

Section 5

Local Public Health Data and Public Health Workshop

*While the requirements for consideration of a variance are centered on source water characterization, public health protection is the impetus behind the regulation and the primary goal for public water systems. The available data on cryptosporidiosis in the region served by Bull Run show no indication of an excess endemic burden of cryptosporidiosis due to the water system. Additionally, no cryptosporidiosis outbreaks have ever been attributed to the Bull Run supply. After considering available data, a panel of public health experts agreed that the probability of exposure to *Cryptosporidium* via consumption of Bull Run water is low and installing additional water treatment to the Bull Run source under current conditions is unlikely to result in a measurable decrease in the occurrence of reported cases of cryptosporidiosis.*

5.1 Public Health Target Embedded in LT2 Rule

The purpose of the Long Term 2 Enhanced Surface Water Treatment Rule (LT2 rule) is the protection of public health, primarily from illness due to *Cryptosporidium*. The preamble to the LT2 rule states that “EPA believes that implementation of the LT2ESWTR will significantly reduce levels of infectious *Cryptosporidium* in finished drinking water. This will substantially lower rates of endemic cryptosporidiosis, the illness caused by *Cryptosporidium*, which can be severe and sometimes fatal in sensitive subpopulations.”¹ As a specific target, “the LT2ESWTR is designed to protect public health by lowering the level of infectious² *Cryptosporidium* in finished drinking water to less than 1 oocysts/10,000 L.”³

The target concentration of one infectious oocyst per 10,000 liters (L) can be converted to an annual risk level of between 15 and 60 infections per 10,000 consumers using the equations and assumptions provided in the LT2 rule.⁴ The risk of infection is a function of both the assumed exposure to *Cryptosporidium* and the assumed infectivity (expressed as the likelihood of infection per oocyst) as described in Box 5-1. This calculated infection rate includes both people who report symptoms and those who carry the infection but show no outward signs of disease.⁵

Box 5-1: Daily and Annual Risk Calculation from the LT2 Rule

Daily Risk = concentration in consumed water
[1 oocyst/10,000 L] * volume consumed
[1.07 L/day] * likelihood of infection per single
oocyst dose [4-16%]

Annual Risk = $1 - (1 - \text{Daily Risk})^{\text{days per year}}$
water consumed from system [350 days]

¹ 71 Fed. Reg. 654. Jan 5, 2006.

² Several experts have noted that the likelihood of *Cryptosporidium* infectious to humans from the Bull Run is quite low. This is because wildlife are the only potentially significant source and tend to carry types of *Cryptosporidium* infectious only to the host species and not humans.

³ 71 Fed. Reg. 658. Jan 5, 2006.

⁴ 71 Fed. Reg. 676. Jan 5, 2006.

⁵ Symptomatic infections are characterized by watery diarrhea and abdominal cramps that typically resolve within 1-2 weeks but may last longer and be more severe in immunocompromised populations.

Determining the rate of symptomatic infection within a community is difficult due to under-ascertainment and under-reporting. Many people experiencing gastrointestinal illness do not seek medical attention. When they do, laboratory testing is often not performed, so the specific pathogenic agent is often not identified. Actual symptomatic infection rates, therefore, are usually higher than reported rates.

5.2 Bull Run Not the Source of Any Waterborne Outbreaks as Certified by the State of Oregon

As part of the conditions of maintaining unfiltered status, an annual watershed survey for the Bull Run watershed is conducted. This survey is conducted by the Regional Engineer of the Oregon

One criterion for maintaining unfiltered status is evidence that the water source “has not been the source of a waterborne disease outbreak.”

Drinking Water Program. One criterion for maintaining unfiltered status is evidence that the water source “has not been the source of a waterborne disease outbreak.”⁶ This criterion has been certified by the Oregon Drinking Water Program for the Bull Run Source since the Surface Water Treatment Rule went into effect in 1991. The most recent survey was completed in

October 2010 (Appendix G, Item 1). The survey certified that the Portland Water Bureau (PWB) continues to meet all the criteria for an exemption to filtration.

