

# Contamination lessons from overseas



**Dr Steve Hruddy** (pictured), professor emeritus at the University of Alberta, delivered the first keynote at the 2017 conference on the subject of learnings from international water contamination events in affluent countries. He also produced a 53-page report on the Havelock North incident which is now on the inquiry website.

These are some highlights from his presentation.

**O**f 38 water contamination outbreaks around the world, nine included fatal outbreaks causing 77 deaths and a total of 460,000 cases of illness, so it's not a trivial subject, he says.

“In order to get something constructive out of it, the message that we learn is that effective water safety plans are essential to provide prevention of these kinds of events.”

Steve and his wife Elizabeth Hruday published their first book with the International Water Association in 2004.

It summarises 73 case studies and outbreaks around the world and then, in 2014, they published a book for frontline water personnel (called *Ensuring Safe Drinking Water: Learning from Frontline Experience with Contamination*) that takes a different approach with its case studies.

“The case studies are written as stories to help frontline personnel identify with what's happened elsewhere and learn from it.

“Essentially our guiding principle is don't learn the hard way. Most frontline personnel are not likely to experience a major disaster in the workplace. That's the good news. But because they don't have that experience they will be unprepared if something does start to go wrong.”

The best start, he says, is to have an effective drinking water safety plan that reflects that you, as someone running the water utility, truly know your own system.

“So the case study approach allows you to learn from these things that have happened in other places and the idea

is that case studies can make something more real; can be adapted to local realities. The bottom line is I don't believe that operators would ever want to harm their neighbours but if they don't understand the consequences of failing to do the job right, they can. So the idea is personal. If they understand the implications of failure, they will want to do a better job, and will be curious and seek out trouble.”

## Case studies

The first case study Steve explained to delegates was from Scotland in a small village called Freuchie, which had a water contamination outbreak in 1995. The village is only 50 miles from Edinburgh and has a population of 1100.

“They were supplied by a regional feed water system that used geography to provide the pressure in the system.

“Basically the water was stored at the top of a hill and fed by gravity to the community. This all played out on a Friday which seems to happen sometimes.

“They got a phone call at 9:55 in the morning, somebody complaining about discoloured water and mentioning not feeling well. The first call was followed by three more complaints.

“Any time a running water utility gets a cluster of complaints alarm bells need to be going off. Ultimately, over the course of the day the problem was traced to a cross connection at the vegetable processing plant.

“Prior to 1992 the plant used to draw all water from the

creek and wash vegetables with raw creek water and then use the public mains water for a final wash.

“At that time the sewage treatment plant was located upstream of this location, with its effluent pipe discharging downstream.

“Between 1992 and 1995, the vegetable plant had decided they were paying too much in town water so they drilled a well and went and used the well water for both the first wash and their second wash and they cut off their connections with the main supply.

“Then this is where the weird stuff happens. When they put in the new well they relocated the stream, so that now, the sewage treatment effluent discharged upstream of the washwater intake.

“Their well failed on them in March 1995 so they reconnected to the raw water drawing downstream from the sewage treatment plant with the intent that it would be used for the first wash and they reconnected to the mains water supply for the second wash.

“The problem was they still had this cross connection between the two systems and the one that was contaminated by sewage was at higher pressure. Bottom line is that a major outbreak happened, with 765 people out of 1100 ill.

“This got written up because it was the toxigenic *E. coli* O157 H7 and the first documented case of drinking water spreading this pathogen. This could have had very serious consequences and it did in Walkerton which I’ll talk about shortly. The fact that so many people were sick but no one died may have been

partially achieved by the fact that the system was chlorinated.

“Next case I want to talk about, which has a lot of similarities with what happened in Havelock North, was in Alamosa, Colorado – a beautiful spot in the shadow of the mountains, a few hours from Denver which is the headquarters of the Water Research Foundation and American Water Works Association.

“This is a town of about 9000 served by seven deep artesian wells, from 150 to 275 metres deep with their producing zones down to 550 metres. Compare that with Havelock North which was 11 metres.

“This was very high-quality groundwater and they had only had detections over the previous decade of total coliform a couple of times in 2002, and one total coliform result in 2006. They were all negative on resampling and total coliforms may not be a great indicator for faecal contamination anyway.

