Moving Beyond Now

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The Walkerton Tragedy

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Introduction

Five years ago, illness and death struck Walkerton, Ontario. It was a tragedy caused by drinking water, something that was supposed to be safe.

The reasons why the tragedy happened are sad. They are, though, familiar and – after the fact – easy to understand. What is not easy to understand is how a similar tragedy can be avoided. What is clear in hindsight may not be enough to make the future better.

The following article explores the causes behind the tragedy and offers some advice. It is not based on the assumption that another tragedy is preventable. Drinking water contamination may be what Charles Perrow calls a "normal accident," a system failure that is unpredictable, inevitable, and not recognized as a significant problem while it is occurring.[1] This article is instead based on a hope that, by learning the lessons of the Walkerton tragedy, people will be sufficiently thorough, thoughtful, and perceptive to ensure that another drinking water tragedy will never happen again.

\- *Bob Morrison*

Indentured Servants, Proof of Innocence, and Mark Twain's Cat Lessons from the Walkerton Tragedy

A Beginning in the Middle

On April 22, 2000, Dave Biesenthal, a farmer living near Walkerton, Ontario, took his stockpile of cattle manure that had built up over the winter and spread it on land just east of his barn. A veterinarian, he understood that livestock manure contains bacteria that can make people sick. That possibility did not cross his mind since what he did was in compliance with the Ontario Government's best management practices. The next day, he plowed the land so the nutrients from the manure would be available to nourish his crops. Plowed into the soil, the bacteria would remain alive for as long as six months.[1]

The Unwell Well

Dr. Biesenthal did not know that just east of the field where he had disposed of the manure there was a well that supplied water to the Town of Walkerton. The well was out of sight, down the hill behind some trees, its location known only to those who were familiar with the operations of the Walkerton Public Utilities Commission (PUC).

The well, called Well 5, had been a risky venture from the start, much more risky than the other wells that supplied the Town (Table 1). It was located in what one neighboring landowner called a swamp and withdrew water from an aquifer that was close to the surface, 5 to 8 meters underground. The rock lying over the aquifer was like a geological sieve with numerous cracks and crevices through which surface water could rapidly move into the well.[2]

The Bacteria

The manure that Dr. Biesenthal spread on his land contained a variety of bacteria. Two played a central role in this story: *E. coli* O157:H7 and *Campylobacter jejuni*. Both cause intestinal illness and can kill people who do not receive proper treatment or whose immune system is weak. *E. coli* O157:H7, in some cases, causes kidney, heart, or brain damage in those who survive. *C. jejuni* can cause neurological problems and reactive arthritis. Children, senior citizens, and people already weakened by other problems are the most vulnerable. In Walkerton, health officials would have expected over the course of a year to see five infections or less from *E. coli* and *C. jejuni*.

SOURCES: The Honourable Dennis R. O'Connor, *Report of the Walkerton Inquiry – Part One: The Events of May 2000 and Related Issues*, Queen's Printer for Ontario, 2002 (http://www.attorneygeneral.jus.gov.on.ca/english/about/pubs/walkerton/part1/), Chapter 1, p. 6 and Chapter 2, pp. 48-52, Bruce-Grey-Owen Sound Health Unit, *The Investigative Report of the Walkerton Outbreak of Waterborne Gastroenteritis: May-June, 2000*, 2000 (http://www.publichealthgreybruce.on.ca/_private/Report/SPReport.htm), p. 3, and Arlene Richards, "The Walkerton Health Study," *Canadian Nurse*, v. 101, no. 5 (May, 2005), p. 18

During a three-day pump test in 1978, the water in Well 5 became contaminated with potentially harmful bacteria within the first twenty-four hours. The water also tested high in nitrates, indicating that fertilizer and manure from nearby farms were leaching into the ground water. Further tests over the next two years confirmed the bacterial contamination and the probability that agriculture was the source.[3]

The hydrogeologist who conducted the 1978 pump test recommended chlorination of the water, monitoring of bacteria and nitrate levels, and the creation of a water protection area west and south of the well to control contamination from land use. In November, 1978, representatives from the Ministry of the Environment (MOE), the Town of Walkerton, and the PUC agreed that:

- Well 5 was vulnerable to contamination
- the water would be disinfected by being treated with chlorine prior to use
- chlorine residuals in the treated water would be tested daily, documented, and kept at a safe level.

Instead of making the agreement legally-binding, the MOE approved the well without restrictions. None of the options for a water protection area – voluntary landowner cooperation, land use controls, purchase or expropriation of land – were pursued by the MOE, the PUC, or the Town of Walkerton.[4]

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Table 1

Walkerton's Water Supply Wells

	Well 5	Well 6	Well 7
Age (as of 2000)	22 years	18 years	13 years
Location	in town	outside town	outside town
Completed depth	15 m	72.2 m	76.2 m
Depth to bedrock	2.5 m	6.1 m	6.1 m
Depth of casing	5 m	12.5 m	13.7 m
Capacity	56% of town's average needs	42-52% of town's average needs	125-140% of town's average needs
Disinfectant	Sodium hypochlorite (bleach)	Chlorine gas	Chlorine gas
Potential for contamination from surface water	Yes (high)	Yes	Yes (low)

SOURCE: The Honourable Dennis R. O'Connor, *Report of the Walkerton Inquiry – Part One: The Events of May 2000 and Related Issues*, Queen's Printer for Ontario, 2002 (http://www.attorneygeneral.jus.gov.on.ca/english/about/pubs/walkerton/part1/), Chapter 3, p. 57 and Chapter 4, pp. 106, 120, & 163-165

People may not have taken Well 5's problems seriously since it was supposed to be a temporary solution. However, after more reliable sources of water were found, the promise to shut down Well 5 was not kept.

Chlorination of the well water was eventually made a legal requirement in 1994. By then, though, the standards had become more strict. Like other wells under the direct influence of surface water, Well 5 was supposed to be intensively monitored (either four times a day or continuously) to test the chlorine residual and check the turbidity of the water. This requirement was not applied to Well 5 because the MOE considered that level of protection to be unnecessary for wells already in use.[5]

The Brothers Who Didn't Learn

Well 5 and the rest of the Walkerton waterworks were owned and operated by the PUC, a municipal corporation. Stan Koebel (pronounced "cable") was the general manager and his younger brother Frank was the foreman.

Although only qualified as electrical system linemen, Stan and Frank never had to prove they knew how to run a waterworks system. Instead, in 1988 when the provincial government began to require proof of competency, Stan and Frank were awarded the necessary certificates as part of a special program that excused existing waterworks employees from having their competence tested. In 1993, this special exemption was limited to three years, after which every operator was supposed to be tested. When three years had passed, though, Stan and Frank were re-certified and had their certificates upgraded without having to prove they knew what they were doing.[6]

Even though the previous general manager, Ian McLeod, had recommended that the Koebels be certified without proof of competence, he had doubts about their abilities. When he decided to retire, McLeod did not recommend either Stan, his second in command, or Frank as his replacement. Instead, he presented the commissioners of the PUC with the names of four people from outside Walkerton whom he considered qualified. The commissioners rejected his candidates and promoted Stan instead. They preferred Stan because he was from Walkerton and because they felt Stan would be able to heal the rift that had developed between McLeod and the town engineer who was responsible for Walkerton's sewer system.[7]

The Koebels could have become qualified to do their jobs. The provincial government required that they take a minimum number of hours of training each year. Year after year, though, they failed to take the minimum amount of training. The "training" they did take was limited to such things as marketing and leadership courses, conferences, and touring the waterworks with MOE employees during inspections. When water safety was the topic, Stan and Frank usually did not understand what was being discussed.[8]

A Few Simple Rules

The knowledge that Stan and Frank needed to keep the water safe was pretty simple. They needed to maintain a chlorine residual in the water after the water had been disinfected. A chlorine residual ensures there is some spare chlorine in the distribution system to kill bacteria, viruses, or other pathogens that might be lurking in the maze of pipes and valves. As well, if the chlorine residual drops, it is a warning that the disinfection process has malfunctioned or the quality of the raw water has deteriorated.

The chlorine residual was supposed to be kept at a minimum of 0.5 mg/L of water, although 0.75 mg/L was preferred. This was not difficult to do. It meant that once a day someone had to measure the chlorine residual at whichever wells were in operation. The only thing that might have been considered onerous was the requirement to wait fifteen minutes to take a measurement. The fifteen-minute wait was a way to reduce the risk that the chlorine residual would disappear before water reached people's faucets.

Aside from testing the chlorine residual, Stan and Frank had to ensure that a minimum number of water samples were, on a regular basis, taken from different parts of the system, including from the raw water in the wells. These samples were to be sent to a laboratory to be tested for contamination. Each sample was supposed to contain enough water to allow the tests to be completed.

Stan and Frank did not follow these procedures. They believed the Town's raw water was safe and that small amounts of chlorine would keep it so. They rarely, if ever, tested the chlorine residual in the treated water. Instead, they logged an almost unbroken string of fictitious 0.5 and 0.75 mg/L entries on their operating sheets. Their approach to water sampling was similar. They routinely took a water sample from one place and labeled it as if it had come from somewhere else. The samples they submitted for testing were often too small in number and did not contain enough water to allow testing to be completed.[9]

The Neglected Safety Net

The Ontario Government had a regulatory system to ensure that Stan and Frank would keep the drinking water safe. This regulatory system looked good on paper. The way it worked was much different.

As with most regulation of drinking water, the Ontario Government's system depended on multiple layers of protection. Overlapping standards and procedures were developed to ensure that the quality of water remained safe. It was a system built on redundancy so that safety would not be compromised if one part of the system failed or, if there were multiple failures, the problems would be identified as quickly as possible and the damage minimized.[10]

Testing

A key element in the system was the lab tests the Koebels were expected to have done. Lab tests are important for identifying substandard practices. As well, since properly treated water sometimes makes people sick, the tests are valuable to detect circumstances that have made good practices ineffective.[11]

Prior to 1996, the provincial government had done routine lab tests on water samples for the operators of municipal waterworks. Without assessing the risks, the government got out of that business to save money. Municipal water utilities had to either do the tests themselves or, like the Walkerton PUC, pay private labs.[12]

The provincial government, though, did not regulate the labs that did the testing. This was because of antagonism to regulation and because privatization of testing had gone ahead without the necessary two to three years of preparation. Although the government required labs to be certified to work for the MOE, the testing of municipal drinking water remained unlicensed, uninspected, and unaudited.[13]

Reporting

Even when lab tests showed that water was contaminated, there was no legal requirement to report the results. Under the provincial government's drinking water objectives, it was expected that the testing labs would inform the MOE when water tested positive for contamination. While some labs followed the

guideline to report contamination, other labs either were unaware of the guideline or ignored it to protect "client confidentiality." Although aware that tests showing contamination were not being reported by labs, the MOE made only sporadic and uncoordinated efforts to monitor the reporting of test results. The MOE expected municipalities to shoulder the burden, advising them to make labs comply by including a reporting requirement in the contracts they signed with the labs.[14]

The Ministry of Health was particularly concerned about lax reporting. However, the Minister of Health's request that notification of contaminated water be made a legal requirement was rejected by the MOE.[15]

The lab that Stan Koebel had started using at the beginning of May, 2000 was one of the labs that did not report contamination to the MOE. It is not clear if that lab's failure to notify the MOE was due to ignorance, the complicated nature of the guideline, a belief that notification was unimportant, or company policy that test results were confidential.[16]

Even when the MOE was notified of contamination, MOE personnel were not necessarily able to properly assess the situation. For example, when the MOE was informed of contaminated water in Walkerton during 1999 and early 2000, officials either did not act or simply called Stan Koebel and were assured that everything was O.K. The officials had not been trained in how to regulate municipal water systems, did not know that people could die from bacteria in the water, and were not aware of or ignored MOE guidelines that, when test results were bad, called for additional sampling, an inspection to determine the cause, and notification of the health unit.[17]

Inspections

Inspections were expected to be an important part of the system for protecting drinking water. During the twenty-two years that Well 5 was in operation, the MOE conducted five inspections of the Walkerton waterworks (1979, 1980, 1991, 1995, and 1998).

Each inspection turned up serious deficiencies. They revealed that chlorine residuals were below the required minimum, potentially harmful bacteria was getting into the drinking water, operating records were inaccurate, water sampling was inadequate, and the requirements for training were not being met. Low chlorine residuals were a chronic problem. Whenever inspectors took measurements, they never found a chlorine residual greater than 0.4 mg/L.[18]

MOE management was not worried when the last inspection in 1998 showed that the problems were continuing. This lack of concern was surprising. The provincial government had been embarrassed by a series of contaminated water episodes during the 1990s: Waterloo in 1993 (*Cryptosporidium*), Collingwood in 1996 (*Cryptosporidium*), and Thunder Bay in 1998 (*Giardia*). More importantly, the MOE was aware that operators of many small town waterworks were saving money by cutting back monitoring and treatment to levels that did not meet the drinking water objectives.[19]

The MOE did very little to try to fix the problems in Walkerton. After each inspection recommendations were made and in 1997 the inability to meet minimum sampling requirements got Walkerton temporarily on a list of non-conforming waterworks. However, Stan Koebel was always able to counter the criticisms of his operation and avoid more serious measures simply by promising to do better.[20]

Priorities

During the 1990s, based on a theory that there was too much regulation and too many checks and balances, the Ontario Government made widespread reductions in both the authority and capability of its agencies to detect and correct unsafe practices. As a result, in the ten years leading to the Walkerton tragedy, the MOE saw its operating budget cut in half and the number of employees drop 40%. Checking to see if guidelines and requirements were being followed became the lowest priority for local MOE staff.[21]

Budget cuts were initially imposed on the MOE by the provincial Cabinet without considering if the MOE would be able to protect the health and safety of the public. When the MOE was finally asked for its views on further budget reductions, it identified a variety of risks to public health including reduced anticipation and prevention of problems, less monitoring and fewer inspections, delays in reacting to issues, decreased

scientific knowledge and skill, and less ability to track down and stop unsafe activities. The impacts of these risks were not analyzed. Instead, the Cabinet decided that the risks were acceptable. The MOE was directed to continue protecting the public with fewer resources. References to the risks from budget reductions were deleted from MOE business plans released to the public.[22]

As the number of MOE personnel serving the Walkerton area declined, the workload increased. In 1994, the best the staff could hope for that year was to inspect twenty-five of the fifty-four municipal water systems in their area. In reality, only sixteen inspections occurred. By 1999, expectations had fallen to having ten waterworks inspected, a goal they managed to achieve. In the fiscal year prior to the tragedy, the time spent on monitoring municipal systems worked out to an average of less than eight hours per year for each of the systems the local MOE was expected to keep safe.[23]

Enforcement

The concerns about the Walkerton waterworks were usually raised in a low-key manner and then forgotten or ignored after Stan Koebel had deflected them with promises. Over the years, the only people who appear to have expressed serious reservations were Michelle Zillinger, an MOE inspector, and Walkerton Town Councillor Mary Robinson-Ramsay.