5.3 Oregon Respected for Infectious Disease Surveillance Program

The State of Oregon is known for a strong public health surveillance and investigation program. Oregon is a participant in the Foodborne Diseases Active Surveillance Network (FoodNet), a federally funded active surveillance network designed to help public health officials better understand the epidemiology of foodborne disease in the United States (CDC 2011).

Cryptosporidiosis is one of the infections monitored under the FoodNet Program. The Center for Science in the Public Interest (2011) also recently used Oregon as a benchmark of excellence for surveillance, investigation, and reporting of foodborne outbreaks in evaluations of other states. The protocols, structures and reporting that make Oregon well known for foodborne investigations are identical to those used for waterborne illness, as both media are potential sources at the beginning of any investigation.

Oregon was also an early adopter of electronic laboratory reporting which automatically reports positive laboratory results for reportable conditions.

⁶ Other criteria include source water quality conditions, redundant disinfection for inactivation of 99.9 percent off *Giardia* cysts with auxiliary power, a comprehensive watershed control program with annual report, annual on-site watershed inspection, and compliance with the total coliform and disinfection by-products rules.

5.3.1 Majority of PWB Service Area in Multnomah County

Although the PWB service area spans three different counties, Table 5-1 shows that the majority of residents within Multnomah County drink PWB water. In comparison, less than half of the estimated population in Washington County, and only a very small percentage in Clackamas County, are served Bull Run water. Thus, Multnomah County public health data are the focus, as it is most relevant for identifying any trends related to PWB water as a source for cryptosporidiosis.

Table 5-1. PWB Customers by County

County	Population Served	Total County Population	% Served by PWB
Multnomah	681,397	730,140	93%
Washington	232,626	532,620	44%
Clackamas	1,739	381,775	0.5%

Source: Population estimates are based on Metro's or Portland State University Population Center forecasts. Population served per county is based on share of water purchased from PWB and other water sources.

5.3.2 Multnomah County Surveillance Program

Cryptosporidiosis in Multnomah County is required to be reported within one working day of identification/diagnosis by laboratories and physicians to the Multnomah County Health

Department (MCHD). MCHD then reports all confirmed and presumptive cases to the Oregon Public Health Division (OPHD) by the end of the calendar week of the initial physician/lab report. Confirmed cases are those for which *Cryptosporidium* oocysts have been identified in fecal specimens. Presumptive cases are those for which a person is epidemiologically linked to a confirmed case plus has shown acute diarrheal illness lasting greater than three days (OPHD 2008).

Infectious disease surveillance in Multnomah County is excellent, at the top end of surveillance systems in the United States.

—Public Health Expert Panel

Currently all reported cases are investigated. Investigations focus on possible exposures in the 2 to 12 days before symptom onset and include the following (OPHD 2008):

- Name and contact information for any acquaintances or household members with a similar illness,
- Attendance or work at a day care facility by the case or a household member,
- Sources of drinking water, including home, work, and potentially untreated sources,
- Recreational water exposures,
- Travel,
- Contact with livestock or other animals, and
- Consumption of high-risk foods such as unpasteurized milk or cider.

Education is provided at the time of investigation about the fecal-oral modes of transmission and the importance of hygiene and hand-washing in preventing spread. For recognized outbreaks, an investigation summary is completed in consultation with an assigned OPHD epidemiologist. When needed (e.g., in the case of a large, complex, or novel-source outbreak), OPHD will provide coordination among counties, other states, and the Centers for Disease Control and Prevention (CDC). However, the county health departments are ultimately responsible for the investigation and control of outbreaks within their jurisdiction (OPHD 2004).

