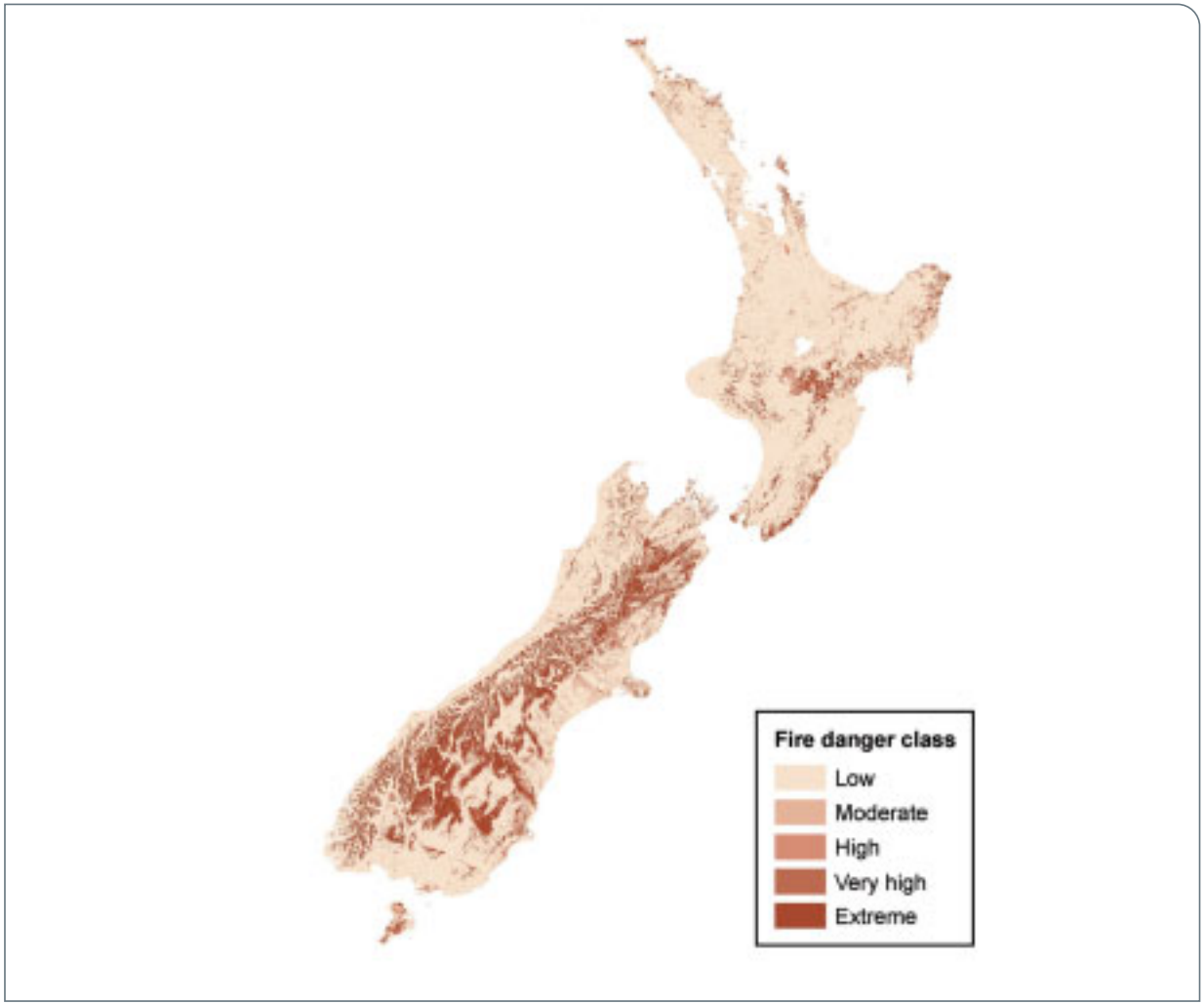
WILDFIRES

A wildfire is any unexpected fire in an open space, such as a gorse-covered hillside, grassland, or forest. A wildfire hazard is created when wildfire threatens lives, properties, commercial plantations, or areas of natural or cultural significance. Fire is not a natural part of New Zealand's ecosystems as it is in North America and Australia, and so native species have not developed adaptive traits to cope with fires.

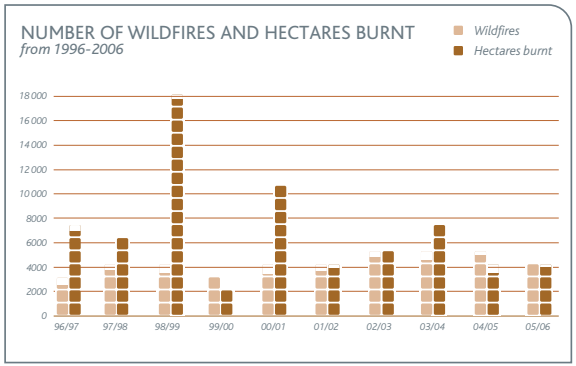
New Zealand's wildfire risk is much smaller than that of other countries, such as Australia and the United States. New Zealand has a generally wetter climate and many sources of water for fighting fires, unlike Australia where water for firefighting is often brought in from a distance. However, wildfire is still a significant risk to New Zealand's forestry industry, which produces more than 10 per cent of New Zealand's total exports. The risk to populated areas in New Zealand is lower, except for places like Wellington, Canterbury, Marlborough and Nelson, where there is increasing development on the rural fringe or in steep areas surrounded by bush.



Average summer fire danger class, 1961–2005. The fire danger class is related to the potential heat output of a fire, which depends on a combination of weather conditions, available fuel, and topography. *National Rural Fire Authority.*

Wildfire occurrence

People start most wildfires, either deliberately or unintentionally; for example, when a land-clearing burn gets out of control. Only one to two per cent of wildfires in New Zealand are ignited naturally. However, the conditions conducive to wildfire ignition and spread depend on the amount of fuel available, temperature, humidity and wind speed. Topography also has a large influence on fire spread – the steeper the slope, the faster the fire will advance. There is a large variation in these factors and, therefore, in the wildfire hazard across New Zealand.



The number of wildfires (light brown) and hectares burnt (dark brown) from 1996/97 to 2005/06. Large fires in Central Otago in the 1998/99 summer, and the Marlborough Boxing Day 2000 fire contributed to those years' high number of hectares burnt. *National Rural Fire Authority.*

The areas most susceptible to wildfire coincide with those most prone to drought: Gisborne, Hawke's Bay, Marlborough, Canterbury, and Central Otago. These areas experience the most severe fire climate with hot, dry summers with frequent warm, gusty northwesterly winds. Taranaki, Southland, and the West Coast have the least severe fire climate.

There are, on average, between 3000 and 4000 wildfires each year in New Zealand, most of which occur between November and March. New Zealand has experienced a large wildfire with significant property or forestry loss about every 10 years. The wildfire hazard is likely to increase with climate change, particularly in eastern areas as they become drier.

Wildfire impacts

Wildfire can have devastating impacts on forests, particularly exotic plantations, which are more flammable than native forests. There are 8 million hectares of forest in New Zealand, covering 30 per cent of the country's land area, 1.8 million hectares of which is exotic forest. An average of 0.05 per cent of New Zealand's exotic forest area is burned each year, although this is less than the average annual wind loss. The 1946 Tahorakuri Fire near Taupo, which burned 30 700 hectares of land including 11 000 hectares of plantation forestry, remains Australasia's largest single pine plantation fire.

Wildfires also cause damage to rural development and lifestyle blocks including farm buildings, fences and stock. Rural communities are at increased risk from wildfire because of their isolation and difficulty with evacuation. Wildfires damage or disrupt infrastructure, for example State Highway 1 was closed for several days during the 2000 Marlborough fire.

The risk to human life from wildfire is low in New Zealand because most fires occur in sparsely populated areas and there is usually time for evacuation if fires threaten an urban area. Fire fighters, forestry and bush workers, and trampers are most at risk.

Wildfires also have impacts on biodiversity, conservation and tourism.

The Boxing Day 2000 Marlborough fire burning in the Wither Hills behind Blenheim. The fire was the largest in the region in 20 years. *Marlborough District Council*.

BOXING DAY 2000 MARLBOROUGH FIRE

The Marlborough fire of 2000 started on Boxing Day and swept through 7000 hectares of land on the Wither Hills behind Blenheim before being brought under control 4 days later. Fanned by a strong northwesterly wind, the fire spread easily through grassland and bush made dry by drought conditions.

The National Rural Fire Management Team and Marlborough District Council Civil Defence were required to help in the response, which was coordinated from the Marlborough District Council Emergency Operations Centre. Many firefighters were needed; bulldozers cut fire breaks and 14 helicopters and planes dumped water on the fire. The response involved many organisations; for example the local 4WD club and Air Force drivers supplied food to firefighters in remote locations.

No lives were lost but there were some injuries. The fire spread faster than a person could run and there were close escapes for people walking in the Wither Hills Farm Park. Several houses were evacuated, but none was lost. Many farm buildings and fences, sheep and cattle, pine plantations, olive groves, vineyards, and a Queen Elizabeth II covenanted block of native bush were lost. State Highway 1 was closed for over 12 hours, disrupting the busy holiday traffic.

The cause of the fire was never determined.

Managing wildfires

All territorial authorities in New Zealand, along with the Department of Conservation and the New Zealand Defence Force, are rural fire authorities and are responsible for wildfire control within their areas of jurisdiction. The National Rural Fire Authority (NRFA), which is part of the New Zealand Fire Service, provides policy, support and some funding for rural fire management in New Zealand.

Risk reduction

Rural fire authorities are responsible for declaring whether a fire season is open, restricted, or prohibited, and for issuing fire permits during restricted fire seasons. Rural fire authorities also maintain fire breaks.

Public education is an extremely important aspect of wildfire-risk reduction, given that people cause most wildfires. People living in high wildfire-hazard areas can make their properties more resilient by keeping a vegetation-free area around their house, clearing roofs and gutters of dead vegetation, and ensuring clear access for firefighters.

Individual rural fire authorities can require land owners or occupiers to remove flammable vegetation or material from their land, if it is considered to be a fire hazard, under the Local Government Act 2002.

Readiness

Rural fire authorities are responsible for training and exercising a rural fire force and for public education.

The NRFA gathers data from 150 remote automatic weather stations, monitored in partnership with rural fire authorities, the MetService and NIWA. The weather data collected is used in conjunction with a Fire Weather Index System to calculate vegetation moisture and expected fire behaviour across the country. This information is supplied daily to rural fire authorities (and to the public by the internet) and is used to manage resources and responses to fires.

A fire-danger sign in North Canterbury. Rural fire authorities maintain fire-danger signs throughout New Zealand that inform the public of the daily fire danger during summer. *Ministry of Civil Defence & Emergency Management*.

Response and recovery

The Rural Fire Authority is the first responder to most wildfires. If a fire occurs close to an urban centre, the New Zealand Fire Service (NZFS) will also attend. In some rural fire districts the NZFS is contracted to provide rural fire response and will be the only attendees to a wildfire.

Managing large wildfires can be beyond the capacity of the local NZFS and Rural Fire Authority, in which case the NRFA may become involved to manage the fire response and coordinate resources from other rural fire authorities.

CDEM involvement may be required during a large wildfire to provide support in an Emergency Operations Centre, and to help in coordinating resources and welfare support to any evacuees. The CDEM response to wildfires follows generic response and recovery procedures set out in CDEM Group plans, the National CDEM Plan and the Guide to the National CDEM Plan.

People responsible for lighting a wildfire, if apprehended, can be prosecuted and made to pay for the cost of fighting the fire. The Rural Fire Fighting Fund, administered by the NRFA, also provides funding for firefighting costs.

A rural firefighter fighting a wildfire at Makara Beach near Wellington.
Wellington Emergency Management Office.

Recovery after a wildfire involves removing any remaining and potentially dangerous vegetation, for example, trees that have been damaged and that may present a windfall hazard; reseeding the burnt area; and repairing damaged assets and infrastructure. These are the responsibility of private land and asset owners.

FURTHER INFORMATION

GENERAL WILDFIRE INFORMATION

NATIONAL RURAL FIRE AUTHORITY
nrfa.fire.org.nz

MCFARLANE, P, PEARCE, G, AND MOORE, J, 2001, FORESTRY AND RISK MANAGEMENT – NEW ZEALAND IN A GLOBAL CONTEXT. Risk Management and Sustainable Forestry, 8 September 2001, Bordeaux, France.

