

# **National Health Emergency Plan**

Hazardous Substances Incident  
Hospital Guidelines 2005

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## Glossary

|         |  |
|---------|--|
| PPE     | Personal protective equipment. In the hazardous substances context this is described as levels 1-4 or A-D. Different levels provide varying degrees of skin and respiratory protection. PPE also refers to masks gowns and eye protection used in a medical setting for infection control. |
| ED      | Emergency department.  |
| DHB     | District Health Board.   |
| CBRE    | Chemical Biological Radiological Explosive.  |
| HSNO    | Hazardous Substances New Organisms Act 1998.   |
| HAZMAT  | Term referring to hazardous materials or resources used in managing hazardous material incidents.  |
| Hazsub  | Term referring to hazardous substances or to resources used in managing them. Used in order to refer to the HSNO Act.  |
| NHEP    | Ministry of Health National Health Emergency Plan.   |
| NHEP:ID | MoH National Health Emergency Plan for Infectious diseases.  |
| CIMS    | Co-ordinated Incident Management System.   |
| NRL     | National Radiation Laboratory.   |



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# 1 Setting the Scene

## 1.1 Overview: hazsub incidents

This document provides advice and recommendations to guide District Health Boards and hospital facilities in planning their response to hazardous substances (hazsub) events.<sup>1</sup>

Hazsub incidents usually involve the accidental release of hazardous substances, although they may be the result of a natural hazard such as a volcanic eruption. Release of hazardous substances as a result of a large fire that involves chemicals is also a plausible scenario.

Gas-release events can cause large numbers of people to complain of symptoms, and many of these people will present to hospital even if they do not require hospital treatment or admission. As a result, gas-release events have the potential to create significant problems for hospitals and emergency departments (EDs).<sup>2</sup>

The Parnell fumes incident that occurred in Parnell, Auckland, in 1973 resulted in 643 people being sent to hospital for health checks, and a total of 4000 with some health concerns. In addition, 41 fire-fighters were admitted to hospital. Subsequently the Emergency Care Co-ordinating Committees were set up, followed shortly afterwards by the establishment of the Hazardous Substances Technical Liaison Committee to provide technical co-ordination and advice (Auckland Regional Council 1973, Ministry for the Environment 1996).

Almost all deaths in hazsub incidents occur promptly, at the scene of the hazsub release, and are caused by the event that caused the hazsub release – usually an explosion or fire in an industrial facility, or a motor vehicle crash. Most people who are admitted to hospital with serious injuries after a hazsub release event suffer from blast, fire or trauma injuries related to the actual release event. Less than 10 percent of all hazsub release incidents cause injuries to people, and most of these are minor, with few requiring hospitalisation. Hazsub release incidents in themselves cause very few deaths.<sup>3</sup>

<sup>1</sup> The Civil Defence Emergency Management Act 2002 and the National Civil Defence Plan set out the functions, roles and responsibilities of the health sector agencies in relation to emergencies or civil defence emergencies.

<sup>2</sup> Based on data from the Hazardous Substances Emergency Events Surveillance (HSEES) system, operated across 16 states by the US Agency for Toxic Substances and Disease registry, a federal public health agency within the US Department of Health and Human Services. All reports are available at <http://www.atsdr.cdc.gov/HS/HSEES/>.

<sup>3</sup> Ibid.

New Zealand Fire Service data from March 2004 until July 2005 shows 6600 chemical incidents occurring. Approximately 60 percent involved mobile property (cars and trucks), with petrol and LPG a significant factor. United States data<sup>4</sup> shows that fixed facilities such as factories and storage plants generate about 70 to 75 percent of all reported hazsub release events, with transportation-related events making up the remainder.<sup>5</sup>

It is important to note that contamination can be odourless and invisible. This is especially true of contamination with radioactive material, where specialised equipment will be needed to determine if contamination is present.

The potential does exist for a hazardous substance incident to involve criminal or terrorist activity, and consequently involve law enforcement or defence agencies. Intentional releases of hazardous substances are commonly referred to as chemical, biological, radiological or explosive (CBRE) incidents (see section 4.4). The likelihood of a terrorist attack involving a CBRE incident is currently considered to be very low in New Zealand.

Therefore, in terms of the health sector's preparations, it is recommended that responses to specific CBRE incidents not be a particular focus for resources. Strengthening systems to make them more resilient in response to *all* types of incidents is a better approach. Where appropriate, the distinction between unintentional incidents and deliberate incidents has been made in the text.

## 1.2 What is a hazardous substance?

In this document the term 'hazsub' is used throughout to denote hazardous substances, but it helps to clear about just what kinds of substance we are planning for. A hazardous substance is defined in section 2 of the Hazardous Substances and New Organisms (HSNO) Act 1996 as any substance:

- (a) With one or more of the following intrinsic properties:
  - (i) explosiveness
  - (ii) flammability
  - (iii) a capacity to oxidise
  - (iv) corrosiveness
  - (v) toxicity (including chronic toxicity)
  - (vi) ecotoxicity with or without bioaccumulation.<sup>6</sup>

Which on contact with air or water (other than air or water where the temperature or pressure has been artificially increased or decreased) generates a substance with any one or more of the properties specified in paragraph (a) of this definition.

<sup>4</sup> Ibid.

<sup>5</sup> See Appendix 4 for further New Zealand data.

<sup>6</sup> Hazardous substances with toxicity or corrosiveness and/or gases produced during combustion of flammable substances and explosive substances are the most likely agents to result in a health risk.

There is also a definition of 'hazardous substance' in the Fire Service Act 1975:

- (a) Any hazardous substance as defined in section 2 of HSNO Act 1996; and
- (b) Any infectious or radioactive substance that may impair human, animal or plant health.

Where specific considerations are required for one type of substance or another, this has been noted in the text.

### **1.3 Why do we need to prepare for hazsub incidents?**

The New Zealand Fire Service has protocols for managing hazardous substances incidents throughout New Zealand. In some districts specialised hazmat response units are available to respond to hazsub release incidents. Hazmat units contain specialised equipment such as breathing apparatus, various levels of personal protective equipment and decontamination equipment. Hazmat units are specialised resources used to support normal appliances and crews managing hazsub events. The Fire Service is responsible for containing releases and for decontaminating people exposed to hazardous substances. Decontaminated patients can then be transported safely and treated in the hospital with minimal precautions.

There is, however, a risk that a hazsub incident could occur in a community where the Fire Service has not taken control, or that an incident is so large that Fire Service resources are overwhelmed or fully committed at the incident site. Therefore hospitals must be prepared to receive and deal with contaminated casualties.

Hazsub incidents can occur anywhere, in rural or urban settings. Incidents may result in no, few or mass casualties. Experience has shown that patients will bypass pre-hospital emergency services and present directly to EDs. If these patients are contaminated and they enter the facility, the staff in the hospital may become contaminated and may become ill from toxic exposure. Parts of the facility may have to be closed for decontamination, and this will impede the facility's ability to continue to provide services. DHBs and hospitals must ensure that systems provide hospital staff with appropriate levels of personal protective equipment training, and containment procedures, in order to enable the management of contaminated patients and to ensure continuity of services.

### **1.4 The scope of these guidelines**

This purpose of this document is to provide advice and recommendations to guide DHBs and hospital facilities in planning their response to hazsub events. In some areas these plans may be made in co-operation with other DHBs in the region and with consideration of what resources are available. In all cases plans should be made in consultation with the local Hazardous Substances Technical Liaison Committee,<sup>7</sup> local and regional authorities, all appropriate DHB personnel, and in light of local risk profiles.

<sup>7</sup> See Appendix 5.

These guidelines specifically deal with ensuring that potentially contaminated casualties can be treated safely while minimising the risk to staff and the spread of contamination.

The roles and responsibilities of other agencies that may be involved in the response to hazsub incidents are outlined (see section 2.1) to provide a context for DHB and facility responses. It should be noted that separate guidance exists for public health services responding to chemical incidents, including their statutory responsibilities under the Hazardous Substances and New Organisms Act (HSNO) 1996.

This document does *not* deal with natural outbreaks of infectious disease or naturally occurring pandemics. See the *National Health Plan: Infectious diseases* (NHEP:ID) (Ministry of Health 2004) for information relating to these.

General guidance on the management of biological hazardous substances incidents that are deliberate releases or aberrant events, other than routine infectious disease situations, is included in section 4.4.

## 1.5 Objectives

This document is a part of the National Health Emergency Plan, available at: <http://www.moh.govt.nz/nhep>. The objectives of this document are to:

- clarify the roles and responsibilities of the Ministry of Health and DHBs in relation to hazsub responses
- provide specific advice to assist DHBs, public health services, hospital facilities and other agencies to prepare their own action plans
- describe the expectations for DHB emergency management systems
- describe the mechanism through which any plan will be activated and stood down.

