



Interior Health

Internal Audit...adding value across the region

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Drinking Water Program Audit

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EXECUTIVE SUMMARY

This audit evaluates the overall performance of Interior Health Authority's Drinking Water Program, specifically its performance as the regulator of large drinking water systems (with more than 300 connections) across the health authority region.

The Internal Audit Team included a subject matter expert from the University of Alberta as well as a water program specialist from another Health Authority.

During February and March 2011, Internal Audit interviewed a sample of 16 Health Protection team members who are responsible for the administration and enforcement of the Drinking Water Protection Act and the Drinking Water Protection Regulation. As well, Internal Audit interviewed 16 large water purveyors (including both political representatives as well as administrative and technical staff) representing various geographic areas and selected BC Health Authorities and relevant Ministry representatives for their insights into Interior Health's Drinking Water Program.

CONCLUSION

In Internal Audit's opinion, based on the interviews conducted and documents reviewed, the Interior Health's Drinking Water Program is achieving the expectations as laid out by the Act, as interpreted using the multiple barrier approach for assuring safe drinking water which Interior Health has adopted as the basis for their program. Further, many of the recommendations in the Ombudsman's 2008 report "Fit to Drink: Challenges in Providing Safe Drinking Water in BC" have been addressed. Lastly, Interior Health's Drinking Water Program is consistent with the other health authorities in overall direction, though there are some notable differences in policy and implementation approaches.

KEY FINDINGS

The regulatory challenge faced by Interior Health's Drinking Water Program is likely greater than any other comparable region in Canada. Maintaining a regulatory program which assures consistent delivery of safe drinking water in this region is inherently a complex, knowledge-intensive undertaking.

- Interior Health (IH) Health Protection staff are thoroughly engaged and fully committed to the principles of safe drinking water for IH residents.
- The program oversight provided by Medical Health Officers as specialists in community medicine has served the program well.
- The IH region includes many water supplies whose sources require substantial treatment to assure safety compared with other B.C. regions where human activities are restricted in source water sheds with corresponding reduction of risk. IH's sources are also more subject than other regions for geophysical reasons to seasonal and episodic turbidity that may be associated with pathogens or may impair disinfection efficiency.

- Microbial pathogens anywhere are a pervasive risk because they occur in human fecal wastes and fecal wastes of pets, livestock and wildlife. Reducing exposure from human, pet and livestock substantially reduces, but does not eliminate microbial pathogen risk.
- The water purveyor administrative, technical and operational staff interviewed for this audit was in fairly consistent agreement with IH goals with only some details of how to achieve goals in dispute: the filtration deferral policy, calling water quality advisories based on fixed turbidity targets and the water purveyors' understanding of requirements for source control as a condition on permit. The most consistent concerns about IH's Program were largely related to how purveyors would finance the required water system improvements.
- One community which is currently not in compliance with its conditions on permit indicated that it had a high risk system failure, but argues that it handled the incident well. This incident must be viewed as a critical warning and it needs to serve as a learning experience to be shared more widely among water purveyors in the province.
- Because of the large number of water systems which IH regulates, even for the larger water systems, IH staff are not in a position to watch over and prevent local errors which could lead to a waterborne disease outbreak. This reality supports a case for the Program focusing, as it has done in most cases, on getting the treatment systems in place operated by knowledgeable and responsible operators who have a good rapport with IH to reduce the likelihood of a catastrophic failure from occurring.
- Although IH has completed many of the recommendations in the Ombudsman's 2008 report, a number of recommendations cannot be achieved without a more functional information management system. The suitability of the current information system, Hedgehog, severely limits the Program to monitor lab results and provide water purveyors and the public with the information they require.
- Overall, much progress has been made in raising the importance of water quality improvement in the region, with some clear wins for implementation of improvements. In many other cases the easy improvements have been achieved and the much tougher and expensive issues remain to be resolved.

SUMMARY OF RECOMMENDATIONS

Note: for ease of reference, the numbers in brackets () relate to specific recommendation numbers within the report.

The President & CEO should request the Ministry of Health to:

1. Coordinate a review of the conditions under which colour or turbidity will substantially interfere with Ultra Violet (UV) disinfection to provide a province-wide evidence base for judging the potential for using UV as an alternative barrier for microbial hazards usually managed by filtration (4).
2. Develop a province-wide communication to water technical and administrative staff and interested elected officials to highlight current evidence on actual health risks from chlorination disinfection by-products so that those individuals will be best-equipped to understand the issues and reduce public misconceptions about chlorine disinfection (5).
3. Develop a province-wide policy requiring the maintenance of a chlorine residual for groundwater systems from confined aquifers if the distribution system involves any storage (7).
4. Revisit the upgrading of Health Protection information systems across all Health Authorities to facilitate the efficient tracking of key data set information, program successes and ongoing regulatory issues across the province (17).
5. Update the BC Drinking Water Officer's Guide to provide consistent guidance for all Drinking Water Officers, share leading practice and to provide improved transparency to water purveyors as to the foundation of provincial program decisions (22).
6. Explore opportunities to enhance the Drinking Water Act and Regulations to better define the outcomes intended to be achieved (23).

The *IH Health Protection Team* should:

1. Review the conditions on permit regarding source control. The conditions should reflect the realities of differing conditions for different water purveyors and focus on source assessment, rather than control, in cases like those where purveyors have committed to 4-3-2-1-0 Drinking Water Objective and have no control over the watershed. In these cases, the emphasis should be on a source assessment to identify threats and the development of feasible response plans (1).
2. Examine all the large water systems to identify those systems needing more urgent resolution because of evident source hazards and inadequate or no treatment. All conditions on permit should be regularly updated and reflect the current identified hazards and other related risks (2).

3. Consider whether the need for a filtration barrier for surface water can be satisfied in some cases without requiring filtration if source water characteristics can be shown to allow alternate technologies such as UV to address the protozoan pathogens that normally require filtration (3).
4. Review requirements for all large water purveyors to assess the contamination risks of their distribution systems and provide the assessment along with a remediation plan to Health Protection (6).
5. Evaluate the water purveyor monitoring and data management practices currently used by other Health Authorities to identify opportunities to improve current IH practices for tracking and monitoring the performance of water purveyors and receiving lab results. Resolution of the current limitations with the Hedgehog information system may be necessary to implement better electronic management of monitoring data (8).
6. Regularly assess the water purveyors' sampling programs to ensure effective representative sampling programs are established and maintained (9).
7. In conjunction with the BC Centre for Disease Control and accredited laboratories, explore all reasonable options to overcome the sample shipping time problem for remote communities to ensure that adequate monitoring results are obtained (10).
8. Develop educational programs, using a water safety plan approach, designed to maximize the ability of water purveyors to improve their knowledge of their own sources and systems and increase capacity across the industry (11).
9. Ensure all water purveyors have emergency response and contingency plans in place, provide summary reports on an annual basis and work with the water purveyors to continually improve the plans and reports (12).
10. Continue to promote to the IH regulated community that the 4-3-2-1-0 Drinking Water Objective is a province-wide treatment objective for surface water or groundwater at risk of pathogens to counter the common perception that this objective is unique to IH (13).
11. Review the filtration deferral program and consider revising it to be a filtration *exemption* program. Consider conducting this review in consultation with technical staff from responsible water purveyors to assure that it is clear and perceived to be reasonable by those water purveyors who have shown a responsible perspective on meeting water improvement goals (14).
12. Consistently adhere to the Turbidity Decision Tree and make it clear to water purveyors that the Turbidity Decision Tree, is being used across the Province for making decisions on when to call a Water Quality Advisory (15).
13. Review the Fraser Health Authority's website, the Vancouver Coastal Health Authority's 'Annual Report to Water Purveyors' template as well as internal policies and guidelines from the other provincial health authorities to determine which, if any, can be adapted readily to support IH activities (16).

14. Develop and implement a comprehensive, yet realistic, facility inspection, lab data interpretation and analysis as well as reporting protocol to achieve consistent practice across all IH offices. This protocol should, to the extent practical, involve the Public Health Engineers working closely with the Water Quality Technical Specialists. Also, further education for the Team as to risk definitions and the use of progressive enforcement would improve the performance of the Program. (18).
15. Work with the IH's Health Emergency Management Team and Site Managers to ensure that site emergency response plans for utility service disruption includes contingency plans for water quality advisories (i.e. supplying of bottled water, installing point of use systems etc) (19).
16. Consider requiring water purveyors to provide water quality analyses covering chemical and physical parameters to allow assessment of chemical risks in drinking water sources. Any source exceeding the Canadian Guideline should be reviewed by the Drinking Water Officer to determine the need for remedial action (20).
17. Request that the water purveyors provide a report of any major incidents or close calls for serious contamination failures which can serve for future training of the water purveyor's staff as well as the Health Protection Team (21).

MANAGEMENT RESPONSE

Provided by Martin McMahon, VP Planning and Strategic Services on behalf of the Health Protection Team (including the Chief Medical Health Officer) and the President & CEO.