NEW ZEALAND FIRE SERVICE
www.fire.org.nz

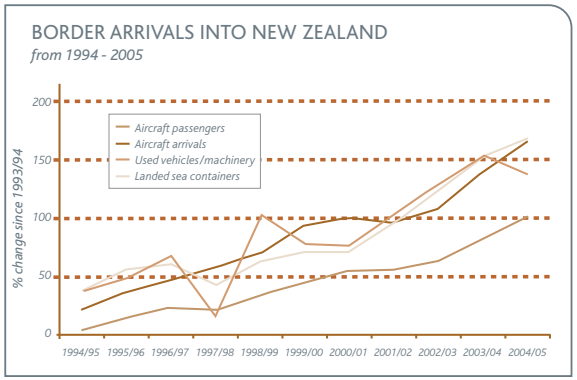
BOXING DAY 2000 MARLBOROUGH FIRE

BROOKS, C, 2001 ONE EYED AND BLINKERED – FORTY YEARS OF CIVIL DEFENCE IN MARLBOROUGH. Darcy Christopher Foundation Civil Defence Trust.

ANIMAL AND PLANT PESTS AND DISEASES

New Zealand's geographical isolation from the rest of the world has meant that its indigenous flora and fauna have been protected from many predators, pests, and diseases. This lack of pests and diseases has benefited New Zealand's agricultural, forestry and marine sectors, by reducing costs of pest control and therefore keeping the cost of production down.

New Zealand's reliance on trade and tourism means that there are now many pathways by which serious pests and diseases may arrive and become established in the country. Pests and diseases can arrive as hitchhikers associated with goods or conveyances, as the result of inadvertent contamination (including genetically modified organisms), or sometimes by deliberate or illegal introductions. A pest or disease that is benign in its country of origin may have significant consequences if it arrives in New Zealand, as its behaviour – distribution, host species, and population growth – cannot always be predicted.



The growth in border arrivals into New Zealand since 1993/94. The large increase provides more opportunities for pests and diseases to be introduced. *Ministry of Agriculture and Forestry.*

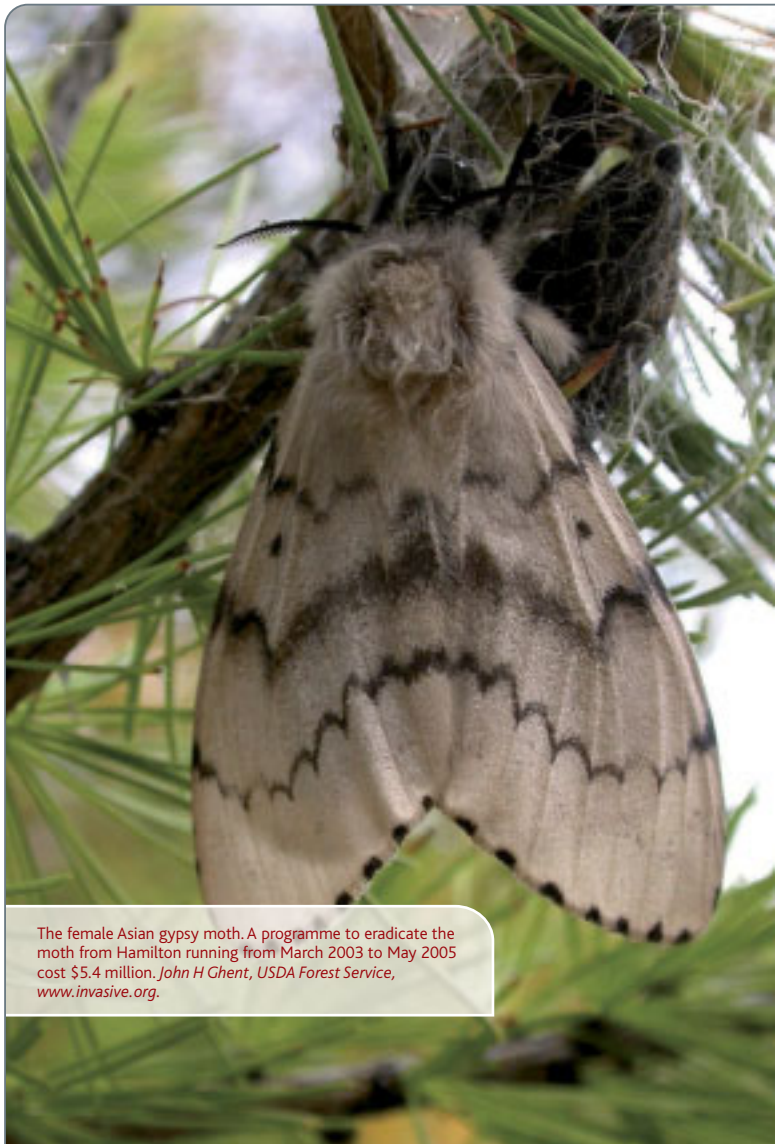
Outwards trade may be affected if some pests and diseases are detected within New Zealand. Many countries New Zealand exports to that do not have particular pests and diseases, and their consumers, will not accept the risks of potential infection.

Some diseases, such as anthrax and avian influenza, can also affect human health. Mosquitoes and other pests can transmit diseases, such as Ross River virus.

Animal pests and diseases

Animal diseases pose a number of threats to New Zealand. They can reduce livestock productivity, or increase pest control costs. They may create risks for handling animals or their products when they can infect humans. Some diseases and their treatments mean the animal cannot enter the food chain or be exported. Some diseases, such as foot-and-mouth disease and avian influenza, are highly contagious and may spread rapidly. Other diseases, such as bovine spongiform encephalopathy (BSE or 'mad cow disease') may not become apparent until long after infection has occurred.

There is a high cost in managing animal pests and diseases. For example, since the bovine tuberculosis strategy was implemented in the mid-1990s, over $600 million has been spent to eradicate the disease. Over $1 billion will be spent by the time the level of infection is reduced to 'official freedom' levels.



The female Asian gypsy moth. A programme to eradicate the moth from Hamilton running from March 2003 to May 2005 cost $5.4 million. *John H Ghent, USDA Forest Service, www.invasive.org.*

2003 ASIAN GYPSY MOTH ERADICATION, HAMILTON

Asian gypsy moth feeds on a wide range of plants, including forestry and amenity species and causes millions of dollars' worth of damage in the Northern Hemisphere. Egg masses containing 50–800 eggs are laid on a range of surfaces, including ships, cars and containers, and can survive through the tropics. Hatching larvae can be dispersed by wind.

The Ministry of Agriculture and Forestry inspects sea containers and imported vehicles for Asian gypsy moth and other species. Pheromone traps are also placed around ports of entry and other risk sites for early detection.

A live male moth was caught in an early warning trap in Hamilton in March 2003. An aerial spray programme using *Bacillus thuringiensis var kurstaki*, a naturally occurring biopesticide, was carried out over 8 weeks. The overall eradication programme lasted for 2 years and included a public communication campaign and spray avoidance protocols for members of the public, and post-operative monitoring. No more moths have been caught, and eradication was declared in May 2005.

The Asian gypsy moth eradication programme cost $5.4m. The social impact of the pest eradication was significant with the people of Hamilton having to endure considerable inconvenience and discomfort during the aerial spray and plant movement controls components of the eradication effort.

FOOT-AND-MOUTH DISEASE

Foot-and-mouth disease (FMD) is a highly contagious disease of cloven-hoofed animals, including sheep, goats, cattle, and deer. It has no known cure. Symptoms include lesions or blisters on the tongue, muzzle, udders and feet, lameness, and salivation. The disease can be carried on infected animals, by air, and on contaminated equipment and vehicles. The preferred approach to a FMD outbreak is to eradicate the disease by destroying and then burying or burning infected and suspect animals.

A FMD outbreak in New Zealand would close trade to key markets, including the EU, North America, Australia and Japan. The potential cost to GDP is estimated at $6 billion in the first year, rising to $10 billion over two years. Fifteen to twenty thousand jobs would be lost.

The 2001 FMD outbreak in Britain saw nearly 5 million sheep, 764 000 cattle and 428 000 pigs killed and burned. Agriculture and tourism were severely affected and about 60 deaths in the farming community were attributed to extreme stress following the outbreak.

In 1971 a piggery near Temuka in South Canterbury reported suspect blisters in 28 pigs. It turned out that this was not the result of an animal disease, but 800 pigs and some sheep were slaughtered and burned as a precaution. In May 2005 the New Zealand Prime Minister received a letter claiming a release of FMD on Waiheke Island. This proved to be a hoax, but a full response was initiated, which directly involved around 100 people.

Plant and forestry pests and diseases

There are many plant pests and diseases that affect plants and forests. Effects may be minor, or severe enough to make cultivating the host species uneconomic. Clover root weevil, for example, discovered in the Waikato in 1996, significantly reduces pasture quality over time because nitrogen-fixing nodules in clover are depleted and alternative nitrogen sources are needed. This weevil costs New Zealand's pastoral industry around $1 billion a year. After ten years of research into biological control, a parasitic wasp has been released in some key locations around New Zealand to mitigate the effects of this introduced pest.

Aquatic pests and diseases

Aquatic pests and diseases are extremely difficult to treat or eradicate because they are often widespread when they are first detected. Ballast water and boat hulls are common means of spread. Risks can be reduced by preventing the discharge of ballast water in New Zealand waters, and by using anti-fouling paints.

When pests and diseases are established, efforts are directed at localised controls or preventing the spread into pristine areas of high ecological value. A public awareness programme, based on 'check–clean–dry', is used to reduce the speed of spread of didymo. However it is unlikely that the spread of a microscopic organism of this nature can be prevented.

Pest and disease impacts

The effects of pests and diseases vary, depending on a number of factors. The key factors are how quickly the population can grow, what parts of New Zealand it can spread to, and the presence or absence of potential predators that may limit spread. The pest or disease may have a narrow or wide range of hosts, and its impact will depend on how important those hosts are to the economy, as well as environmental and biodiversity values. The host species could be destroyed or the increase in costs associated with the pest or disease could make growing the host species no longer economic.

The effect of a pest or disease on New Zealand's trade depends on the closure of export markets, the amount of additional screening required to demonstrate freedom from the pest or disease, and consumer behaviour, which may be based on a perception of risk rather than the actual risk. If New Zealand is identified as having a significant plant or animal disease, importing countries under bilateral and other trade agreements have rights to refuse to accept imports of potentially affected product until New Zealand can again demonstrate freedom from the disease.

Even where freedom can be demonstrated, this will not prevent importers refusing New Zealand products, and this can be wider than the specific hazard identified. For example, when fruit fly was detected near Auckland airport in 1996, a number of countries put in place different responses. China banned all imports of fresh produce from the North Island for a period of over 12 months, and Indonesia for approximately 5 years.

Some pests and diseases may also have the capacity to be transferred to humans, with associated effects on human health and wellbeing.

Effects will also depend on the technical feasibility of response options; the availability of effective chemical, biological or other controls; and the public acceptability of these options.

Some pests and diseases may be of minor or localised significance, or may be managed alongside existing management options, such as treatment for intestinal parasites.

Managing animal and plant pests and diseases

Animal and plant pests and diseases are managed by the Ministry of Agriculture and Forestry (MAF) and MAF (Biosecurity NZ). Their role extends across reduction, readiness, response and recovery.

Wide-scale responses to new pest or disease incursions require rapid access to resources, and can quickly exceed the capability of communities to respond. Central government plays a large role in these responses, while regional government and industry sectors have a greater role in long-term pest and disease management. While central government does not have a legal responsibility for responding to animal and plant pests and diseases, the Biosecurity Act 1993 sets out the provisions for reducing the risks by the implementation of border controls, and through a range of powers that can be used to manage responses to pests and unwanted organisms.

Managing biosecurity hazards can have considerable economic impact. For example, 1080 is a pesticide that can negatively affect our forestry certification. This effect is a trade-off against our ability to control pests and disease.

Biosecurity risks can increase from efforts to reduce losses from natural hazards events. For example, responding to animal welfare issues following an adverse event can have longer term implications for biosecurity risk. In a drought, for instance, stock feed may be brought in from other areas that pose an unacceptable biosecurity risk. In 1996 in Australia, a drought led to stock being fed cotton trash. The trash was contaminated with pesticide residues which subsequently contaminated the meat and led to a loss of confidence in Australian residue-tracing.

Risk reduction

The primary means of risk reduction is preventing pests and diseases from entering New Zealand. Strategies include pre-border screening and inspection of risk goods and conveyances at ports of entry. Public awareness and reporting complements surveillance programmes, where early detection of a problem means a wider range of possible options for response, including eradication.

Readiness

Readiness focuses on the capability and systems to detect and respond to pest and disease incursions. MAF's capability is complemented by arrangements with biosecurity and research organisations and by inter-country cooperation. Contingency plans for specific organisms or groups of organisms are prepared, and site-specific readiness plans within industry sectors are encouraged. The involvement of other stakeholders depends on those affected, but always includes the public.

Response and recovery

Biosecurity responses may involve rapid emergency response measures or more considered long-term approaches. Generic responses consider the costs and benefits of the values being protected, the impact of the organism being managed and the impact of the response actions. Incursions may be managed for long periods of time, including pest management strategies of greater than 10 years. Options include eradication, containment, or exclusion from designated areas.