By assisting all parts of the health and disability sector to understand the systems, processes and roles required in response to a hazsub incident, activation of a hazsub plan will allow for:

- rapid, timely, co-ordinated and effective action
- maintenance of normal health services to the greatest possible degree.

## 1.6 Guiding principles

The *NHEP Guiding Principles for Emergency Management Planning in the Health and Disability Sector* (Ministry of Health 2005, available at: <http://www.moh.govt.nz/nhep>) identify four principles for emergency planning.

- 1 *Activating and co-ordinating a response* – providers are able to respond quickly and effectively to the health care needs of patients/clients following a major incident while ensuring the continuation of the community's health services.
- 2 *Managing service delivery* – providers are able to provide services that, as much as possible, meet the needs of patients/clients and their community during and after an emergency event, even when resources are limited.
- 3 *Setting up a safe and appropriate environment* – providers aim to provide services that are managed in a safe, efficient and effective manner, given the circumstances of the incident.
- 4 *Organisational management and structure* – the provider is able to establish efficient and effective governance that ensures major incident and emergency management services are planned, co-ordinated and appropriate to the needs of the population.

## 1.7 Who is this document aimed at?

This document should be used by all agencies and individuals in the health and disability sector as a guide to preparing for and responding to hazsub incidents. It is particularly recommended to:

- DHB chief executive officers and chief operating officers
- emergency planners
- ED managers and clinicians
- senior health service managers, facility engineering managers and technicians
- chief medical advisors and directors of nursing
- medical officers of health, health protection officers and HSNO officers
- primary health organisation (PHO) and Independent Practitioners Association (IPA) managers, and primary care clinicians
- private accident and emergency clinics
- first response agencies – Fire Service, Ambulance and Police.

## 1.8 Currency

This document remains in force until it is replaced by a later version. Once published, the latest version will always be available on the Ministry of Health website at: [www.moh.govt.nz/nhep](http://www.moh.govt.nz/nhep).

## 2 System Preparedness

Please refer to the *National Health Emergency Plan: Infectious diseases* (NHEP: ID) and the *Operational Policy Framework* (OPF, Ministry of Health 2005) for details of:

- national-level system preparedness
- the roles and responsibilities of government agencies
- the Co-ordinated Incident Management System (CIMS), which is the system used by government agencies to manage emergencies – it is important that staff in hospitals are trained in this system
- communications and a single point of contact
- the NHEP activation system
- DHB high-level responsibilities and funding issues
- other generic emergency procedures information
- mandatory major incident and emergency planning requirements.

### 2.1 Non-DHB/hospital response agencies: principal roles and responsibilities

DHBs must understand the role and responsibilities of other agencies that may be involved in managing a hazsub event. This section outlines the roles and responsibilities of the non-hospital response agencies that may be involved in a hazsub release incident, and any related considerations for health emergency planners.

DHBs (including hospitals, public health services and contracted primary care providers) must establish and maintain relationships with their local Ambulance Service, Fire Service, New Zealand Police, Hazardous Substance Technical Liaison Committees and Civil Defence and emergency management groups. The development of good relationships between sectors and agencies will improve the course and outcome of any unusual event, and is an important aspect of resilience planning.

#### **New Zealand Police**

The Police role in a hazsub incident will be mostly related to securing and managing the scene, investigating the incident to determine if the hazsub release is the result of a criminal or terrorist act, and securing evidence for any resulting prosecution.

Police resources are unlikely to be available to assist in the management of people presenting to health facilities, at least during the early stages of any incident. DHB emergency planners should assume that the management of presenting people, their supporters and their relatives will be entirely the responsibility of facility staff and management for the duration of any incident.

The Police have responsibility for accessing the Emergency Service Co-ordination Committees.

## **The Fire Service**

Fire Service roles and responsibilities relate to scene management, containment and management of any released hazardous substance, and decontamination of individuals at the scene, working in co-operation with the Ambulance Service.

Fire Service resources may not be available to assist in the management or decontamination of people presenting to health facilities at any stage of a hazsub release incident, depending on the size of the incident. Therefore DHBs need to be prepared for a situation where management and decontamination of people presenting with known or suspected hazsub contamination is entirely the responsibility of facility staff and management.

The Fire Service has an additional responsibility to chair Hazardous Substance Technical Liaison Committees. These committees are accessed through the Fire Service.

## **Ambulance Service**

The Ambulance Service role in a hazsub incident is related to the assessment, triage, initial treatment and transport of people injured during a hazsub release, or otherwise affected by a hazardous substance. Ambulance services are principally operational in the cold zone (see section 3.3), although this capability may vary from region to region.

## **New Zealand Defence Force**

Police are responsible for activating the response of the New Zealand Defence Force Improvised Explosive Device Disposal (IEDD) team. This team has the responsibility to 'render safe' and dispose of improvised explosive devices. The New Zealand Defence Force also has some CBR (chemical, biological and radiological) incident response and decontamination capability.

## **Hazardous Substance Technical Liaison Committees**

There are Hazardous Substance Technical Liaison Committees in each centre (see Appendix 5) to advise and support the Fire Service when they are dealing with hazardous chemical incidents. Public health staff are represented on each committee. Generally, the committees' expertise is in dealing with spills of chemicals from a transport vehicle or at an industrial site.

## **National Poisons Centre**

The National Poisons Centre maintains a database of chemicals, their effect on people and the recommended treatment methods. The centre has worldwide connections to similar services, and staff have been involved in preparing information for health workers on chemicals and hazardous materials.

The centre maintains a website ([www.toxinz.com](http://www.toxinz.com)) containing information on chemicals and treatments (including antidotes), and also maintains a national antidote stock database. All major hospital EDs must have full access to the centre's website and database. All other hospitals can gain access via **0800 POISON / 0800 764 766**. The National Poisons Centre is the primary agency to which others refer for advice on the treatment and management of chemical hazsub-affected individuals.

### **National Radiation Laboratory**

The National Radiation Laboratory (NRL) is a specialist business unit within the Ministry of Health. The NRL:

- administers and enforces current radiation protection legislation
- advises government, key agencies, radiation workers and the public on radiation risks, and the application of radiation safety principles to reduce the potential for radiation incidents in its role as a regulatory body through the tracking of radioactive sources, compliance monitoring and other processes and initiatives.

The NRL will provide expert advice and technical support to the emergency and health services, in particular to the health protection officers who are likely to attend any ionising radiation incident. In relation to all incidents involving ionising radiation, whether caused as a result of an accident or a deliberate act, the NRL will:

- provide expert advice and assistance (including specifying appropriate control measures) for the purposes of minimising the radiation dose to workers and the public, and damage to the environment
- provide, in terms of human resources and equipment, laboratory support and on-site measurement capability, supported by health protection officers – essentially this is seen as providing survey and analytical measurements<sup>8</sup>
- secure radioactive material and remove it to a place of safety, and/or advise on the securing and evacuation of affected areas
- provide radiation dose assessments
- assist in the mass screening of people for external radioactive contamination
- provide expert advice and assistance in the development and implementation of remediation plans.<sup>9</sup>

<sup>8</sup> In relation to on-site measurements, assuming that key agencies are equipped with personal monitors (indicating individual dose received) and sensitive equipment for indicating the presence of radioactive materials, the NRL's role immediately following the discovery of any radioactive material would be to carry out necessary radiation surveys, establish the identity of the radioactive material and other necessary measurements and assessments (including personal dosimetry), and secure any radioactive material found.

<sup>9</sup> More information is available on the NRL website at <http://www.nrl.moh.govt.nz>. The NRL can be contacted on a 24-hour/seven-day basis at 03 366 5059.

## **2.2 DHB roles and responsibilities: response management planning**

DHB plans for both external and internal hazsub events should be included in the DHB major incident plan. The Health and Safety in Employment Act 1992 and Health and Safety in Employment Amendment Act 2002 require employers to have plans in place to manage and/or respond to all identifiable hazards. The presentation of hazsub-contaminated people who put hospital employees, patients or other people at risk, or a hazsub spill inside a hospital facility or on a hospital site, would constitute a risk that should have been foreseen under the Act.

The specific DHB hospital roles and responsibilities in relation to the management of a hazsub incident lie in the development, testing, exercising and continued updating of facility hazsub response plans. These are designed to:

- protect and ensure the health and safety of employees
- protect the facility, its personnel, and its ability to continue to provide services from being affected by a hazsub presentation or incident
- provide for safe assessment, triage, decontamination and treatment (as appropriate) for presenting hazsub-affected casualties or people
- ensure the safe disposal or decontamination of hazsub-contaminated equipment or supplies
- ensure the security of personal effects and maintain a chain of evidence
- ensure the decontamination of hazsub-contaminated areas of the hospital and return to normal operations at the earliest possible time
- ensure the maintenance, restocking and replenishment of consumables and supplies.

