

# Chemical Incident Report

ISSN 1364-4106

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

Number 13  
July 1999

## **Editorial**

*Dr Virginia Murray, Director, Chemical Incident Response Service*

The Chemical Incident Response Service (CIRS) has had a busy three months since the last Chemical Incident Report (CIR). As a result of these activities, this CIR targets three main areas of concern, these are:

- **non-domestic fires** and the need for an early public health response in order to minimise the impact of the plume and particulate fall-out on members of the public. Two HAs have written up recent incidents where their participation has been valuable. A draft fire checklist has been prepared and CIRS would be grateful for any comments. A table of the possible products of combustion from fires has also been included.
- **chemical contamination of Accident and Emergency Departments (A&E)** has a potentially significant impact on health care resources for the local community. Unfortunately such events continue even though new guidance from NHS Executive was published in November 1998. CIRS is grateful to two A&E consultants and one HA team who have contributed reports on their experience in recent incidents. CIRS has recently published a book for A&E on the management of chemical incidents which may be a helpful source of information which HA might care to bring to the attention of A&Es. Continuing surveillance of such events and any additional lessons learnt will be published in future CIRs.
- **food and drink contamination** has received wide media coverage recently. Some of these incidents are summarised in this CIR from a UK viewpoint. However continuing concern exists about the potential for such incidents to occur and CIRS will remain vigilant.

## **Contents**

	<b>Page</b>
FIRES	2
A fire in a plastics packaging warehouse in South Lancashire	2
Warehouse fire at Wolverton, Milton Keynes, Buckinghamshire	3
Draft non-domestic fire incident checklist for Health Authorities	5
Proposed products of combustion	8
ACCIDENT AND EMERGENCY DEPARTMENTS CLOSURES DUE TO CHEMICAL CONTAMINATION	10
Accident and Emergency Departments and CIRS experience	10
Chemical incident responded to by University Hospital Aintree	10
Chemical incident responded to by Maidstone Hospital	11
Chemical incident in an aircraft hangar in Wiltshire	12
Editorial on Accident and Emergency closures due to chemical contamination	13
FOOD AND DRINK RELATED INCIDENTS	14
Review of recent food and drink incidents	14
Intoxication of curry at Wakayama, 1998	14
Itai Itai Byo – Japan, 1940's	15
Detection and identification of unknown poisonous substances from patients materia: the experience of CIRS, London	16
11th World Congress on Disaster and Emergency Medicine, Japan, May 10-13 1999	17
The Healthy Planet Forum, London, June 15-18 1999	18
Setting the Freshwater Agenda for the 21st Century, London, June 16 1999	19
Announcement: Guy's, King's and Thomas' Institute of Toxicology	20
Training days	20

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**FIRES**

*Dr Virginia Murray, Chemical Incident Response Service*

CIRS has assisted Health Authorities in responding to non-domestic fires for some years. Some responses have been effective in reassuring members of the public appropriately but others have resulted in continuing concern. Bridgman<sup>1</sup> reports in the June issue of the Journal of Public Health Medicine on a fire where fallout containing asbestos resulted in considerable public concern. He lists a series of lessons learnt including the need for the early creation of an acute environmental incident team, even in incidents that do not result in immediate adverse health effects amongst the community exposed.

This and other fires have suggested the need for a review by CIRS:

- two recent fires are described below where rapid response has helped to minimise potential harm to the public.
- CsCDC have requested a checklist for response to non-domestic fires, this is provided on pages 5 – 7.
- identifying the products of combustion is difficult toxicologically. A table reporting on the likely products of combustion is included on pages 8 – 9. Continuing research will be required to verify these chemicals.

*Reference*

1. Bridgman SA, Lessons learnt from a factory fire with asbestos-containing fallout. J Pub Health Med 1999; **21**, 158-165

**A fire in a plastics packaging warehouse in South Lancashire**

*Dr. Kenneth Lamden, Consultant in Communicable Disease Control, South Lancashire Health Authority*

**The Incident**

On Sunday 30th May 1999 at 15.30 hours, the CCDC on-call for South Lancashire Health Authority was advised of a large fire that had activated the county wide chemical incident procedure, ‘Operation Merlin’. Twenty fire tenders were at the scene of the fire at a plastic packaging warehouse and a large plume of smoke over 400 feet high and stretching 3 miles had formed. The warehouse was situated on an industrial estate next to an animal feed producer and near to a unit which stored diesel. Immediately downwind of the plume were the M6 motorway and a railway line. The plume was drifting over a housing estate of approximately 2,000 people and moving over farmland with grazing cattle. There were two immediate problems relating to the plume:

- Hydrochloric acid formed from the combustion of polyvinyl chloride - there were reports of some fire fighters with skin tingling and irritation of the nose and throat
- Reduced visibility on the M6 which soon caused the motorway to be closed

The emergency services had given advice via the helicopter at the scene and on the local radio for people to stay

Table 1: Environmental sampling strategy agreed for plastics packaging factory in South Lancashire

Purpose of sample	Type of sample	Sample number	Site of sample	Site of control sample	Timing/frequency	Time period for sampling & analyses
Detect asbestos fibres released by fire or from site	Air	Serial samples	At site	Not applicable	Daily 8 hour samples	Until site covered or cleared
		2 paired samples	In path of plume	Outside path of plume	Single 8 hour sam-	Further samples if initial sample posi-
	Gutter water	2 paired samples	In path of plume	Outside path of plume	Single 8 hour sam-	Further samples if initial sample posi-
Determine proportion of asbestos containing debris deposited in plume	Debris	Multiple samples	From multiple sites in plume path pme	Not applicable	As debris is retrieved	Until adequate samples (10 plus) obtained
Sample for storage and analysis if required dependent on reported symptoms	Soil (samples to be stored for 1 year)	3 samples	At site	Not applicable	Single samples	Analyses to be undertaken only if concerns about dioxins or other chemicals arise
		3 paired samples	In path of plume	Outside path of plume	Single samples	

indoors and close windows and doors. Nevertheless a large crowd had gathered to observe the fire.

The police set up Gold Command, which the CCDC attended along with representatives from the emergency services, the County Analyst, the Environment Agency and the Environmental Health Department. In Gold Command the CCDC was asked for advice on the effects of the plume on emergency services personnel, on the local population and on farm animals. The CCDC was also asked for advice on the effects of moving from containment to extinguishing the fire. Gold Command ran for 2 hours until the fire was under control and the motorway was re-opened. During this time all Nursing and Residential Homes were contacted and advised to close windows and doors.

Immediately following the fire the Environmental Health Department organised a clean-up of debris which had been deposited over the surrounding area. The debris was found to contain asbestos from the warehouse roof. A local incident team including Public Health was formed to manage the incident. People were advised not to pick up debris and not to mow their lawns. At this point media interest was re-awakened and television interviews were given.

The Public Health response to the incident included:

- *Surveillance for health effects* by alerting all GPs, the A & E Department and by contacting NHS Direct to identify any people with symptoms that may have been attributable to the fire. A questionnaire was devised and administered to a sample of patients attending local GPs. This was intended to estimate the level of any unreported health effects. No important level of unreported symptoms which could have been associated with the fire was detected.
- *A site visit* by CIRS to advise on the clean-up and highlight any ongoing environmental and public health risks.
- *Devising a sample strategy* (Table 1).

#### *Lessons Learnt*

Several issues relating both to the acute phase (Gold Command) and the post-acute phase (clean-up and population surveillance) were highlighted by this incident:

#### *Acute Phase:*

- the need for timely and accurate information from the site of the incident
- the public health doctor needs immediate access to high level technical support (as provided by CIRS) which may include advice on plume dynamics and on the effect of the combustion products in the plume of putting water on the fire
- the presence of the County Analyst at Gold Command was extremely helpful in this respect.
- the presence of the Environment Agency in Gold Com-

mand was extremely helpful.

- whilst in Gold Command another public health doctor needs to be available for out of hours calls

#### *Post Acute Phase*

- the need for good e-mail links with CIRS during the questionnaire design phase for timely contribution and feedback
- the value of a site visit by a specialist
- the need to specify a sampling strategy, Table 1 lists the agreed sampling strategy
- the need to undertake actions with a view to answering questions that may be asked several months or even years hence
- it is not clear what the threshold should be for undertaking a potentially resource intensive epidemiological study, although several factors will influence this decision
- NHS Direct do not have an 'incident' field on their call logging system and this may be a useful to develop

## **Warehouse fire at Wolverton, Milton Keynes, Buckinghamshire**

*Dr Diane Gray, Specialist Registrar in Public Health Medicine, Buckinghamshire Health Authority*

#### *Incident summary*

A major fire in a white goods warehouse in Milton Keynes in June 1999 which caused a dramatic plume of smoke and gases to be blown through Buckinghamshire demanded an immediate and follow-up public health response.

Risks from exposure to the large plume necessitated public health advice and investigation supported by the Chemical Incident Response Service (CIRS), and liaison with NHS services and environmental health departments.

An outline of events is provided in Table 2.

