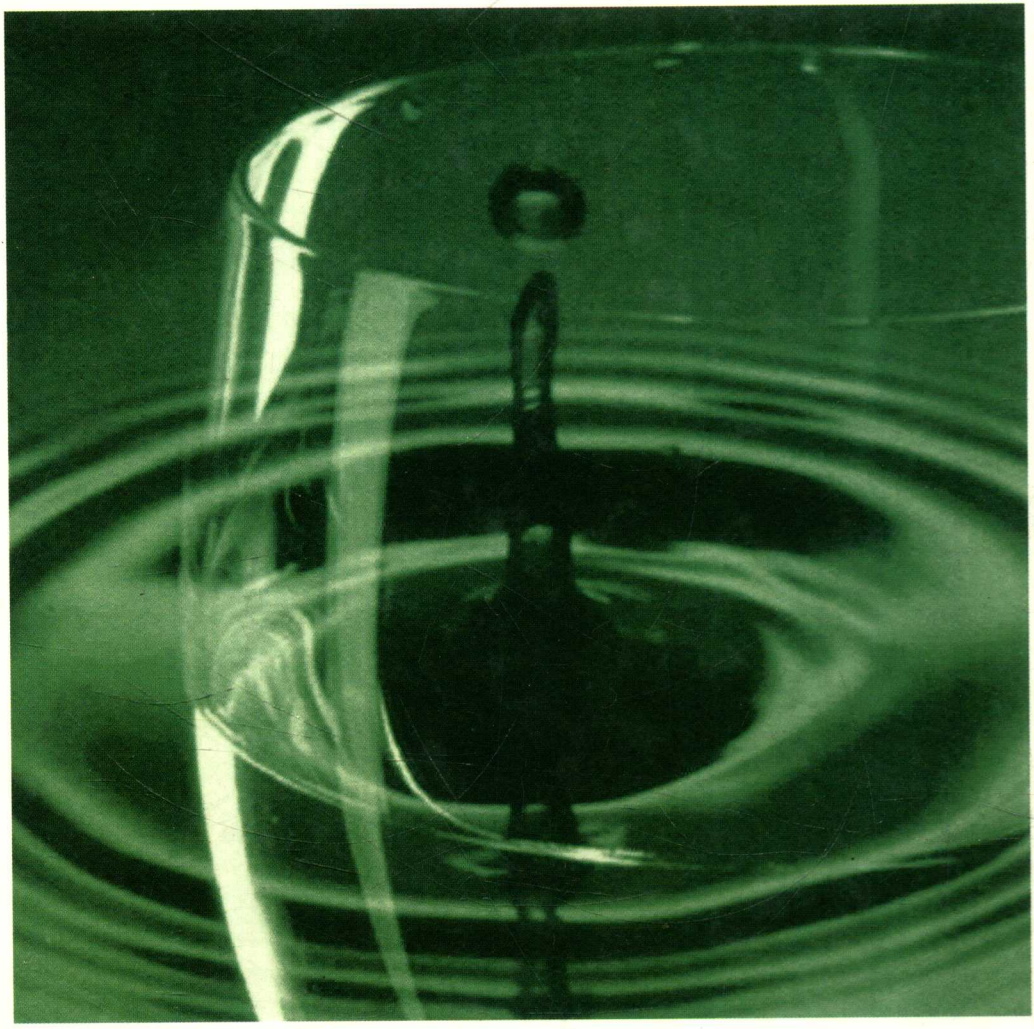
Edited by John Gray and K Clive Thompson

Water Contamination Emergencies

Collective Responsibility



RSC Publishing

Water Contamination Emergencies
Collective Responsibility

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The proceedings of the International Conference on Water Contamination Emergencies: Collective Responsibility held at the Royal Society of Medicine, London on 7–8 April 2008.