### **Public health services**

The role of public health services in DHB emergency management planning and response is to improve preparedness for the response to an emergency or civil defence emergency. In responding to a chemical incident, the HSNO enforcement officer will be acting under the delegated authority of the Director-General of Health. A health protection officer or medical officer of health acting under the HSNO may give directions to DHB staff, and these must be followed.

Public health services work with other agencies to plan responses for:

- infectious disease outbreaks
- hazardous substances incidents
- natural disasters such as flooding or earthquakes.

Public health service plans are made in collaboration with other key response agencies and planning groups, and include threat assessment, procedures and technical information. Specific public health plans for the unintentional or deliberate release of hazardous substances will include:

- procedures for identifying, removing, decontaminating and disposing of hazardous substances
- advice on evacuation
- inter-agency response details, including those of the New Zealand Fire Service and local authorities
- planning and preparedness for chemical poisonings and other releases of chemical agents
- an inventory of major sites of chemical storage, and the quantities held
- consideration of the risk of terrorist activity
- liaison with DHB emergency management contacts to ensure they have plans for mass chemical poisoning events and access to antidotes and treatment agents (Environmental Health Protection Manual 2005).

Public health services have a key role in providing advice about and managing events involving biological events – both unintentional and deliberate. Hazsub incident plans for both deliberate and unintentional incidents at DHB facilities must represent an integrated planning approach, and must include public health response functions.

### **2.3 DHBs and hospital facility planning**

Planning must link with hospital major incident plans to ensure that hospitals can effectively carry out their roles and responsibilities as outlined above. Although hazsub presentations as a proportion of all patient presentations are relatively rare, all hazsub presentations or events have the potential to have a significant impact on hospital facilities and services by disrupting the ability to provide normal services. Plans specifically need to ensure that hospitals are able to protect their ability to continue to provide services to the general population to the greatest extent possible during a response to a hazsub incident.

### **2.4 Risk assessments**

DHBs and hospitals must participate in assessments of the hazardous substances risks in their community. Risk assessments may be carried out in co-operation with public health services, the Fire Service or other relevant organisations (Ministry of Health 2005). A hazard analysis of all local hazards will be a part of the Civil Defence Emergency Management (CDEM) group plans. Hazards of national significance will be identified in the national CDEM plan.

Risk assessments will identify the predominant natural and human activity hazards (including deliberate contamination) likely to give rise to emergency situations affecting public health within each DHB district.<sup>10</sup> Emergency planning and response capacity must be sufficient to deal with identified risks, or to manage those risks until assistance

<sup>10</sup> Risk Management AS/NZS 4360:2004.

can be provided by other DHBs in the region, or from other identified organisations. The plans will include reduction, readiness, response and recovery.<sup>11</sup>

Response plans for hazsub incidents should include:

- decontamination facility capacities
- personal protective equipment volumes
- associated supplies appropriate to the level of risk (see section 3).

Although most hazsub events will involve a small number of patients, hospitals should develop plans to manage incidents involving a large number of people. This kind of incident is likely to be related to gas releases (eg, chlorine) rather than solid contamination or liquid releases. All main facilities should have plans in place to manage the presentation of at least 30 potentially gas-hazsub-affected patients within an hour of the first arrival, with a total of at least 50 to 60 presentations over a three-hour period.<sup>12</sup>

Hospital plans in large urban centres should acknowledge that up to 250 people could present in a rare, larger-scale hazsub release incident, or as the result of an actual or supposed terrorist-related hazsub release. In these situations, plans should assume it is likely that the great majority of presentations will require no significant medical intervention or decontamination, and that the main problems will be crowd management, facility security, and providing reassurance to many anxious and demanding people.<sup>13</sup>

## **2.5 Fast activation**

Hospital hazsub plans must specifically prepare for hazsub-affected patients who bypass emergency services or the ambulance system and self-present at the hospital without any prior warning. In a sudden and/or large event, the first arrivals will be closely followed by others, so for the protection of the facility it is essential that the hazsub presentation response can be activated immediately.

## **2.6 Facility security**

Presentations of hazsub-affected patients have the potential to disrupt normal hospital response services and make areas of the facility potentially unsafe for hospital employees, patients and others. Hazsub events may also be the focus of intense media scrutiny.

<sup>11</sup> An example of a risk assessment tool is available at:  
[http://www.hazmatforhealthcare.org/download/doc/misc/Kai\\_Perm\\_HVA\\_11-29-01.xls](http://www.hazmatforhealthcare.org/download/doc/misc/Kai_Perm_HVA_11-29-01.xls)

<sup>12</sup> These estimates and requirements are based on data from the HSEES system.

<sup>13</sup> Ibid.

Hospital hazsub plans should include procedures for rapidly securing the hospital site and/or facilities from unauthorised entry. Provision should be made for personal protective equipment (see section 3.3) for those charged with maintaining security. Hazsub-contaminated people must be prevented from entering main hospital buildings or areas apart from through the decontamination facility. Communications plans should clearly assign responsibility for media liaison.

## 3 Clinical Preparedness

This section details key issues relating to clinical preparedness for hazsub incidents, and outlines DHB and health service provider roles and responsibilities in this area. As a minimum requirement, all appropriate DHB hospitals must be able to provide triage, assessment, decontamination, and at least initial treatment for hazsub-affected patients (child or adult), while maintaining to the greatest extent possible the ability to treat others.

### 3.1 The clinical care pathway and associated requirements

DHB planning must describe a primary-, secondary- and tertiary-sector clinical care pathway for suspected or probable hazsub-affected patients. The clinical care pathway must provide for the protection for health care workers, other patients and the general public. The clinical care pathway should define:

- processes for the safe assessment and triage of suspected or actual hazsub-affected patients, away from unprotected people, wherever the patients may present
- non-DHB health service providers in the area that may have a frontline clinical service role in the case of a large-scale hazsub event – these services should be included in planning for such events (eg, privately owned accident and emergency clinics)
- transport or transfer and clinical hand-over processes for hazsub-affected patients
- personal protective equipment, decontamination facilities and processes to ensure the safety of staff and facilities where contaminated patients may present or be taken
- clear and agreed internal communications processes to inform operational personnel of a hazsub-related emergency situation, and the required actions
- agreed processes for prioritising services during a hazsub-related emergency situation.

### 3.2 Occupational safety and health

Hazsub-affected patients may arrive at hospitals with no warning, thereby presenting an immediate risk to frontline staff and the facility. The immediate nature of the threat means that all staff who may have to manage such a presentation must maintain appropriate competencies at all times.

All DHB hospitals must ensure that:

- a safe working environment is provided for all staff
- all staff who may have to manage a hazsub-related incident have access to personal protective equipment, and are trained in its use through hazsub management training programmes (see section 3.5)
- all relevant staff are trained and skilled in all aspects of hazsub management, and maintain ongoing competency.

## Co-ordinated Incident Management System

The Co-ordinated Incident Management System (CIMS) is the system used by government agencies to manage emergencies, and it is important that staff in hospitals are trained in this system.

## Training plans

Training plans should be based on the duties and responsibilities of each team member, and must include support personnel. Hazsub and personal protective equipment training plans must include incident training and exercise plans, demonstrated competencies, refresher training, and participation in scheduled exercises.

## 3.3 What personal protective equipment should a facility have?

### Personal protective equipment (PPE)

Emergency Management Australia describes four levels (A to D) of personal protective equipment (PPE).<sup>14</sup> Levels A and B are required for working in actual or suspected grossly contaminated areas. Level C provides protection from skin, eye or mucous membrane contact with chemicals, and (with appropriate filters) respiratory protection against relatively low concentrations of gases or vapours. Level D provides little more protection than ordinary clothing, and no respiratory protection (see Table 1 and Figure 1).

Because vapour concentrations associated with ED presentations will not be high, and oxygen concentrations are most likely to be normal, Level C PPE will provide an appropriate level of protection for hospital staff responding to an actual or suspected hazsub-affected presentation in the New Zealand ED environment (Janes Information Group 2003b).

**Table 1:** Levels of personal protective equipment

|                        | Level A (4)         | Level B (3)        | Level C            | Level D (1) <sup>15</sup> |
|------------------------|---------------------|--------------------|--------------------|---------------------------|
| Respiratory protection | SCBA                | SCBA               | Respirator         | None                      |
| Skin protection        | Total encapsulation | Chemical resistant | Chemical resistant | Eye or face shield        |

<sup>14</sup> Emergency Management Australia, <http://www.ema.gov.au/>.

