# PREPARING FOR A CHEMICAL INCIDENT

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identifies the significant role A&E nurses have to play in treating and resuscitating victims of chemical incidents

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Since the terrorist attack on the US on September 11 2001 and the increasing prevalence of global terrorist activity including threats to the UK, attention has focused on the threat of chemical and biological warfare. Before the attack, bioterrorism had occupied only a small part of the UK public consciousness and threats to civilians from hazardous materials primarily had come from industrial events.

Chemical incidents are unforeseen events leading to the acute exposure of individuals to any non-radioactive substance and resulting in illness or a potentially toxic threat to health (Schonfield *et al* 1995). NATO defines bioterrorism as a chemical substance that is intended for use in military operations to kill, seriously injure or incapacitate people because of the physiological effects (NATO 1996).

This article provides guidance on how to prepare A&E departments for a potentially serious chemical incident.

## TOKYO

The Tokyo subway attack involving sarin in 1995 is the largest documented exposure of a civilian population to a military nerve agent to date (Rodgers 1998). The attack focused on three rail lines that intersected beneath government offices (Okumura *et al* 1996).

Evison *et al* (2002) describe how the terrorists left plastic bags of sarin on an underground train, releasing the gas by allegedly piercing them with umbrella tips before escaping. More than 5,500 people needed hospital treatment and 11 people died. It is obvious that such an attack on this scale in the UK would overwhelm hospital and emergency services.

Following September 11, the Department of Health issued guidance to health authorities on practical steps to be taken in the event of a biological or chemical threat. The DoH has also recently issued chemical personal protective equipment (CPPE) suits to all A&E departments. Hospitals must be prepared to receive, decontaminate and treat chemically contaminated patients.

Hazardous chemical emergencies may also arise from accidents in producing, storing, transporting and disposing of chemical substances (Totenhofer and Kierce 1999). On the issue of transportation, Han *et al* (1999) describe how many millions of tonnes of chemicals are manufactured by the UK chemical industry each year and suggest that, although the manufacture and transportation of chemicals are highly regulated, there are frequent near misses and some occasions when chemical incidents do occur.

A more worrying scenario is exposure to toxic chemicals that may have been dumped illegally. Walsh and Kent (2001) suggest that this is an increasing problem. But environmental contamination can also be due to improper waste management. Friends of the Earth (www.foe.co.uk/) describes how many land fill sites, such as rubbish tips, accept hazardous chemical wastes from industry, thereby potentially causing human contamination.

## MECHANISMS OF EXPOSURE

Exposure to hazardous chemicals can kill. The extent of injury depends on the concentration of the agent, the quantity used

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**Box 1. Request and document the following information**

> Time and source of call
> Site of the incident
> Estimated number of casualties to be transferred
> Name of chemicals involved
> Whether casualties have been decontaminated already
> Estimated time of arrival (ETA)

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and the manner and duration of contact (Totenhofer and Kierce 1999). The principle routes of exposure are inhalation, absorption, ingestion and injection (Palmer 1997).

Following exposure, toxins are distributed throughout the body by the lymphatic system, blood and gastrointestinal tract. Elimination of these toxins occurs through perspiration, exhalation and excretion, potentially contaminating others (Palmer 1997).

A&E clinical staff require adequate CPPEs and decontamination procedure guidelines that can be instigated swiftly should chemical incidents occur. Rodgers (1998) agrees by suggesting that plans should include how to protect the hospital from contamination and prevent its personnel from becoming secondary casualties.

## THE LOCAL PICTURE

Middlesbrough General Hospital is situated in Teesside, among the biggest industrial conurbations in Europe. Due to the amount of local industry, the A&E department houses substantial decontamination facilities and procedures are in place should chemical incidents occur.

Ambulance service decontamination units attend to most contaminated casualties involved in chemical incidents but casualties can always present to A&E of their own volition. A&E departments must be prepared therefore to receive contaminated victims.

## RECEIVING THE CALL

Chemical incidents may be declared by the emergency services, industrial sites and the military. The person taking the call should request and document the details outlined in Box 1. Chemical incidents can also manifest through unannounced or unexplained presentations by any number of casualties with collapse, flu like symptoms, convulsions, skin blistering, burns, watering eyes, salivation or gastrointestinal disturbance. Senior A&E staff should be notified at once (see Box 2). More information on the chemicals involved can be obtained from the National Poisons Information Service and the chemical plant involved.