Zillinger conducted the inspection of the system in 1998. She was an experienced inspector who was very concerned about the bacterial contamination showing up in Walkerton's test results, the low chlorine residuals, the lack of training records, and the inability of Stan Koebel to maintain a minimum sampling program. She wanted the MOE to move from giving advice and making recommendations to forcing compliance. In particular, she wanted the MOE to take the relatively small, though potentially time-consuming step of issuing a Director's Order for Stan Koebel to meet the basic requirements for proper sampling. Her supervisor declined to do that. In a letter to Koebel, he merely warned that a Director's Order might be necessary, a threat Koebel dodged by saying he would do what he was told.[24]

Robinson-Ramsay read Zillinger's inspection report when it was given to Town Council in June, 1998. Her grandfather and father had each been a medical officer of health. She had also been to South Africa and visited the countryside where contaminated water was a widespread danger. She pointed out to the other councillors that the problems identified by Zillinger, especially the presence of *E. coli* in the water, showed that something was wrong. She emphasized the complex nature of running a public water system and urged the hiring of someone with the knowledge and sophistication to ensure the water was safe.[25]

The other councillors did not agree with Robinson-Ramsay. Instead, Town Council sent a resolution to Premier Mike Harris that the MOE continue "as the guardian of water quality, ensuring basic, healthy water standards for all Ontarians." In reply, Premier Harris thanked them for that information.[26]

The provincial government's idea of a guardian of water quality appears to have been different from what Robinson-Ramsay and Town Council had in mind. Although the MOE could resort to enforcement to ensure drinking water was safe, MOE management believed in voluntary compliance and had instilled a value system that viewed enforcement as less "productive" and running counter to the belief that municipalities would cooperate. This soft approach was discredited by a 1999 internal audit that showed that enforcement produced better results than voluntary compliance. Two months before the Walkerton outbreak, MOE personnel were instructed to rely more heavily on enforcement.[27]

Enforcement would not necessarily have been an easy thing to do since the approval for Well 5 included few specific requirements concerning what the operators could or could not do. At least three times during the early and mid-1990s as part of province-wide initiatives, the MOE had the opportunity to make the approval for Well 5 more legally enforceable. Instead of doing so, the MOE relied on the initiative of others to draw attention to the need for legal requirements.[28]

The Local Health Unit

The local health unit could have stepped in to protect Walkerton's drinking water. However, unless there was an emergency, the MOE, not the health unit, was responsible for regulating waterworks. As a result,

local health units were not actively involved in regulating waterworks. Their day-to-day responsibility was limited to reviewing whatever reports of adverse test results were sent to them.[29]

If a health unit wanted to take a more active role, it would have relied, at least initially, on the MOE. Test results showing contamination would have come from the MOE and the health units would have followed MOE standards since the Ministry of Health did not have clear and specific rules and procedures for regulating municipal drinking water. As well, the provincial government had not given health units the mandate or the budget to analyze water quality trends and had further reduced the possibility of trend analysis by directing the MOE to only send adverse test results to the health units.[30]

Even when the 1998 inspection report was sent to the local health unit, the report was passed, unread by managers, to the local health inspector who read it and filed it. The inspector acted in this way because there was no direction provided that he should respond and, more importantly, it was assumed that the MOE would do its job and fix the situation.[31]

The Ministry of Agriculture

The Ontario Ministry of Agriculture, Food and Rural Affairs could also have played a key role in protecting Walkerton's water supply. By 1992, the Ministry knew it had a problem with agricultural contamination of ground water. Coliform bacteria levels in a third of Ontario's private wells were in violation of drinking water standards and the wells closest to livestock operations were in the worst shape. The Ministry tried to cope with the problem by providing information, particularly concerning planning and best management practices. In developing this information, though, the Ministry only produced materials, developed programs, and provided technical advice that were compatible with the needs of agricultural producers.[32]

More energetic involvement in protecting water quality would probably not have been possible. By 2000, the Ministry of Agriculture had lost three-quarters of its staff due to budget cuts. The Walkerton area saw the number of Ministry personnel serving its needs fall from ten to one.[33]

Under the direction of the provincial Cabinet, though, the Ministry of Agriculture had done a good job making sure farming received special treatment. Normal farm practices such as Dr. Biesenthal's manure spreading were untouchable by municipal bylaws and farmers were not required to inform the MOE of manure spreading even when it might have an adverse effect. Normal farm practices were also exempt from regulations designed to protect against the "impairment of the quality of the natural environment."[34]

The Ministry of Agriculture did have guidelines for normal farm practices such as manure spreading. The guidelines, though, were crude, having been developed through a public consultation process that did not include rigorous scientific analysis. The best management practices were also "one-size-fits-all," based, in part, on the erroneous assumption that normal farm practices were not subject to legal requirements to protect human health.[35]

The Utility Commissioners

Even if the provincial system was not working well, Stan and Frank Koebel had bosses, the commissioners of the PUC, who could have made sure the Koebels' behavior was safe. The primary topic among the commissioners, though, was electricity service, especially after the 1998 overhaul of the electrical utility sector. Discussion among the commissioners rarely included water quality issues. Most water concerns involved money and the waterworks infrastructure. Commissioners were not even alarmed by the 1998 inspection report showing that bacteria was in Walkerton's water and PUC staff were not following proper procedures. The commissioners did not know what they needed to know and were at the mercy of Stan Koebel's own lack of knowledge and the often irrelevant or misleading information he provided.[36]

The System Fails[37]

In May, 2000, people were not worried about problems at the Walkerton waterworks or about a regulatory system that had allowed those problems to go unchecked for over twenty years. Things were running smoothly, especially for Stan Koebel. Test results from three of four sets of water samples in April had shown

Table 2

Timeline
Walkerton Tragedy

Date	Summary of Events	Stan Koebel		Ministry of the Environment			Local Health Unit			Walkerton Residents		
		Awareness	Remedial Action	Awareness	Remedial Action	Communication with Stan Koebel	Awareness	Remedial Action	Communication with Stan Koebel	Awareness	Remedial Action	Communication with Stan Koebel
April	▪ Water samples from 3 out of 4 days show contamination.											
May 1												
2												
3	▪ Well 7 begins pumping unchlorinated water.											
4												
5	▪ Results from May 1st water samples show contaminated water.											
6												
7												
8	▪ Heavy rains begin.											
9	▪ Well 7 turned off. Wells 5 & 6 begin pumping.											
10												
11	▪ Results from May 8th water samples do not show contamination.											
12	▪ Heavy rains end. Well 5 site flooded.											
13												
14												
15	▪ Wells 5 & 6 turned off. Well 7 re-started without chlorinator.											
16												
17	▪ 6 out of 7 water samples from May 15th show contamination.											

KEY

Awareness	
	Not aware water is contaminated
	Suspicion water is contaminated
	Aware water is contaminated

Remedial Action	
	No remedial action
	Questions/investigation
	Remedial measures

Communication with Stan Koebel	
	None or assurance water is O.K.
	Admission water is contaminated

Table 2 (continued)

Timeline
Walkerton Tragedy

Date	Summary of Events	Stan Koebel		Ministry of the Environment			Local Health Unit			Walkerton Residents		
		Awareness	Remedial Action	Awareness	Remedial Action	Communication with Stan Koebel	Awareness	Remedial Action	Communication with Stan Koebel	Awareness	Remedial Action	Communication with Stan Koebel
May 18	▪ People begin contacting the PUC to see if the water is safe. ▪ Owen Sound pediatrician suspects *E. coli* O157:H7 in 2 cases of illness.											
19	▪ Chlorinator installed on Well 7. ▪ Pediatrician suspects contaminated water, calls health unit. ▪ Retirement home contacts health unit about illness among residents. ▪ Health unit contacts schools & hospital, finds many people sick. ▪ Health unit calls Stan Koebel twice. Koebel says water is O.K., but starts to flush system and increase chlorination		Uninformed, ineffective flushing & chlorination[38]									
20	▪ Well 5 turned on. ▪ Health unit notified that *E. coli* O157:H7 is the likely source of illness. ▪ Health unit calls Stan Koebel twice. Koebel says there had been no problems with contaminated water. ▪ A PUC employee anonymously tells MOE of tests showing contamination. MOE contacts Stan Koebel and is told of some concern with water main construction and that Koebel is flushing and chlorinating but not finding contamination. ▪ Test results show water from May 18th samples is contaminated.											
21	▪ *E. coli* O157:H7 confirmed as a source of illness. ▪ Boil water advisory issued. ▪ MOE & health unit call Stan Koebel who does not reveal problems. ▪ MOE does not act because boil water advisory had been issued, health unit is investigating, & Koebel is flushing & chlorinating the system. ▪ Health unit begins collecting its own water samples.											
22	▪ MOE begins investigation after being requested to do so by health unit. ▪ Stan Koebel denies to MOE that unusual events have occurred, but upon request surrenders previous test results showing contamination and operating sheets for Wells 5 & 6. Koebel says Well 7 operating sheet is not available. ▪ MOE does not tell health unit of test results showing contamination. ▪ MOE takes water samples. ▪ Health unit finds illness is widely dispersed in Walkerton. Concludes water is the source.											

KEY

Awareness	
(black)	Not aware water is contaminated
(grey)	Suspicion water is contaminated
(white)	Aware water is contaminated

Remedial Action	
(black)	No remedial action
(grey)	Questions/investigation
(white/hatched)	Remedial measures

Communication with Stan Koebel	
(black)	None or assurance water is O.K.
(white)	Admission water is contaminated

Table 2 (continued)

Timeline
Walkerton Tragedy

Date	Summary of Events	Stan Koebel		Ministry of the Environment			Local Health Unit			Walkerton Residents		
		Awareness	Remedial Action	Awareness	Remedial Action	Communication with Stan Koebel	Awareness	Remedial Action	Communication with Stan Koebel	Awareness	Remedial Action	Communication with Stan Koebel
May 23	▪ On the 22nd or 23rd, Stan Koebel has his brother alter the operating sheet for Well 7 to show that the well had not been pumping water without a chlorinator. Altered operating sheet given to MOE. ▪ MOE finds that, according to the operating sheets, no wells were in use from May 3 to May 9 and chlorine residuals were all 0.5 or 0.75 mg/L. ▪ Health unit water samples show contamination. ▪ MOE does not tell health unit of earlier tests showing contamination. However, after being questioned, Stan Koebel tells health unit about test results showing contamination and admits that the Well 7 chlorinator had not operated all the time. ▪ Health unit tells the public how bad the outbreak is and what they need to do to protect themselves. ▪ MOE promises action plan.		Uninformed, ineffective flushing & chlorination									

KEY

Awareness	
(black)	Not aware water is contaminated
(grey)	Suspicion water is contaminated
(white)	Aware water is contaminated

Remedial Action	
(black)	No remedial action
(grey)	Questions/investigation
(hatched)	Remedial measures

Communication with Stan Koebel	
(black)	None or assurance water is O.K.
(white)	Admission water is contaminated

that the water was contaminated, but Stan thought the results were "wacky." The May 1st samples had also shown contamination, but the May 8th samples had come back clean. As before, when people from the MOE contacted Stan, they had been satisfied with his assurances that everything was O.K. If there was something important to worry about, they would have told him.

The only water safety issue that concerned Stan was to get a new chlorinator installed on Well 7, the newest and safest of Walkerton's three wells. The new chlorinator had arrived over a year earlier, but no one had taken the time to install it. There was no need to rush since Stan and those who worked for him believed that the raw water – which they often drank themselves – was safe. On May 3rd, Stan told his brother Frank to put in the new chlorinator. Frank removed the old chlorinator, turned on Well 7, and left the well site without installing the new unit. Well 7 ran until May 9th when it was taken off line. On May 15th, after returning from a waterworks conference, Stan turned Well 7 back on again and left it on even after he found out there was no chlorinator on the well.

While Stan was away at the conference, it had rained. From May 8th to the 12th, 134 mm of rain fell, an unusual event – something that is only expected to happen every sixty years or so. The rain left the Well 5 site flooded and its pump was shut down for fifteen and a half hours. Despite the shutdown, Well 5 provided most of the water to the town during the heavy rain and for three days after.

On May 15th, water samples were taken and two days later Stan got back the results. Six out of seven water samples, including three from a water main construction site, were contaminated. Stan went down to the construction site and made sure everything was secure.

The next day, the 18th, more water samples from the construction site were sent for testing. A large number of people in Walkerton were sick with diarrhea and the PUC office received calls about the safety of the water. Stan gave instructions to tell people that the water was fine. He also told his brother to install the chlorinator on Well 7, a task finished the next day. In the evening Stan went to the PUC commissioners meeting and reported on such as things as who had been connected and disconnected and some new equipment that had been installed. He did not mention the series of bad test results, the missing chlorinator, the large number of illnesses, or the phone calls from the public.

People continued to get sick. On May 19th, Stan received two phone calls from the local health unit asking if there were any problems with the water. Two callers to the health unit – a school administrator in Walkerton and a pediatrician in nearby Owen Sound – thought the water was making people sick. Stan told people from the health unit that the water was O.K. He mentioned there had been water main construction and, inaccurately, that a new chlorinator was installed the day before. He did not inform the health unit of the test results showing contaminated water or that Well 7 had been operating without a chlorinator. Just to be safe, though, Stan began to flush out the system and increase the amount of chlorine used to disinfect the water.

On May 20th, the health unit received the results of tests on a stool sample from a child from Walkerton being treated in Owen Sound. The tests showed that the deadly bacteria *E. coli* O157:H7 had likely made the child ill. Stan received his own test results showing that contaminated water had been found in the second set of samples from the water main construction site. The health unit, in its second day of investigating the illnesses, called Stan twice and each time was assured that there had not been any problems. The MOE, upon receiving an anonymous call from a PUC employee, called Stan and was told that there had been some concern with water main construction but that the system was being flushed and heavily chlorinated with no contamination being found. In his effort to flush the system, Stan turned on Well 5 in the morning. By afternoon, chlorine residuals in the distribution system had dropped.