<sup>15</sup> Brackets indicate NZ Fire Service equivalent levels 1–4. There is no Level C equivalent used by the Fire Service at this time.

**Figure 1:** Personal protective equipment



Level A PPE



Level C with mask respirator



Example of hood for Level C protection and use with powered respirator

### **Hazardous substances incident zones**

To ensure standardisation of terminology, hospitals must adopt the following terms for decontamination facility areas (Janes Information Group 2003a).

- Hot zone – the area where there is immediate danger to life or health. Accordingly, Level A personal protective equipment with self-contained breathing apparatus or supplied-air respirator is required for first responders or other personnel working inside the hot zone (see Figure 1). The hot zone is at the incident site.
- Warm zone – an uncontaminated environment into which contaminated patients, first responders and equipment are brought. The warm zone may be in the area outside the ED entrance or even inside the hospital. The warm zone is the area where decontamination is carried out. Secondary contamination is a risk in this area, and consequently PPE is required for workers in this area. Level of PPE required is dependent on degree of potential exposure.
- Cold zone – the area that is completely uncontaminated. It is the safe or clean zone where no protective equipment is required.<sup>16</sup>

### **New Zealand PPE specifications**

Agreement should be reached between DHBs and regions on compatible systems for PPE. This is important to ensure familiarity with equipment for staff from out of the area, to allow for surge capacity, and to potentially allow for economies of scale when sourcing equipment. Note that ancillary services may require a level of protection as well (eg, security services).

<sup>16</sup> Personal protective equipment: choosing the right protective equipment, in e-medicine. Available at: <http://www.emedicinehealth.com/articles/8745-6.asp>

When replacing current PPE the recommendations in this document should be followed. As noted, Level C PPE will provide an appropriate level of protection for hospital staff responding to an actual or suspected hazsub-affected presentation in the New Zealand ED environment. The New Zealand ED PPE Level C specification<sup>17</sup> is:

- full head (preferably) or full-face mask (when full-face mask respirators are being replaced, consider doing so with hoods, which are preferable because they can fit anyone, unlike masks. Masks can be time consuming to fit and may be difficult for people with beards)
- hood ventilation from a battery-powered unit, with integrated multi-gas/P3 filters that cover both chemical and biological cases<sup>18</sup> and have an integral end-of-service-life indicator
- single-use batteries for operational use<sup>19</sup>
- disposable, impermeable, chemical-resistant overall suit, with or without an attached hood as appropriate to match with the selected full-head or full-face ventilated hood, and with cuffs large enough to fit over gloves and boots<sup>20</sup>
- chemical-resistant gloves with moderate dexterity<sup>21</sup>
- chemical-resistant boots.

### **Rationales for PPE volumes**

Recommended minimum PPE holdings according to decontamination facility sizes are given below, and summarised in Table 2. Note that these are the recommended minimum – individual facilities may increase volumes or capacities according to specific local considerations or enhanced risk profiles. Facilities may also plan for a capability to manage in the short term until backup resources are provided from within the region, if this is feasible.

### **Large urban or provincial base hospital (seven PPE outfits)**

This type of facility should be able to make available:

- one suited person to triage and/or direct individuals into the decontamination facility
- one team of five suited personnel to manage and decontaminate a non-ambulant stretcher patient
- one suited spare/safety officer.

<sup>17</sup> ED Physicians Working Group, CBRE equipment workstream, 30 September 2004.

<sup>18</sup> The filters need to be integrated so that users do not have to use the specific filters or stack parts together according to the specific requirement.

<sup>19</sup> Rechargeable batteries can be used for training, but cannot be guaranteed to last the course for a real deployment.

<sup>20</sup> Slick tape is probably the handiest material for sealing the suit/glove and suit/boot junctions. It will be available in any ED. Duct tape could also be used.

<sup>21</sup> Dexterity and sensitivity sufficient to intubate or cannulate is not essential – gloves need to be adequate for handling and decontaminating patients while performing basic airway support.

### Rural or minor facilities (two PPE outfits)

This type of facility should be able to make available two outfits, which is the minimum necessary to protect staff who may have to direct or assist decontamination of an ambulant casualty, or provide basic assessment and assistance to a contaminated stretcher casualty. (This may be altered according to the local risk assessment.)

Assistance will be required from local ambulance or fire services if decontamination of stretcher patients is necessary.

**Table 2:** PPE volumes and showerhead capabilities, by facility size

| Facility type  | PPE hoods | Splash suits | Showerhead capability |
|--|-----------|--------------|-----------------------|
| Major urban or provincial base hospital  | 7         | 21           | 4                     |
| Small rural facilities or minor (ie, non-base hospital) city facilities  | 2         | 4            | 1                     |
| Major and base facilities: 3 suits per hood (small/medium/large).<br>Minor facilities: 2 suits per hood (s/l).<br>Gloves, boots and associated equipment at scales to match suits. |           |              |                       |

### 3.4 What decontamination capacities should a facility have?

Health facilities where known or suspected hazsub-affected patients could present themselves must have decontamination facilities capable of safely removing hazsub contamination before patients are allowed into the ED or the main hospital facility.

It is recommended that agreement be reached between DHBs and regions on compatible systems for PPE. This is important to ensure familiarity with equipment for staff from out of the area, to allow for surge capacity, and to potentially allow for economies of scale when sourcing equipment. Note that ancillary services may require a level of protection as well (eg, security services).

#### Incident sizing

Urban and provincial base hospital facilities should plan to manage about a dozen people with skin contamination, acknowledging that larger events, typically involving gas releases, could occur (see section 4.2). Four showerheads, including a hand held shower head for management of stretcher patients, is recommended. This number will provide a minimum of 16 persons per hour facility throughput on a 15-minute cycle (see Table 2). It is likely that less time would be required for most decontaminations.

Minor facilities should plan to manage and decontaminate one or two ambulant contaminated patients, calling for assistance from larger facilities or (potentially) from the local fire brigade if necessary.

## Hospital decontamination facilities specifications

Hospital decontamination facilities should:

- be located *outside* the main hospital buildings and ED, or have an entrance clearly separated from the main ED or facility entrance
- have clearly demarcated hot, warm and cold zones
- have a 'flow-through' patient pathway from hot to cold zones, and from there into the ED or other suitable main hospital reception area
- conform to minimum showerhead requirements (see Table 2)
- be of a size and layout suitable to accommodate the appropriate number of staff
- provide for both ambulant and stretcher patients
- provide for the separation of ambulant patients into male and female areas, with appropriate privacy provisions, or provide individual shower/decontamination areas for ambulant patients
- make provision for the safe containment and security of contaminated patient clothing and/or possessions
- if contained within a building, have ventilation and air exhaust systems separate from the main ED or facility systems, with outlets well clear of other air or ventilation intakes
- have water services able to continuously deliver warm (not hot, see section 4) water for each showerhead or equivalent, for two hours.

Decontamination facilities must be able to be started at any time of the day or night, by the ED staff normally present in the facility, within five minutes of the presentation of a known or suspected hazsub-contaminated patient. Full operation of all capabilities may not be achieved at the five-minute stage, but by this time water needs to be running, and sufficient capability to manage the initial presentation must be available.

Hazsub plans must provide for the appointment of a safety officer or officers whose task is to oversee the general clinical management of the response, and in particular to monitor the safety of staff wearing PPE and directly involved in the response.

See Appendix 1 for a full facility requirements checklist.

### 3.5 PPE and decontamination training

All hospital staff likely to take part in contaminated patient reception, assessment, triage, or decontamination should be trained in the use of Level C PPE. All decontamination team members must be adequately trained to perform their anticipated duties without endangering themselves or others. This includes training in:

- PPE use
- decontamination procedures
- hot/warm/cold zone considerations and locations

- the operation of all fixed and mobile equipment required for decontamination, clean-up and associated processes.

All staff likely to use PPE should receive training (or refresher training) in PPE use at least every 12 months. Support staff should be familiar with safety and security response measures to hazardous incidents at their facility.

Hazsub exercises should include:

- incident recognition
- communications
- security lockdowns
- the set-up, operation and clean-up of decontamination facilities and processes
- the use of treatment protocols and patient-tracking procedures.<sup>22</sup>

### 3.6 Antidotes

DHBs must either have available in their facility or have rapid access to antidotes for the following hazardous substances.

