronic exposure has received less attention. The following review looks at two epidemiological studies (Legator at al, 2001[2] and Logue et al, 2001[3]), a review of neurobehavioral measurements (Kilburn, 2001[4]) and three case reports (Parraet al, 1991[5], Gabbay et al, 2002[6] and Gaitonde et al, 1987[7]).

Review

Legator et al, 2001[2]: Legator et al conducted an ecological study involving selected subjects from 2 exposed communities and 3 unexposed communities in the USA. They reported a wide variety of self-reported health effects in several categories including: the central nervous system, respiratory problems, blood, ear/nose/throat, muscle/bone, skin, immune, cardiovascular, digestive, teeth/gums & urinary problems.

The exposed group was selected from people who had been involved in legal cases against the producers of hydrogen sulphide and so would be likely to attribute health problems to hydrogen sulphide exposures. Health effects were measured as increases of self reported symptoms during the previous 5 year period. Hydrogen sulphide exposure was based on historic records of ambient levels (usually taken during legal proceedings) and no exposure measurements at the community level were conducted. Potential confounders such as age or socio-economic status were not taken into account. Furthermore the removal of two of the reference groups from the analysis of specific categories (respiratory and endocrine) due to 'inconsistencies' in the data raises doubts about the study's robustness.

The methodological weaknesses of this study mean that it is difficult to assess whether this was due to chronic exposure of hydrogen sulphide or not. The absence of exposure measurements further limits the usefulness of this study and the exclusion of smokers reduces its generalisability.

Logue et al, 2001[3]: Logue et al investigated complaints from an elementary school in Pennsylvania USA. It was alleged that odours from a nearby mushroom composting operation were making the children ill. Two health surveys were carried out in Spring (33 days) and Autumn (42 days). Children from the 'exposed' school and a reference school 5 miles away who visited the school nurse for a specific health complaint (not for regular medication or accidents) were interviewed. They were questioned about the presence of 11 specific symptoms and 6 existing medical conditions. Hydrogen sulphide was measured continuously using one measuring device outside and one inside at both schools. An hourly average level of 10ppb (the probable odour threshold) was used to determine 'high' exposure events. Choosing this level appeared to be done post hoc. A more sensible level would have been the safe level set by the State authorities (100 ppb averaged over 1 hour), but the ambient hydrogen sulphide levels did not exceed this limit during the study period.

During the spring period there were a few days when more symptoms were reported in the 'exposed' school compared to the reference school (14 days). However, only three of these days coincided with 'high' pollution days. Visits to the school nurse for medical conditions occurred on 9 days coinciding with 4 'high' pollution days. However, during the Autumn more visits due to medical conditions were reported in the reference school where hydrogen sulphide levels never exceeded 10ppb.

As levels of hydrogen sulphide in ambient air never exceeded the State safety threshold and only occasionally exceeded the odour threshold it is not surprising that no clear health effects were observed. The symptoms and medical conditions studied are common to children (runny nose, dry throat, nausea, etc) and might have been caused by other factors. Furthermore statistical comparisons were made for every symptom and medical conditions on each day leading to a very large number of comparisons (693 in the Spring period and 882 in the Autumn period). From such a large number of comparisons one would expect to see 80 statistically significant differences due to chance alone. A more suitable approach would have been to calculate a correlation coefficient for the number of symptoms and the level of ambient hydrogen sulphide.

Kilburn, 2001[4]: Kilburn reviewed methods of testing neurobehavioral functions to evaluate the effects of environmental exposures to chemical that had occurred on several occasions and in different locations throughout the United States. A wide range of neurobehavioural tests were carried out and grouped into three categories (most to least efficient) and included both physiological and psychological tests. These test scores were adjusted for age, sex, education level, social class and smoking as well as physical factors (height/weight). These measurements were carried out on people who had been exposed to 15 classes of chemicals and abnormality in brain function was ranked (after adjustment). Hydrogen sulphide and polychlorinated biphenyls caused the most abnormalities in brain function relative to other chemical exposures. Details of the type, level and duration of exposure was not reported in this paper.

Parra et al, 1991[5]: Parra et al reported a case of subacute respiratory problems possibly caused by exposure to hydrogen sulphide. The incident occurred in workers at a steel foundry in Spain who had used a toilet that was attached to a manure pit. The toilets had been out of use for several months prior to the incident. Three workers were admitted to hospital because of nausea, vomiting, dizziness and dysponea. One of them died a few days later. Ten more workers complained of nausea, vomiting, itchy eyes and nose irritation but recovered after a few hours. Three weeks later, one of the workers that had mild symptoms (a long-term smoker with no previous health problems) was admitted to hospital with dysponea, chest tightness and haemoptysis. Residual exertion dyspnoea persisted after five months and was thought to be due to mild fibrosis caused by exposure to hydrogen sulphide. Ammonia, methane and carbon monoxide may also have been present in the toilets but were thought unlikely causes of these unusual long term sequelae.

Gabbay et al, 2002[6]: Gabbay et al highlight the 'knockdown' effect of extremely high exposures of hydrogen sulphide in a case report. A 30 year pipe fitter working at a large oil refinery was found semi-conscious at the bottom of a ladder. He was taken to hospital where he was found to have minor injuries to the head and spine caused by the fall. A 'rotten egg' smell was also noticeable from his clothing and his state of consciousness improved dramatically with the administration of oxygen. On further investigation it was found that he had been exposed to 1000 ppm of hydrogen sulphide at the top of the ladder causing him to loose consciousness and fall. Exposure to extremely high levels of hydrogen sulphide caused a direct toxic effect on the brain (particularly intracellular inhibition of cytochrome oxidase) causing the 'knockdown'. The patient was discharged from hospital after three days and no cognitive effects were noticeable at 1 week follow-up.

Gaitonde et al, 1987[7]: The case reported by Gaitonde et al showed subacute toxic encephalopathy in a 20 month old child. The cause was assumed to be chronic exposure to hydrogen sulphide originating from a burning colliery tip heap near the family home. Levels of around 0.6ppm were detected within the family's home (although at times levels were potentially higher). Clinical symptoms in the child improved after the removal of exposure and there was complete resolution of abnormalities of the basal ganglia. The toxicological mechanism involved was suggested as the selective binding of sulphide ions to the cytochrome oxidase within the mitochondria disrupting the electron transport chain. No other cases were identified either within the same family or within the community. The reasons why only this child was affected are unclear.

Summary

The two epidemiological studies by Legator et al, 2001[2] and Logue et al, 2001[3] both suffer from weaknesses that make conclusions about potential health problems extremely difficult; the principle weakness being the lack of specific outcome measurements. Conversely Kilburn, 2001[4] enthusiastically reports neurobehavioural effects of chemical exposures (including hydrogen sulphide), but omits information about the type and level of exposure. The case study by Gaitonde et al[7] suggests that long term chronic exposure caused encephalopathy in a 20 month old infant. However the uniqueness of this case raises questions about whether the condition was actually caused by hydrogen sulphide or if other unique factors were at work. The other two case reports by Parra et al, 1991[5] and Gabbay et al, 2002[6] highlight effects of short exposures at very high levels. Such health effects are unlikely to be similar to chronic exposures as hydrogen sulphide toxicity is very dose-dependent.

Conclusion

The small number of studies that have investigated low-level chronic exposure to hydrogen sulphide do not provide sufficient evidence to assess the health risks. While health effects may occur at 50-100ppm (mild mucous membrane irritation, nausea, conjunctivitis, keratoconjunctiviitis and corneal ulceration), the odour threshold may be much lower (around 10ppb[6]). Although there is currently no evidence to show that such low exposure levels have a toxic effect, vulnerable groups (e.g. the elderly), or people exposed for very long periods may be affected. Even without toxic action, the considerable nuisance effect may cause stress, resulting in the type of non-specific symptoms commonly reported. Furthermore, in the absence of accurate exposure measurements, one cannot rule out the presence of other non-odorous chemical agents released along with hydrogen sulphide in situations such as landfill sites. Further research is needed to establish the risk to health of low-level chronic exposure to hydrogen sulphide.

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CONFERENCE REPORT: Asbestos

Meeting： 16th April 2002, London School of Hygiene and Tropical Medicine

Dr Desiree Elkabir, SpR in Respiratory Medicine on secondment to CIRS

This well-attended meeting at the London School of Hygiene and Tropical Medicine comprised eight short talks from international speakers with a variety of different experience and interests surrounding the present and past use of asbestos worldwide.

The first talk focused on a process being set up in the Netherlands to search for and quantify past asbestos exposure to facilitate the process of claims and settlement in the light of the possible peak of mesothelioma cases predicted to occur around 2020. The author Jock Mc Cullock gave a fascinating presentation based on his personal investigation, now published in his book, on the history of blue asbestos mining in South Africa and in particular the underreported role of unpaid women in the mining workforce until the 1980s. Production of asbestos peaked in South Africa in 1976 continuing until the 1990s despite the known medical effects being published in 1960. The legal representative in this country for the 7500 South African claimants in the Cape PLC case presented insights into the legal process involved and the problems and implications arising from such large settlements from a single company. In particular, he highlighted the problems of the limited resources available for compensation of such a large number of individuals with the consequent risk of bankruptcy, and the length of time taken to agree a settlement with the inevitable consequence of the death of many claimants.