#### *Consequences*

There were no casualties from the fire itself.

In the 48 hours after the fire the Milton Keynes Accident and Emergency department treated one asthma case related to the fire and gave telephone advice to several callers.

The A&E department in Stoke Mandeville Hospital 20 miles south of the fire and within the path of the plume treated 26 asthma cases, anecdotally depleting the department of nebuliser supplies. On investigation twelve asthmatics were treated the previous weekend in June 1999 and 14 asthmatics treated during the equivalent weekend in 1998. However, although the air quality over the weekend

11-13 June 1999 was average pollen counts were moderate-high.<sup>1</sup>

The telephone help line, NHS Direct, received 24 calls; 10 seeking general advice about safety measures, and 14 about symptoms experienced after smoke exposure.

The local GP co-operatives did not receive any calls relating to the fire.

**Lessons learnt**

- In this incident, despite prompt and correct public health advice, many members of the public including children and toddlers remained outside - and exposed - to watch the progress of the emergency services at the fire. Attempts by the police and environmental health to usher people indoors were largely unsuccessful.
- The need for urgent laboratory analysis to determine if

any asbestos was present required the use of a laboratory known to have 24 hour facilities in Sefton, North West Region. The Health Authority is grateful for their support.

- This incident occurred on a Friday afternoon. Out of office hours, it would have been difficult for the on-call public health practitioner to mount a speedy and thorough response. To ensure an efficient emergency response to all incidents, improved organisational support is being secured from the Health Authority and its local NHS Trusts.
- To be effective Public Health Departments must work in partnership with local NHS services and environmental health departments, CIRS and, especially, new services such as NHS Direct.

1. Source of pollen information: National Pollen Research Unit: 01 905 855200, Department of Environment, Transport and Regions

**Table 2: Outline of events, 11 June 1999**

Time	Event	Public Health Action
1350	Fire started at warehouse, Wolverton	
14.32	'Major Incident' called by Thames Valley police. <ul style="list-style-type: none"> <li>• Silver Command established at Milton Keynes Police Station.</li> <li>• Incident Room opened at Milton Keynes Council Environmental Health Department</li> </ul>	
14.45	Buckinghamshire's Public Health Department informed of fire by Environmental Health & CIRS: large cloud of thick black smoke rising an estimated 1000ft into air, blowing eastwards across Milton Keynes city. Debris - particulate matter & ash - falling from plume onto areas of city	<ul style="list-style-type: none"> <li>• Advice sought from CIRS</li> <li>• Consultant in A&amp;E at Milton Keynes General Hospital contacted &amp; faxed information from CIRS</li> <li>• Letter produced to alert medical professionals of the incident, for distribution to GPs in Milton Keynes area, local out-of-hours GP co-operative NHS Direct, and local Community Trust</li> </ul>
15.04	Faxed information arrived from CIRS on Products of Combustion	<ul style="list-style-type: none"> <li>• Regional Emergency Planning Officer alerted</li> <li>• Bedfordshire's Public Health Team alerted of plume blowing towards that county</li> </ul>
16.15	Wind changed direction - plume now being blown south towards Aylesbury Vale (mid- Buckinghamshire)	Alert letter sent to all GPs in Aylesbury Vale and GP co-operative, and to A&E at Stoke Mandeville Hospital, Aylesbury
17.40	CCDC & Specialist Registrar joined CIRS's Dr Murray in the Incident Room	Review toxicology of products of combustion and potential hazards from debris with CIRS
18.00	Plume reached South Buckinghamshire	Alert letter sent to A&E at Wycombe Hospital and local GP co-operative
19.00	Emergency meeting held by Milton Keynes Council Chief Executive	Assessment of health risk and need to evacuate local inhabitants required
20.30	Visit to warehouse site by Health Authority and CIRS with Environmental Health officers	Fire controlled. Samples taken for analysis including asbestos. No need for evacuation.



**Acknowledgement**

CIRS is grateful to Andy Barnes and the other Environmental Health Officers of Milton Keynes Council for the photographs of the fire. Above the photograph shows the plume from the top of the Council Offices at the time of the fire, 11 June 1999, and the photograph below the aftermath at the fire site, dated 17 June 1999



**DRAFT NON-DOMESTIC FIRE INCIDENT CHECKLIST FOR HEALTH AUTHORITIES**

*Dr Virginia Murray and Fiona Welch, Research Engineer-Air, CIRS*

The concept of a checklist for public health response to fires was raised at the CIRS Air Strategy Training Day, 11 February 1999. Checklists provide a summary of the experiences CIRS has gained as a result of response to incidents. No checklist includes all issues that are likely to be raised.

We are grateful for comments from Dr Bob Maynard, Department of Health, and from the following CsCDC:

- Dr Ken Lamden, South Lancashire
- Dr Amelia Cummins, South Essex
- Dr Lorna Milne, West Hertfordshire

Any further comments on the checklist would be welcome.

*Introduction*

Large industrial fires are relatively rare but do present specific issues that need to be addressed quickly. Please do not hesitate to contact CIRS in the event of such an incident.

This draft checklist applies to non-domestic, warehouse, waste treatment plant or factory fires and should be used in conjunction with:

- acute chemical incident checklist (published in CIR 10, October 1998)
- chemical water incident checklist for health authorities (published in CIR 8, April 1999) for water run off from fire management (updated version to be published in CIR, October 1999).

The draft checklist addresses the following issues including an Action card summary overview and

- Questions to ask notifying organisation
- Initial risk assessment - recommendations
- Whom to consider alerting
- Points to consider for discussion with Ambulance Service, Accident and Emergency and GPs and NHS Direct
- Environmental sampling
- Clean up
- Data required for completion of incident assessment

**ACTION CARD SUMMARY OVERVIEW**

1. What are casualties complaining of?
2. What toxic hazard should I be thinking about?
3. Is there a downwind hazard?
4. Do I need to warn/evacuate anybody?
5. Can I get samples: smoke or water runoff?
6. Is clean up safe?
7. Have I alerted all the key groups including CIRS?

**DRAFT NON-DOMESTIC FIRE INCIDENT CHECKLIST FOR HEALTH AUTHORITIES**

**QUESTIONS TO ASK NOTIFYING ORGANISATION**

- **Fire**
  - ⇒ Where is the fire?
  - ⇒ When did the fire start?
  - ⇒ What is burning?
  - ⇒ Is there a risk of significant spread or of explosion?
  - ⇒ How big is the fire? How many fire tenders are in attendance?
  - ⇒ How hot is the fire? i.e. over 1,000°C or less than 1,000°C - ask Fire Brigade
  - ⇒ How is the fire being managed? left to burn / dowsing with water or foam / other ?
- **Any estimate of what is in the smoke plume (the products of combustion)?**
  - ⇒ What information does the Fire Brigade, Local Authority, Environment Agency or other services or manufacturer or warehouse owner hold on chemicals and their storage building materials
  - ⇒ Ask specifically about the following
    - asbestos in roofing material
    - chlorinated products (e.g. polyvinyl chloride)
    - nitrogen containing products (e.g. fertilisers)
    - plastics and isocyanates
    - radioactive materials
- **What is within the affected area? i.e. information on down-wind hazard?**
  - ⇒ Is the area urban, residential, industrial or rural? Any motorways or major transport routes? Any susceptible population e.g. hospitals, schools, nursing homes? Any caravan parks? Most fires require population sheltering to protect from plume and products of combustion
  - ⇒ Local weather conditions? What is the wind direction? Is it raining? Is it sunny or cloudy?
  - ⇒
- **Is a CHEMET available: if yes ask for copy, if no ask Fire or Police to request**

**INITIAL RISK ASSESSMENT - RECOMMENDATIONS**

- **Aim**
  - ⇒ *to minimise risks to public and confirming value of harm minimisation process*
- **Methods**
  - ⇒ *to consider methods to reduce exposure to hazard*
  - ⇒ *to define affected population and monitor disease levels*

- Identify the potential health effects from the products of combustion
- Limit public exposure to hazards, consider advising on evacuation or sheltering until fire is out
- Consider identifying all affected casualties
- Consider taking biological samples from any affected sentinel cases
- Consider environmental sampling to confirm contents of building or plume and for any particulate or building debris including asbestos

**WHOM TO CONSIDER ALERTING**

- Refer to health authority chemical incident plan and ensure relevant members of health authority are informed
- Alert CIRS as soon as you are aware of the incident and pass on as many details as possible
- Urgently identify if possible plume pathway, range and possible particulate deposition
- With this plume data, consider informing neighbouring CsCDC and any local hospitals and GPs under or near to the plume. Part of warning may need to include advice about turning off air conditioning intakes
- Remember vehicles (cars, lorries, trains, aeroplanes) can travel through plumes and can spread contamination some distance from the source: wider warnings may be required
- Ensure 'at risk' groups of patients especially those with pre-existing respiratory disease are alerted. This may be via loudspeaker van, local radio or a letter drop etc.
- Ask an EHO to attend scene of fire to gather extra information and possibly undertake sampling. EHOs or PH staff attending fires or involved in sampling or clean-up should wear appropriate personal protective equipment
- Check Environment Agency has been contacted to warn of potentially contaminated run-off water entering drains or sensitive water courses
- Check MAFF has been contacted to warn of any secondary contamination to food sources from plume deposition