**Table 3:** Common hazardous substances and their antidotes

| Hazardous substance                      | Antidote   |
|--|--|
| Cyanide                                  | Sodium thiosulfate and either sodium nitrite or dicobalt edetate or hydroxocobalamin (2–2.5 g vials) |
| Organophosphates, including nerve agents | Atropine and pralidoxime iodide and benzodiazepine (eg, diazepam)                                    |
| Arsenic                                  | Dimercaprol  |

Note: these recommendations may change due to access to improved antidotes, or in the light of better knowledge regarding efficacy.

Recommended indications, methods of administration and doses of these antidotes are available on the TOXINZ poisons information database ([www.toxinz.com](http://www.toxinz.com)). Hospital stockholdings of these antidotes are available to authorised users at [www.antidote.co.nz/](http://www.antidote.co.nz/).

<sup>22</sup> Downloadable training resources are available at [www.hazmatforhealthcare.org](http://www.hazmatforhealthcare.org). Information on HAZMIMM courses (in the UK) is available at [www.nbcservices.co.uk](http://www.nbcservices.co.uk). Other contact for MIMM training in is Australia Advanced Life Support Group.

## 4 Responding to a Hazsub Incident

The DHB major incident plan should include response plans for internal hazsub incidents.

### 4.1 General guidelines for hospital decontamination of hazsub patients

Any patient presenting with known or suspected hazsub contamination must be decontaminated before being moved into unprotected facility areas, or being treated by unprotected staff.

In the New Zealand ED setting decontamination should be carried out by removing the patient's clothing and showering with warm (not hot) water,<sup>23</sup> using liquid soap. Removal of clothing and showering should be carried out from the head down to avoid as much as possible the potential for ingesting contaminate.

Ambulant patients can decontaminate themselves with instruction from and oversight by appropriately protected staff. Stretcher patients will need to be decontaminated by protected staff.

Patients must be supplied with appropriate clothing on moving into the cold zone after drying themselves, or being dried. Towels and any facecloths used in the decontamination facility are regarded as contaminated and should be bagged, labelled and treated appropriately.

Decontamination should require 15 minutes at most, although patient stabilisation considerations may prolong the process. After decontamination, the patient can be moved into the general treatment area (the cold zone) and treated like any other patient. Treatment within the decontamination area should be limited to basic life support measures and life-saving procedures (Cox 2005).

The goal of decontamination is to remove the maximum amount possible of the contaminating material from the patient. This is done in order to prevent further harm to the patient and to eliminate the danger of secondary contamination to those providing medical care to the patient.

More detailed decontamination guidelines depend on the kind of hazardous substance involved. In the following subsections we cover:

- gas-release events
- radioactive contamination
- the intentional release of CBRE (chemical, biological, radiological and explosive) agents.

<sup>23</sup> Hot water can cause vaso-dilation and increase transcutaneous absorption of contaminate into the patient's bloodstream.

Note: this document does *not* deal with natural outbreaks of infectious disease or naturally occurring pandemics. See the *National Health Plan: Infectious diseases* (NHEP:ID) for information relating to these.

## 4.2 Responding to gas-release events<sup>24</sup>

### Likely scenarios

Since the First World War it has been recognised that gas-release event casualties obey a power law, with a relatively low proportion of serious casualties or deaths compared to the number of moderate to negligible casualties. Even in the Bhopal incident, which was by far the largest and most lethal peacetime gas release event in history, deaths were between 1.1 and 2.7 percent of the total casualties: 5800 officially recognised deaths and more than 9000 other death claims paid out of approximately 550,000 total casualties (Kumar 2004).

Ammonia is the most commonly released gas, but it results in few casualties because it is lighter than air and will disperse readily. Chlorine releases, although fewer in number, result in more casualties because the gas is heavier than air and takes longer to disperse. About 30 percent of all chlorine releases will result in at least one casualty, although not all will present at or be taken to hospital.

Most deaths in gas-release events are caused by an explosion, fire or motor vehicle crash that caused the release, rather than from gas poisoning as such. Deaths from gas exposure alone are rare, and are usually prompt (ie, occur at the scene). US data indicates that in most gas-exposure events about 30 to 40 percent of all those affected by exposure to gas will be treated at the scene. Many of these people will have been affected by nothing worse than a bad smell for a short time. 'Treatment' in this case involves sitting the person in the fresh air for a while and having them checked by ambulance or paramedic personnel before they resume normal activities.

The remaining people will either make their own way to the hospital or will be transported by ambulance. Of all those arriving at the hospital, fewer than 10 percent will be admitted. In most cases these admissions are essentially precautionary and will be short. The rest of the presenting patients will be assessed, reassured and discharged home after a short time.

Experience from many hospitals in many countries shows that in a sudden, unexpected event such as a gas release, with or without an accompanying explosion and/or fire, hospitals typically learn about the event from the first people to present. Generally about half of all the patients seen by an ED will arrive in the hour after the first presentation. Most of the first-hour people will have transported themselves, or will have been transported by bystanders, and will be relatively lightly affected. More seriously affected patients will come along later in the sequence, by ambulance.

<sup>24</sup> The information in this gas-release subsection has been synthesised from relevant literature, principally the HSEES system. All reports are available at <http://www.atsdr.cdc.gov/HS/HSEES/>. Little New Zealand data is available, although some individual DHB emergency departments have collected relevant statistics.

## **ED management of gas incidents**

The major issues for EDs in managing presentations relating to a large gas-release event are essentially crowd control with a medical overlay, and maintaining the ability to provide effective triage and prioritisation. Decontamination of arriving patients is not usually required, although the gas involved must be identified before a firm decision to forgo all contamination precautions can safely be made. The ED must also take care to maintain sufficient capacity to manage potentially more seriously affected patients who may arrive after the first wave, as well as any 'business as normal' presentations that may come along.

Crowd control problems may include the need to manage large numbers of unaffected but anxious and demanding people turning up at the hospital to look for relatives. If the gas release involves children, there will be large numbers of parents/caregivers (possibly more than two for every child) turning up as well. There will be intense media interest, with all the associated management and public information issues.

Many (but by no means all) of those presenting to hospital from a gas-release event will need or demand a chest X-ray to exclude their concerns, so radiology capacity is usually a major pacing item in clearing the ED.

As a general guide, an unexpected large gas-release event affecting 100 people at the site of the release (and assuming no significant injuries from an explosion, fire, motor vehicle crash or other cause) could impact on the local ED in the following ways.

- The ED learns about the release from the first presentation(s) to arrive.
- There are 30 to 40 presentations in the hour from the time of first arrival, with 60 to 70 presentations in total.
- More seriously affected people tend to arrive by ambulance later in the sequence.
- Up to 200 (or possibly more) non-affected people turn up at the ED asking about relatives, friends or children.
- All the local media arrive on-site very early in the sequence.
- Radiology throughput is an important factor controlling ED clearance rates.
- Up to six admissions are made for observation.

The impact will be largely confined to the hospital front-end services, and there will generally be no need to clear wards to accommodate potential admissions.

## **4.3 Responding to radioactive contamination**

### **Pre-hospital care of casualties**

Pre-hospital care of patients with radioactive contamination is based on triage principles and priority of treatment for injury and illness – regardless of contamination. Do not delay the rescue or transport of a seriously injured contaminated patient.

## **Transport of contaminated casualties**

When transporting contaminated patients:

- remove contaminated outer clothing
- place the casualty on a clean sheet on the stretcher
- fold the sheet over the casualty to form a 'package' to contain any remaining contamination
- transport the patient, and advise the receiving facility that the patient has been contaminated.

Ambulance personnel and vehicles must be monitored for radioactive contamination before leaving the hospital.

## **Hospital treatment area**

- Establish a contamination-controlled area with temporary barriers, signs, and security staff.
- Cover the floor of controlled areas (eg, with polysheeting) and tape the covering in place.
- Use large bins with plastic liners for waste.
- Ensure sufficient plastic bags are available for samples.
- Remove non-essential items from the controlled area (or cover them in polysheeting).
- Establish an access control point and ensure all people and equipment are monitored when entering or leaving the controlled area.

## **PPE for hospital staff**

Hospital staff dealing with radioactive contamination should be provided with:

- gown and waterproof apron
- cap
- overshoes
- two pairs of gloves – the inner pair taped to the gown, the outer pair to remove and replace as indicated
- surgical mask
- eye protection
- personal radiation dosimeters.

## **Casualty management**

- Prior to decontamination, triage casualties with life-threatening conditions to the treatment area and stabilise.
- Casualties with less serious injuries should be directed to a controlled area for radioactive contamination monitoring and decontamination.

## Personnel monitoring

Radiation monitors are held by public health services.<sup>25</sup> When monitoring personnel, follow these procedures. People are monitored while clothed, paying particular attention to exposed parts of the body. Outer clothing is then carefully removed and contaminated clothing double bagged. The person is then re-monitored and decontaminated as necessary.