5.4 Cryptosporidiosis Data within Multnomah County Points to Low Risk

The apparent rate of cryptosporidiosis has increased in the United States, Oregon, and Multnomah County since 2005, although there was an apparent lull in cases during 2008, as shown in Figure 5-1. The increased number of cases could be due to greater awareness of cryptosporidiosis among physicians and patients, as well as new antigen tests that allow for more confirmations of cases rather than increased incidence (OPHD 2010, OPHD 2007). Given the large number of asymptomatic cases and infections that go undiagnosed, surveillance data

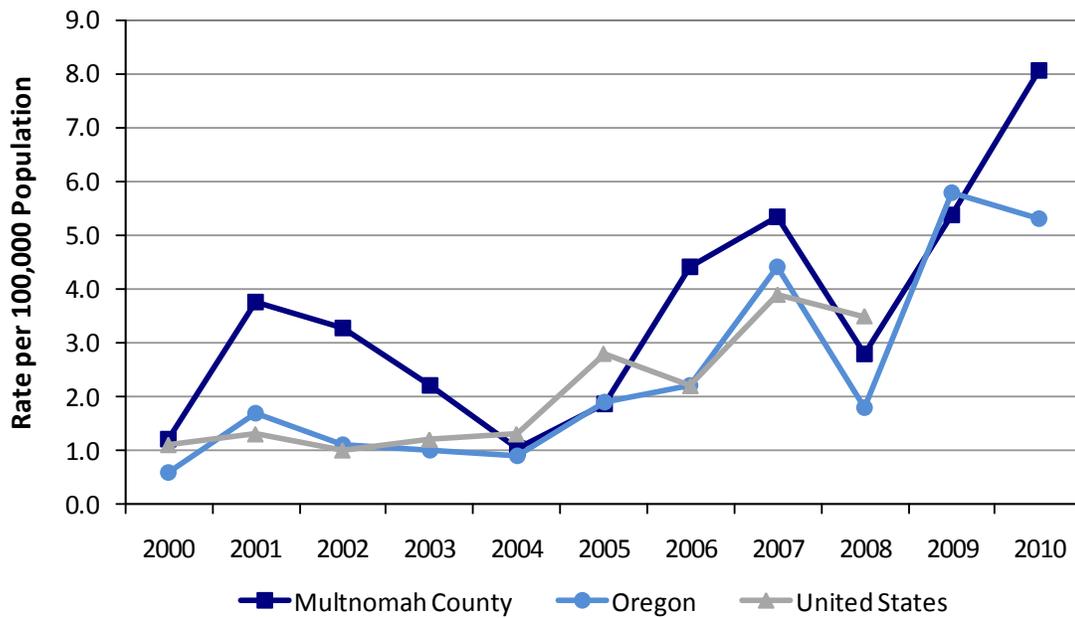


Figure 5-1. Cryptosporidiosis Rates by Year, 2000-2010*

* The higher rates shown for Multnomah County compared with the state and the country are likely a result of higher-quality surveillance methods, rather than an indicator of increased incidence. (Personal communication with MCHD Communicable Disease Services Program Manager Amy Sullivan at the PWB Public Health Workshop, March 25, 2011.)

Sources: National and Oregon data from CDC's Morbidity and Mortality Weekly Report Cryptosporidiosis Surveillance Reports for 2000-2008; Oregon 2009-2010 data from Oregon Health Authority Monthly Communicable Disease Surveillance; Multnomah County rates based on surveillance data. Population estimates of the U.S. Census Bureau (2000) and Portland State University Population Research Center (2001-2009).

are difficult to interpret. The higher rates shown for Multnomah County compared with the state and the country are likely a result of higher-quality surveillance methods rather than an indicator of increased incidence.⁷ Similarly, in their ranking of disease surveillance systems, the Center for Science in the Public Interest gave states with more identified outbreaks higher marks as it signaled robust detection and reporting and not more actual outbreaks.

Based on the site-specific data for Multnomah County, there was no information which would suggest that drinking water has been a source of cryptosporidiosis.