We would like to acknowledge the work that has been undertaken by the audit team and the support which has been provided by the independent consultants who joined the audit team for this project. The consultants' credentials in water quality management bring a high degree of professional and technical credibility which has ensured that independence has been brought to bear during the audit process.

The report frames the complexity of both water provision and water quality monitoring and recognizes that the Interior Health's Drinking Water Program operates in possibly one of the most complex regulatory environments in Canada. The report confirms the view that the program is meeting the expectations laid out in the Act and that good progress has been made in implementing the recommendations of the 2005 Ombudsman's Report, "Fit to drink". However, we acknowledge that the audit team has made recommendations for improvement. To this end, we will be working diligently over the coming months to implement these recommendations.

Specific to the recommendations directed to the CEO, we share the concern that the regulatory environment in British Columbia is predicated on an outcome based system. As such, there will inevitably be some variations between Health Authority approaches, however, we concur that broad provincial direction is preferred on several key, largely scientific, issues such as UV efficacy, disinfection bi-product formation standards and chlorination requirements for groundwater, the definition of Groundwater Under the Direct Influence of Surface Water (GUDI) in the context of unconfined aquifers and the criteria for filtration in the province. The issue of data management is a serious concern. Investment is required to improve data management to ensure timely and accurate data is available to our staff to support evidence based decision making, as well as improving the information to the public to help them better understand the risks and choices open to them. We are asking that IH view this as a priority area for investment.

We concur with the recommendations directed to our Health Protection Team and are anxious to work toward implementation. The auditors noted variation in practise and we will be taking steps to address this as part of our action plan.

Overall the recommendations can broadly be categorized into four core areas: refining IH outcome objectives, improving communications, inspectional efficiency and process monitoring. With respect to IH outcome objectives, we have already started to evaluate alternative treatment options, filtration deferral criteria and are reviewing our graduated enforcement processes. In the communication area we recognize that our program attracts considerable criticism, but that criticism is often rooted in the notion that the risks are low and the costs of reducing those risks are too high. We need to be more proactive in our

communication strategy and fully support incident reporting, better data management, more robust tracking of conditions on operating permits and an enhanced web presence. This along with clearer articulation of provincial standards, IH objectives such as 4-3-2-1-0 and the unique challenges that turbidity presents in our region will support a more informed public and ultimately aide in greater public understanding for the necessary costs of enhanced water treatment. We have started work to improve our inspection processes and have developed enhanced risk assessment tools, source protection strategies and better integration between Public Health Engineers, Drinking Water Officers and the clients they serve. Process monitoring improvements will include better laboratory utilization and improved sampling and shipping logistics, a sharper focus on emergency planning, developing of a 'WaterSafe' approach along with industry and post secondary institutions and finally assisting internally to help IH Managers recognize and manage the risks water supply can present to our own health care facilities.

It's important to restate the high degree of public risk that is associated with this program, risks, which on a scale, if they were to be realized, would probably be larger than any other experienced by residents of the interior. This single program may represent the highest area of risk for the health authority. The staff and physicians who over see this program, are to be commended for the quality of their work and their commitment to safe drinking water for the residents of the interior. Water is by its nature a public concern, but more than many other areas, it is also a political concern. The report recognizes that, among other jurisdictions, BC has much catching up to do with respect to capital investment and infrastructure needed to support high quality drinking water. As the agency tasked with enforcement of the Act, it is inevitable that we will find that we are not always in agreement with the opinions of the water providers, nor of the politicians, who are the publicly elected officials challenged with the very difficult task of balancing over sight with their fiduciary accountabilities to the tax payer. It is with this challenge in mind that the focus of the program and of the decisions that we make, public safety will take centre stage.

DETAILED REPORT

BACKGROUND TO THIS AUDIT

Ensuring the public has clean, safe, and reliable drinking water is a priority for Interior Health (IH) and specifically, Health Protection staff and Medical Health Officers, who are entrusted by the public to ensure that drinking water is safe and of high quality. This objective is pursued by means of the IH Drinking Water Program (the “Program”) which seeks the reduction of background illness in a community with improved health indicators while assuring prevention of a waterborne disease outbreak.

Arguably, since its creation in 2001, IH has faced the most challenging regulatory landscape for drinking water among any of Canada’s “have” provinces (Alberta, B.C. and Ontario). This challenge arises because of the nature of the provincial regulatory system which IH must implement, the exceptional number of water purveyors to be regulated in IH region, the number of systems requiring major improvement to meet current drinking water standards, the diversity of governance for drinking water systems in the region, the substantial infrastructure deficit which many systems have accrued and the inadequacy of water rates in many communities to meet infrastructure funding needs.

The *Drinking Water Protection Act* (2001) (the “Act”) covers all water systems other than single-family dwellings and outlines requirements for water suppliers in terms of ensuring that the water supplied to their users is potable as well as any additional requirements established by the *Drinking Water Protection Regulation* (the “Regulation”) or by the water supply system's operating permit, as established by the Drinking Water Officers. The Act and the Regulation have established the basis for all Regional Health Authorities to deliver a drinking water program. The Act is intended to be outcome-based, but the Act provides very little tangible direction and neither the Act nor the Regulations adequately define the intended outcome. These matters are explained in our findings with respect to the audit objectives.

The BC Drinking Water Officer’s Guide (the “Guide”) is used with respect to administering, enforcing, and applying discretionary authority under the provisions of the Act and the Regulation and provides general recommendations on some intended outcomes. The Guide serves as a companion document and provides for more detailed advice on roles and responsibilities of Drinking Water Officers under the Act and Regulation.

The Guidelines for Canadian Drinking Water Quality (the “Canadian Guidelines”) are another source available to assess the safety of drinking water and help determine treatment needs, but the Canadian Guidelines have no legal status under the Act or Regulation. While all health authorities within BC use the Canadian Guidelines to support the same general outcomes, different health authorities have different approaches with respect to interpretation and implementation, partly because the Act, Regulations and other provincial guidance do not provide detail on the specifics of the intended outcomes.

The IH region includes approximately 1900 identified water systems - the largest number of systems in any health authority in British Columbia. This report focuses on 83 of the largest systems in the region which serve over 80% of the population of IH.

Water suppliers or purveyors in the IH region have been accustomed to a historical perspective that water sources in B.C. are inherently natural and presumed to be pristine and therefore safe. In contrast, B.C. has experienced the highest rates of gastrointestinal disease among Canadian provinces and an inordinate number of waterborne disease outbreaks. Conventional levels of treatment for surface water supplies that are accepted elsewhere in Canada have only been adopted by some communities in the IH region during the last decade. Water systems themselves vary in complexity and sophistication from simple deep well systems in confined aquifers to large systems supplied by open multiple-use surface watersheds requiring multi-stage treatment and involving complex distribution systems. As well, the water system operators vary in training from home owners with various backgrounds, to recent graduates, to unionized public works employees who are in positions based on seniority, and in some cases professional engineers.

Water purveyors are the owners of the water systems and are responsible for testing, issuing notices and advisories, planning for emergencies, and reporting. Water purveyors across IH include: municipalities, regional districts, improvement districts, irrigation districts, independent water utilities, private companies, water user communities and unorganized groups of neighbours. These multiple governance structures provide a program delivery challenge as the different suppliers are both publicly and privately owned and are of varying sizes and abilities to raise funds to improve and maintain water systems. Some water purveyors have not practised sustainable asset management, allowing substantial infrastructure deficits to develop. Water rates in some cases are inadequate to finance asset management let alone newly required treatment improvements.

The overall accountability for the Act is through the Medical Health Officers, who are appointed Drinking Water Officers, to the Provincial Health Officer on behalf of the Minister of Health. Working under delegation from the Medical Health Officers, the Water Quality Technical Specialists are delegated Drinking Water Officers, Public Health Engineers as well as other members of the Health Protection Team, are responsible for the monitoring of drinking water systems and the administration and enforcement of the Act and the Regulation ensure water suppliers take appropriate actions.

For the large systems, the four Water Quality Technical Specialists are based in Cranbrook, Penticton, Kelowna and Kamloops and are assigned water purveyors in four geographic areas: 1) East and West Kootenay and Boundary, 2) South Okanagan, 3) Central/North Okanagan and 4) Thompson, Cariboo and Shuswap regions. The vast majority of systems in the small to medium size range are regulated by 45 Environmental Health Officers who are also delegated Drinking Water Officers. The Health Protection team is led by the Regional Director who reports to the Vice President Planning and Strategic Services.

IH uses the Hedgehog software system and a database as key tools to record water quality data and to generate water quality reports. The suitability of this information system for the purposes of the Program is a major issue which has a bearing on the ability of the Program

to report to management and to provide water purveyors and the public with the information they require.

An audit of IH's Drinking Water Program was included in Internal Audit's 2010/2011 Audit Plan at the request of the Board of Directors which has a program oversight role. The Drinking Water Program was identified as a higher risk program due to the potential significant health risk to the general public should the IH Program not be effective, as well as to address concerns expressed by the water purveyors as to the consistency of the IH Program both internally as well as compared with other health authorities.