The MP John Battle spoke passionately about the dozens of "neighbourhood" victims affected by asbestos-related disease in his constituency in Leeds resulting from the indiscriminate venting of asbestos dust directly into the streets of a residential area from an asbestos factory. After a long battle in the courts, delayed by voluntary liquidation of the company involved and their appeal against the damages awarded, there have been 60 case settlements since 1995. Carolyn Stevens highlighted the global issues involved in the implementation of a total asbestos ban and the problems being faced as a result of increasing claims for compensation.

John Gilbert spoke about the current situation in Kazhakstan, where there has been increasing asbestos production since 1998 without government asbestos safety regulations or general population awareness of the health risks involved. He presented photographs of employees working now without any protection or ventilation in asbestos factories and the dumping of tonnes of asbestos waste within city limits. He described implementing staff awareness and safety training, decontamination and the resultant first safe asbestos plant in Kazakhstan. The final two talks described the current situations in Brazil and India where again general awareness of the health hazards of asbestos are low and there is as yet no monitoring and no possibility of claims or compensation for asbestos-related disease.

This meeting has demonstrated clearly that the problems resulting from asbestos mining and manufacturing are very much ongoing. Internationally, there is still a need for education and awareness of current and past asbestos workers as well as a recognition by industries and governments of the medical consequences of asbestos exposure and their and acceptance of responsibility for compensation claims.

AIR ACCIDENTS

Introduction
Virginia Murray, CIRS

On Thursday 26 July 2001 CIRS held a **Transport Training Day.** The day aimed to address the fact that CIRS has been increasingly concerned about the difficulties of planning for transport related incidents and to try and develop a clearer approach on how to respond to chemical incidents arising from transport accidents. The day looked at air, road, rail and sea events by reviewing recent incidents. Various agencies were asked to present their roles and responsibilities. Air accident data is included in this Chemical Incident Report.

CIRS is grateful to Sid Hawkins from the Air Accident Investigation Branch who provided a summary of their work and a report on an incident at Biggin Hill in 2002 and to Jane Cooper for providing a comprehensive overview of air accidents and public health.

Air Accidents Investigation Branch

United Kingdom
Air Accidents Investigation Branch

AIR ACCIDENTS - RESPONSE

Sidney Hawkins MIOSH, RSP, I.Eng., AMRAeS Engineering management/H&S post with the Air Accidents Investigation Branch.

Aircraft, as with other modes of transport, have a potential to pose environmental and health hazards following transport accidents. Unlike road and rail vehicles, however, aircraft may come to grief almost anywhere, making the planning for, and response to, accidents more demanding than with other transport modes. When considering the potential environmental and public health issues resulting from air accidents, it is important to review the processes adopted by the organisations charged with responding to air accidents.

Over recent years, aviation has shown a tremendous growth in business both within the UK and internationally. Aircraft flights to and from UK airports currently exceed 3.4 million per year, with passenger numbers totalling 170 million and with 2.5 million Tonnes of freight being carried. Within the UK, regulation of aviation is the responsibility of the Civil Aviation Authority (CAA), and accidents investigation is the responsibility of the Air Accidents Investigation Branch (AAIB) (currently part of the Department for Transport, Local Government and the Regions). Although in communication on a daily basis, these two organisations work totally independently of each other.

Incidents involving aircraft may occur at any time during storage, maintenance, ground handling, cleaning, replenishment, loading, and of course during its flying operations. Under specific legislation governing aviation, only certain categories of incidents are deemed to be 'accidents' or 'serious occurrences' and are therefore to be investigated by the AAIB. These are where:

- the incident occurs to an aircraft between the time that the aircraft is prepared for flight, and when all occupants have disembarked, and;
- a person suffers a fatal or serious injury as a result of being in, upon or in direct contact with the aircraft or its jet blast (note: a serious injury includes verified exposure to radiation or infectious substances), or;
- the aircraft sustains damage or structural failure which affects the strength or performance of the aircraft.

For all other types of incident occurring at airports to public transport and turbine aircraft, the Civil Aviation Authority will investigate. In addition, the other regulatory authorities may also be involved, i.e. HSE, EA, etc. During the course of its investigations, if criminal intent is suspected, the AAIB will inform the Police. Where breaches of the rules of flying (the Air Navigation Order) are identified, the AAIB will inform the Civil Aviation Authority.

Civil accidents

Pilots/Operators are required by law to inform the authorities of air accidents, although in practise, reports of accidents, particularly those of a significant scale, will be passed by a range of organisations/ individuals. Frequently this is the Police, but may also be airport operators, the public, air traffic control, other aviators, etc.

The Emergency Services respond to the accident depending upon the scale of the incident, and by the time AAIB staff arrive, a wide range of responding organisations are likely to have been called to site. In addition to the emergency services, local authorities may be in attendance, environment authorities, utilities authorities and landowners may also be present at the site. As soon as survivors have been rescued and there is no further risk to the public, the Fire Service will generally hand over the site to the Police. Their officers will then provide security at site for as long as is required. A cordon will have been established, and apart from essential personnel, entry to site will be restricted. The accident location as well as the aircraft wreckage may provide evidence for investigators, therefore it is essential to prevent evidence being lost or damaged.

For the AAIB, operations and responsibilities at site are limited to the collection of evidence. Where the accident is to a small aircraft, site operations may take no more than 24 hours. At the other end of the scale, site operations at the location of a major accident may take many weeks. Aircraft wreckage, and other site materials, are recovered by the AAIB where they are required for evidence purposes. Aircraft owners or their insurance representatives, landowners, and appropriate authorities will ensure that remediation is undertaken as required. In many cases, representatives from local authorities, environment agencies, forestry commission and nature conservancy organisations will have attended the site. Where a need is identified by site personnel, the presence of such representatives is requested by the emergency services or by the AAIB.

To ensure the safety of AAIB staff and of others working on behalf of the AAIB, an assessment of health & safety hazards will be conducted. The assessment will utilise information gathered off-site by duty personnel on the aircraft and its load. Further on-site assessment will be conducted by AAIB personnel taking into account the factors affecting operations at site (aircraft type, age, damage, fuel contents, location, occupants, cargo, weather, etc.). For small aircraft, the assessment is likely to identify hazards associated with fuel, electrical systems, torn metal, human remains and the location. For major accidents, additional hazards covering cargo, pressurised containers, stored energy systems, unstable wreckage, toxic materials, hazardous ground structures, and many others may have to be considered. Some assessments may also identify potential hazards to the public, therefore the involvement of local authorities will be sought. For major accidents, the incident is likely to have triggered County emergency plans, and the authority will consider and respond to issues affecting the public. In response to accidents of significant scale, the AAIB encourages the establishment of a risk management group at sites to include responsible safety personnel from the organisations involved in on-site operations, together with authorities having public health responsibilities. Apart from the AAIB this will also include the Police, local authorities, recovery organisations, insurers agents, etc.

Where accidents occur within airport confines, the response is generally more systematic, given that airports are required to compile emergency plans to cover such occurrences. In most cases, all the appropriate personnel are made known to the AAIB at a very early stage, and all the airport facilities and organisation is made available to deal with the incident. This invariably includes personnel with health and safety, and environmental responsibilities, together with Police, engineering, emergency and resource planning, etc.

In many cases, planning and remediation processes are undertaken whilst site investigation is taking place. This is obviously important given the scale of certain accidents, and/or the sensitivity of the location. Following the conclusion of on-site investigation, the site is handed over to the land owner, his representative or to representatives of the aircraft insurers.

Civil occurrences

Incidents which are not classed as accidents, but which endanger aircraft, cargo or personnel at airfields are responded to by airfield emergency personnel with assistance from local authority sources where required. The AAIB does not generally get involved in the investigation of these incidents, although it retains the right to if it is felt that it would be in the public interest. The CAA requires the establishment of emergency plans to cover on airfield incidents, together with the undertaking of regular planning and practical exercises involving the responding organisations. For all incidents not investigated by the AAIB, a Mandatory Occurrence Report will be filed to inform CAA of occurrence or near miss which then ensures the incident is appropriately investigated. Specific offices within the CAA will review incidents within their field of operation. For example, the Dangerous Goods Office has specific responsibility to ensure the safe transport and storage of items classified as 'Dangerous Air Cargo', and monitors closely the operators and organisations involved in this work.

Military accidents/occurrences

In the case of military air accidents, once the emergency service involvement has ceased, the on site response is undertaken entirely by military personnel, although in the case of fatalities, the coroner and his officers will continue to be involved. Close liaison with appropriate authorities is maintained, particularly with local environmental health personnel. Accident investigation will be undertaken by military Boards of Enquiry, and aircraft wreckage will be removed from site by military teams (Royal Navy will recover helicopters, RAF will recover fixed wing). Detailed monitoring and analysis of environmental hazards associated with the accident will be conducted, and appropriate remediation action undertaken by the responsible Service.