Special Publication No. 317

ISBN: 978-0-85404-172-5

A catalogue record for this book is available from the British Library

Published by The Royal Society of Chemistry,
Thomas Graham House, Science Park, Milton Road,
Cambridge CB4 0WF, UK

Registered Charity Number 207890

For further information see our web site at www.rsc.org

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Preface

The third international conference in the generically entitled series "Water Contamination Emergencies" was the most ambitious. Two previous conferences asked the question "Can we cope?" and identified ways of "Enhancing our response". The main theme running through the two-day programme of the third conference was Collective Responsibility which developed the previous conferences by recognising the need for all those involved in responding to water contamination emergencies to share, collaborate and draw on lessons learnt. It was emphasised that achievement of the desired outcome required the co-ordination of significant effort in preparation and response. The conference provided the opportunity to understand others' roles, responsibilities and limitations, and positively encouraged the development of trust that is a vital ingredient of any emergency response team.

The book opens with an introductory chapter setting the scene from a public health perspective. The following 39 chapters were written by experts in their field, including medical and health professionals, environmental protection professionals, risk and business continuity managers, emergency planners, service and support providers, detection and equipment suppliers, disaster recovery specialists, water security experts, water distribution modellers and from water companies and regulators. Three broad themes of Operations; Information and Data Management; and Communications, and include chapters which cover a wide range of scenarios and follow the sequence of an incident, that is: the threat, the developing scenario, further response; and remediation. Chapters consider in detail the modelling of the threat; water safety plans and preparedness; security; incident management; contingency planning; remediation; vulnerability assessments; surveillance, early warning systems and detection; information management and databases; forensic investigations; interagency collaboration and integrated response; command and control; medical responses; mutual aid and exercises. The USEPA water security initiative; experience with vulnerability assessments; UK emergency planning; communicating with the public during water contamination emergencies; radioactivity monitoring in emergencies; and rapid analysis methods are also covered.

Responsibilities of particular post-holders and organisations are defined in legislation or other national requirements. Although individuals will have identified their own key responsibilities it is hoped that readers of this book will take further action to establish effective and efficient working relationships and knowledge-sharing networks with those with whom they will be required to work in an emergency - in other words, taking "Collective Responsibility".

John Gray
November 2008

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1 INTRODUCTION

This is the third conference in the series "Water Contamination Emergencies" and is the most ambitious. The first conference in 2003 in Kenilworth, Warwickshire[1], challenged delegates with the question, 'Can We Cope?' The conference focussed on the more traditional water quality incidents that have recently occurred and considered the handling of seven major case studies of contamination events. Papers were presented by invited experts and, together with posters, reviewed lessons learned and identified ways to better cope in future.

It was concluded that there was particular key information needed to respond appropriately to incidents, including:

- the need to be aware it has happened;
- knowledge of the extent of problem;
- accurate and timely identification and quantification of contaminant; and
- identification of the origin of contaminant.

Other key features include consideration of:

- remediation issues;
- communication with consumers and users;
- liaison with health professionals and local authorities; and
- communication with media.

The conference concluded that, in general, water companies and key agencies respond well and were well positioned to deal with typical emergencies but more awareness and pre-planning would improve the response.

The second conference in 2005 in Manchester[2] addressed the issue of "Enhancing Our Response". It provided a forum for sharing new knowledge gained from two years experience following the first conference and considered the development of expertise and responses to contamination events, particularly in the areas of analysis and emergency planning. There was an international focus and particular consideration of possible

malicious acts of contamination. New strategies and technologies were presented and again there was emphasis on communications with and between all parties, with the need to address consumer perceptions. A prime requirement for robust and rapid screening of samples was confirmed and areas of good practice were identified. The conference also considered the potential challenges associated with preparedness and heightened security in the CBRN context.

Again there was evidence of progress in preparedness, both in the UK and globally, and a desire to see greater interaction between key players in an incident to develop improved procedures and provide learning opportunities. This gave an immediate focus for this third conference.

2 THEMES AND OBJECTIVES

This conference has as its theme 'Collective Responsibility'. The organising committee believes that individuals should identify their own key responsibilities and take action to establish effective and efficient working relationships and knowledge-sharing networks with those with whom they will be required to work in an emergency – in other words, taking Collective Responsibility. A key aim of the conference is to provide a sharing forum for individuals in key organisations actively involved in any water contamination incident. Collective responsibility requires prior consideration of how to plan, respond, communicate and manage risk in an emergency and how to share, learn and develop after the event. We question whether individuals and teams have fully learned, shared best practice, established effective networks, collaborated, targeted research or exercise together. There appears to be no common set of values for evaluating risk and prioritising that risk; a constrained enthusiasm and desire to make a common approach work; and there seems to be little opportunity to modify systems. By encouraging international involvement, it is hoped that broader networks to promote these objectives can be established.