“They were operating under a state granted waiver since 1974 allowing them to distribute that high quality water with no chlorination.

“From March to April 2008 they experienced an outbreak of salmonellosis. Source water was not the cause, coliform was not detected, this was contamination that occurred in the storage and distribution system.

“The water reservoir was constructed in 1979 and last inspected in 1997 – so more than 10 years earlier. The roof and exterior wall were in poor condition, the roof was cracking and it hadn’t been drained or cleaned since 1984 – so poor maintenance. So even though they had high quality groundwater coming in, the storage site was grossly inadequate and the best explanation for what happened was that bird waste managed to get into the reservoir and, whether the birds physically got in or whether it was just their faeces that washed off the roof, it was not secure for that purpose.

“They also identified a number of cross connections including three that were funeral homes and one was a meat packing plant.

“Almost every investigation I’ve seen into outbreaks will uncover cross connections that could be a cause of trouble. But none of them was judged as a cause of this, the most plausible explanation was salmonella from the leakage into the roof and sides of the tank.

“Unfortunately in their attempts to characterise the salmonella in the tank, the samples of salmonella were mishandled and they weren’t able to analyse it. Consequently, it was 434 reported cases, 124 confirmed lab confirmed cases of salmonellosis, 20 hospitalisations and one death. Telephone surveys said the total number of cases was 1300, of those with reported diarrhoea illness 29 percent had long term health consequences.

The insurer for the city had to pay \$360,000 to residents including [the family of] the 54-year-old male who died, but the city never accepted that they had any role with what went wrong. Cost estimates by residents and local businesses were \$1.5 million and the total costs by government and public agencies were \$2.5 million.”



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## Pathogen control

“I’ll wrap up by saying we can’t pretend that we’ve solved all the problems with ensuring safe drinking water. We clearly have not. Outbreaks like Havelock North wouldn’t be happening if we’d solved them.

“The catch, and what’s frustrating, is we do know how to prevent them.

“The greatest risks to consumers are pathogenic microorganisms. You need to have this under control, if you can’t get your water system under control from pathogens you can’t claim it’s safe because it’s not.

“Drinking water systems need and must have continuous robust multiple barriers. And the operative word there is multiple, and multiple means more than one and there’s a reason for that.

“You need to recognise any sudden change in water quality; that these disasters are always preceded by change. And not every change leads to disaster, but if you’re not paying attention to the changes you can’t detect the disaster.

“System operators need to be able to respond quickly and effectively to adverse monitoring signals – that means you need to understand what you’re monitoring, and why you’re monitoring, because just writing down numbers alone, is a waste of time.

“System operators, and this includes everybody in the system not just the people turning the valves, have to have a personal

sense of responsibility and dedication to providing consumers with safe water.

“As pointed out with the Freuchie example, you don’t ever want to ignore customer complaints because a lot of the cases that we have come across have been detected by customers first.

“And you need a sensible risk management approach and you need to be aware that a lot of things are described as risk management which are not truly risk management.

“Good risk management requires a preventive approach.”

As to costs, Dr Hrudey observed: “Bottom line, you can have cheap water or you can have safe water but you cannot have cheap, safe water.”

Dr Hrudey made reference to guidelines written by a group of international drinking water experts, including New Zealand’s Michael Taylor, that he says are as relevant today as they were when developed in 2001.

These are incorporated in the Australian Drinking Water Guidelines, originally in the 2004 edition and still in the current edition: [www.nhmrc.gov.au/guidelines-publications/eh52](http://www.nhmrc.gov.au/guidelines-publications/eh52), Chapter 1, page 1. **WVZ**

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- The Hrudeys 2014 AWWA book, *Ensuring Safe Drinking Water: Learning from Frontline Experience with Contamination*, is also available. Download a PDF of a free excerpt from the book – [www.awwa.org/Portals/0/files/publications/documents/EnsuringSafeDrinkingWaterExcerpt.pdf](http://www.awwa.org/Portals/0/files/publications/documents/EnsuringSafeDrinkingWaterExcerpt.pdf).