E. coli O157:H7 was confirmed on Sunday May 21st as a cause of the illnesses. The health unit, having eliminated all other possible sources of contamination, issued a boil water advisory and began collecting water samples. During calls from the health unit and the MOE, Stan continued to withhold the information that contaminated water had been detected and Well 7 had operated without a chlorinator. The MOE did not begin an investigation because it felt that the health unit and Stan had things well in hand.[39]

On May 22nd, after mapping where sick people lived, the health unit found that illness was widely dispersed in Walkerton. They decided water was the problem. After a request from the health unit, the MOE began

an investigation. Stan continued to deny that any unusual events had occurred. However, after being asked, he did give the MOE the previous test results showing contaminated water, as well as the operating sheets for Wells 5 and 6. He did not include the operating sheet for Well 7, saying it was not available. The MOE took water samples, but did not inform the health unit of the test results Stan had turned over.

Although there would be many months of investigations, hearings, and legal proceedings, the situation was finally clear on May 23rd. The health unit received its own test results proving the water was unsafe and, on its own, got Stan to admit that earlier tests had shown contamination. The MOE received an operating sheet for Well 7 that, on Stan's orders, had been altered to hide the fact that Well 7 had operated without a chlorinator. The operating sheets for the wells, genuine and falsified, revealed two impossible "facts:" an unblemished record of chlorine residuals of 0.5 or 0.75 mg/L and a town that had been without water from May 3rd to May 9th, a period when none of the wells had supposedly been in operation. Stan Koebel's improper and deceptive practices had been exposed.

The Result

In the end, contaminated water from Well 5 killed seven and made an estimated 2,300 sick. Some survivors are expected to suffer permanent damage, predominantly to their kidneys. Permanent damage will primarily affect those who were children at the time.[40]

A month after the tragedy began, the provincial government appointed Justice Dennis O'Connor to lead an inquiry into what happened. After almost two years of work, Justice O'Connor had made 121 recommendations (Appendix), many of which have been implemented.[41]

Estimates of the cost of the tragedy range from $65 million to $500 million.[42] Lower estimates are for direct costs such as the expenses incurred by the sick, the cost of the inquiry, and the cost to restore the safety of Walkerton's waterworks. Higher estimates ($200 million+) include the costs of implementing the stricter regulation required because the water could not be kept safe using a more voluntary and less scientifically-rigorous approach.

Implications for Planning

Many factors contributed to the failure to protect Walkerton's water supply (Figure 1). Although the Koebels were eventually convicted for their roles in the tragedy,[43] their actions were symptoms of poor planning that led to poor decision-making. They were faulty parts in a machine that was a honeycomb of flaws. They deserve blame, but to put all or even the majority of blame on them is, in a perverse way, to dignify them, to make them into the intelligent, industrious, and independent men of action that they assumed they were. It also lets us pretend that those who designed and implemented the regulatory system were simply blindsided by the "bad luck" of unusual, but foreseeable behavior and events.[44]

Like many other cases of contaminated drinking water supplies,[45] the Walkerton tragedy was not an engineering or financial failure. It was a sociological failure. It was a failure to develop, organize, and implement an effective system for managing people and their interactions with each other.

So, what can planners do to make sure that plans do not fail as happened in Walkerton? There are the obvious answers and the answers that were obviously not obvious to those who made the decisions that led to the tragedy.

The Obvious

A key conclusion that emerged from the judicial inquiry was that, with proper chlorination, the outbreak would not have happened.[46] This is obvious, but not helpful. Chlorination does not happen on its own.

It is equally obvious that the outbreak was the result of an unusual combination of events: heavy rain and recently dumped and buried manure. That is not a terribly helpful conclusion. Good planning takes into account unusual situations.

Figure 1

Contributing Factors: Walkerton Outbreak

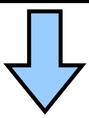
SOURCES: The Honourable Dennis R. O'Connor, *Report of the Walkerton Inquiry – Part One: The Events of May 2000 and Related Issues* (http://www.attorneygeneral.jus.gov.on.ca/english/about/pubs/walkerton/part1/), and *Part Two: A Strategy for Safe Drinking Water*, (http://www.attorneygeneral.jus.gov.on.ca/english/about/pubs/walkerton/part2/), Queen's Printer for Ontario, 2002

System Operators

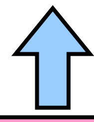
- Inadequate Training
- Inadequate Knowledge
- Inadequate Research
- No Risk Assessment
- Assumption Water was Safe
- Self-Importance
- Inadequate Chlorination
- Inadequate Monitoring
- Inadequate Reporting
- Misleading Information
- Falsification of Records
- No Chlorinator on Well 7
- Belief Well 7 was the Problem
- Cover-up

Public Utility Commissioners

- Inadequate Training
- Inadequate Knowledge
- Inadequate Research
- No Risk Assessment
- Assumption Water was Safe
- Belief in Promises
- Inadequate Priorities
- Inadequate Supervision
- Inadequate Follow-up



Contaminated Water, Illness, and Death



Ministry of the Environment

- Inadequate Training
- Inadequate Knowledge
- Inadequate Research
- Inadequate Risk Assessment
- Belief in Promises
- Inadequate Certification of Wells
- No Continuous Chlorine Residual Monitors
- No Continuous Turbidity Monitors
- Inadequate Certification of Operators
- Unclear Policy & Procedures
- Inadequate Manpower
- Inadequate Time
- Inadequate Notification of Problems
- Inadequate Inspections
- Inadequate Enforcement

Provincial Cabinet

- Inadequate Knowledge
- No Risk Assessment
- Assumption Water was Safe
- Budget Reductions
- Inadequate Regulation
- Reliance on Voluntary Compliance
- Special Treatment for Agriculture

Other Factors

- Manure Spreading
- Heavy Rainfall

KEY				
Awareness	Faith	Inaction	Action	Natural Event

It is also obvious that, if people had been well-informed, conscientious, perceptive, empowered, courageous, and so on, Walkerton would have been spared illness and death. This is only a tiny step toward better planning since people do not automatically become well-informed, conscientious, etc.

The Importance of Self-Importance

One lesson to be learned from Walkerton is that people will be governed by self-interest. Following their needs and perceptions, they will not do things they consider inconvenient, difficult, pointless, or a threat to their philosophy, self-image, or livelihood. The default setting in planning must be that people will be self-important, putting their own self-interest first.

The planner's job is to calculate the self-interest of those who will implement a decision or be affected by it. This must go beyond the simple calculation of who gains and loses in terms of money or other material benefits. Calculating the distribution of material benefits is essential, but the system failure in Walkerton shows that material considerations are only a small part of what motivates people. A planner must delve into the dreary, bewildering world where factors such as ignorance, indulgence, inaction, and a belief in infallibility will, if unopposed, lead to disaster.

Defining people's self-interest should not assume that there is a common definition of rationality. Instead, rationality is self-evident, that is, decisions are rational "at a particular time based on people's knowledge, the risks, and the importance attached to economic, political, social, and emotional factors." [47]

For Stan Koebel before the tragedy, it was rational to ignore rules for safe drinking water. He had many other things to do and his belief in the rightness of his actions had not been defeated by criticism from MOE inspectors or by illness in Walkerton. His actions made sense to him based on his calculation of cause and effect and right and wrong.

A planner must determine how personally rational decisions will be compatible or in conflict with decision-making that serves the public. This information can then be used to create both incentives that will reward people for acting in the public interest and safeguards that will either stop people from undesirable actions or convince them to abandon autonomous self-interest and pursue expedient or altruistic self-interest.

Predicting the behavior of people such as Stan Koebel is not impossible and neither is detecting and stopping it. Tools are available. They only need to be used.

Different Levels of Self-Interest

Autonomous self-interest: goals and actions that are unfettered by what is in the public interest, e.g., a person deliberately violates the conditions in a water licence

Expedient self-interest: goals and actions that conform to the public interest because it is advantageous for the person to do so, e.g., a person obeys licence conditions to avoid trouble from the authorities

Altruistic self-interest: goals and actions that conform to the public interest because meeting the community's needs is considered to be correct, e.g., a person obeys licence conditions because that is the right thing to do.

SOURCE; Bob Morrison, "Civilized Ill-Will, Self-Evident Rationality, Faith-Based Consent, and Selfless Authoritarianism: Definitions of Decision-Making," *Moving Beyond Now*, v. 1, no. 3 (July, 2004), p. 5

Denying Denial

The tools to ensure the right choices are made are often not used because people have a great capacity for denial. People do not like bad news or conflict, especially if it concerns them.

There was plenty of denial before, during, and after the Walkerton tragedy. In May of 2000, Stan Koebel was in denial as more and more Walkerton residents became ill. His denial continued after his mistakes and deception had been revealed. He even took the position at the inquiry into the tragedy that his failings could be excused because he did not have the knowledge and qualifications to run the Walkerton waterworks.[48]

The provincial government's denial of the need for better supervision was a key factor in the tragedy. The denial continued at the inquiry where the government argued that Stan Koebel was the only person responsible for the tragedy. Even Dr. Biesenthal, after finding out that the DNA of the bacteria had been traced to his herd, did not understand how his actions could have led to the outbreak and did not think there was anything he could have done to prevent it.[49]

A planner's objective is to deny people the opportunity to deny; to deny their responsibilities, to deny their actions or inaction, and to deny they could have done better. The objective is to build a plan that kicks out the props that support plausible deniability. It means a regulatory culture designed to eliminate the hierarchy of excuses best described in the words of a child in hot water:[50]

- I didn't know
- I didn't think
- I didn't mean to
- I didn't care.

Knowledge is obviously an important element in ending unsubstantiated denials. It takes a regulatory system beyond the first level of deniability – lack of knowledge.

Knowledge on its own, though, can not solve two key problems: people who will not do what is right and people who can not successfully cope with the demands placed on them. Those problems require rules and procedures that strengthen a person's ability to manage details, overcome unfamiliar and uncomfortable problems, and tell right from wrong. This means regulation that, within the bounds of human rights and necessity, will intrude into the lives of those who are responsible for serving the public.

The Will in Free Will

The Walkerton tragedy was a story about personal views leading to bad decisions, from Premier Mike Harris's obsession with budget-cutting and de-regulation to Stan and Frank Koebel's apparent belief that all they needed to know about safe drinking water was that they thought it was safe. The prevalence of individual miscalculation in the Walkerton story makes one wonder if freedom of choice has a valuable role in something as important as the protection of drinking water.

Consider the job of a commissioner on the board of the Walkerton PUC. In the waterworks world, there is a difference of opinion about how much commissioners should know about what is going on. Some knowledgeable individuals feel that the level of involvement of a commissioner in the operation and management of a waterworks is a personal choice. Others think commissioners should know the laws, regulations, procedures, science, and other aspects of supplying drinking water and should be responsible for guaranteeing that the water is safe.[51]

These philosophies differ in their assumption about whether or not the managers who report to the commissioners are competent. The validity of the assumption depends on whether or not a person can have faith that the process established for training, testing, hiring, and evaluating the managers will call them on unsafe or risky behavior and weed out incompetents. As the Walkerton tragedy demonstrated, faith in that process is untenable. There is no freedom of choice. Commissioners and others responsible for overseeing the provision of drinking water can not assume that the system is working properly. They must rely on their own ability to evaluate the information provided to them, analyze the performance of personnel, establish policies that will alert people to ignorance, ineptitude, and deceit, and make sure problems are solved. Ensuring that water is safe is not a choice, but a duty.[52]

That duty means curtailing and, in some cases, eliminating freedom of choice for those who manage drinking water systems. It means stringent and sometimes personally disagreeable restrictions to avoid three problems that dominated the Walkerton situation:

- **Too much freedom.** Virtually all decision-makers, including the Koebels, Dr. Biesenthal, MOE administrators, and provincial politicians, based their action or inaction on their personal beliefs and assumptions. They did not know or could choose to ignore the rules governing their behavior and the consequences of their choices.

- **An imbalance of freedom.** There was a distorted mix of authority. Stan Koebel was granted immense authority, mainly by default. Provincial politicians assumed too much authority because they presumed their ability to manage public safety could be derived from electoral success and abstract theories about how society ought to work. In contrast, regulators in the MOE and the health unit had

too little authority because of legal constraints, inadequate training and information-sharing, lack of initiative, and a pervasive desire on the part of politicians and MOE management to make voluntary compliance work.

- **The freedom to deceive.** Provincial and local politicians created a culture that made it possible for a person like Stan Koebel to flourish. They focused on financial affairs, particularly on keeping costs low. As well, at the provincial level, politicians created a philosophy in which bureaucracy, complexity, and enforcement were reviled, while, at the municipal level, elected commissioners and town councillors were unable to understand, much less manage water quality issues. They allowed Stan Koebel the freedom to believe that the procedures for providing safe drinking water were not important and neither were the problems that lingered in the operation of the waterworks system.

Limiting freedom of choice is especially important in a job where high standards must be maintained. As Justice O'Connor concluded "[t]he goal of any drinking water system should be to deliver water with a level of risk that is so negligible that a reasonable and informed person would feel safe drinking it."[53]

Although Justice O'Connor's standard is high, it does not place sufficient constraints on freedom of choice. It assumes that people, particularly those responsible for managing the system, will be reasonable and informed. Yet, as the Walkerton tragedy demonstrated, it is the ***unreasonable*** and ***uninformed*** whom the system must protect and often must protect against. They are the ones most likely to act in a way that will make water unsafe or support measures that increase the risk that water supplies will become contaminated.[54]

It must be assumed that people will be unreasonable and uninformed and, like the residents of Walkerton prior to the tragedy, will have only a fuzzy understanding of what is at stake and what needs to be done. Whether they are regulators, waterworks operators, or consumers, for something as important as drinking water, people will have surrendered the freedom to make bad choices. Instead, they need the knowledge, rules, and procedures that allow them to make good choices, including the choice to believe the water is safe.

Masters of Our Fate

Rules and procedures that restrict freedom of choice are a contract between the public and the person allowed to make a decision.[55] From the explicit and obligatory (laws, regulations) to the vague and flexible (campaign promises, policies), they let members of the public get on with their lives and let decision-makers get on with making decisions. When they work, they are an efficient, effective compromise.

As those who drank Walkerton water in May, 2000 found out, when the "contracting out" of decision-making does not work, people are no longer masters of their own fate. They are, instead, at the mercy of someone unable or unwilling to protect their interests.