Many pests and diseases affect a specific sector – for example, the seasquirt *Styela* affects the aquaculture and recreational marine sectors – or they may have a flow-on effect to the wider economy, as with foot-and-mouth disease. The scale of the impact will determine

whether MAF handles the response, leads a whole-of-government response, or helps regional councils and industry groups manage responses. The Governor-General can declare an emergency on the advice of Ministers under Part VII of the Biosecurity Act 1993.

For livestock diseases, a national livestock standstill may be needed to prevent further spread of the disease, while government agencies attempt to find the source of the outbreak or identify clusters of infection. Processing plants may stop production to reduce the risks to shareholders. Recovery, which mostly involves rebuilding herds and restoring markets, may take several years, but the damage to buildings and equipment is likely to be minimal.

In a large enough response, MAF's stand-alone capability may be quickly exceeded, or be unable to be sustained. Field-based responses will require local support, operations centres and other logistical supply services that cannot be obtained through national industry organisations where MAF's main stakeholder relationships lie. Support can come from government agencies and the CDEM sector, particularly through their knowledge of existing community infrastructure, and local coordination of resources.

FURTHER INFORMATION

GENERAL BIOSECURITY INFORMATION
BIOSECURITY NEW ZEALAND
www.biosecurity.govt.nz

ANIMAL PESTS AND DISEASES AFFECTING GLOBAL TRADE
WORLD ORGANISATION FOR ANIMAL HEALTH
www.oie.int/eng/maladies/en_classification.htm

PLANT PESTS AND DISEASES AFFECTING GLOBAL TRADE
INTERNATIONAL PLANT PROTECTION CONVENTION
www.ippc.int

ECONOMIC IMPACTS OF A FOOT-AND-MOUTH DISEASE OUTBREAK
THE TREASURY
www.treasury.govt.nz/footmouth/

INFECTIOUS HUMAN DISEASE PANDEMICS

Infectious disease pandemics are characterised by the global spread of a new type of virus that can cause unusually high rates of illness and mortality for an extended period of time. Most people are not immune to a new virus and are therefore susceptible to infection. A pandemic can overwhelm the resources of a society due to the exceptional number of people affected. A new strain of the influenza virus is the most likely cause of the next infectious disease pandemic.

Influenza

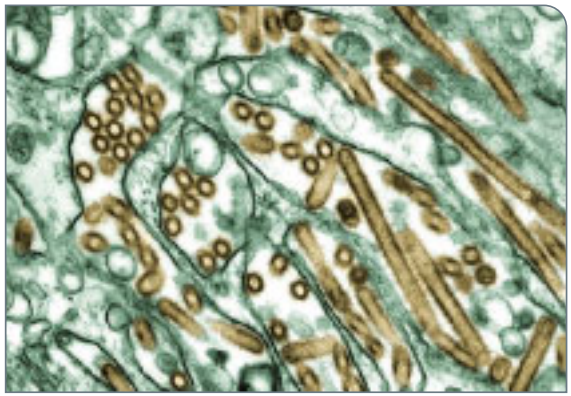
The influenza virus

The influenza virus infects the respiratory tract, causing fever, aches and fatigue for around 7–10 days, and sometimes secondary infections such as pneumonia. The virus is easily spread from person to person through droplets and hand to mouth transmission, and can be fatal. The incubation period is generally 1–3 days but can be up to 7 days. Minor influenza outbreaks (epidemics) typically occur during winter and influenza is directly responsible for around 100 deaths each year in New Zealand.

There are three types of influenza virus – A, B and C. Influenza C viruses only cause mild symptoms and are not thought to generate epidemics, whereas influenza A and B viruses can cause epidemics. Influenza B viruses are only found in humans, but influenza A viruses, responsible for pandemics, are found in humans and many different animals including birds, pigs, whales, horses, and seals.

Influenza A viruses are divided into subtypes based on the hemagglutinin (H) and neuraminidase (N) proteins on the surface of the virus. There are 15 different H subtypes and nine different N subtypes, all of which have been found among influenza A viruses in wild birds.

Influenza A and B viruses continually change over time through antigenic drift, which occurs when small changes in the virus create new strains. People may have some degree of immunity to these new strains as they are similar to previous ones. Influenza A viruses can also undergo antigenic shift. This is an infrequently occurring abrupt major change in the virus resulting in new H or N proteins and the formation of a new influenza A subtype. This process can occur within humans or other animals, such as pigs, if they are infected with two different types of virus at the same time. Most people have little or no immunity against the new virus, and developing a vaccine for a new virus can take 6–9 months.



A colourised transmission electron micrograph of the H5N1 Avian influenza virus. *Center for Disease Control*.

Influenza pandemics

An influenza pandemic is generated when a new type of influenza virus evolves which causes illness in humans and is efficiently transmitted between people, spreading rapidly around the globe. Pandemic influenza is different from seasonal influenza – it can occur at any time of year and can affect any age group, not just the young or elderly.

The emergence of several new influenza A virus subtypes caused three pandemics last century, all of which spread around the world within a year of being clinically recognised.

The 1918/19 'Spanish flu', A(H1N1), was the most severe pandemic causing between 50 and 100 million deaths worldwide with a large impact in New Zealand. The 1957/58 'Asian flu', A(H2N2), and the 1968/69 'Hong Kong flu', A(H3N2), each killed one to four million people worldwide. The 1957/58 pandemic infected 70–80 per cent of New Zealanders but the mortality rate was very low, and the 1968/69 pandemic had little effect in New Zealand.

Both the 1957/58 and 1968/69 pandemics were caused by viruses containing a combination of genes from a human influenza virus and an avian influenza virus. The 1918/19 pandemic virus appears to have been completely avian in origin.

1918 INFLUENZA PANDEMIC

The 1918 pandemic arrived in New Zealand in early October 1918 and had a profound effect on the country, which took years to recover. Many people died within the first few days after infection and others died of secondary infections like pneumonia. Little was known about the cause of the disease or how it spread, and a variety of ineffective treatments such as public throat-spray facilities, while well-meaning, may have created additional sources of cross-infection. Quarantining and travel restrictions around the country were not introduced until the pandemic was well under way. Public health knowledge was limited and in each community doctors were totally overwhelmed; there was ultimately little they could do to halt the course of the influenza in those who contracted it. Communities formed groups and committees to look after those most in need with food or home help, and it seems that without this basic care even more could have died.

Within 4 months, 30–50 per cent of the population had contracted the virus and 8600 had died, nearly half of whom were young, healthy adults. Because it occurred at the end of World War I the trauma suffered was masked, but in many ways it was more damaging than the effects of the war itself.

The 1918 pandemic had a severe impact on Māori, whose death rate of 4.2 per cent (a total of 2160) was around six times higher than non-Māori. Possible explanations for this difference have included inequalities in socio-economic status, lack of access to health care, and a higher incidence of other illnesses at the same time. Some of these factors still exist today, potentially making the Māori population more vulnerable in the event of a pandemic.

An influenza medicine depot in Cathedral Square, Christchurch, during the 1918 influenza pandemic. The pandemic was the worst disease outbreak to hit New Zealand and prompted reforms to the health system, including the 1920 Health Act. *Alexander Turnbull Library.*

New Zealand's pandemic hazard

Another pandemic will occur in the future but there is no certainty about when or how large it will be, or where it will originate. New Zealand has some advantages in being a geographically isolated country with a limited number of well-controlled entry points. Depending on the nature of a pandemic it may, therefore, be possible to delay the impact in New Zealand, but the effects would still be significant.

Current influenza viruses

There are currently five different types of new influenza A virus that have caused human infections. One virus, H5N1, is an avian influenza virus that, since 2003 in particular, has been infecting birds in an increasing number of countries. It has also caused severe human disease although so far it has been reported as only affecting a relatively small number of people. Should a virus such as H5N1 mutate to become easily and readily transmissible between humans it would represent a credible and potentially serious pandemic threat.

The World Health Organisation uses six phases of pandemic alert level to convey the seriousness of the pandemic threat and the need to launch progressively more intense preparedness activities. Phases range from 1 (interpandemic phase: low risk of human cases) to 6 (pandemic: efficient and sustained human-to-human transmission). The current status is phase 3 (pandemic alert: no or very limited human-to-human transmission) as at September 2006, in response to the H5N1 avian influenza situation.

New Zealand pandemic planning model

It is not possible to predict what will happen in New Zealand if a pandemic occurs, because that will depend on the nature of the new virus, which cannot be known until it exists. However, New Zealand has adopted a pandemic planning model, based on World Health Organisation guidelines and the impacts of the 1918 epidemic, to assist in pandemic planning.

The model assumes a pandemic wave in which 40 per cent of New Zealand's population, around 1.6 million people, become ill over an 8-week period. The peak incidence is over weeks 3 to 5 when about 1.3 million people, or a third of the population, would be ill, convalescent or just recovered.

The model assumes a fatality rate of two per cent of those infected, which would see about 33 000 deaths over the eight-week period, peaking at about 10 000 in week 4, compared to around 550 deaths per week normally.

Pandemic impacts

In contrast to many other hazards, the impacts of a pandemic manifest as a loss of human capability. They affect the ability of society and the economy to function normally, and can indirectly lead to a subsequent deterioration of infrastructure services. These impacts would occur on a national and international level. Consequently a greater degree of community resilience is required, compared to the response for other hazards, because assistance is unlikely to be available from outside affected areas.

A pandemic is likely to cause high absentee rates in the workforce as people fall ill or stay at home to care for the sick. The planning assumption used in New Zealand is for up to 50 per cent absenteeism at the peak of an epidemic. This would significantly affect all services including health and other essential services such as police, fire, transportation, communications and CDEM organisations.

Other services and supplies – including food, water, gas, electricity supplies, educational facilities, postal services and sanitation – are also likely to be affected. Food shortages are possible if food distribution and shopping is affected. A heavy load is likely on information and communication technology infrastructure as people work and interact from home.

National and international business activities, regardless of their nature, are likely to suffer during a pandemic. A serious pandemic is likely to have severe adverse short-term effects on the economy. Uncertainty about how serious any pandemic may turn out to be, how long it may last, and when communities may regain daily functioning, would have a major effect on business and consumer confidence. Such confidence effects are likely to play a major role in how severe the economic impact is, and in how quickly the economy can recover afterwards. Based on the pandemic planning model Treasury has estimated a reduction in GDP of 5–10 per cent in the year of the pandemic and cumulative losses over 4 years of 10–15 per cent of one year's GDP.

Managing pandemics

The Ministry of Health is the lead agency for managing pandemics. The Ministry of Health has led the development of the New Zealand Influenza Pandemic Action Plan that provides a consistent framework for pandemic management in New Zealand. The plan is built around a five-stage strategy to:

- plan for it – reduce the health, social and economic impact
- keep it out – prevent, or delay to the greatest extent possible, its arrival
- stamp it out – control or eliminate any clusters that are found
- manage it – reduce the impact on the population
- recover from it – speed the recovery of health, communities and society.

Managing the pandemic hazard involves a whole-of-government approach, and early, decisive leadership is critical in the event of a pandemic.

Risk reduction and readiness

MONITORING

An ongoing effective national surveillance system is an essential component of preparedness. There are currently two national surveillance systems in New Zealand.

The general-practice sentinel disease and virological surveillance system, involving more than 90 practices throughout New Zealand, operates annually during winter (May to September), recording the daily number of consultations that fit the case definition of an influenza-like illness.

In addition, specimens are collected from hospitalised patients with an influenza-like illness throughout the year for analysis at designated virology diagnostic laboratories. Data collected from these laboratories is reported nationally in the Virology Weekly Report. Authorities in New Zealand maintain contact with the World Health Organization Collaborating Centre for Reference and Research on Influenza in Melbourne.

Internationally, the Global Outbreak Alert and Response Network is a technical collaboration of institutions and networks who pool human and technical resources for the rapid identification, confirmation

People receiving a dose of zinc sulphate in an inhalation chamber in Christchurch during the 1918 influenza pandemic. Such treatments probably did more harm than good by bringing people together. Social distancing would be encouraged in any future pandemic. *Alexander Turnbull Library*.

and response to outbreaks of international importance. The Network provides an operational framework to link expertise and skill, keeping the international community constantly alert to the threat of outbreaks and ready to respond.

COMMUNICATION AND PUBLIC EDUCATION

An important element of reducing the impact of a pandemic and maintaining readiness for one is to raise people's awareness of the threat and prepare them for it by suggesting actions that can be taken to mitigate the threat. This includes informing people about community self-support, and advising them of good infection prevention and control practices to promote good hygiene and prevent cross-infection. Important messages include covering coughs and sneezes and keeping a distance of at least one metre from other people where at all possible.

People are encouraged to have a well-stocked emergency supplies kit, including food for a period of at least 10 days, along with a plan that includes how they will manage if they live on their own and are unwell, identification of pre-arranged contacts, and having a way to call for help and to offer help to neighbours.

BUSINESS CONTINUITY PLANNING

Organisations will need robust arrangements for continuing their business in the event of a pandemic. A pandemic represents a particular challenge for business continuity planning, which will need to include staff welfare, solutions for working in an environment of 'social distancing', managing large-scale absenteeism, maintaining continuity of senior management roles and management systems, realigning business activities to focus on critical functions and services, and identifying any additional roles in responding to the pandemic.