In order that all subject areas can be appropriately covered, three streams have been chosen for the delegates:

- Operations (systems, security and procedures);
- Data/Information (quality testing, analysis, on line monitoring, modelling and data interpretation); and
- Communication (emergency planning, public communication and inter agency working).

The two days of the conference are further divided into sessions which cover planning and preparedness, security and initial responses, incident management and the aftermath. The conference will end with three plenary sessions on day two.

This conference will deal with the full range of potential contaminations scenarios - chemical, biological and radiological. It will be of strategic, tactical and operational interest to organisations involved in civil contingency response, emergency planners, medical and health professionals, local authorities, service and support providers, detection equipment suppliers, disaster recovery specialists, remediation companies, research organisations and water companies and regulators. It will also provide a significant networking opportunity which all delegates are encouraged to utilise to the full.

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WATER EMERGENCIES – OPENING REMARKS

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1 INTRODUCTION

Emergencies related to drinking water remain a cause of public concern. This conference will cover public health, waterborne disease and flooding looking at the planning and preparedness, security and initial responses, incident management and the examining the aftermath of such emergencies. It will look at operations, information and data management and communications and their importance in tackling these emergencies.

2 EXAMPLES OF OUTBREAKS

I have been involved in the investigation of outbreaks and incidents of food and waterborne disease for most of my career and in varying capacities. These range from a community outbreaks of *Shigella sonnei*, a hospital outbreak of *Clostridium perfringens*, early work on the role of *Cryptosporidium* in diarrhoeal disease, microsporidiosis in AIDS patients, outbreaks of cryptosporidiosis related to drinking water, badly pasteurized milk and swimming pools. There have been foodborne outbreaks such as *Salmonella* Enteritidis associated with imported eggs, *Salmonella* Schwarzengrund linked to chocolate coated nuts and *Salmonella* Barelli in sandwiches. I was involved in responses to flooding in 2000 and 2007, the foot and mouth outbreak in 2001 and the Yorkshire water drought in 1995. I have also investigated outbreaks of *Pseudomonas aeruginosa* folliculitis, Pontiac fever associated with a spa pool and an increase in deaths associated with *Clostridium novyi* in injecting drug users and have been involved in decisions about instituting and lifting boil water notices and withdrawals of bottled water that were subject to faecal contamination.

We have looked at 114 waterborne outbreaks involving 22,975 people associated with public and private drinking water supplies in England and Wales between 1910 and 1999[1]. Outbreaks during the first half of the 20th century that are recorded in the scientific literature were predominantly typhoid and paratyphoid fever. These organisms declined during the second half of the 20th century and in the last two decades the newly discovered

organisms *Cryptosporidium* and *Campylobacter* were associated with the majority of outbreaks. These differences tell us that surveillance identifies real changes in disease (e.g. reduction in typhoid and paratyphoid), changes in laboratory detection (e.g. *Campylobacter* and *Cryptosporidium*) and changes in surveillance and outbreak detection. The outbreaks identified have a wide geographic spread and if you're in area hasn't had an outbreak there may be one within the next decade or two. There have been dramatic changes in pathogens over the last 100 years. Will we be looking back in the next century at similar changes and are there pathogens that we are currently missing?

3 THE IMPACT OF RAINFALL EVENTS

Of the outbreaks identified in this work, 89 had sufficient information about the time and place of occurrence to allow rainfall data to be collected for the 90 days before the onset of the outbreak. It was also possible to collect the rainfall for the same location and dates for the previous five years to use as a control.

There was a significant association between excess cumulative rainfall in the previous 7 days and outbreaks ($p= 0.001$). There was an excess of rainfall below 20mm for the three weeks previous to this in outbreak compared to control weeks ($p= 0.002$). These data imply that the attributable fraction of outbreaks associated with a sustained period of low rainfall is 20% compared to a period of heavy rainfall of 10%. Because the dataset used in this study are historical the results may not reflect current risks, because water companies may have adopted treatment strategies which limit the problems associated with heavy rainfall. Because 15% of the outbreaks were preceded by heavy rainfall in the week before the outbreak and 28% of outbreaks were preceded by a period of lower than average rainfall in the three weeks before the week of the outbreak it is important to consider weather when constructing water safety plans for public and private drinking water supplies.