**POINTS TO CONSIDER FOR DISCUSSION WITH AMBULANCE, ACCIDENT AND EMERGENCY DEPARTMENTS AND GP AND NHS DIRECT**

- Record all names of patients or enquiries with address, post code and telephone numbers. Follow up may be required
- Ambulance and A&E to confirm that they can
  - ⇒ activate plans as appropriate with the aim to minimise secondary and tertiary exposure and contamination; confirm staff are using appropriate personal protective equipment

- ⇒ try to prevent any patient entering ambulances or A&E without appropriate decontamination if practical.
- ⇒ remove and bag patients' clothing as soon as possible
- ⇒ assess and manage affected cases according to hazard exposure and consider taking biological samples from any affected sentinel cases
- ⇒ check water used in decontamination is contained and disposed of safely - consider contacting the Environment Agency
- ⇒ manage those exposed who may resist decontamination or follow up if they have no symptoms
- Alert GPs and NHS Direct to the need to identify those exposed, record any reported adverse health effects and pass this information to Health Authority
- Consider seeking NHS Direct assistance to provide a help-line information source; provide them with any information on clean up recommendations

### ENVIRONMENTAL SAMPLING

- Depending on the spread of plume, ensure relevant local authority(ies) are alerted so that environmental sampling to confirm contents of plume, any particulate or building debris including asbestos, can be initiated if required. Consider asking an EHO to attend scene of fire to gather extra information
- Consider developing a sampling strategy urgently. Where relevant and following discussion with Health Authority(ies), Local Authority(ies) and CIRS, environmental samples required may include, if safe to collect, the following:
  - ⇒ At time of fire in order to identify products of combustion
    - air sampling within the plume, under the plume and/or at plume grounding, if safe and feasible
    - fire water run off samples
  - ⇒ After the fire is contained and controlled in order to identify other contaminants such as asbestos, collect from:
    - fire site* to include if possible air samples, debris samples and soil samples
    - area of plume deposition* to include if possible window sill wipes and gutter run off samples, particulate and debris samples, food samples including allotment samples and soil samples
- Consider taking samples from an area within plume and use area not covered by plume as control
- Consider having a 'chain of custody' for sample collection, and document laboratory UKAS accreditation and share results between the Health Authority, CIRS and others in incident team
- Consider having those samples which may have an impact on clean up analysed urgently: many of the other samples may be held and only analysed later if required

### CLEAN UP

- Contain fire site - children have regularly been found playing on these sites - therefore rapid implementation of effective site security with fencing and security patrols if necessary is essential
- Check no further contamination is likely to spread from fire site when fire contained - consider recommending use of water or tarpaulins to maintain dust and debris control
- Clean up must be carried out by appropriately trained and protected staff - consider seeking advice from Health and Safety Executive (HSE)
- Information on clean up needs to be implemented quickly - consider providing information to the public with the help of the local media which can be followed up by letter drops
- Asbestos must be identified urgently - follow advice from HSE and do not let untrained and unprotected staff remove debris
- Depending on the reported health effects and the products of combustion, it may be appropriate to consider advising local inhabitants on issues to minimise their exposure such as:
  - ⇒ prevent children playing with any debris
  - ⇒ consider keeping pets indoors until clean up complete
  - ⇒ do not mow lawns until clean up complete
  - ⇒ depending on safety consider either providing a full clean up service by the Local Authority, or alternatively consider asking adults to wear thick plastic gloves and collect debris in gardens, etc. and place in clearly marked containers, for the safety of refuse collectors
  - ⇒ consider setting up a help line to provide full clean up assistance for the elderly or those with disabilities or impaired vision

### DATA REQUIRED FOR COMPLETION OF INCIDENT ASSESSMENT

- Data from CIRS fact sheets and any literature review
- Data from hospital and GP attendance. Even negative reports are valuable to show minimal harm from fire and mitigation. Any surveillance data should be undertaken and analysed in conjunction with CIRS
- Data from environmental sampling, including sampling strategy, laboratory UKAS accreditation and results
- Request copy of Fire Brigade report, photographs, video and other relevant material
- Request copy of any CHEMET or other plume modelling information if not already provided
- Consider requesting copies of Police report, Environment Agency report, MAFF report or others
- Copies of any media reports
- Copies of HA reports to CIRS for data records and incident written up to disseminate lessons learnt

**PROPOSED PRODUCTS OF COMBUSTION**

*Dr Virginia Murray, CIRS*

An Ad-Hoc Working Group on the Toxicology and Health Effects of Smoke Toxins was set up in 1996. Working party members included from the Department of Health Dr Bob Maynard, Dr Fraser Kennedy (who then worked at the Department), Sandy Whitehead, from the Fire Research Station at Building Research Establishment, Watford, Prof. David Purser and from the Medical Toxicology Unit Dr Virginia Murray. The working party met under the chairmanship of Sir Eric Stroud, as part of the work of the Health Advisory Group on Chemical Contamination Incidents.

The main output of the group was an internal document on smoke toxins. This has not been published. However, with the support of Dr Maynard, this CIR publishes the table that was prepared to identify the products of combustion from eleven non-domestic fires likely to arise in the UK. This

data has been prepared to show the relationship between fire type and hazard development (Table 3). It does not include information on building materials, in particular asbestos. Dioxins and other exotics are also not included.

The products of combustion identified in this table have not been verified. Research is needed into fires to determine whether these chemicals are the most likely products of these fires. Fire management may also change the type of products of combustion: for instance water will lower the temperature of the fire which can result in different chemicals being present in the plume.

One of the reasons for publishing this data is to provide information for environmental health departments as they will be concerned with environmental monitoring. This allows them to confirm that their Departments have the appropriate protective clothing, sampling equipment, 'chain of custody' and analytical laboratories able to analyse for these chemicals if necessary and for their staff to have had the necessary training.

**Table 3: Relationship between fire type and hazard development**

Fire Type	Zon e of risk	CO	HCN	HCl	P <sub>2</sub> O <sub>5</sub>	Iso-cynate	Irritants eg Acrolein	HF HBr	PAHs eg Benzene	NO <sub>x</sub>	SO <sub>2</sub>	NH <sub>3</sub>	Particles
Rubber tyres, Belt-ing	1	+++	+	+	-	-	+++/ ++	-	++	+	+++ +	-	+++
	2	+-	+-	+	-	-	++/+	-	+-	+-	+++/ ++	-	++
	3	-	-	-	-	-	+	-	-	-	++	-	+
Petrol stor-age eg. Pet-rol station	1	++	-	-	-	-	++	-	+	-	-	-	+++
	2	-	-	-	-	-	+	-	+-	-	-	-	++
	3	-	-	-	-	-	-	-	-	-	-	-	+
Plastics Factory/Warehouse	1	+++	+++	+++	+	++	++	+	++	++	+	+	+++
	2	+-	+-	++	-	++	++	+-	+-	+	+	+-	++
	3	-	-	+	-	+	+	-	+-	-	-	-	+
Resins and Adhesives	1	+++	++	+	-	++	++	+	++	++	-	+	+++
	2	+-	+-	+	-	++	++	+-	+-	+	-	+-	++
	3	-	-	-	-	+	+	-	-	-	-	-	+
Paints and Solvents	1	+++	-	++	+	++	++	-	++	-	-	-	++
	2	+-	-	+	-	++	+	-	+-	-	-	-	+
	3	-	-	-	-	+	-	-	-	-	-	-	-
Upholstery-Polyur-ethane	1	+++	+++	+++	-	++	++	+	++	++	+	+	+++
	2	+-	+-	++	-	++	++	+-	+-	+	+	+-	++
	3	-	-	+	-	+	+	-	-	-	-	-	+

**Table 3: Relationship between fire type and hazard development – continued**

Fire Type	Zone of risk*	CO	HCN	HCl	P <sub>2</sub> O <sub>5</sub>	Iso-cynate	irritants eg Acrolein	HF HBr	PAHs eg Benzene	NO <sub>x</sub>	SO <sub>2</sub>	NH <sub>3</sub>	Particles
Vegetation - Forests	1	+	-	-	-	-	+	-	+	+	-	-	+++
	2	-	-	-	-	-	+	-	+-	+-	-	-	+-
	3	-	-	-	-	-	-	-	-	-	-	-	-
Oil Refineries Storage tanks	1	+	-	-	-	-	++	-	+++	-	+	-	+++
	2	-	-	-	-	-	++	-	+-	-	+	-	++
	3	-	-	-	-	-	+	-	-	-	-	-	+
Waste Tips	1	-	+	+	-	+	++	+	+	+	+	+	++
	2	-	+-	+	-	+	+	+-	+-	+-	+	+-	+
	3	-	-	-	-	-	-	-	-	-	-	-	-
Pesticide and especially OP stores	1	+++	-	++	++	++	++	-	++	-	-	-	++
	2	+-	-	++	++	++	+	-	+-	-	-	-	+
	3	-	-	+	+	+	-	-	-	-	-	-	-
Phosphorus fires	1	+++	-	+	+++	++	++	-	++	-	-	-	++
	2	+-	-	+	++	++	+	-	+-	-	-	-	+
	3	-	-	-	+	+	-	-	-	-	-	-	-