Response

A range of control measures may prevent, eliminate, or slow down transmission of an influenza virus, in the hope that it would allow time for the development and arrival of a pandemic vaccine. These traditional public health measures include border management, intensified surveillance, early detection and isolation of cases and quarantine of contacts, use of antivirals, restriction of public gatherings, and closure of educational institutions.

The particular pandemic control interventions that will be adopted depend on the nature and stage of the pandemic, the severity of disease (a more virulent strain will justify more socially demanding measures), and the extent of transmission within the country and community. In general, as a pandemic develops, the strategy changes from individual interventions, such as finding and identifying cases, tracing contacts, prevention and quarantine, to more population-wide actions, and managing their impacts.

In a severe pandemic, alternatives to providing a regular health service may be required as primary and secondary health services struggle to cope with the increased demand for services. Community-based assessment centres may be established as a means of concentrating the initial assessment of people who may have the pandemic influenza virus away from individual general practices and hospital emergency departments. They may also distribute antivirals or antibiotics to those who meet agreed clinical criteria, support home-based self-care and advice, and refer patients to the hospital if clinical interventions are required.

It is expected, however, that even in a substantial pandemic most people will suffer uncomplicated influenza, which will resolve itself. Self-management at home can be safe and effective if good information is available to the public on how to look after themselves and others, how to identify complications, and how to seek advice if complications occur.

Planning and coordination by the CDEM sector, as noted in the New Zealand Influenza Pandemic Action Plan, can help support the health sector and local government in community leadership and in managing community services and assets. It also supports the 'fast moving consumer goods' sector to maintain essential food and grocery supplies.

Recovery

The recovery from a pandemic will be a very long process involving complex global issues. In particular, New Zealand's economy is strongly linked to international economies which will also be affected, prolonging economic recovery. On a national level a pandemic will affect the physical, financial and emotional wellbeing of large numbers of people who may suffer bereavement, severe illness or separation from families and support. People may also experience losses of employment and income along with social and community isolation. Recovery strategies therefore need to be based primarily around social and economic initiatives.

FURTHER INFORMATION

GENERAL PANDEMIC INFORMATION
MINISTRY OF HEALTH
www.moh.govt.nz/pandemicinfluenza

NEW ZEALAND INFLUENZA PANDEMIC ACTION PLAN 2006
MINISTRY OF HEALTH
www.moh.govt.nz/moh.nsf/indexmh/nz-influenza-pandemic-action-plan-2006

LOCAL GOVERNMENT AND CDEM GROUP PANDEMIC PLANNING GUIDE
MINISTRY OF CIVIL DEFENCE & EMERGENCY MANAGEMENT
www.civildefence.govt.nz/memwebsite.nsf/wpg_URL/For-the-CDEM-Sector-Readiness-and-Response-Pandemic-Influenza

BUSINESS CONTINUITY PLANNING AND WORKPLACE ISSUES
DEPARTMENT OF LABOUR
www.dol.govt.nz/initiatives/workplace/pandemic/index.asp
MINISTRY OF ECONOMIC DEVELOPMENT
www.med.govt.nz/templates/ContentTopicSummary____14451.aspx

IMPACTS OF AN INFLUENZA PANDEMIC ON NEW ZEALAND'S MACROECONOMY
THE TREASURY
www.treasury.govt.nz/workingpapers/2006/tpp06-03.pdf

VIROLOGICAL SURVEILLANCE
ENVIRONMENTAL SCIENCE AND RESEARCH
www.surv.esr.cri.nz/virology/virology.php

1918 INFLUENZA EPIDEMIC IN NEW ZEALAND
NEW ZEALAND'S HISTORY ONLINE
www.nzhistory.net.nz/culture/influenza-pandemic
RICE, G, 2005, BLACK NOVEMBER: THE 1918 INFLUENZA EPIDEMIC IN NEW ZEALAND.
Canterbury University Press, Christchurch.

WORLD HEALTH ORGANISATION PANDEMIC ALERT PHASES
WORLD HEALTH ORGANISATION
www.who.int/csr/disease/avian_influenza/phase/en/index.html

INFRASTRUCTURE FAILURES

New Zealand, like all developed nations, is highly reliant on its infrastructure: energy (electricity, gas, petroleum), information and communications technology (ICT), transport, and water. New Zealand's linear shape, rugged topography, and low population density result in long and often isolated infrastructure networks that are vulnerable to natural hazards. Infrastructure networks may also be disrupted by other external factors such as terrorism, or internal causes such as a lack of maintenance or planning.

Local infrastructure failure is not uncommon and can generally be dealt with by lifeline utilities (infrastructure providers). However, because of interdependencies, a failures of one can cascade across others. The resulting widespread and potentially long-term failure can affect the economy and may require coordinated regional involvement for welfare and logistical issues. While a single utility failure can be a significant event, the disruption from multiple utility failure is potentially very severe.

The physical nature, along with ownership, operational and regulatory frameworks of infrastructure sectors vary, as do levels of resilience and operational response capability. While there are pressures in some sectors, for example energy supply and road congestion, a 2004 infrastructure audit prepared by PricewaterhouseCoopers (PwC) as part of a government infrastructure stocktake concluded that at a national level New Zealand's infrastructure is in reasonable condition. The audit did, however, draw attention to some previously identified local and sector-level issues that may have a significant local and national impact.

Energy

Electricity

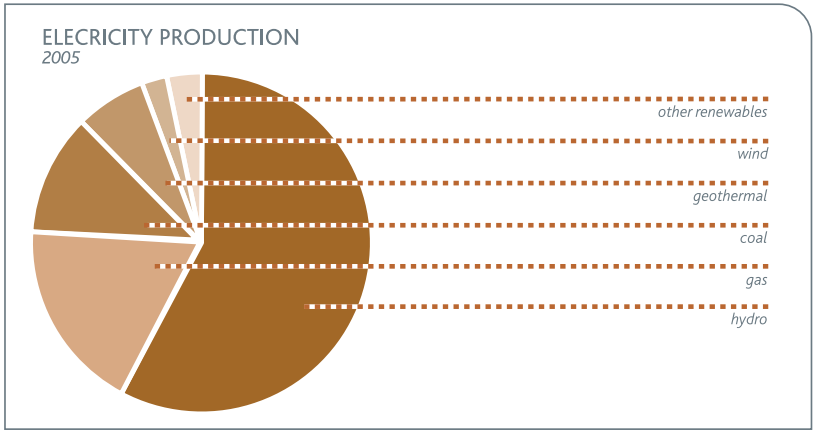
New Zealand currently uses almost 40 000 gigawatt hours (GWh) of electricity each year and this is projected to grow significantly over the next 20 years.

Before 1987 the Government controlled and operated almost all electricity generation and transmission in New Zealand through the New Zealand Electricity Department. Reforms over the last 20 years have seen the Department and other electricity market entities corporatised to a combination of state-owned enterprises and trust-owned or private companies.

Five major power companies now generate 93 per cent of New Zealand's electricity and dominate the electricity retail market. Transpower, a state-owned enterprise, operates the national transmission grid connecting power stations to local distribution lines and major industries. The grid comprises more than 12 300km of high voltage transmission lines including the Cook Strait submarine cable between the North and South Islands.

As at March 2005, 28 network distribution businesses in New Zealand supplied electricity from the national grid to customers. Network ownership ranged from community-owned trusts, shareholder cooperatives, and local authorities, to publicly listed companies.

The 2004 PwC infrastructure audit identified long-term security of electricity supply as a concern. The national transmission grid is



In the year ending March 2005, hydro-generation provided 64 per cent of New Zealand's electricity (65 per cent of this in the South Island). Ten per cent was generated by other renewable resources and the remaining 26 per cent from fossil fuels. Figures vary from year to year because of hydro-generation's dependence on rainfall. Industry was the largest user of electricity during the same period. *Ministry of Economic Development*.

coming under increasing pressure as electricity demand grows, but new regulatory arrangements need to be established, and land access issues resolved, before new investment can take place. Capacity into and north of Auckland, and between the Waitaki Valley and Christchurch, are key areas requiring upgrading.

Transpower has plans to upgrade the national grid's capacity. Vulnerabilities do exist; for example, just one substation supplies most of Auckland city. This vulnerability was highlighted in the power cut of 12 June 2006, which blacked out central Auckland for 5 hours.

While New Zealand's existing electricity generation plant is generally reliable, there is uncertainty around fuel availability for future generation and supply during dry periods. Uncertainty about regulation – for example, the Government's response to climate change – may also affect new generation investment. In December 2006, the Government released a Draft Energy Strategy and associated documents aimed at establishing clear policies for electricity generation and other energy sources.

Along with internal risk factors, electricity infrastructure is vulnerable to natural hazards. Earthquakes, volcanic eruptions, lahars, tsunamis, wind, lightning strikes, and snow could all cause widespread damage to electricity infrastructure, particularly transmission and distribution lines. An influenza pandemic could also affect electricity supply if illness causes staff shortages.

The consequences of a widespread or long-term electricity outage include:

- welfare issues, particularly heating, sanitation, and medical facilities for vulnerable groups such as the elderly and sick
- water and wastewater pump system failures and subsequent sewage releases
- disruption to communications, air-traffic control and fuel supply (as many fuel pumps rely on electricity)
- economic losses from businesses unable to operate without ATM and EFTPOS transactions
- loss of refrigerated food
- farm animal welfare issues
- reduced security and lighting
- school closures.

These consequences can be reduced where local emergency generation is available.

Power poles brought down by the weight of snow during the June 2006 Canterbury snowstorm. The snowstorm left thousands of people in South Canterbury without power for up to 4 weeks. *Electricity Ashburton*.

1998 AUCKLAND POWER CRISIS

New Zealand's worst recent infrastructure failure occurred in January and February 1998, when electricity supply to the Auckland central business district (CBD) was disrupted for almost 2 months.

Four cables supplied almost all of the Auckland CBD's electricity. One cable failed on 20 January, followed by another on 9 February. The two remaining overloaded cables failed on 19 and 20 February, leaving most of the CBD without power.

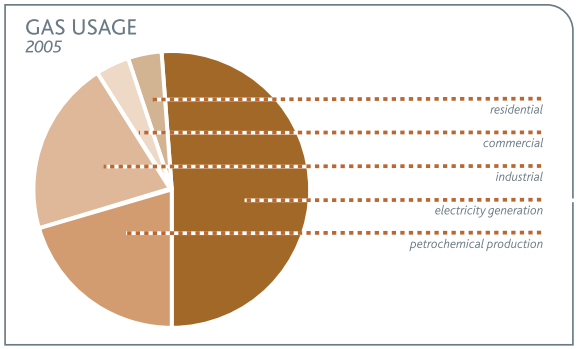
Generators were brought in to the CBD to power essential services, such as Auckland Hospital, but most shops and businesses could not operate. Around 6000 inner-city apartment residents had to find alternative accommodation. Sixty thousand of the 74 000 people who usually worked in the CBD had to work from home or in relocated offices elsewhere in Auckland or further away.

It was 5 weeks before an emergency cable was completed and electricity restored to the CBD. The long-term economic impact was estimated at 0.1–0.3 per cent of GDP, and many small businesses never recovered from the event.

Auckland, early morning, during the 1998 power crisis. The crisis left the city without power for five weeks. *PhotoNewZealand*.

Gas

New Zealand's natural gas comes primarily from seven gas fields in the Taranaki region, with 74 per cent coming from the two largest fields, Maui and Kapuni.



Electricity generation uses most of New Zealand's extracted gas. The remainder is used to produce petrochemicals or is reticulated for industrial, commercial and residential use. *Ministry of Economic Development*.

Gas is supplied throughout the North Island by two transmission companies through 3400km of high-pressure transmission pipelines, and five distribution companies through 2800km of distribution networks. There are two small South Island LPG reticulation networks in Christchurch and Queenstown. The gas industry is currently moving from a situation of a few large companies managing a few large gas fields to a larger number of companies managing a larger number of fields of varying sizes.

Most of the gas transmission network in New Zealand was constructed in the late 1960s, and both transmission and distribution networks are currently able to meet demand. However, natural gas is a non-renewable resource. Supply will be determined by the rate of use and by the discovery and exploitation of new gas fields.

Gas supply is vulnerable to hazards, in particular earthquakes, floods, landslides, and tsunamis. Gas supply may also be affected by staff shortages during an influenza pandemic. A volcanic eruption affecting Taranaki, the source of all New Zealand's gas, could disrupt gas supply throughout the country.

Possible effects of gas infrastructure failure include:

- reduced capacity for industry and businesses (for example, food processors) to operate
- disruption to heating, cooking, and hot water for homes and essential facilities such as hospitals
- reduced gas-fuelled electricity generation.

Petroleum

New Zealand, like other developed countries, is highly dependent on oil products, particularly petroleum.

