



Technical Support Document for the Draft Fifth Contaminant Candidate List (CCL 5) - Microbial Contaminants

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Acronyms

CCL	Contaminant Candidate List
CCL 1	EPA’s First Contaminant Candidate List
CCL 2	EPA’s Second Contaminant Candidate List
CCL 3	EPA’s Third Contaminant Candidate List
CCL 4	EPA’s Fourth Contaminant Candidate List
CCL 5	EPA’s Fifth Contaminant Candidate List
CDC	Centers for Disease Control and Prevention
CIS	Contaminant Information Sheet
CNS	Central Nervous System
EPA	Environmental Protection Agency
GWR	Ground Water Rule
MAC	<i>Mycobacterium avium</i> complex
MCL	Maximum Contaminant Level
MCM	Manual of Clinical Microbiology
MMWR	Morbidity and Mortality Weekly Reports
NDWAC	National Drinking Water Advisory Council
NIH	National Institute of Health
NORS	National Outbreak Reporting System
NPDWR	National Primary Drinking Water Regulation
NRC	National Research Council
NTM	Nontuberculous mycobacteria
OGWDW	Office of Groundwater and Drinking Water
PCCL	Preliminary Contaminant Candidate List
PWS	Public Water System
SAB	Science Advisory Board
SDWA	Safe Drinking Water Act
WBDO	Waterborne Disease Outbreak

Chapter 1.0 Introduction

The 1996 Safe Drinking Water Act (SDWA) Amendments (section 1412(b)(1)) require the United States Environmental Protection Agency (EPA) to publish every five years a list of drinking water contaminants that are known or anticipated to occur in public water systems (PWSs) and that may cause adverse health effects. SDWA specifies that the list (referred to as the Contaminant Candidate List, or CCL) must include contaminants that are not subject to any proposed or promulgated National Primary Drinking Water Regulations, are known or anticipated to occur in PWSs, and may require regulation under SDWA.

EPA uses this list of unregulated contaminants to help identify priority contaminants for regulatory decision making and prioritize research and data collection efforts. SDWA also requires the agency to consult with the scientific community, including the Science Advisory Board (SAB), and provide notice and opportunity for public comment prior to the publication of the Final CCL. In addition, SDWA directs the agency to consider the health effects and occurrence information for unregulated contaminants to identify those chemicals and microbial pathogens that present the greatest public health concern related to exposure from drinking water.

Section 1.1 Background to the CCL

The first CCL (CCL 1), published on March 2, 1998, (63 FR 10274, USEPA, 1998a) was developed based on recommendations by the National Drinking Water Advisory Council (NDWAC) and reviewed by technical experts. CCL 1 contained 50 chemicals and 10 microbial contaminants/groups. EPA published the second CCL (CCL 2) on February 24, 2005 (70 FR 9071, USEPA, 2005). With CCL 2, EPA carried forward the 51 remaining chemical and microbial contaminants from CCL 1 (that did not have regulatory determinations).

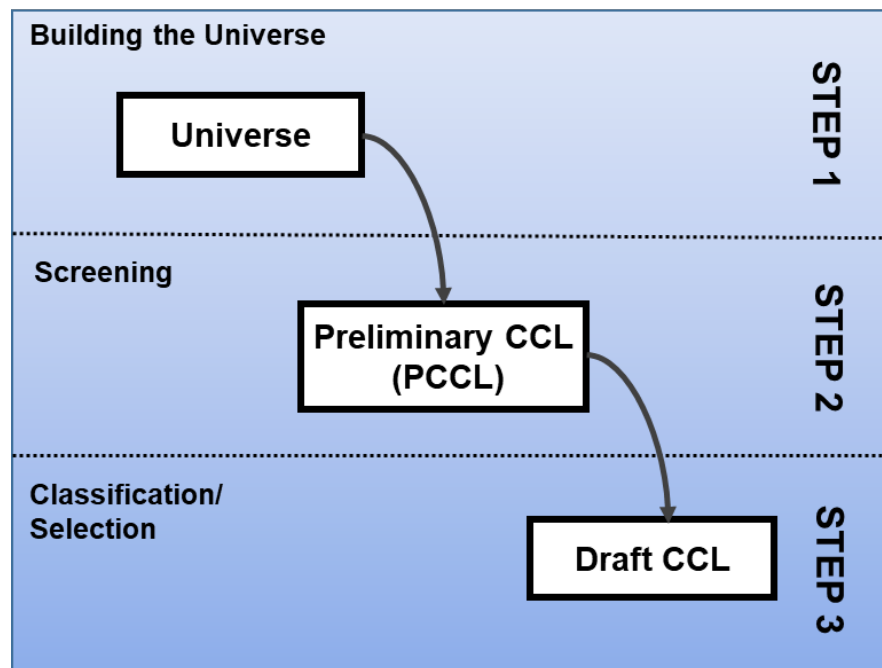
During the development of the CCL 3, EPA requested assistance from the Water Science and Technology Board of the National Academy of Sciences' National Research Council (NRC) in developing a more robust approach to identifying and prioritizing potential drinking water contaminants. NRC formed the Committee on Drinking Water Contaminants, and the committee published their recommendations in 1999 and 2001 (NRC, 1999a; NRC, 1999b; NRC, 2001). EPA used these recommendations to develop the CCL classification process implemented during CCL 3.

In developing the CCL 3, EPA established and implemented a multi-step process to select contaminants (Figure 1). The steps listed below were established to select microbial contaminants specifically. The NRC also provided recommendations for chemical contaminants, the process for how EPA prioritizes chemical contaminants can be found in a separate document- Technical Support Document for the Draft Fifth Contaminant Candidate List (CCL 5) - Chemical Contaminants.

- Step 1. Building a broad universe of all microbes that may cause human disease.
- Step 2. Screening that universe of microbial contaminants to produce a Preliminary CCL (PCCL).

- Step 3. Selecting the Draft CCL microbial list by ranking the PCCL contaminants based on occurrence in drinking water (including waterborne disease outbreaks) and human health effects.

Figure 1: Draft CCL Development Process



Following the process developed for CCL, CCL 3 was published October 8, 2009 (74 FR 51850, USEPA, 2009a) and contained 104 chemicals or chemical groups and 12 microbial contaminants.

EPA carried forward all microbes listed on the CCL 3 to the Fourth Draft CCL (CCL 4). EPA also reviewed the nominations and supporting information provided by nominators to determine if additional microbes should be added to the Draft CCL 4. This process involved evaluating new data provided by the nominators that had not been previously evaluated for CCL 3. The agency also collected additional data for the nominated contaminants, when available, from updated CCL 3 data sources and any new data sources that were not available at the time of the CCL 3. EPA evaluated the nominated contaminants utilizing the best available health effects and occurrence data and followed the same process for screening and scoring contaminants used for the CCL 3. The agency published its final CCL 4 on November 17, 2016 (81 FR 81099, USEPA, 2016a). The final CCL 4 contained 97 chemicals or chemical groups and 12 microbial contaminants.

Section 1.2 Overview of Draft CCL 5 Process for Microbes

EPA developed the Draft Fifth CCL (CCL 5) using a similar process used for the CCL 3 and CCL 4 including developing a microbial universe, PCCL, and Draft CCL, as described in detail in Chapters 3, 4, and 5 of this document.

Chapter 2.0 Summary of CCL 5 Nominations for Microbial Contaminants

EPA sought public nominations in a Federal Register notice on October 5, 2018 for unregulated chemical and microbial contaminants to be considered for possible inclusion in the CCL 5 (83 FR 50364, USEPA, 2018). EPA compiled and reviewed the information from the nominations process to identify the contaminants nominated and any sources of supporting data submitted that could be used to supplement the data gathered by EPA to inform selection of the Draft CCL 5.

Section 2.1 Microbial Nominations for CCL 5

Sixteen unique microbial nominations were submitted by the public in response to EPA's request for nominations for microbial contaminants to be considered for the Draft CCL 5. Eight microbes were nominated by more than one organization or individual. *Legionella pneumophila* received the most nominations, nominated by 18 organizations or individuals. Appendix A shows the organisms or group of organisms that were nominated, along with the number of nominators and any supporting information provided.

Section 2.2 Analysis of Nominated Microbial Contaminants

EPA reviewed the nominated microbial contaminants and the supporting information provided by nominators to determine if any new data provided had not been previously evaluated. Furthermore, the agency collected additional data for the nominated microbial contaminants by updating both the CCL 3 and the CCL 4 data sources and conducting literature searches covering the time between the CCL 4 and the CCL 5.

Chapter 3.0 Building the CCL 5 Microbial Universe

Section 3.1 Overview of the Microbial Universe

The microbial universe was defined as any pathogen that causes human disease. The microbial CCL 5 Universe was developed based upon previous CCL universes, in particular, the CCL 3 and the CCL 4 Universes. During the development of the CCL 3, EPA followed the NDWAC's recommendation to specifically use Taylor et al. (2001) and literature reviews as the starting point for the microbial CCL 3 Universe (NDWAC, 2004). For the CCL 3, the agency added organisms to the Taylor et al. (2001) list, with input from subject matter experts and data collected through a literature search. For example, EPA reviewed fungi in drinking water literature and identified six fungal species reported to occur in drinking water distribution systems that did not appear on the Taylor et al. 2001 list. EPA also added reovirus to the CCL 3 Universe based on additional health effects information (Tyler et al., 2004). Additional microbes, *Methylobacterium* (with two species) and mimivirus, were added to the universe during CCL 3. Adding these two bacterial species, two viral groups (e.g., reovirus and mimivirus) and six fungal species to the microbial universe brought the CCL 3 Universe list to 1,425 microbes. These microbes remained in the CCL 4 Universe.

EPA conducted a literature search, sought input from subject matter experts, and reviewed nominations for potential microbial contaminants to add to the CCL 5 Universe. As a result of the literature search, 14 organisms were added to the CCL 5 Universe (Table 1). Changes to nomenclature were made as necessary (in most cases combining two species into one organism

group), which brought the total to 1,435 microbes. EPA recognizes that given the dynamic nature of ongoing microbial research the listing of all human pathogens on the CCL universe needs to be periodically updated to keep up with the latest science. The full microbial CCL 5 Universe is presented in Appendix B.

Table 1. Organisms Added to the Microbial CCL 5 Universe

Organism	Reference
<i>Alloscardovia omnicolens</i> (bacteria)	Brown, M. et al., 2016
<i>Elizabethkingia anophelis</i> (bacteria)	Figueroa Castro, C.E. et al., 2017
<i>Neoehrlichia mikurensis</i> (bacteria)	Portillo, A. et al., 2018
<i>Parachlamydia acanthamoebae</i> (bacteria)	Greub, G., 2009
<i>Waddlia chondrophila</i> (bacteria)	Baud, D. et al., 2014
Human bocavirus (virus)	Allander, T., 2008
Human coronavirus SARS-CoV-2 (virus)	Ciotti, et al., 2019
KI polyomavirus (virus)	Bofill-Mas, S., et al., 2010
Kobuvirus (virus)	Ramírez-Castillo et al., 2015
Lujo virus (virus)	https://www.cdc.gov/vhf/lujo/transmission/index.html
Parvovirus 4 (virus)	Sharp, C.P., et al., 2010
WU polyomavirus (virus)	Bofill-Mas, S., 2010
<i>Botrytis cinerea</i> (fungi)	Hashimoto et al., 2017
<i>Epiccocum purpurascens</i> (fungi)	https://www.inspq.qc.ca/en/moulds/fact-sheets/epicocum-purpurascens

Chapter 4.0 Screening the Microbial Universe to Select the PCCL 5

The development of the microbial Preliminary CCL 5 (PCCL 5) adhered to the process developed for the CCL 3 with additional updates described below. The CCL 3 process followed NRC recommendations to use a hierarchical framework for evaluating the potential occurrence of microbial contaminants in drinking water (NRC, 2001). For CCL 3, EPA also followed recommendations provided by NDWAC (2004) to select microbial contaminants for a PCCL based upon an assessment of occurrence and health effects attributes. This assessment related the plausibility of pathogen presence, survival, and transport through drinking water to disease manifestations from drinking water exposure. The CCL 3 screening criteria were developed based upon epidemiology, geographical distribution, and biological properties in the host and in

the environment. The screening criteria were recommended by NDWAC and amended by EPA following an external peer review resulting in 12 screening criteria used for initial screening of pathogens in the microbial CCL 3 Universe for placement on the PCCL 3 (NDWAC, 2004). Additional information on recommendations provided by NRC and NDWAC are described in EPA's Final CCL 3 Microbes: Screening to the PCCL (USEPA, 2009b) and NRC (NRC, 2001) and NDWAC reports (NDWAC, 2004).

The 12 exclusion criteria were used to evaluate the five microbial groups (bacteria, viruses, fungi, helminths, and protozoa) but each criterion did not necessarily apply to every group. Some evaluation criteria would never be used to exclude microbes in a group because of fundamental characteristics of the microbes in that group. For example, Criterion 5: Microflora indigenous to the gastrointestinal tract, skin, and mucous membranes was not used to evaluate viruses and helminths. This was because viruses and helminths do not have a commensal relationship with a human host and are not considered a part of normal human microflora (Davis, 1996). Criteria that were not used are greyed out in their respective columns in the screening table presented in Appendix B.

EPA restricted the PCCL to pathogens associated with source water, and recreational water (e.g., swimming pools, hot tubs) only if the source water was also utilized for drinking water. The screening criteria excluded those pathogens whose biological properties are incompatible with water transmission by ingestion, inhalation, or dermal contact, and those pathogens that are typically introduced from sources other than drinking water.

For the CCL 5, EPA re-evaluated the 12 criteria utilized in the CCL 3 and the CCL 4 for applicability to microbes and reviewed certain criteria in depth per recommendations received from the SAB (USEPA, 2016c) and stakeholders during the development of the CCL 3 and CCL 4. In particular, Criterion 1 (anaerobes), Criterion 9 (natural habitat is in the environment without epidemiological evidence of drinking water-related disease) and Criterion 10 (not endemic to North America) were closely re-evaluated based on previous comments for the CCL 3 and the CCL 4 from NDWAC, SAB, and the public. Upon further evaluation, EPA did not find supporting evidence to modify Criterion 1 and Criterion 10. EPA's evaluation included literature searches for new information, internal EPA expert review, as well as feedback from subject matter experts at the Centers for Disease Control and Prevention (CDC).

To determine if Criterion 1, anaerobes, should be modified, EPA conducted a literature search and found insufficient evidence supporting waterborne illnesses attributed to anaerobic microbes. Therefore, Criterion 1 remains unchanged.

In response to the SAB's comments from CCL 3 and CCL 4 that Criterion 9 was too restrictive, EPA evaluated and expanded Criterion 9 to include nosocomial infections where drinking water is implicated. This expansion also recognized a growing concern for microbial contaminants within distribution systems, building water systems, and biofilms. For past CCLs, microorganisms that had outbreaks with no connection to contaminated distribution system water as their cause were screened out. Thus, outbreaks occurring due to nosocomial exposure or attributable to recreational water resulting from post-delivery contamination of drinking water were not sufficient to place a microorganism on the PCCL unless the drinking water was shown to be contaminated. A literature search was conducted for citations from 2009-2019 (post CCL 3 data collection) to look for evidence of waterborne diseases for certain microbes that were

excluded using Criterion 9. There is now evidence of either aerosol transmission from water or water-linked transmission for several microorganisms that were excluded from the PCCL 3.

EPA also evaluated Criterion 10 to determine if additional microbes not previously considered endemic to North America should be passed through to the PCCL. The evaluation supported that Criterion 10 should remain unchanged.

Upon completion of the re-evaluation of the 12 criteria, EPA screened all the microbes in the CCL 5 Universe with the updated Criterion 9 along with the other criteria through the exclusionary screening criteria listed and described below.

Criterion 1:

Anaerobes (microorganisms that cannot survive in oxygenated environments)

Anaerobes are microorganisms that cannot survive in the presence of oxygen (Murray et al., 2007). Due to oxygen toxicity, anaerobes are unable to survive in the ambient water environment, and they pose a negligible threat to human health from drinking water exposure. Examples of anaerobes that were screened out based on this screening criterion included members of the bacterial genera *Actinomyces*, *Bacteroides*, *Clostridium*, *Eubacterium*, *Fusobacterium*, and *Prevotella*, among others (Murray et al., 2007).