In the case of Walkerton, it is unlikely that even legally-binding requirements would have fixed the contract between the public and decision-makers. With their approach to public safety, Stan and Frank Koebel probably would have continued to ignore the rules. The MOE might have acted more forcefully. However, with the MOE mired in red tape, the priorities caused by dwindling resources, and the politically-correct culture of de-regulation, it is unlikely its staff would have penetrated the fog of ignorance and promises that surrounded operation of the Walkerton waterworks.[56]

Inspections were the tool that had the greatest potential for restoring the contract between the public and decision-makers. There are several reasons why inspections of the Walkerton waterworks did not solve the problems that led to the tragedy:[57]

- **No explicit instructions to carefully review files and operating records.** Inspectors were told to look at the relevant approvals but not the historical information on file. As well, they were not told to look over operating records beyond those for the current month.

- **Budget cutbacks.** Because of less money, fewer staff were available, inspections were reduced, contact with waterworks operators decreased, and inspectors were not allowed the time to find and review more material than the absolute minimum.

- **Access to information.** Even if MOE inspectors had gone looking for more information, it is not certain they would have found it. Much of the information on the Walkerton system either had been discarded or was stored separately from the main file in a storage room, in a report room, in the archives, or in an incomplete, poorly cross-referenced computer data base.

- **Ignorance.** Lack of knowledge was not just a problem for Stan Koebel. Key MOE staff did not know waterborne bacteria could kill people. As well, MOE staff did not understand their own regulations, guidelines, and procedures. In part, lack of knowledge within the MOE was because of budget cuts in the 1990s that reduced training and led to an emphasis on management and administration courses instead of technical/scientific instruction. The shift to non-technical training came from management's expectation that staff members would be generalists rather than have specialized expertise.

- **Lack of follow-up.** In 1990, the MOE adopted the goal of an annual inspection of every waterworks. This requirement was reduced to an inspection every two years and then in 1994 to every four years with a one-year follow-up inspection for "problem plants." By 1999, inspections of municipal waterworks were no longer a requirement. Two years and three months passed after the last inspection in Walkerton, even though the results from the 1998 inspection showed that Walkerton's system had serious problems.

- **Faith, hope, and charity.** The MOE and the PUC board took Stan Koebel's word that he and others would do the right thing.

- **No unannounced inspections.** As of 1991, MOE's policy was that unannounced inspections were to be the norm. This policy was not adhered to because it was considered more efficient to announce inspections to ensure that waterworks staff and relevant information would be available when an inspector arrived.

- **Reaction rather than prevention.** Ordinarily, inspections were used as a response to a problem that had already been identified rather than an effort to anticipate trouble.

In short, the inspections were unsophisticated. They lacked specific tasks, enough money, the ability to track down the facts, and due diligence – including unfettered scrutiny of operations.

The opportunity to inspect what is going is an important part of a plan. The scope of "inspection" can extend to a variety of other measures ranging from biological work (e.g., testing water quality) to meetings of regulatory and management bodies, advisory groups, and members of the public. The key criterion for judging the effectiveness of these inspection measures is whether they efficiently allow individuals and groups to provide informed consent, that is, "to provide advice on, understand, and voluntarily concur with a decision – before the decision is made."[58] This includes the ability to review the contract between the public and decision-makers to determine if it continues to be appropriate and is being honored.

The ability to "inspect" must also deal with the question of who regulates the regulator. Before Walkerton, the primary regulator – the MOE – was, for practical purposes, in charge of regulating itself. This tradition has continued.[59]

Instead of self-regulation, the task of overseeing the performance of the important and powerful MOE should have rested with a group, audit process, or legal mechanism that would provide both the expertise and independence necessary to judge whether the right jobs were getting done properly. For example, in Ontario it would have been appropriate to assign responsibility for oversight of the MOE to the Ministry of Health or an advisory panel, conduct random assessments (as Justice O'Connor proposed for health boards), or establish a statutory standard of care (as Justice O'Connor proposed for municipal waterworks executives). It would, thus, have been possible to reduce the conflict of interest that undermined the public/decision-maker contract.[60]

Regulating the regulator is considered by some to be inappropriate because the job of regulator is formidable and underappreciated. Yet, it is precisely because the job is formidable and underappreciated that measures to ensure accountability are necessary. The Walkerton tragedy shows that the safe drinking water contract between the public and decision-makers depends on thorough and persistent activity by a regulator like the MOE. The regulator must be on top of the situation so that gaps in the system of protection can be identified and closed. This does not diminish or remove the responsibility of municipalities and others to supply safe drinking water. Instead, it means that, like any organization with "policing" responsibilities, the MOE needs sufficient oversight and accountability to ensure that it acts diligently and effectively.

The need to eliminate conflict also applies to interpreting political promises. In the case of Walkerton, Ontario residents had, in exchange for safe drinking water, delegated supervision of drinking water quality to the provincial government. However, through the election of politicians who actively opposed government intervention in the affairs of municipalities and the private sector, Ontarians had also created a political and bureaucratic culture that discouraged clear, timely, and firm policing of safe practices. That culture allowed Stan Koebel to operate the way he did with little fear that the public's servants in the provincial government would become his masters.

The opposition to government intervention is a misunderstanding of the role of a regulator. Regulatory measures are put in place because an activity has the potential to cause harm. Regulatory measures restrict what some people can do because those restrictions are considered less undesirable than the consequences if the restrictions were not in place. The people conducting an activity have rights that must be respected, but the regulator is their master if they step outside the boundaries prescribed by society. This is an infringement of individual liberty, but to believe that a justifiable infringement of liberty is unacceptable is to deny potential victims the freedom – using the regulator as intermediary – to be safe.

The Certainty of Uncertainty

Plans are expected to be an intermediary that will provide the proper balance between conflicting freedoms. A plan must create a culture in which regulators clearly understand their job, not because of what they think should happen or what someone told them to do, but because they understand why restrictions of some people's freedom are necessary to maintain the more important freedoms of others. As part of the culture created by the plan, the regulators must also be valued by their bosses, their peers, and the people who depend on them to act skillfully and decisively.

This is an inclusive view of planning that is, potentially, all-encompassing. It is what some people might think is intrusive because participants in a planning exercise will venture into areas that are sensitive, peripheral, apparently in good hands, or too difficult for ordinary people to understand. Before Walkerton, those reasons for arbitrarily limiting the scope of a plan might have had some credibility. The Walkerton tragedy, though, has shown that those reasons are dangerous assumptions about how human systems function and fail.

Placing artificial boundaries on planning is a more significant flaw than unsound excuses for doing nothing. Since all aspects of life are planned in one way or another, artificial boundaries create two types of planning: the official kind that is open to scrutiny and the other kind that is not.

Placing preemptive restrictions on planning is a form of "selective benevolence," one of the components of a restrictive style of management. It is a way to control "public involvement and access to information according to the needs and comfort level of decision-makers," rather than "informing and involving the public based on their needs."[61]

People try to place restrictions on planning because it is clear to them what needs to be done. Sometimes this is because what is being done is not in the public interest. Other times, though, the rejection of inclusive planning is based, like Stan Koebel's rejection of safe operating practices, on the belief that anything worth knowing is already known and that anything worth doing is already being done.

Yet, the objective of planning is to predict the future, a task for which the only certainty is uncertainty. Whether a person is trying to predict natural events, human values and behavior, the impact of

technology, or the best course of action, the task of prediction is dominated by unknowns and assumptions. It is not something that – if the public interest is to be served – can be done successfully with arbitrary restrictions on what may or may not be relevant.

The planning that led to the Walkerton tragedy had many arbitrary restrictions and, therefore, little transparency and accountability. It left huge gaps in the multi-layered shield that was supposed to protect drinking water. Despite the warning signs, no one saw that three known hazards – manure disposal, heavy rain, and a vulnerable well – would easily combine to turn the water toxic. Key technological fixes such as shutting down an unsafe well and requiring equipment to continuously monitor chlorine residuals were ignored. Faith in people replaced faith in science.

Walkerton's story of restricted planning did not end with the planning to avoid the tragedy, but extended to the planning for what would happen when a tragedy occurred. When the tragedy hit, Stan Koebel was for over a week oblivious to what was going on, misdiagnosed the problem, pursued futile solutions, and tried to cover up his misdeeds. The MOE was equally disoriented, its "institutional memory" lost in a jungle of paperwork, its strength drained by budget cuts and managerial timidity, and its initiative reined in by ignorance and ambivalence.

A few residents guessed water was the problem, but the health unit was the only government agency that was able to muster an effective response to the crisis. Yet, the health unit, left in the dark by Stan Koebel and the MOE, did not get involved until the day the rate of illness peaked (Figure 2). Two days later when the boil water advisory was issued, no one had yet broken through Stan Koebel's stonewalling. The health unit targeted the water, not because they could prove what was going on, but because contaminated water was the only explanation that made sense.

A six-month clean-up eventually restored the health of Walkerton's water system. The remedial action, though, was not the immediate response that is assumed in plans. Just as a planner can not assume that people will know what they are doing when trying to make the system work properly, a planner must assume that people will not have a clue what is happening when the system breaks down.

Precaution

In hindsight, the right answer for the MOE in the 1990s was to tell the provincial Cabinet that people would get sick and die if the system for protecting drinking water was weakened by budget cuts and a reduction in regulatory capability. Yet, prior to Walkerton, it is unlikely the Cabinet would have believed them. The MOE had no proof except for the proof that a Walkerton tragedy had not occurred. Predictions of a tragedy would merely have been speculative. The uncertain truth of illness and death was no match for the certainty of the Cabinet's belief that to spend and regulate less was the right thing to do.

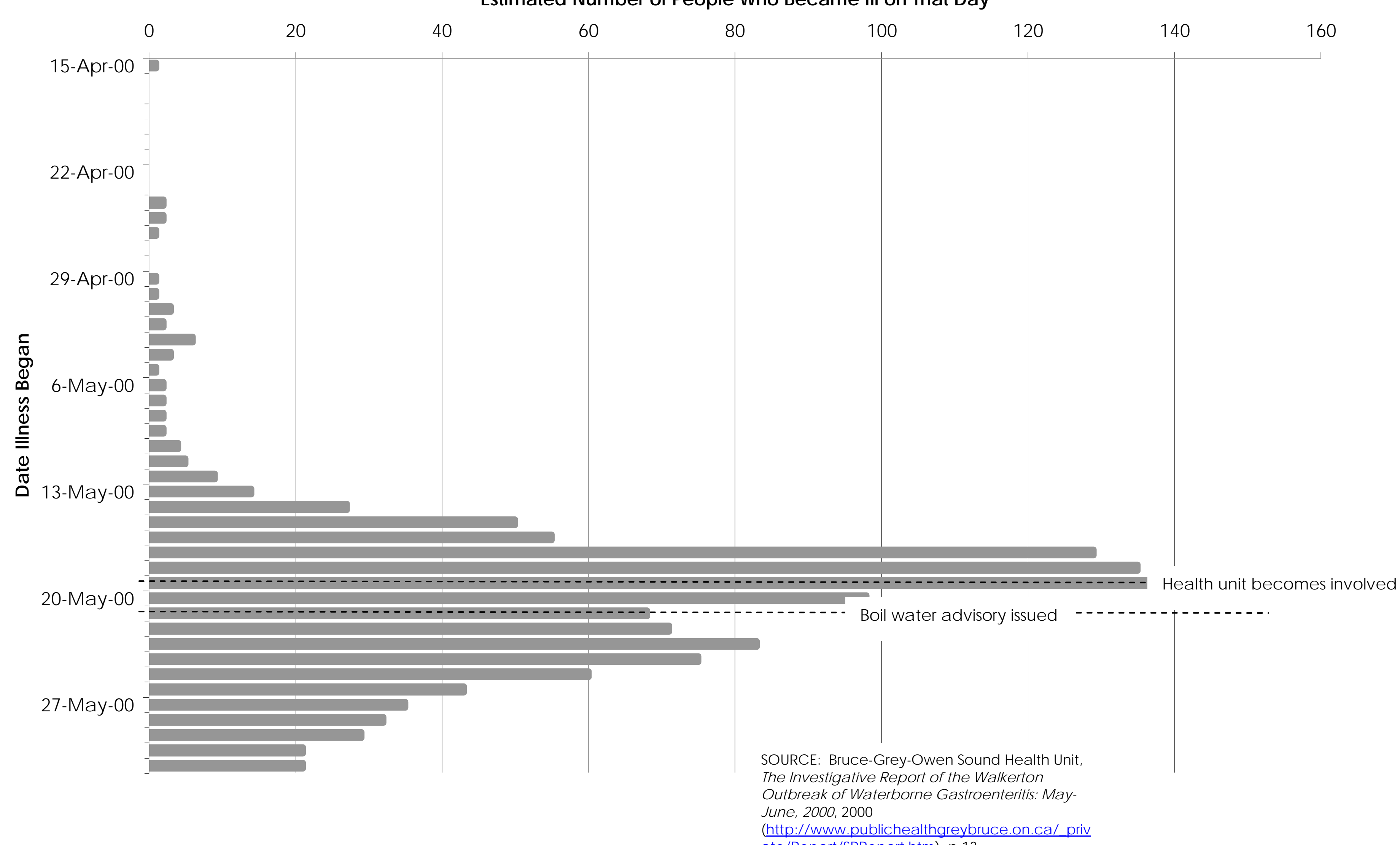
There is no reliable answer to the conflict between invalid certainty and valid uncertainty, except to be more cautious. That raises the issue of how safe is safe. Even in an area such as drinking water with its many years of research and experience, the answer is we do not know for sure. We can not predict all the things that can go wrong and what the consequences will be when bad things happen.

It is a question of what precautions to take, a question that, over the years, drinking water experts have tried to answer by being safe rather than sorry. In doing so, they adopted a philosophy similar to the precautionary principle that evolved in the field of environmental protection.

The precautionary principle has focused on what to do when somebody proposes to do something that could be harmful, but it is not clear if the harm will occur or how bad it would be. Three views of how to respond to this uncertainty have developed: do not allow the proposal to proceed, adopt a different, less risky technology, or modify the proposal and the way it is managed to avoid or reduce harmful effects.[62]

Despite the name, precaution is not what distinguishes the precautionary principle from traditional decision-making about drinking water. The precautionary principle incorporates key "precautionary" aspects of the traditional approach: management by objectives, reliance on science, assessment of alternatives, comprehensiveness, and reducing risks to a negligible level. The key aspects of the

Figure 2
The Onset of Illness
from Water Contamination - Walkerton, Ontario



precautionary principle not prominent in the traditional approach are that a proponent should prove something will be acceptable and that decision-making should be open to the outside world.[63]

These two elements are crucial to avoiding another Walkerton. In the Walkerton case, it was presumed that Stan Koebel and his staff were innocent until proven guilty. The precautionary principle changes the burden of proof. Although not assuming a person is guilty of wrongdoing, it requires that innocence be demonstrated. This is at the heart of any regulatory system where someone has the privilege of managing a public good. At Walkerton, the regulators had the right and the responsibility to prove conclusively that the public goods entrusted to Stan Koebel and his staff – water, the waterworks system, and public trust – were managed properly.