The purpose of this audit is to evaluate the overall performance of IH's Drinking Water Program.

IH's Drinking Water Program along with similar programs in other health authorities were reviewed by the provincial Ombudsman in 2008, in response to public complaints. Resulting from the "Fit to Drink: Challenges in Providing Safe Drinking Water in BC" report were 34 recommendations. The audit team has reviewed the Ombudsman's findings and recommendations to reduce duplication of previous efforts.

Due to the complexity of the Program, many abbreviations are used throughout this report. Appendix 1 contains a listing of all abbreviations used and their definitions for reference.

OBJECTIVES

The objectives of this audit were to:

1. Assess how well IH's Drinking Water Program is achieving the expectations as laid out by the Act and the related Regulations through the application of the Guide and IH policies to large systems (WS1s).
2. Evaluate the completion of recommendations relating to large systems in the Ombudsman's 2008 "Fit to Drink: Challenges in Providing Safe Drinking Water in BC" report.
3. Identify significant differences, if any, between IH's Program and that of other health authorities in BC.
4. Identify leading practices both across IH as well as in other health authorities for potential implementation across IH.

METHODOLOGY AND SCOPE

To complete this audit, the Internal Audit team, comprising of the Director, Internal Audit, a Professor Emeritus in the Environmental and Analytical Toxicology Division of the Faculty of Medicine and Dentistry at the University of Alberta and a seconded Water Specialist from Vancouver Coastal Health adopted the following methodology:

- Reviewed provincial and IH drinking water quality requirements that are expected to be implemented for large sized systems.
- Reviewed the Ombudsman’s 2008 report “Fit to Drink”, as well as other provincial audit reports.
- Interviewed 16 delegated Drinking Water Officers, Public Health Engineers, Medical Health Officers and other key program staff at various Health Protection Offices (Appendix 2).
- Reviewed a sample of drinking water files at each of the four offices.
- Interviewed a sample of 16 water purveyors (elected officials/ administrative/ technical staff to determine the uniform application of the program requirements and the effectiveness of the communication links (Appendix 2).
- Interviewed other BC health authorities (Vancouver Island, Fraser and Vancouver Coastal) and the Provincial Drinking Water Officer as well as other representatives from various BC government ministries involved with the provision of safe drinking water (Appendix 2).
- Analyzed internal reports to evaluate their effectiveness.
- Performed additional tests and procedures as deemed necessary.

Based on the impact of potential health related risks, included in the scope of the audit were the large sized water systems with greater than 300 connections, categorized as WS1s. Smaller systems were not examined. Also, the scope of the audit included the administrative processes in effect to deliver the program. Testing was limited to interviews and observation. Drinking water samples were not collected and analyzed to test the sufficiency of monitoring controls, however file records of water quality data were considered.

KEY AUDIT FINDINGS AND RECOMMENDATIONS – BY AUDIT OBJECTIVE

OBJECTIVE 1

Assess how well the Drinking Water Program is achieving the expectations as laid out by the Act and other relevant legislation through the application of the Guide and IH policies to large systems (WS1s).

Context for findings on Objective 1

Evaluating the Program against expectations requires first that we identify what expectations are expressed in legislation. The Act does not have an overall statement of purpose, it simply begins with definitions. The key requirement of the Act is specified in Part 2,

Section 6 indicating that water supply systems must provide potable water.¹ Potable water is defined to include that it must be safe to drink without further treatment.²

The standards prescribed by the Regulation are limited to microbial indicators of fecal pollution, which while extremely important as one element for assuring safe drinking water, are not otherwise informative on the broader question of whether drinking water is safe. There is no reference in the regulation to the Canadian Guidelines for example.

The meaning of the legislative direction provided for the Program clearly turns on what is meant by “is safe to drink”. None of the Canadian Guidelines, the Ontario Safe Drinking Water Act or the U.S. Safe Drinking Water Act attempt to define safe drinking water. The only “official” definitions of safe drinking water that are relevant to IH are those provided by the World Health Organization (WHO) and the Walkerton Inquiry (O’Connor 2002).

The WHO Drinking Water Guidelines (WHO 2004) state: “Safe drinking-water, as defined by the Guidelines, does not represent any significant risk to health over a lifetime of consumption, including different sensitivities that may occur between life stages.”

This is an adequate functional definition in the sense that water which continuously meets the numerical guidelines for a wide range of water quality parameters is deemed safe by the experts who contribute to the WHO guidelines development process. This definition indicates that safe drinking water poses a negligible, but not a zero health risk, the latter being unattainable. However, different people will have different views about what is negligible—the assessment of the scientists who recommend the WHO guidelines may not align with everyone among the consuming public. A case in point is that the WHO guidelines encourage chlorine disinfection while acknowledging that the production of chlorination disinfection by-products may carry a very small, but essentially negligible health risk for consumers.

The WHO definition by itself does not explain how assurance of continuously meeting the WHO guidelines can be achieved. That is explained in the full WHO guideline approach of assuring that water purveyors develop and implement water safety plans. Although this practice has been gaining traction throughout the world since 2004, it is not explicitly reflected in current Canadian Guidelines or current provincial regulatory practices except that Alberta is currently in the process of rolling out a water safety plan program. Ontario’s requirement for water purveyors to develop a detailed operational plan addresses many of the features of a water safety plan approach.

¹ **WATER SUPPLY SYSTEMS MUST PROVIDE POTABLE WATER**

- 6** *Subject to the regulations, a water supplier must provide, to the users served by its water supply system, drinking water from the water supply system that*
- (a) is potable water, and*
 - (b) meets any additional requirements established by the regulations or by its operating permit.*

² Part 1, Section 1

"potable water" *means water provided by a domestic water system that*

- (a) meets the standards prescribed by regulation, and*
- (b) is safe to drink and fit for domestic purposes without further treatment;*

Justice O'Connor in his part 2 report of the Walkerton Inquiry - A Strategy for Safe Drinking Water (O'Connor 2002, p.75) stated: "The 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."

Justice O'Connor's goal, which includes a somewhat circular reference to safe does acknowledge that consumer trust in a water system is important and that it plays a critical part in whether consumers will judge drinking water to be safe. These examples establish some important features that are at the heart of any judgment about the IH Program and how well it meets its legislated mandate which the Act does not define in any detail.

First, safe drinking water, which is the key determinant relevant to a health mandate under the Act, is not clearly defined, likely because those who draft legislation are aware of the element of personal value judgment that is embedded in the notion of safety.

Second, there is some consensus that safe does not mean zero risk; the realistic target is negligible risk. Different observers will have different views on what constitutes negligible, but Justice O'Connor has touched on this by noting that a pragmatic concept is a risk that is too small to worry about, provided the observer is well informed.

Third, while there may be scope for disagreement about what constitutes safe, there should be unanimous agreement that the drinking water which killed seven people in Walkerton was not safe. The challenge arises because there is not a sharp dividing line between safe and unsafe opening the issue to argument and debate about where a regulatory line should be drawn for assuring safe drinking water.

Finally, this issue needs to distinguish between the nature of scientific evidence and the needs of risk management decision-making. Risk management decisions must not run contrary to available scientific evidence, but in all but the most extremely hazardous situations, the available scientific evidence will carry sufficient uncertainty and inadequacy of data that the evidence alone cannot drive the details of a risk management decision. Rather, IH must make a mature judgment based upon careful consideration of many factors, some scientifically-derived and others that will have imbedded values about what measures are appropriate to assure a negligible risk to consumers via their drinking water. The best guidance which IH can follow for this purpose is to pursue, as it has sought to do, the effective implementation of a multiple barrier approach (MBA) for assuring safe drinking water.

The most meaningful framework for judging the effectiveness of the Program in relation to the Act, given its lack of specificity, is the MBA which underlies international best practice approaches to assuring safe drinking water. Unfortunately, there are multiple concepts of what the multiple barrier approach means. The primary national references on this topic are a little fuzzy about what is required to successfully implement a MBA (CCME 2002, 2004). In contrast, a 30 year old statement by Edwin Lippy provides a useful succinct description of the MBA.

“The ‘multiple barrier’ concept that relies on placing protective systems between the water consumer and actual as well as potential sources of contamination should be emphasized, with appropriate consideration for natural features (distance, dilution, geologic factors), man-made facilities (adequate waste treatment, water treatment, operational considerations) and conscientious surveillance by regulatory agencies (monitoring, inspection, certification). (Lippy 1981)

The Walkerton Inquiry adopted a widely cited description of the MBA as consisting of effective and robust measures dealing with the following major elements:

- (a) **source protection and selection** to keep the raw water as clean as possible, to reduce the risk of contamination breaching the drinking water system;
- (b) **treatment**, normally involving more than one process, to remove or inactivate contaminants, must be effectively designed, operated and maintained;
- (c) **distribution system security** to protect against intrusion of contaminants and use of a disinfectant residual to assure delivery of safe water to consumers;
- (d) **monitoring** to control treatment processes and detect contamination in a timely manner to inform risk management responses;
- (e) **response capabilities** to adverse conditions that are well-conceived, thorough and effective, including a focus on well-trained operators who fully understand their own systems.