Criterion 2:

Fastidious or obligate intracellular pathogens (environmental survival in water implausible)

Fastidious or obligate intracellular pathogens rely upon their host to provide essential nutrients and growth factors that are not present in the environment, hence these pathogens cannot survive outside their hosts. Many fastidious or obligate intracellular pathogens have a narrow temperature and pH range as a result of host adaptation, and they cannot survive the wide range of temperatures and pH common in the ambient environment. Examples of fastidious or obligate intracellular pathogens that were screened out included members of the genera *Chlamydophila*, *Mycoplasma*, and *Orientia* (Murray et al., 2007). This criterion was applied only to bacteria, since all viruses are obligate intracellular pathogens (Knipe and Howley, 2007).

Criterion 3:

Pathogens exclusively transmitted by direct or indirect contact with blood or body fluids (including sexually transmitted diseases)

Some pathogens are transmitted by direct or indirect contact with blood or body fluids, where fecal-oral transmission or transmission by aerosolized water is not observed (Mandel et al. 2005). Pathogens causing bloodborne diseases and sexually transmitted diseases are highly host adapted, fastidious, and are usually not present in feces. They do not survive under environmental conditions, and they are not transmitted by the fecal-oral route, either by direct contact with feces or indirect contact with contaminated drinking water. Examples of pathogens transmitted by blood or body fluids include the etiologic agents of gonorrhea and syphilis, *Chlamydia*, herpes virus, human immunodeficiency virus, and hepatitis virus B, C, D and G (Murray et al., 2007).

Criterion 4:

Pathogens transmitted by vectors

Vectors include arthropods and rodents (Acha and Szyfres, 2001). Pathogens transmitted by vectors depend upon either insect or other bites, or close contact with rodents, and these pathogens are not transmitted by contact with drinking water. Mosquitoes, ticks, and fleas are the most common vectors of arthropod-borne diseases (Krause, et al., 2003). Examples of vector-borne pathogens include bacteria, viruses, protozoa, and helminths. The genera *Babesia*, *Borrelia*, *Brugia*, *Dirofilaria*, *Ehrlichia*, *Leishmania*, *Plasmodium*, *Trypanosoma*, *Rickettsia*, and all arthropod-borne viruses were not moved to the PCCL (Murray et al., 2007).

Criterion 5:

Microflora indigenous to the gastrointestinal tract, skin, and mucous membranes

The human body is colonized with a rich and commensal microflora (Finegold et al., 1983; Drasar and Barrow, 1985; Isenberg and D'Amato, 1995). Some microbes that colonize the human body are transitory, while others are part of the continuing normal flora of the body. Microbes comprising normal flora have a characteristic ecological niche, but sometimes conditions permit their access to areas of the body where they may exhibit pathogenic potential resulting in infection and disease. Infections with normally innocuous microbes are called opportunistic infections, because of their ability to exploit host conditions that may periodically predispose them to disease. Exposure to normal flora microbes is continuous throughout life, and because the populations of normal flora microbes exceed the number of these microbes present in drinking water by many orders of magnitude, drinking water represents an improbable source of infection and disease. Examples of normal flora include members of the genera *Capnocytophaga*, *Corynebacterium*, *Staphylococcus*, *Streptococcus*, and several yeasts (Murray et al., 2007).

Criterion 6:

Pathogens transmitted solely by respiratory secretions

Pathogens causing respiratory disease are typically transmitted by direct contact with respiratory secretions, either by inhalation of aerosols, by direct person-to-person contact, or by contact with fomites. Drinking water is an unlikely mode of transmission because the number of pathogens in respiratory secretions and the continuity of exposure to respiratory secretions far exceed exposure through drinking water (Bennet and Brachman, 2007). Examples of pathogens transmitted by respiratory secretions include the etiologic agents of tuberculosis, diphtheria, whooping cough, measles, rubella, and influenza (Knipe and Howley, 2007; Murray et al., 2007; Mandel et al., 2005).

Criterion 7:

Pathogens whose life cycle is incompatible with drinking water transmission

Some pathogens, such as helminths, require intermediate hosts to complete their life cycles, and incidental infection of humans results in an interruption of their life cycle with subsequent death of the pathogen (Acha and Szyfres, 2001). Some pathogens are adapted to a single route of transmission such as rabies virus, which is transmitted by animal bites. Some pathogens are specifically adapted to survive in a unique ecological niche, and they cannot withstand any alteration of conditions to which they are adapted. For example, rabies virus, *Dientamoeba fragilis*, *Enterobius vermicularis*, and many helminths remain in the microbial CCL 5 Universe and were not considered for the PCCL based on this criterion (Murray et al., 2007; Ashford and Crewe, 2003).

Criterion 8:

Pathogens where drinking water-related transmission is not implicated

Some pathogens cause such rare occurrences of disease that only a few cases have been reported in medical literature, and these rare occurrences of disease present limited opportunity to protect public health from drinking water exposure (Acha and Szyfres, 2001; Knipe and Howley, 2007; Murray et al., 2007; Mandel et al., 2005). Some pathogens are associated with direct transmission from animals to humans, or other transmission routes that do not involve drinking water (Acha and Szyfres, 2001; Krause et al., 2003; Howard, 2003). Examples of pathogens that remained in the microbial CCL 5 Universe after application of this criterion are *Leptospira*, *Listeria*, *Nosema*, and the etiologic agents of several zoonotic virus infections (Knipe and Howley, 2007; Murray et al., 2007).

Criterion 9:

Natural habitat is in the environment without epidemiological evidence of drinking water-related disease **and without evidence of drinking water-related nosocomial infection¹**.

The environment is teeming with microorganisms, at varying concentrations, and humans are in constant contact with these microorganisms throughout their lives (Bennett and Brachman, 2007; Isenberg and D'Amato, 1995). Microorganisms naturally present in the environment are not considered a threat to public health as a result of drinking water exposure unless epidemiological evidence demonstrates a potential for water-related disease. Thus, outbreaks occurring in attributable to recreational water resulting from post-delivery contamination of drinking water are not sufficient to place a microorganism on the PCCL unless the drinking water system was shown to be contaminated (Wenzel, 2003). *Gordonia*, *Nocardia*, and most fungi were excluded from the PCCL based on this criterion (Murray et al., 2007; Howard, 2003).

Criterion 10:

Pathogens not endemic to North America

¹ Bolded language indicates CCL 5 update to previous CCL 3 and CCL 4 Criterion 9

Some pathogens have an exclusive geographical distribution, and they are not naturally present in North America (Ashford and Crewe, 2003; Murray et al., 2007; Palmer et al., 1998). Only pathogens endemic to North America have the potential to contaminate drinking water in the U.S. Several helminths such as most *Diphyllobothrium*, and *Paragonimus* species and several viruses such as the hemorrhagic fever viruses and poxviruses would remain in the microbial CCL universe after application of this criterion.

Criterion 11:

A genus and species or serotype may be chosen to represent a group of closely related organisms EPA has chosen a few pathogens to represent a group based on all serotypes within a group sharing essential biological properties in common with the group. Designation of a representative group provides adequate protection of public health under the PCCL (Murray et al., 2007). Pathogens that represent other pathogens in their group are the following: *Arcobacter butzleri*, *Campylobacter jejuni*, *Helicobacter pylori*, *Legionella pneumophila*, *Salmonella enterica*, *Shigella sonnei*, Adenovirus, Astrovirus, Enterovirus, Microsporidia, and *Entamoeba histolytica*. For example, human adenovirus A, human adenovirus B, human adenovirus C, human adenovirus D, human adenovirus E, and human adenovirus F were listed as a group under adenovirus.

Criterion 12:

Current taxonomy does not support the classification listed by Taylor et al. (2001).

Microbial taxonomy and nomenclature are a dynamic science, and taxonomic classifications are constantly changing. Original taxonomic classifications were based upon the phenotypic characteristics of microorganisms, but these classifications are being revised as genotypic information becomes available. New genera are formed, sometimes prematurely, based upon partial genomic data, and taxonomists do not always agree with proposed changes. Under this criterion, the genera *Fluoribacter* and *Tatlockia* were combined with the genus *Legionella* for screening purposes (Murray et al., 2007).

Section 4.1 Application of Screening Criteria to the Microbial CCL Universe

As the pathogens are screened through the 12 criteria, a pathogen needs to only to meet one criterion to be excluded from moving on to the PCCL. Some pathogens may meet multiple criteria, however, because the pathogens are evaluated through the exclusionary screening criteria sequentially, the criteria that the pathogen meets first will exclude the pathogen and the pathogen will not be further evaluated through the rest of the criteria. For example, if a pathogen could be excluded based on meeting Criteria 3 and 7, the pathogen will be screened out based on meeting Criterion 3 and not further evaluated to see if any other criterion is met. The pathogen will be documented as meeting just that one criterion.

All pathogens that pass through all screening criteria are moved to the PCCL. Bacteria, viruses, protozoa, helminths, and fungi in the CCL 5 Universe are shown screened individually through the CCL exclusionary screening criteria in Appendix B. Each table identifies the pathogens in each category and indicates which screening criteria were applied to remove pathogens from

further consideration in the CCL process. Those pathogens not excluded by at least 1 of the 10 screening criteria or consolidated under Criteria 11 or 12 pass on to the PCCL. Table 2 summarized the number of microbes in the CCL 5 Universe, the number of microbes screened out by each criterion, and the resulting number of microbes passed on to the PCCL.

Table 2. Summary of Screening Microbial CCL 5 Universe

Pathogen Class	Total	Number of Microbes Excluded by Each Screening Criterion												Pathogens Screened Out	On PCCL
		1	2	3	4	5	6	7	8	9	10	11	12		
Bacteria ¹	545	121	16	10	38	121	7	0	29	150	2	28	5	527	18
Viruses	225	0	0	29	104	0	20	1	20	0	36	8	0	218	7
Protozoa ²	66	0	0	1	29	3	0	4	7	7	0	6	0	59	7
Helminths	286	0	0	0	25	0	0	105	0	0	156	0	0	286	0
Fungi	313	0	0	0	0	12	3	0	0	295	0	0	0	310	3
Total	1,435	121	16	40	196	136	30	110	56	452	194	42	5	1,400	35

¹ NTM were included on the PCCL as a group as well as individual *Mycobacterium* species.

² *Cryptosporidium* and *Giardia* (protozoa) are considered to be regulated by the Long-Term Surface Water Treatment Rule (LT-2); even though counted in the microbial universe, they were not evaluated for screening.

Based upon this screening exercise conducted on 1,435 pathogens in the microbial CCL universe 1,400 pathogens were excluded from consideration while 35 pathogens passed on to the PCCL. Thirteen of the 16 nominated microbial contaminants were listed on the PCCL 5. Appendix A details which nominated microbes were included on the PCCL 5.

The modification made to Criterion 9 expanded the PCCL to include nosocomial infections where drinking water was implicated. This resulted in the addition of five bacteria (*Aeromonas hydrophila*, *Acinetobacter baumannii*, *Comamonas testosteroni*, *Pseudomonas aeruginosa*, and *Mycobacterium abscessus*) to the PCCL 5 for further evaluation of the CCL process. The specific screening decisions and references are presented in Appendix B.

Chapter 5.0 Determining the Draft Microbial CCL 5

EPA used scoring protocols to rank pathogens on the PCCL to produce a Draft CCL. This section briefly describes the process developed under CCL 3 and explains the elements included in the microbial Contaminant Information Sheets (CISs). EPA derived the CCL 3 scoring process in part from recommendations of the NRC and an expert workgroup established by the NDWAC, and two external workshops (USEPA, 2009c). EPA made two minor modifications to the CCL 3 microbial scoring process regarding data sources that were used to select microbial contaminants from the PCCL for the CCL 5 as described below. For a more detailed discussion on the CCL 3 scoring process and rationale used to develop the scoring process see Final Contaminant Candidate List 3 Microbes: PCCL to CCL Process (USEPA, 2009c).

Microbes were evaluated for their occurrence in water and their ability to cause adverse health effects in humans. Pathogens on the PCCL were scored for placement on the CCL using a scoring system to assign a numerical value to each pathogen and rank the pathogens based upon both occurrence (waterborne disease outbreaks (WBDOs) and occurrence in water) and health effects. Those microbes receiving high scores were considered for placement on the CCL.

Each microbe was scored using three scoring protocols, one protocol each for WBDOs, occurrence in water, and health effects (both for general and sensitive populations). Data

collected during CCL 3 and CCL 4 were not removed from consideration and remain on the contaminant information sheets presented in Appendix E. If found, new data were added and scores were adjusted as necessary. EPA compiled data sources identified from the CCL 3 and the CCL 4, along with data sources recommended by the CCL 5 EPA workgroup and subject matter experts. EPA accessed each potential data source and evaluated them using the following assessment factors: relevance, completeness, redundancy, and retrievability.

Combining WBDO information and occurrence information allowed EPA to consider: 1) pathogens that are tracked by public health surveillance programs (i.e., CDC's National Outbreak Reporting System (NORS) (CDC, 2020); and 2) pathogens that are not yet tracked by public health surveillance programs but for which occurrence information is available (i.e., emerging pathogens). To determine the WBDO score for CCL 3 and CCL 4, EPA utilized outbreak information from CDC's Morbidity and Mortality Weekly Report (MMWR) (CDC, 2017). For the CCL 5, EPA also included the CDC's NORS data for outbreak information (note, NORS was launched in 2009). CCL 3 and CCL 4 examined outbreaks that occurred between 1990 and 2004. For CCL 5, EPA determined outbreaks that occurred in and after 2009 to capture the microbes of concern. The cutoff date was updated to reflect the impact of the Long Term 2 Enhanced Surface Water Treatment Rule (71 FR 654, USEPA, 2006a), and the Ground Water Rule (GWR) (71 FR 65573, USEPA, 2006b), both promulgated in 2006 with three years to comply. WBDOs were scored on a five-level hierarchy ranging from never caused a WBDO (score of 1) to two or more documented WBDOs in the U.S. (score of 5) in the timeframe specified (Table 3).

Table 3. Waterborne Disease Outbreak Scoring Protocol

Category	Score
Has caused multiple (2 or more) documented WBDOs in the U.S. reported by CDC between 2009-2017	5
Has caused at least one documented WBDOs in U.S. reported by CDC between 2009-2017	4
Has caused documented WBDOs at any time in the U.S.	3
Has caused documented WBDO in countries other than the U.S.	2
Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease	1

The second attribute of the scoring process evaluates the occurrence of a pathogen in drinking water and source water. Because water-related illness may also occur in the absence of recognized outbreaks, EPA scored the occurrence (direct detection) of microbes using cultural, immunochemical, or molecular detection of pathogens in drinking water under the Occurrence Protocol. Occurrence characterizes pathogen introduction, survival, and distribution in the environment. Occurrence implies that pathogens are present in water and that they may be capable of surviving and moving through water to cause illness in persons exposed to drinking water by ingestion, inhalation, or dermal contact.

Pathogen occurrence is considered broadly to include treated drinking water, and all waters using a drinking water source for recreational purposes, ground water, and surface water bodies. This

attribute does not characterize the extent to which a pathogen's occurrence poses a public health threat from drinking water exposure. Occurrence was scored on a three-level hierarchy ranging from not detected in the U.S. (score of 1) to detected in drinking water in the U.S. (score of 3) (Table 4).

Table 4. Occurrence Scoring Protocol

Category	Score
Detected in drinking water in the U.S.	3
Detected in source water in the U.S.	2
Not detected in the U.S.	1

The health effects scoring protocol evaluated the extent of illness produced in humans from drinking water. The severity of disease manifestations produced by a pathogen was evaluated across a range of potential endpoints. Pathogens may produce a range of illness from asymptomatic infection to severe illness progressing rapidly to death. The seven-level hierarchy developed for this protocol begins with mild, self-limiting illness (score of 1) and progresses to death (score of 7) (Table 5). The protocol scored the representative or more common clinical presentation for the specific pathogen for the population category under consideration, rather than the extremes. These scores were based on data from recent clinical microbiology manuals (Carroll et al., 2019).