—Public Health Expert Panel

5.4.1 Surveillance System Sensitive Enough to Identify Outbreaks

Despite the challenges inherent in cryptosporidiosis surveillance, the surveillance systems in Oregon are sensitive enough to identify local outbreaks. During Multnomah County cryptosporidiosis case investigations, people are asked about potential exposure routes. Typically, people identify multiple risk factors, including food preparation, travel, contact with people with diarrheal illness, and recreational water use. From these investigations outbreaks can be identified, such as a 1998 outbreak traced to a swimming pool in Multnomah County and other outbreaks in Oregon traced to swimming pools (Oregon Health Authority 2005), a private youth camp (Oregon Health Authority 2007), and health care facilities (Oregon Health Authority 2010). No outbreaks have ever been attributed to PWB drinking water as a source.

5.4.2 Seasonal and Demographic Distribution Shows No Significant Trends

There is no strong seasonal trend in cryptosporidiosis cases within Multnomah County. Most of the cases are identified in adults, as shown in Figure 5-2. The slightly higher rates among children in January and September may be due to children returning to school during these months, thus increasing the opportunities to spread infection to each other. Higher rates in summer months may be due to recreational water exposure.⁸ Cryptosporidiosis cases are also distributed equally between genders, with males accounting for 52 percent of cases. Overall, no other demographic or seasonal trends stand out from the data set.

Based on the data presented, it appears that the majority of the reported cases of cryptosporidiosis in Multnomah County are sporadic in nature.

—Public Health Expert Panel

⁷ Personal communication with MCHD Communicable Disease Services Program Manager Amy Sullivan at the PWB Public Health Workshop, March 25, 2011. An additional factor potentially contributing to higher rates in Multnomah County compared to Oregon is the assignment of cases to a county based on the provider address when the patient address is unavailable. Because many large providers are in Multnomah County, this would shift case counts to a higher rate. The population of Multnomah County also has lifestyle characteristics, such as consumption of restaurant meals and travel, that could affect rates compared to other parts of the state.

⁸ Personal communication with MCHD Communicable Disease Services Program Manager Amy Sullivan at the PWB Public Health Workshop, March 25, 2011.

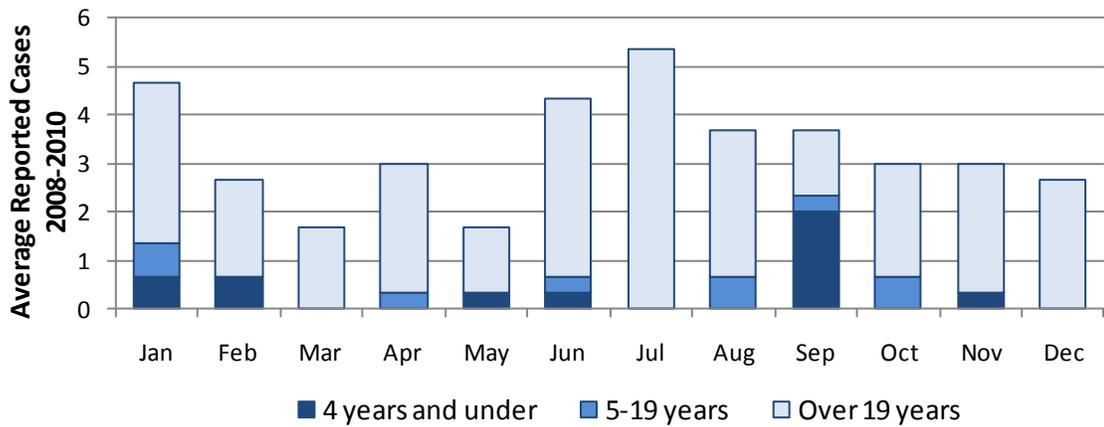


Figure 5-2. Seasonal and Age Distribution of Cryptosporidiosis Cases in Multnomah County*

* Distributions show no reason for concern.