## PREPARING STAFF

It is crucial to establish whether victims have been decontaminated at the scene of the incident or elsewhere. If they were not, it suggests that people can contaminate each other. Were the chemicals involved potentially harmful to staff? If so, what degree of personal protection is required; full CPPEs, or aprons and gloves. If there is any doubt, full CPPEs must be worn.

## CPPES

The DoH has recently issued NHS-specified Respirex CPPE suits to all A&E departments. As only trained competent personnel should wear them, it is essential that all A&E staff receive training about the suits and associated safety considerations, and are familiar with checking them and their filter units before use.

One nurse and one doctor should be nominated to don the CPPE suits first, although this may vary depending on how many patients are involved. Another member of staff should be allocated the role of 'dresser' to help nominated staff members don their suits before entering the decontamination room.

Respirex CPPE suits have filters that need changing after 30 minutes unless otherwise indicated. So a fourth member of staff should be allocated the role of 'control officer' to document the details of staff entering the decontamination area. This includes staff names and the time at which they go in.

Staff wearing the CPPE suits may experience a rise in body temperature. Light clothing should be worn underneath to prevent the loss of too much body fluid. After 30 minutes, different staff members may be required to take over from those in the decontamination room. Drinking water should be available for staff leaving the area.

Before removing suits and leaving the decontamination area, staff should use the 'buddy decontamination' method to decontaminate each other. Assistants

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**Box 2. Contacts**

> Senior nurse in charge of A&E department

> Senior doctor on duty for A&E

> The A&E consultant on call

> Clinical manager

wearing CPPEs or gloves and aprons should cut decontaminated suits off staff at the edge of the decontamination area

Full procedure details can be found in the CPPE instruction booklets (NHS 2002a).

## PREPARING FOR PATIENT ARRIVAL

Ensure that external decontamination room doors are unlocked and ready to receive casualties to reduce the risk of contaminating the emergency department.

Triage nurse and reception staff should be informed that contaminated patients may attend A&E of their own volition. To prevent department contamination, patients should be directed to the external decontamination room entrances.

Decontamination areas should be sealed off from the rest of the department.

## CLINICAL ACTIVITIES

During decontamination, only simple life saving procedures will be possible (NHS 2001b). These include simple airway opening manoeuvres, manual cervical spine immobilisation, bag-valve-mask ventilation, and putting pressure on wounds.

Patients' clothing should be removed, preferably using scissors to reduce the risk of pulling contaminated clothing over the head.

The rinse-wipe-rinse method should be used to decontaminate. Rinse affected areas starting from the face down, wipe with a sponge or soft brush using an appropriate decontaminant solution, followed by a further rinse. The decontaminant of choice for most chemicals is a weak, warm detergent solution. (NHS 2002b).

In the case of eye injuries, substantial amounts of normal 0.9 per cent saline may be required for irrigation.

Some procedures such as establishing intravenous access and taking bloods may prove difficult to perform while wearing CPPEs and may only be possible once patients have been decontaminated. Arterial blood gas analysis may also be required. Other investigations should include electrocardiograms, chest X-ray, peak flow monitoring and urinalysis.

## DECONTAMINATED PATIENTS

If patients have been decontaminated at the incident scene, it is still recommended that they access A&E through the outside decontamination room doors. This allows brief assessment, which clarifies whether and how decontamination has taken place. After this initial assessment and confirmation that decontamination has taken place, patients can be treated in appropriate areas within A&E depending on need.

## PSYCHOLOGICAL EFFECTS

How would large chemical or biological incidents affect communities? One study by Kovalchick *et al* (2002) suggests that psychological effects can vary depending on duration and whether they are 'natural', for example volcanic eruptions and earthquakes, or due to human design or error, such as nuclear explosions, wars and chemical spills.

Other studies suggest there are common psychological complaints following both sorts of disaster; anxiety, depression, hostility, post traumatic stress disorder, hysteria, fatigue and sleep disturbance (Morrow *et al* 1990, Baum and Fleming 1993).

DiGiovanni (1999) suggests that chemical or biological incidents produce psychological impairment at individual and community levels and may generate enough casualties to overwhelm medical resources.

The above studies suggest that mental health services also need to be prepared for mass chemical incidents to support local clinical facilities and treat those experiencing psychological effects of disaster.

## CONCLUSION

Chemical incidents can result in one or many casualties and present particular difficulties. It is essential that A&E departments are well prepared to receive chemically contaminated patients and have specific incident plans in place. Decontamination procedures should be implemented without delay and conducted so as to minimise risk to staff and other patients.