New Zealand's only oil refinery is operated by the New Zealand Refining Company at Marsden Point near Whangarei. Built in the mid-1960s, Marsden Point refines fuel for the country's four major fuel distribution companies and supplies around 80 per cent of New Zealand's jet fuel, 72 per cent of its diesel, and 63 per cent of its petrol. The remainder is imported directly, mostly into Lyttelton, Wellington, and Tauranga. About half Marsden Point's produce is transported by pipeline to the Wiri storage facility in South Auckland, and the remainder is either shipped to other New Zealand ports for road distribution or trucked directly from the refinery around Northland and North Auckland.

A natural hazard or hazardous-substance event at Marsden Point refinery could result in a loss of production capacity which would be felt nationwide. Damage to a number of New Zealand's ports or a large area of the road network, most likely from an earthquake, flood, or tsunami, could disrupt fuel supplies. Oil is a non-renewable resource and petroleum prices in New Zealand will continue to be dependent on global oil availability and international events.

Disruption to petroleum supplies would reduce the ability of many businesses and households to function normally, reduce emergency services' capability, and disrupt supply lines of other goods and services.

Information and communication technology

New Zealand has a high uptake of information and communication technology (ICT). ICT networks in New Zealand are generally privately owned by a few large companies.

ICT infrastructure tends to be more flexible than other infrastructure sectors and investment can generally occur in small increments. The ability to re-route traffic, along with the diverse capacity of main trunk lines, helps reduce the impact of failure or congestion along a particular route. The PricewaterhouseCoopers infrastructure audit did not identify any immediate ICT concerns with respect to security of supply.

ICT failures can occur through electricity outages, software problems (including viruses and hackers), or electromagnetic pulses. Hardware failure is often responsible for ICT failure. This includes the accidental severing of cables and damage from natural hazard events such as earthquakes, volcanic eruptions, floods, landslides, tsunamis, wind, or snow.

Service outages due to hardware failure, including those caused by natural hazard events, are often much shorter than failures in other sectors. For example, most ICT links were restored within 2 days after the 2006 Canterbury snowstorm, compared to up to 4 weeks for the restoration of electricity supply to some users. The New Zealand rural community is highly dependent on ICT, particularly landlines. Restoration of ICT services is a major priority for rural communities following adverse events.

Where ICT is most vulnerable is in the potential for overloading during and after an emergency. An influenza pandemic could also place stress on the ICT sector through both staff absences and an increase in ICT traffic as people work and interact from home using the internet.

While the undergrounding of the ICT infrastructure has lowered its risk to physical damage, modern ICT systems, particularly the extension of broadband, means ICT is increasingly reliant on mains power supply and is therefore more vulnerable to extended mains power failure. Facilitating access to Asymmetric Digital Subscriber Line (ADSL) broadband has increased the dependence of networks on continuous power supplies as electronic equipment is moved progressively closer to end-users. Radio ICT links are also reliant on mains power and are widely used in remote regions where difficult terrain makes cable ICT links uneconomic. Cabinets and radio sites both rely on mains power to operate and contain batteries that provide short term (up to 24 hours) back-up power.

The consequences of a large-scale ICT failure include:

- security issues
- economic losses to business
- disruption to banking and implications for international trade
- disruption to air and sea transport
- risk to public safety from disruption to the medical sector, emergency services, water and electricity supply, and traffic.

ICT failure is unlikely to be of national significance unless it seriously disrupts large areas of a major city such as Auckland, Wellington, or Christchurch.

Transport

Roads

There are 11 000km of state highway in New Zealand, managed by Transit New Zealand, and 82 000km of local road managed by territorial authorities. Overall, the state highway network is of a good, consistent standard, but the standard of the local road network is variable.

The road network is particularly vulnerable to earthquake shaking and liquefaction, landslides, lahars, and tsunamis. Floods and earthquakes often damage bridges and the services attached to them. Work has been carried out in recent years to strengthen major links such as the Thorndon overbridge in Wellington and the Newmarket viaduct in Auckland.

Disruption to the road network could isolate communities and cause economic losses from disrupted freight services.

Rail

New Zealand's rail network carries more than 14 million tonnes of freight a year, mainly coal, forestry and dairy products, and containers, and this amount is increasing. There are now only four remaining passenger services, linking Christchurch with Picton and Greymouth, Palmerston North with Wellington, Wellington with Auckland, and two metropolitan commuter systems in Auckland and Wellington.

Although there has been a general lack of investment in rail infrastructure over recent years, the main risks to failure of the rail network are from earthquake, landslide, tsunami, lahars, and flood damage. The primary impact of rail infrastructure disruption would be on freight distribution. However, a major event in Wellington or Auckland metropolitan areas would have a significant impact on commuters.

Ports

New Zealand has 13 commercial ports throughout the country. Sea ports carry 80 per cent by value and 99 per cent by weight of New Zealand's exports. Twenty-six billion dollars worth of cargo was exported from New Zealand sea ports, and almost $28 billion worth of cargo was imported into them in the year to June 2005.

Ports are particularly vulnerable to earthquakes and tsunamis. If the event is very large and affects a number of ports, or affects one of the larger ports – Auckland, Wellington, Tauranga, Lyttelton or Port Chalmers – it is likely to have a significant national economic effect.

Airports

Major international airports are located at Auckland and Christchurch with five minor international airports at Dunedin, Hamilton, Queenstown, Palmerston North, and Wellington. There are 20 local airports. Airports are critical for New Zealand's economy in terms of both trade and tourism, particularly Auckland International Airport. In the year ending June 2005, 70 per cent of international visitors, 80 per cent of air exports and 92 per cent of air imports by value went through Auckland International Airport.

Airports are vulnerable to earthquake damage and to disruption during volcanic eruptions and extreme weather. It is unlikely that an event would seriously affect more than one major airport and there is generally enough airport capacity within New Zealand to cope

The Saddle Road bridge over the Pohangina Bridge in the Manawatu after the February 2004 storm. The bridge carried the main gas transmission line between the Manawatu and Hawke's Bay and its loss affected food processing industries in Hawke's Bay. *Westmoreland School*.

with this. An exception would be a volcanic eruption in Auckland which would likely close Auckland International Airport for weeks to months, or ash from a large central North Island eruption affecting several airports.

Given the importance of Auckland International Airport for international visitors and trade, closure for a length of time would have significant impacts on tourism and export industries. An influenza pandemic would also have major impacts on airports, particularly international airports, as international visitor numbers reduce, and from staff absences.

Air travel in New Zealand can be significantly affected by poor localised weather conditions at any one of the five main airports (Auckland, Wellington, Christchurch, Dunedin and Nelson), causing widespread disruption of flights across the country. It is unusual for poor weather conditions to continue for longer than 24 hours.

Water

Territorial authorities manage most of New Zealand's water supply, stormwater, and wastewater infrastructure as geographically self-contained networks. Most of the country's medium to large urban areas have reliable and high-quality water supplies, although supplies for communities of less than 5000 people tend to vary in quality.

Most New Zealanders (83 per cent) receive water from around 700 public water-supply systems run by local government. These water networks are generally integrated – most territorial authorities, except those in the Auckland and Wellington metropolitan areas, collect, treat and distribute water, and collect, treat, and dispose of wastewater. Four per cent of the population are connected to around 1500 small privately owned or cooperative supplies. The remaining 13 per cent of the population have their own water supply, mostly from rainwater collection or bores, and dispose of wastewater through septic tank systems.

The water infrastructure sector is governed by several pieces of legislation and standards and is accountable to several different organisations. There has been substantial investment in water and wastewater treatment plants over the last 10 years. However, the 2004 PwC infrastructure audit noted concern over the security of water supply in drought-prone areas, such as Nelson, Tasman, Kapiti, and Tauranga; and over water supply and wastewater treatment capacity in small communities with large tourist-driven seasonal population fluctuations, such as Kaikoura.

Water infrastructure is critical for communities and is highly vulnerable to earthquakes, volcanic eruptions (particularly ash, in the case of surface water supplies), floods, tsunamis, droughts, and electricity failure. An influenza pandemic may disrupt water supplies due to staff shortages and disruption to supplies of treatment chemicals, electricity and telecommunications. Hazardous substance releases, pollution incidents, and terrorism can result in contaminated water supplies.

The potential consequences of damage to water and wastewater networks include:

- environmental damage and public health risk from sanitation issues or untreated sewage releases
- reduced fire fighting capability
- economic losses for industries reliant on reticulated water supplies
- school closures.

Dam failure

There are currently around 400 large dams in New Zealand – that is, those that are more than three metres high and with a capacity greater than 20 000m^3. These dams are predominantly used for irrigation, stock water, flood control, hydroelectric generation and water supply. Of these 400 dams, 96 are classed as having a medium potential impact if they fail, and 58 as having a high potential impact, under the New Zealand Society of Large Dams Dam Safety Guidelines.

Most dam failures worldwide have occurred within a few years of construction as a result of inadequate foundation or construction materials, or because of internal erosion. Dams have also failed when they have been overtopped because of inadequate spillway capacity. Dams may also fail by overtopping in natural events such as earthquakes, which cause the dam to settle, or landslides into reservoirs, which generate waves.

The potential consequences of dam failure include:

- downstream flooding of land and communities with associated casualties, damage, and economic losses
- erosion and deposition of sediment
- reduced capacity of the dam's function, for example electricity generation or water supply.

The failure of a high potential impact dam may require a coordinated response through regional or national CDEM involvement, particularly if it affects a large community, or the water supply for a large urban area or hydroelectric generation.

Managing infrastructure vulnerability

Many different organisations are responsible for managing New Zealand's infrastructure.

Electricity assets are owned mostly by government agencies; gas, petrol and ICT are largely privately owned; transport infrastructure is in private, central and local government ownership; and water is controlled by local government. All infrastructure sectors are governed by a range of regulatory and funding organisations. They have well-developed arrangements for asset maintenance and new investment.

The need for continued investment across all infrastructure sectors is recognised but there is uncertainty over required margins for security of supply. However, resilience depends not only on security of supply but also on managing demand. The more reliant New Zealand is on infrastructure, the more vulnerable it is to infrastructure failure.

Managing demand means promoting efficient use of existing assets, but there are differences between sectors in the scope for and adoption of demand-management approaches.

Risk reduction

ENGINEERING AND PLANNING

Engineering lifeline groups play a significant role in raising the awareness of infrastructure vulnerability, and promoting and advocating engineering, planning and other initiatives to reduce risk.

REGULATION AND MONITORING

The policy frameworks within which infrastructure sectors operate are set out in sector-specific legislation including the Electricity Act 1992, the Gas Act 1992, the Telecommunications Act 2001, the Local Government Act 2002, and the Land Transport Management Act 2003. These Acts contain provisions relating to establishing markets, regulation of monopolies, new investment and safety. In addition, the RMA sets out a framework to consider community and environmental impacts of infrastructure development, and the Commerce Act 1986 contains provisions that promote competition and control prices where necessary.

Policy advice on infrastructure is provided to the Government by a range of Ministries. These include the Ministry of Economic Development (for energy and ICT) and the Ministry of Transport (for transport). Policy advice on water issues is provided by Ministry for the Environment, the Ministry of Health, the Ministry of Agriculture and Forestry, and the Department of Internal Affairs. The Treasury also has a role in infrastructure policy advice, especially where central government provides funding.

Many of the sector-specific Acts set up governance institutions or other arrangements to ensure that policy objectives are met.

1997 OPUHA DAM COLLAPSE

The partially completed Opuha Dam in the Opihi catchment in South Canterbury collapsed on 6 February 1997, releasing 13 million m^3 of water down the Opuha River.

Intermittent heavy rain over the preceding few days had exceeded the capacity of the culvert through the dam and the available storage within the reservoir. A cut was made at the dam abutment but water was able to erode a larger channel into the earth dam, and eventually the dam collapsed.

A state of emergency was declared early on 6 February, and 200 residents were evacuated from four settlements. No human lives were lost but 1000 head of stock died and farms adjacent to the river sustained hundreds of thousands of dollars' worth of damage.

Half a million dollars' worth of damage was done to flood protection works in the Opuha and Opihi river catchments, and State Highway 79 was washed away at Skipton Bridge.

This collapse, along with floods in 2004, highlighted the need for dam safety provisions and reinforced the need for emergency management plans to be developed for medium and high potential impact dams.

The Electricity Commission was set up by Government in 2003 under the Electricity Act 1992, to ensure security of supply in response to the variability of water levels in New Zealand's main hydro-generation lakes resulting from uneven year-to-year rainfall. The Gas Industry Company is the industry body under the co-regulatory governance model established for the gas sector. They are responsible for developing and implementing gas market arrangements.

Land Transport New Zealand was formed in 2004 to take responsibility for land transport funding and promote land transport safety and sustainability. New Zealand is required under the International Energy Agreement to hold 90 days' supply of petroleum for emergency use.

Infrastructure supply risks are also addressed in the CDEM Act, which requires lifeline utilities to plan so they can function during and after an emergency, even if at a reduced level, and to take part in developing CDEM plans.