Source: Multnomah County surveillance data provided by MCHD staff

5.4.3 Low Risk to Immunocompromised Individuals as Monitored by MCHD

Cryptosporidiosis is often more severe for those with compromised immune systems than for those with healthy immune systems. Symptoms in immunocompromised individuals persist longer and potentially result in severe complications (including death). MCHD has an HIV Health Services Center that provides medical care and a variety of other services for people living with HIV throughout the Portland metropolitan area. Data from the clinic are reviewed monthly by MCHD's epidemiology staff. Any potential cryptosporidiosis cases within this sensitive sub-population are carefully monitored, and PWB is alerted if potential ties to the water system are identified. This surveillance has identified a maximum of two cases of cryptosporidiosis recorded in the clinic during any year since 2008.⁹ No pattern indicating a tie to the water system has ever been identified.

5.4.4 Comparison to other Diarrheal Disease Agents Shows *Cryptosporidium* as a Minor Contributor

Rates of *Cryptosporidium* infection are compared to other diarrheal disease agents in Figure 5-3. Compared with other disease agents, *Cryptosporidium* is a minor contributor to endemic diarrheal disease within the county.

⁹ Information from Amy Sullivan, MCHD Communicable Disease Services Program Manager, March 10, 2011.

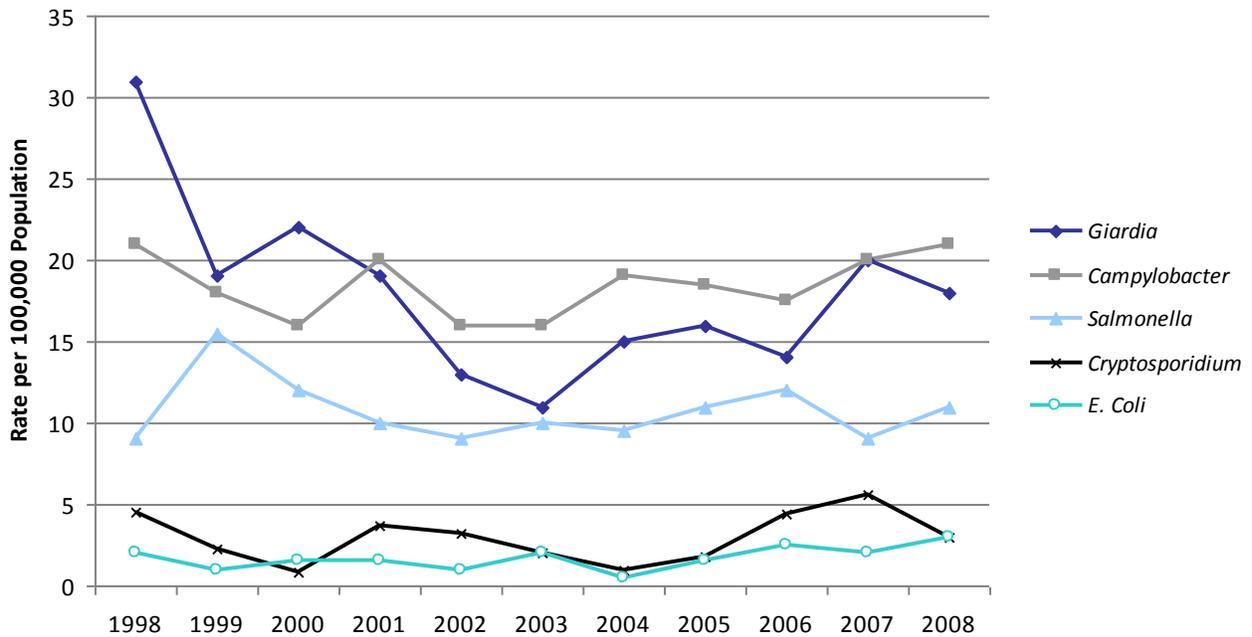


Figure 5-3. Multnomah County Diarrheal Disease Rates

Source: Multnomah County Health Department, Communicable Disease Assessment, December 2009.