Requiring people to demonstrate innocence is an onerous and thankless task. The Walkerton case allows us to see how the demonstration of innocence can be done more efficiently and effectively:

- **Monitoring:** Stan Koebel demonstrated that self-monitoring does not work for those who are either incompetent or dishonest. Inspections and lab tests can be valuable deterrents, but they do not provide the immediate response necessary to control poor or non-existent monitoring. Regulators need the technological and administrative sophistication to know, without delay, when everyday monitoring of the water is either not happening or is showing that safety is threatened.

- **Ground water:** The separation of "normal" ground water from ground water "under the direct influence of surface water" was considered a helpful distinction by Justice O'Connor. Yet, leaving aside the issue of whether a safe definition of "direct influence" can be created, the presumed innocence of normal ground water puts the burden of proof on regulators to demonstrate otherwise. Instead, the precautionary principle would set a standard that will achieve safe drinking water in all situations and then require those allowed to supply water to conclusively prove that they can be held to less exacting requirements.

- **Risk analysis:** In water management, when trying to determine if something should be considered "innocent," the frequent response is to do a risk analysis. However, risk analysis, as it is conventionally practiced, is the wrong way to test for innocence. This is because risk analysis is value-laden, imprecise, advocacy-driven, and usually based on benefit-cost analysis which, for health and safety issues, is inappropriate.[64] It is a crude tool and an unsuitable substitute for the science and informed consent necessary to confirm innocence.

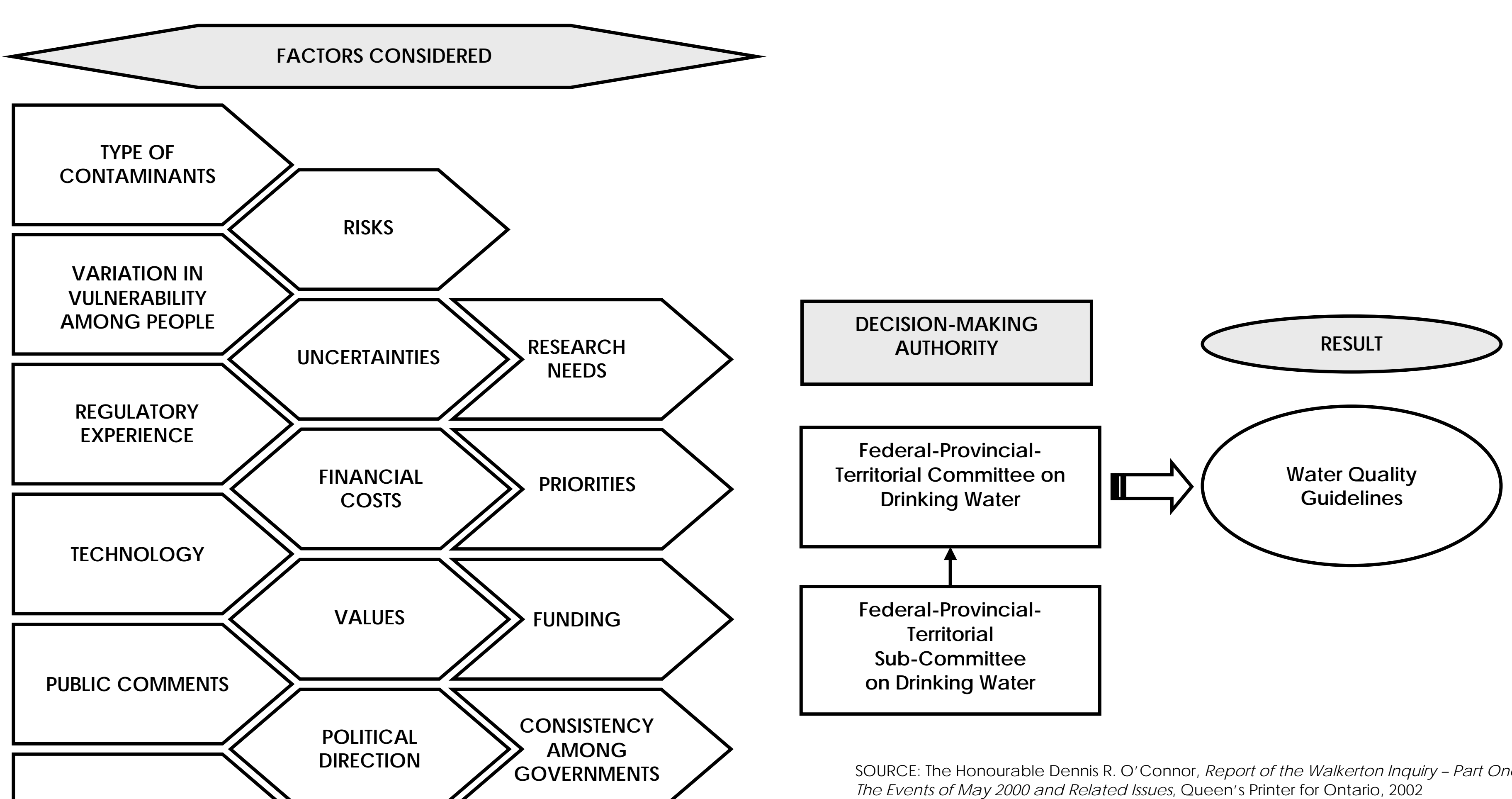
- **Drinking water quality guidelines:** Canada's drinking water guidelines are an important ingredient in drinking water safety. The guidelines, though, are developed using risk analysis that combines science with financial, social, technological, and political considerations (Figure 3). Although free to accept or reject the guidelines, governments have set up a process of negotiation that creates safety standards that are already compromised by feasibility, priorities, and other values. As a result, the guidelines are not the scientific "gold standard" people would expect for confirming innocence under the precautionary principle.

Openness to the outside world, the second key difference between the precautionary principle and traditional practice, is probably more important than confirmation of innocence. For advocates of the precautionary principle, this usually means being open to scrutiny by the "public," those people not part of the government's approval and regulatory system. While that type of scrutiny is valuable, it is not the kind of openness that was lacking in the Walkerton case. Instead, it was a lack of openness within the system that caused the system to fail.

The most obvious lack of openness came from Stan Koebel who, knowingly or unknowingly, deceived so many. Yet, most of the other participants in the system contributed to the lack of clarity, candor, and cooperation that led to the tragedy. Bureaucrats were not straight with their political masters or their political masters did not listen to them. Administrators at the testing lab and in the MOE did not share information with the health unit. The MOE, the Ministry of Agriculture, and the politicians who felt that farmers needed special treatment left Dr. Biesenthal in the dark about how his decisions could have serious consequences for his friends and neighbors. The MOE was not even open enough with itself to be able to understand the history of risky practices at a troubled public utility.

Figure 3

PROCESS FOR ESTABLISHING WATER QUALITY GUIDELINES



SOURCE: The Honourable Dennis R. O'Connor, *Report of the Walkerton Inquiry – Part One: The Events of May 2000 and Related Issues*, Queen's Printer for Ontario, 2002 (http://www.attorneygeneral.jus.gov.on.ca/english/about/pubs/walkerton/part1/), Part Two, Chapter 5, pp. 151-156 and Federal-Provincial Subcommittee on Drinking Water, *Canadian Drinking Water Guidelines Development Process*, 1999 (http://www.hc-sc.gc.ca/hecs-sesc/water/pdf/dwg_development_process.pdf)

As the Walkerton tragedy demonstrates, the enemies of openness are not just the usual suspects of deception, turf protection, and political and legal roadblocks. Factors such as unjustified faith, timidity, simplicity, and, most prominently, ignorance can just as easily and seriously sabotage the openness needed to make precautionary measures succeed.

One enemy of openness that is not immediately obvious is flexibility. In the case of Walkerton, Stan Koebel was flexible about monitoring and sampling. The MOE was flexible with Koebel – ready to cut him slack in exchange for promises. Provincial government managers and politicians were flexible with themselves, allowing the burden of their offices to be lightened by not carefully analyzing the risks of budget cuts and voluntary compliance. As a result, the provincial government was in the dark about the possibility of a tragedy occurring, Stan Koebel convinced himself that he was doing O.K., and Koebel's ignorance of his town's water supply sealed off any chance that he (or anyone else) would know when and where contamination was occurring in time to avert disaster. Everything was so ill-defined and uninhibited – in a word, open-ended – that openness itself had disappeared.

Discrimination

A plan must ensure unconditional, convenient, and coherent access to the information necessary to make decisions that will protect the public interest. If those in control of the system – the most powerful and closest to the problems – are blind to what is going on, there is little hope that the vulnerable and unaware will be protected.

The people most at risk of becoming ill, enduring long-term harm, and dying because of water contamination are children, seniors, and those whose ability to fight off disease is weak. Water contamination is not a problem in which victims are randomly selected. It is discrimination based on the principle of survival of the fittest.

Yet, surely that is too harsh a judgement. The Walkerton tragedy was an accident. People made mistakes, usually out of ignorance, but they did not intend to hurt anyone. Even if good intentions are not an acceptable defence, the accident had no culprit who was prejudiced against the victims.

These reasons are not relevant. The actions and inaction that led to the tragedy were deliberate. The lack of bad intentions may make us more sympathetic to those who failed. The term "accident" may make things seem less contemptible. Those things, though, do not excuse what happened.

The purpose of a regulatory system is to allow people to be able to trust that the public interest is in good hands so they can get on with looking after other aspects of their lives.[65] The Ontario Government neglected to keep this purpose foremost in their decision-making. In their drive to downsize government and eliminate red tape, they worked hard not to discriminate against the operators of waterworks. The result was a discriminatory weeding out of the weak, the people who depend the most on the government to look after their best interests.

Conclusions

A Definition of Good Governance

Just know your lines and don't bump into the furniture.
- Spencer Tracy

The Walkerton tragedy is about governance gone bad. By understanding the multiple failures that led to the tragedy, we can better understand what it takes to make governance good.

Good governance is about being able to trust others to look after the public interest. When people are granted the privilege of developing plans and making decisions on our behalf, we expect they will do the right thing. We expect their self-interest will become the same as the public interest.

To ensure this happens, we establish rules and procedures – a contract between us and our indentured servants, those who act for us. Those rules and procedures allow us to infringe on the liberty of those who are expected to act on our behalf. This infringement of liberty begins with the requirement that those who act for us must demonstrate their innocence, that is, they are doing their jobs properly. It extends to our ability – through regulators – to eliminate the freedom of the unreasonable or uninformed to make bad choices and to deny any bad choices they make.

The literature on governance provides a variety of criteria for judging whether or not governance is good (Table 3). These criteria provide helpful clues to good governance and are consistent with the lessons learned at Walkerton.

They are merely hints, though. The actual concept of good governance is fuzzy. It is based on an explicit or presumed foundation of informed consent and public interest goals. Beyond that, there is not a cohesive definition of what good governance is.

Based on what happened at Walkerton, a definition of good governance would be:

> A contract between the public and decision-makers in which decision-makers are obligated, in an altruistic and inclusive manner, to
> - protect people, their interests, and the environment they live in
> - achieve other mutually beneficial objectives
> - anticipate the factors, both commonplace and unusual, that promote or hinder the public interest
> - eliminate the freedom of the unreasonable or uninformed to cause harm and deny responsibility.

Too Much of a Bad Thing

We should be careful to get out of an experience only the wisdom that is in it – and stop there; lest we be like the cat that sits down on a hot stove lid. She will never sit down on a hot stove lid again – and that is well; but also she will never sit down on a cold one any more.
- Mark Twain

Ontario now has one of the strictest regimes for regulating drinking water in the world. If all the recommendations made by Justice O'Connor are implemented, it will become even stricter. However, looking at the recommendations (Appendix), you will see that an immense amount of red tape has been proposed to ensure that drinking water is safe.

This red tape is necessary, but it is sad that a vastly more complicated regulatory system is needed to control such simple failings as not following procedures, not mothballing a dangerous well, not disposing of manure somewhere safe, and not accepting that safety requires diligence and redundancy.

A beefed-up regulatory system, though, will not be sufficient. Avoiding another tragedy will require people who, unlike Mark Twain's cat, can tell danger from safety. Planners must be those kind of people. They must build plans to ensure that those entrusted with making decisions will be those kind of people as well.

- *Bob Morrison*

Thanks to Bev Middleton, Mark Rabbior, John Steele, and Mariella Vigneux for reviewing and providing comments on an earlier draft of this article. Their advice is greatly appreciated. The view expressed here are mine and I am, of course, responsible for any errors or deficiencies.