To obtain a representative characterization of health effects in all populations, EPA evaluated separately the general population and four sensitive populations (children, elderly, pregnant woman, and persons with chronic diseases) as to the common clinical presentation of illness for that population. EPA added the general population score to the highest score among the four sensitive populations for an overall health effects score. The resulting score acknowledged that sensitive populations have increased risk for waterborne diseases. Table 6 shows the health effects scoring protocol template for general and sensitive populations.

Table 5. Health Effects Scoring Protocol for Pathogens

Outcome Category	Score	Manifestation in Population Class				
		General Population	Children/ Infants	Elderly	Pregnant Women	Chronic Disease
Does the organism cause significant mortality (> 1/1,000 cases)?	7					

Outcome Category	Score	Manifestation in Population Class				
		General Population	Children/ Infants	Elderly	Pregnant Women	Chronic Disease
Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term hospitalization (> week)?	6					
Does the illness result in long term or permanent dysfunction or disability (i.e., sequelae)?	5					
Does the illness require short term hospitalization (< week)?	4					
Does the illness require physician intervention?	3					
Is the illness self-limiting within 72 hours (without requiring medical intervention)?	2					
Does the illness result in mild symptoms with minimal or no impact on daily activities?	1					

EPA evaluated the possibility of using antibiotic susceptibility as part of the health effects scoring protocol, and/or antibiotic resistance as scoring consideration for microbes as part of the review process for the development of CCL 5. Each microbe on the CCL was evaluated for its specific antibiotic resistance and mortality rate. The results of the literature search showed that antibiotic resistance cannot be used as a scoring consideration for microbes in the CCL process at this time. There was too much variability among individual microbes and across all microbial groups to determine a criterion that would effectively apply to the universe of microbes.

The highest of the individual WBDO score or occurrence score was added to the normalized health effects score to produce a composite pathogen score. Although the composite score was not shown on the CISs, the scoring summary table at the top left corner of each CIS shows the values used to calculate the composite score. The formula for the pathogen score was as follows:

$$\text{Pathogen Total Score} = \text{Highest Score between WBDO and Occurrence} + \left(\left(\frac{\text{General Population Score} + \text{Highest Sensitive Population}}{2} \right) \times 5/14 \right)$$

EPA normalized the health effects score so that occurrence (or WBDO) and health effects had equal value in determining the ranking of the CCL. The highest possible score for WBDO or occurrence was 5 and the highest possible health effect score was 14. To normalize this imbalance in the calculated total score, the agency multiplied the health effects score by 5/14. An example of this calculation is shown in Appendix E.

The CISs that had been developed for CCL 3 were updated for each CCL 5 contaminant and new CIS sheets were developed for those microbes not previously included. The references in the CISs were also updated to reflect information that became available after EPA published the final CCL 3 and CCL 4. Scores were based on new and previous data available for each CCL 5 contaminant. The CIS tables present the final scores for each of the data types under consideration and a brief description of the data used to assign those scores with their respective references.

Elements of each CIS include:

Scoring Summary – shows the scores used to calculate the final composite score for each microbial contaminant which included the highest score between the WBDO and occurrence, health effects score for the general population, and the highest health effects score of the sensitive populations.

Data Table – shows the categories for each potential score, the scoring data, if applicable, and reference(s) used to support a score. The highest-ranking score for each of the three scoring categories is shown in bold font. The WBDOs scoring results are presented first, followed by the occurrence results and the health effects.

References – presents the full references for the data presented in the table.

For more information on the microbes scoring process and the CISs, see Appendix E.

Section 5.1 Application of Scoring Protocol to the PCCL and Selection of the Draft CCL 5 Microbes from the PCCL

The 35 PCCL pathogens were ranked according to an equal weighting of their summed scores for normalized health effects and the higher of the individual scores for WBDO and occurrence in drinking water. EPA determined that this ranking indicated the most important pathogens to consider for the Draft CCL 5. To determine which of the 35 PCCL pathogens should be the highest priority for EPA's drinking water program and included on the draft CCL 5, EPA considered scientific factors and the opportunity to advance public health protection. These factors included the PCCL scores for WBDO, occurrence, and health effects; comments and recommendations from the various expert panels including EPA's internal workgroup and CDC's subject matter experts; and the greatest opportunity to advance public health protection. After consideration of these factors, EPA listed the 12 highest-ranked pathogens in the Draft CCL 5 (Table 6). A comparison to previous CCLs can be found in Appendix D and scores can be found in Appendix E.

Table 6. The Draft Microbial CCL 5

Microbial Name	Microbial Class
Adenovirus	Virus
Caliciviruses	Virus
<i>Campylobacter jejuni</i>	Bacteria
<i>Escherichia coli</i> (O157)	Bacteria
Enteroviruses	Virus
<i>Helicobacter pylori</i>	Bacteria
<i>Legionella pneumophila</i>	Bacteria
<i>Mycobacterium abscessus</i>	Bacteria
<i>Mycobacterium avium</i>	Bacteria
<i>Naegleria fowleri</i>	Protozoa
<i>Pseudomonas aeruginosa</i>	Bacteria
<i>Shigella sonnei</i>	Bacteria

The selection of microbial pathogens for the Draft CCL 5 was similar to the method used for CCL 3 with the exception that there were no “natural” breaks in the pathogen’s scores, meaning where there were no large numerical gaps in the PCCL scores (as was for the previous PCCL 3 microbes) for the Draft CCL 5 listing.

EPA determined that the overall rankings strongly reflected the best available scientific data and high-quality expert input employed in the CCL selection process, and therefore should be important factors in helping to identify the top priority pathogens for the Draft CCL 5.

Section 5.2 Microbial Organisms Covered by Existing Regulations

According to Section 1412(b)(1) of the 1996 SDWA Amendments, EPA must select CCL contaminants that “at the time of publication, are not subject to any proposed or promulgated national primary drinking water regulation.” In promulgating regulations for contaminants in drinking water, EPA can set either a legal limit (maximum contaminant level or MCL) and require monitoring for the contaminant in drinking water or, for those contaminants that are difficult to measure, EPA can establish a treatment technique requirement. The Surface Water Treatment Rule (54 FR 27486, USEPA, 1989a) established maximum contaminant level goals (MCLGs) of zero for *Legionella*, *Giardia*, and viruses because any amount of exposure to these contaminants represents some public health risk. Since measuring disease-causing microbes in drinking water was not considered to be feasible at the time of the development of the SWTR, EPA established treatment technique requirements for these contaminants. The purpose of subsequent treatment technique requirements (Interim Enhanced Surface Water Treatment Rule (63 FR 69478, USEPA 1998a), Long Term 1 Surface Water Treatment Rule (67 FR 1813,

USEPA, 2002a), and the Long Term 2 Surface Water Treatment Rule (71 FR 654, USEPA, 2006a), which included an MCLG of zero for *Cryptosporidium*, is to reduce disease incidence associated with *Cryptosporidium* and other pathogenic microorganisms in drinking water. These rules apply to all public water systems that use surface water or ground water under the direct influence of surface water.

The Ground Water Rule (GWR) (71 FR 65573; USEPA, 2006c) set treatment technique requirements to control for viruses (and pathogenic bacteria) because it was not feasible to monitor for viruses (or pathogenic bacteria) in drinking water. Under the GWR, if systems detect total coliforms in the distribution system, they are required to monitor for a fecal indicator (*E. coli*, coliphage, or enterococci) in the source water. If fecal contamination is found in the source water, the system must take remedial action to address contamination.

EPA considered *Legionella* and specific viruses in CCL even though they are regulated under the Surface Water Treatment Rules (SWTR)). In this draft document, EPA proposes to specifically list *Legionella pneumophila*, the primary pathogenic bacterium, on the Draft CCL 5 because it has been identified in numerous WBDOs and is the most common cause of reported drinking water-associated outbreaks in the U.S. Furthermore, reported Legionnaires' disease has increased 10-fold in the last 20 years (CDC, 2020b). A recent National Academies of Science report estimated 52,000-70,000 cases of Legionnaires' disease annually, with 3-30% mortality (NASEM, 2020).

EPA is also proposing to list certain viruses on the Draft CCL 5. Viruses include a wide range of taxa and different viral taxa have been implicated in various WBDOs for which EPA did not have dose response or treatment data when promulgating its treatment technique requirements.

Even though there are MCLGs for *Legionella* and viruses, and these contaminants are subject to limitations as a class through the treatment techniques under the Surface Water Treatment Rules, there are no monitoring, treatment, or notification requirements within those NPDWRs that are specific to *Legionella pneumophila* or the specific viruses listed on CCL5 (although systems may use coliphage for source water monitoring for ground water systems). Therefore, EPA considers *Legionella pneumophila* and the specific viruses listed on CCL5 to be unregulated contaminants for purposes of eligibility for the CCL. Additionally, EPA received public nomination for viruses and *Legionella* for the Draft CCL 5, with *Legionella pneumophila* receiving the highest number of nominations.

Section 5.3 Listing Outcomes for the Nominated Microbial Contaminants

All the microbes nominated for the CCL 5, except for *Salmonella enterica*, *Aeromonas hydrophila*, and Hepatitis A, were listed on the Draft CCL 5. *Salmonella enterica*, *Aeromonas hydrophila* and Hepatitis A did not produce sufficient composite scores to place them on the Draft CCL 5. Although *Salmonella enterica* and Hepatitis A have numerous WBDOs, the route of exposure was not explicitly waterborne. Non-tuberculous *Mycobacterium* (NTM) and *Mycobacterium* (species broadly found in drinking water) were nominated for the CCL 5 and were not listed on the Draft CCL 5 as a group; instead, they were listed as *Mycobacterium avium* and *Mycobacterium abscessus*, two species of NTM that are found in drinking water.

Chapter 6.0 Microbial Data Sources for the Draft CCL 5

Multiple data sources were used to gather the information for the development of the Draft CCL 5. The data sources used were evaluated by EPA to ensure they were authoritative and appropriate. Under the CCL 3, for microbes, the universe list was defined as all known human pathogens using the compilation of Taylor et al. (2001) as a practical starting point. This list was supplemented with literature searches and nominations from the public. The Draft CCL 5 used the previous universes from the CCL 3 and the CCL 4 and updated with literature searches of peer reviewed sources and nominations.

The hierarchy of text-based resource materials begins with recently compiled authoritative reference books such as *The Manual of Clinical Microbiology* (MCM), 9th Edition, and *Field's Virology*, 5th Edition, both published in 2007. Both of these two-volume reference books have become established as the leading authoritative reference sources in their respective fields. These references have evolved through multiple editions and both publications are considered reference standards to the scientific community for their scope and depth of coverage. They were edited by world-recognized authorities, and chapters were written by an international team of subject experts. *The parasites of Homo sapiens*, second edition, is a comprehensive source for information on helminths. These and other compiled sources listed in the reference list in Section 7 provided the information for screening the pathogens in the microbial CCL 3 Universe. The 12th edition of the MCM was published in 2019 and was consulted for CCL 5 (Carroll et al., 2019).

Web references were used to find information for screening rarely encountered viruses, protozoa, and fungi, primarily for information related to Criterion 9, “natural habitat in the environment,” or Criterion 10, “pathogen not endemic to North America”. Selected Web references were evaluated to ensure that the site sponsors possessed the expertise to authoritatively address the issues of habitat and geographical distribution of the pathogen in question, and that the information was presented objectively and reviewed by members of the scientific community. Emphasis was placed upon websites sponsored and supported by government agencies or academic institutions, with evidence of peer review, such as an editorial board and/or expert contributors and reviewers.

Appendix B tabulates the screening decisions for the CCL 5 Microbial Universe and shows the screening reference used to support the decision. Page ranges cited and Web addresses/links provided are as narrow and specific as they can be, to identify the information related to the screening criterion used. Many pathogens could be screened by several criteria, however only one criterion is noted in the tabulation. Understanding the complete context and rationale for a screening decision often requires a review of the complete chapter from which the specified page range was taken.

The MCM (Carroll et al., 2019) was one of the main sources of information used to inform the scoring of the PCCL microbes for Draft CCL 5. EPA also conducted a literature search covering the time period between CCL 4 and CCL 5 (2016-2019). The literature search focused on health effects and occurrence of the nominated microbial contaminants in water.

For CCL 5 WBDOs, the primary source for scoring data was outbreak information pulled from CDC's NORS dashboard. Outbreak information was available from 2009-2017. NORS data was used as an alternative to CDC's Morbidity and Mortality Weekly Reports (MMWR) for more

recent outbreak data (as of August 2019, the most recent MMWR report was published in 2017). Appendix F contains additional detail on data sources.

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Appendix A: List of CCL 5 Microbial Nominations

Common Name	Nominator(s)	Health Effects Information Provided with Nomination	Occurrence Information Provided with Nomination	Additional Information Provided with Nomination	CCL Universe	PCCL 5	Draft CCL 5
<i>Aeromonas hydrophila</i>	C.J. Volk	No information provided	No information provided	No information provided	X	X	
Adenovirus*	G. Tracy Mehan, AWWA	No information provided	No information provided	No information provided	X	X	X
Caliciviruses*	G. Tracy Mehan, AWWA	No information provided	No information provided	No information provided	X	X	X
<i>Campylobacter jejuni</i> *	C.J. Volk	No information provided	No information provided	No information provided	X	X	X
	G. Tracy Mehan, AWWA	No information provided	No information provided	No information provided			
CCL 4 contaminants (12 microbes)*	Mae Wu and Anna Reade, NRDC	Known public health threats.	No information provided	No information provided	X	X	
Enterovirus*	G. Tracy Mehan, AWWA	No information provided	No information provided	No information provided	X	X	X
<i>Escherichia coli</i> (O157)*	C.J. Volk	No information provided	No information provided	No information provided	X	X	X
	G. Tracy Mehan, AWWA	No information provided	No information provided	No information provided			
<i>Helicobacter pylori</i> *	C.J. Volk	No information provided	No information provided	No information provided	X	X	X
	G. Tracy Mehan, AWWA	No information provided	No information provided	No information provided			
Hepatitis A virus*	G. Tracy Mehan, AWWA	No information provided	No information provided	No information provided	X	X	
<i>Legionella pneumophila</i> * ^a	Anonymous	No information provided	Typically found in biofilms	No information provided	X	X	X
	Paul McDermott, PJM-HS Consulting Ltd	No information provided	No information provided	No information provided			
	Jason Dobranic, EMSL Analytical, Inc.	No information provided	No information provided	No information provided			
	Matthew Freije, hcinfo.com	No information provided	No information provided	No information provided			
	Anonymous	No information provided	No information provided	No information provided			
	Cam Pham, Enthalpy Analytical, LLC	No information provided	No information provided	No information provided			
	W.E. Pearson II, BPEARSON Consulting LLC	No information provided	No information provided	No information provided			
	C.J. Volk	No information provided	No information provided	No information provided			

Common Name	Nominator(s)	Health Effects Information Provided with Nomination	Occurrence Information Provided with Nomination	Additional Information Provided with Nomination	CCL Universe	PCCL 5	Draft CCL 5
	Sharon Sweeney, Central Arkansas Water	No information provided	No information provided	No information provided			
	Philippe Hartemann	No information provided	No information provided	No information provided			
	Anonymous	No information provided	No information provided	No information provided			
	Patsy Root, IDEXX Laboratories, Inc.	No information provided	No information provided	No information provided			
	Paul R. Easley, Central Arkansas Water	No information provided	No information provided	No information provided			
	Stan Hazan, NSF	According to the CDC, reported cases of legionella increased 286% during the time period 2000-2014.	The bacterium is known to propagate in premise plumbing and other mechanical systems. This places the elderly and individuals with compromised immune systems at risk when water contaminated with the bacteria aerosolizes and disperses.	No information provided			
	Robert Bohannon, City of Moline, Illinois	No information provided	No information provided	No information provided			
	Mae Wu and Anna Reade, NRDC	No information provided	No information provided	No information provided			
	G. Tracy Mehan, AWWA	No information provided	No information provided	No information provided			
	Jennifer Clancy, ESPRI	There are 8,000 to 18,000 people hospitalized with LD each year and estimates of ten times that many cases that are unrecognized. CDC estimates that it costs \$434,000,000 to treat LD in the US annually; LD is now the #1 cause of WBDOs in the US (CDC, 2015).	Based on CDC outbreak data, LD is responsible for 66% of waterborne disease outbreaks (WBDO) attributable to the distribution system.	No information provided			
<i>Mycobacterium avium</i> *	C.J. Volk	No information provided	No information provided	No information provided	X	X	X