(adapted from O’Connor 2002 and Hrudehy & Hrudehy 2004)

These five categories of the MBA will be used to frame and judge the effectiveness of the IH Program in relation to the ability of the MBA to assure safe drinking water.

The MBA provides intentional redundancy that is necessary to assure that drinking water risk is negligible. The MBA is essentially an insurance policy against drinking water disaster. Unless the water is consistently grossly unfit for human consumption, not something likely to occur often anywhere in Canada in 2011, illness caused by drinking water will most likely be episodic. An unsafe water supply may cause endemic illness at a low rate that is too difficult to detect through normal public health surveillance, but outbreaks will be caused when a series of failure conditions combine.

The relationship between the requirements of MBA and managing risk to a negligible level may be conceptually represented as shown in Figure 1.

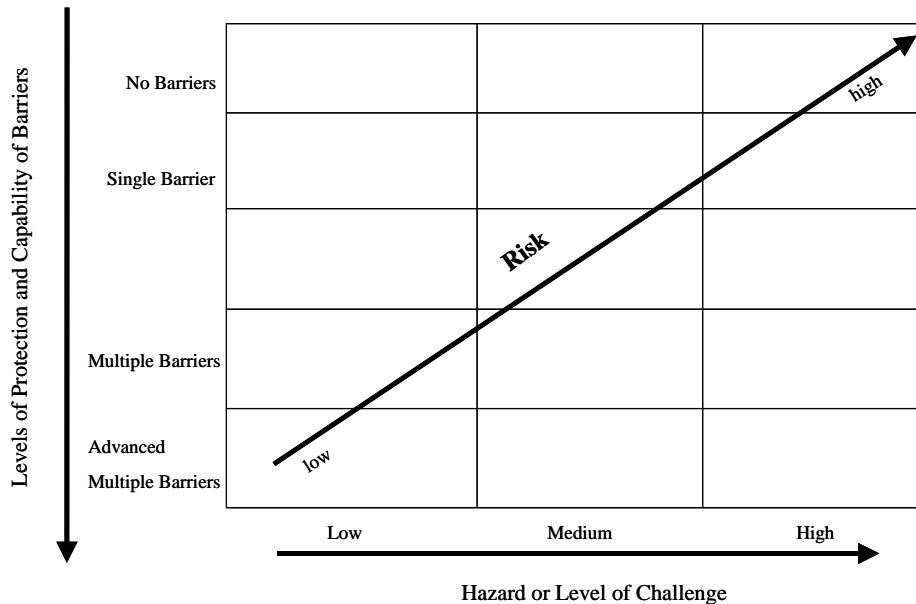


Figure 1: Drinking water risk management (Hrudey, 2001)

Figure 1 illustrates that the MBA is not a rigid, one size fits all approach. The needs of the MBA are determined in relation to the levels of health hazards facing a given water system. Using risk as the metric that must be managed to negligible levels for the purposes of achieving safe drinking water, a system with no barriers would require facing negligible hazards or challenges to provide such assurance. Because of the pervasive nature of microbial pathogens (including wildlife sources), no surface water source can provide that level of assurance without some effective treatment barriers and even exceptionally high quality groundwater must be maintained as safe in a community distribution system to arrive safely at a consumer's tap. Likewise, any source subject to a high level of hazards or challenge (e.g. major sewage or industrial waste discharges directly impacting the water source) will demand advanced multiple barriers to assure that drinking water poses essentially a negligible risk to consumers. IH is fortunate to not have any larger water systems facing the most extreme conditions although direct or indirect exposure to agricultural runoff is a significant risk / challenge for some large systems in IH.

Most water systems that IH regulates are at neither of these extremes on the hazard scale, but lie in between on the continuum shown in Figure 1. Although there must clearly be substantial experience and judgment applied to implement the premise depicted in Figure 1, this framework is a relevant guide to show the rationale for how the MBA should be used for managing drinking water risk to a negligible level, i.e. to assure safe drinking water.

By definition, a single barrier does not provide the MBA. Likewise some barriers are more effective for certain hazards than others. There is a commonly expressed preference for an emphasis on source water protection. Clearly whatever measures can be implemented to minimize contaminant release to source waters can provide multiple benefits in terms of ecological and recreational uses which makes source protection justifiably attractive. However, source protection is the most difficult barrier to achieve in a multiple use scenario

(almost all water sheds in the IH region), source protection cannot achieve negligible risk on its own and water purveyors have almost no authority to implement source protection controls.

Monitoring is an essential part of the MBA, but its capabilities, particularly the benefits of compliance monitoring with infrequent samples for a limited range of parameters are often substantially over-estimated. Process control monitoring of parameters that can be measured continuously to verify treatment performance (e.g. chlorine residual, turbidity) is critical for assuring safe drinking water. Likewise, the monitoring of source water to characterize the threats facing the water system is also critical.

There are other key features bearing on the Program which must be recognized in order to accurately interpret the findings in relation to Objective 1. These additional features are listed below.

- The Regulation provides details on bacterial monitoring requirements, but no other substantive guidance is provided to the Program.
- The Guide provides administrative policy and procedural details about the duties, powers and limitations of drinking water officers under the Act and Regulation. There is no substantive guidance on technical matters or functional advice on implementation of the various requirements under the Act and Regulation.
- Treatment of drinking water by communities in B.C. has generally lagged substantially behind the other “have” provinces of Ontario and Alberta. For example, a circumstance equivalent to Kamloops providing drinking water to a city of 80,000 residents drawn from a river source subject to substantial rural residential, agricultural and industrial contamination risk would have been resolved no later than the 1970s in either Ontario or Alberta compared with the 2005 resolution for Kamloops.
- The IH region includes many water supplies whose sources require substantial treatment to assure safety compared with other B.C. regions where human activities are restricted in source water sheds with corresponding reduction of risk. IH sources are also more subject than other regions for geophysical reasons to seasonal and episodic turbidity that may be associated with pathogens or may impair disinfection efficiency.
- Microbial pathogens anywhere are a pervasive risk because they occur in human fecal wastes and fecal wastes of pets, livestock and wildlife. Reducing exposure from human, pet and livestock substantially reduces, but does not eliminate microbial pathogen risk. Livestock, in particular, are a risk within IH – much more so than most other HAs. In particular, studies show massive shedding of *Cryptosporidium* oocysts can occur during calving season which may coincide with freshet conditions when turbidity is commonly a problem for surface waters.
- The management of many water systems in the IH region is woefully inadequate for various risk scenarios making achievement of water safety standards very challenging to achieve. Governance problems are apparent to varying degrees

within most types of institution that provide drinking water services. These are, in the order from greatest governance challenges to least, communal water systems, irrigation districts, private utilities, municipalities and regional districts.

- Water rates for many IH water purveyors have been unrealistically low (even compared with locations on Vancouver Island) causing a serious infrastructure deficit just to repair and replace existing infrastructure, let alone make any necessary improvements.
- IH staff appreciates that they cannot rely on the lack of detected illness to be assured that drinking water is safe as several administrators and elected officials interviewed have suggested they should. Walkerton had an unsafe vulnerable drinking water system in place for 22 years before the outbreak, North Battleford more than 30 years.
- Unlike other public health-related activities regulated by IH, in most cases it is not practical to close a water facility, making it necessary to apply “soft” regulatory hands to get results required.
- Because the Provincial Regulations have not provided clear direction on what the intended outcomes are to be, individual health authorities are left with the “burden of proof” in the court of public opinion when dealing with communities whose water purveyors dispute the need for improvements. Having the 4-3-2-1-0 Drinking Water Objective(4-3-2-1-0), an IH developed approach for implementing the MBA, adopted province-wide has helped shift the burden of proof and the recently proposed provincial treatment objectives may help further.
- Because of the large number of water systems which IH regulates, even for the larger water systems, IH staff are not in a position to watch over and prevent local errors which could lead to a waterborne disease outbreak. This reality supports a case for the Program focusing, as it has done in most cases, on getting the treatment systems in place operated by knowledgeable and responsible operators who have a good rapport with IH to reduce the likelihood of a catastrophic failure from occurring.

Audit Findings – by MBA Elements

A. Source Protection and Selection

A number of water purveyors, both those close to fully satisfying 4-3-2-1-0 and some far removed from that goal, expressed concern about the intentions of the Program with regard to the source water element of the MBA.

- Requirements of the conditions on permit governing source water issues need to be clarified between source water assessment and source water control. If a water purveyor is applying for a filtration deferral there is a clear case to be made for demonstrating some level of source control. For a water purveyor which has implemented 4-3-2-1-0, the case should be limited to source assessment, i.e.

assuring that the water purveyor is fully informed on source water hazards and has appropriate contact with potential hazard sources affecting its water source. Source assessments need to be driven by a preliminary assessment of what are the most critical problems: fecal sources, eutrophication, turbidity to drive a need for filtration, chemical contamination, or other hazards.