4 WATERBORNE OUTBREAKS

From the outbreaks that have been published we can build evidence of what problems cause outbreaks related to drinking water[2]. These include the contamination of surface waters by animal waste and sewage, and problems of the streaming of waters on the surface of lakes. As I have indicated, weather can influence risk with groundwater vulnerability in drought, reduced dilution of sewage effluent into rivers in drought times, lower water table opening up new surface to ground routes, contamination of ground water, heavy rainfall and in some countries problems with ice melting quickly. There have been problems with the treatment operation and management of drinking water treatment works including filtration bypass, failure of slow sand filters, the performance of filtration in removing pathogens, the recycling of backwash water and turbidity control. In distribution there have been problems with cross contamination through incorrect plumbing backflow, post-treatment contamination, network repair and problems with aqueduct integrity. In addition there have been examples where several outbreaks have occurred at the same time

that appear to be related as well as outbreaks occurring in the same location as previous outbreaks.

The introduction of new *Cryptosporidium* regulations in 1990, has been associated with improvements in the removal of cryptosporidiosis from drinking water treatment works, the removal of some poor supplies and the building of new water treatment facilities. A large drinking water outbreak in the North West of England in 1999 resulted in new drinking water treatment measures being introduced over the next few years. Surveillance data from the health authorities associated with this outbreak were compared to other health authorities in the area that were not affected. It appeared that unrecognized outbreaks had occurred in most of the previous years. Following the introduction of the *Cryptosporidium* regulations in 2001 the annual spring outbreaks have disappeared and the overall number of cases per year has declined substantially[3,4]. This works suggests that we can easily miss outbreaks. Problems occurring every year may be wrongly viewed as seasonal trends rather than regular outbreaks. Comparison between areas over time can be useful. There has been a significant burden of *Cryptosporidium* related disease associated with drinking water. This burden has substantially decreased but much of the burden has not been within identified outbreaks. The disease reduction has been predominantly with infection due to *Cryptosporidium parvum* and the reduction is mostly in the spring period. It is likely that a burden of illness associated with drinking water still remains.

5 FLOODS

In 2007 there were a number of problems relating to flooding. A bottled water product had to be withdrawn due to its contamination with *E. coli*. The contamination of the borehole occurred after heavy rain. An incident occurred in which surface flooding entered the final water tank in a water treatment works as a result of seals in the lid not being watertight. A boil water notice was introduced for a short period. The Mythe water treatment works supplying Tewkesbury was put out of use as a result of flooding of the treatment works. The population was supplied by bowser and bottled water supplies. A national emergency coordination centre (NECC), a national surveillance cell, regional emergency operation centres (EOC), health protection units and a command structure were set up to deal with the problem and there was a scientific and technical advisory cell (STAC) set up to provide scientific advice. These incidents raise the question of whether utilities are well enough prepared for the floods which can occasionally affect them. This was the first level 4 incident experienced by the HPA since the finalisation of its emergency plan. A coordinated approach based on emergency plans was established and the appropriate structures were created and their respective tasks undertaken. Limited resources were used efficiently and effectively. Various risks were identified and addressed using evidence and expert advice. Partner organisations were supported, advice to the public was produced and ultimately public health protected.

The summer floods in 2007 have been described as the country's largest peacetime emergency since World War II[5].The Mythe treatment works supplies water to around 350,000 people in Tewkesbury, Cheltenham and Gloucester[6]. Half a metre of flood water covered the site affecting buildings offices and equipment and preventing staff from returning to three days. Environment agency staff, fire and rescue services and other organizations quickly put up temporary barriers around the site and restored it to normal

service as quickly as possible. The works was out of action for 17 days as a result of the flooding and 140,000 households were without water. More than 50 million litres of bottled water were provided to those affected. Following the floods more permanent defences were built around the site and extra pumping equipment was installed. The overall cost of the flooding at Mythe has been estimated at between 25 million and 35 million pounds.