Common Name	Nominator(s)	Health Effects Information Provided with Nomination	Occurrence Information Provided with Nomination	Additional Information Provided with Nomination	CCL Universe	PCCL 5	Draft CCL 5
	G. Tracy Mehan, AWWA	No information provided	No information provided	No information provided			
Mycobacterium species predominantly found in finished drinking water	Anonymous	No information provided	Typically found in biofilms	No information provided	X		
<i>Naegleria fowleri</i> *	G. Tracy Mehan, AWWA	No information provided	No information provided	No information provided	X	X	
Nontuberculous mycobacteria (NTM)	Jennifer Clancy, ESPRI	Pseudomonas aeruginosa which is the most common cause of hospital-acquired pneumonia and nontuberculous mycobacteria (NTM), an increasing cause of lung infections in both immunocompromised and otherwise healthy individuals.	In the chloraminated system, NTM colonized the pipe loops by the first sampling round and continued to be observed in the bulk water of all pipe materials, with greater numbers recovered consistently from the high use pipe loops.	No information provided	X	X	
<i>Pseudomonas aeruginosa</i>	Anonymous		Typically found in biofilms		X	X	X
	C.J. Volk	No information provided	No information provided	No information provided			
	Jennifer Clancy, ESPRI	Pseudomonas aeruginosa which is the most common cause of hospital-acquired pneumonia and nontuberculous mycobacteria (NTM), an increasing cause of lung infections in both immunocompromised and otherwise healthy individuals.	No information provided	No information provided			
<i>Salmonella enterica</i> *	C.J. Volk	No information provided	No information provided	No information provided	X	X	
	G. Tracy Mehan, AWWA	No information provided	No information provided	No information provided			
<i>Shigella sonnei</i> *	C.J. Volk	No information provided	No information provided	No information provided	X	X	X
	G. Tracy Mehan, AWWA	No information provided	No information provided	No information provided			

*CCL 4 microbes

Appendix B: The CCL 5 Microbial Universe

The CCL 5 Microbial Universe

Table B-1 presents the CCL 5 Universe and the exclusion criteria used to keep a microbe in the universe. The source used for the exclusion criteria is listed in the reference column. Those microbes for which a source could not found to support exclusion moved forward to the PCCL.

The CCL 5 Microbes Exclusion Screening Criteria:

1. All anaerobes.
2. Obligate intracellular fastidious pathogens.
3. Transmitted by contact with blood or body fluids.
4. Transmitted by vectors.
5. Indigenous to the gastrointestinal tract, skin and mucous membranes.
6. Transmitted solely by respiratory secretions.
7. Life cycle incompatible with drinking water transmission.
8. Drinking water-related transmission is not implicated.
9. Natural habitat is in the environment without epidemiological evidence of drinking water-related disease and without evidence of drinking water-related nosocomial infection.
10. Not endemic to North America.
11. Represented by a pathogen for the entire genus or species (that are closely related).
12. Current taxonomy changed from taxonomy used in Universe.

Table B-1: The CCL 5 Microbial Universe and Exclusion Criteria

Bacteria	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Reference
<i>Abiotrophia defectiva</i>					x									MCM-12 th Edition
<i>Achromobacter piechaudii</i>									x					MCM-12 th Edition

Bacteria	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Reference
<i>Achromobacter xylosoxidans</i>									x					MCM-12 th Edition
<i>Acidaminococcus fermentans</i>	x													MCM-12 th Edition
<i>Acinetobacter baumannii</i>													<i>Acinetobacter baumannii</i>	
<i>Acinetobacter calcoaceticus</i>									x					MCM-12 th Edition
<i>Acinetobacter haemolyticus</i>									x					MCM-12 th Edition
<i>Acinetobacter johnsonii</i>									x					MCM-12 th Edition
<i>Acinetobacter junii</i>									x					MCM-12 th Edition
<i>Acinetobacter lwoffii</i>									x					MCM-12 th Edition
<i>Acinetobacter radioresistens</i>									x					MCM-12 th Edition
<i>Actinobacillus equuli</i>			x											MCM-12 th Edition
<i>Actinobacillus hominis</i>			x											MCM-12 th Edition
<i>Actinobacillus lignieresii</i>			x											MCM-12 th Edition
<i>Actinobacillus pleuropneumoniae</i>			x											MCM-12 th Edition
<i>Actinobacillus suis</i>			x											MCM-12 th Edition
<i>Actinobacillus ureae</i>					x									MCM-12 th Edition
<i>Actinomyces georgiae</i>	x													MCM-12 th Edition
<i>Actinomyces gerencseriae</i>	x													MCM-12 th Edition
<i>Actinomyces israelii</i>	x													MCM-12 th Edition
<i>Actinomyces meyeri</i>	x													MCM-12 th Edition
<i>Actinomyces naeslundii</i>	x													MCM-12 th Edition
<i>Actinomyces neuii</i>	x													MCM-12 th Edition
<i>Actinomyces odontolyticus</i>	x													MCM-12 th Edition

Bacteria	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Reference
<i>Actinomyces radingae</i>	x													MCM-12 th Edition
<i>Actinomyces turicensis</i>	x													MCM-12 th Edition
<i>Aerococcus viridans</i>									x					MCM-12 th Edition
<i>Aeromonas caviae</i>									x					MCM-12 th Edition
<i>Aeromonas hydrophila</i>													<i>Aeromonas hydrophila</i>	
<i>Aeromonas sobria</i>									x					MCM-12 th Edition
<i>Aeromonas veronii</i>									x					MCM-12 th Edition
<i>Aggregatibacter actinomycetemcomitans</i>					x									MCM-12 th Edition
<i>Aggregatibacter aphrophilus</i>					x									MCM-12 th Edition
<i>Alcaligenes odorans</i>					x									MCM-12 th Edition
<i>Alloprevotella tannerae</i>	x													MCM-12 th Edition
<i>Alloscardovia omnicolens</i>					x									Brown, M et al., 2016
<i>Amycolatopsis orientalis</i>									x					MCM-12 th Edition
<i>Anaplasma phagocytophilum</i>				x										MCM-12 th Edition
<i>Arcanobacterium heamolyticum</i>					x									MCM-12 th Edition
<i>Arcobacter butzleri</i>													<i>Arcobacter butzleri</i>	
<i>Arcobacter cryaerophilus</i>											x			MCM-12 th Edition
<i>Bacillus anthracis</i>									x					MCM-12 th Edition
<i>Bacillus cereus</i>									x					MCM-12 th Edition
<i>Bacillus circulans</i>									x					MCM-12 th Edition
<i>Bacillus coagulans</i>									x					MCM-12 th Edition
<i>Bacillus licheniformis</i>									x					MCM-12 th Edition
<i>Bacillus mycoides</i>									x					MCM-12 th Edition
<i>Bacillus pumilus</i>									x					MCM-12 th Edition
<i>Bacillus subtilis</i>									x					MCM-12 th Edition

Bacteria	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Reference
<i>Bacillus thuringiensis</i>									x					MCM-12 th Edition
<i>Bacteroides caccae</i>	x													MCM-12 th Edition
<i>Bacteroides eggerthii</i>	x													MCM-12 th Edition
<i>Bacteroides fragilis</i>	x													MCM-12 th Edition
<i>Bacteroides galacturonicus</i>	x													MCM-12 th Edition
<i>Bacteroides ovatus</i>	x													MCM-12 th Edition
<i>Bacteroides pectinophilus</i>	x													MCM-12 th Edition
<i>Bacteroides stercoris</i>	x													MCM-12 th Edition
<i>Bacteroides thetaiotaomicron</i>	x													MCM-12 th Edition
<i>Bacteroides uniformis</i>	x													MCM-12 th Edition
<i>Bacteroides vulgatus</i>	x													MCM-12 th Edition
<i>Bartonella bacilliformis</i>				x										MCM-12 th Edition
<i>Bartonella elizabethae</i>				x										MCM-12 th Edition
<i>Bartonella henselae</i>				x										MCM-12 th Edition
<i>Bartonella quintana</i>				x										MCM-12 th Edition
<i>Bergeyella zoohelcum</i>					x									MCM-12 th Edition
<i>Bifidobacterium dentium</i>	x													MCM-12 th Edition
<i>Bilophila wadsworthia</i>	x													MCM-12 th Edition
<i>Blautia producta</i>	x													MCM-12 th Edition
<i>Bordetella avium</i>						x								MCM-12 th Edition
<i>Bordetella bronchiseptica</i>						x								MCM-12 th Edition
<i>Bordetella parapertussis</i>						x								MCM-12 th Edition
<i>Bordetella pertussis</i>						x								MCM-12 th Edition
<i>Borrelia brasiliensis</i>				x										MCM-12 th Edition
<i>Borrelia burgdorferi</i>				x										MCM-12 th Edition
<i>Borrelia caucasica</i>				x										MCM-12 th Edition
<i>Borrelia crocidurae</i>				x										MCM-12 th Edition

Bacteria	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Reference
<i>Borrelia duttonii</i>				x										MCM-12 th Edition
<i>Borrelia hermsii</i>				x										MCM-12 th Edition
<i>Borrelia hispanica</i>				x										MCM-12 th Edition
<i>Borrelia latyschewii</i>				x										MCM-12 th Edition
<i>Borrelia mazzottii</i>				x										MCM-12 th Edition
<i>Borrelia parkeri</i>				x										MCM-12 th Edition
<i>Borrelia persica</i>				x										MCM-12 th Edition
<i>Borrelia recurrentis</i>				x										MCM-12 th Edition
<i>Borrelia turicatae</i>				x										MCM-12 th Edition
<i>Borrelia venezuelensis</i>				x										MCM-12 th Edition
<i>Brevibacillus brevis</i>									x					MCM-12 th Edition
<i>Brevundimonas diminuta</i>									x					MCM-12 th Edition
<i>Brevundimonas vesicularis</i>									x					MCM-12 th Edition
<i>Brucella melitensis</i>		x												MCM-12 th Edition
<i>Burkholderia cepacia</i>									x					MCM-12 th Edition
<i>Burkholderia mallei</i>										x				MCM-12 th Edition
<i>Burkholderia pseudomallei</i>									x					MCM-12 th Edition
<i>Campylobacter coli</i>											x			MCM-12 th Edition
<i>Campylobacter concisus</i>					x									MCM-12 th Edition
<i>Campylobacter curvus</i>					x									MCM-12 th Edition
<i>Campylobacter fetus</i>								x						MCM-12 th Edition
<i>Campylobacter gracilis</i>					x									MCM-12 th Edition
<i>Campylobacter hyointestinalis</i>								x						MCM-12 th Edition
<i>Campylobacter jejuni</i>													<i>Campylobacter jejuni</i>	
<i>Campylobacter lari</i>											x			MCM-12 th Edition
<i>Campylobacter rectus</i>					x									MCM-12 th Edition

Bacteria	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Reference
<i>Campylobacter sputorum</i>								x						MCM-12 th Edition
<i>Campylobacter upsaliensis</i>								x						MCM-12 th Edition
<i>Campylobacter ureolyticus</i>	x													MCM-12 th Edition
<i>Capnocytophaga canimorsus</i>					x									MCM-12 th Edition
<i>Capnocytophaga cynodegmi</i>					x									MCM-12 th Edition
<i>Capnocytophaga gingivalis</i>					x									MCM-12 th Edition
<i>Capnocytophaga ochracea</i>					x									MCM-12 th Edition
<i>Capnocytophaga sputigena</i>					x									MCM-12 th Edition
<i>Cardiobacterium hominis</i>					x									MCM-12 th Edition
<i>Cedecea davisae</i>									x					MCM-12 th Edition
<i>Cedecea lapagei</i>									x					MCM-12 th Edition
<i>Cedecea neteri</i>									x					MCM-12 th Edition
<i>Cellulomonas turbata</i>									x					MCM-12 th Edition
<i>Cellulosimicrobium cellulans</i>									x					MCM-12 th Edition
<i>Centipeda periodontii</i>	x													MCM-12 th Edition
<i>Chlamydia trachomatis</i>			x											MCM-12 th Edition
<i>Chlamydophila pneumoniae</i>		x												MCM-12 th Edition
<i>Chlamydophila psittaci</i>		x												MCM-12 th Edition
<i>Chromobacterium violaceum</i>								x						MCM-12 th Edition

Bacteria	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Reference
<i>Chryseobacterium balustinum</i>									x					MCM-12 th Edition
<i>Citrobacter amalonaticus</i>					x									MCM-12 th Edition
<i>Citrobacter braakii</i>					x									MCM-12 th Edition
<i>Citrobacter farmeri</i>					x									MCM-12 th Edition
<i>Citrobacter freundii</i>					x									MCM-12 th Edition
<i>Citrobacter koseri</i>					x									MCM-12 th Edition
<i>Citrobacter rodentium</i>					x									MCM-12 th Edition
<i>Citrobacter sedlakii</i>					x									MCM-12 th Edition
<i>Citrobacter werkmanii</i>					x									MCM-12 th Edition
<i>Citrobacter youngae</i>					x									MCM-12 th Edition
<i>Clostridium baratii</i>	x													MCM-12 th Edition
<i>Paraclostridium bifermentans</i>	x													MCM-12 th Edition
<i>Clostridium botulinum</i>	x													MCM-12 th Edition
<i>Clostridium butyricum</i>	x													MCM-12 th Edition
<i>Clostridium chauvoei</i>	x													MCM-12 th Edition
<i>Clostridoides difficile</i>	x													MCM-12 th Edition
<i>Clostridium fallax</i>	x													MCM-12 th Edition
<i>Clostridium histolyticum</i>	x													MCM-12 th Edition
<i>Clostridium novyi</i>	x													MCM-12 th Edition
<i>Clostridium perfringens</i>	x													MCM-12 th Edition
<i>Clostridium ramosum</i>	x													MCM-12 th Edition
<i>Clostridium septicum</i>	x													MCM-12 th Edition
<i>Clostridium sordellii</i>	x													MCM-12 th Edition
<i>Clostridium sporogenes</i>	x													MCM-12 th Edition
<i>Clostridium tertium</i>	x													MCM-12 th Edition
<i>Clostridium tetani</i>	x													MCM-12 th Edition
<i>Collinsella aerofaciens</i>	x													MCM-12 th Edition

Bacteria	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Reference
<i>Comamonas testosteroni</i>													<i>Comamonas testosteroni</i>	
<i>Corynebacterium afermentans</i>					x									MCM-12 th Edition
<i>Corynebacterium argenteorotense</i>					x									MCM-12 th Edition
<i>Corynebacterium bovis</i>					x									MCM-12 th Edition
<i>Corynebacterium diphtheriae</i>						x								MCM-12 th Edition
<i>Corynebacterium jeikeium</i>					x									MCM-12 th Edition
<i>Corynebacterium kutscheri</i>					x									MCM-12 th Edition
<i>Corynebacterium macginleyi</i>					x									MCM-12 th Edition
<i>Corynebacterium minutissimum</i>					x									MCM-12 th Edition
<i>Corynebacterium propinquum</i>					x									MCM-12 th Edition
<i>Corynebacterium pseudodiphthericum</i>					x									MCM-12 th Edition
<i>Corynebacterium pseudotuberculosis</i>					x									MCM-12 th Edition
<i>Corynebacterium striatum</i>					x									MCM-12 th Edition
<i>Corynebacterium ulcerans</i>					x									MCM-12 th Edition
<i>Corynebacterium urealyticum</i>					x									MCM-12 th Edition
<i>Corynebacterium xerosis</i>					x									MCM-12 th Edition