- Many water purveyors believe that IH wants them to assume all of the responsibility for watershed protection even though water purveyors have none of the control as the watersheds are usually owned by the Crown. Water purveyors need to understand the hazards in their watershed and develop a response plan for all the things they cannot control. Water purveyors can advocate for controls, but cannot be reasonably expected to implement controls over others.
- Specific cases such as the Raleigh Waterworks District and the City of Penticton where the water purveyors have implemented 4-3-2-1-0 and the water purveyor clearly does not have control over the water shed are cases where the emphasis should be on understanding what are the water quality threats posed by the source and developing feasible response plans for dealing with those threats.
- The process of identifying threats and feasible response plans is part of the broader need for all water purveyors to fully understand their own systems. Consequently, while it may be useful to hire consultants to support the source assessment process, the assessment and response plans will be more valuable if the water purveyor plays the major role in developing these documents. In contrast, having a consultant produce a report which may satisfy IH, but which is not truly “owned” by the water purveyor through full engagement in producing the assessment will be less valuable for influencing the water purveyor’s plans and actions.
- IH is justified in disagreeing with water purveyors who wish to use source protection as a single and only barrier for assuring safe drinking water. Conflicts which may arise from this stance are a consequence of the regulatory responsibility that IH must discharge. While IH must maintain their role in such disagreements at a professional level, the premise that source protection alone, as a single barrier, can assure safe drinking water is not justified and should not be negotiable.

Recommendation 1

Health Protection should review the conditions on permit regarding source control. The conditions should reflect the realities of differing conditions for different water purveyors and focus on source assessment, rather than control, in cases like those where purveyors have committed to 4-3-2-1-0 Drinking Water Objective and have no control over the watershed. In these cases, the emphasis should be on a source assessment to identify threats and the development of feasible response plans.

- There is a serious issue for inadequate systems with no or inadequate treatment barriers which may be affected by rural / suburban septic systems which are very difficult to monitor and are not strongly regulated. Any opportunity for human sewage to contaminate drinking water sources for systems that have limited or inadequate treatment is a serious health risk.
- The case of Robson Raspberry Improvement District, a community water system of about 500 connections run by volunteers has been on a boil water notice since the 90s. This system draws water from an upland creek that could be affected by rural septic tank systems and currently provides no treatment. The CONDITIONS ON PERMIT has not been updated since 2008 and when interviewed, the purveyors were not aware of the conditions on permit. Conditions have been discussed over a period of years, but no resolutions have been achieved. This type of risk to a water system which IH is responsible for regulating must be seen as an urgent priority for improvement more-so than was evident in our interviews and file review.

Recommendation 2

Health Protection should examine all the large water systems to identify those systems needing more urgent resolution because of evident source hazards and inadequate or no treatment. All conditions on permit should be regularly updated and reflect the current identified hazards and other related risks.

B. Treatment

Treatment has long been recognized as an essential element of assuring that public water supplies can be safe. While we might all prefer to believe in pristine natural water as the ideal, the range of human activity and the pervasive nature of microbial pathogen contamination mean that some level of treatment for any realistic and sustainable source of water is necessary to assure negligible risk of contamination.

- Filtration is the terminology used regarding surface water treatment for fine particle removal (noting that all microbial pathogens are fine particles), but the pathogen risk that must be managed requires assurance that the treatment barriers provided are capable of dealing with all potential pathogen risks. Chlorination alone is not effective against protozoa and Ultra Violet (UV) alone has some limitations on some viruses. Both methods raise concerns about turbidity affecting the ability of disinfection methods to provide the level of efficiency required of them.
- Filtration, by any number of specific technologies, provides the means for removing fine particles and thereby turbidity. There is a need for the Ministry to become involved or to get FPT-CDW to develop meaningful guidance on when and how UV can be reliably used as an alternative to filtration. Vancouver Metro has developed some evidence showing the capability of UV to function successfully at turbidities above 5 nephelometric turbidity units (NTU). Some effort should be pursued to obtain and judge the applicability of this evidence to circumstances in IH.

- Many of the turbidity issues are seasonal or episodic. This reality opens the scope for creative alternatives to manage the risk that requiring filtration normally provides. There may well be a cost-effective case for approving raw water storage with continuous turbidity / colour monitoring followed by UV / chlorination rather than requiring filtration / chlorination where the problems are demonstrably seasonal.
- Source waters that are provided by deep intakes from comparatively high water quality lakes (e.g., Kelowna and Salmon Arm) with minimal turbidity problems pose a particular challenge for assessing contamination risk. The massive Milwaukee outbreak in 1993 was a case where source water was drawn from a large lake (Lake Michigan) with a deep intake (2.3 km offshore, 12.8 m depth), but Milwaukee did experience low level source water turbidity problems. Milwaukee also had conventional filtration when sewage contamination caused the outbreak estimated to have caused over 400,000 cases of cryptosporidiosis. In that case, filtration was in place, but was not being operated in an optimal effective manner. Viewing Milwaukee in hindsight highlights the need to understand extremely well the contamination risks for deep lake intakes. Filtration can provide an effective barrier for *Cryptosporidium* contamination, but only if continuously operated in an optimum manner. Water purveyors elsewhere in Canada (e.g. Epcor in Edmonton) that recognize a source water risk from *Cryptosporidium* have added UV disinfection in addition to filtration for additional risk reduction.
- There is scope within international best practices for assuring safe drinking water for the Health Protection Team to adopt a more flexible approach to applying the treatment component of the MBA approach in keeping with the framework illustrated in Figure 1.

Recommendation 3

Health Protection should consider whether the need for a filtration barrier for surface water can be satisfied in some cases without requiring filtration if source water characteristics can be shown to allow alternate technologies such as UV to address the protozoan pathogens that normally require filtration.

Recommendation 4

The President & CEO should request the Ministry of Health to coordinate a review of the conditions under which colour or turbidity will substantially interfere with UV disinfection to provide a province-wide evidence base for judging the potential for using UV as an alternative barrier for microbial hazards usually managed by filtration.

- Chlorination may be the most important element within an MBA approach and needs to be promoted as such – at all levels. In addition to its benefits as a disinfectant, it

facilitates real time process control monitoring – which is difficult to achieve otherwise.

- There is a lot of public opposition to the use of chlorination in BC, including many places in IH with perhaps the greatest opposition found in the Kootenay regions. The public's perception, which is partially driven by inaccurate information as to the health risks from chlorination disinfection by-products, makes cost effective disinfection without using chlorination, a challenge, particularly for smaller systems. There is no coordinated approach to redress this and Program personnel are challenged to deal with the public fear of chlorine on a day to day basis. The Act, Regulation and the Guide are not explicitly supportive of chlorination.

Recommendation 5

The President & CEO should request the Ministry of Health to develop a provide-wide communication to water technical and administrative staff and interested elected officials to highlight current evidence on actual health risks from chlorination disinfection by-products so that those individuals will be best-equipped to understand the issues and reduce public misconceptions about chlorine disinfection.

C. Distribution System Security

High quality source water (e.g. from confined aquifer groundwater) or well-treated water can be made safe before distribution, but a water purveyor must still deliver it to individual users without allowing it to become contaminated. Distribution systems involving storage, with potential contaminated cross-connections or with opportunities for contamination from sewers or during maintenance, these all create risks to safe drinking water which have caused fatal outbreaks in other jurisdictions.

- There have now been at least three fatal drinking water outbreaks in the U.S. in the past 20 years where high quality groundwater was contaminated in the distribution system.
- IH has recognized the obvious treatment deficiencies evident for many of the water purveyors that it regulates but in pursuing this considerable challenge it has likely not given as much attention to the distribution system risks (storage and mains contamination potential) as is warranted based on outbreak experience elsewhere, particularly for systems such as the City of Nelson's which have severe infrastructure deficits.
- In dealing with the public health risks for systems with serious infrastructure deficits, IH should be careful not to underestimate the public health risks posed by infrastructure (storage and distribution failures) compared with treatment failures.

- Managing distribution system risks requires more than just a cross-connection control program.
- Erickson Water Service, operated by the Regional District of Central Kootenay, is a case where years of effort by the local Health Unit predating IH finally achieved a competent treatment system to match the source water threats which the system faced. However, the well-treated water from this system still passes through an open reservoir that was described in audit interviews as a “duck pond”. Given the prolific fecal production of ducks and geese and documented cases of waterborne outbreaks caused by avian sources, this open storage of treated water remains a substantial risk to this drinking water system. Provision of re-chlorination at this point is appropriate and necessary, but having open storage after treatment certainly invites a contamination risk.

Recommendation 6

Health Protection should review the requirements for all large water purveyors to assess the contamination risks of their distribution systems and provide the assessment along with a remediation plan to Health Protection.

- There is an inconsistency between requiring distribution system chlorination for water that is filtered and not requiring such chlorination for water that comes from confined aquifers. It is not clear how the risks to consumers are truly different if storage and significant distribution (with attendant risks of contamination) are involved in both cases.