The Walham electricity substation is built on the raised ground in the River Severn flood plane to the north of Gloucester. It provides power to half a million homes across Gloucestershire in South Wales. It was necessary to construct a 1000 m flood defence to protect the site. The response involved environment agency staff alongside the fire and rescue services, local authorities, utility companies and the military on 22nd July to work on temporary defences to protect the site from flooding. The work was conducted in extremely difficult conditions. It was dark and wet with floodwaters rising fast and it was potentially very dangerous with live high-voltage equipment within metres of where staff were working. After 10 hours the site was secured and the fire and rescue services began pumping water out of the critical area. Work was completed just in time narrowly averting a major shutdown of the site which would have left half a million homes without power. Power to 42,000 homes from nearby Castle Mead substation was cut temporarily whilst defences were put in place. More permanent defences have now been constructed around both Walham and Castle Mead substations and the electricity industry must make more effective long-term plans to protect the many other sites at risk from flooding.

What does this tell us? This was a severe flood. The flooding at both Mythe and Walham should not have been unexpected. Flood maps showed these and many other critical sites are vulnerable to flooding. Mythe flooded in 1947 and 2000 and narrowly escaped flooding in 1990 and 1998. The summer floods must now be a wake-up call for the water industry and other utilities to take action. A substantial percentage of public utilities may be at risk from flooding.

There are potential risks of infection following flooding. Flooded areas may act as breeding grounds for mosquitoes, there can be disturbance of rodent populations, waterborne outbreaks, contamination of water supplies and contamination of people and clothing of those in contact with floodwaters. Runoff from fields and storm drains can make floodwater contaminated at the start of a flood, but substantial dilution can reduce the importance of this. People whose houses are flooded may have problems with damp for months afterwards. Despite this, flooding in developed countries carries a relatively low risk of infectious disease outbreaks. Prevention can be attributed to effective public health systems and good surveillance. There can be psychological distress and illness as a result of the disruption associated with flooding, and there is a significant risk from carbon monoxide poisoning in people using pumping or drying equipment indoors.

5 REPORTING OF OUTBREAKS

Where a serious incident has occurred it is important for the outbreak to be reported by the investigating team, and where possible reported in the scientific literature. The reporting is an important opportunity for examining the successes and failures of the incident, including praise, censure, audit and learning. It can provide an opportunity for increasing awareness of new problems within the water industry and the health community. On

occasions it can necessitate changes in water treatment paradigms and occasionally legislation. Legal action has on occasion delayed publication of scientific papers. In reviewing water emergency incidents there is an opportunity to examine the roles and perspectives, to raise questions and to examine shared objectives by the different organizations involved. It is important to ensure that arrangements are made to get across consistent messages to the public from the different organizations involved. There is an opportunity to examine what went well, what went badly, what should be done in the future and what we are already doing. There is a chance to clarify our roles and responsibilities and to share information with other professionals. There is an opportunity to influence policy to review research, to examine organizational resilience and to take any preventive action that may be deemed necessary.

6 CONCLUSION

In conclusion it is important for there to be regular contact between water companies and the health protection units and the HPA will be working with DWI to improve advice during incidents and to improve training.

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WATER IS LIFE: A VIEW OF ORGANISATIONAL RESILIENCE IN THE AUSTRALIAN WATER INDUSTRY

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"In all my experience at sea, I have never been in any accident of any sort worth speaking about. I have seen but one vessel in distress in all my years at sea. I never saw a wreck or have been wrecked nor was I ever in any predicament that threatened to end in disaster of any sort"

E.J. Smith Captain RMS Titanic

1 ABSTRACT

Most people are familiar with the term resilience. The question is often asked, why are some organisations more resilient than others? Is there a single common theme or are there a range of characteristics that contribute to a resilient organisation? This paper provides a view of organisational resilience in the water industry in Australia, particularly in the Victorian context of a risk and business continuity.

The objective of this paper is to further stimulate thought regarding issues associated with organisational resilience, with particular interest in indicators of resilient behaviour.

A key area for consideration is behaviours and characteristics of a resilient water business.

2 INTRODCUTION

Water is life.

Looking back over history, the supply of fresh clean safe drinking water has been the cornerstone of a well developed society. Water supply systems have sustained the growth of urbanised civilisation since ancient times[1] and today include large cities such as London and Melbourne.