The Air Accident Investigation Branch is happy to receive enquiries as well as requests for 24 hour support in an emergency: Tel: 01252 512 299 http://enquiries@aaib.gov.uk

AIR ACCIDENTS INVESTIGATION BRANCH ACCIDENT SITE ASSESSMENT/REPORT

Accident Reference: EW/C/2001/6/03

Aircraft Type: DeHavilland D115 Vampire T11, G-DHAV

Accident Location/Date:
Biggin Hill, 2 June 2001

Report: S Hawkins, 14 Aug 2001

ACCIDENT DETAILS

Vampire, G-DHAV, was taking part in the Biggin Hill airshow, and was part way through a display with a second vintage aircraft, when it was seen to enter a steep descent before impacting the ground at an estimated 200knts. A post-impact fireball occurred which was followed by a ground fire, although this was quickly extinguished by the airfield fire services. The impact area and wreckage trail extended for approximately 150m in length and 50m in width.

The accident location was approximately 1 km from the end of the runway threshold, in a field of crops of around 0.5m height. The initial point of impact was just 3m from a fence-line at the end of gardens belonging to domestic properties, with the houses within these properties being a further 40-50m away from the fence-line. As the attached photographs show, the direction of approach of the aircraft was almost parallel to the fence-line, and the resultant spread of debris was in a 30^{O} arc from the point of impact. Some items of debris were spread as far as the electricity pylons, with some small pieces of debris reported to have reached a short distance into the adjacent gardens. The wind direction on the ground at the time was Northerly, with a strength of 4 Knts. Wind direction at 1000’ was also Northerly, but with a strength of 20Knts.

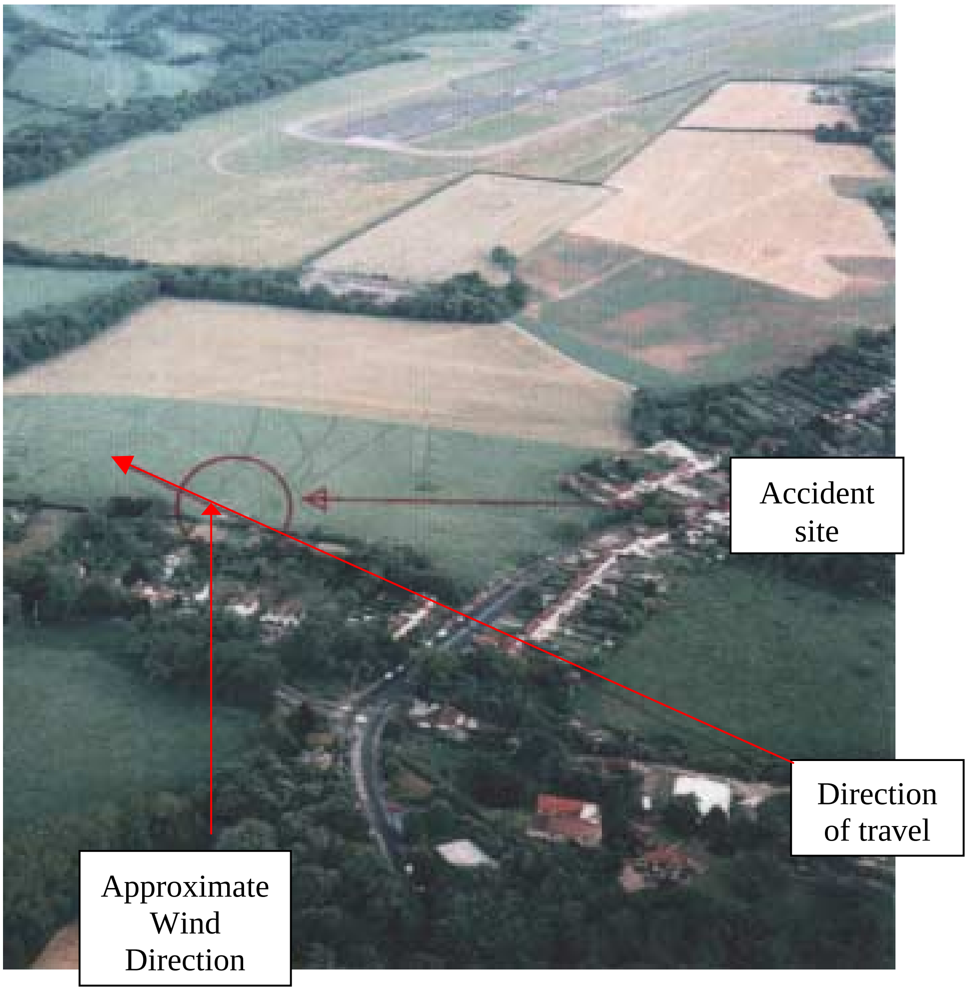
The Vampire is a 1950's vintage, two seat, twin tail-boom aircraft, powered by a turbo-jet engine. The structure of the aircraft is primarily metal, light alloys, although a significant volume of wood is used in the construction of the cockpit area.

The RAF assisted with the recovery of the aircraft.

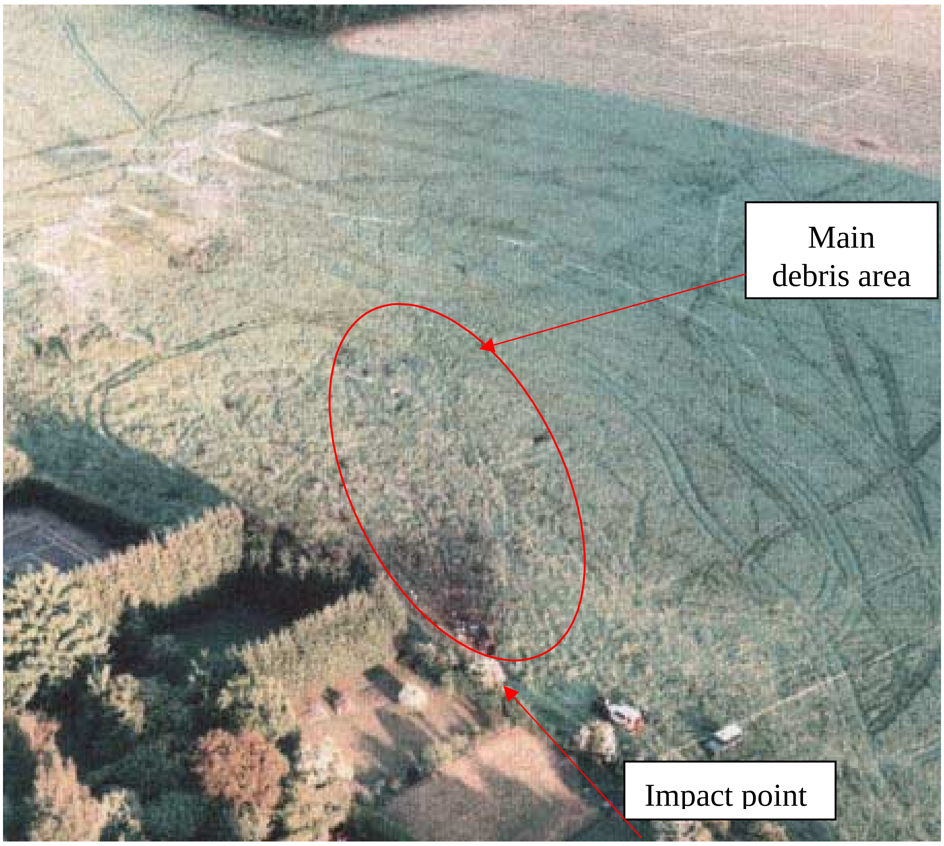
POTENTIAL HAZARDS

Fuel/fluids

- The aircraft was carrying between 1300-1500 ltrs of turbine fuel (kerosene, Jet A1), most of which was destroyed in the post-impact explosion and fire. Some fuel staining of grass was noted over a limited area.



- The engine lubrication system contained 12 pints of light mineral oil, all of which was destroyed or dispersed in the accident.
- The aircraft flying control and undercarriage systems contained a small volume of hydraulic fluid (<10 litres), only traces of which were found remaining in components and pipelines.
- No discernible volume of fluid was noted in the wreckage or on the soil surface during recovery.
- The Fire Service advised that approximately 300 litres of AFFF foam was used in fighting the fire.



Bio-hazard

- The two crew of the aircraft received fatal injuries during impact. Tissue and fluid remains were discovered at points across the accident site, and within the aircraft wreckage.

Dust/debris

- The accident was attended immediately by the airfield emergency services, and the fire was quickly extinguished. The fire service report that their total time on site was less than 40 minutes. The aircraft structure suffered severe impact damage, but relatively minor damage as a result of the fire. No significant volume of dust/particulate was produced.