*Key to Table:*

*\* Zone of risk*

- **Zone 1 Risk:** This is within the immediate vicinity of the fire. Conditions here are very dangerous and it is recommended that only fire brigade personnel wearing breathing apparatus and protective clothing enter this zone. Main risks include smoke, heat and asphyxiant gases.
- **Zone 2 Risk:** This is immediately outside the fire zone. Although a hazardous location it is not likely to present immediate danger to health. The size of this area is dependent of the fire and substances within the fire. It is anticipated that only emergency services will occupy this zone. However a risk of exposure to diluted toxins from the fire still exists and personnel should avoid exposure to smoke as far as possible.
- **Zone 3 Risk:** This area covers the surrounding locality. Not thought to be immediately dangerous or life threatening. However, exposure may result in 'nuisance effects' in people's health. Exposure of

sensitive individuals should be avoided and the general population should be advised to shelter. Buildings within this zone with heating and ventilation systems may be affected and consideration should be given to this. Toxic effects will be the same as zone 2 though less pronounced.

*Key to Chemicals*

- CO= carbon monoxide
- HCN= hydrogen cyanide
- HCl= hydrogen chloride
- P<sub>2</sub>O<sub>5</sub>= phosphorous pentoxide
- HF= hydrogen flouride
- HBr= hydrogen bromide
- PAHs= polyaromatic hydrocarbons
- NO<sub>x</sub>= oxides of nitrogen
- SO<sub>2</sub>= sulphur dioxide
- NH<sub>3</sub>= ammonia.

Source: Table adapted from Stroud (1996). Smoke Toxins. DoH Health Advisory Group on Chemical Contamination Incidents

## ACCIDENT AND EMERGENCY DEPARTMENTS CLOSURE DUE TO CHEMICAL CONTAMINATION

### CIRS experience

Dr Virginia Murray, CIRS

From the experience of CIRS, chemical incidents have resulted in contamination of hospital facilities from incidents occurring:

- outside hospitals:
  - ⇒ with contaminated patients arriving with/without warning
  - ⇒ with contaminated water supplies coming into hospitals
- inside hospitals:
  - ⇒ from chemical use or spills
  - ⇒ from contaminated air conditioning, water and food
  - ⇒ from inappropriate maintenance and leaking refrigeration units

As a result of these events a special study covering October 1998 was set up and the results provided below show that of the incidents reported to CIRS, eight health care facilities were shut in part during this month:

- CS spray used by police in a hospital medical assessment unit: 1 patient, 3 nurses with asthma and 1 doctor unwell, and unit shut for 50 hours while clean up completed
- GP surgery: mercury spill, GP exposed and room closed for clean up
- Deliberate potassium cyanide ingestion: 1 death and paramedics and Accident and Emergency (A&E) staff exposed, and resuscitation closed for clean up
- Ethidium dibromide spill in laboratory: 1 doctor and laboratory staff exposed and laboratory shut until decontamination complete
- Ammonia spill on pharmacy van: pharmacy driver & pharmacists exposed and decontamination of van and pharmaceuticals required
- Roofing material repair causing gassing into air intake for paediatric intensive care unit: 3 nurses and 1 consultant exposed and symptomatic, and 3 bedded unit shut for clean up
- Coal gasification soil spill onto a road causing gassing and contaminating traffic wardens: 7 traffic wardens & 3 nurses exposed and symptomatic, decontamination of and containment in A&E required
- Fluothane spill in A&E: 1 nurse exposed and symptomatic, others at risk, and resuscitation cleared & decontaminated

This Chemical Incident Report presents three incident reports documenting similar events from an A&E or public health perspective.

## Chemical incident responded to by University Hospital Aintree

Mr Alan Armstrong, Consultant in Accident and Emergency, University Hospital Aintree

### The incident

On Saturday 22 May 1999 at 04.30 hours a 1.5kg package at a Parcel Force office fell from a conveyor belt and broke open. A female member of staff was in close proximity and inhaled an unknown quantity of the material and her hands, face and clothing became contaminated. She rapidly felt unwell, developing a sore throat, a hoarse voice and becoming short of breath. She was taken by a colleague in a car to the A&E at the University Hospital Aintree arriving at 04.49 hours.

The ambulance services at this point were not involved - they would have had the role of warning A&E of attendance of any chemically contaminated casualties in Merseyside

### Sequence of events in A&E

In common with many A&Es, there are two entrances to the A&E, one for minor injuries and the second for ambulance cases. Without advance warning, this patient came in through minor injuries, and was seen at the triage area by a nurse and very soon after that by a doctor. She had significant powder contamination of her clothes, hands and face. The only information available was a leaflet with the parcel from the German exporter identifying the compound as acrylamido tertiary butyl sulphonic acid.

At 04.50 hours A&E contacted the National Poisons Information Service, London (NPIS,L) who had little information on this chemical. Initial information was given from related chemical data that this chemical could cause respiratory irritation, cardiac arrhythmias, ataxia, coma and convulsions. No specific antidote is available. The incident was cascaded to CIRS who recommended decontamination and if necessary admitting for observation. Further searches showed that the toxicological properties had not been thoroughly investigated and that the chemical is potentially destructive to tissues and harmful if swallowed, inhaled or absorbed through skin.

With this initial information, the A&E Casualty Officer went to get equipment and contact the A&E consultant. In doing this he used a telephone in the resuscitation area. Once the relevant equipment and phone calls had been made, the doctor who had most contact with the patient and the patient were kept in a separate area. The A&E was cordoned off. The Duty A&E Consultant was informed and attended A&E at 05.30 hours.

Meanwhile the fire service were contacted to assist with decontamination at approximately 05.12 hours and attended A&E at 05.15 hours.

At this stage the patient was clearly distressed, her voice was hoarse, her throat was red and she was having difficulties in breathing and a degree of bronchospasm.

The problems faced by the A&E at that time were:

- Available information suggested that the compound was very toxic and could be harmful if inhaled, swallowed or absorbed through the skin
- There was potential powder contamination of the minor injury entrance, the waiting room for patients, the triage area, ambulance entrance and the resuscitation room. It was not clear how extensive the contamination was nor how toxic small amounts of this chemical could be.
- There was possible contamination of two doctors and four nurses and some staff members were reporting mild adverse health effects, leaving only one doctor and five nurses to staff the A&E.

These problems led to the closure of A&E at 06.27 hours to patients until decontamination was complete and the identity of the chemical confirmed. Protective clothing with liquid resistant but breathable suits were issued to staff along with over shoes and masks.

At 07.10 hours the patient deteriorated becoming extremely wheezy and significantly hypoxic. She was moved into resuscitation where oxygen and salbutamol were administered to treat bronchospasm. She made a good response, was stabilised and admitted for observation for 24 hours. She has had no sequelae related to this incident on follow-up.

A further eight casualties attended A&E from Parcel Force with potential contamination. They were examined and decontaminated. They showed no adverse affects and were discharged.

#### *Clean up of A&E*

Decontamination of the contaminated areas of the department was undertaken by suitably protected staff. All staff involved had their clothing bagged and subsequently destroyed and all equipment which could have been touched was thoroughly cleaned. The A&E was reopened seven hours later when clean up was complete at 11.30 hours.

#### *Lessons learnt*

- One patient contaminated with a toxic chemical arriving without warning can lead to closure of an A&E.
- Spread of contamination within an A&E can be difficult to prevent if equipment is stored outside the triage area.
- Identification and confirmation of chemical data is essential in chemical incident management
- Had this incident occurred during the flu epidemic in winter it is difficult to know how the Merseyside area could have coped without a major A&E unit.

#### *Comment by CIRS*

- CIRS is most grateful to the help provided by Sefton Health Authority: the CCDC attended the A&E to assist in the incident management
- Since this incident, CIRS has learned that University Hospital Aintree A&E have dealt with casualties from two further chemical incidents. These have not resulted in A&E closure.

### **Chemical incident responded to by Maidstone Hospital**

*Mr Graham Cook, Clinical Director of Surgery and Director and Consultant Accident & Emergency Service, Maidstone Hospital, Kent*

#### *The incident*

At around 03.00 hours on Tuesday 20 July 1999, at a local warehousing and distribution company, there was leakage from a drum containing a chemical which spilled onto the legs of one of the workforce. The container of the chemical gave only a UN number to identify its contents. The chemical rapidly destroyed the worker's trousers at the point of contact and he experienced burning and redness of the skin where the liquid had been in contact. He also reported burning of eyes, tongue and hands, and tingling of lips, with a dry cough.

The Fire and Ambulance Services were contacted, despatching the appropriate staff and vehicles. The worker was transported by a front line ambulance to Maidstone Hospital.