- Instruct the person to stand straight, feet spread slightly, arms extended with palms up and fingers straight out.
- Monitor both hands and arms; then repeat with hands and arms turned over.
- Starting at the top of the head, cover the entire body, monitoring carefully the forehead, nose, mouth, neckline, torso, knees and ankles.
- Request the subject to turn around, and repeat the survey on the back of the body.
- Monitor the soles of the feet.

## Decontamination

Patients may have been decontaminated at the incident site, but be prepared to carry out decontamination at hospital if this is not the case.

- Remove the patient's clothing, double bag it and set it aside for monitoring. Over 90 percent of whole-body contamination can be removed this way.
- In general contaminated wounds and body orifices are decontaminated first, followed by areas on the skin with the highest levels of contamination.
- Radioactive contamination in wounds or burns should be handled as if it were dirt.
- Unknown metallic objects embedded in patients should be handled with forceps and treated as potentially radioactive in the absence of any indications to the contrary.
- For whole-body decontamination, wash under running, tepid water for at least five minutes with soap, soft brush or cotton wool swab.
- Wounds are first draped to limit the spread of radioactive contamination, then irrigated with saline or water.
- To decontaminate the mouth, brush teeth and rinse frequently.
- For the pharyngeal region, gargle with 3 percent hydrogen peroxide.
- For the eyes, direct a stream of water from the inner to the outer canthus while avoiding contamination of the nasolacrimal duct.
- For ears, carry out external rinsing and rinsing of the auditory canal if the tympanic membrane is intact.

<sup>25</sup> Equipment being issued to Health Protection Officers consists of a radiation doserate meter and an alpha/beta/gamma pancake Geiger contamination probe. It is the contamination probe that would be used for checking personnel and equipment for contamination. Hospitals with a nuclear medicine department should have similar suitable contamination monitoring equipment.

- Avoid harsh scrubbing, as breaking the skin will result in increased absorption of the contaminant.
- Repeat the contamination monitoring process at the end of decontamination, paying particular attention to areas of greatest contamination.
- It is unlikely that all contamination will be removed. A satisfactory end-point is a reading that is twice that of background.

### **Treatment of internal contamination**

The basic principles of treatment for internal contamination are to reduce absorption and internal deposition, and enhance excretion of absorbed contamination. Examples of treatment include:

- saturation of target organs (eg, potassium iodide for radio-iodine)
- complex formation at the site of entry or in body fluids, followed by rapid excretion (eg, DTPA for plutonium isotopes)
- acceleration of the metabolic cycle of the radionuclide by isotope dilution (eg, beer for tritium)
- precipitation of the radionuclide in the intestinal lumen, followed by faecal excretion (eg, barium sulphate administration of strontium-90)
- ion exchange in the gastrointestinal tract (eg, Prussian blue for caesium-137).

## **4.4 Responding to the intentional release of chemical, biological radiological and explosive (CBRE) agents**

### **Chemical agents**

The effects of most chemical events are likely to be visible immediately or very soon after exposure, whether due to overt, covert or accidental release.<sup>26</sup> Rapid identification of the agent concerned is required to aid in the management of the incident, the treatment of affected persons and the decontamination of people and the environment. Response to a chemical event is most likely to be initiated by calls to the emergency services, which will then respond in the normal way.

### **Biological agents**

The effects of a biological event will usually take time to appear.<sup>27</sup> This delay may be a number of hours or days from exposure to exhibiting symptoms, and this will be the case irrespective of whether it was an overt or covert delivery. Timeliness in determining the nature of the agent is critical to initiating the appropriate treatment, isolation, vaccination and contact tracing, and decontamination actions.

<sup>26</sup> Overt events are where no effort is made to disguise or hide the delivery of the chemical. Predominantly overt events will fall into the hazsub area, but some may be criminal or terrorist acts. Covert events are more likely to be criminal in nature and occur where the perpetrators attempt to hide or disguise the delivery of the agent, probably in an effort to escape from the scene undetected.

<sup>27</sup> The effect of some toxins may be apparent within a few hours of exposure depending on the route of exposure and the dose.

The management of a communicable disease outbreak is different from the management of events involving chemical or radiological agents, simple because the full hazard is communicable. In the case of a communicable disease that is transmitted readily from person to person, the main priority will be ensuring that further transmission does not occur in order to avoid a much more extensive outbreak in the community. This is achieved by isolating cases and contacts, and rapid contact tracing, vaccination and treatment (where applicable).

Covert deliveries will have the added complication of authorities not knowing exactly where or how the exposure has occurred, thus requiring extensive investigation to determine if this is a natural occurrence or the result of criminal action. Initial awareness of the event may not occur in the traditional way (with a call to the emergency services), but instead may come from people presenting to health facilities with symptoms that will need to be interpreted and then reported. The time delay in this process becomes critical to the effective management and containment of biological agents transmittable between people. A site for the release may be difficult to establish, and so the investigation may require a different approach to that of a traditional crime scene investigation.

Organisms that are most likely to be used for the purpose of intentional release fall into two commonly agreed categories.

- *Category A agents and diseases:* these are easily disseminated or transmitted from person to person, and have high mortality rates and the potential for major public health impacts. Release of these agents may cause social disruption, and they require special action for public health preparedness. Category A agents and diseases include anthrax, smallpox, botulism, plague, tularaemia and the viral haemorrhagic fevers.
- *Category B agents and diseases:* these are moderately easy to disseminate, have moderate morbidity rates and relatively low mortality rates. Diseases in this category include glanders, melioidosis, brucellosis, psittacosis and Q fever.

Further information for all these agents can be found via the UK Health Protection Agency deliberate release homepage ([http://www.hpa.org.uk/infections/topics\\_az/deliberate\\_release/menu.htm](http://www.hpa.org.uk/infections/topics_az/deliberate_release/menu.htm)), the Center for Disease Control and Prevention (<http://www.bt.cdc.gov/>), or from a wide variety of other sources.

### **Biological agents: decontamination considerations**

Although hospitals regularly manage infectious diseases, intentional biological agent releases or events will create new challenges to responding effectively.

Patient decontamination will only be required when contamination with a bioactive substance is known or suspected, as in 'white powder' incidents or the actual or suspected release of a biological toxin such as a mycotoxin. For practical purposes these events can be managed in the same way as a chemical event. Prophylactic medication may be considered in the case of potentially infectious agents.

The decision to perform decontamination should be made in collaboration with an infectious disease consultant, ED physicians and local public health personnel, taking all available information into account. The need for patient decontamination is assessed taking into account the pathogen(s) involved or potentially involved and their incubation periods, the potential for aerosolisation of any contaminate, the risk associated with cutaneous exposure, and the presence of any visible powder. However, for practical purposes, if there is any doubt, decontamination procedures should be activated.

During or after the recognition of an unannounced biological release, decontamination of patients will not normally be a consideration. Normal infectious disease precautions and infection control measures will be required. The NHEP-ID (Ministry of Health 2004) provides a framework for response to biological hazards that have the potential to create a national health emergency.

In any biological event, close co-ordination between EDs, acute medical care and infectious disease units, the local public health unit and the Ministry of Health will be necessary. It is likely the Ministry of Health will activate NHEP:ID on learning of an intentional biological release incident.

### **Radiological agents**

An intentional radiological event is very unlikely to contaminate people in a way or to a degree that would be of any immediate concern to the safety of first responders or caregivers. Casualties who may be contaminated with radioactive material will not present an immediate life-threatening risk to persons treating them, and consequently administering life-saving medical treatment should take precedence over any radiological assessment or decontamination. First responders and caregivers need to protect themselves from contamination by observing, as a minimum, standard precautions, including protective clothing, gloves and a mask. Decontamination should be carried out as soon as practicable (see section 4.3).

Radioactive material released from a radiological dispersal device (a dirty bomb) would be unlikely to result in anyone receiving a fatal dose of radiation. Any radioactive material dispersed into the air would be reduced to relatively low concentration, but could conceivably lead to a significant part of an urban area being contaminated with radioactive material. Disruption and clean-up costs would be considerable.

Timeliness in quantifying the radiological risks involved (or threatened) will be vital in minimising radiological exposures and the spread of radioactive contamination. The general public's perception of the risks associated with ionising radiation tends to skew towards an increased level of dread not seen with most other risks (IAEA 1997).<sup>28</sup>

<sup>28</sup> Reference should be made to section 4.2.11 (Mitigating the non-radiological consequences) of IAEA-TECDOC-953. The following quotations are taken from a report by the USA's Department of Homeland Security. 'Lack of consensus among experts can increase public fear and anger. Because it is such an unknown, then, radiation stimulates worst-case fantasies ... Prior technological disasters, terrorist attacks and use of novel weapons in the context of war suggests that healthcare providers' offices, medical clinics, and hospitals will be deluged with symptomatic and asymptomatic patients seeking evaluation and care for possible contamination following a radiation event.'