Pressurised Systems

- Aircraft operating systems included pressurised cylinders of fire extinguishant (BCF), oxygen, and compressed air. Additionally, an accumulator in the hydraulic system was charged with nitrogen. All were found damaged and discharged.

Electrical Systems

- One alkaline battery was installed in the aircraft, and this was found intact and externally undamaged with no apparent spillage of electrolyte. However, on moving the battery, it started to become hot which suggested it may have suffered an internal short circuit. The battery was moved to a safe area to cool, and was later placed in a protective container for transit.

Ejector seats

- Two ejector seats were installed in the aircraft. Neither had been operated, and both had suffered catastrophic damage. Before any seat components were moved, the initiating cartridges were identified and made safe by engineers.

Physical Hazards

- The limited physical hazards evident were those presented by damaged structures.

ENVIRONMENTAL CONSIDERATIONS

No noticeable volume of fluid or particulate was visible at site during the recovery of wreckage. A considerable spread of tissue and body fluid was identified, particularly in the high grass. The airfield operators/landowners arranged for the cutting and disposal of the affected crop.

Site remediation was left in the hands of the authorities, landowners and insurers.

Aircraft incidents and public health

Dr Jane Cooper, SpR in Public Health London CDSC,
On secondment to CIRS January—April 2002

Introduction

The World Trade Centre attacks of September 11th last year have changed many perceptions world wide, and have raised awareness of the potential public health impacts of aircraft incidents. The range of potential impacts will be similar for both accidental and malicious incidents. In the initial stages of response, uncertainty over many aspects of the incident, including the cause, is likely. Actual or suspected malicious intent may amplify fear, and increase the complexity of investigation and management.

While risks of aircraft incidents are highest in the vicinity of airports, incidents may occur anywhere, or affect those resident anywhere. This brief summary, based on a literature review and information from experts, reviews potential impacts (Table 1), and aspects of management relevant to public health specialists. The wider issues of benefits and risks associated with air travel and airports are not discussed.

Table 1: Potential consequences of aircraft incidents

1, Damage to aircraft, other vehicles and ground structures

2. Physical injury to crew, passengers, rescuers, and others on ground

3. Fire and explosion (direct injury, hazardous release, smoke plumes)

4. Environmental release (chemical, radioactive or biological; arising from aircraft components, contents, cargo or damage to ground structures), which may result environmental contamination and in contact, airborne, waterborne or food borne human exposure in the short or long term.

5. Challenges to NHS capacity (including impaired access to health care for others)

6. Evacuation of residents

7. Psychosocial effects on survivors, relatives, rescuers and witnesses

8. Intense public and media interest

9. Disruption of transport and other services and utilities (with possible public health impacts)

10. Corporate risks - breakdown of alliances and co-ordination, allocation of blame, media management, scrutiny of adequacy of planning, and appropriate commissioning, audits, public inquiry.

11. Suspicion of malicious intent may impact community and international relations

Box 1: 1992 El Al crash, Netherlands

In the 1992 El Al crash at Biljmermeer (Bijlmer), Amsterdam, a Boeing 747-200 freighter crashed into an apartment building soon after takeoff, and caught fire[5, 6]. Four on board and 43 on the ground were killed, with 11 serious and 15 minor injuries. Management was complicated by uncertainty over the numbers and immigration status of residents. 31 flats were demolished, 49 were burned, and a further 266 were rendered uninhabitable, creating massive needs for emergency accommodation and support. Initial estimates were of several hundred casualties. An immigration amnesty intended to aid clarification of the numbers affected resulted in over a thousand declared missing, considerable political embarrassment, and deterioration in community and international relations. Complaints were made of poor co-ordination of assistance. Persistent rumours of hazardous cargo were finally confirmed in the 1999 public inquiry report. The cargo included precursors of sarin nerve gas, and the aircraft contained depleted uranium balance weights. Some hundreds of residents allege persistent ill health.

The 1998 major incident planning guidance remains the key document for NHS emergency planning[1]. Preparedness for aircraft incidents needs to include the management of mass casualties, toxic hazards arising from both aircraft structure and cargo, evacuation, psychosocial impacts and critical public attention and subsequent public enquiry. The collaborative response required will include airport agencies and airlines; military aircraft may be associated with particular hazards and specialist military advice will be required.

While accidents are rare, the volume of traffic is large. Aviation statistics for UK airports in 2000 report a total of 161.3 million passenger movements, 2,269,000 tonnes of cargo handled, and 1,674,000 aircraft movements; these totals include non commercial flights. There were 1,020,000 scheduled international aircraft movements[2].

The USA Federal Aviation Authority reports a world wide hull loss rate of 1-2 per million departures for commercial jet aircraft heavier than 60,000 pounds[3]. “Third party” crash risks to residents around Schiphol airport in the Netherlands have been assessed as at least equivalent to those posed by chemical installations[4]. These risks were illustrated by the 1992 El Al crash (Box 1).

Health care needs and service impact

In addition to immediate casualties, there may be health and safety issues in relation to rescue workers and bystanders, and decontamination of casualties may be required. Psychological distress may affect survivors, relatives, rescuers, health care workers, residents and witnesses. Mobilisation of primary and community care may be required in direct response to need, or because of disruption to hospitals.

Immediate health care needs: A review of world airline accidents between 1960 and 1970 advised that in only 1 in 20 accidents will the number of seriously (nonfatally) injured exceed 25% of the aircraft's capacity[7]. A review of 473 world civilian crashes between 1977 and 1986 found only three incidents resulting in more than 50 seriously injured survivors[8]. Incidents that involve ground casualties, or ground collision between passenger aircraft, may cause more casualties; 500 resulted from the Ramstein accident[9]. Fire is more likely in crashes on take off when fuel tanks are full.

Survivors have been reported as suffering primarily head, pelvic and limb injuries[10] (Table 2). The main health care needs will be for resuscitation, general and orthopaedic surgery, intensive care and anaesthetics. Fire will result in burns and smoke inhalation. Capacity to ventilate survivors with upper airways obstruction following smoke inhalation may be important[11]. Pulmonary oedema may develop up to 72 hours after smoke inhalation; casualties may require admission and monitoring although initially well. Existing capacity for burns may be exceeded. Paediatric capacity may be needed; relevant advice has been published[12].

Secondary health service impact: Disruption to receiving hospital(s) function may create secondary impacts (e.g. closure of accident and emergency departments, cancellation of out patient clinics and elective admissions), placing additional burdens on other hospitals, community and primary care, other statutory and voluntary services, and carers. Arrangements must be communicated to audiences including the general public, primary care, and other agencies. After the M1 crash, elective surgery was suspended for 24-48 hours, and ITU was busy for 3 weeks, necessitating cancellation of some operations[13].

Those with minor injuries, contamination or distress may present in primary care, requiring advice on management and mobilisation of resources. Discharge and transfer of patients and delays to treatment may create risks to the health of some patients, and adverse perceptions. Impacts may fall outside the locality requiring co-ordination and communication across boundaries.

Psychosocial effects: Those affected may include those directly injured, relatives and friends of casualties, rescuers, carers, witnesses, and those suffering disruption. Previous life events, and particularly similar events, may increase vulnerability. Evacuees in temporary accommodation may include vulnerable groups and will experience helplessness and uncertainty.

Table 2: Reported injury patterns

Crash	Dead	Injured	Comment
Manchester 1985: 137 on board	52	15 admitted with smoke inhalation: 5 ventilated 2 severe burns	Fire at take off
"MI crash" 1989: 126 on board	39	87 or 88 initial survivors with 324 injuries; 3 hospitals Most had pelvic & leg injuries; fewer spine, skull, chest 27 required ITU 77 head & facial injury - 6 severe	Crash on approach
New York 1990: 161 on board	72	89 admissions; 13 hospitals 26 multiple orthopaedic injuries (fatal & non fatal)	Plastic surgeons' report

The Emergency Planning Society's comprehensive guidance document on the human aspects of disaster advises on good practice and warns of pitfalls to be avoided[14]. Provision of debriefing for rescuers has been seen as good practice, but recent evidence suggests that debriefing may worsen outcomes[15, 16]. Airport emergency plans make provision for reception centres where support includes counselling. Care of evacuees requires liaison with Local Authority departments and primary care.

Environmental hazards

Aircraft structure, contents or impacted ground structures may include hazardous materials. Those exposed may include rescuers, bystanders and residents. Explosion and fire are important mechanisms of release. Environmental contamination may result in immediate or delayed exposure and/or impacts e.g. contamination of the water supply or the food chain. Adverse effects on aircrew due to leaking hazardous cargo have been reported; resulting incapacity may have contributed to the crash[17, 18, 19].

Risk assessment, management, communication and follow up will be needed, as for any chemical incident; some details of potential hazards are given below. Detailed information on hazards (e.g a military database which identifies hazards by model of aircraft) and expert advice on risks will be needed.