In the meantime, other workers were developing symptoms on exposure to the fumes of the unknown liquid chemical. The ambulance officer decided to transfer these patients to hospital by two patient transport ambulances so as not to contaminate any more front line vehicles.

At 03.15 hours the patients started to arrive at A&E and were restricted to the waiting area and one treatment area. Advice was sought from NPIS,L at 05.30 hours. NPIS,L and CIRS recommended:

- decontamination with removal of all clothing which was double-bagged, sealed and stored in a safe area away from patients and staff and the skin cleansed with water and soap and the eyes irrigated with saline
- symptomatic treatment with base line investigations, including peak expiratory flow rates. This was undertaken. Despite the symptom of dry cough at no time was there any bronchospasm and peak expiratory flow rates were stable and within normal limits.

A total of 24 casualties attended A&E and were decontaminated with the assistance of the Fire Service. No patient ex-

posed to the chemical required admission to hospital

At around 06.30 hours it was apparent that medical and nursing staff, together with ambulance crews who had been in contact with the patients, were starting to describe similar symptoms. The staff also required decontamination. The only means of communication with the contaminated area was by telephone.

At 06.45 hours the decision was taken to close A&E to all cases. One area of the A&E that had not been contaminated was identified to deal with any ambulance blue-light cases. The 'walking wounded' were asked to attend later, or to go to their General Practitioner. The General Practitioner co-operatives were contacted and asked to keep patients at home, or use direct referral to hospital teams and to send more urgent cases to be sent to neighbouring hospitals.

At around 09.00 hours the A&E was contacted by Dr. Vernon Hochuli, Consultant in Communicable Disease Control for West Kent Health Authority to collaborate on response.

In the meantime, the Fire Service had located the company who had despatched the chemical in France and was given the identification of the chemical involved, isodecyl acrylate. The receiver of the chemical in Kent was also contacted and confirmed the identity of the chemical. At 10.35 hours the chemical was confirmed by the fire officer and it was also confirmed that no further decontamination was required. Thus we re-opened the Department fully. No blue-light cases had been received. Fortunately, few 'walking wounded' patients attended on that morning.

Two re-attended late in the afternoon on 21 July 1999 stating that they felt mild headache, were tired and unable to work. Examination did not reveal any abnormal physical signs.

The whole operation was run smoothly by the emergency services and the hospital with good collaboration.

#### Lessons learnt

- Communication requires improvement and we will be considering the purchase of walkie-talkies to provide mobile communications within the A&E
- The Fire Service supplied paper boiler suits and all clothing was removed and double-bagged. The A&E will be purchasing supplies to be held within the department
- Thought needs to be given to the possibility of the whole Department being contaminated and thus unusable to other patients. We will be discussing solutions to this problem which will include the possibility of an inflatable building for decontamination being purchased and sited near but outside the A&E
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## Chemical incident in an aircraft hangar in Wiltshire

*Dr Bernadette Purcell, Specialist Registrar in Public Health Medicine and Dr John Simpson, Consultant in Communicable Disease Control, Wiltshire Health Authority*

#### The incident

At 03.00 hours on 24 November 1998, CIRS was notified of a major incident by the Accident and Emergency Department (A&E) of Princess Margaret Hospital (PMH), Swindon. This incident resulted in closure of the A&E to walking and blue light casualties for approximately 12 hours. CIRS notified the Health Authority of the closure and of a possible need for investigation.

On the evening of 23 November 1998, the index case was discovered unconscious in his tent inside a hangar. He was part of a unit of Royal Electrical and Mechanical Engineers on exercise at RAF Hullavington who had been living and working inside an aircraft hangar since November 6. They were repairing helicopters using diesel engines, machines and solvents.

Investigation of the sentinel case in hospital showed hypoxia and hypercapnia in keeping with CNS depression. The carboxyhaemoglobin on admission was not available, though he had been given oxygen immediately when found. In the circumstances the Medical Registrar requested the entire company (70 soldiers) to be screened for suspected chemical exposure. 69 were assessed and 46 admitted with mainly neurological symptoms. The suspected cause was exposure to carbon monoxide (CO).

#### Investigation

CIRS initiated a site visit in parallel with a joint medical/toxicology ward round that day.

*Clinical assessment:* Most cases had headaches, sore throats and eye irritation. Some complained of poor concentration and blurred vision. Cerebellar signs, abnormal cognitive functioning and skin lesions were documented. Blood and urine specimens were collected on all the cases and analysed by the Medical Toxicology Unit. The differential diagnosis at this stage was CO and/or volatile organic compound poisoning. Infection and mass psychogenic illness were also considered, but felt to be unlikely.

*Site visit:* During the site visit it was possible to detail the work they were doing. Machinery and chemicals in use were observed and documented, as were operations, eating and sleeping arrangements. Photographs were taken of the scene.

*Epidemiological investigation:* The Health Authority undertook to survey the whole Battalion (about 300 members) who were involved in the exercise. 283 self-administered

questionnaires, developed jointly with CIRS, the Health and Safety Executive and the army, were completed on the 1<sup>st</sup> December. Public health doctors were present to explain the purpose, and provide reassurance with respect to neutrality and confidentiality to improve validity of the responses. National media reporting had reflected uncertainty as to the cause, which minimised the possibility that 'media bias' would influence responses.

Descriptive analysis revealed a clear excess of cases at the hangar in question (56/70), but also unearthed cases at other locations on the exercise who had not had contact with the Hullavington hangar (31/104). There was an early peak of onset of symptoms at day 2 (range 1-24 days), consistent with an inhalation route of exposure to a chemical. Cases were more likely to have suffered prior illness and have a higher intake of alcohol. Certain jobs, such as cleaning and painting aircraft and performing systems checks, and working with methyl ethyl ketone, a volatile organic compound, were associated with an increased risk. However, this increased risk was mainly associated with working at Hullavington.

*Lessons learnt*

This investigation has benefited from a joint approach.

- Early investigation facilitated the reopening of the A&E
- There has been feedback to the army at all stages, and continuing liaison with their Occupational Health.
- This incident has highlighted the usefulness of an epidemiological approach, as other strands of investigation may be unrevealing.

A more detailed report is currently being prepared for publication.

**Editorial on Accident and Emergency Department closures due to chemical contamination**

*Dr Alison L Jones, Deputy Director, CIRS*

The excellent contributions of Alan Armstrong, Graham Cook and Bernadette Purcell point to the importance of vigilance to avoid potential contamination of A&Es by patients exposed to a variety of chemical toxins. On a practical level it is of course sometimes quite difficult to identify the exact chemical involved. An open mind as to hazard identification has to be kept as the incident is running and if the toxicological symptoms and signs do not match, the search for further identification must take place.

The only practical way of ensuring that an A&E does not have to shut in a chemical incident is to ensure that any individuals exposed to a chemical are not permitted to enter until thorough decontamination has taken place, preferably at the site of exposure, but if necessary in A&E itself. Protection of staff is important and provision of adequate training

in decontamination methods and suitable protective clothing should be of high priority. In order to be prepared it might be worth considering an exercise to test responses of staff and their ability to carry out practical procedures.

It is also vitally important that the decisions in running an incident are made by sufficiently senior staff, both at the Health Authority and within the individual A&E. Thus Consultant staff do need to become available to oversee that all runs smoothly and problem are solved at an early stage.

The staff of CIRS are more than happy to be involved in the management of chemical incidents as they impact A&Es and again, we find that early involvement seems to work best.



Dr Judith Fisher, Lt Col David Morgan-Jones, Dr Virginia Murray and Dr Gareth Davies have just published this handbook on chemical incident management for A&E clinicians. It is available from the Stationery Office, ISBN 0-11-322106-1 and costs £40.

## FOOD AND DRINK RELATED INCIDENTS

The recent cluster of chemically related food contamination incidents is reviewed in the CIR. It also provides an opportunity to report on two incidents from Japan, one recent and deliberate – the trial was ongoing in May 1999, and the other an incident from the 1940s that required extensive investigation.

Problems of analytical resources remain but a review of the approach offered by the Medical Toxicology Unit appears pertinent and is given at the end of this section on page 16.

### *Dioxins in Belgian Food, 1999*

CIRS and NPIS,L received a number of enquiries probably as a result of the widespread publicity about possible hazard and toxic risk arising from ingestion of food products from Belgium containing eggs, poultry, beef and pork some of which were reported to contain dioxins and related substances such as polychlorinated biphenyls at more than 100 times normal levels.

#### *Incident summary*

Chemistry in Britain (July 1999) reported that the contamination has been traced back to a fat rendering works in Belgium which supplied fat as a raw material in animal feed. It is thought that some contaminated oil containing dioxins and PCBs was included in recycled fats used for animal feed. Up to nine animal feedstuff producers are believed to have supplied contaminated feed to 445 poultry farms, 746 pig breeding farms and 393 cattle farms in Belgium.