Consequently, a proactive communication strategy involving clear, consistent messages is a critical consideration (see section 4.6).

#### **4.5 Management of patient clothing and valuables**

It is strongly recommended that DHB/hospital planners consult with public health and environmental health officers when planning this process, as well as with police. If criminal or terrorist intent is suspected, the police will have an interest in collecting evidence in the form of contaminated clothing or effects. DHB/hospital planning should therefore take inter-agency co-operation, and the needs of other agencies, into account (see section 4.4). It is strongly recommended that DHB/hospital planners consult with public health and environmental health officers when planning this process, as well as with police.

Contaminated or potentially contaminated clothing and effects removed from patients during the decontamination process should be double-bagged in clear, vapour-proof bags, and appropriately identified with the owner's name and/or other details. Clear bags are preferable to opaque bags because they enable the contents to be seen easily. A warning label should be placed on the bag indicating that the contents are contaminated.

Valuables should be similarly bagged and held in a secure location until returned to the patient. Spectacles, hearing aids, walking sticks, and other personal sensory or mobility aids should be decontaminated with the patient.

Do not release contaminated clothing or valuables to the patient without appropriate advice on decontamination methods to render the effects safe. Public health and environmental health officers can provide advice about decontamination of clothing and effects.

If criminal or terrorist intent is suspected, the police will have an interest in collecting evidence in the form of contaminated clothing or effects. DHB/hospital planning should take inter-agency co-operation, and the needs of other agencies, into account.

#### **4.6 Social and mental health impact**

In hazsub emergencies there may be many people presenting with psychological effects of the incident as well as those suffering from physical injuries. To assist in managing the situation, health service personnel must ensure that all patients are sensitively and appropriately managed. Providing positive, effective leadership and clear, credible and timely information during and after the incident will help to produce an effective response.

#### **4.7 Mortuary facilities and management of the deceased**

The New Zealand Police are required to report to the coroner where deaths occur in suspicious or unusual circumstances. The bodies of people who die in these circumstances will be taken to, and kept in, appropriate mortuary facilities until released by the Police.

Bodies that have been contaminated will require special care and handling. It may be that, due to circumstances, decontamination does not take place immediately on receipt at a hospital facility.

Mortuary facilities for bodies that have not been decontaminated, or otherwise pose a health risk to staff, should be separate from the standard mortuary, with exterior exhaust venting, and the room(s) must be locked to prevent accidental entry.

## 5 NHEP Activation and Shut-down

### 5.1 Incident size and NHEP: hazsub activation guidelines

The great majority of hazsub incidents can and should be managed satisfactorily at the facility level without reference to regional or national frameworks. A larger incident requiring support from surrounding DHBs would require a regional response. However, the Ministry of Health 24-hour contact system should be used and the Ministry informed if there is any likelihood that any event:

- threatens the ability of a facility to continue to provide services as normal for more than two hours
- threatens to cascade throughout several facilities in one district or region
- may be the result of terrorist action.

The Ministry of Health will then decide whether to inform, warn of, or activate a regional response via the single-point-of-contact system. It is also possible that a DHB or region will activate its own response. National plan activation is unlikely except in the case of a terrorist-related event, or an event with a very heavy impact on a major urban facility.

Although it is most likely that the Ministry will hear about significant hazsub releases or events from individual facilities or their DHBs, it is possible it could learn of an actual or threatened hazsub release event from other sources, such as the Police or Fire Service. In this case the DHBs would be alerted immediately.

No matter how the Ministry of Health becomes aware of hazsub events, a Code White, Yellow or Red notice may be sent to local or regional facilities, as appropriate. Example situations in which the standard code structure may be used are outlined in Table 4 below.

**Table 4: Alert codes for hazsub incidents**

| Phase       | Example situation  | Alert code |
|-------------|--|------------|
| Information | Possible or potential hazsub emergency in specified region or district.                      | White      |
| Standby     | Hazsub emergency confirmed, health facility involvement required or probably required.       | Yellow     |
| Activation  | Health services and/or facilities impacted by or involved in a significant hazsub emergency. | Red        |
| Stand-down  | Hazsub emergency resolved.   | Green      |

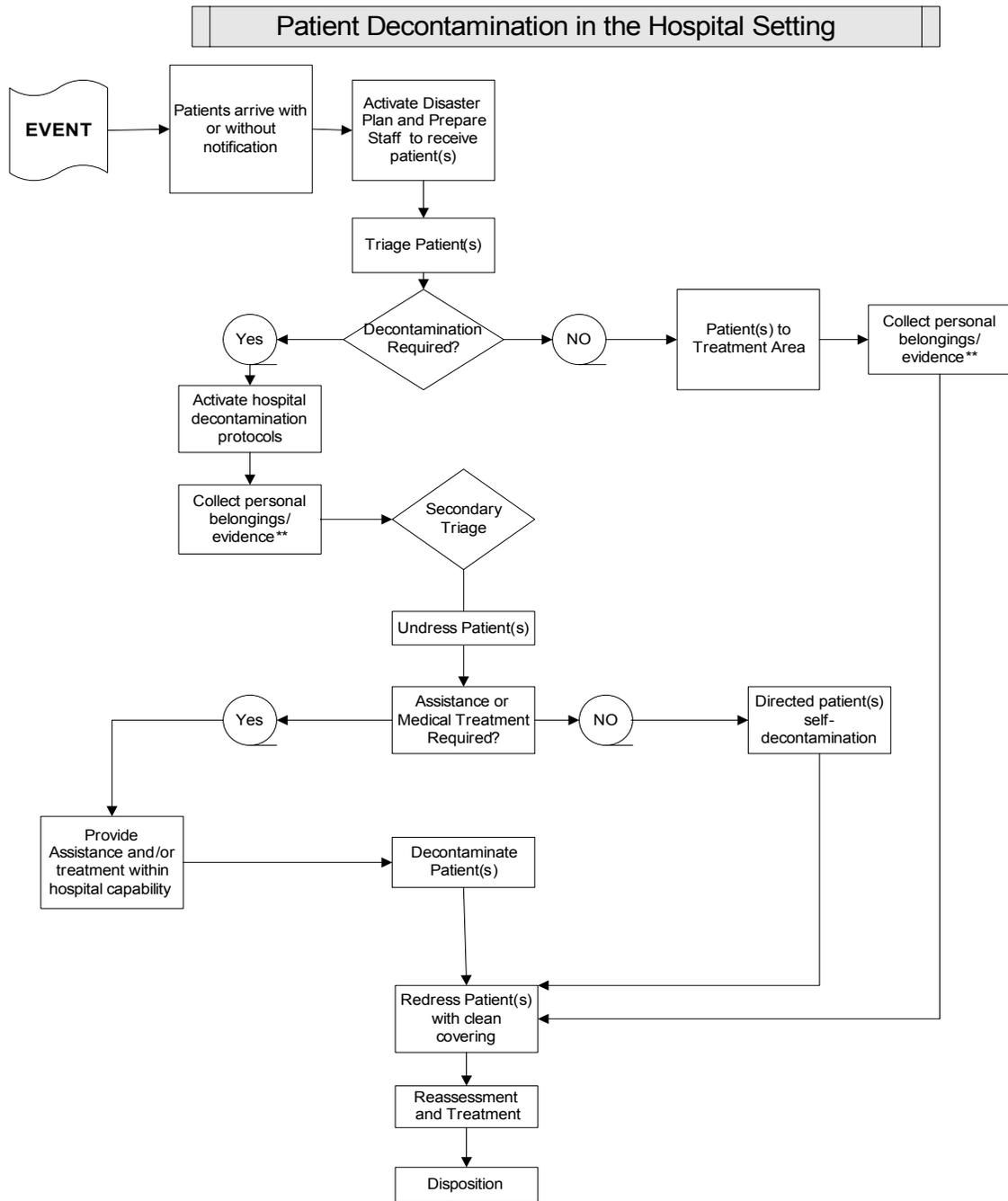
### 5.2 DHB, provider arm and Ministry communications

Once NHEP communication pathways are activated, all DHB/Ministry of Health communications should be through the appropriate single points of contact or regional co-ordination centres until a Code Green stand-down message notifies the end of NHEP activation.