5.5 Public Health Expert Panel Convened to Review Available Data

In order to ensure the soundness of a variance request from the public health perspective, PWB convened a panel to examine the available data. On March 25, 2011, several public health experts participated in a workshop at the Portland Water Bureau. The invited panelists and their backgrounds are listed in Table 5-2.

Additionally, two representatives from MCHD acted as resources for the panelists during the discussion:

- Gary Oxman, MD – Tri-County Health Officer (Multnomah, Clackamas, and Washington counties)
- Amy D. Sullivan, PhD, MPH – Communicable Disease Services Program Manager, MCHD

Table 5-2. Public Health Expert Panelists

Expert	Affiliation	Biographical Summary
Jeffrey Griffiths, MD	Tufts University	Dr. Griffiths is Director of Global Health in the public health program at Tufts University School of Medicine. His research interests include the human, animal, and environmental epidemiology of <i>Cryptosporidium</i> , plus the public policy and regulation of waterborne disease. He has served on numerous national committees and advisory groups, including the U.S. Environmental Protection Agency's (EPA) Science Advisory Board Drinking Water Committee, and has served as a federal representative for the National Association of People with AIDS to the EPA Drinking Water Microbial Disinfection and Byproducts Committee. He has also been the lead researcher for many studies on cryptosporidiosis levels in the service area of the Massachusetts Water Resources Authority.
Scott Meschke PhD Microbiology	University of Washington	Dr. Meschke is an environmental and public health microbiologist, specializing in the mobility, persistence, and detection of pathogens in the environment. His research interests include comparative adsorption and survival of enteric viruses in soil and groundwater; development of molecular methods for detection of infectious viruses; development of detection techniques for enteric pathogens in soil, water, and food; indicators of fecal contamination in soil, water, and food; and comparative survival and transport of enteric pathogens in the environment.
David Spath PhD Civil and Environmental Engineering	Consultant (Formerly of the California Department of Health Services)	Dr. Spath worked for the California Department of Health Services from 1972 to 2005 and was chief of the department's Division of Drinking Water & Environmental Management. In this role, he oversaw the state's public water system program, as well as several other health and safety programs. He also served on the EPA's National Drinking Water Advisory Council from 1998 through 2004 and was chair of the council from 2001 through 2003, as well as council liaison to EPA's Science Advisory Board Drinking Water Committee during that period.
Thomas Ward MD	Oregon Health & Science University	Dr. Ward is currently Training Program Director for Infectious Diseases at Oregon Health & Science University. His main research interests are HIV and clinical investigations. He has also practiced infectious disease and internal medicine in Portland, Oregon, for more than 30 years.
Marylynn Yates PhD Microbiology	University of California, Riverside	Dr. Yates is Professor of Environmental Microbiology at the University of California, Riverside, and is currently part of the EPA Science Advisory Board. She also serves as the Program Leader for Natural Resources and Animal Agriculture within the Division of Agriculture and Natural Resources of the University of California system. Dr. Yates' research interests include characterizing and predicting the fate and transport of human enteric pathogenic microorganisms in soils, water, and wastewater; development of methods for rapid, sensitive detection of infective enteric viruses in water samples; human pathogen considerations associated with wastewater reuse and biosolids application to land; and the use of indicators for predicting pathogen occurrence and behavior in the environment.

5.5.1 Public Health Workshop Structured to Provide a Complete Overview of Relevant Data

The purpose of the workshop was for the invited experts to formulate an opinion on the soundness of PWB's decision to seek a variance to the LT2 rule from a public health perspective. The workshop format featured presentations and questions followed by a discussion guided by Phillippe Daniel of Camp Dresser & McKee Inc., workshop facilitator and consultant.