Continuing investigation suggests that the level of contamination was low in the UK as little food is imported from Belgium. Current advice suggests that there is unlikely to be a health problem, which would require exposure to high levels over a prolonged period of time. In the UK it is thought that most enquiries report concern and not adverse health effects.

#### *Reference*

Chemistry in Britain. Food: Dioxin dilemma for Belgium, July 1999, 11

### *Belgian Coca-Cola, 1999*

CIRS and NPIS,L received a number of enquiries about the possible hazard and toxic risk from ingestion of Coca-Cola from Belgium.

#### *Incident summary*

It is considered that the contamination occurred in two separate incidents:

⇒ returnable glass bottles from a plant in Antwerp with carbon dioxide in head space with a musty smell

⇒ cans from a plant in Dunkirk with a chlorinated phenol compound on the outside of the can resulting in smell on cans but not direct contamination of drink

A review of the incident and the possible causes was published in the Lancet on July 3 1999. Nemery et al<sup>1</sup> propose that the cause was likely to have been a mass sociogenic illness. Investigation into the incident with case follow-up is ongoing and CIRS has been in communication with the authors.

#### *Reference*

Nemery B, Fischler B, Boogaerts M, Lison D. 1999. Dioxins, Coca-Cola and mass sociogenic illness in Belgium. Lancet; 354, 77

### *Threat to poison water supply, 1999*

On July 11 1999, newspapers reported on a threat to poison a water supply which suggested that people at most risk were kidney dialysis patients. Many of the methods of communication and information provision reflected on the preparations undertaken for and tested by Exercise Boadicea. Any comment from public health departments on any aspect of response to this threat would be gratefully received by CIRS. This data will be collated and passed to appropriate decision makers.

### *Intoxication of curry at Wakayama, 1998*

Dr Masahiro Shinozaki, Department of Critical Care Medicine, Wakayama Medical College, Wakayama City, Japan presented a paper at the 1999 WADEM conference held in Osaka in Japan (for meeting review see pages 17 – 18) on Intoxication with arsenic mixed in curry at Wakayama<sup>1</sup>. From his paper & abstract Dr Virginia Murray has prepared an incident summary

#### *Incident summary*

On 25 July 1998, a jazz festival was held for the local inhabitants of Wakayama, a small residential area near Osaka in Japan. At 18.00 hours, people ingested locally prepared curry and rice. 67 complained of vomiting, abdominal pain, headache, and were taken to hospital by 20.30. An attending doctor notified police of suspicion of food contamination at about 22.00 hours. 4 patients died overnight. At 06.00 hours on 26 July 1998, the police reported that analysis of food and vomit had shown that cyanide was present. As a result about 30 patients were treated with sodium thiosulphate.

Several days later patients started to develop pancytopenia and the International Programme on Chemical Safety (part of WHO/ILO/UNEP) was asked to provide assistance. Dr Alan Hall, a medical toxicologist in the USA, was asked to suggest a possible other toxin. He considered that the

likely cause could be arsenic. Further analysis confirmed arsenic poisoning eight days after the initial incident. The patients were managed supportively and chelation therapy not given. Their urinary arsenic level returned to normal 2 months later.

#### *Comment*

Dr Alan Hall, Editor-in-Chief, Toxicology and Environmental health, Micromedex, Inc, Colorado, USA also presented a paper at the WADEM meeting<sup>2</sup>. He addressed the problem of differential diagnosis of mass foodborne poisoning incidents. Acute arsenic and acute cyanide poisoning by ingestion show similarities as both result in mouth & throat irritation or burning, nausea & vomiting and central nervous system depression, spasms and seizures. However, acute arsenic versus acute cyanide poisoning differences show that arsenic also causes diarrhoea, garlic like odour to breath and has as its main late sequelae: peripheral polyneuropathy and bone marrow depression. Cyanide on the other hand causes anxiety, agitation, hyperventilation, giddiness, headache, mild hypertension, bitter almonds/musty breath odour and has as its main late sequela, a parkinsonian-like condition.

As a result of this incident an emergency network for treatment of mass poisoning by Japan Poisons Information Centre (JPIC) is being prepared<sup>3</sup>. This will hold a diagnostic database of 100 poisonous substances selected by extent of systemic toxicity, by previous use in crime and by the availability of antidotes. Currently 122 chemicals grouped into 40 categories have been identified but the database will not include gaseous inhalation poisons and local corrosives. This database will be available through the JPIC.

The JPIC identified the need for a co-ordinated service of chemical analyses. For this reason a paper was presented on the detection and identification of unknown poisonous substances from patients materia: the experience of the Chemical Incident Response Service, London (Summary abstract on page 16).

#### *References*

1. Shinozaki, M. 1999. Intoxication with arsenic mixed in curry in Wakayama. *Prehospital and Disaster Medicine*: **14**, 1, S65 – S66
2. Hall A. 1999. Mass foodborne poisoning incidents: clinical and screening laboratory data may differentiate cyanide from arsenic poisoning. *Prehospital and Disaster Medicine*: **14**, 1, S64 – S65
3. Yoshioka T, Endoh Y, Ikeuchi H, Shimazu T. 1999. An emergency network for the treatment of a mass poisoning by the Japan Poisons Information Centre. *Prehospital and Disaster Medicine*: **14**, 1, S66

## **Itai Itai Byo - Japan, 1940's**

*Alex Pearson - a student on the MSc in Toxicology Course at the University of Surrey*

#### *Incident recognition*

In 1946 Dr Hagino, returned from the war to his general practice in the Toyama Prefecture in Japan. Within a year he noted that several patients were complaining of an unusual condition. Patients typically complained of painful bones and in less severe cases (i.e. those who could walk) had a characteristic waddle or 'duck-like' gait. Dr. Hagino called this condition 'Itai Itai Byo' which literally translated, means 'Ouch Ouch Disease'. Some of the patients who Dr. Hagino had referred to the local hospital were diagnosed as having 'kidney trouble and/or diabetes'. Reports published in 1956-57 suggested that Itai Itai disease resulted from a vitamin D deficient osteomalacia.

In 1968 the Japanese Ministry of Health and Welfare declared 'the Itai Itai disease is caused by chronic cadmium poisoning'. However, it has also been recognised that a number of other factors such as diet, sex and age had contributing effects.

#### *Clinical Features and Treatment*

The majority of patients were post menopausal women, although some men of a similar age were effected. Moderate symptoms included lumbar pains, leg myalgia, and the characteristic 'duck-like' gait. In more severe cases patients were unable to walk and were susceptible to microfractures in most bones from relatively minor traumas. There were also reports of serious skeletal deformities.

Initially, treatment was with large daily doses of cod liver oil (equivalent to 1000 I.U. Vit.D/day, where 1 I.U.= 0.025g) which had only a small effect on the symptoms. Total reverse of the symptoms was possible only with extremely large doses of vitamin D (on average 100,000 I.U. Vit.D/day). Symptoms were found to return if vitamin D treatment was stopped.

#### *Probable cause*

Japan has a large copper, lead and zinc mining industry. The ores are predominantly sulphides and are also relatively high in cadmium. Arable land is extensively used for growing rice, and river water is often used to irrigate the rice fields. During the Second World War, in Toyama Prefecture, the local rice crop failed. The local farmers believed that the Kamioka Mining Company's mine had polluted the Jintsu River upstream.

Subsequent studies showed that rice in the polluted areas contained nearly ten times as much cadmium as rice from unpolluted areas. Therefore exposure to cadmium was by

ingestion of polluted foodstuffs (mainly rice) and water.

It is not possible to quantify how many people were exposed to toxic levels of cadmium, partly because exposure was over several decades and partly because the whole population of the area were exposed. Some confusion exists over the numbers of people diagnosed with Itai Itai disease as other areas besides the Toyama Prefecture were affected.

#### *Mechanism of toxicity*

The actual mechanism of toxicity is unknown, but it is thought to involve the accumulation of a cadmium-metallothionein complex in the kidney. When a critical concentration of this Cd<sup>2+</sup>-protein complex is reached (100-200g/g renal cortex), Cd<sup>2+</sup> is thought to disassociate, and it is the cadmium ion which is considered the toxic species. However the skeletal effects are less well understood.

#### *Analysis for Cadmium*

Little published data exists on the analysis of cadmium in Itai Itai patients. The few data available are from patients at autopsy: analysis was by atomic absorption and the results suggest an accumulation of cadmium in the liver and a decrease in cadmium concentration in the kidney. This decrease in the kidney may be as a result of the tubular damage caused by the cadmium.

#### *Sources of information*

##### *Detailed Texts*

- Friberg L, Piscator M, Nordberg GF, Kelljstrom T, 1974. Cadmium in the Environment, second edition, CRC Press Inc.
- Friberg L, Nordberg GF, Vouk VB, 1986. Handbook on the Toxicology of Metals, volume 2: Specific Metals, Elsevier Science Publishers BV.

##### *General Texts*

- Smith, RP, 1992. A Primer of Environmental Toxicology, Lea and Febiger, Philadelphia.
- Timbrell, JA, 1995. Introduction to Toxicology, second edition. London: Taylor and Francis.
- Amdur, MO, Doull, J, Klaassen, CD, 1991. Casarett and Doull's Toxicology, The Basic Science of Poisons, fourth edition, Pergamon Press, Inc.