Table 3

Criteria for Good Governance

Issue	Criteria
RIGHTS	Protection of the most vulnerable
	Equality of opportunity
	Rule-based resolution of conflict
RESPONSIBILITIES	Clear objectives and duties
	Honesty
	Competence
	Consideration of the needs of all
	Fulfillment of the public interest
RELIABILITY	Stability and order
	Consensus and commitment to a common cause
	Sustainability
	Transparency and accountability
	Well-defined, pertinent rules
	Independent, effective monitoring and evaluation
	Impartial and diligent compliance
RESULTS	Clear, coherent facts, theories, and assumptions
	Unimpeded and prompt dissemination of information
	Cooperation, coordination, and compliance
	Efficient and effective action
	Trust

Sources: Derived from Gili S. Dori, Yong Suk Jang, and John W. Meyer, *Sources of Rationalized Governance: Cross-National Longitudinal Analyses, 1985-2002*, Center on Democracy, Development, and the Rule of Law, Stanford Institute for International Studies, Working Paper No. 16, 2004 (http://iis-db.stanford.edu/pubs/20697/Sources_of_Rationalized_Goverance_.pdf), pp. 4-9, Daniel Kaufman, Aart Kraay, and Pablo Zoido-Lobatón, *Governance Matters*, The World Bank, Policy Research Working Paper 2196, 1999 (http://www.worldbank.org/wbi/governance/pdf/govmatrs.pdf), p. 1, Daniel Kaufmann, Aart Kraay, and Massimo Mastruzzi, "Governance Matters IV: Governance Indicators for 1996-2004," The World Bank, 2005 (http://www.worldbank.org/wbi/governance/pdf/GovMatters%20IV%20main.pdf), p. 4, Organisation for Economic Cooperation and Development, "Public Governance and Management" (http://www.oecd.org/about/0,2337,en_2649_37405_1_1_1_1_37405,00.html), United Nations Economic and Social Commission for Asia and the Pacific, "Human Settlements: What is Good Governance?" (http://www.unescap.org/huset/gg/governance.htm), and "Governance" (http://en.wikipedia.org/wiki/Governance)

Appendix

Summary of Recommendations

from the Walkerton Inquiry

Recommendations of the Walkerton Inquiry (Part Two recommendations take precedence over Part One recommendations where they differ.)		
Recommendation (Each number shows first the part of the Inquiry, then the recommendation's number used during that part of the Inquiry)	**Summary of Recommendation**	**Responsibility**
Authority and Organization		
1.3	Clarify and strengthen the role of local Medical Officers of Health and health units concerning treated and untreated municipal water systems, in particular, clarify whether local Medical Officers of Health are required to implement a proactive approach to responding to adverse drinking water sample test results upon receiving notification of those results.	MOH
1.1	Require vacant Medical Officer of Health positions to be expeditiously filled on full-time basis.	PG
2.69	Create a Drinking Water Branch within the MOE to be responsible for overseeing the drinking water treatment and distribution system.	PG
2.54	Give the MOE's Drinking Water Branch the responsibility for recognizing the drinking water quality management standard that will apply and for ensuring that accreditation is properly implemented.	PG
2.72	Create an office of Chief Inspector - Drinking Water Systems.	PG
2.70	Create a Watershed Management Branch within the MOE to be responsible for oversight of watershed-based source protection plans and, if implemented, watershed management plans.	PG
2.90	Move to a quality management standard over time, even if the consequence is that several communities, perhaps both reserve and non-reserve, might collaborate on a regional basis, or that First Nation communities might choose to contract with others to manage their water supply systems.	FN FG
Requirements		
2.67	Enact a *Safe Drinking Water Act* to deal with matters related to the treatment and distribution of drinking water.	PG
2.71	Require the owners of municipal water systems to obtain an owner's licence for the operation of their waterworks. In order to obtain a licence, an owner should have: • a Certificate of Approval for the facility • a Permit to Take Water • approved operational plans • an approved financial plan • an accredited operating agency.	MOE
2.81	Regulate (Ontario Regulation 459/00) any system that provides drinking water to more than a prescribed number of private residences.	PG
2.82	Establish a procedure under which owners of communal water systems may apply for a variance from provincial regulations only if a risk analysis and management plan demonstrate that safe drinking water can be provided by means other than those laid down in regulations.	MOE
2.83	Do not approve water systems that would not be economically viable under the regulatory regime existing at the time of the application.	PG
2.84	Require approved systems that are not economically viable under the improved regulatory scheme to explore all managerial, operational, and technological options to find the most economical way of providing safe drinking water. If the system is still too expensive, make assistance available to lower the cost per household to a predetermined level.	PG
2.85	Broaden regulation (Ontario Regulation 505/01) to include all owners of water systems that serve the public for a commercial or institutional purpose and not covered by other regulations (Ontario Regulation 459/00).	PG
2.51	Require all owners of municipal water systems, as condition of their licence to have an accredited operating agency, whether internal or external to the municipality.	PG
2.52	Base accreditation on an independent audit and a periodic review by a certified accrediting body.	PG
2.55	By a fixed date, bring in the drinking water quality management standard and require all municipalities to have an operating agency for their water system accredited within a specified time.	PG
2.45	Hold those who discharge the oversight responsibilities of the municipality to a statutory standard of care.	PG
2.56	Require municipalities to have operational plans for their water systems by a fixed date.	PG
2.47	Require municipalities to submit a financial plan for their water system, in accordance with provincial standards, as a condition of licence for their water systems.	PG
1.11	Require continuous chlorine and turbidity monitors for all groundwater sources under the direct influence of surface water or that serve municipal populations greater than a prescribed size.	MOE
2.36	Require all municipal water providers to have, as a minimum, continuous inline monitoring of turbidity, disinfectant residual, and pressure at the treatment plant, together with alarms that signal immediately when any regulatory parameters are exceeded. The disinfectant residual should be continuously or frequently measured in the distribution system. Where needed, alarms should be accompanied by automatic shut-off mechanisms.	PG

ACS = Advisory Council on Standards; CA = Conservation Authorities; FG = Federal Government; FN = First Nations
HC = Health Canada; MOA = Ministry of Agriculture, Food and Rural Affairs; MOE = Ministry of Environment
MOH = Ministry of Health; MUN = Municipalities; PG = Provincial Government

Recommendations of the Walkerton Inquiry (continued) (Part Two recommendations take precedence over Part One recommendations where they differ.)		
Recommendation (Each number shows first the part of the Inquiry, then the recommendation's number used during that part of the Inquiry)	**Summary of Recommendation**	**Responsibility**
2.37	Make every municipal water provider responsible for developing an adequate sampling and continuous measurement plan as part of its operational plan.	PG
2.38	Have sampling plans provide for sampling under the conditions most challenging to the system, such as after heavy rainfalls or spring floods.	PG
2.39	Require standard protocols for the collection, transport, custody, labelling, testing, and reporting of drinking water samples, and for testing all scheduled contaminants, that meet or better the protocols in Standard Methods.	PG
1.12	Limit Certificates of Approval to a specific period of time, subject them to a renewal process that considers the current circumstances, including recent indicators of water quality, and add conditions as required.	MOE
2.10	Do not issue Certificates of Approval for the spreading of waste materials unless they are compatible with the applicable source protection plan.	MOE
1.15	Conduct inspections of municipal water systems (announced or unannounced) at least annually.	MOE
1.16	Legally require that systems with significant deficiencies be inspected at least once per year.	MOE
1.19	Establish and require adherence to time lines for the preparation and delivery of inspection reports and operator responses and delivery of interim status reports regarding remedial action.	MOE
2.59	Continue to require the mandatory certification of persons who perform operational work in water treatment and distribution facilities, with education, examination, and experience being essential components of ensuring competence.	MOE
1.20	Require all water system operators to become certified through examination within two years, and to be periodically recertified.	PG
2.60	Require water system operators who currently hold certificates obtained through the grandparenting process to become certified through examination within two years and to be recertified periodically.	MOE
2.61	Require all applicants for an operator's licence at the entry level to complete a training course that has a specific curriculum to ensure a basic minimum knowledge of principles in relevant subject areas.	MOE
2.73	Require inspectors to have the same or higher qualifications as the operators of the systems they inspect and receive special training in inspections.	PG
1.22	Define "training" clearly for annual mandatory training, with an emphasis on the subject matter described in Recommendation 1.21 (See below under "Information, Communication, and Cooperation").	MOE
1.23	Proceed with the proposed requirement that operators undertake 36 hours of MOE-approved training every three years as a condition of certification or renewal. Include in such courses training in emerging issues in water treatment and pathogen risks, emergency and contingency planning, the gravity of the public health risks associated with a failure to treat and/or monitor drinking water properly, the need to seek appropriate assistance when such risks are identified, and the rationale for and importance of regulatory measures designed to prevent or identify those risks.	PG
2.68	Amend the *Environmental Protection Act* to implement the recommendations regarding source protection.	PG
2.4	Make decisions that affect the quality of drinking water sources consistent with approved source protection plans.	PG
2.5	Where the potential exists for a significant direct threat to drinking water sources, make municipal official plans and decisions consistent with the applicable source protection plan. Otherwise, municipal official plans and decisions should have regard to the source protection plan. The plans should designate areas where consistency is required.	PG MUN
2.6	Provide for limited rights of appeal to challenge source protection plans and provincial and municipal decisions that are inconsistent with the plans.	PG
2.11	Take the lead role in regulating the potential impacts of farm activities on drinking water sources. The Ministry of Agriculture, Food and Rural Affairs should provide technical support to the MOE and should continue to advise farmers about the protection of drinking water sources.	MOE MOA
2.12	Establish minimum regulatory requirements for agricultural activities that generate impacts on drinking water sources.	MOE
2.13	Require all large or intensive farms and all farms in areas designated as sensitive or high-risk by the applicable source protection plan to develop binding individual water protection plans consistent with the source protection plan.	PG
2.14	Once a farm has an individual water protection plan consistent with the applicable source protection plan, do not allow municipalities to require the farm to meet a higher standard of protection of drinking water sources.	PG

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Recommendations of the Walkerton Inquiry (continued)

(Part Two recommendations take precedence over Part One recommendations where they differ.)

Recommendation (Each number shows first the part of the Inquiry, then the recommendation's number used during that part of the Inquiry)	Summary of Recommendation	Responsibility
2.17	Make the regulation of other industries consistent with approved source protection plans.	PG MUN
2.24	Continue to be the government responsible for setting legally binding drinking water quality standards.	PG
2.18	Set drinking water quality standards so that, if the standards are met, a reasonable and informed person would feel safe drinking the water.	PG FG
2.19	Base standards setting on a precautionary approach, particularly with respect to contaminants whose effects on human health are unknown.	PG FG
2.23	Adopt standards that are as stringent as or more stringent than provincial regulations for all federal facilities, Indian reserves, national parks, military installations, and other lands under federal jurisdiction.	FG
2.28	Do not establish a formal maximum contaminant level for protozoa until real-time tests are available and establish an objective of zero for bacterial and viral pathogens, specified as a treatment standard in terms of log removal dependent on source water quality.	PG
2.34	Encourage the federal government, to work with the Standards Council of Canada, with advice from municipalities, the water industry, and other stakeholders, to develop standards for materials, including piping, valves, storage tanks, and bulk chemicals, that come into contact with drinking water.	PG
2.41	Phase in the mandatory accreditation of laboratories for all testing parameters and require all drinking water testing be performed only by accredited facilities.	PG
2.42	Licence and periodically inspect, as required, environmental laboratories that offer drinking water testing and make continuing accreditation a condition of a licence.	MOE
2.89	Formally adopt drinking water standards, applicable to reserves, that are as stringent as, or more stringent than, the standards adopted by the provincial government.	FN FG
Guidelines		
2.20	For drinking water quality research, adopt as a priority the development of sufficiently detailed definitions of the susceptibility of vulnerable population groups to drinking water contaminant exposures to allow appropriate adjustments in drinking water quality guidelines.	HC
2.21	Refine the federal-provincial process for proposing drinking water quality guidelines to provide for greater transparency and public participation.	PG FG
2.22	At the Federal-Provincial Subcommittee on Drinking Water, focus on drinking water quality guidelines and commit the required scientific support to the federal-provincial process for proposing drinking water quality guidelines.	PG FG
1.9	Develop criteria for identifying "groundwater under the direct influence of surface water."	MOE
2.15	Create a provincial framework for developing individual farm water protection plans.	MOE
1.14	Develop and make available to all MOE inspectors a written direction or protocol, for both announced and unannounced inspections of a water system: • outlining specific matters to be reviewed in preparing for the inspection • providing a checklist of required matters to review and matters that it may be desirable to review during an inspection • providing guidance concerning matters to be discussed with the operator during an inspection.	MOE
1.4	Provide written guidance to Medical Officers of Health, including steps to be taken upon receipt of MOE inspection reports and adverse drinking water sample test results.	MOH
1.7	Develop a written protocol outlining the circumstances in which a boil water advisory or a boil water order could and should be issued.	MOH
1.8	Develop the Boil Water Protocol in consultation with Medical Officers of Health, municipalities, and the MOE and provide guidance concerning an effective communications strategy for the dissemination of a boil water advisory or order.	MOH
Infrastructure		
2.35	As part of an asset management program, locate and replace lead service lines over time with safer materials.	PG MUN
Analysis and Evaluation		
1.13	Use a combination of announced and unannounced inspections with unannounced inspections used at least once every three years and when the inspector deems it appropriate, taking into account such factors as work priority and planning, time constraints, and the record of the operating authority.	MOE
1.15	Conduct inspections of municipal water systems (announced or unannounced) at least annually.	MOE

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Recommendation (Each number shows first the part of the Inquiry, then the recommendation's number used during that part of the Inquiry)	Recommendations of the Walkerton Inquiry (continued) (Part Two recommendations take precedence over Part One recommendations where they differ.) Summary of Recommendation	Responsibility
1.16	Legally require that systems with significant deficiencies be inspected at least once per year.	MOE
1.24	Inspect municipal water systems regularly for compliance with certification and training standards, strictly enforce, and follow up when non-compliance is found.	MOE
1.26	Undertake a full needs assessment for training of MOE technical staff with a component of that assessment focusing on communal drinking water.	MOE
2.3	Review and approve draft source protection plans.	MOE
1.2	Conduct regular, random assessments of public health boards to ensure their compliance with the provincial Mandatory Health Programs and Services Guidelines and track, on an annual basis, trends in non-compliance by health boards to assess whether altered guidelines are required and resourcing allocations require adjustment to ensure full compliance.	MOH
2.9	Inspect septic systems as a condition for the transfer of a deed.	PG
2.42	Licence and periodically inspect, as required, environmental laboratories that offer drinking water testing and make continuing accreditation a condition of a licence.	MOE
2.40	Where remoteness dictates that samples for bacteriological analysis cannot be delivered to a lab either within regulated times or under guaranteed conditions, determine the feasibility of alternative means of providing microbiological testing that meet the requirements of Standard Methods.	MOE
2.44	Have municipalities review the management and operating structure for their water system to ensure that it is capable of providing safe drinking water on a reliable basis.	MUN
2.57	Approve and review operational plans as part of the approvals and inspections programs.	MOE
2.87	Review the current practices for the delivery of drinking water in bulk and the need for a regulatory framework in this area.	PG
Information, Communication, and Cooperation		
1.10	Maintain an information data system that includes all relevant information arising from an approval application process, in particular, information relating to the quality of source water and relevant details from expert reports and tests.	MOE
2.79	Create an Integrated Divisional System which provides central electronic access to information: • relevant to source protection • relevant to each drinking water system in Ontario (including a description of the system, trend analyses, water quality, and systems data) • required by the Drinking Water Branch (including for approvals and inspections) • required by local Boards of Health.	MOE
1.25	Proceed expeditiously to complete the design and implementation of the Integrated Development System. Include in that system the capacity for the creation and maintenance over time, in electronic form, of water system operator profiles consisting of any hydrogeological or other consultant's report relating to the water system; relevant operator chlorine residual measurements; past inspection reports; drinking water test results for a reasonable period; all operator responses to inspection reports; and all applicable Certificates of Approval, Permits to Take Water, Field and Director's Orders, occurrence reports, and information concerning the safety and security of public water sources and supplies.	MOE
1.6	Allow access to the MOE's proposed management information system by local health units and, where appropriate, the public, including access to profiles of municipal water systems and data concerning adverse drinking water quality sample test results.	MOE
2.43	Provide the results of laboratory accreditation audits to the MOE and the public.	PG
2.49	Make municipal contracts with external operating agencies public.	PG MUN
2.77	Establish a steering group within each public health unit area in the province, comprised of representatives of affected local hospitals, municipalities, local MOE offices and local boards of health, for the purpose of developing in a coordinated fashion emergency response plans for the control of, or the response to, infectious diseases and public health hazard outbreaks.	PG
1.5	Schedule regular meetings between the local MOE office and local health unit personnel to discuss public health issues, including issues related to waterworks facilities as documented in MOE inspection reports. Invite affected operator or laboratory to attend.	MOE MOH

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Recommendations of the Walkerton Inquiry (continued)

(Part Two recommendations take precedence over Part One recommendations where they differ.)