DAM SAFETY

Changes in the Building Act 2004 recognise the potential for dam failure and the need for a formal system of monitoring and maintaining dams given the continuing changes to dam ownership, operation, and management.

Dam owners are required to classify their dam according to the potential impact its collapse would have (low, medium, or high) and to register that classification with their regional council. This classification is regularly reviewed, which means that changing risk factors such as new downstream development or changing hydrological conditions can be taken into account. Owners must also prepare dam safety assurance programmes, which include emergency action plans, and provide an annual compliance certificate for medium or high potential impact dams.

Regional councils process building consents for dams, administer and monitor dam safety management (including holding a dam register) and develop policy.

Readiness

The gas industry has developed its own emergency and contingency arrangements in the National Gas Outage Contingency Plan. The Gas Industry Company is currently reviewing the contingency arrangements to ensure they are appropriate to the changing nature of the gas market.

The Transport Emergency Management Coordination Group aims to coordinate responses to critical transport infrastructure failures. This will support the transport sector to make rapid damage assessments, identify critical interdependencies, and set regional transport infrastructure recovery priorities.

Most of the territorial authorities surveyed as part of the 2004 PwC infrastructure audit had water supply contingency plans but they varied in standard. These included emergency response plans, risk management, and lifeline documentation and scenario planning. MCDEM is engaging with a number of local government and other organisations to develop a water sector CDEM contingency plan. The main issues to be addressed are the supply of drinking water for vulnerable populations during an emergency, and the most rapid and effective way to restore damaged water systems.

Government agencies, regulatory bodies, and industry organisations are working with lifeline utilities to develop or review contingency plans for the supply of water, wastewater, transport, energy, and telecommunications services.

The Guide to the National CDEM Plan encourages the formation of regional and national CDEM clusters of lifeline utilities. The Guide encourages lifeline utilities to coordinate readiness activities, to develop disaster resilience summaries, hold joint exercises, and exchange emergency contact details with other lifeline utilities and CDEM agencies.

ENGINEERING LIFELINES GROUPS

Engineering lifelines groups are regionally based voluntary organisations of lifeline utilities (infrastructure providers) working together and with other agencies to identify interdependencies and vulnerabilities to emergencies.

There are currently engineering lifelines groups in most regions, which aim to reduce both the damage to infrastructure during an emergency and the time taken to restore services after a large event. This includes coordinating hazard investigations and collaborating on reduction and readiness activities.

Lifelines groups focus on hazard events which are likely to affect several infrastructure sectors at the same time. Until recently, engineering lifelines projects have dealt mainly with natural hazards, particularly earthquakes, but are now including other hazards such as influenza pandemic.

Lifelines groups do not have any statutory basis or obligations, but operate within the context that the member lifeline utilities are responsible under the CDEM Act for ensuring they can function to the fullest extent possible.

Response and recovery

Priorities for restoring infrastructure after an event are determined by individual lifeline utilities. However, the Guide to the National CDEM Plan does outline the priorities for restoring services to different groups or areas.

The Guide to the National CDEM Plan requires lifeline utility and CDEM Group coordination if:

- a lifeline utility service is disrupted in more than one territorial authority area or multiple lifeline utility services are disrupted by an event
- significant community impacts are expected because of a lifeline utility service disruption.

In other aspects, CDEM response to infrastructure failures would follow generic response and recovery procedures set out in CDEM Group plans, the National CDEM Plan and the Guide to the National CDEM Plan.

FURTHER INFORMATION

GENERAL INFRASTRUCTURE INFORMATION AND REGULATION

MINISTRY OF ECONOMIC DEVELOPMENT
www.med.govt.nz/templates/StandardSummary____11.aspx
www.med.govt.nz/templates/StandardSummary____33.aspx
www.med.govt.nz/templates/StandardSummary____36.aspx
www.med.govt.nz/templates/StandardSummary____37.aspx
MINISTRY OF TRANSPORT
www.mot.govt.nz
ELECTRICITY COMMISSION
www.electrictycommission.govt.nz
COMMERCE COMMISSION
www.comcom.govt.nz
GAS INDUSTRY COMPANY
www.gasindustry.co.nz

2004 PRICEWATERHOUSECOOPERS INFRASTRUCTURE AUDIT

MINISTRY OF ECONOMIC DEVELOPMENT
www.med.govt.nz/templates/ContentTopicSummary____5541.aspx

INTERNATIONAL CARGO STATISTICS

STATISTICS NEW ZEALAND
www.stats.govt.nz/products-and-services/info-releases/oseas-cargo-info-releases.htm

BUILDING ACT 2004 (DAM SAFETY)

MINISTRY OF BUILDING AND HOUSING
www.dbh.govt.nz/bofficials-dam-safety

OPUHA DAM COLLAPSE

LEES, P AND THOMSON, D, 2003, 'EMERGENCY MANAGEMENT, OPUHA DAM COLLAPSE, WAITANGI DAY 1997'.
IPENZ Proceedings of Technical Groups 30/2.
www.ipenz.org.nz/nzsold/2003Symposium/LargeDams2003pages84-104.pdf#search=%22opuha%20dam%20collapse%22

LIFELINE UTILITIES AND CDEM, AND ENGINEERING LIFELINES GROUPS

MINISTRY OF CIVIL DEFENCE & EMERGENCY MANAGEMENT
www.civildefence.govt.nz/memwebsite.nsf/wpg_URL/For-the-CDEM-Sector-Lifelines-Index?OpenDocument&menuexpand=forthecdemsector

HAZARDOUS SUBSTANCE INCIDENTS

New Zealand imports, uses, stores, and transports hazardous substances to a similar extent to most other developed countries. There is less primary manufacturing of hazardous substances in New Zealand compared to other countries, but New Zealand does have a significant petrochemicals industry, based on oil and gas resources in the Taranaki region, and a large-scale oil refinery at Marsden Point. Storage and usage quantities are generally smaller than other countries because of the low population.

Hazardous substances in New Zealand

Many different hazardous substances are used, stored, transported and, to some extent, manufactured in New Zealand.

Petrochemicals, including petrol, diesel, aviation fuel, and natural gas-based products and solvents are manufactured, transported, used, and stored. Pesticides are widely stored and used, although not generally manufactured in New Zealand. Pesticide use is highest in timber treatment, antifouling treatments for boats, agriculture, and horticulture.

Explosives are both imported and manufactured in New Zealand and are extensively stored and used in mining, quarrying, tunnelling, demolition and military operations.

Industrial chemicals are widely used, typically in urban industry and within specific zones. For example, resins are used in manufacturing plastics and other polymers, inks are used in printing, and specialty chemicals are used in research and diagnostic laboratories. Paints are used in the industrial, motor vehicle, and domestic sectors. Domestic products, such as cleaners and detergents, that incorporate hazardous substances are widely used.

The use of hazardous substances has many benefits, but New Zealand experiences day-to-day adverse effects of hazardous-substance use on people, property, and the natural environment. There is no readily available data that gives the precise extent of these impacts, but there is sufficient information to show that death and illness from acute and chronic exposure to hazardous substances affect many thousands of people each year.

Most adverse health effects arise from exposure to hazardous substances in the workplace. Other common incidents result from LPG use, and children swallowing household products. There are about 8000 chemically contaminated sites in New Zealand, and about 800 of these are timber industry sites.

Hazardous substance incidents

A hazardous substance incident is an unplanned or uncontrolled release of hazardous substances such as fuels, flammable substances, explosives, toxic chemicals, pesticides, radioactive material, or micro-organisms, including contaminated waste products. The New Zealand Fire Service attended more than 1750 hazardous substances incidents in 2003/04.

Hazardous substance incidents can be caused by a natural hazard affecting a production and storage site, transport vehicle or end-user site, a transportation accident, lack of care during use, criminal activity, or inadequate storage or disposal. Hazardous substance releases can cause large explosions or toxic gas plumes and can, therefore, affect large areas. The consequences of hazardous substance incidents can include death, illness (potentially long-term), evacuations, environmental contamination and economic losses for businesses involved from damage and site clean-up. The effects of a hazardous substance release can be worsened if two hazardous substances stored near each other trigger a chemical reaction.

However, large-scale hazardous substance incidents that would require mass evacuations and coordinated CDEM involvement are uncommon. The most likely cause of an incident would be the release of a hazardous substance during transit, either at a port or from a road transport accident in an urban area, or a large fire ignited by, or near, chemicals.

1973 PARNELL DEFOLIANT LEAK

One of New Zealand's largest hazardous substance incidents occurred in February 1973 when drums which were leaking cotton defoliant were unloaded from the ship *Good Navigator* in Auckland.

The boat had encountered a storm en route from San Francisco to Auckland, which had damaged some of the drums and washed off the toxic warning labels. Twenty-five drums were unloaded from the boat when it berthed on 26 February and taken to two storage facilities in Parnell. By the following morning fumes were affecting people in the vicinity, and the leaking drums were discovered. A state of emergency was declared, which lasted 6 days. Parts of Parnell were evacuated and several hundred people required medical attention.

A commission of inquiry found that several factors had contributed to the incident, in particular the actions of the ship's captain and the removal of drums from the port contrary to New Zealand Customs Service and Ministry of Health instructions. However, the response to the incident was effective. This hazardous substance incident led to the establishment of emergency services coordinating committees to assist in the coordinated response to emergencies.

The New Zealand fire service removing drums after the 1973 Parnell defoliant leak. 4000 families were evacuated from the area during a six-day Civil Defence emergency. *New Zealand Herald*.

Managing hazardous substances

The response to hazardous substance incidents is managed by the New Zealand Fire Service. Hazardous substance technical liaison committees provide expertise in managing hazardous substance emergencies. The Environmental Risk Management Agency (ERMA) is the principle agency implementing the Hazardous Substances and New Organisms Act 1996 (HSNO Act).

Risk reduction and readiness

Most hazardous substances are regulated under the HSNO Act. The purpose of the Act is, among other things, to protect the environment and people by preventing or managing the adverse effects of hazardous substances. All hazardous substances in New Zealand must be approved and used in accordance with risk management controls set by ERMA.

Other agencies manage specific substances, many of which are also regulated under the HSNO Act. The Ministry of Health approves medicines and regulates radioactive substances (under the Radiation Protection Act 1965), and the New Zealand Food Safety Authority registers agricultural compounds and veterinary medicines. The Department of Labour enforces provisions of the HSNO Act in the workplace.

Regional councils are responsible under the RMA for controlling the discharge of hazardous substances and territorial authorities are responsible for managing land use to prevent or mitigate the adverse effects of storing, using, transporting and disposing of hazardous substances.

Response and recovery

The New Zealand Fire Service is responsible for managing the response to a hazardous substance incident. Other agencies such as the Police and health organisations may also need to assist with response and recovery, particularly if many people are affected or evacuated, or if a large cleanup is necessary.

Any CDEM response to hazardous substance incidents follows generic response and recovery procedures set out in CDEM Group plans, the National CDEM Plan and the Guide to the National CDEM Plan.

HAZARDOUS SUBSTANCES TECHNICAL LIAISON COMMITTEES

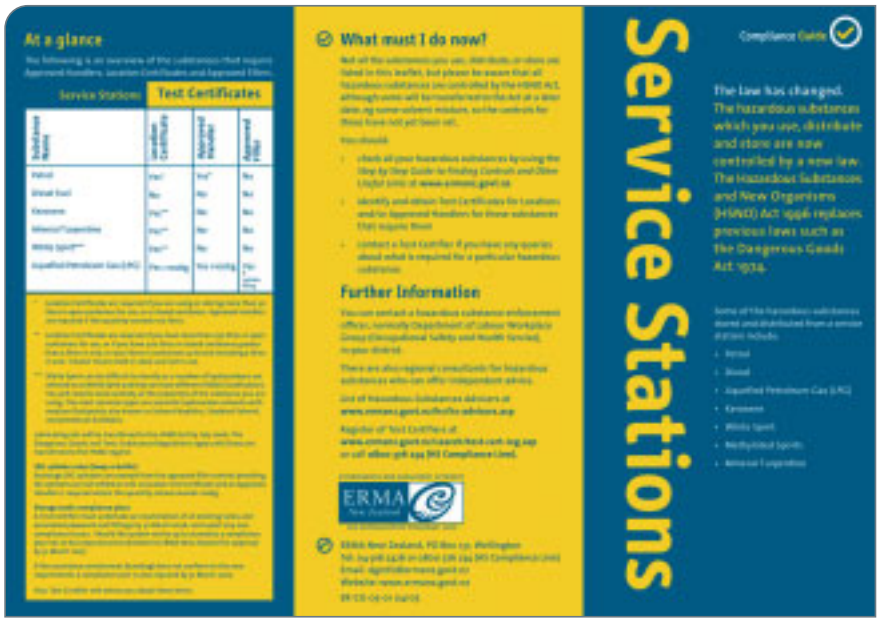
Hazardous substances technical liaison committees (HSTLCs) have been established in many parts of New Zealand. These voluntary groups are chaired by local New Zealand Fire Service representatives and include people from other emergency services, health organisations and CDEM Groups. HSTLCs provide technical information on a 24-hour basis for co ntrolling, neutralising and disposing of hazardous substances and decontaminating affected sites. HSTLCs also catalogue hazardous substance information and provide advice for hazardous substance emergency planning.