#### *Acknowledgement*

CIRS is grateful to Dr Julie Howarth from the University of Surrey for providing this and a number of other reports produced by the MSc in Toxicology students at the University.

## **Detection and identification of unknown poisonous substances from patients materia: the experience of the Chemical Incident Response Service, London**

*Dr Virginia Murray and Dr Brian Widdop, Medical Toxicology Unit.*

#### *Methods of detection of unknown poisonous substances*

Clinical assessment together with biochemical and physiological data obtained from local laboratories can sometimes point to the type of chemical involved, but proper confirmation can come only from analytical work. Environmental samples (air, soil, water etc.) are the easiest to deal with, but if these are not available biological materials are the other alternative. Samples of blood and urine should be taken immediately and it is vital to guard against contamination and to ensure that the correct containers are used. For a "blind screen" in adults, 10mls of lithium heparinised blood, 4mls of EDTA blood and 50mls of unpreserved urine will suffice. Prepared sample collection kits with instructions and request forms supplied by the incident centre help a great deal. The samples must be transported to the laboratory as quickly as possible to avoid losses of chemicals during storage.

Techniques such as gas-liquid chromatography (GLC) and high performance liquid chromatography (HPLC) cover a wide range of chemicals. Ideally, these should be linked to a mass-spectrometer which provides unequivocal analytical evidence. Mass-spectrometers are equipped with vast libraries of spectra which can be matched to those of the unknown chemical within minutes. Groups of compounds which can be detected include volatile solvents, alcohols, glycol ethers, pesticides and drugs. For toxic metals, Inductively Coupled Plasma Mass-Spectrometry (IPC-MS) is the best technique and can screen for elevated levels of over 30 elements in less than an hour.

No amount of investment in these expensive analytical instruments will bear fruit without having a team of fully trained and experienced analytical toxicologists available to undertake the assays.

#### *Results*

CIRS has identified and responded to an increasing number of incidents since 1994, with 937 recorded in 1998. Over the last year, incidents have lead to the specialised toxicological analysis of over 2,000 biological samples, and these results have been invaluable in managing these incidents.

#### *Discussion*

Our multidisciplinary approach within CIRS is apparently a novel development. It requires close collaboration, and training. In order to assess this system of incident response and management, links with other expert organisations nationally and internationally have been developed.

## CONFERENCE REPORTS

### 11th World Congress on Disaster and Emergency Medicine: World Association of Disaster and Emergency Medicine, Osaka, Japan

May 10-13 1999

Dr Virginia Murray, CIRS

I was fortunate to be asked by the meeting organisers to attend this meeting. I was asked to present a paper on the need for laboratory identification of hazards which was prepared in collaboration with the Medical Toxicology Laboratory (abstract on page 16). This excellent meeting provided me with an opportunity to meet many colleagues also concerned with chemical incident response.

Many important topics were discussed including environmental and nuclear disasters, medical response against terrorism, post traumatic stress disorders, preparedness for a disaster and international repatriation.

#### *Chemical incidents presented*

Various organisations reported on chemical incidents and the local response to such events. Four examples are given below:

#### *Great Hanshin-Awaji Earthquake, Japan, 1995*

- Several papers, a site visit and a video were presented giving information on the outcome of this disaster. Problems identified included the management of fires when water supplies were broken. The Fire Service pumped sea water to control these fires. At least one chemical factory reported damage which provided an additional containment problem. In all 6,107 patients were admitted to 97 hospitals of which 48 hospitals were inside the disaster area and all these were effected by the earthquake.
- One of the most unexpected problems was presented in a paper on dental care following the earthquake. The difficulties identified included the fact that there was no service water or electricity available for surgeries. As a result ten temporary clinics were set up and these managed 1,043 cases of dental infection, 1,834 cases of caries and 1,108 cases of dental loss or breakage of prostheses. In this later group concern was expressed about the fact that these people were not able to eat the emergency food supplies provided easily without prostheses and some were thought to be at risk of starvation.

#### *Haze in Indonesia, Malaysia, Singapore, Thailand, Brunei, Philippines and Hong Kong, 1997*

- Smoke from forest fires in Indonesia was reported in May 1997 and affected all the above countries. The haze resulted in poor visibility until October 1997 and led, for example, to the closure of some airports and several aeroplane and ship collisions or other accidents. Adverse ef-

fects reported included increased incidence of upper respiratory tract infections, sore eyes, exacerbation of asthma and bronchitis. In one retrospective study by a medical centre in Singapore between October 1997 and April 1998 of 500 soldiers aged 18-24 showed lower respiratory airways disease and conjunctivitis with significant correlation to their Pollution Standard Index ( $p = 0.037$  &  $p = 0.02$ ) and the authors concluded that under such conditions strenuous exercise requires precautionary measures

#### *South Korea*

- recent urban area disasters in South Korea included a train derailment, an airline accident, the collapse of a bridge, the explosion of a city gas tank, several gas explosions at subway construction sites, the collapse of a department store and a fire in a technology school. This resulted in a total of over 1,000 deaths with over 1,500 reported ill.

#### *The Istanbul Straits, 1998 and 1994*

- In 1998, Romanian tanker, *Independenta*, collided with a Greek freighter leading to a massive explosion with 43 sailors burnt alive. The tanker sank leaving a burning lake of crude oil for six weeks and black smoke over Istanbul for two months. The slick travelled down into the Aegean Sea and caused environmental damage on the coast of Turkey.
- March 1994, a Greek Cypriot oil tanker carrying 19,000,000 gallons of crude oil collided with an empty cargo ship. The explosion and fire caused similar damage with a total halt to navigation for nine days

#### *Medical response against terrorism*

In the session on medical response against terrorism, comments included the fact that 'every hospital must have the capacity to safely assess and treat at least one patient exposed to hazardous material'. In this CIR, incident reports on pages 10-13 show this to be a potential problem within the UK health care system.

#### *Post traumatic stress disorders*

In this session, a paper was given describing disaster stress reactions. The authors divided the causes of disaster stress into life threatening experiences, bereavement, property loss and relocation (temporary shelter or housing). The phases of post-disaster reaction were presented as:

- heroic
- honeymoon
- disillusionment
- re-stabilisation.

They reported that several mental disorders were particularly associated with or exacerbated by disaster. These included acute stress disorder, post-traumatic stress disorder, manic episodes, depression, brief reactive psychosis, adjustment disorders, relapsed schizophrenia and alcohol abuse.

A paper on critical incident debriefing for emergency personnel discussed the types of stress reactions reported as:

- *Physiological* - tachycardia, gastrointestinal irritation, headaches
- *Cognitive* - memory problems, disorientation, confusion
- *Psychological* - anxiety, fear, depression
- *Behavioural* - outbursts of anger, increased use of alcohol/drugs, violence

Here the authors recommended phased critical stress debriefing (PCSD) with referral to professional experts if required. The PCSD process is summarised below

Phase 1: *Introduction* and explanation of rules

Phase 2: *Fact phase* - What was your job? What happened?

Phase 3: *Thought phase* - What were your first thoughts?

Phase 4: *Reaction phase* - What was the worst thing that happened to you?

Phase 5: *Symptoms* - What symptoms did you experience at the scene? Next few days? Left over now?

Phase 6: *Teaching phase* - What to expect, coping strategies

Phase 7: *Re-entry phase* - Transition back to work

These papers encouraged me to consider that more work should be undertaken in this area. CIRS has been in discussion with psychiatric colleagues and will try to develop a checklist type approach to incident debriefing and disaster stress reactions

### *Preparedness for a disaster*

Another session addressed the need for planning for disasters and the assessment of these plans

In the USA a new standard on disaster management has been set up. The agencies involved are

- Federal Emergency Management Agency: FEMA
- International Association of Fire Chiefs
- American Insurance Services Group
- National Co-ordinating Council on Emergency Management

The purpose of these new USA standards are to implement a process of:

- mitigation
- preparedness
- response
- recovery

These reflect the approach taken by the Home Office. CIRS has already considered this approach and the books in the Series on Chemical Incident Management address these headings.

Recommendations on the use of tabletop exercises and realistic drills were given. The authors considered that these should:

- co-ordinate community response to a mass casualty event

- highlight deficiencies
- develop lasting relationships between fire, emergency medical systems, emergency management and hospitals
- enable a safe response to a wide range of hazards

This type of paper provides a tool that could be used to test the adequacy of plans prepared by Health Authorities in a similar manner to the two surveys summarised below.

A survey of state level catastrophic casualty plans from the USA was presented. It followed a two stage approach of assessment by firstly requesting plans and then identifying in particular five topics for comparison between plans. The topics assessed were:

- was the plan based on hazard-risk analysis?
- was the plan based on vulnerability analysis studies?
- was the plan integrated into larger context of state emergency operations plans?
- were mutual aid agreements included?
- were contacts for material and personnel resources for disaster response identified?