Recommendation 7

The President & CEO should request that the Ministry of Health develop a province-wide policy requiring the maintenance of a chlorine residual for groundwater systems from confined aquifers if the distribution system involves any storage.

D. Monitoring to Control Treatment Processes and Detect Contamination

There is a common misunderstanding among some elected officials and administrators interviewed that treated water monitoring alone can assure water safety. The premise might be true if it was possible to continuously monitor for all pathogenic threats in real time, but infrequent *E. coli* testing (all that is practical at the moment) provides very little reassurance of safety for intermittent contamination. Detection of *E. coli* is definitely grounds for concern about drinking water safety, but the real prospect of intermittent contamination means that absence of detecting *E. coli* does not by itself assure safe drinking water. *E. coli* monitoring

does not provide a reliable warning for *Cryptosporidium* risk. Routine non-detection of *E. coli* may actually increase risk by creating misguided complacency over pathogen risk.

- Monitoring requirements specified by the Regulations must be viewed as minimal and, by themselves, inadequate to provide much reassurance of safe drinking water. IH has shown attention to source water and process monitoring with regard to turbidity and chlorine residual monitoring. This aspect is critical and must be used to encourage operators and their managers to learn what such monitoring can tell them about their systems.
- IH currently requires water purveyors to collect their own samples and to submit these samples to an analytical laboratory. While there is a legal obligation of the laboratory to report to IH any results that fail (i.e., positive *E. coli*), IH is otherwise relying on water purveyors to submit monitoring results.
- The current lab results monitoring data system by which IH relies upon water purveyors to report monitoring data to IH rather than receiving such data directly from the laboratory is not in the best interest of IH because:
 - Access to data can take several weeks – including lag times to format and transmit; receive and read monthly reports.
 - The format in which many reports are received make the review of information overly onerous for staff and challenging to identify trends.
 - Follow up action by IH, if necessary, cannot be achieved in a timely fashion.
 - The Audit Team found an example of a positive *E. coli* (23 Dec. 2010, Shuswap Lake Estates) which was reported by the laboratory to the water purveyor, however not to IH. Fortunately, in this case, further testing did not indicate any undue health risks.
 - IH cannot easily reprocess the data (or does not) to evaluate compliance with the Regulation or the Canadian Guidelines.
 - Through control of the lab data, the purveyor effectively usurps the lead responsibility IH should hold.
 - More involvement by Health Protection participating in the selection of sampling site locations and sampling frequencies appears to be necessary (it is the only parameter required in legislation).

Recommendation 8

Health Protection should evaluate the water purveyor monitoring and data management practices currently used by other Health Authorities to identify opportunities to improve current IH practices for tracking and monitoring the performance of water purveyors and receiving lab results. Resolution of the current limitations with the Hedgehog information system may be necessary to implement better electronic management of monitoring data.

Recommendation 9

Health Protection should regularly assess water purveyors' sampling programs to ensure representative sampling programs are established and maintained.

- Many IH communities are remote from major centers in terms of access to laboratory service which creates a problem with maximum travel time for samples reaching the lab too late.
- The current practice of not analyzing samples which exceed the maximum travel time (30 hour limit) may not serve the best interests of all parties. Samples that exceed the allowable travel time by a few hours may show results slightly higher than would be found in a valid sample, but they should not show contamination where it does not exist, nor should they cause false negatives.

Recommendation 10

Health Protection, in conjunction with the BC Centre for Disease Control and accredited laboratories, should explore all reasonable options to overcome the sample shipping time problem for remote communities to insure that adequate monitoring results are obtained.

E. Response Capabilities

Water purveyors must show their ability to respond appropriately to detection of inadequacies in their system, whether these are detected in real time requiring immediate action or whether they are longer term issues requiring implementation of measures such as treatment addition or upgrades.

- A properly trained operator with experience commensurate with the complexity of the water system will be able to identify and respond to challenges and changing conditions. Furthermore, by understanding the limitations of their system they will know when they are close to exceeding them. Whenever those exceeded limits cannot be controlled with assurance, the operator will know to engage with the health authority for back up intervention strategies such as Boil Water Notices.

Recommendation 11

Health Protection should develop educational programs, using a water safety plan approach, designed to maximize the ability of water purveyors to improve their knowledge of their own sources and systems and increase capacity across the industry.

OBJECTIVE 2

Evaluate the completion of recommendations relevant to large systems in the Ombudsman's 2008 "Fit to Drink: Challenges in Providing Safe Drinking Water in BC" report.

The Provincial Ombudsman completed a report on the Province's drinking water in June 2008 which included 34 recommendations. Annual updates on progress in meeting these recommendations are published on the Ombudsperson's website³, with the most recent being published in November, 2010.

IH has completed or made progress on most of these recommendations except for recommendations 12, 18, 21 and 22⁴ which cannot be implemented without a more functional information management system than is currently provided by Hedgehog. The improvement which the Health Protection Team expected through the implementation of Hedgehog.Net in late 2010 was not achieved because the expenditure for this upgrade was not approved.

Recommendation 10 concerned providing greater consistency across the province for issuing water quality advisories based on turbidity. IH committed in spring 2009 to implementing the provincial Turbidity Decision Tree as the basis for issuing water quality advisories based on turbidity. Some water purveyors we interviewed during the audit believed that IH was not using the Turbidity Decision Tree in its decision-making. There is a

³ www.ombudsman.bc.ca/resources-and-publications/122-fit-to-drink-update-2010-10-01

⁴ R.12 - At least once a year, each regional health authority publicly report the length of time each advisory in force for more than one year within its jurisdiction has been in effect, the steps taken since its last report to remedy the underlying problems that necessitate the notice or advisory, and the corrective actions that remain outstanding. The regional health authorities establish a similar process for advisories that recur on a regular basis.

R. 18 - The regional health authorities develop systems to track and publicly report water sampling data including the list of substances tested for, how frequently the sampling is carried out, and the test results. Test results should be promptly posted on the health authorities web sites, **by June 1, 2009.**

R. 21 - IHA, NHA, VCHA and VIHA develop system that will allow them to monitor and track whether water suppliers have provided annual reports to their customers, and take steps to enforce compliance where necessary.

R. 22 - FHA, IHA, VCHA, and VIHA post the results of water sampling on their websites.

need for IH to make the basis for its decision-making regarding public notification better known in each individual case.

Recommendation 18 called for elimination of water systems being on advisories for more than 18 months by the end of fiscal year 2011-2012. While this recommendation is mainly applicable to small systems which are outside the scope of this audit, a system like the Robson Raspberry Improvement District, which has been on a boil water notice since the late 90s will need to be resolved soon to meet the requirements of this recommendation. Progress evident during our audit interviews did not provide confidence that this system can be resolved by that deadline in the spring 2012.

Recommendation 24 called for inspection reports to be posted on the IH website. Although this is now being done, the inspection reports that IH is posting provide such limited information that in the Internal Audit Team's opinion, this achievement has not satisfied the Ombudsman's intent.

Recommendation 25 called for health authorities to enforce the requirement of the Act for water purveyors to have a current emergency response and contingency plan. IH has not been consistently enforcing this requirement along with the requirement by water purveyors to provide annual reports.

Recommendation 12

Health Protection should ensure all water purveyors have emergency response and contingency plans in place, provide summary reports on an annual basis and work with the water purveyors to continually improve the plans and reports.

OBJECTIVE 3

Identify significant differences, if any, between IH's Program and that of other health authorities in BC.

Context for findings on Objective 3

The Act and the Regulation create substantial discretion for Drinking Water Officers and for individual health authorities in implementing their defined responsibilities. This reality will inevitably allow inconsistency that should be countered by extensive and detailed guidance on what and how individual health authorities are expected to achieve their responsibilities under the Act and the Regulation. Interviewees for this audit were almost unanimous in advising that the Ministry has provided very little guidance that would assure consistency among health authorities in delivering their drinking water programs.

There is a distinct conflict between calling for greater consistency among drinking water programs for different health authorities at the same time as asking for greater discretion and

flexibility from the IH Program. During interviews, we heard these conflicting objectives from several water purveyors.

Finally, we note that consistency is a two-edged sword, not all variations in Program delivery are wrong. If one health authority is different than another health authority, it is entirely possible that this difference is justified. Certainly, IH played an acknowledged leadership role in developing 4-3-2-1-0 which has now been adopted province-wide, suggesting that it differed from some other HAs on this point before this policy was adopted province-wide. What is required is that inconsistencies occurring between apparently similar circumstances must be justified based on true differences which can be logically rationalized based on an objective evidence-informed framework, such as the MBA outlined in this audit.

A. The IH Program Is Consistent with Other Health Authorities in Overall Direction

Overall, several interview sources in a position to know about practices at other HA's do not find major inconsistencies between the overall outcome direction of IH and other Health Authorities. In particular, 4-3-2-1-0 which was initiated by IH has now been adopted province-wide and is supported by all HA's and the Ministry and included in the Guide, however, several water purveyors interviewed were not aware of this widespread acceptance.