Bacteria	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Reference
<i>Coxiella burnetii</i>		x												MCM-12 th Edition
<i>Cronobacter sakazakii</i>									x					MCM-12 th Edition
<i>Cutibacterium acnes</i>					x									MCM-12 th Edition
<i>Cutibacterium avidum</i>					x									MCM-12 th Edition
<i>Cutibacterium granulosum</i>					x									MCM-12 th Edition
<i>Delftia acidovorans</i>									x					MCM-12 th Edition
<i>Dermatophilus congolensis</i>									x					MCM-12 th Edition
<i>Dichelobacter nodosus</i>	x													MCM-12 th Edition
<i>Edwardsiella hoshinae</i>									x					MCM-12 th Edition
<i>Edwardsiella tarda</i>									x					MCM-12 th Edition
<i>Eggerthella lenta</i>	x													MCM-12 th Edition
<i>Ehrlichia chaffeensis</i>				x										MCM-12 th Edition
<i>Ehrlichia equi</i>				x										MCM-12 th Edition
<i>Ehrlichia ewingii</i>				x										MCM-12 th Edition
<i>Eikenella corrodens</i>					x									MCM-12 th Edition
<i>Elizabethkingia anophelis</i>									x					Figueroa Castro, Carlos E et al., 2017
<i>Elizabethkingia meningoseptica</i>									x					MCM-12 th Edition
<i>Enterobacter amnigenus</i>									x					MCM-12 th Edition
<i>Enterobacter asburiae</i>									x					MCM-12 th Edition
<i>Enterobacter cancerogenus</i>									x					MCM-12 th Edition
<i>Enterobacter cloacae</i>									x					MCM-12 th Edition
<i>Enterobacter gergoviae</i>									x					MCM-12 th Edition
<i>Enterobacter hormaechei</i>									x					MCM-12 th Edition
<i>Enterococcus avium</i>									x					MCM-12 th Edition

Bacteria	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Reference
<i>Enterococcus casseliflavus</i>									x					MCM-12 th Edition
<i>Enterococcus durans</i>									x					MCM-12 th Edition
<i>Enterococcus faecalis</i>									x					MCM-12 th Edition
<i>Enterococcus faecium</i>									x					MCM-12 th Edition
<i>Enterococcus flavescens</i>									x					MCM-12 th Edition
<i>Enterococcus gallinarum</i>									x					MCM-12 th Edition
<i>Enterococcus hirae</i>									x					MCM-12 th Edition
<i>Enterococcus mundtii</i>									x					MCM-12 th Edition
<i>Enterococcus raffinosus</i>									x					MCM-12 th Edition
<i>Erysipelothrix rhusiopathiae</i>									x					MCM-12 th Edition
<i>Escherichia coli</i>													<i>Escherichia coli</i>	
<i>Eubacterium brachy</i>	x													MCM-12 th Edition
<i>Eubacterium cylindroides</i>	x													MCM-12 th Edition
<i>Eubacterium limosum</i>	x													MCM-12 th Edition
<i>Eubacterium moniliforme</i>	x													MCM-12 th Edition
<i>Eubacterium multiforme</i>	x													MCM-12 th Edition
<i>Eubacterium nodatum</i>	x													MCM-12 th Edition
<i>Eubacterium rectale</i>	x													MCM-12 th Edition
<i>Eubacterium saburreum</i>	x													MCM-12 th Edition
<i>Eubacterium saphenum</i>	x													MCM-12 th Edition
<i>Eubacterium sulci</i>	x													MCM-12 th Edition
<i>Eubacterium tenue</i>	x													MCM-12 th Edition
<i>Ewingella americana</i>					x									MCM-12 th Edition
<i>Faecalicatena contorta</i>	x													MCM-12 th Edition
<i>Fibrobacter intestinalis</i>	x													MCM-12 th Edition

Bacteria	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Reference
<i>Filifactor alocis</i>	x													MCM-12 th Edition
<i>Finegoldia magna</i>	x													MCM-12 th Edition
<i>Fluoribacter bozemanai</i>												x		MCM-12 th Edition
<i>Fluoribacter dumoffii</i>												x		MCM-12 th Edition
<i>Fluoribacter gormanii</i>												x		MCM-12 th Edition
<i>Francisella tularensis</i>				x										MCM-12 th Edition
<i>Fusobacterium mortiferum</i>	x													MCM-12 th Edition
<i>Fusobacterium necrophorum</i>	x													MCM-12 th Edition
<i>Fusobacterium nucleatum</i>	x													MCM-12 th Edition
<i>Fusobacterium periodonticum</i>	x													MCM-12 th Edition
<i>Fusobacterium ulcerans</i>	x													MCM-12 th Edition
<i>Fusobacterium varium</i>	x													MCM-12 th Edition
<i>Gardnerella vaginalis</i>					x									MCM-12 th Edition
<i>Gemella morbillorum</i>					x									MCM-12 th Edition
<i>Gordonia amarae</i>									x					MCM-12 th Edition
<i>Gordonia bronchialis</i>									x					MCM-12 th Edition
<i>Gordonia rubropertincta</i>									x					MCM-12 th Edition
<i>Gordonia sputi</i>									x					MCM-12 th Edition
<i>Gordonia terrae</i>									x					MCM-12 th Edition
<i>Granulicatella adiacens</i>					x									MCM-12 th Edition
<i>Haemophilus ducreyi</i>			x											MCM-12 th Edition
<i>Haemophilus haemolyticus</i>					x									MCM-12 th Edition
<i>Haemophilus influenzae</i>					x									MCM-12 th Edition
<i>Haemophilus parahaemolyticus</i>					x									MCM-12 th Edition

Bacteria	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Reference
<i>Haemophilus parainfluenzae</i>					x									MCM-12 th Edition
<i>Haemophilus paraphrophilus</i>					x									MCM-12 th Edition
<i>Haemophilus segnis</i>					x									MCM-12 th Edition
<i>Hafnia alvei</i>									x					MCM-12 th Edition
<i>Helicobacter cinaedi</i>											x			MCM-12 th Edition
<i>Helicobacter fennelliae</i>											x			MCM-12 th Edition
<i>Helicobacter heilmannii</i>											x			MCM-12 th Edition
<i>Helicobacter pullorum</i>											x			MCM-12 th Edition
<i>Helicobacter pylori</i>													<i>Helicobacter pylori</i>	
<i>Kingella denitrificans</i>					x									MCM-12 th Edition
<i>Kingella kingae</i>					x									MCM-12 th Edition
<i>Klebsiella aerogenes</i>									x					MCM-12 th Edition
<i>Klebsiella granulomatis</i>									x					MCM-12 th Edition
<i>Klebsiella oxytoca</i>									x					MCM-12 th Edition
<i>Klebsiella pneumoniae</i>									x					MCM-12 th Edition
<i>Kluyvera ascorbata</i>									x					MCM-12 th Edition
<i>Kluyvera cryocrescens</i>									x					MCM-12 th Edition
<i>Lactobacillus sp.</i>	x													MCM-12 th Edition
<i>Legionella anisa</i>											x			MCM-12 th Edition
<i>Legionella birminghamensis</i>											x			MCM-12 th Edition
<i>Legionella cherrii</i>											x			MCM-12 th Edition
<i>Legionella cincinnatiensis</i>											x			MCM-12 th Edition
<i>Legionella feeleyi</i>											x			MCM-12 th Edition
<i>Legionella hackeliae</i>											x			MCM-12 th Edition
<i>Legionella jordanis</i>											x			MCM-12 th Edition
<i>Legionella lansingensis</i>											x			MCM-12 th Edition
<i>Legionella longbeachae</i>											x			MCM-12 th Edition

Bacteria	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Reference
<i>Legionella oakridgensis</i>											x			MCM-12 th Edition
<i>Legionella pneumophila</i>													<i>Legionella pneumophila</i>	
<i>Legionella rubrilucens</i>											x			MCM-12 th Edition
<i>Legionella sainthelensi</i>											x			MCM-12 th Edition
<i>Legionella tucsonensis</i>											x			MCM-12 th Edition
<i>Legionella wadsworthii</i>											x			MCM-12 th Edition
<i>Leifsonia aquatica</i>									x					MCM-12 th Edition
<i>Leptospira borgpetersenii</i>								x						MCM-12 th Edition
<i>Leptospira inadai</i>								x						MCM-12 th Edition
<i>Leptospira interrogans</i>								x						MCM-12 th Edition
<i>Leptospira kirschneri</i>								x						MCM-12 th Edition
<i>Leptospira meyeri</i>								x						MCM-12 th Edition
<i>Leptospira noguchii</i>								x						MCM-12 th Edition
<i>Leptospira santarosai</i>								x						MCM-12 th Edition
<i>Leptospira weilii</i>								x						MCM-12 th Edition
<i>Leptotrichia buccalis</i>	x													MCM-12 th Edition
<i>Listeria ivanovii</i>								x						MCM-12 th Edition
<i>Listeria monocytogenes</i>								x						MCM-12 th Edition
<i>Listeria seeligeri</i>								x						MCM-12 th Edition
<i>Listeria welshimeri</i>								x						MCM-12 th Edition
<i>Lysinibacillus sphaericus</i>									x					MCM-12 th Edition
<i>Mannheimia haemolytica</i>					x									MCM-12 th Edition
<i>Megamonas hypermegale</i>	x													MCM-12 th Edition
<i>Megasphaera sp.</i>	x													MCM-12 th Edition
<i>Methylobacterium mesophilicum</i> *								x						MCM-12 th Edition

Bacteria	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Reference
<i>Methylobacterium zatmanii</i> *								x						MCM-12 th Edition
<i>Micromonas micros</i>	x													MCM-12 th Edition
<i>Mogibacterium timidum</i>	x													MCM-12 th Edition
<i>Moraxella atlantae</i>					x									MCM-12 th Edition
<i>Moraxella bovis</i>					x									MCM-12 th Edition
<i>Moraxella catarrhalis</i>					x									MCM-12 th Edition
<i>Moraxella caviae</i>					x									MCM-12 th Edition
<i>Moraxella cuniculi</i>					x									MCM-12 th Edition
<i>Moraxella lacunata</i>					x									MCM-12 th Edition
<i>Moraxella lincolnii</i>					x									MCM-12 th Edition
<i>Moraxella liquefaciens</i>					x									MCM-12 th Edition
<i>Moraxella nonliquefaciens</i>					x									MCM-12 th Edition
<i>Moraxella osloensis</i>					x									MCM-12 th Edition
<i>Moraxella ovis</i>					x									MCM-12 th Edition
<i>Morganella morganii</i>					x									MCM-12 th Edition
<i>Mycobacterium abscessus</i>													<i>Mycobacterium abscessus</i>	
<i>Mycobacterium africanum</i>										x				MCM-12 th Edition
<i>Mycobacterium asiaticum</i>									x					MCM-12 th Edition
<i>Mycobacterium avium</i>													<i>Mycobacterium avium</i>	
<i>Mycobacterium bovis</i>		x												MCM-12 th Edition
<i>Mycobacterium celatum</i>									x					MCM-12 th Edition
<i>Mycobacterium chelonae</i>									x					MCM-12 th Edition
<i>Mycobacterium conspicuum</i>									x					MCM-12 th Edition

Bacteria	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Reference
<i>Mycobacterium fortuitum</i>									x					MCM-12 th Edition
<i>Mycobacterium genavense</i>									x					MCM-12 th Edition
<i>Mycobacterium gordonae</i>									x					MCM-12 th Edition
<i>Mycobacterium haemophilum</i>									x					MCM-12 th Edition
<i>Mycobacterium kansasii</i>									x					MCM-12 th Edition
<i>Mycobacterium leprae</i>		x												MCM-12 th Edition
<i>Mycobacterium mageritense</i>									x					MCM-12 th Edition
<i>Mycobacterium marinum</i>									x					MCM-12 th Edition
<i>Mycobacterium mucogenicum</i>									x					MCM-12 th Edition
<i>Mycobacterium peregrinum</i>									x					MCM-12 th Edition
<i>Mycobacterium porcinum</i>									x					MCM-12 th Edition
<i>Mycobacterium scrofulaceum</i>									x					MCM-12 th Edition
<i>Mycobacterium senegalense</i>									x					MCM-12 th Edition
<i>Mycobacterium shimoidei</i>									x					MCM-12 th Edition
<i>Mycobacterium simiae</i>									x					MCM-12 th Edition
<i>Mycobacterium smegmatis</i>									x					MCM-12 th Edition
<i>Mycobacterium szulgai</i>									x					MCM-12 th Edition

Bacteria	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Reference
<i>Mycobacterium tuberculosis</i>						x								MCM-12 th Edition
<i>Mycobacterium ulcerans</i>									x					MCM-12 th Edition
<i>Mycobacterium xenopi</i>									x					MCM-12 th Edition
<i>Mycoplasma fermentans</i>		x												MCM-12 th Edition
<i>Mycoplasma genitalium</i>		x												MCM-12 th Edition
<i>Mycoplasma hominis</i>		x												MCM-12 th Edition
<i>Mycoplasma pneumoniae</i>		x												MCM-12 th Edition
<i>Mycoplasma salivarium</i>		x												MCM-12 th Edition
<i>Myroides odoratus</i>								x						MCM-12 th Edition
<i>Neisseria cinerea</i>					x									MCM-12 th Edition
<i>Neisseria elongata</i>					x									MCM-12 th Edition
<i>Neisseria flava</i>					x									MCM-12 th Edition
<i>Neisseria flavescens</i>					x									MCM-12 th Edition
<i>Neisseria gonorrhoeae</i>			x											MCM-12 th Edition
<i>Neisseria lactamica</i>					x									MCM-12 th Edition
<i>Neisseria meningitidis</i>						x								MCM-12 th Edition
<i>Neisseria mucosa</i>					x									MCM-12 th Edition
<i>Neisseria perflava</i>					x									MCM-12 th Edition
<i>Neisseria sicca</i>					x									MCM-12 th Edition
<i>Neisseria subflava</i>					x									MCM-12 th Edition
<i>Neisseria weaveri</i>					x									MCM-12 th Edition
<i>Neoehrlichia mikurensis</i>				x										Portillo, A et al., 2018
<i>Neorickettsia sennetsu</i>				x										MCM-12 th Edition
<i>Nocardia asteroides</i>									x					MCM-12 th Edition
<i>Nocardia brasiliensis</i>									x					MCM-12 th Edition
<i>Nocardia caviae</i>									x					MCM-12 th Edition
<i>Nocardia farcinica</i>									x					MCM-12 th Edition

Bacteria	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Reference
<i>Nocardia nova</i>									x					MCM-12 th Edition
<i>Nocardia otitidiscaviarum</i>									x					MCM-12 th Edition
<i>Nocardia pseudobrasiliensis</i>									x					MCM-12 th Edition
<i>Nocardia transvalensis</i>									x					MCM-12 th Edition
<i>Ochrobactrum anthropi</i>									x					MCM-12 th Edition
<i>Odoribacter splanchnicus</i>	x													MCM-12 th Edition
<i>Oligella ureolytica</i>					x									MCM-12 th Edition
<i>Oligella urethralis</i>					x									MCM-12 th Edition
<i>Orientia tsutsugamushi</i>		x												MCM-12 th Edition
<i>Paenibacillus alvei</i>									x					MCM-12 th Edition
<i>Paenibacillus macerans</i>									x					MCM-12 th Edition
<i>Pantoea agglomerans</i>													<i>Pantoea agglomerans</i>	
<i>Parabacteroides distasonis</i>	x													MCM-12 th Edition
<i>Parabacteroides merdae</i>	x													MCM-12 th Edition
<i>Parachlamydia acanthamoebae</i>		x												Greub, G., 2009
<i>Pasteurella aerogenes</i>					x									MCM-12 th Edition
<i>Pasteurella caballi</i>					x									MCM-12 th Edition
<i>Pasteurella canis</i>					x									MCM-12 th Edition
<i>Pasteurella dagmatis</i>					x									MCM-12 th Edition
<i>Pasteurella multocida</i>					x									MCM-12 th Edition
<i>Pasteurella stomatis</i>					x									MCM-12 th Edition
<i>Peptococcus niger</i>	x													MCM-12 th Edition
<i>Peptostreptococcus anaerobius</i>	x													MCM-12 th Edition