Hazard identification

Hazards may arise from aircraft structures, fuel and other consumables, contents (including cargo, passengers and other biological cargo), and damaged ground structures. CIRS has recognised issues relating to the toxicological hazards and has prepared CIRS chemical hazard handout data (see page 6-7).

Hazard type may be

- Physical (e.g. metal and MMMF fragments[20])
- Chemical (e.g. beryllium and depleted uranium (DU)[21], products of combustion of soft furnishings and plastic wiring)
- Biological (e.g. ruptured sewage tanks[22], body parts and fluids[23])
- Radioactive (e.g. DU, tritium escape lighting)

Risk management and communication

Risk management aims to:

- limit exposure to known or suspected hazards
- provide appropriate care, investigation, follow up and information to those actually or potentially at risk

A rapid and appropriate response will require:

- confirmed and updated information;
- a sound assessment process;
- dialogue with experts;
- effective communication with those affected and involved agencies.

The evaluation of benefits and risks of possible interventions will include opportunity costs, secondary impacts, and feasibility in the time available.

Aircraft crashes will include many of the "trigger factors" affecting public perception and media interest[24, 25]. In the vicinity of airports local residents may be members of protest groups and veterans of the planning process. A keen interest in identifying the cause and attributing blame is likely, as is media pressure for access to information on victims.

There might be advantages in adopting a low threshold for initiation of epidemiological follow up i.e. collection of samples and compilation of a database of those potentially exposed. Perceived risks may generate considerable and prolonged anxiety; prompt investigation may demonstrate that residents' concerns are being addressed as well as giving a sound basis for subsequent discussion of alleged health effects. Precautionary sampling may be cost effective compared to the costs of lengthy parliamentary inquiries, and of meeting the demands of large numbers of symptomatic and resentful individuals. In the case of significant exposure, investigation would add to the evidence base and allow surveillance of those at risk of adverse outcomes.

Role of public health physicians

The role of public health physicians is described below:

Before an incident

- to develop and test appropriate plans
- to undertake strategic risk assessment and mitigation.

During and after an incident

- to identify hazards and information sources
- to estimate potential exposures
- to assess possible toxicities
- to assess potential advantages and disadvantages of risk management options
- to assess health needs due to physical injury, exposure to potential hazards and psychological distress
- to advise on risk management strategies, tactics and implementation
- to assess needs and services in relation to evacuated or otherwise affected groups
- to identify vulnerabilities in the health service response to both immediate and delayed needs
- to mobilise resources to augment the health service response
- to communicate advice to those at (perceived) risk and services in contact with them
- to implement data and sample collection if appropriate
- to prioritise these tasks and continually reassess the situation
- to evaluate the response, incorporate lessons, revise plans and publish reports.

Table 3 presents these tasks in relation to type of health impact.

Aircraft incidents are rare but potentially catastrophic events which may suddenly present major challenges to public health. Recent events have further increased the media and public attention likely to attend such events, and raised the awareness of the variety of possible impacts. Meeting these challenges requires speedy and accurate collection of information, expert advice and multiagency collaboration in order to manage risks. To assist these tasks, a detailed framework structuring the information requirements and management decisions while providing a documentary record is under development; an electronic version is planned.

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Table 3 Tasks by type of health impact

Identify risks	• Confirm and gather information • Liaise with specialist advisors • Establish and maintain communications with relevant agencies		
Categorise risks	**Health services impact**	**Public health impact**	**Psychosocial impact**
Characterise risks	• Assess needs • Assess NHS impact	• Risk assessment	• Categories at risk • Assess needs
Facilitate management of risks & responses	• Evaluate local provision • Support onward referral • Mobilise community & primary care • Mobilise voluntary sector	• Advise on risk management	• Advocate & mobilise appropriate targeted provision
Document & communicate	• NHS, partner agencies, media, public • Publish evaluations		
Longer term	• Evaluate response	• Epidemiological studies • Evaluate risk management	• Follow up • Evaluation

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Categorising chemical incidents

Emma Eagles, Research Engineer Land, CIRS

At CIRS we are currently considering the benefits of developing a rapid response tool to be able to measure the potential public health impact of a chemical incident, to be able to define a 'major incident' and a 'no impact incident' from a public health perspective.

Incident categorisation systems have a number of potential uses:

- assessment of the impact of the event on resources
- assessment of the health and environmental impact of the event
- surveillance
- risk communication

In order to develop a scale for chemical incidents it was considered necessary to

- review existing models and how they were developed
- consider the value of devising a scale for chemical incidents
- if appropriate define categories and identify examples

Review of existing systems

Searches were carried out on Web of Science, Science Direct, BIDS and the Internet. The following broad search terms were used:

accident OR incident OR event OR pollution OR risk OR hazard
AND
categor* OR score OR classif* OR system OR scale
(AND)
impact

Overall, results highlighted that very few categorisation systems for assessing the impact of an event have been published. The majority of those that do exist are for natural hazards and that these have some similarities, for example:

- some kind of risk profiling
  - threat (any circumstance or event with the potential to cause harm)
  - likelihood of occurrence
  - impact/consequence
- one-dimensional numerical scoring system

Scales are either used as planning tools or for response (and risk communication) to events when they do occur, although there may be some overlap between the two.

Planning tools

A risk analysis report prepared by the Artic Council's Emergency Prevention, Preparedness and Response (EPPR) Working Group (September 1998) contains the qualitative risk matrix that the eight Arctic nations use to identify and assess potential environmental hazards. The eight Artic nations are Canada, Finland, Greenland, Iceland, Norway, Russian Federation, Sweden, USA. All pollution incidents are considered to fall in one of four categories, which reflect the probability that the incident will occur and the magnitude of the threat (Table 1).

Table 1: Risk categories used by EPPR

Category 1 High probability of occurrence High magnitude of threat	Category 2 High probability of occurrence Low magnitude of threat
Category 3 Low probability of occurrence High magnitude of threat	Category 4 Low probability of occurrence Low magnitude of threat

Response/Risk Communications tools

Three scales for response and/or risk communication have been identified for natural hazards. They are:

- ◊ Beaufort scale (wind speed)
- ◊ Richter and modified Mercalli scales (earthquakes)
- ◊ Torino scale (asteroid collision).

Details about the use of each of these, a description of the scale and examples are summarised in Table 2. Information about two other scales is also included in Table 2. The first of these is the International Nuclear Event Scale (INES). This was developed in the late 1980's following the Chernobyl incident to provide a means of promptly communicating to the public in consistent terms the safety significance of events reported at nuclear installations. The final scale in the table is that used by the Environment Agency to record all types of pollution incident across all aspects of the environment.

A scale for chemical incidents

The idea of being able to categorise events to enable an assessment of their potential impact is not new. A number scales have been developed for natural hazards and other scales have been developed by the nuclear industry and the Environment Agency. Incidents and events are categorised in many different ways.

Chemical incidents could be categorised by:

- the incident impact – health, environmental, resource, overall
- something that is measurable – amount of chemical, number of people affected
- the type of incident – chemical, event, location

This demonstrates that chemical incidents present multi-dimensional problems and so it is difficult to translate the impact of an event to a single number. However, Binzel (2000) suggests that by using a one-dimensional scale some immediate sense of context for the hazard is provided even if there is no understanding of the construction of the scale.

At CIRS we are working towards developing a scale to use as a tool for communicating the potential public health risk of a chemical incident to agencies involved in managing incidents and also to the public. The scale will be used to categorise all incidents from 'major public health impact' to 'no public health impact'. It will be a tool for rapid response and so will initially consider the potential public health impact, not necessarily the actual impact of the event.

We would be very interested to hear and ideas and views about the proposed chemical incidents public health impact scale. Please e-mail any comments to virginia.murray@gstt.sthames.nhs.uk or emma.eagles@gstt.sthames.nhs.uk.