## Appendix 1: Emergency department decontamination facility requirements checklist

| Features   | Yes | No |
|--|-----|----|
| Entrance to decontamination area outside of or clearly separated from the main ED or facility entrance   |     |    |
| Clearly demarcated hot, warm and cold zones  |     |    |
| Patient pathway from hot to cold zones, and from there into ED or other suitable main hospital reception area  |     |    |
| Provide for both ambulant and non-ambulant patients  |     |    |
| Provide for the separation of ambulant patients into male and female areas, with appropriate privacy provisions, or provide individual shower/decontamination areas for ambulant patients  |     |    |
| Provide for the safe containment and security of contaminated patient clothing and/or possessions  |     |    |
| If contained within a building, have ventilation and air exhaust systems separate from the main ED or facility systems, with outlets well clear of other air or ventilation intakes  |     |    |
| Provide sufficient showerheads or shower stations for the modelled patient flow volumes (see sections 3.3 and 3.4)   |     |    |
| Water services able to continuously deliver warm (not hot) water for each showerhead or equivalent, for three hours  |     |    |
| Able to be started at any time of the day or night, by the ED staff normally present in the facility, within five minutes of the presentation of a known or suspected hazsub-contaminated patient. Full operation of all capabilities may not be achieved in at the five-minute stage, but by this time water needs to be running, and sufficient capability to manage the initial presentation must be available. |     |    |

# Appendix 2: Summary of the decontamination process in a hospital setting



Source: Disaster Interest Group  
 California Emergency Medical Services Authority  
 July, 2001

## Appendix 3: Statutory reporting requirement

### HSNO Act 1996

All chemical incidents must be reported to the Environmental Risk Management Authority (ERMA) by the attending Hazardous Substances and New Organisms (HSNO) officer. Section 143 of the HSNO Act 1996 regarding notification of hazardous substances injuries states:

- (1) In this section, 'hospital' means a hospital care institution with the meaning of section 58(4) of the Health and Disability Services Act 2001.
- (2) If any person, upon admission to a hospital, is found to be suffering from any injury caused by a hazardous substance, the person for the time being in charge of the hospital shall give notice of the injury to the Medical Officer of Health.
- (3) The Medical Officer of Health shall ensure that information about any injury notified in accordance with subsection (2) of this section (not being information which identifies any individual person) is supplied to the Minister of Health.

This reporting requirement should be carried out as soon as possible after a relevant incident.

### Radiation Protection Regulation

The Radiation Protection Regulation 1982 imposes reporting requirements on licensees (regulation 11(2)) and on any person (regulation 19(1)).

### Health Regulations

Routine powers in the Health (Infectious and Notifiable Diseases) Regulations 1966, Regulation 7(a) state that:

On becoming aware of a case of notifiable infectious disease, or a suspected case, an inspector is required to forthwith visit the premises and inquire into the causes and circumstances of the case and to take such steps as are necessary or desirable to prevent the spread of infection and is to remove conditions favourable to infection.

## Appendix 4: New Zealand Fire Service data

New Zealand Fire Service statistics from 2001 to July 2005 show that there are between 2000 and 2500 'non-fire' hazardous emergencies that do not involve mobile property every year. Approximately 60 percent of these are electrical emergencies such as electrical lines down.

The next most common type of incidents are 'liquid, gas leak or spill' incidents, and there are about 800 of these per year. Chemical emergencies occur at a rate of approximately 100 to 140 a year. There have been rare incidents of radiological emergencies. After a high of 75 biohazard emergencies in 2001/2002, these have also become rare.

The other non-fire emergency classification involves mobile property. For these incidents, the most common type is accidents with no hazardous substances spills; there are from 1300 to 3600 of these per year. Gas and liquid spills with accidents occur at about 300 to 400 per year. Chemical spills from accidents or incorrect loading occur at about 50 per year.

**Table A1:** Non-fire hazardous emergencies

|  | 2005/06    | 2004/05      | 2003/04      | 2002/03      | 2001/02      |
|--|------------|--------------|--------------|--------------|--------------|
| <b>Incidents with No Mobile Property Involvement</b>                 |            |              |              |              |              |
| Liquid, Gas leak or spill: No fire                                   | 96         | 875          | 861          | 751          | 816          |
| Liquid, gas leak or spill - not classified above                     | 7          | 16           | 30           | 11           | 4            |
| Chemical emergency   | 20         | 142          | 144          | 120          | 106          |
| Biohazard emergency  | 1          | 2            | 11           | 33           | 76           |
| Radioactive condition  | 0          | 1            | 0            | 0            | 1            |
| Chemical, Biohazard and Radioactive incidents - not classified above | 1          | 7            | 9            | 9            | 2            |
| Power line down  | 42         | 339          | 454          | 291          | 289          |
| Arcing, shorted electrical equipment                                 | 107        | 745          | 771          | 763          | 709          |
| Electrical hazard - not classified above                             | 12         | 92           | 68           | 90           | 120          |
| Explosive present  | 1          | 11           | 11           | 3            | 7            |
| Attempted burning  | 1          | 8            | 12           | 3            | 4            |
| Miscellaneous hazardous condition - not classified above             | 13         | 112          | 133          | 24           | 15           |
| <b>Total</b>   | <b>301</b> | <b>2,350</b> | <b>2,504</b> | <b>2,098</b> | <b>2,149</b> |
| <b>Incidents Involving Mobile Property</b>                           |            |              |              |              |              |
| Gas, Liquid spill: Vehicle accident                                  | 30         | 314          | 337          | 488          | 378          |
| Petrol spill: No vehicle accident                                    | 16         | 154          | 157          | 377          | 277          |
| Gas, liquid spill: Incorrect vehicle loading                         | 0          | 18           | 20           | 37           | 40           |
| Chemical spill: Vehicle accident                                     | 2          | 21           | 15           | 17           | 8            |
| Chemical spill: Incorrect vehicle loading                            | 0          | 6            | 14           | 30           | 25           |
| Mobile property accident: No hazardous substance spill               | 164        | 1,344        | 1,604        | 3,524        | 3,637        |
| Mobile property hazardous incident - not classified above            | 3          | 40           | 42           | 46           | 50           |
| <b>Total</b>   | <b>215</b> | <b>1,897</b> | <b>2,189</b> | <b>4,519</b> | <b>4,415</b> |
| <b>Non-Fire Hazardous Emergencies Total</b>                          | <b>516</b> | <b>4,247</b> | <b>4,693</b> | <b>6,617</b> | <b>6,564</b> |

## Appendix 5: National Hazardous Substances Technical Advisory Committees

In May 2005 Mike Hall, the CE of the New Zealand Fire Service signed the National HSTLC Terms of Reference and copies were distributed to all identified HSTLC Groups.

There are 22 identified groups ranging in size and methods of operation, such as a single stand alone in Gisborne, to a 'mother' group with satellite subgroups in Dunedin/Otago. This is an increase from the 16 reported in 2003.

Meeting frequency also ranges from annual meetings to quarterly or six weekly.

All groups have responded with some documentation relating to activities and all have indicated an increasing awareness of the need to re-establish functionality and verify membership.

### Regional District HSTLCs

| Location   | Meeting frequency          | New Zealand Fire Service representative                            |
|--|----------------------------|--|
| Gisborne   | Reforming                  | Stu Law  |
| Dunedin (with satellite groups in Oamaru, Queenstown, Alexandra and Balclutha, Invercargill)             | Two-monthly                | Dave Seque<br>Peter Burtonwood<br>Barry Gibson                     |
| Whangarei  |                            | Craig Bain   |
| Auckland   | Three-monthly              | Dick Thornton-Grimes   |
| Napier/Hastings  | Six-monthly                | Ray Brown  |
| Horizons Region Council (Ruapehu, Rangitikei, Wanganui, Manawatu, Palmerston North, Horowhenua, Tararua) | Six-weekly                 | Mitch Brown  |
| Taranaki   | 2–3 months                 | Pat Fitzell  |
| Wellington region  | Three or four times a year | Peter Dempsey  |
| Wairarapa/Masterton  | Twice year (EMG)           | Henry Stechman   |
| Marlborough  | Twice a year               | Rob Dalton   |
| Nelson/Tasman  | Twice a year               | Graeme Daikee/Brian Lucas  |
| Canterbury<br>South Canterbury (Timaru)<br>Greymouth   | Annually                   | Steve Barclay<br>Artie Lind/Kevin Collins<br>Dave Hyde/Mark Thomas |
| Rotorua  | Twice yearly               | Wayne Bedford  |
| Tauranga/Kawerau   | Quarterly                  | Ron Devlin   |
| Waikato  | Irregularly                | Roy Breeze   |
| Thames   | Irregularly                | Martin Berryman  |
| Taupo  |                            | Charlie Turei  |

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