Recommendation 13

Health Protection should continue to promote to the IH regulated community that the 4-3-2-1-0 Drinking Water Objective is a province-wide treatment guideline on surface water or groundwater at risk of pathogens to counter the common perception that this objective is unique to IH.

B. The IH Program Differs on Policy for Implementing Filtration

IH has a detailed policy for Filtration Deferral whereas other HAs view their filtration policy as a Filtration Exemption. The IH policy document (Planning for Drinking Water Filtration Recommendation, HP-WQ-9037 February 2008) notes that IH policy is derived from the Canadian Guidelines exclusion criteria (FPT-CDW 2003 Guidelines for Canadian Drinking Water Quality: Supporting Documentation – Turbidity). The IH policy document states: “*Water supply systems that currently meet the exclusion criteria cannot guarantee they will do so indefinitely. Therefore, the focus of this document is filtration ‘deferral’ criteria not ‘exclusion’ criteria.*” While the logic behind this statement is understandable, we heard from most interviewees outside of IH that a policy of “deferral” rather than the terminology of “exclusion” used by the Canadian Guidelines and other HAs is at best sending mixed messages and at worst is sending a message that IH is inflexible and arbitrary. The IH

Filtration Policy states: “*Water suppliers must provide filtration for all water supply systems using surface water sources or ground water under direct influence of surface water.*” This IH wording is not consistent with the intent of the Canadian Guidelines, nor does it effectively reflect the interactive concept of the MBA approach depicted in Figure 1 whereby barriers required to manage drinking water risk are influenced by source characteristics.

Further, the Capital Regional District (CRD) has been given a filtration exemption based on meeting the Canadian Guidelines exemption criteria for a watershed that it owns and controls, but that the CRD understands that if a major fire happened in the watershed for example, the CRD would likely be required to implement filtration and the CRD has set aside, on land it already owns, a footprint sufficient to house a filtration plant for that eventuality.

The Program could send a clearer message to regional water purveyors by adopting a filtration exemption policy that relies on clear examples of factors which would void an exemption such as those currently listed as grounds for voiding a deferral. These could include other relevant examples such as fires or logging for pine beetle and other matters remaining at the discretion of IH. An ongoing rigorous monitoring requirement to prove that exemption conditions have persisted is certainly a reasonable approach given the scale of capital investment that is being avoided by being exempted from filtration.

It is appropriate for water purveyors to bear the burden of proof on a filtration exemption, but IH needs to be more clear and explicit about reasonable requirements for providing a footprint for filtration and having the financial wherewithal to implement filtration. Some water providers we interviewed interpreted the current filtration deferral policy to be that only owning the land for a future filtration plant and having the money in the bank would be acceptable to meet the deferral. Having feasible plans, both for land optioning or acquisition to avoid becoming boxed in by development and financing which can be implemented in a timely manner would seem reasonable. Requiring water purveyors to own land with no other current purpose and have all the funds in place for a filtration system that may never be necessary seems substantially less reasonable.

Recommendation 14

Health Protection should review the filtration deferral program and consider revising it to be a filtration exemption program. Consider conducting this review in consultation with technical staff from responsible water purveyors to assure that it is clear and is perceived to be reasonable by those water purveyors who have shown a responsible perspective on meeting water improvement goals.

C. Direct Access to Monitoring Results

IH currently relies upon water purveyors to provide monitoring results which water purveyors receive from their laboratory. IH must rely on the laboratory to fulfill its legislative obligation to report directly to IH any non-compliant *E. coli* results. This IH approach differs from other HAs in the province. This difference may undermine the ability of the Program to assure a rapid risk management response to any negative monitoring results and it weakens the ability of IH to track the performance of water purveyors regarding any non-reportable results such as trends in total coliforms.

Management's action plans for Recommendation 8 should address this finding.

D. Other Implementation Approaches

The IH Program Differs on Policy for Water Quality Advisories When Turbidity Is > 1 NTU But Less Than 5 NTU

Current practice in IH of normally calling a Water Quality Advisory when drinking water exceeds 1 NTU, but does not exceed 5 NTU continues to cause confusion according to a number of sources we interviewed. One of the few cases where the Ministry has provided guidance to HAs is regarding turbidity whereby it has issued a Turbidity Decision Tree in 2009 following the 2008 report of the Minister's Technical Advisory Committee on Turbidity and Microbial Risk. We were told by some interviewees that IH does not use this decision tree, preferring to use an automatic Water Quality Advisory if turbidity for an unfiltered surface water supply exceeds 1 NTU. The Turbidity Decision Tree seems to provide carefully considered thoughtful advice on the decision-making process triggered by turbidity spikes in unfiltered surface water supplies. The perception among some water purveyors that IH has refused to use the province-wide turbidity decision tree makes IH appear arbitrary and out-of-step on this matter.

There is a risk of message fatigue in the public with frequent or recurring Water Quality Advisories. Further, the public may not see any meaningful difference between a Water Quality Advisory and a Boil Water Notice. Water Quality Technical Specialists should be encouraged to review the Turbidity Decision Tree and use their best judgment on each circumstance.

Recommendation 15

Health Protection should consistently adhere to the Turbidity Decision Tree and make it clear to water purveyors that the Turbidity Decision Tree, is being used for making decisions on when to call a Water Quality Advisory.

OBJECTIVE 4

Identify leading practices both across IH as well as in other health authorities for potential implementation across IH.

There are a number of clear examples in which the IH Program has been recognized by its peers and in some cases by its clients for excellence and leadership in B.C.

- IH can rightfully claim credit for developing both the conditions on permit as well as 4-3-2-1-0. 4-3-2-1-0 has been adopted province-wide as the rationale for treating drinking water in B.C. to meet the purposes of the Act. The new draft treatment objectives for microbial contaminants can also be traced largely to IH initiatives. Vancouver Coastal Health Authority has adopted many IH policies.
- The Program has a clear and appropriate priority on microbial pathogens, consistent with the Act and demonstrable threats to health via drinking water
- The conditions on permit are relatively consistent across IH.
- Water Quality Advisories and Boil Water Notices readily accessible on the IH website.
- IH has been willing to learn from the many challenges and problems encountered and to adapt the Program in search of improvement.

There are some elements evident in other HAs that would be worthwhile for IH to emulate.

- The Fraser Health Authority's website is noteworthy among HAs for public posting of information on its external website
- The Annual Report provided by the Vancouver Coastal Health Authority to its water purveyors is a valuable form of communication
- Cooperative relationships with water purveyors, which were reported in other HAs, are noteworthy even if the scope of challenges encountered by other HAs have generally been lower.
- Some of the internal guidelines provided to this audit by Vancouver Island Health Authority, Fraser Health Authority and Vancouver Coastal Health Authority may be useful for application to IH.

Recommendation 16

Health Protection should review the Fraser Health Authority's website, the Vancouver Coastal Health Authority's 'Annual Report to Water Purveyors' template as well as internal policies and guidelines from other provincial health authorities to determine which, if any, can be adapted readily to support IH activities.

ADDITIONAL FINDINGS

- The number and complexity of water systems which IH must regulate requires IH to achieve a high level of efficiency in tracking these systems and the regulatory requirements they must meet. Because resources are constrained and consistency is encouraged, a province-wide information system capable of better supporting drinking water regulatory requirements would be an excellent investment for the province to undertake. Done well, the purposes of the Act, the Regulation and some of the recommendations of the Ombudsman could be satisfied better with existing personnel resources.

Recommendation 17

The President & CEO should encourage the Ministry to co-ordinate the upgrading of Health Protection information systems across all Health Authorities to facilitate the tracking of key data set information, program successes and ongoing regulatory issues.

- A number of purveyors interviewed indicated they will not invest in any improvements unless they are ordered to do so. The principles of administrative law which govern the HA's role as a regulator require that IH proceed in a methodical manner, carefully documenting all of its efforts at seeking compliance before an order is ultimately made.
- Progressive enforcement is universally considered desirable, but it presents real challenges when dealing with truly intransigent parties. IH is obliged to follow an administratively fair process to satisfy the requirements for natural justice. Those requirements become very onerous when followed through to prosecution, so IH must be very selective in how it determines the need to pursue prosecution.
- A critical step in progressive enforcement is developing a sound understanding of each system and which systems need substantial improvements to be able to assure the production of safe drinking water. A sound understanding of each system and of the water purveyor's actual progress in achieving improvements requires onsite inspections, including the physical facilities. Current practices regarding performing and documenting facility inspections in regions of IH like the Kootenays are not adequate.
- There is an evident need for Inspection Reports to be created and transmitted to the water purveyor, along with indicators that IH is interested in water purveyor performance such as an analysis of water quality data. Some water purveyors expressed that they would like to have some feedback on inspections and they currently do not get much if anything back after infrequent inspections.

Recommendation 18

Health Protection should develop and implement a comprehensive, yet realistic, facility inspection and reporting protocol to achieve consistent practice across all IH offices. This protocol should, to the extent practical, involve the Public Health Engineers working closely with the Water Quality Technical Specialists. Also, further education for the Health Protection Team as to risk definitions and the use of progressive enforcement would improve the performance of the Program.