Recommendation (Each number shows first the part of the Inquiry, then the recommendation's number used during that part of the Inquiry)	**Summary of Recommendation**	**Responsibility**
1.18	Provide copies of MOE inspection reports to the manager of the water system, the members of the operating authority, the owner of the water system, the local Medical Officer of Health, the MOE's local office, and the MOE's Approvals Branch.	MOE
2.2	Ensure that draft source protection plans are prepared through an inclusive process of local consultation, where appropriate, managed by conservation authorities.	MOE
2.88	Invite First Nations to join in the watershed planning process.	PG
2.76	Initiate a process whereby the public can require the Investigations and Enforcement Branch to investigate alleged violations of drinking water provisions.	MOE
2.80	Prepare an annual "State of Ontario's Drinking Water Report" to be tabled in the Legislature.	MOE
2.86	For private drinking water systems not covered by regulation (Ontario Regulation 459/00 or Ontario Regulation 505/01), provide the public with information about how to supply water safely and ensure that this information is well distributed. Maintain the system of licensing well drillers and ensure the easy availability of microbiological testing, including testing for *E. coli*.	PG
2.8	Make conservation authorities (or, in their absence, the MOE) responsible for implementing local initiatives to educate landowners, industry, and the public about the requirements and importance of drinking water source protection.	CA MOE
2.64	Meet with stakeholders to evaluate existing training courses, determine the long-term training requirements of the waterworks industry, and play an active role in ensuring the availability of an array of courses on the subjects required to train operators.	MOE
2.62	Develop a comprehensive training curriculum for operators and consolidate the current annual training requirement and the proposed requirement into a single, integrated program.	MOE
1.21	In materials for water operator course examinations and continuing education courses, emphasize, in addition to the technical requirements, the gravity of the public health risks associated with a failure to treat and/or monitor drinking water properly, the need to seek appropriate assistance when such risks are identified, and the rationale for and importance of regulatory measures designed to prevent or identify those risks.	PG
1.27	On the basis of the needs assessment (Recommendation 1.26 – see above under "Analysis and Evaluation"), develop and maintain both introductory and advanced mandatory courses for environmental officers pertaining to communal drinking water systems. In these courses emphasize science and technology, including all matters that could present a risk to public health and safety; emerging pathogen risks; existing, new, and emerging treatment technologies; the limits of particular technologies; and the proper interpretation and application of government regulations, guidelines, and policies.	MOE
2.63	Take measures to ensure that training courses are accessible to operators in small and remote communities and that the courses are tailored to meet the needs of the operators of these water systems.	MOE
2.25	Have an Advisory Council on Standards provide advice In setting drinking water quality standards.	MOE
2.46	Provide guidance and technical advice to support municipal reviews of water systems.	PG
2.91	Require the Ontario Clean Water Agency to offer its services to First Nations band councils for operating on-reserve water systems on a normal commercial basis.	PG
2.92	Actively offer, on a cost-recovery basis, training facilities and curriculum to First Nations water system operators.	PG
2.93	Make technical assistance, drinking water testing, inspection, and enforcement available to First Nations communities on a cost-recovery basis, if requested.	PG
Research, Planning, and Advice		
2.65	Develop a comprehensive "source to tap" drinking water policy covering all elements of the provision of drinking water, from source protection to standards development, treatment, distribution, and emergency response.	PG
2.66	Be the lead ministry responsible for developing and implementing the "source to tap" Drinking Water Policy.	MOE
2.53	Initiate the development of a drinking water quality management standard, actively recruiting municipalities, the water industry, and other relevant stakeholders to take part in the development of the standard.	MOE
2.26	Give the Advisory Council on Standards the authority to recommend the adoption of standards for contaminants that are not on the current federal-provincial agenda.	PG
2.27	Consider whether to replace the total coliform test with an *E. coli* test.	ACS
2.29	Seek the advice of the Advisory Council on Standards regarding the desirability of a turbidity limit that is lower than the limit specified in the federal-provincial guidelines.	PG

ACS = Advisory Council on Standards; CA = Conservation Authorities; FG = Federal Government; FN = First Nations; HC = Health Canada; MOA = Ministry of Agriculture, Food and Rural Affairs; MOE = Ministry of Environment; MOH = Ministry of Health; MUN = Municipalities; PG = Provincial Government

Recommendation (Each number shows first the part of the Inquiry, then the recommendation's number used during that part of the Inquiry)	Summary of Recommendation	Responsibility
	Recommendations of the Walkerton Inquiry (continued) (Part Two recommendations take precedence over Part One recommendations where they differ.)	
2.30	Subject all raw water intended for drinking water to a characterization of each parameter that could indicate a public health risk and, regardless of the type of source, take the results into account in designing and approving any treatment system.	PG
2.31	Have the Advisory Council on Standards review the standards for disinfection by-products to take account of the risks that may be posed by the by-products of all chemical and radiation-based disinfectants.	PG
2.32	Support major wastewater plant operators in collaborative studies aimed at identifying practical methods of reducing or removing heavy metals and priority organics (such as endocrine disruptors) that are not removed by conventional treatment.	PG
2.1	Protect drinking water sources by developing watershed-based source protection plans and requiring them for all watersheds in Ontario.	PG
2.74	Increase commitment to the use of mandatory abatement.	MOE
2.75	Increase commitment to strict enforcement of all regulations and provisions related to the safety of drinking water.	MOE
2.46	Provide guidance and technical advice to support municipal reviews of water systems.	PG
2.50	Maintain the role of the Ontario Clean Water Agency in offering operational services to municipalities. Clarify the Ontario Clean Water Agency's status and mandate so that, In particular, it will be: • an arm's-length agency with an independent, qualified board responsible for choosing the chief executive • available to provide standby emergency capabilities.	PG
2.56	Require municipalities to have operational plans for their water systems by a fixed date.	PG
2.58	Work with Emergency Measures Ontario and water industry associations to develop a generic emergency response plan for municipal water providers and make a viable and current emergency response plan, and procedures for training and periodic testing of the plan, an essential element of mandatory accreditation and operational planning.	MOE
Funding		
2.78	Ensure that programs relating to the safety of drinking water are adequately funded.	PG
2.33	Provide adequate resources to support a water sciences and standards function in relation to drinking water.	MOE
2.7	Ensure that sufficient funds are available to complete the planning and adoption of source protection plans.	PG
2.16	Establish a system of cost-share incentives for water protection projects on farms.	PG MOA
1.17	Ensure that adequate resources are provided so that inspections are thorough and effective.	PG
1.28	Devote sufficient resources for technical training to allow the ministry to meet the challenges outlined in its "Human Resources Business Plan and Learning Plan for Fiscal Year 2000-2001."	MOE
1.2	Conduct regular, random assessments of public health boards to ensure their compliance with the provincial Mandatory Health Programs and Services Guidelines and track, on an annual basis, trends in non-compliance by health boards to assess whether altered guidelines are required and resourcing allocations require adjustment to ensure full compliance.	MOH
2.47	Require municipalities to submit a financial plan for their water system, in accordance with provincial standards, as a condition of licence for their water systems.	PG
2.48	Have municipalities plan to raise adequate resources for their water systems from local revenue sources, barring exceptional circumstances.	MUN
2.84	Require approved systems that are not economically viable under the improved regulatory scheme to explore all managerial, operational, and technological options to find the most economical way of providing safe drinking water. If the system is still too expensive, make assistance available to lower the cost per household to a predetermined level.	PG

Source: The Honourable Dennis R. O'Connor, Report of the Walkerton Inquiry – Part One: *The Events of May 2000 and Related Issues* (http://www.attorneygeneral.jus.gov.on.ca/english/about/pubs/walkerton/part1/), and Part Two: *A Strategy for Safe Drinking Water*, (http://www.attorneygeneral.jus.gov.on.ca/english/about/pubs/walkerton/part2/)Queen's Printer for Ontario, 2002

ACS = Advisory Council on Standards; CA = Conservation Authorities; FG = Federal Government; FN = First Nations; HC = Health Canada; MOA = Ministry of Agriculture, Food and Rural Affairs; MOE = Ministry of Environment; MOH = Ministry of Health; MUN = Municipalities; PG = Provincial Government

Notes

Introduction

1 Charles Perrow, Normal Accidents: Living With High-Risk Technologies, Basic Books, 1984

Article

1 The Honourable Dennis R. O'Connor, Report of the Walkerton Inquiry – Part One: The Events of May 2000 and Related Issues, Queen's Printer for Ontario, 2002 (http://www.attorneygeneral.jus.gov.on.ca/english/about/pubs/walkerton/part1/), Chapter 4, pp. 128-129. Biesenthal had applied manure at a rate of approximately twelve tons per hectare. That rate of application meant between 20 million to 20 billion fecal coliforms had been deposited on every square meter of land.

2 O'Connor, Part One, Chapter 4, pp. 106 & 120 and Colin N. Perkel, *Well of Lies: The Walkerton Water Tragedy*, McClelland and Stewart, 2002, p. 23

3 O'Connor, Part One, Chapter 4, pp. 106 & 113-116

4 O'Connor, Part One, Chapter 5, pp. 206-207, Chapter 7, pp. 235-236, and Chapter 9, pp. 279-282 & 285

5 O'Connor, Part One, Chapter 4, p. 123 and Chapter 9, p. 288

6 O'Connor, Part One, Chapter 5, pp. 185-188 and Chapter 9, pp. 338-341. Stan and Frank were certified as distribution operators rather than treatment operators.

7 Perkel, pp. 25-26

8 O'Connor, Part One, Chapter 5, pp. 185-188. For example, Stan Koebel claimed as six hours of training the two hours he spent showing the MOE's Michelle Zillinger around during the 1998 inspection.

9 O'Connor, Part One, Chapter 5, pp. 189-196 and Chapter 9, p. 300. Throughout the critical period when Well 5 was flooded with contamination, the operating sheet showed consistently perfect chlorine residuals of 0.75 mg/L. (O'Connor, Part One, Chapter 4, pp. 158-159)

10 For a discussion of the multi-barrier approach, see O'Connor, Part One, Chapter 4, pp. 108-112.

11 Researchers have found that 20% to 30% of gastrointestinal disease can be traced back to treated water when the raw water quality is poor. The amount of gastrointestinal illness drops to 15% or less when the raw water quality is good. (See The Honourable Dennis R. O'Connor, Report of the Walkerton Inquiry – Part Two: A Strategy for Safe Drinking Water, Queen's Printer for Ontario, 2002 (http://www.attorneygeneral.jus.gov.on.ca/english/about/pubs/walkerton/part2/), Chapter 6, p. 186)

12 O'Connor, Part One, Chapter 10, pp. 374-378

13 O'Connor, Part One, Chapter 10, pp. 372-373, 379-380, & 384-385

14 O'Connor, Part One, Chapter 8, pp. 255-257 and Chapter 10, pp. 380-395

15 *Ibid.* At the time of the Walkerton tragedy, the provincial government was prepared to further weaken the reporting of contaminated water. The committee responsible for the drinking water objectives was finalizing its plan to eliminate the need for the MOE to inform health units of adverse test results. Instead, sole responsibility for informing a health unit would be shifted to the waterworks operator. (O'Connor, Part One, Chapter 10, pp. 395-398)

16 O'Connor, Part One, Chapter 3, pp. 64-65, Chapter 10, pp. 398-399, and Chapter 13, pp. 454-457

17 O'Connor, Part One, Chapter 9, pp. 306, 332-335, and 351-352 and Perkel, p. 120

18 O'Connor, Part One, Chapter 4, pp. 155-156, Chapter 5, pp. 188-204, Chapter 6, pp. 227-228, and Chapter 9, pp. 287-288 & 299-317. The pattern of Walkerton operators not following proper procedures began early and extended to other areas. When Walkerton applied for approval to drill Well 5, the well had actually been drilled three months before – a practice that was not only illegal, but rare. When the MOE approved the well anyway, it told the PUC to construct a force main to allow chlorine to act on the water for the required fifteen minutes before the water was discharged into the distribution system. The force main was not added to the system and for nine months the system operated illegally and unsafely before another solution was found. (O'Connor, Part One, Chapter 9, pp. 278-279 & 286-287) The Koebels also altered records in preparation for inspections. For example, before the February, 1998 inspection, all monthly sheets of chlorine residual except for February's were removed from the well sites. February's sheets were then altered by replacing with the number 0.4 all the dashes that had been entered when no reading was taken. This deviated from the normal practice of entering 0.5 or 0.75 and, although 0.4 mg/L was not an acceptable level, it left the impression that the numbers on the sheets were real. (Perkel, p. 34)

Chlorine residuals below 0.4 mg/L should not be a surprise because, based on the faulty practices used by the Koebels, it was not possible to maintain a chlorine residual greater than 0.4 mg/L during periods when the quality of raw water was poor. After the tragedy, one expert estimated that for Well 5 the maximum chlorine residual possible using PUC procedures was 0.4 mg/L. Another expert, using records of chlorine use and water withdrawals, estimated that the average chlorine residual for Well 5 water would have been 0.44 mg/L. Although the second estimate appears to be different from the first, for all practical purposes they are telling the same story. The

estimate of the average residual means that during periods when the quality of the well water was good, the chlorine residual was high – possibly higher than necessary, thus, explaining why some residents complained about the chlorine taste. When the well water was contaminated, the chlorine residual would have plummeted as the chlorine did its job disabling bacteria and other pathogens. During those periods of contamination, it would have been impossible to maintain chlorine residual even close to a safe level.