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Table 2: Scales for natural hazards

Name of scale	Use	Description of scale	Levels
Beaufort scale	• created in 1805 help sailors at sea estimate wind speed via visual observations • later modified for use on land	• 12 categories for wind speeds of less than 1 to greater than 119 km/hour • for each category a description and observations have been outlined	*Beaufort force: 0* Description: Calm Observations: Smoke rises vertically *Beaufort force: 8* Description: Gale Observations: Twigs break from trees, difficult to walk.
Richter scale Modified Mercalli scale	• devised in 1935 to identify the magnitude of an earthquake • value calculated reflects the amount of energy released • less precise and measures the intensity of the earthquake	• logarithmic scale • outlines characteristic effects of shocks in populated areas for 12 categories	*Modified Mercalli Scale: I* Richter magnitude: <3.4 Numbered per year: 800000 Characteristics: Recorded only by seismographs *Modified Mercalli Scale: VII* Richter magnitude: 5.5 – 6.1 Number per year: 500 Characteristics: Slight building damage; plaster cracks, bricks fall
Torino scale	• communication tool for astronomers and the public to assess the seriousness of predictions of close encounters by asteroids and comets • colour coded scale (5 categories)	• an object is assigned a 0 to 10 value based on its collision probability and its kinetic energy	*Number on Torino scale: 0* Description: likelihood of a collision is zero Category: White zone – event having no likely consequence *Number on Torino scale: 8* Description: collision capable of causing regional destruction Category: Red zone – Certain collisions
International Nuclear Event Scale	• developed in 1989 as a tool for communicating to the public safety significance of events reported at nuclear installations	• events classified on a scale of seven levels from major accident (7) to anomaly (1). • on-site and off site impacts are considered	*Category: 1:* Description: anomaly *Category: 4:* Description: accident without significant off-site risk
Environment Agency Pollution Incident Categories	• two-tier system looking at both the impact on Agency resources and the actual impact of environmental damage	• environmental impact for each incident recorded for the effect on water, land or air • highest selected criteria determines level of impact	*Category 1:* serious long-lasting or extensive damage to the environment or people *Category 2:* significant effect on the environment or people *Category 3:* minimal effect on the environment or people *Category 4:* no impact occurred

Update on CIRS IPPC activities

Dr Jackie Spiby, Environmental Public Health Consultant IPPC, CIRS

The IPPC regulations which require new and existing installations to apply to the Environment Agency (EA) for a permit to operate, have been in place for a year. CIRS aims to support health authorities (and PCTs in the future) in their role as consultees to the EA. That support varies according to local requirements but ranges from advice on the process to reviewing the application in advance. CIRS is in a position to review the content of the applications but cannot assess the impact of the industry's output on health in the local context.

CIRS has reviewed 120 to date. These include the Corus steel works at Scunthorpe (photograph 1)

IPPC Iterative meeting report

On April 16th an IPPC iterative response development meeting was held in London between CIRS, Birmingham and North East Chemical Incident Providers Units (CIPU) with representatives from the regions supported by CIRS. The Food Standards Agency and the Department of Health (DH) also attended. The aim of the day was to review experiences to date and identify areas where further work is required

Relations with the Environment Agency

The group discussed the importance of developing a good relationship with the EA. It was felt that this helped the two agencies when there was a difficult application. Where there are good relations health authorities have found it easier to get a waiver on the 28-day limit.

Further work:

- CIRS and the other CIPUs agreed to develop a crib sheet for who does what in the EA and an outline of what wording is best used in a formal IPPC response.
- Discussions have also been started with the EA and DH on developing greater understanding between the agencies especially in relation to what the EA expects of health consultees and getting feedback to health agencies.

Ensuring capacity and capability in the future

One of the greatest frustrations for those replying to the EA on applications is the unpredictable workload. This is unavoidable because the applications are reviewed by the EA in batches according to the industry.

CIRS are trying to get the EA to provide advanced warning of what can be expected. CIRS have now increased their capacity and will endeavour to return applications as soon as possible. However it is suggested that locally a discussion with the local EA staff will provide the most useful information on what can be expected.

Further work:

- A major part of the meeting looked at how IPPC will be dealt with in the NHS over the next year. Several regions have appointed dedicated local staff to help the Health Authorities. It is expected that the responsibility will be devolved to Primary Care Trusts (PCTs) and that PCT Chief Executives will be advised of this. However as yet this has not been formally confirmed.
- The chemical providers have agreed to collaborate on various projects including sharing expertise, developing information on specific industries, sharing responses especially where there is one company with several factories across the country. The aim is to attempt to develop a more consistent approach and responses across the country. One of the EA's concerns is the level of variability of responses from different health authorities.

Integrating the IPPC process into a wider environmental needs assessment.

IPPC is just one of the processes available that can be used to develop a process of environmental monitoring across a geographical area. The others include Part IIa land contamination and air quality monitoring.

CIRS are now developing a GIS capacity and would be keen to work with any health agencies that would like to develop a monitoring project in more depth.

Further work:

- Several people said how useful carrying out a site visit is during the process. The visit provides an opportunity to see the process and gain a better understanding. It was felt that a visit with the local EA officers was especially useful. Nobody had had any problems getting access and all had been given a comprehensive visit.

Undertaking health assessments

One of the major frustrations in replying to IPPC applications is the limitation of the health assessment required. For example the EA are not able to take into consideration issues such as increased traffic. This has been discussed previously in the January 2001 issue of the Chemical Incident Report.

Further work:

- A small project team is being set up to look into this further. Please contact us if you would like to be involved.

Forth-coming IPPC applications

Applications are expected from the following:

- Glass and glass fibre, other mineral fibres, ferrous metal (part 2), printing and textiles treatments and treatment of animal and vegetable matter and food industries are due as from May 2002 until 31st July 2002. CIRS have produced fact sheets.
- Organic chemicals are due between January 2003 and August 2003. CIRS are working with the other providers to develop information and help in advance of the applications. Anyone who has organic chemical industries in their patch and would like to be involved should contact us please.
- It is likely that the landfill applications will also be coming earlier than expected. We will keep you informed.

The CIRS IPPC team

The team now consists of Dr Jackie Spiby Consultant in Environmental Public Health, Dr Graham Robertson IPPC Coordinator, Mr Robert Grant IPPC scientist and Mr Richard Mohan GIS Research Engineer. Please feel free to contact us with your queries and any development projects that you would like to develop.

Robert D Grant, IPPC Support Scientist

Robert has recently been appointed IPPC Support Scientist within CIRS and started the position on Monday April 22nd. With an academic background in Cardio-Respiratory physiology, at 23 years, Robert has just graduated with his M.Sc in Human & Applied Physiology from King's College London in January 2002. He promises to pull out all the stops over the next few weeks to get himself up to speed with the hierarchy and various institutions associated with both CIRS and IPPC and looks forward to finding his role within the service. Robert has just returned from a five week trip to the Himalayas of Nepal which included a trek to Mt Everest Base Camp raising funds for Macmillan Cancer Relief.

Richard Mohan, GIS Research Engineer

Richard is a Research Engineer registered with the University of Surrey and is undertaking an Engineering Doctorate (EngD) while working at CIRS. His project will involve using GIS to improve the applicability and resolution of Health Impact Assessment, particularly within the context of Integrated Pollution Prevention and Control. Originally from Co. Fermanagh in Northern Ireland, he obtained a BSc (Hons) in Environmental Science from the University of Ulster in 2000 and a MSc in Ecotoxicology in 2001. He brings to the CIRS team experience of studying a broad range of pollution issues as well as a good knowledge of the modelling of environmental phenomena.

Brief IPPC Guidance

CIRS has been preparing brief IPPC guidance on the different industry. As an example the brief IPPC guidance for glass manufacturing is given on pages 28 and 29. Others have been prepared or are in preparation.

Photograph 1: One of the most complicated IPPC application processed by CIRS so far has been that for the Corus integrated steel works in Scunthorpe, which covers an area of 840 Hectares and produces over 4 million tonnes of steel per year. The photograph shows three of the Four Queens – blast furnace vessels which are named Queen Mary, Queen Bess, Queen Anne and Queen Victoria. © CIRS

Brief IPPC guidance for glass manufacturing

Glass Manufacturing Sector

Schedule 1 of PPC Regulations 2000, Section 3.3

Dr Anyanate Ephraim, Locum CIRS IPPC Support Scientist

1. Key Installations in this sector

- Manufacturing glass and glass fibre
- Production of other mineral fibres

2. Main activities in glass manufacturing

Glass is made by cooling certain molten materials so that, they do not crystallise but remain in an un- crystallised state. Silica is the most commonly used material for this purpose. The industry covers manufacture of flat glass, and pressed and blown glass. Flat glass includes plate and architectural glass, automotive windscreens and mirrors. Pressed and blown glass includes containers, machine and hand-blown glassware, lamps and television tubing. The use of recycled glass is increasing and this requires extensive sorting and cleaning prior to batch treatment to remove impurities. The use of recycled glass reduces the consumption of both raw materials and energy.

For the manufacture of special and technical glass, lead oxide (up to 32 wt. %), potash, zinc oxide, and other metal oxides are added. Refining agents include arsenic trioxide, antimony oxide, nitrates, and sulphates. Metal oxides and sulphides are used as (de-) colouring agents.

3. What are the chemicals used and Summary of Human Toxicity

This list is by no means exhaustive but includes most of the substances that are used or produced during the manufacturing process

Silica

- Substances containing silica are capable of causing silicosis.
- There is sufficient evidence in humans for the carcinogenicity of inhaled crystalline silica
- Silica is irritating to the eye
- Cough, tachypnoea, and wheezing are common after inhalation.
- Redness, swelling and pain may occur on exposure to the skin
- Nausea, vomiting and diarrhoea are possible if ingested

Possible environmental fate

- Silicon is a common air contaminant as dust.
- Occurs freely in nature as sand

Lime (Calcium hydroxide)

- Irritant to the eye and causes burns when in contact with the eyes
- Dust irritates eyes, nose and throat and skin

Possible environmental fate

- Addition of lime to soft water lakes has increased biological activity, possibly by providing a carbon dioxide reservoir.
- Calcium hydroxide does not degrade oxidatively; it is neutralized by absorption of atmospheric carbon dioxide.
- Does not show bioaccumulation or food chain concentration toxicity potential.