- The IH acute care hospital water supply in a place like Cranbrook was noted to have only one barrier for a drinking water system with a surface water supply vs. other communities being required to put in filtration. Acute care patients and residents of residential care are likely to have compromised or weakened immune systems and thus more susceptible to variations in water quality.

Recommendation 19

Health Protection should work with IH's Health Emergency Management Team and Site Managers to ensure that site emergency response plans for utility service disruption includes contingency plans for water quality advisories (i.e. supplying bottled water, installing point of use systems etc).

- Chemical risks are a much lower profile, which in general is quite appropriate, but localized issues over arsenic, uranium and algal blooms are important. Reliance on the Canadian guidelines is okay for initial evaluation, but IH may need to draw on more specialized advice to deal with the few water systems which have health-related chemical contamination issues.

Recommendation 20

Health Protection should consider requiring water purveyors to provide water quality analyses covering chemical and physical parameters to allow assessment of chemical risks in drinking water sources. Any source exceeding the Canadian Guideline should be reviewed to determine the need for remedial action.

- One community which is currently not in compliance with its condition on permit indicated that it had high risk system failure, but argues that it handled the incident well.

Recommendation 21

Health Protection should request that water purveyors provide a report of any major incidents or close calls for serious contamination failures which can serve for future training of the water purveyor's staff as well as the Health Protection Team.

- The Guide needs to be updated to provide more Provincial guidance to Drinking Water Officers for more consistency across all health authorities.

Recommendation 22

The President & CEO should request that the Ministry update the Drinking Water Officer's Guide to provide consistent guidance for all Drinking Water Officers, share leading practice and to provide improved transparency to water purveyors as to the foundation of provincial program decisions.

- As indicated throughout this report, the Province's Drinking Water Act and Regulations are challenging for IH's Health Protection Team to administer as they Act is intended to be outcome-based, but provides very little tangible direction and neither the Act nor the Regulations adequately define the intended outcome. As the Act was initially drafted in 2001, with the lessons learned of the past decade, along with international advances, further tangible direction would be of benefit to both the purveyors as well as the regulators.

Recommendation 23

The President & CEO should request the Ministry to explore opportunities to enhance the Drinking Water Act and Regulations to better define the outcomes intended to be achieved.

CONCLUSION

Overall the Program has faced a remarkable range of complex and diverse challenges in seeking to meet the expectations of the Act, the Regulation, the Guide and IH policies. Given the nature and extent of those challenges, the Program has done very well to achieve the progress that it has achieved to date.

Drinking water programs in other “have” provinces are dealing with comparatively small incremental improvements to a situation whereby public water systems have been meeting province-wide treatment requirements and are primarily in a maintenance mode concerned with ongoing operational issues or the occasional new water quality issue. By comparison, the IH program is still facing the need for major system improvements that require major investments in treatment for many systems.

Looking forward, the Program needs to find ways to gain better compliance with requested improvements from several water purveyors if progress is going to be achieved. While there has undoubtedly been a change of attitude across the IH region, attributable to the considerable efforts of Program staff, many of the next steps required to maintain progress may require a fresh perspective about what has been achieved and what strategies will be most effective for sustaining improvements.

- The overall status of water supply systems in the Kootenays (and possibly Cariboo) districts lag behind other areas within IH. This may be due to several reasons including:
 - a) Weaker economies and lack of new development / growth.
 - b) Remote from professional services including IH staff; consulting engineers; access to trained operators, etc.
 - c) Historically IH has apparently had a higher profile in the Okanagan and in the Kamloops areas where the largest populations in the region are located.
- Some water purveyors were saying that orders from IH are necessary if IH wants results while others were saying that if IH issues an order, the water purveyor will fight it to the bitter end. Criticisms of IH are most commonly about not being collaborative enough. Clearly a challenge exists between obligations under the Act and expectations of IH getting along with water purveyors. Some outside IH have observed that complaints about IH are simply the result of IH doing its job as a regulator. The audit interviews revealed that all HAs get some push back from some water purveyors; it is not just IH who generate complaints to the Ministry.
- The management of drinking water systems, making this a municipal or local responsibility, sets up drinking water to become politically controversial. If drinking water was operated strictly as a utility like gas or hydro, there would not be so much engagement from local elected officials. This situation exists across Canada, but in B.C. and in IH particularly there is greater complexity because of the involvement of irrigation districts and other entities as water purveyors.

- Most Canadian provinces, certainly Alberta and Ontario, set and regulate treatment requirements province-wide substantially reducing the scope for local disputes about regulatory requirements. In B.C., the Act transferred responsibility for setting treatment requirements onto HAs and it is only recently that there has been some engagement by the province to provide more consistency in water treatment expectations across the province.
- The Act does not deal with the management of systems issues, such as is done in the Ontario Safe Drinking Water Act, for example, and inadequate governance poses a big challenge for many systems that IH has encountered challenges with in bringing into compliance.
- Water rates in many communities have been unrealistically low (in the sense that insufficient funds are collected to cover preventive maintenance and ongoing investment for infrastructure renewal) causing a serious infrastructure deficit just to repair and replace existing infrastructure, let alone make any necessary improvements. Many community representatives believe their water rates are high even when they are inadequate for sustaining existing systems.
- Many interviewees observed that if there was substantial provincial and federal funding for municipal infrastructure funding that many of IH regulatory challenges would be vastly reduced (at least for municipalities and regional districts, not for irrigation districts or private systems). However, this raises a question about sustainability. Communities must come to grips with the concept of responsible financial and asset management and not expect or rely on other levels of government to pay for municipal services through grants.
- The range and complexity of remaining challenges for IH in moving forward with the Program are substantial. However, there remain many issues that are required by the Act, notably all water purveyors must file annual reports and have a current emergency response plan that have not been satisfied by many of the WS1 water purveyors. Addressing the numerous outstanding deficiencies regarding these comparatively easy to complete missing elements needs to be achieved.
- The Ombudsman's report applies in many cases to small systems. For larger water systems, IH is largely on track. Areas that require further development include the broader use of the turbidity decision tree, upgrades to the information system, improvements to the inspection process and reports and ensuring requirements for emergency response plans are fully implemented.
- IH's Program is generally consistent with other health authorities. There is a need to make it more widely known that 4-3-2-1-0 has been adopted as a province-wide objective, to bring filtration deferral more into line with filtration exemption as outlined in the Canadian Guidelines, to review IH access to water purveyor monitoring results, to publicize IH use of the turbidity decision tree and to bring IH expectations for source assessments as conditions on permit into line with expectations in other health authorities.

ACKNOWLEDGEMENTS

Internal Audit acknowledges the contributions of water purveyors who agreed to be interviewed. Internal Audit also recognizes the keen participation of the Health Protection Team who was very supportive of the audit process. The Team is to be recognized for their commitment to improving drinking water quality across the region and to live IH's values of integrity, respect, quality and trust.



Givonna De Bruin, CA, CIA
Corporate Director, Internal Audit

APPENDIX 1: ABBREVIATIONS

CRD	Capital Regional District
HA	Health Authority
IH(A)	Interior Health Authority
MBA	Multiple Barrier Approach
NTU	Nephelometric Turbidity Unit
UV	Ultra Violet
VCHA	Vancouver Coastal Health Authority
VIHA	Vancouver Island Health Authority
WHO	World Health Organization
WS1s	Large water systems (greater than 300 connections)

APPENDIX 2: INTERVIEWEES

Interior Health Health Protection Team

- Anita Ely
- Bryn Lord
- Curtis Neville
- Dan Byron
- Dan Ferguson
- Don Corrigan
- Dr. Andrew Larder
- Dr. Paul Hasselback
- Elizabeth Sigalet
- Gundie Volk
- Ivor Norlin
- Ken Christian
- Martin McMahon
- Rob Birtles
- Ron Popoff
- Wayne Radomske

Representatives from the Provincial Government

- Barry Boettger, Provincial Drinking Water Officer
- Dave Fishwick, Drinking Water Manager
- Glen Brown, Executive Director Local Government and Infrastructure
- Mike Zemanek, Director Health Community Environment
- Pieter Bekker, Manager, Water Allocation and Utilities

Representatives from Other Health Authorities

- Bob Weston, Manager, Health Protection, VCH
- Lynne Magee, Regional Drinking Water Coordinator, VIHA
- Marc Zubel, Manager, Drinking Water Program, FHA

Water Purveyors

- Black Mountain Irrigation District
- City of Grand Forks
- City of Kelowna
- City of Kimberly
- City of Nelson
- City of Penticton
- City of Salmon Arm
- District of West Kelowna
- Greater Vernon Water Services, Regional District of the North Okanagan
- Municipality of Summerland
- Okanagan Falls Irrigation District
- Rayleigh Waterworks District
- Regional District of Central Kootenay, Rural Affairs Committee
- Robson Raspberry Improvement District
- Shuswap Lake Estates

APPENDIX 3: REFERENCES CITED

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