19 O'Connor, Part One, Chapter 9, p. 272 and Perkel, p. 55

20 O'Connor, Part One, Chapter 5, pp. 198-204

21 O'Connor, Part One, Chapter 9, p. 298 and Chapter 11, pp. 413-415 and Part Two, Chapter 3, p. 72. The MOE operating budget fell from $363 million in fiscal year 1990-91 to $174 million in fiscal year 1999-2000. MOE staff was reduced from 2,306 in 1990-91 to 1,374 in 1999-2000.

22 O'Connor, Part One, Chapter 11, pp. 404-405 & 409-413

23 O'Connor, Part One, Chapter 11, pp. 407-408

24 O'Connor, Part One, Chapter 9, pp. 302-306, 317, & 328-330

25 O'Connor, Part One, Chapter 7, p. 236 and Perkel, pp. 38-39

26 O'Connor, Part One, Chapter 7, p. 237

27 O'Connor, Part One, Chapter 9, pp. 325-327

28 O'Connor, Part One, Chapter 9, pp. 288-295. The three times that the MOE had the opportunity to add conditions to existing approvals were: 1992 when model conditions for approvals were developed, 1994 when the drinking water objectives changed so that continuous monitoring of chlorine residuals was required for wells under the direct influence of surface water and without filtration, and 1996 when the model conditions were revised.

29 O'Connor, Part One, Chapter 8, pp. 249 & 251

30 O'Connor, Part One, Chapter 8, pp. 251-252

31 O'Connor, Part One, Chapter 8, pp. 253-255

32 O'Connor, Part One, Chapter 12, pp. 428-432

33 O'Connor, Part One, Chapter 12, p. 429

34 Based on O'Connor, Part One, Chapter 12, pp. 429-432 and *Environmental Protection Act*, RSO 1990, c. E-19, s. 1(1)(a)-(h), 14(2), & 15(2). Normal farm practice is "a practice that … is conducted in a manner consistent with proper and acceptable customs and standards as established and followed by similar agricultural operations under similar circumstances."

35 O'Connor, Part One, Chapter 13, pp. 449-450

36 O'Connor, Part One, Chapter 5, pp. 204-206 and Chapter 6, pp. 218 & 224-229

37 O'Connor, Part One, Chapter 3, pp. 58-97 & 101, Chapter 4, pp. 132-134 &161, and Chapter 9, p. 324 and Perkel, pp. 69-70.

38 Stan Koebel's "remedial" efforts at flushing and chlorinating the system were uninformed. He did not know what was causing the contamination, where it was coming from, and whether his efforts would make a difference. His actions show that he mistakenly thought that Well 7 was the problem, though later he denied he was trying to cover-up his mistake with the chlorinator. His efforts were also ineffective. Even after adding more chlorine and flushing the system on May 19th, chlorine residuals only reached between 0.01 an 0.10 mg/L within the Town's distribution system. (According to MOE records, Koebel reported that the May 19th residuals were ten times higher (0.1 – 1.0 mg/L) and, for the upper end of the range, higher than the residual supposedly measured at the wellhead.) By the next day, the chlorine residual in the distribution system increased to 0.23 mg/L, but Koebel turned on Well 5 and the residual in the system dropped to 0.19 mg/L. It should be noted that, even if Stan Koebel or MOE staff had been paying attention to the requirements, the low levels of chlorine residual would not necessarily have caused alarm since the guidelines only required that residuals in the distribution system be "detectable". (O'Connor, Part One, Chapter 4, p. 162)

39 Even when they knew that at least one of the causes of illness was *E. coli* O157:H7, the health unit did not initially suspect that water was the source of the problem. In the past, infections from *E. coli* O157:H7 – often referred to as "hamburger disease" – had normally come from contaminated food, not water. The provincial government did not give health units direction on issuing boil water advisories. Instead, the provincial government relied on the knowledge and discretion of the Medical Officer of Health as to if, when, and how a boil water advisory would be used. (O'Connor, Part One, Chapter 8, p. 258)

40 O'Connor, Part 1, Chapter 1, p. 6 and Chapter 2, pp. 48-52, "Walkerton drinking water caused kidney problems," *Toronto Globe and Mail* (http://www.theglobeandmail.com/servlet/ArticleNews/TPStory/LAC/20050528/NATS28-3/TPNational/?query=walkerton), and Arlene Richards, "The Walkerton Health Study," *Canadian Nurse*, v. 101, no. 5 (May, 2005), pp. 18-21

41 O'Connor, Part One, Chapter 15 and O'Connor, Part Two, Chapter 1. A summary of the implementation of the 28 Part One recommendations can be found on http://www.ene.gov.on.ca/envision/water/sdwa/status_part1.htm. A summary of the implementation of the 93 Part Two recommendations can be found on http://www.ene.gov.on.ca/envision/water/sdwa/status_part2.htm

42 Colin Perkel, "Total cost of Walkerton water tragedy pegged at $155 million" (http://www.canoe.ca/EcoliTragedy/011126_ecoli-cp.html), David W. Eryou, "Risk Analysis of the Livestock Industry," Manure Management 2003 Conference, Lethbridge, Alberta, June 24-26, 2003, (http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/sag7032?opendocument), and Dr. Murray McQuigge, Recovery and Continuity Session, *Counter-Terrorism and Public Health*, conference proceedings,

October 29-November 1, 2003, Toronto, Ontario, Canadian Public Health Association and Centre for Emergency Preparedness and Response, Health Canada (http://www.cpha.ca/splct/CTPH_finalreport1.pdf). As of February 24, 2005, the Ontario Government had paid $54 million as part of the settlement of a class action lawsuit. (http://www.walkertonclassaction.com/statistics.html).

[43] Colin Perkel, "Jailed for a year, water manager Stan Koebel hopes Walkerton will forgive him," Canadian Press, December 20, 2004 (http://www.medbroadcast.com/health_news_details.asp?news_id=5582&rss=67)

[44] In addition to the factors shown in Figure 1, several other factors were considered in the aftermath of the tragedy, but not found to be significant. These factors included the diversion of time and energy away from water issues because of the restructuring of Ontario's electrical power industry, the changes in responsibilities and the urban-rural balance of power brought about by municipal amalgamation, the downloading of formerly provincial responsibilities onto municipalities, the finances of the Walkerton PUC, and employee morale at the MOE. (O'Connor, Part One, Chapter 12) In terms of the analogy to defective parts in a machine, people are, without dishonoring their abilities or their contributions, components of a system that, like all components, do not independently and mysteriously fail. Their failure is the effect of another cause. For an engineering discussion of this in terms of the Walkerton tragedy, see Nancy Leveson, Mirna Daouk, Nicholas Dulac, and Karen Marais, "A Systems Theoretic Approach to Safety Engineering," Aeronautics and Astronautics Department, Massachusetts Institute of Technology, 2003 (http://sunnyday.mit.edu/accidents/external2.pdf)

[45] O'Connor, Part Two, Chapter 3, p. 78, citing S.E. Hrudey et. al., "A fatal waterborne disease outbreak in Walkerton, Ontario: Comparison with other waterborne outbreaks in the developed world," proceedings at the International Water Association World Water Congress Health Related Water Microbiology Symposium, Melbourne, Australia, April 7-12, 2002.

[46] O'Connor, Part One, Chapter 4, pp. 106-107

[47] "Civilized Ill-Will, Self-Evident Rationality, Faith-Based Consent, and Selfless Authoritarianism: Definitions of Decision-Making," *Moving Beyond Now*, v. 1, no. 3 (July, 2004), p. 4

[48] O'Connor, Part One, Chapter 9, pp. 337-338

[49] O'Connor, Part One, Chapter 1, p. 13 and Chapter 9, pp. 268 & 295-296, O'Connor, Part Two, Chapter 2, pp. 61-69 citing from Executive Resource Group, *Managing the Environment: A Review of Best Management Practices*, 2001, and Perkel, pp. 191 & 222-223. The provincial government was particularly creative in its denials. For example, when asked during the inquiry what it would have taken to review all existing waterworks approvals such as Walkerton's to determine what conditions should be applied, the MOE replied that a "relatively small number of additional resources" were needed. However, when the Auditor General had previously asked the question, the MOE stated that there would be a "significant workload and expense."

Mike Harris denied that he knew there was a risk to public health from his government's cost-cutting, saying that his job was to improve the provincial government's finances and that "the biggest risk to the people of Ontario was doing nothing."

After witnessing the events in Walkerton, the provincial government hired consultants to advise it on how to strengthen its environmental regulation. The authors responded as if the Walkerton tragedy had never happened. They criticized the MOE for using a command and control approach, not delegating responsibility to others, relying too heavily on risk management, and not concentrating enough on "innovative compliance mechanisms." The report recommended, among other things, more partnerships, more cooperation, more sharing of responsibility (including self-regulation by industry), and more flexible regulation. (See Executive Resource Group, *Managing the Environment: A Review of Best Management Practices*)

[50] "Aesop's Fables, Informed Consent, and Social Engineering: The Trouble With Risk Analysis," *Moving Beyond Now*, v. 1, no. 2 (May, 2003), p. 15. For a discussion of plausible deniability, see http://en.wikipedia.org/wiki/Plausible_deniability. The conventional use of the term presumes some forethought to avoid blame. As in the Walkerton tragedy, denials manufactured after the fact are equally potent. The key goal is to eliminate plausibility for those who were wrong – whether or not they thought up their excuses ahead of time.

[51] O'Connor, Part One, Chapter 6, p. 222

[52] Based on O'Connor, Part One, Chapter 6, p. 223. All of this, of course, must be done without alienating those who are competent and those who have the potential to be competent.

[53] O'Connor, Part Two, Chapter 3, p. 74

[54] This assumes, of course, that a society and its government believe in serving the public interest and, therefore, have a responsibility to protect people against risks that those people do not understand or would prefer to ignore. However, even in a society or government not committed to serving the public interest, most decision-makers would have a self-interest in regulating water systems so that society and their own personal advantages are not debilitated by the higher health care costs and lost productivity that come from the choices made by the foolish or unaware.

[55] Rules and procedures are the ***social contract*** made explicit. In terms of the safety of water supply, the contract is a trading away of liberty in exchange for protection, similar to the more elementary and authoritarian idea of a social contract advocated by Thomas Hobbes (*Leviathan*, Chapters XIII – XVI (http://wikisource.org/wiki/Leviathan/The_First_Part:_Of_Man#Chapter_XIII:_Of_the_Natural_Condition_of_Mankind_as_Concerning_Their_Felicity_and_Misery), and Chapters XVII-XXI & XXV

(http://wikisource.org/wiki/Leviathan/The_Second_Part:_Of_Commonwealth#Chapter_XVII:_Of_the_Causes.2C_Generation.2C_and_Definition_of_a_Commonwealth). The contract is particularly important to consumers of water because they are at the mercy of people whose decisions are, on a day-to-day basis, beyond accountability because of the complex and routine nature of those decisions.

56 For a different view, see O'Connor, Part One, Chapter 9, pp. 295-296.

57 O'Connor, Part One, Chapter 9, pp. 301-322, 330, & 347-354

58 "Civilized Ill-Will," p. 6

59 Those who are dissatisfied, of course, have the options of going to the provincial Cabinet or the courts to challenge the MOE's opinion of itself. On routine matters at least, those options are no better than self-regulation since the issue of MOE performance in protecting public health is a scientific and technical question that political deliberations and legal challenges are ill-equipped to handle.

60 In addition to the standard oversight provided by the Provincial Auditor and Ontario's Environmental Commissioner, the Government of Ontario has implemented several measures to provide greater supervision of the MOE. These include legal requirements for

- annual inspection of all municipal drinking water systems serving a residential development of six or more private residences
- mandatory reporting of inspection results to the local health unit
- notification of the local health unit when an order concerning an imminent drinking water health hazard or a notice of emergency response has been issued
- greater coordination and cooperation between the MOE and health units
- notification to those who alert the MOE of possible wrongdoing of either the results of an investigation or the reasons why an investigation was not conducted
- publicly available annual reports on drinking water
- the Advisory Council on Drinking Water Quality and Testing Standards which can make non-binding recommendations to the MOE.

These measures can aid in making the MOE more accountable for its decisions. However, they do not hold the MOE to the same standards imposed on the owners of municipal drinking water systems in two key areas: liability and finances.

- **Liability:** While the owners of municipal systems are required to exercise the level of care, diligence, and skill of a prudent person and to act honestly, competently, and with integrity, MOE employees are, for the most part, protected from personal liability when acting in good faith and are not liable for the actions of the organizations responsible for accrediting operating authorities and drinking water testing.
- **Finances:** The owners of municipal systems are required to follow financial plans identifying the full cost of the services they provide and how those costs will be recovered. Similar financial requirements are not imposed on the drinking water regulatory activities of the MOE.

61 "Matching Management Style with Public Views: The Case of Alberta's *Water Strategy*," *Moving Beyond Now*, v. 1, no. 2 (May, 2003), p. 27

62 Based on Chris Phoenix and Mike Treder, "Applying the Precautionary Principle to Nanotechnology," Center for Responsible Nanotechnology, 2004 (http://www.crnano.org/precautionary.htm) and O'Connor, Part Two, Chapter 3, pp. 76-78. The precautionary principle does not have a specific meaning that would find consensus among its advocates. One of the better general definitions of the precautionary principle is "[w]hen an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically." ("Wingspread Statement on the Precautionary Principle" cited in Joel Tickner, Carolyn Raffensperger, and Nancy Meyers, *The Precautionary Principle in Action: A Handbook*, Science and Environmental Health Network, n.d. (http://www.biotech-info.net/handbook.pdf), p. 19)

63 Based on Tickner, et. al., pp. 4-5

64 "Aesop's Fables," pp. 13-17

65 The need for regulation that frees ordinary people from devoting time to looking after an interest they have in common with other members of society was recognized as early as the fourth century BCE. See Aristotle, *Politics*, translated by H. Rackham, Harvard University Press, 1944, Book IV, 4.1292b (http://www.perseus.tufts.edu/cgi-bin/ptext?doc=Perseus%3Atext%3A1999.01.0058&layout=&loc=4.1292b)