Dolomite

- This is a mixture of calcium and magnesium carbonates that is probably carcinogenic
- It is irritant to the eyes
- Cough, tachypnoea, and wheezing are common after inhalation
- Leads to burns on touching the skin

Possible environmental fate

- May ignite on contact with water or moist air.
- Some react vigorously or explosively on contact with water.

Soda (Sodium hydroxide)

- Sodium hydroxide, both solid and in solution, has a very corrosive action upon all body tissue causing burns and frequently deep ulceration, with ultimate scarring.
- Inhalation can cause respiratory irritation and pulmonary oedema
- Exposure to the dust or mist may cause multiple small burns, with temporary loss of hair.

Possible environmental fate

- Persistent in water
- Does not bio-accumulate
- In the case of a solid, anhydrous sodium hydroxide spill on soil, ground water pollution will occur if precipitation occurs prior to clean up. Precipitation will dissolve some of the solid (with much heat given off) and create an aqueous solution of sodium hydroxide, which then would be able to infiltrate the soil. However, prediction of the concentration and properties of the solution produced would be difficult.

Arsenic

- Arsenic is carcinogenic in humans
- Inhalation causes cough, sore throat and respiratory distress.
- It is highly irritating to the eyes and leads to sore eyes, conjunctivitis, itching, photophobia and visual disturbances when in contact with eyes.
- Dermal exposure may cause hyper-pigmentation and other skin disorders
- Ingestion may lead to abdominal pain, vomiting and rice water diarrhoea

Possible environmental fate

- Airborne arsenic is mainly inorganic and concentrations in urban areas may range from a few nanograms to a few tenths of a nanogram per cubic metre
- Arsenic is mainly transported into the environment by water.
- Methylation of inorganic arsenic is associated with biological activity in water

Antimony

- Oral intoxication may lead to violent vomiting due to mucosal irritation
- Systemic exposure to antimony compounds causes loss of hair, dry scaly skin, and weight loss.

Possible environmental fate

- When released to the atmosphere, antimony is generally associated with very small particles that will be removed principally by rain.

- In the absence of rain, antimony-containing particles will be removed very slowly from the atmosphere by gravitational settling and dry deposition. It may therefore, be transported far from source areas.
- Antimony adsorbs strongly to soil and sediment
- Antimony released to water will generally end up in sediment where it is associated with iron, manganese, and aluminium hydroxyoxides.
- The general population will be exposed to low levels of antimony via inhalation of ambient air, ingestion of food and dermal contact with products containing antimony**.**

4. What are the contaminative activities and wastes?

- Activities that lead to pollution include the combustion of fuel to operate the glass melting furnaces and the vaporization and recrystallization of materials in the melt.
- Liquid effluents result from forming, finishing, coating, and electroplating operations. Heavy metal concentrations in effluents occur where silvering and copper plating processes are in use.

Wastes (table 1 and table 2)

- The major emissions are sulphur oxides (SOx), nitrogen oxides (NOx), CO_2, VOCs and particulates, which can contain heavy metals such as arsenic and lead.
- Certain specialty glasses can produce releases of hydrogen chloride (HCl), hydrogen fluoride (HF), arsenic, boron and lead from raw materials.
- Container, press and blow making operations produce a periodic mist when the hot gob comes into contact with the release agent used on the molds.

Table 1: Maximum permissible Benchmark release levels to **air** (Source: BREF section5.5)

Substance	**Benchmark release level (mg/Nm^3)**
NOx	700
SOx	1400
Chlorides	30
Flourides	15
Metals (i)	5
Metals (ii)	1
Particulate	30
Total VOCs	50
CO	200
H2S	5

Key:

Metals (i): arsenic, cobalt, nickel, selenium, chromiumVI

Metals (ii): antimony, lead, chromium III, copper, manganese, vanadium, tin

Table 2: Maximum permissible Benchmark release levels to **water** (Source: BREF section5.5)

Parameter	**Benchmark release level (mg/l)**
Suspended solids	30
Chemical Oxygen Demand	130
Ammonia	10
Sulphate	1000
Fluoride	25
Arsenic	0.3
Antimony	0.3
Barium	3.0
Cadmium	0.05
Total chromium	0.5
Copper	0.5
Lead	0.5
Nickel	0.5
Tin	0.5
Zinc	0.5
Phenol	1.0
Mineral oil	20

5. Possible health effects?

- A risk to human health exists because of the likelihood of exposure to hazardous substances mainly via emissions to air and liquid effluents contaminating surface and ground water.
- Health effects from odours occurring as a result of the curing process
- *Noise pollution is also an important issue from the production process*
- An assessment of the epidemiological evidence base for the possible human health effects attributable to the glass industry will be undertaken by CIRS and shared with Health Protection Units by the end of May 2002.

Sources of information

- Chemical Incident Response Service fact sheets
- Hazardous Substances Data Bank (HSDB) National Library of Medicine http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB
- Environment Agency-IPPC Sector Guidance Note for Glass Manufacturing http://www.environment-agency.gov.uk/commondata/105385/glassa1nov.pdf
- BRIEF IPPC guidance for glass manufacturing http://eippcb.jrc.es/pages/FAbout.htm

Future arrangements for chemical surveillance reports

Dr Giovanni Leonardi, Consultant Environmental Epidemiologist, CIRS

2002 is a transition year for the chemical surveillance systems in England. The arrival of the Health Protection Agency next year means that many of the new arrangements agreed by health protection teams with Primary Care Trusts (PCTs) this year will be revisited and possibly changed next year. Also, there is considerable variation across England with regards to the form of local arrangements and the geographical area covered by health protection teams. In some cases, several PCTs have joined forces to support and work with a single health protection team, elsewhere individual PCTs look after health protection aspects separately from their neighbours.

What does this mean for the surveillance system CIRS is part of? There is a flow of information from the area where the incident occurred to CIRS and another from CIRS back to the health protection teams, but it is not clear at what level the incident data should be aggregated. A common denominator is the PCT, however in many areas of England the health protection function operates across several PCTs, perhaps covering the area of a Strategic Health Authority (SHA), perhaps less. In some cases the health protection function for a particular PCT is therefore provided by a team residing and operating from a neighbouring PCT.

For the next few months, CIRS proposes to aggregate chemical incident data at the level both of PCT and SHA, and to produce summary tables at SHA level, and report these to individual SHAs, with copies to all PCTs included in that SHA. This will also be sent to the local Health Protection Team serving that area. Is this a satisfactory transitional arrangement?

CIRS intends to change this arrangement as soon as the relationship between local health protection teams and PCTs/SHAs/Regional Government Offices are clarified. For the time being, this is CIRS's plan. We welcome any feedback and comments you may have on this issue.

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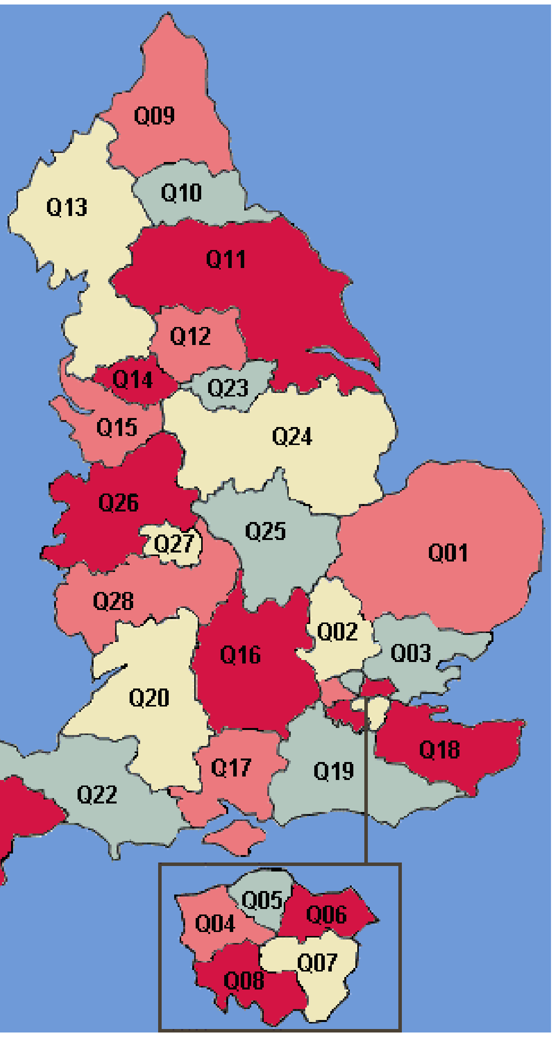

Key

Table 1: All SHAs in England, CIRS will only provide data in its contracted areas

HA	Name
Q01	Norfolk, Suffolk and Cambridgeshire
Q02	Bedfordshire and Hertfordshire
Q03	Essex
Q04	North West London
Q05	North Central London
Q06	North East London
Q07	South East London
Q08	South West London
Q09	Northumberland, Tyne and Wear
Q10	County Durham & Tees Valley
Q11	North and East Yorkshire and Northern Lincolnshire
Q12	West Yorkshire
Q13	Cumbria & Lancashire
Q14	Greater Manchester
Q15	Cheshire & Merseyside
Q16	Thames Valley
Q17	Hampshire and Isle of Wight
Q18	Kent and Medway
Q19	Surrey and Sussex
Q20	Avon, Gloucestershire & Wiltshire
Q21	South West Peninsula
Q22	Somerset & Dorset
Q23	South Yorkshire
Q24	Trent
Q25	Leicestershire, Northamptonshire & Rutland
Q26	Shropshire and Staffordshire
Q27	Birmingham and the Black Country
Q28	Coventry, Warwickshire, Herefordshire and Worcestershire

Getting Ahead of the Curve

The opportunity for Establishing a
National Chemical Hazard Function

Dr Jackie Spiby, Environmental Public Health Consultant, CIRS

Getting Ahead of the Curve provides a unique opportunity to review and develop the provision of chemical hazards and health protection services in the UK.