Bacteria	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Reference
<i>Peptostreptococcus asaccharolyticus</i>	x													MCM-12 th Edition
<i>Peptostreptococcus lactolyticus</i>	x													MCM-12 th Edition
<i>Peptostreptococcus prevotii</i>	x													MCM-12 th Edition
<i>Peptostreptococcus vaginalis</i>	x													MCM-12 th Edition
<i>Photobacterium damsela</i>									x					MCM-12 th Edition
<i>Plesiomonas shigelloides</i>													<i>Plesiomonas shigelloides</i>	
<i>Porphyromonas asaccharolytica</i>	x													MCM-12 th Edition
<i>Porphyromonas catoniae</i>	x													MCM-12 th Edition
<i>Porphyromonas circumdentaria</i>	x													MCM-12 th Edition
<i>Porphyromonas endodontalis</i>	x													MCM-12 th Edition
<i>Porphyromonas gingivalis</i>	x													MCM-12 th Edition
<i>Porphyromonas levii</i>	x													MCM-12 th Edition
<i>Porphyromonas macacae</i>	x													MCM-12 th Edition
<i>Prevotella bivia</i>	x													MCM-12 th Edition
<i>Prevotella buccae</i>	x													MCM-12 th Edition
<i>Prevotella buccalis</i>	x													MCM-12 th Edition
<i>Prevotella corporis</i>	x													MCM-12 th Edition
<i>Prevotella dentalis</i>	x													MCM-12 th Edition
<i>Prevotella denticola</i>	x													MCM-12 th Edition

Bacteria	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Reference
<i>Prevotella disiens</i>	x													MCM-12 th Edition
<i>Prevotella enoeca</i>	x													MCM-12 th Edition
<i>Prevotella heparinolytica</i>	x													MCM-12 th Edition
<i>Prevotella intermedia</i>	x													MCM-12 th Edition
<i>Prevotella loescheii</i>	x													MCM-12 th Edition
<i>Prevotella melaninogenica</i>	x													MCM-12 th Edition
<i>Prevotella nigrescens</i>	x													MCM-12 th Edition
<i>Prevotella oralis</i>	x													MCM-12 th Edition
<i>Prevotella oris</i>	x													MCM-12 th Edition
<i>Prevotella oulora</i>	x													MCM-12 th Edition
<i>Prevotella ruminicola</i>	x													MCM-12 th Edition
<i>Prevotella veroralis</i>	x													MCM-12 th Edition
<i>Prevotella zoogloformans</i>	x													MCM-12 th Edition
<i>Propionibacterium propionicus</i>	x													MCM-12 th Edition
<i>Proteus mirabilis</i>									x					MCM-12 th Edition
<i>Proteus penneri</i>									x					MCM-12 th Edition
<i>Proteus vulgaris</i>									x					MCM-12 th Edition
<i>Providencia alcalifaciens</i>									x					MCM-12 th Edition
<i>Providencia rettgeri</i>									x					MCM-12 th Edition
<i>Providencia stuartii</i>									x					MCM-12 th Edition
<i>Pseudomonas aeruginosa</i>													<i>Pseudomonas aeruginosa</i>	
<i>Pseudomonas alcaligenes</i>									x					MCM-12 th Edition
<i>Pseudomonas fluorescens</i>									x					MCM-12 th Edition

Bacteria	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Reference
<i>Pseudomonas pseudoalcaligenes</i>									x					MCM-12 th Edition
<i>Pseudomonas putida</i>									x					MCM-12 th Edition
<i>Pseudomonas stutzeri</i>									x					MCM-12 th Edition
<i>Pseudonocardia autotrophica</i>									x					MCM-12 th Edition
<i>Pseudoramibacter alactolyticus</i>	x													MCM-12 th Edition
<i>Psychrobacter phenylpyruvicus</i>									x					MCM-12 th Edition
<i>Rahnella aquatilis</i>									x					MCM-12 th Edition
<i>Ralstonia pickettii</i>									x					MCM-12 th Edition
<i>Raoultella ornithinolytica</i>									x					MCM-12 th Edition
<i>Rhodococcus equi</i>									x					MCM-12 th Edition
<i>Rhodococcus erythropolis</i>									x					MCM-12 th Edition
<i>Rhodococcus fascians</i>									x					MCM-12 th Edition
<i>Rhodococcus rhodnii</i>									x					MCM-12 th Edition
<i>Rhodococcus rhodochrous</i>									x					MCM-12 th Edition
<i>Rickettsia africae</i>				x										MCM-12 th Edition
<i>Rickettsia akari</i>				x										MCM-12 th Edition
<i>Rickettsia australis</i>				x										MCM-12 th Edition
<i>Rickettsia conorii</i>				x										MCM-12 th Edition
<i>Rickettsia felis</i>				x										MCM-12 th Edition
<i>Rickettsia honei</i>				x										MCM-12 th Edition
<i>Rickettsia japonica</i>				x										MCM-12 th Edition
<i>Rickettsia massiliae</i>				x										MCM-12 th Edition
<i>Rickettsia prowazekii</i>				x										MCM-12 th Edition
<i>Rickettsia rickettsii</i>				x										MCM-12 th Edition

Bacteria	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Reference
<i>Rickettsia sibirica</i>				x										MCM-12 th Edition
<i>Rickettsia typhi</i>				x										MCM-12 th Edition
<i>Rodentibacter pneumotropicus</i>					x									MCM-12 th Edition
<i>Rothia dentocariosa</i>					x									MCM-12 th Edition
<i>Saccharomonospora viridis</i>									x					MCM-12 th Edition
<i>Saccharopolyspora rectivirgula</i>									x					MCM-12 th Edition
<i>Salmonella bongori</i>											x			MCM-12 th Edition
<i>Salmonella choleraesuis</i>											x			MCM-12 th Edition
<i>Salmonella enteritidis</i>											x			MCM-12 th Edition
<i>Salmonella typhi</i>											x			MCM-12 th Edition
<i>Salmonella typhimurium</i>													<i>Salmonella enterica</i>	
<i>Seibaldella termitidis</i>	x													MCM-12 th Edition
<i>Selenomonas artemidis</i>	x													MCM-12 th Edition
<i>Selenomonas diana</i>	x													MCM-12 th Edition
<i>Selenomonas flueggei</i>	x													MCM-12 th Edition
<i>Selenomonas infelix</i>	x													MCM-12 th Edition
<i>Selenomonas noxia</i>	x													MCM-12 th Edition
<i>Serratia ficaria</i>									x					MCM-12 th Edition
<i>Serratia marcescens</i>									x					MCM-12 th Edition
<i>Serratia odorifera</i>									x					MCM-12 th Edition
<i>Serratia plymuthica</i>									x					MCM-12 th Edition
<i>Serratia proteamaculans</i>									x					MCM-12 th Edition
<i>Serratia rubidaea</i>									x					MCM-12 th Edition
<i>Shigella boydii</i>											x			MCM-12 th Edition
<i>Shigella dysenteriae</i>											x			MCM-12 th Edition
<i>Shigella flexneri</i>											x			MCM-12 th Edition

Bacteria	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Reference
<i>Shigella sonnei</i>													<i>Shigella sonnei</i>	
<i>Sphingomonas paucimobilis</i>									x					MCM-12 th Edition
<i>Spirillum minus</i>		x												MCM-12 th Edition
<i>Staphylococcus aureus</i>					x									MCM-12 th Edition
<i>Staphylococcus epidermidis</i>					x									MCM-12 th Edition
<i>Staphylococcus haemolyticus</i>					x									MCM-12 th Edition
<i>Staphylococcus hyicus</i>					x									MCM-12 th Edition
<i>Staphylococcus intermedius</i>					x									MCM-12 th Edition
<i>Staphylococcus lugdunensis</i>					x									MCM-12 th Edition
<i>Staphylococcus saprophyticus</i>					x									MCM-12 th Edition
<i>Staphylococcus warneri</i>					x									MCM-12 th Edition
<i>Stenotrophomonas maltophilia</i>									x					MCM-12 th Edition
<i>Streptobacillus moniliformis</i>			x											MCM-12 th Edition
<i>Streptococcus acidominimus</i>					x									MCM-12 th Edition
<i>Streptococcus agalactiae</i>					x									MCM-12 th Edition
<i>Streptococcus anginosus</i>					x									MCM-12 th Edition
<i>Streptococcus bovis</i>					x									MCM-12 th Edition
<i>Streptococcus canis</i>					x									MCM-12 th Edition
<i>Streptococcus constellatus</i>					x									MCM-12 th Edition

Bacteria	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Reference
<i>Streptococcus criceti</i>					x									MCM-12 th Edition
<i>Streptococcus equi</i>					x									MCM-12 th Edition
<i>Streptococcus gordonii</i>					x									MCM-12 th Edition
<i>Streptococcus intermedius</i>					x									MCM-12 th Edition
<i>Streptococcus milleri</i>					x									MCM-12 th Edition
<i>Streptococcus mitis</i>					x									MCM-12 th Edition
<i>Streptococcus mutans</i>					x									MCM-12 th Edition
<i>Streptococcus pneumoniae</i>					x									MCM-12 th Edition
<i>Streptococcus pyogenes</i>					x									MCM-12 th Edition
<i>Streptococcus salivarius</i>					x									MCM-12 th Edition
<i>Streptococcus sanguis</i>					x									MCM-12 th Edition
<i>Streptococcus sobrinus</i>					x									MCM-12 th Edition
<i>Streptococcus suis</i>					x									MCM-12 th Edition
<i>Streptococcus uberis</i>					x									MCM-12 th Edition
<i>Sutterella wadsworthensis</i>	x													MCM-12 th Edition
<i>Suttonella indologenes</i>					x									MCM-12 th Edition
<i>Tanerella forsythia</i>	x													MCM-12 th Edition
<i>Tatlockia maceachernii</i>												x		MCM-12 th Edition
<i>Tatlockia micdadei</i>												x		MCM-12 th Edition
<i>Tatumella ptyseos</i>								x						MCM-12 th Edition
<i>Treponema carateum</i>								x						MCM-12 th Edition
<i>Treponema pallidum</i>			x											MCM-12 th Edition
<i>Tropheryma whippelii</i>									x					MCM-12 th Edition
<i>Trueperella bernardiae</i>					x									MCM-12 th Edition
<i>Trueperella pyogenes</i>					x									MCM-12 th Edition
<i>Tsukamurella inchoensis</i>									x					MCM-12 th Edition

Bacteria	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Reference
<i>Tsukamurella paurometabola</i>									x					MCM-12 th Edition
<i>Tsukamurella pulmonis</i>									x					MCM-12 th Edition
<i>Tsukamurella tyrosinosolvens</i>									x					MCM-12 th Edition
<i>Ureaplasma urealyticum</i>		x												MCM-12 th Edition
<i>Veillonella atypica</i>	x													MCM-12 th Edition
<i>Veillonella dispar</i>	x													MCM-12 th Edition
<i>Veillonella parvula</i>	x													MCM-12 th Edition
<i>Vibrio alginolyticus</i>									x					MCM-12 th Edition
<i>Vibrio cholerae</i>													<i>Vibrio cholerae</i>	
<i>Vibrio cincinnatiensis</i>									x					MCM-12 th Edition
<i>Vibrio fluvialis</i>									x					MCM-12 th Edition
<i>Vibrio furnissii</i>									x					MCM-12 th Edition
<i>Vibrio hollisae</i>									x					MCM-12 th Edition
<i>Vibrio mimicus</i>									x					MCM-12 th Edition
<i>Vibrio parahaemolyticus</i>									x					MCM-12 th Edition
<i>Vibrio vulnificus</i>									x					MCM-12 th Edition
<i>Waddlia chondrophila</i>		x												Baud, David et al., 2014
<i>Wolinella succinogenes</i>	x													MCM-12 th Edition
<i>Yersinia bercovieri</i>								x						MCM-12 th Edition
<i>Yersinia enterocolitica</i>													<i>Yersinia enterocolitica</i>	
<i>Yersinia frederiksenii</i>								x						MCM-12 th Edition
<i>Yersinia intermedia</i>								x						MCM-12 th Edition
<i>Yersinia kristensenii</i>								x						MCM-12 th Edition
<i>Yersinia mollaretii</i>								x						MCM-12 th Edition
<i>Yersinia pestis</i>				x										MCM-12 th Edition
<i>Yersinia pseudotuberculosis</i>									x					MCM-12 th Edition
<i>Yersinia rohdei</i>								x						MCM-12 th Edition

Bacteria	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Reference
<i>Yersinia ruckeri</i>								x						MCM-12 th Edition

Viruses	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Page Reference
Andes virus										x				MCM-12 th Edition
Apoi virus				x										Field's Virology, 5th Ed., p. 1153-1158, 1206
Australian bat lyssavirus				x										Field's Virology, 5th Ed., p. 1364
Bagaza virus				x										Field's Virology, 5th Ed., p. 1153-1158, 1199
Bangui virus				x										MCM-12 th Edition
Banna virus				x										MCM-12 th Edition
Banji virus				x										MCM-12 th Edition
Barmah Forest virus				x										MCM-12 th Edition
Batken virus				x										http://phene.cpmc.columbia.edu/7thReport/sites/descriptions/Orthomyxoviridae/thogotovirus.htm
Bayou virus				x										MCM-12 th Edition
Bebaru virus				x										Field's Virology, 5th. Ed., p. 1024
Bhanja virus				x										MCM-12 th Edition
BK virus			x											MCM-12 th Edition
Black creek canal virus				x										MCM-12 th Edition
Borna disease virus						x								Field's Virology, 5th Ed., p. 1835
Bovine Ephemeral Fever virus				x										Field's Virology, 5th Ed., p. 1367
Bovine Papular Stomatitis virus			x											Field's Virology, 5th Ed., p. 2948, 2955-2956, 2963

Viruses	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Page Reference
Bovine Spongiform Encephalopathy (BSE) agent										x				MCM-12 th Edition
Buffalopox virus								x						Field's Virology, 5th Ed. p. 2955-2956
Bunyamwera virus				x										MCM-12 th Edition
Bussuquara virus				x										MCM-12 th Edition
Bwamba virus				x										MCM-12 th Edition
California encephalitis virus				x										MCM-12 th Edition
Candiru virus complex				x										MCM-12 th Edition
Caraparu virus				x										MCM-12 th Edition
Catu virus				x										MCM-12 th Edition
Cercopithecine herpes virus 1								x						Field's Virology, 5th Ed., p. 2895-2897
Chandipura virus				x										MCM-12 th Edition
Changuinola virus				x										MCM-12 th Edition
Chikungunya virus				x										MCM-12 th Edition
Chim virus				x										http://phene.cpmc.columbia.edu/ICTVdB/11000000.htm
Creutzfeld-Jakob Disease (CJD) agent								x						Field's Virology, 5th Ed., p. 443-444, 3077-3078
Colorado tick fever virus				x										MCM-12 th Edition
Cote d'Ivoire Ebola virus										x				Field's Virology, 5th. Ed., p. 619, 1411-1412, 1432-1434
Cowpox virus										x				MCM-12 th Edition
Crimea-Congo Haemorrhagic Fever Virus										x				MCM-12 th Edition
Dakar bat virus								x						Field's Virology, 5th Ed., p. 1158, 1206
Dengue virus				x										MCM-12 th Edition

Viruses	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Page Reference
Dhori virus				x										MCM-12 th Edition
Dobrava-Belgrade virus										x				MCM-12 th Edition
Dugbe virus				x										MCM-12 th Edition
Duvenhage virus										x				Field's Virology, 5th Ed., p. 1364
Eastern equine encephalitis virus				x										MCM-12 th Edition
Edge Hill virus				x										MCM-12 th Edition
Encephalomyocarditis virus								x						Field's Virology, 5th Ed., p. 796, 840, 858-860
European bat lyssavirus 1										x				Field's Virology, 5th Ed., p. 1364
European bat lyssavirus 2										x				Field's Virology, 5th Ed., p. 1364
European Tick-borne encephalitis virus				x										Field's Virology, 5th Ed., p. 1153-1158, 1200-1203
Everglades virus				x										MCM-12
Eyach virus				x										Krause et al., p. 87-89
Far eastern Tick-borne encephalitis virus				x										Field's Virology, 5th Ed., p. 1153-1158, 1200-1203
Foot and mouth disease virus								x						Field's Virology, 5th Ed., p. 796, 840, 858-860
Ganjam virus				x										MCM-12 th Edition
Getah virus				x										Field's Virology, 5th Ed., p. 1024
Guama virus				x										MCM-12 th Edition
Guanarito virus										x				MCM-12 th Edition
Guaroa virus				x										MCM-12 th Edition
Hantaan virus										x				MCM-12 th Edition
Hendra virus										x				MCM-12 th Edition
Hepatitis A virus													Hepatitis A	
Hepatitis B virus			x											MCM-12 th Edition