The results showed that of the 28 states which participated, only 12 states sent plans, of which two met four of the criteria listed above and one met three of the above criteria

A similar study was undertaken on the disaster & emergency medical systems plans for nuclear plant accidents in Japan. In this study a questionnaire survey was sent to 14 nuclear plants to assess

- primary medical systems
- emergency transportation systems for patients
- drills that deal with a nuclear disaster
- communication and co-operation between plant and medical facilities outside

Of the 8 plants that replied weaknesses were identified including poor night time cover, disaster drills only on a small scale with variation in communication outside plants making the efficacy of this communication difficult to compare.

### **The Healthy Planet Forum: United Nations Environment and Development UK Committee, Westminster Central Hall, London**

**June 15-18 1999.**

*Rico Euripidou, Environmental Epidemiologist, CIRS*

The Healthy Planet Forum sought specifically to assess and ultimately make people aware of the impact of the total environment on public health. Voluntary and campaign groups came together for discussion and dissemination on issues that affect health and environment. The Forum also ran in parallel with the WHO European Region Third Ministerial Conference on Environment and Health.

The WHO has previously stated that 'Reports on the state of the environment and/or health provide a useful basis for pe-

riodic reviews of policy... The information should be made available to the public in an accessible and user-friendly manner'.

Specific topic on the agenda included water and health, health and transport issues, climate change policies, vulnerable groups and public participation and planning for better health and a better environment.

Simultaneously the Forum included other topics such as:

- women, health and environment
- building healthy communities, focusing on city wide and local levels most effective on delivering a safe and healthy environment and community
- public exposure to pesticides run by the UK Pesticides Trust
- chemicals in the human environment run by the World Wildlife Fund and focusing on endocrine disrupting chemicals and persistent organic pollutants in the environment and how they affect health.
- children and environmental health
- the food summit.
- local action and health, a look at how local non-governmental organisations can network effectively on health and environmental issues.

The underlying aim of the Forum was to cover diverse issues and disciplines with strategies to tackle issues affecting health and environment.

**Setting the Freshwater Agenda for the 21st Century: United Nations Environment and Development UK Committee, London**

**June 16 1999**

*Faith Goodfellow, Research Engineer – Water, CIRS*

This was a one day conference held at the Chartered Institute of Environmental Health, and forming part of the Healthy Planet Forum and the Third WHO European Conference on Environment and Health. The main objectives of the day were:

- to increase the profile and understanding of freshwater in the debate on environment and health in Eastern and Western Europe;
- to provide a focused look at the role of water in cities and in conflict situations;
- to increase awareness of the 1998 UN Commission on Sustainable Development Freshwater Agreement and of the 1999 Draft WHO Protocol on Water and Health.

Contributors to the seminar included: William Cosgrove, Director of the World Water Vision Unit of the World Water Council; Grant Lawrence, Acting Director of DGXI, Environmental Quality and Natural Resources; Niels Thyssen, Project Manager of Inland Waters for the European Environ-

ment Agency; and Dr. Rainer Enderlein from the UN Economic Commission for Europe.

I attended a morning workshop on the European Union Guidelines on a Strategic Approach to the Management of Water Resources. The main issues discussed were: river catchment management planning; partnership and participation in managing aquatic ecosystems; the ecosystem approach to water resource management; water pricing; and water demand management. The proposed EU Water Framework Directive will introduce catchment management planning across the EU. Member States will be obliged to identify their *river basins* and establish the necessary administrative arrangements so that a *River Basin Management Authority* can produce a *River Basin Management Plan* in order to achieve various objectives. The objective of the *River Management Plan* is to achieve *good* status in all surface waters and all groundwater. Good status for surface water is a combination of good chemical status and good ecologic status. Good groundwater status is assessed by chemical status and quantitiveness status.

The afternoon workshop that I took part in was the WHO Draft Protocol on Water and Health to the 1992 Convention on the Protection and Use of Transboundary Watercourses and International Lakes. The measures the protocol is based on are:

- provision of adequate supplies of wholesome drinking water;
- adequate sanitation of a standard which sufficiently protects human health and the environment;
- effective protection of water resources used as sources of drinking water, and their related ecosystem, from pollution;
- sufficient safeguards for human health against water-related disease arising from the use of water for recreational purposes, aquaculture, shellfish harvesting, irrigation;
- effective systems for monitoring situations likely to result in outbreaks or incidents of water-related disease and for responding to such outbreaks and incidents and to the risk of them.

This protocol is the first one in which the environment has been affiliated with social and economic issues. It is also the first time that health and environment departments have been united to facilitate implementation. Another aspect of the protocol is the obligation to involve the public in planning the targets to be met.

Although the conference was aimed at an international audience, including less developed countries, there were still lessons to be learnt for the UK. In terms of water resources, Britain has experienced a number of summer droughts recently which has highlighted concerns regarding the sufficiency of water resources and as was highlighted at the conference waterborne diseases have by no means been eradicated from the UK.

## Announcement: GUY'S, KING'S AND THOMAS' INSTITUTE OF TOXICOLOGY

Readers of the Chemical Incident Report are amongst the first to be informed of the establishment of a new Interdisciplinary Research Group, to be known as the GKT Institute of Toxicology, starting from August 1 1999. The Group has formulated a Mission Statement, indicating that its interest can be adapted to cover a wide range of topics within 'Education and Research into Human Poisoning'. It takes advantage of the expertise found in the GKT Health and Life and Medical Schools, including departments of Nutrition, Pharmacy, Forensic Science, Chemical Pathology, the Liver Unit, The Drug Control Centre and the Medical Toxicology Unit (including CIRS). Key areas for research during the initial phase include Environmental Toxicology, Hepatotoxicity, Dietary Supplements and Traditional Remedies and Drugs of Abuse. Other key areas will be established as appropriate to needs. For further information, contact Dr Glyn Volans, Director of the Medical Toxicology Unit or visit the Institute Website on [www.kcl.ac.uk/depsta/lbmhs/instox/](http://www.kcl.ac.uk/depsta/lbmhs/instox/)

## TRAINING DAYS

### 1999 – 2000 Programme

Following the success of previous training days, CIRS has reviewed its 1999 – 2000 Training Programme. For booking information on these courses and further details please contact Rico Euripidou or Catherine Farrow on 0171 771 5382 for the CIRS courses, for the 14th December 1999 Heather Wiseman 0171 771 5295 and for the Part-time Toxicology course, Prof John Timbrell 0171 333 4789.

### CIRS Update for Thursday 7th October 1999 and Thursday January 27 2000

*((for CsCDC)*

Courses will be held at St Thomas' Hospital, Block 9.

### CIRS How to Respond to Chemical Incidents – basic course Wednesday 24th November

*(for CsPHM and Specialist Registrars on call).*

Courses will be held at St Thomas' Hospital, Block 9.

### CIRS Land Contamination Incidents:

#### Thursday 14th October 1999

*((for CsCDC, CsPHM and Specialist Registrars, and Local Authority Environmental Health Officers, 13 spaces left)*

The aim of the land training day is to provide delegates with the tools and information required to provide a prepared and timely response to acute and chronic land-based chemical incidents. As always with our training days, much of the work will include interactive exercises.

Much of the day will be based around a land incident checklist which will be presented on the day and published in the October edition of the Chemical Incident Report.

Topics to be discussed include:

- the role and responsibilities of the Environment Agency
- current legislation
- site investigation, sampling and remediation

- social impact of land contamination
- review of land contamination incidents to include significant events overseas and those responded to CIRS
- landfill and the Eurohazcon study
- checklist evaluation

The course will be held at St Thomas' Hospital, Block 9.

### CIRS Water Contamination Incidents:

#### Thursday 11th November 1999

*((for CsCDC, CsPHM and Specialist Registrars, and Local Authority Environmental Health Officers, 20 spaces left).*

The aim of this specialised CIRS training day is to provide the knowledge and skills necessary to deal with water contamination incidents specifically. One of the aims of the day will be to further develop the water incident checklist, published in the April 1998 issue of the Chemical Incident Report. As with all CIRS training days, interactive exercises will be included, along with case studies of actual water contamination incidents.

Topics to be discussed include:

- how the water industry works;
- water sampling;
- a review of CIRS water incidents & significant overseas incidents;
- susceptible populations, renal dialysis and biological sampling;
- a case study of diesel contamination of drinking water
- health surveillance and questionnaire design

Course will be held at St Thomas' Hospital, Block 9.

### Management of Chemical Incidents in A&Es -

#### Tuesday 14th December 1999

*(for A&E Consultants, Senior Medical Professionals and Senior Nurses).*

Course will be held at St Thomas' Hospital, Block 9.

### Part-time course in Toxicology

#### Six three day modules September 1999 and June 2000

For more information please contact Prof John Timbrell, Department of Pharmacy, King's College, London, on 0171 333 4789.

## Chemical Incident Report

Edited by Dr Virginia Murray, prepared and distributed in collaboration with Rico Euripidou, Joan Bennett, Ivan House and the staff of the Chemical Incident Response Service.

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