The past few years of health scares around landfill sites, incinerators, hair dyes etc and the potential for chemical warfare have highlighted the importance of chemical hazards in relation to health protection. It has also become apparent that their importance is not just around acute incidents but chronic issues such as land contamination and sustainability. There has also been a significant development of public interest and concern and desire to be involved in decision-making as well as major legislative changes such as the Integrated Pollution Control Act.

Addressing chemical and health is different to infectious hazards. There are a wide range of other agencies and professionals involved (including fire, local authority, water authorities, Environment Agency) as well as health agencies. The evidence base and surveillance systems are limited as is the level of research into health and chemicals and understanding about how to translate evidence into action and effective policy. There is a general lack of expertise especially within the NHS. Therefore within the NHS there is a need for a skills development programme to develop expertise and ensure it is integrated into the existing services.

As identified in the document 'Getting Ahead of the Curve' there is a lack of clarity about the role of the Department of Health and the NHS in dealing with chemical incidents and the mechanisms established to resolve this still have problems. The current structure is fragmented and with inadequate central control. It has been suggested that the present contractual system between health authorities and regional chemical provider units be changed and the arrangements for managing chemical incidents be revisited.
The Agency gives just such an opportunity.

The general trend and expectation among the future field service practitioners (i.e. Consultants in Communicable Disease Control, Regional Epidemiologists and associated staff) is to increase capacity and expertise available in the field service units at regional or local level. This would include better trained doctors and nurses but also other staff with environmental and chemical related professional backgrounds. These teams would primarily be responding to incidents but would also support surveillance activities, participate in research, undertake IPPC responses and work with local public health staff in PCTs to develop environmental policy and integrate environmental sustainability into local health development programmes.

An increased local capacity would require (as is already the case in infectious diseases) a division within the Agency that had sufficient capacity and skills to lead and support the chemical activities in the field and provide national leadership. This leadership would span response, surveillance and epidemiology, research, policy development, training, provision of expert advice and reference laboratories, development of risk assessment and risk prediction, collaborating with the other agencies, industries and the international community as well as communicating with the public.

At present this function is not focused within any one agency. It is undertaken by The Department of Health, The Focus, Regional Service Provider Units and other agencies. The Agency will not be in a position to directly manage all the functions as so much of the resource lies outside of the NHS and public service arena. But it will provide a central point for coordination and leadership, a function at present missing. However to be achieved successfully it will need more than bringing together the existing players but investment of resources and a development programme which in reality will take several years to achieve.

Reference

Chief Medical Officer, Department of Health, England. Getting ahead of the curve. 10 January 2002
http://www.doh.gov.uk/cmo/idstrategy

National Focus for Chemical Incidents CONFERENCE

The conference will be held in Cardiff (St.David's hotel & spa, Cardiff Bay) from October 2nd.-4th, 2002.

Topics covered will include health emergency planning, deliberate release, integrated health protection, computational advances in chemical incident management and public health surveillance. International aspects will also be highlighted.

Further information is available from:
The National Focus Office 02920 416388
web site: www.natfocus.uwic.ac.uk
e-mail:nfocus@uwic.ac.uk

CIRS Training for 2002

CIRS How to Respond to Chemical Incidents, ***Tuesday 21 May 2002*** *for all Public Health Consultants, Specialist Registrars, Nurses and Professionals who are on call .*
This one day course is an introduction to chemical incident response. Topics covered include a review of recent chemical incidents, how to respond to chemical incidents and lessons learnt, decontamination, exercises and information available from CIRS and the Medical Toxicology Unit. A maximum of 12 places are still available.

CIRS Food Training Day, ***Thursday 20 June 2002*** *for CsCDC, Public Health Consultants, Specialist Registrars, Nurses and Professionals and Local Authority Environmental Health Practitioners.*
This one day course is designed to consider CIRS and CDSC Surveillance, the role
of the Food Standards Agency in responding to chemical incidents, Local Authorities role in investigating chemically related food incidents, and Scrombotoxin and other nasties. A maximum of 20 places are available for this course.

CIRS Update on Environmental Law ***Thursday 18 July 2002*** *for all Public Health Consultants, Specialist Registrars, Nurses and Professionals on call, Directors of Public health of Primary Care Trusts and Local Authority professionals*
This one day course is designed to provide an update in environmental law. The day will concentrate on problems reported to CIRS by public health professionals and will include issues relating to potentially exposed individuals who refuse decontamination to planning issues about proximity of housing to landfill sites. In addition it is proposed to review the implications of 'class actions' and new legislation from the European Community. A maximum of 30 places are available for this course.

CIRS Environmental Management Training Day. ***Thursday 19 September 2002*** *for CsCDC, Public Health Consultants, Specialist Registrars, Nurses and Professionals on call and Local Authority Environmental Health Practitioners*
This one day course is an introduction to environmental management of chemical incident response. Topics covered include a review of recent chemical incidents, which environmental issues to consider in response to chemical incidents and lessons learnt, with the related environmental issues such as sampling strategies, exercises and information available from CIRS. A maximum of 40 places are available for this course.

CIRS How to Respond to Chemical Incidents, ***Thursday 17 October 2002,*** *for all on call Public Health Consultants, Specialist Registrars, Nurses and Professionals*
This one day course is an introduction to chemical incident response. Topics covered include a review of recent chemical incidents, how to respond to chemical incidents and lessons learnt, decontamination, exercises and information available from CIRS and the Medical Toxicology Unit. A maximum of 40 places are available for this course.

Waste Management Training Day,
Thursday 21 November 2002
(for Public Health Professionals/Managers and Local Authority Environmental Health Practitioners)
This one day course is an introduction to waste management issues. Topics to be covered will include a review of waste management strategies, landfill and incinerator studies, media handling and legal issues with exercises and information available from CIRS. A maximum of 40 places are available for this course.

Current training secondments

The current public health trainees with CIRS are:

Dr Cleo Rooney, London Region
Dr Ibrahim Abubakar, Eastern Region
Dr Gill Lewenden, South West Region

Dr Desiree Elkabir is undertaking a three month secondment to CIRS. She is a 5th year SpR on the SE Thames rotation in Respiratory Medicine. She intends to look at the acute and chronic respiratory morbidity resulting from chemical incidents, in particular those involving air incidents, explosions and fires but also incidents involving asbestos and pollution.

CIRS Staff developments

Sarah Qureshi: Sarah has recently joined CIRS as our Business Manager. Previously she has worked for the Human Fertilisation and Embryology Authority as an Inspector/Auditor before completing her MSC in Management at the University of Bath. One of her main duties will include managing the service level agreements, please also contact her for all your training day bookings and requirements.

Jaimie Cunningham: Jaimie has joined the CIRS as our Office Administrator. Jaimie trained in administrative skills at the Insititute of Civil Engineers. She is the main port of call for public enquiries and provides secretary support for our three consultants.

Rico Euripidou CIRS regrets to announce that our Environmental Epidemiologist, Rico Euripidou gone travelling.. Rico joined our team in 1998 and has been a regular contributor to the CIR as well as a dedicated member of the CIRS team.

Nannerl Herriot: Nannerl will be joining CIRS in early June 2002 as our environmental epidemiologist. She will be joining us from North and East Devon Health Authority where she has spent the last eighteen months developing local capacity in Health Impact Assessment for local concerns such as foot and mouth disease and composting. Nannerl presented her work on foot and mouth at an international symposium in October 2002. Her first training was as an Environmental Health Officer and she has had over ten years experience in this field. During this period she acquired specialist expertise in pollution control, health and safety and food safety.

Chemical Incident Report
Edited by Dr Virginia Murray, prepared and distributed in collaboration with Dr Jackie Spiby, Dr Giovanni Leonardi, Henrietta Harrison, Sarah Qureshi, Jaimie Cunningham, Ivan House and the staff of the Chemical Incident Response Service.