Viruses	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Page Reference
Hepatitis C virus			x											MCM-12 th Edition
Hepatitis delta virus			x											MCM-12 th Edition
Hepatitis E virus													Hepatitis E	
Hepatitis G virus			x											MCM-12 th Edition
HU39694 virus				x										http://www.cdc.gov/ncidod/diseases/hanta/hps/noframes/phys/ecology.htm
Hughes virus				x										Field's Virology, 5th Ed., p. 1743-1745
Human adenovirus A													Adenovirus	
Human adenovirus B						x								MCM-12 th Edition
Human adenovirus C											x			MCM-12 th Edition
Human adenovirus D						x								MCM-12 th Edition
Human adenovirus E						x								MCM-12 th Edition
Human adenovirus F											x			MCM-12 th Edition
Human astrovirus													Astrovirus	
Human bocavirus								x						Allander, T., 2008
Human Coronavirus 229E						x								MCM-12 th Edition
Human Coronavirus OC43						x								MCM-12 th Edition
Human coronavirus SARS-CoV-2						x								Ciotti, et al., 2019
Human enterovirus 68											x			MCM-12 th Edition
Human enterovirus 70											x			MCM-12 th Edition
Human enterovirus A													Enterovirus	
Human enterovirus B											x			MCM-12 th Edition
Human enterovirus C											x			MCM-12 th Edition
Human enterovirus D											x			MCM-12 th Edition
Human Herpesvirus 1			x											MCM-12 th Edition
Human Herpesvirus 2			x											MCM-12 th Edition
Human Herpesvirus 3			x											MCM-12 th Edition

Viruses	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Page Reference
Human Herpesvirus 4			x											MCM-12 th Edition
Human Herpesvirus 5			x											MCM-12 th Edition
Human Herpesvirus 6			x											MCM-12 th Edition
Human Herpesvirus 7			x											MCM-12 th Edition
Human Herpesvirus 8			x											MCM-12 th Edition
Human Immunodeficiency Virus 1			x											MCM-12 th Edition
Human Immunodeficiency Virus 2			x											MCM-12 th Edition
Human papillomavirus			x											MCM-12 th Edition
Human parainfluenza virus 1			x											MCM-12 th Edition
Human parainfluenza virus 2						x								MCM-12 th Edition
Human parainfluenza virus 3						x								MCM-12 th Edition
Human parainfluenza virus 4						x								MCM-12 th Edition
Human parechovirus type 1								x						MCM-12 th Edition
Human parechovirus type 2								x						MCM-12 th Edition
Human Respiratory Syncytial virus						x								MCM-12 th Edition
Human Rhinovirus A						x								MCM-12 th Edition
Human Rhinovirus B						x								MCM-12 th Edition
Human T-Lymphotropic Virus 1			x											MCM-12 th Edition
Igbo-ora virus				x										Field's Virology, 5th Ed., p. 1024, 1048

Viruses	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Page Reference
Ilheus virus				x										MCM-12 th Edition
Influenza A virus						x								MCM-12 th Edition
Influenza B virus						x								MCM-12 th Edition
Influenza C virus						x								MCM-12 th Edition
Issyk-Kul virus				x										MCM-12 th Edition
Japanese encephalitis virus				x										MCM-12 th Edition
JC virus			x											MCM-12 th Edition
Junin virus			x											MCM-12 th Edition
Juquitiba virus				x										Field's Virology, 5th Ed., p. 1743-1745
KI polyomavirus			x											Bofill-Mas, S., et al., 2010
Karshi virus										x				MCM-12 th Edition
Kasokero virus				x										http://phene.cpmc.columbia.edu/ICTVdB/11000000.htm
Kedougou virus				x										Field's Virology, 5th Ed., p. 1153-1158, 1199
Kemerovo virus				x										MCM-12 th Edition
Kobuvirus								x						Ramírez-Castillo et al., 2015
Kokobera virus				x										MCM-12 th Edition
Koutango virus				x										MCM-12 th Edition
Kyasanur forest disease virus				x										MCM-12 th Edition
Laguna Negra virus										x				MCM-12 th Edition
Lanjan virus				x										http://phene.cpmc.columbia.edu/ICTVdB/11000000.htm
Lassa virus										x				MCM-12 th Edition
Lebombo virus				x										MCM-12 th Edition
Lechiguanas virus				x										http://phene.cpmc.columbia.edu/7thReport/sites/descriptions/Bunyaviridae/hantavirus.htm

Viruses	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Page Reference
Louping ill virus				x										MCM-12 th Edition
Lujo virus			x											https://www.cdc.gov/vhf/lujo/transmission/index.html
Lymphocytic choriomeningitis virus								x						MCM-12 th Edition
Machupo virus										x				MCM-12 th Edition
Madrid virus				x										MCM-12 th Edition
Marburg virus			x											MCM-12 th Edition
Marituba virus				x										MCM-12 th Edition
Mayaro virus				x										MCM-12 th Edition
Measles virus						x								MCM-12 th Edition
Menangle virus										x				http://www.cdc.gov/ncidod/eid/vol4no2/philbey.htm
Mimivirus ¹								x						Field's Virology, 5th Ed., p. 627-628, 637-638
Mokola virus				x										Field's Virology, 5th Ed., p. 1363-1364
Molluscum contagiosum virus			x											MCM-12 th Edition
Monkeypox virus										x				MCM-12 th Edition
Monongahela virus				x										http://phene.cpmc.columbia.edu/7thReport/sites/descriptions/Bunyaviridae/hantavirus.htm
Mucambo virus				x										MCM-12 th Edition
Mumps virus			x											MCM-12 th Edition
Murray Valley encephalitis virus				x										MCM-12 th Edition
New York virus				x										MCM-12 th Edition
Newcastle disease virus						x								Field's Virology, 5th Ed., p. 1497-1498
Nipah virus										x				MCM-12 th Edition

Viruses	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Page Reference
Norwalk-like viruses													Calicivirus	
Nyando virus				x										MCM-12 th Edition
Ockelbo virus				x										MCM-12 th Edition
Omsk haemorrhagic fever virus				x										MCM-12 th Edition
O'nyong-nyong virus				x										MCM-12 th Edition
Oran virus				x										http://phene.cpmc.columbia.edu/7thReport/sites/descriptions/Bunyaviridae/hantavirus.htm
Orf virus								x						MCM-12 th Edition
Oriboca virus				x										MCM-12 th Edition
Oropouche virus				x										MCM-12 th Edition
Orungo virus				x										MCM-12 th Edition
Parvovirus 4			x											Sharp, C. P., et al., 2010
Parvovirus B19						x								MCM-12 th Edition
Phnom-Penh bat virus								x						Field's Virology, 5th Ed., p. 1153-1158, 1206
Picobirnavirus								x						MCM-12 th Edition
Piry virus				x										MCM-12 th Edition
Poliovirus											x			MCM-12 th Edition
Powassan virus				x										MCM-12 th Edition
Pseudocowpox virus			x											Field's Virology, 5th Ed., p. 2948, 2960, 2963
Punta Toro virus				x										MCM-12 th Edition
Puumala virus										x				MCM-12 th Edition
Quaranfil Virus				x										MCM-12 th Edition
Rabies virus							x							MCM-12 th Edition
Reovirus								x						Field's Virology, 5th Ed., p. 1897-1900
Reston Ebola virus										x				MCM-12 th Edition
Rift Valley fever virus										x				MCM-12 th Edition

Viruses	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Page Reference
Rio Bravo virus								x						Field's Virology, 5th Ed., p. 1153-1158, 1206
Rocio virus				x										MCM-12 th Edition
Ross River virus				x										MCM-12 th Edition
Rotavirus A													Rotavirus	
Rotavirus B										x				MCM-12 th Edition
Rotavirus C										x				MCM-12 th Edition
Rotavirus D										x				MCM-12 th Edition
Rotavirus E										x				MCM-12 th Edition
Rotavirus F										x				MCM-12 th Edition
Royal Farm virus				x										Field's Virology, 5th Ed., p. 1153-1158, 1204
Rubella virus						x								MCM-12 th Edition
Sabia virus										x				MCM-12 th Edition
Saimiriine herpesvirus 1								x						Field's Virology, 4th Ed., p. 2383, 2483, 2511, 2848
Salehabad virus				x										http://phene.cpmc.columbia.edu/ICTVdB/11041008.htm
Sandfly fever Naples virus				x										MCM-12 th Edition
Sandfly fever virus group				x										MCM-12 th Edition
Saumarez Reef virus				x										Field's Virology, 5th Ed., p. 1153-1158, 1206
Sealpox virus								x						MCM-12 th Edition
Semliki Forest virus				x										MCM-12 th Edition
Seoul virus				x										MCM-12 th Edition
Sepik virus										x				MCM-12 th Edition
Sin Nombre virus				x										MCM-12 th Edition
Sindbis virus										x				MCM-12 th Edition
St. Louis encephalitis virus				x										MCM-12 th Edition
Sudan Ebola virus										x				MCM-12 th Edition

Viruses	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Page Reference
Suid herpesvirus								x						Field's Virology, 4th Ed., p. 2385, 2484, 2707
Swine vesicular disease virus										x				Field's Virology, 5th Ed., p. 963
Tacaiuma virus				x										MCM-12 th Edition
Tamdy virus				x										MCM-12 th Edition
Tanapox virus										x				MCM-12 th Edition
Tataguine virus				x										MCM-12 th Edition
Thogoto virus				x										MCM-12 th Edition
Trubanaman virus				x										MCM-12 th Edition
Tyuleniy virus				x										Field's Virology, 5th Ed., p. 1153-1158, 1206
Usutu virus				x										MCM-12 th Edition
Variola virus			x											MCM-12 th Edition
Venezuelan Equine Encephalitis virus				x										MCM-12 th Edition
Vesicular stomatitis virus				x										MCM-12 th Edition
Wad Medani virus				x										Field's Virology, 5th Ed., p. 1975-1977
Wanowrie virus				x										MCM-12 th Edition
Wesselsbron virus				x										MCM-12 th Edition
West Nile virus				x										MCM-12 th Edition
Western Equine Encephalitis virus				x										MCM-12 th Edition
WU polyomavirus						x								Bofill-Mas, S., 2010
Wyeomyia virus				x										MCM-12 th Edition
Yaba monkey tumor virus										x				MCM-12 th Edition
Yellow fever virus				x										MCM-12 th Edition
Yogue virus				x										http://phene.cpmc.columbia.edu/ICTVdB/11000000.htm
Zaire Ebola virus										x				MCM-12 th Edition

Viruses	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Page Reference
Zika virus										x				MCM-12 th Edition
Zinga virus				x										http://www.cdc.gov/mmwr/preview/mmwrhtml/00001253.htm

Protozoa	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Page Reference
<i>Acanthamoeba astronyxis</i>									x					MCM-12 th Edition
<i>Acanthamoeba castellani</i>									x					MCM-12 th Edition
<i>Acanthamoeba culbertsoni</i>									x					MCM-12 th Edition
<i>Acanthamoeba hatchetti</i>									x					MCM-12 th Edition
<i>Acanthamoeba palestinensis</i>									x					MCM-12 th Edition
<i>Acanthamoeba polyphaga</i>									x					MCM-12 th Edition
<i>Acanthamoeba rhysodes</i>									x					MCM-12 th Edition
<i>Babesia bovis</i>				x										MCM-12 th Edition
<i>Babesia divergens</i>				x										MCM-12 th Edition
<i>Babesia gibsoni</i>				x										MCM-12 th Edition
<i>Babesia microti</i>				x										MCM-12 th Edition
<i>Balamuthia mandrillaris</i>								x						MCM-12 th Edition
<i>Balantidium coli</i>								x						MCM-12 th Edition
<i>Blastocystis hominis</i>													<i>Blastocystis hominis</i>	
<i>Cryptosporidium parvum</i> ¹														

Protozoa	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Page Reference
<i>Cyclospora cayetanensis</i>													<i>Cyclospora cayetanensis</i>	
<i>Dientamoeba fragilis</i>							x							MCM-12 th Edition
<i>Encephalitozoon cuniculi</i>											x			MCM-12 th Edition
<i>Encephalitozoon hellem</i>											x			MCM-12 th Edition
<i>Encephalitozoon intestinalis</i>													Microsporidia	
<i>Entamoeba chattoni</i>											x			http://www.itg.be/itg/DistanceLearning/LectureNotesVandenEndenE/06_Amoebiasisp2.htm#IX_450
<i>Entamoeba histolytica</i>													<i>Entamoeba histolytica</i>	
<i>Entamoeba moshkovskii</i>											x			http://www.itg.be/itg/DistanceLearning/LectureNotesVandenEndenE/06_Amoebiasisp2.htm#IX_450
<i>Enterocytozoon bieneusi</i>											x			MCM-12 th Edition
<i>Giardia duodenalis</i> ¹														
<i>Isospora belli</i>													<i>Isospora belli</i>	
<i>Leishmania aethiopica</i>			x											MCM-12 th Edition
<i>Leishmania amazonensis</i>			x											MCM-12 th Edition
<i>Leishmania braziliensis</i>			x											MCM-12 th Edition
<i>Leishmania chagasi</i>			x											MCM-12 th Edition
<i>Leishmania donovani</i>			x											MCM-12 th Edition
<i>Leishmania guyanensis</i>			x											MCM-12 th Edition
<i>Leishmania infantum</i>			x											MCM-12 th Edition
<i>Leishmania lainsoni</i>			x											MCM-12 th Edition
<i>Leishmania major</i>			x											MCM-12 th Edition

Protozoa	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Page Reference
<i>Leishmania mexicana</i>				x										MCM-12 th Edition
<i>Leishmania naiffi</i>				x										MCM-12 th Edition
<i>Leishmania panamensis</i>				x										MCM-12 th Edition
<i>Leishmania peruviana</i>				x										MCM-12 th Edition
<i>Leishmania pifanoi</i>				x										MCM-12 th Edition
<i>Leishmania shawi</i>				x										MCM-12 th Edition
<i>Leishmania tropica</i>				x										MCM-12 th Edition
<i>Leishmania venezuelensis</i>				x										MCM-12 th Edition
<i>Naegleria fowleri</i>													<i>Naegleria fowleri</i>	
<i>Nosema africanum</i>								x						MCM-12 th Edition
<i>Nosema ceylonensis</i>								x						MCM-12 th Edition
<i>Nosema connori</i>								x						MCM-12 th Edition
<i>Nosema ocularum</i>								x						MCM-12 th Edition
<i>Pentatrichomonas hominis</i>					x									MCM-12 th Edition
<i>Plasmodium falciparum</i>				x										MCM-12 th Edition
<i>Plasmodium knowlesi</i>				x										MCM-12 th Edition
<i>Plasmodium malariae</i>				x										MCM-12 th Edition
<i>Plasmodium ovale</i>				x										MCM-12 th Edition
<i>Plasmodium simium</i>				x										MCM-12 th Edition
<i>Plasmodium vivax</i>				x										MCM-12 th Edition
<i>Retortamonas intestinalis</i>					x									MCM-12 th Edition
<i>Sarcocystis hominis</i>							x							MCM-12 th Edition
<i>Sarcocystis lindermanni</i>							x							MCM-12 th Edition
<i>Sarcocystis suihominis</i>							x							MCM-12 th Edition
<i>Toxoplasma gondii</i>													<i>Toxoplasma gondii</i>	
<i>Trachipleistophora hominis</i>											x			MCM-12 th Edition