Unknown hazardous substances leaking from unlabelled, unsealed drums into a drain, Christchurch. *Environment Canterbury.*

FURTHER INFORMATION

GENERAL HAZARDOUS SUBSTANCES INFORMATION

ENVIRONMENTAL RISK MANAGEMENT AUTHORITY
www.ermanz.govt.nz/hs/index.html



Part of a Compliance Guide for Service Stations. Service stations are an essential element of the New Zealand economy and contribute significantly to the transport sector. In order to achieve this they store and handle significant quantities of flammable substances. Careful management of these is important to protect people and the environment. ERMA New Zealand has produced a series of compliance guides for a wide range of industry groups. *ERMA New Zealand*.

MAJOR TRANSPORT ACCIDENTS

Many of New Zealand's disasters during the 1800s and early 1900s were transport accidents. Many people drowned when ships, which were a common mode of transport at the time, sank in bad weather or because of navigation errors in poorly charted waters. Over the last 60 years, New Zealand's most serious disasters, in terms of deaths, have been transport accidents – the 1953 Tangiwai train derailment, the 1968 *Wahine* sinking, and the 1979 flight TE901 crash at Mt Erebus in Antarctica. Together these three accidents killed 459 people.

Major transport accidents often have high death and injury rates and are generally localised occurrences. Transport accidents killed 573 people in New Zealand in 2000.

Damage to property and infrastructure from transport accidents is usually confined to a much smaller area than damage from natural hazards. However, the economic impact of a major transport accident could have short-term consequences for tourism, and the loss of a large aircraft or ship has significant financial implications.

Transport accidents are a common cause of hazardous substance releases or spills, which are hazards themselves.

Land transport

New Zealand has 93 000km of road and about 3.1 million registered motor vehicles, of which 416 000 are heavy vehicles. The number of vehicles on the road and the amount of freight carried by road both continue to increase. Road crashes are frequent and kill about 400 people each year. Major crashes involving several vehicles, however, are uncommon and rarely affect many people. A bus colliding with a petrol tanker is considered a potentially possible event.

Few long-distance passenger rail services remain in New Zealand and rail accidents are uncommon. The probability of a major rail accident causing many deaths is low. An accident involving a full commuter train carrying up to 750 people in either Wellington or Auckland would requires significant emergency service and local authority response, and most likely require broader CDEM involvement.

Marine transport

New Zealand's often rocky coastline, and its windy and changeable weather, make marine navigation a challenge. There have been more than 2300 shipwrecks around New Zealand since 1790, killing hundreds of people. The worst single shipwreck was that of the *Orpheus* at the entrance to Manukau Harbour in 1863, when 189 naval officers and crew died.

Several factors contributed to these shipwrecks, including a poorly charted coastline, a lack of navigational aids, the difficulty of manoeuvring sailing ships, the wooden construction of many ships, a lack of lifeboats, and in some cases poorly trained captains.

Today's navigation aids, better boat construction, and safety regulations mean that marine transport accidents are much less common. However, New Zealand's weather and the possibility of human error may cause a large marine accident, such as the 1968 *Wahine* sinking in Wellington Harbour and the 1986 sinking of the *Mikhail Lermontov* in the Marlborough Sounds.

Passenger ferries and cruise ships can carry hundreds or even thousands of people, so the consequences of an accident involving such a ship could be large and likely require coordinated emergency service and CDEM involvement. The risk of a large container ship grounding and releasing fuel or hazardous cargo is significant on much of New Zealand's coastline, and this would also likely require coordinated emergency service and CDEM involvement.

1968 WAHINE SINKING

Although there have been worse shipping disasters in New Zealand, the sinking of the *Wahine* in 1968 is the most recent and well known.

The ferry *Wahine* set out for Wellington from Lyttelton Harbour on the evening of 9 April. The weather was calm, and although a storm was causing problems in the north of the North Island, it was considered too far away to be a problem for the sailing. However, during the night of 9 April the storm, which was expected to move southeast towards the Chatham Islands, changed course and headed south towards Wellington. The storm collided with a deep depression that had been moving north up the South Island directly over Wellington on the morning of 10 April, creating winds of up to 230km/h just as the *Wahine* was approaching the harbour entrance.

The ship struggled in the large swell; the radar was not operating and visibility was poor. It hit Barrett Reef at the entrance to the harbour, losing its starboard propeller and sustaining damage to the hull and the port engine. The ship started taking on water, and with no propulsion it drifted into the harbour, listing to starboard. Anchors were dropped and finally held just off Seatoun beach on the western side of the harbour entrance. Rescue efforts with tugs failed in the rough seas, and at 1.15 pm the order was given to abandon the ship.

The first lifeboat launched capsized in the heavy seas, killing many people. Other lifeboats capsized as they approached the shore and people died from exposure or because they were driven against rocks. Some passengers had no choice but to jump into the water and were blown to the eastern side of the harbour entrance. The *Wahine* finally capsized at 2.30 pm. Fifty-one of the 734 passengers and crew died.

The weather was the main cause of the *Wahine* sinking, but a subsequent Court of Inquiry found that a number of errors and omissions were made both on shore and on the ferry.

The *Wahine* after capsizing in 12m of water at the entrance to Wellington Harbour. The ship took 5 years to demolish and remove from the site.
New Zealand Maritime Museum.

Air transport

New Zealand has a high number of aircraft, particularly small privately owned planes, for its low population. This is the main reason for the high rate of small-aircraft crashes compared to other developed countries. However, aside from the 1979 Air New Zealand DC10 crash at Mt Erebus, Antarctica, which killed 257 people, there have been few major aircraft accidents in New Zealand.

The wreckage of Air New Zealand flight TE901 on Mt Erebus near McMurdo Sound in Antarctica. The sightseeing flight crashed into the active volcano in November 1979 in whiteout conditions. *Antarctica New Zealand*.

Thirteen people were killed when a National Airways Electra flew into Mt Ruapehu in 1948 and 15 people died the following year when a National Airways Lodestar crashed in the Tararua Range. These accidents were caused by a number of factors, but deficiencies in aircraft and ground navigation systems were major contributors. The crashes highlighted the need for better safety measures and industry regulation. The worst aircraft crash in New Zealand was the National Airways DC3 crash in the Kaimai Range in 1963, which killed 23 people.

There have been no large commercial aircraft crashes within New Zealand. However, aircraft crashes involving many deaths are not uncommon worldwide and an aircraft accident involving a large passenger plane is possible in New Zealand.

Most aircraft crashes result from a combination of factors. Human error, either during manufacture, maintenance, or flying, is often the underlying cause. However, weather conditions can also contribute, especially with New Zealand's mountainous terrain and often strong winds and turbulence.

A jet aircraft crash in an urban area is likely to cause several hundred deaths and injuries, structural and fire damage to buildings and infrastructure, local economic impacts, and require evacuations.

Managing transport systems

Many organisations are involved in managing transportation in New Zealand. Regulators include the Civil Aviation Authority, Maritime New Zealand, and Land Transport New Zealand. Airport and port authorities also play a role, as do Transit New Zealand (for state highways) and territorial authorities (for local roads).

Emergency services provide the initial response to all major accidents.

Risk reduction and readiness

Air, sea and rail transport systems adopt a complete approach to risk reduction which requires operators to use safety or quality management systems that cover the machines (boat, plane or train), the guidance systems (radar, lighthouses, signals, radio beacons) and the human input (pilots, drivers, controllers).

The road transport system does not have the benefit of such well-controlled management systems, and risk management is less rigid. Registrations and warrants of fitness set minimum operational standards for vehicles, and driver testing and licensing sets minimum operator standards. Standards relating to the safety of the roading infrastructure include warning and regulatory signs, road markings, and controls.

Most agencies with transport safety functions have developed risk assessment plans that identify vulnerable areas of operation and have developed response plans for various scenarios.

Response and recovery

The effects of major transport accidents place extreme demands on emergency services in the initial response stage of dealing with victims, and controlling secondary hazards such as fire or pollution. The requirements for preserving evidence at the scene for accident investigators can mean that roads and rail could be out of use for many days, causing disruption. The Transport Accident Investigation Commission (TAIC) is responsible for the independent investigation of significant aviation, rail and marine accidents and incidents. Police also carry out accident investigations in order to support criminal prosecutions.

Most transport accidents are localised events and can be managed

at a local level. Broader CDEM involvement may be required during a major transport accident to provide support in an Emergency Operations Centre, and to assist in coordinating resources and welfare support to any other people affected.

FURTHER INFORMATION

GENERAL TRANSPORT INFORMATION

MINISTRY OF TRANSPORT
www.mot.govt.nz

GENERAL LAND TRANSPORT AND ACCIDENT INFORMATION

LAND TRANSPORT NEW ZEALAND
www.ltsa.govt.nz

GENERAL MARINE TRANSPORT AND ACCIDENT INFORMATION

TE ARA ENCYCLOPAEDIA OF NEW ZEALAND
www.teara.govt.nz/EarthSeaAndSky/SeaAndAirTransport/Shipwrecks/en
Maritime New Zealand
www.msa.govt.nz

WAHINE DISASTER

WELLINGTON CITY LIBRARIES
www.wcl.govt.nz/wellington/wahine.html
New Zealand Maritime Museum
www.nzmaritime.co.nz/wahine.htm

GENERAL AIR TRANSPORT AND ACCIDENT INFORMATION

TE ARA ENCYCLOPAEDIA OF NEW ZEALAND
www.teara.govt.nz/EarthSeaAndSky/SeaAndAirTransport/AirCrashes/en
CIVIL AVIATION AUTHORITY
www.caa.govt.nz

TERRORISM

A terrorist act is defined as 'an act that has the purpose of advancing an ideological, political or religious cause, with the intention of inducing terror in a civilian population or of compelling or forcing a government or international organisation to do or abstain from doing any act.'

The consequences of terrorism can include:

- death or serious injury
- damage or destruction of property of great value or importance
- interference or disruption to infrastructure with the intention of causing large-scale impacts on the functioning of society
- devastation of the national economy through the introduction or release of a disease-bearing organism or significant contamination of the environment.

There has been an increased worldwide focus on terrorism and preventing terrorist incidents since the attacks on the United States in September 2001.

The *Rainbow Warrior* in Auckland Harbour in 1985. The sinking of the ship was the first and only act of international state-sponsored terrorism to be committed in New Zealand. *Greenpeace*.

Terrorism in New Zealand

The most significant act of terrorism to occur in New Zealand in recent times was the bombing of the *Rainbow Warrior*, the flagship of international environmental organisation Greenpeace, ordered by the French Secret Service. The ship was visiting Auckland before leading a fleet of vessels to Mururoa Atoll in French Polynesia to protest against French nuclear testing in the South Pacific. Just before midnight on 10 July 1985, two explosions rocked the harbour, sinking the *Rainbow Warrior*. One of the twelve crew members on board at the time was killed.

The letter to the Prime Minister in 2005, claiming release of foot-and-mouth disease on Waiheke Island, while later proved a hoax, and the deliberate introduction of rabbit calicivirus by farmers to control rabbits, are examples of the risks of bioterrorism to primary industries. Illegal introductions of unwanted organisms may have far-reaching consequences. For example, the introduction of varroa mite, affecting both the honey industry and industries relying on pollination, may have been through a smuggled, infected honey bee.

Managing terrorism

Managing the risks associated with terrorism involves dealing with a problem of low probability but potentially high consequences, and as such involves difficult judgments about possible threats.

The government framework for managing terrorism is well established and uses the Domestic and External Security Coordination (DESC) system. Within this system, the Cabinet Committee for Domestic and External Security Coordination (DESC) is the central decision-making body on terrorism.

The Cabinet DESC Committee is chaired by the Prime Minister, and includes those Ministers responsible for departments that play an essential role in managing terrorist risks and in responding to a particular terrorist event. Cabinet involvement is necessary to ensure that responses meet New Zealand's national interests, quickly restore community functioning, and minimise adverse outcomes: death and injury, damage to property and the environment, and social and economic disruption.

The Officials' Committee for Domestic and External Security Coordination (ODESC) advises the Cabinet DES Committee on matters relating to terrorism. Its members are the chief executives of departments and agencies that have a role to play in counter-terrorism and it is chaired by the Chief Executive of the Department of Prime Minister and Cabinet. ODESC is primarily concerned with the strategic aspects of counter-terrorism including incidents requiring whole-of-government management.

Legislation is an important part of countering terrorism, providing the necessary powers to enable intelligence, security, law enforcement, border control, public health, fire, and defence agencies to prevent, suppress, and respond to terrorism. It establishes serious offences and penalties for planning, organising, facilitating, financing, and carrying out terrorist acts. The legislation acts as a deterrent and enables prosecution of those who are involved in such activities. Legislation also implements New Zealand's obligations under international conventions and agreements.