Prior to the workshop, panelists were provided with detailed overviews of the material to be presented for their initial review. This included excerpts from the PWB Sampling Plan and Study, an overview of the LT2 rule, an overview of Portland's *Cryptosporidium* data, and an overview of cryptosporidiosis rates in Multnomah County.

At the workshop, Dr. Amy Sullivan presented the demographic and public health statistics for Multnomah County and Oregon as well as the reported rates and cases of cryptosporidiosis and other gastrointestinal illnesses by population groups and by season. Dr. Sullivan and Dr. Gary Oxman also gave an overview of the communicable disease surveillance and reporting system in Oregon and the strategic goals for the MCHD for the next three years.

Adding additional water treatment to Bull Run is not likely to result in a measurable decrease in the occurrence of reported cases of cryptosporidiosis based on the current conditions characterized in the Bull Run.

—Public Health Expert Panel

PWB staff Yone Akagi, Ann Richter, and Zoe Rodriguez del Rey presented an overview of the Bull Run water system, PWB's one-year variance sampling results, and a closer look at the characteristics and conditions of the protected Bull Run watershed, respectively. An overview of PWB's historical *Cryptosporidium* data set was also provided, including a review of the analytical methods used and a summary of other water quality events such as turbidity spikes and *E. coli* detections.

5.5.2 Public Health Expert Consensus Statement

The panel discussed the data presented and asked questions of the PWB staff. After the workshop, eight consensus findings were developed by the panel based on the data presented. The consensus findings are quoted below:

1. *Infectious disease surveillance in Multnomah County is excellent, at the top end of surveillance systems in the United States.*
2. *Availability of public health data is very good; it is comprehensive and targets sensitive population groups, such as persons with HIV/AIDS.*
3. *Based on the data presented, it appears that the majority of the reported cases of cryptosporidiosis in Multnomah County are sporadic in nature.^a*
4. *Based on the site-specific data for Multnomah County, there was no information which would suggest that drinking water has been a source of cryptosporidiosis. Reported rates of cryptosporidiosis are comparable to those seen elsewhere.*
5. *The Bull Run watershed is unique among watersheds. It is well-protected in ways that surpass that of other watersheds in the United States known to the panel, including those for other unfiltered utilities. Since human activity is highly restricted in the Bull Run watershed, it is most likely that any *Cryptosporidium* within the watershed is normally of animal origin.*
6. *The data collection effort the Water Bureau has undertaken for characterizing the amount of *Cryptosporidium* in the Bull Run watershed has been extremely thorough.*
7. *Based on the data set the Portland Water Bureau has gathered, the probability of exposure to *Cryptosporidium* via consuming Bull Run water is expected to be low. In the absence of human intrusion into the Bull Run watershed, the probability of exposure to *C. hominis*, which is almost solely found in humans, would be even lower.*
8. *Adding additional water treatment to Bull Run is not likely to result in a measurable decrease in the occurrence of reported cases of cryptosporidiosis based on the current conditions characterized in the Bull Run.^b*

^a Generally, potential routes of cryptosporidiosis transmission include person-to-person (most frequently associated with families with small children, caregivers, schools, inter-family dwellings); recreational water contact; and fomites (i.e., contaminated surfaces), as well as waterborne transmission.

^b To add treatment now would act as an insurance policy for risk of cryptosporidiosis from water if there were changes in the watershed.

5.6 Conclusions

The State of Oregon is recognized nationally for the quality of its public health surveillance data. The available data on cryptosporidiosis within Multnomah County shows no indication of transmission from drinking water. The Bull Run watershed is certified by the State each year as not being the source of any outbreaks. Through a public health workshop, a group of public health experts with diverse professional and geographical backgrounds reviewed local Multnomah County health data and discussed the results of the PWB Sampling Plan and Study. After reviewing the available data, the panelists deemed that the probability of exposure to *Cryptosporidium* via consuming Bull Run water was expected to be low and adding additional treatment was not likely to result in a measurable improvement to public health.