Risk reduction

Reducing the threat of terrorism involves taking whatever steps are possible to reduce the likelihood of terrorists selecting a target in New Zealand or attacking New Zealanders or their interests overseas.

The Interagency Combined Threat Assessment Group assesses terrorist threats to New Zealand. Risk reduction measures include collecting, analysing, and disseminating intelligence on terrorist intentions and capabilities; having robust pre-boarding and border security management that prevents known or suspected terrorists from travelling to or entering New Zealand; and identifying and protecting critical infrastructure and assets.

Readiness

Readiness for a terrorist attack includes whole-of-government planning to reduce vulnerability of potential victims and targets, training, and providing contingency resources for critical infrastructure.

Response

Response includes providing the skills, capabilities and logistics needed to act quickly to prevent further damage or cascading effects, and dealing with the immediate consequences.

These resources include early warning and alert systems, Coordinated Incident Management Systems, prompt messages to the public and other response agencies, and in the case of events overseas, having international arrangements to ensure the security of New Zealanders and New Zealand interests.

The national crisis management arrangements for a terrorist event are collectively known as the Terrorist Emergency Group (TEG). The TEG comprises:

- the Cabinet DESC Committee
- ODESC
- an interdepartmental watch group responsible for analysing the terrorist situation and advising on response and recovery strategies
- an interdepartmental media coordination centre responsible for advising on the media and public information aspects of a terrorist event
- a joint intelligence group responsible for providing operational situation reports, intelligence and assessments
- support groups from departments and agencies.

Recovery

Recovery after a terrorist attack aims to return communities to everyday functioning quickly and efficiently. This involves having robust financial, legal and social systems in place, and having support systems for those affected by overseas attacks where New Zealand interests or citizens are involved. This may include assisting survivors and their families, rebuilding destroyed or damaged property, rebuilding or replacing critical infrastructure, re-establishing New Zealand's reputation, and rapidly regenerating economic and social functions.

FURTHER INFORMATION

GENERAL TERRORISM INFORMATION

NEW ZEALAND POLICE
www.police.govt.nz/service/counterterrorism
MINISTRY OF FOREIGN AFFAIRS AND TRADE
www.mfat.govt.nz/foreign/spd/terrorism/campaignterrorism.html

FOOD SAFETY

The food and beverage sector is by far the largest contributor to the New Zealand economy. It is growing at approximately the same rate as the overall economy, averaging a nominal growth of 5.3 per cent a year over the past decade. The sector:

- generates NZ$25.3 billion net of exports (Coriolis Report, 2005)
- employs one in five New Zealanders across the entire population, and 40 per cent of the total workforce
- generates half of New Zealand's merchandise export earnings.

As the most significant contributor to the New Zealand economy, the food and beverage sector is critical to our country's economic performance. Any significant change in its performance will materially and directly affect the national economy.

New Zealand's food hazardscape

Potential food hazards may arise naturally, accidentally, or deliberately. They may be chemical, biological, physical, or radiological in nature.

Common natural or accidental food chemical hazards include, for example, cadmium, lead, and mercury. Chemical hazards include compounds such as residues of pesticides, veterinary medicines, a range of environmental contaminants such as dioxins and polycyclic aromatic hydrocarbons, or toxic breakdown products such as histamine in scombroid species of fish.

An increasing number of New Zealanders identify themselves as allergic to specific food groups. The Australia New Zealand Food Standards Code[1] has identified the eight most common food allergens, which are responsible for up to 90 per cent of all allergic reactions. These are the proteins in cows' milk, eggs, peanuts, wheat, soy, fish, shellfish, and tree nuts. Allergic reactions vary, ranging from a mild skin rash to life-threatening anaphylactic shock.

Biological food hazards are an equally diverse group and include many infectious pathogens. In 2006 enteric pathogens formed the overwhelming majority of all human disease notifications in New Zealand. Of the 15 873 cases of enteric illness, campylobacteriosis contributed almost 70 per cent of notifications that identified food as a possible significant source.

E coli (Escherichia coli) is a bacteria and one of the leading causes of food poisoning. However, not all strains are harmful – without a type of E coli found in intestines, humans wouldn't be able to absorb vitamins.

Other food-borne biological hazards include *Salmonella*, *Shigella*, *Yersiniosis*, *Escherichia coli (E coli)*, *Listeria monocytogenes*, *Clostridium perfringens*, *Staphylococci*, rotavirus, norovirus, and *Bacillus cereus*, which in 2006 collectively caused over 1000 notified infections.

Mycotoxins are naturally occurring metabolites produced by certain species of moulds. Moulds may occur on a crop when growing or during storage or processing.

Parasites can also be found in this group although they are rare. Examples are, *Cysticercus bovis* in beef meat (producing the tapeworm *Taenia saginata* in humans), *Anisarkis simplex* in some species of fish and *Trichinella spiralis* in pork.

Marine biotoxins may be present in molluscan shellfish after they have fed on toxic algal blooms. The most serious biotoxins found in New Zealand are those that cause paralytic shellfish poisoning in humans.

Physical food hazards include, foreign body contamination such as glass, metal, wood or plastic which results in a significant number of food product recalls. Physical hazards inherent in the food such as bone, may also cause problems.

Avoiding eating food that has been exposed to nuclear irradiation is a key means of limiting human exposure following a nuclear event. Although New Zealand has no nuclear installations, a nuclear accident anywhere is a nuclear accident everywhere. Radiation as a result of the Chernobyl disaster which occurred over 20 years ago is still excluding a range of foods across Europe from the food chain.

In addition to these naturally occurring and accidental hazards, food has been identified as a vehicle for terrorist acts. Deliberate contamination of food by chemical, biological, physical, or radiological agents can occur at any vulnerable point along the food chain, from farm to table, depending on the food and the agent.

Although few incidents or threats of deliberate contamination of the food supply on a massive scale have been documented, food is regarded as a vulnerable target.

Factors that increase the vulnerability of food to be used effectively as a terrorist vehicle include:

- large batch size
- short shelf life
- production systems that facilitate the uniform mixing of a contaminant into food
- ease of accessibility to product at a critical point.

[1]The Food Standards Code is a set of food labelling and composition standards for both New Zealand and Australia. The Code was adopted in New Zealand in February 2001 and took full effect on 20 December 2002.

Impacts

New Zealand exports over 80 per cent of the food it produces. It also imports an increasing variety of foods from a widening range of countries. Unmanaged food safety hazards in this country therefore pose risks not only to New Zealanders but to customers throughout the world. And in the same way, unmanaged hazards arising offshore may have an impact on New Zealand.

A recent example of a relatively small impact arising from an imported hazard was the Eden Park gastroenteritis outbreak. In June 2006, 387 rugby supporters succumbed to norovirus infection after eating uncooked Korean oysters, likely to have been grown in sewage-contaminated waters[2].

Contamination of food products can have significant health, economic, trade, and political consequences. In 1985, for example, the unintentional contamination of milk in the United States resulted in 17 deaths and 16 000 confirmed cases in six states. Health experts estimated that 200 000 individuals were sickened in this event as a result of bacterial contamination of milk from a single, small, dairy plant in midwest United States [3].

The current campylobacteriosis epidemic is costing New Zealand about $78 million a year. This estimate includes only direct costs and so is conservative. It does not include wider indirect economic costs and possible harm to the export and tourism industries[4].

New Zealand is a significant participant in global trade in a limited number of food items that it is exceptionally good at producing. Total production is small in world terms for most food items (sheep meat being the exception). However, a high percentage of New Zealand's product is exported, due to volume of production and the small domestic market.

Relatively small food incidents in New Zealand, or identified by any country as relating to New Zealand food, are quickly picked up by overseas governments and consumers, and may quickly escalate into costly sanctions.

[2]*An outbreak of norovirus gastroenteritis associated with the consumption of imported Korean oysters. June 2006. Outbreak report AK 2006124*

[3]*Agenda item: VI.F.2 2006/sOM1?CTTF/012 APEC Counter-terrorism task force meeting, Hanoi 27 Feb 2005*

[4]*Proceedings of the Food Safety, Animal Welfare and Biosecurity Branch of NZVA, 2007. 'The Compelling case for urgent action to control New Zealand's Foodborne Campylobacterioisis epidemic.' M Baker, N Watson*

Generally, natural or accidental food contamination incidents result in few deaths but many cases of illness. Intentional contamination events have the potential to result in many deaths.

Managing food safety

Risk reduction and readiness

The New Zealand Food Safety Authority (NZFSA) takes a risk-based approach to food safety that allows it to identify, evaluate, and manage risks in food.

NZFSAs risk-management framework ensures a regulatory response that is appropriate to the level of risk and provides a consistent and transparent way of ensuring safety and suitability of food sold domestically and exported.

It sets out a process that takes the results of risk assessments and identifies appropriate options to manage these risks. This framework is underpinned by a four-step procedure, which involves:

- identifying a specific food safety problem and evaluating the risks presented
- assessing the risk and the management options available and deciding on the appropriate level of consumer protection to be provided
- implementing the risk-management decision
- monitoring and reviewing – analysing the data at appropriate points from farm to fork.

An integral part of this process is communicating with stakeholders.

NZFSA risk managers rely on risk assessments to make decisions on food controls. Having identified which hazards are risks, an assessment allows NZFSA to prioritise its work in this area so that it can tackle those risks of most concern first.

NZFSA is currently upgrading the systems relating to managing risks in domestic and imported foods, and associated legislation, to synchronise with this approach.

The food regulatory system

The Domestic Food Review initiated in 2003 is aimed at better managing the food regulatory system to ensure it can address problems and gaps, and deal adequately with the significant growth expected over the next 20 years.

A key aim is to make food operators responsible for providing safe and suitable food. There are interfaces with the production sector, tourism, environment, imports and exports. People and organisations at every step in the food chain have a part to play to ensure the safety of food. But in a country like New Zealand, where the food sector is so important, it is crucial that consumers have confidence in the food they buy at the time of purchase.

As a result of the review the current Food Act 1981 and Food Hygiene Regulations 1974 are being redrafted with a view to introducing a new Food Bill.

Other legislation managing risks to food include the Animal Products Act 1999, the Wine Act 2003 and the Agricultural Chemicals and Veterinary Medicines Act 1997.

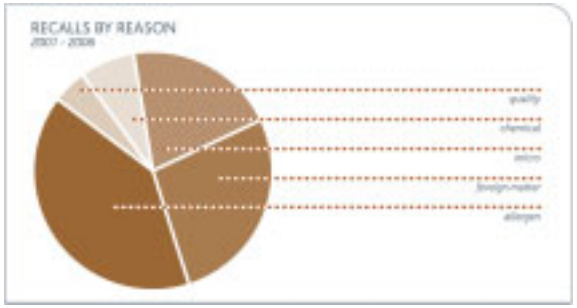
A range of surveillance programmes support reduction and readiness activities. The Ministry of Health carries out surveillance activities and reports on notifiable and other diseases. NZFSA completes a number of surveys targeting a range of foods in the National Chemical Contaminant Programme and the National Chemical Residue Programme. NZFSA also collates microbiological information on foods in a national microbiological database.

In addition to these programmes, New Zealand shares information on food safety incidents with Australia under the National Food Incident Response Protocol, and with the World Health Organisation as part of the INFOSAN network. It completes daily environmental scanning, usually via food-focused web-based list serves such as FSNet.

Response

Day-to-day frontline investigations and management of domestic food-safety issues or breaches are carried out by public health unit staff contracted by NZFSA. Overview of food safety incidents relating to exported food is the responsibility of NZFSA, sometimes working alongside independent third-party verifiers.

All incidents must be notified to NZFSA, and many procedures outline possible emergency risk-mitigation activities. The most common of these is a voluntary recall of the affected product by the manufacturer or distributor.



NZFSA has a dedicated Event and Emergency Response Coordination Unit to support incident management, which is carried out under a risk-based framework. As incidents scale up in size and complexity, the operational team evolves to work in a modified Coordinated Incident Management System type structure, and strategic command rises to the level of appropriate delegation. Likely joint agencies in food incidents are the Ministry of Foreign Affairs and Trade, the Ministry of Health, and the Ministry of Agriculture and Forestry.

Recovery

During management of food incidents, the incident action plan will identify risk-mitigation measures. Once the issue at hand is brought under control, the risk is fed into the business as usual workstream so that standards that will describe how the risk should be managed can be developed or amended.

FURTHER INFORMATION

GENERAL FOOD SAFETY INFORMATION

CORIOLIS REPORT TO THE FOOD AND BEVERAGE TASKFORCE, SEPTEMBER 2005: MAPPING THE STRUCTURE OF THE NEW ZEALAND FOOD INDUSTRY.
FOOD HAZARDS
www.nzfsa.govt.nz
NOTIFIABLE AND OTHER DISEASES IN NEW ZEALAND ANNUAL REPORTS – prepared as part of a Ministry of Health contract for scientific services by Population and Environmental Health Group Institute of Environmental Science and Research Limited.