Protozoa	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Page Reference
<i>Trichomonas tenax</i>					x									MCM-12 th Edition
<i>Trichomonas vaginalis</i>			x											MCM-12 th Edition
<i>Trypanosoma brucei</i>				x										MCM-12 th Edition
<i>Trypanosoma cruzi</i>				x										MCM-12 th Edition
<i>Vittaforma corneae</i>								x						MCM-12 th Edition

Helminths	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Page Reference
<i>Acanthocephalus rauschi</i>							x							Ashford and Crewe, 2003
<i>Achillurbainia nouveli</i>										x				Ashford and Crewe, 2003
<i>Achillurbainia recondita</i>							x							Ashford and Crewe, 2003
<i>Alaria americana</i>							x							Ashford and Crewe, 2003
<i>Alaria marcianae</i>							x							Ashford and Crewe, 2003
<i>Amphimerus pseudofelineus</i>										x				Ashford and Crewe, 2003
<i>Anatrichosoma cutaneum</i>										x				Ashford and Crewe, 2003
<i>Ancylostoma braziliense</i>							x							Ashford and Crewe, 2003
<i>Ancylostoma caninum</i>										x				Ashford and Crewe, 2003
<i>Ancylostoma ceylanicum</i>										x				Ashford and Crewe, 2003
<i>Ancylostoma duodenale</i>							x							Ashford and Crewe, 2003
<i>Ancylostoma malayanum</i>										x				Ashford and Crewe, 2003
<i>Anisakis physeteris</i>							x							Ashford and Crewe, 2003
<i>Anisakis simplex</i>							x							Ashford and Crewe, 2003
<i>Aonchotheca philippinensis</i>										x				Ashford and Crewe, 2003
<i>Apophallus donicus</i>							x							Ashford and Crewe, 2003

Helminths	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Page Reference
<i>Artyfechinostomum mehrai</i>										x				Ashford and Crewe, 2003
<i>Ascaris lumbricoides</i>							x							Ashford and Crewe, 2003
<i>Ascaris suum</i>							x							Ashford and Crewe, 2003
<i>Ascocotyle sp.</i>							x							Ashford and Crewe, 2003
<i>Australobilharzia terrigalensis</i>										x				Ashford and Crewe, 2003
<i>Baylisascaris procyonis</i>							x							Ashford and Crewe, 2003
<i>Bertiella mucronata</i>							x							Ashford and Crewe, 2003
<i>Bertiella studeri</i>										x				Ashford and Crewe, 2003
<i>Bilharziella polonica</i>										x				Ashford and Crewe, 2003
<i>Bolbosoma sp.</i>										x				Ashford and Crewe, 2003
<i>Brugia beaveri</i>				x										Ashford and Crewe, 2003
<i>Brugia guyanensis</i>				x										Ashford and Crewe, 2003
<i>Brugia malayi</i>				x										Ashford and Crewe, 2003
<i>Brugia pahangi</i>				x										Ashford and Crewe, 2003
<i>Brugia timori</i>				x										Ashford and Crewe, 2003
<i>Bunostomum phlebotomum</i>							x							Ashford and Crewe, 2003
<i>Calodium hepaticum</i>							x							Ashford and Crewe, 2003
<i>Carneocephallus brevicata</i>										x				Ashford and Crewe, 2003
<i>Cathaemasia cabrerai</i>										x				Ashford and Crewe, 2003
<i>Centrocestus armatus</i>										x				Ashford and Crewe, 2003
<i>Centrocestus formosanus</i>										x				Ashford and Crewe, 2003
<i>Cheilospirocheta sp.</i>										x				Ashford and Crewe, 2003
<i>Clinostomum complanatum</i>										x				Ashford and Crewe, 2003
<i>Contracaecum osculatum</i>										x				Ashford and Crewe, 2003

Helminths	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Page Reference
<i>Corynosoma strumosum</i>							x							Ashford and Crewe, 2003
<i>Cryptocotyle lingua</i>										x				Ashford and Crewe, 2003
<i>Cyclodontostomum purvisi</i>										x				Ashford and Crewe, 2003
<i>Dicrocoelium dendriticum</i>							x							Ashford and Crewe, 2003
<i>Dicrocoelium hospes</i>										x				Ashford and Crewe, 2003
<i>Diectophyme renale</i>							x							Ashford and Crewe, 2003
<i>Dipetalonema arbuta</i>				x										Ashford and Crewe, 2003
<i>Dipetalonema reconditum</i>				x										MCM-8, p. 634, 1209
<i>Diphyllbothrium cameroni</i>										x				Ashford and Crewe, 2003
<i>Diphyllbothrium cordatum</i>							x							Ashford and Crewe, 2003
<i>Diphyllbothrium dalliae</i>							x							Ashford and Crewe, 2003
<i>Diphyllbothrium dendriticum</i>							x							Ashford and Crewe, 2003
<i>Diphyllbothrium elegans</i>										x				Ashford and Crewe, 2003
<i>Diphyllbothrium erinaceieuropaei</i>										x				Ashford and Crewe, 2003
<i>Diphyllbothrium hians</i>										x				Ashford and Crewe, 2003
<i>Diphyllbothrium houghtoni</i>										x				Ashford and Crewe, 2003
<i>Diphyllbothrium nihonkaiense</i>										x				Ashford and Crewe, 2003
<i>Diphyllbothrium lanceolatum</i>							x							Ashford and Crewe, 2003
<i>Dibothriocephalus latus</i>							x							Ashford and Crewe, 2003

Helminths	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Page Reference
<i>Diphyllbothrium mansonoides</i>							x							Ashford and Crewe, 2003
<i>Diphyllbothrium klebanovskii</i>										x				Ashford and Crewe, 2003
<i>Diphyllbothrium orcini</i>										x				Ashford and Crewe, 2003
<i>Adenocephalus pacificus</i>										x				Ashford and Crewe, 2003
<i>Diphyllbothrium scoticum</i>										x				Ashford and Crewe, 2003
<i>Diphyllbothrium stemmacephalum</i>							x							Ashford and Crewe, 2003
<i>Diphyllbothrium theileri</i>										x				Ashford and Crewe, 2003
<i>Diplogonoporus balaenopterae</i>										x				Ashford and Crewe, 2003
<i>Diplogonoporus brauni</i>										x				Ashford and Crewe, 2003
<i>Diplogonoporus balaenopterae</i>										x				Ashford and Crewe, 2003
<i>Diplostomum spathaceum</i>										x				Ashford and Crewe, 2003
<i>Dipylidium caninum</i>							x							Ashford and Crewe, 2003
<i>Dirofilaria immitis</i>				x										Ashford and Crewe, 2003
<i>Dirofilaria repens</i>				x										Ashford and Crewe, 2003
<i>Dirofilaria striata</i>				x										Ashford and Crewe, 2003
<i>Dirofilaria subdermata</i>				x										Ashford and Crewe, 2003
<i>Dirofilaria tenuis</i>				x										Ashford and Crewe, 2003
<i>Dirofilaria ursi</i>				x										Ashford and Crewe, 2003
<i>Dracunculus insignis</i>										x				Ashford and Crewe, 2003
<i>Dracunculus medinensis</i>										x				Ashford and Crewe, 2003
<i>Drepanidotaenia lanceolata</i>							x							Ashford and Crewe, 2003

Helminths	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Page Reference
<i>Echinocasmus japonicus</i>										x				Ashford and Crewe, 2003
<i>Echinocasmus jiufensis</i>										x				Ashford and Crewe, 2003
<i>Echinocasmus perfoliatus</i>										x				Ashford and Crewe, 2003
<i>Echinococcus granulosus</i>							x							Ashford and Crewe, 2003
<i>Echinococcus multilocularis</i>							x							Ashford and Crewe, 2003
<i>Echinococcus oligarthus</i>										x				Ashford and Crewe, 2003
<i>Echinococcus vogeli</i>										x				Ashford and Crewe, 2003
<i>Echinoparyphium recurvatum</i>										x				Ashford and Crewe, 2003
<i>Echinostoma cinetorchis</i>										x				Ashford and Crewe, 2003
<i>Echinostoma echinatum</i>										x				Ashford and Crewe, 2003
<i>Echinostoma hortense</i>										x				Ashford and Crewe, 2003
<i>Echinostoma ilocanum</i>										x				Ashford and Crewe, 2003
<i>Echinostoma jassyense</i>										x				Ashford and Crewe, 2003
<i>Echinostoma macrorchis</i>										x				Ashford and Crewe, 2003
<i>Echinostoma malayanum</i>										x				Ashford and Crewe, 2003
<i>Echinostoma revolutum</i>										x				Ashford and Crewe, 2003
<i>Enterobius gregorii</i>							x							Ashford and Crewe, 2003
<i>Enterobius vermicularis</i>							x							Ashford and Crewe, 2003
<i>Episthmium caninum</i>										x				Ashford and Crewe, 2003
<i>Eucoleus aerophilus</i>							x							Ashford and Crewe, 2003
<i>Eurytrema pancreaticum</i>							x							Ashford and Crewe, 2003
<i>Eustrongylides sp.</i>							x							Ashford and Crewe, 2003
<i>Fasciola indica</i>							x							Ashford and Crewe, 2003

Helminths	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Page Reference
<i>Fasciola hepatica</i>							x							Ashford and Crewe, 2003
<i>Fasciola indica</i>							x							Ashford and Crewe, 2003
<i>Fasciolopsis buski</i>										x				Ashford and Crewe, 2003
<i>Neodiplostomum seoulense</i>										x				Ashford and Crewe, 2003
<i>Gastrodiscoides hominis</i>										x				Ashford and Crewe, 2003
<i>Gigantobilharzia huttoni</i>							x							Ashford and Crewe, 2003
<i>Gigantobilharzia sturniae</i>										x				Ashford and Crewe, 2003
<i>Gnathostoma doloresi</i>										x				Ashford and Crewe, 2003
<i>Gnathostoma hispidum</i>										x				Ashford and Crewe, 2003
<i>Gnathostoma nipponicum</i>										x				Ashford and Crewe, 2003
<i>Gnathostoma spinigerum</i>							x							Ashford and Crewe, 2003
<i>Gongylonema pulchrum</i>							x							Ashford and Crewe, 2003
<i>Gymnophalloides sp.</i>										x				Ashford and Crewe, 2003
<i>Haemonchus contortus</i>										x				Ashford and Crewe, 2003
<i>Haplorchis pumilo</i>										x				Ashford and Crewe, 2003
<i>Haplorchis taichui</i>										x				Ashford and Crewe, 2003
<i>Haplorchis vanissima</i>							x							Ashford and Crewe, 2003
<i>Haplorchis yokogawai</i>							x							Ashford and Crewe, 2003
<i>Heterobilharzia americana</i>							x							Ashford and Crewe, 2003
<i>Heterophyes dispar</i>										x				Ashford and Crewe, 2003
<i>Heterophyes heterophyes</i>										x				Ashford and Crewe, 2003
<i>Heterophyes nocens</i>										x				Ashford and Crewe, 2003
<i>Heterophyopsis continua</i>										x				Ashford and Crewe, 2003

Helminths	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Page Reference
<i>Himasthala muehlensi</i>							x							Ashford and Crewe, 2003
<i>Hymenolepis diminuta</i>							x							Ashford and Crewe, 2003
<i>Hymenolepis nana</i>							x							Ashford and Crewe, 2003
<i>Hypoderaeum conoideum</i>										x				Ashford and Crewe, 2003
<i>Inermicapsifer madagascariensis</i>										x				Ashford and Crewe, 2003
<i>Isoparorchis hypselobagri</i>										x				Ashford and Crewe, 2003
<i>Lagochilascaris minor</i>							x							Ashford and Crewe, 2003
<i>Ligula intestinalis</i>										x				Ashford and Crewe, 2003
<i>Loa loa</i>				x										Ashford and Crewe, 2003
<i>Macracanthorhynchus hirudinaceus</i>										x				Ashford and Crewe, 2003
<i>Macracanthorhynchus ingens</i>							x							Ashford and Crewe, 2003
<i>Mammomonogamus laryngeus</i>										x				Ashford and Crewe, 2003
<i>Mammomonogamus nasicola</i>										x				Ashford and Crewe, 2003
<i>Mansonella ozzardi</i>				x										Ashford and Crewe, 2003
<i>Mansonella perstans</i>				x										Ashford and Crewe, 2003
<i>Mansonella rodhaini</i>				x										Ashford and Crewe, 2003
<i>Mansonella semiclarum</i>				x										Ashford and Crewe, 2003
<i>Mansonella streptocerca</i>				x										Ashford and Crewe, 2003
<i>Marshallagia marshalli</i>										x				Ashford and Crewe, 2003
<i>Mathevotaenia symmetrica</i>										x				Ashford and Crewe, 2003
<i>Mecistocirrus digitatus</i>							x							Ashford and Crewe, 2003
<i>Meningonema peruzzii</i>										x				Ashford and Crewe, 2003
<i>Mesocestoides lineatus</i>										x				Ashford and Crewe, 2003

Helminths	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Page Reference
<i>Mesocostoides variabilis</i>							x							Ashford and Crewe, 2003
<i>Metagonimus minutus</i>										x				Ashford and Crewe, 2003
<i>Metagonimus yokogawai</i>										x				Ashford and Crewe, 2003
<i>Metastrongylus apri</i>							x							Ashford and Crewe, 2003
<i>Metorchis albidus</i>							x							Ashford and Crewe, 2003
<i>Metorchis conjunctus</i>							x							Ashford and Crewe, 2003
<i>Microfilaria bolivarensis</i>				x										Ashford and Crewe, 2003
<i>Micronema deletrix</i>							x							Ashford and Crewe, 2003
<i>Moniezia expansa</i>							x							Ashford and Crewe, 2003
<i>Moniliformis moniliformis</i>							x							Ashford and Crewe, 2003
<i>Multiceps brauni</i>										x				Ashford and Crewe, 2003
<i>Taenia glomeratus</i>										x				Ashford and Crewe, 2003
<i>Multiceps longihamatus</i>										x				Ashford and Crewe, 2003
<i>Multiceps multiceps</i>							x							Ashford and Crewe, 2003
<i>Taenia serialis</i>							x							Ashford and Crewe, 2003
<i>Nanophyetus salmincola</i>							x							Ashford and Crewe, 2003
<i>Necator americanus</i>							x							Ashford and Crewe, 2003
<i>Nematodirus abnormalis</i>							x							Ashford and Crewe, 2003
<i>Neodiplostomum sp.</i>										x				Ashford and Crewe, 2003
<i>Oesophagostomum aculeatum</i>										x				Ashford and Crewe, 2003
<i>Oesophagostomum bifurcum</i>										x				Ashford and Crewe, 2003
<i>Oesophagostomum stephanostomum</i>							x							Ashford and Crewe, 2003
<i>Onchocerca volvulus</i>				x										Ashford and Crewe, 2003
<i>Opisthorchis (Chlonorchis) sinensis</i>										x				Ashford and Crewe, 2003

Helminths	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Page Reference
<i>Opisthorchis felineus</i>										x				Ashford and Crewe, 2003
<i>Opisthorchis noverca</i>							x							Ashford and Crewe, 2003
<i>Opisthorchis viverrini</i>										x				Ashford and Crewe, 2003
<i>Orientobilharzia turkestanica</i>										x				Ashford and Crewe, 2003
<i>Ornithobilharzia sp.</i>										x				Kolářová, 2007
<i>Ostertagia ostertagi</i>										x				Ashford and Crewe, 2003
<i>Paragonimus africanus</i>										x				Ashford and Crewe, 2003
<i>Paragonimus bankokensis</i>							x							Ashford and Crewe, 2003
<i>Paragonimus caliensis</i>							x							Ashford and Crewe, 2003
<i>Paragonimus heterotremus</i>										x				Ashford and Crewe, 2003
<i>Paragonimus hueitungensis</i>										x				Ashford and Crewe, 2003
<i>Paragonimus kellicotti</i>							x							Ashford and Crewe, 2003
<i>Paragonimus mexicanus</i>							x							Ashford and Crewe, 2003
<i>Paragonimus miyazakii</i>										x				Ashford and Crewe, 2003
<i>Paragonimus ohirai</i>										x				Ashford and Crewe, 2003
<i>Paragonimus phillipinensis</i>										x				Ashford and Crewe, 2003
<i>Paragonimus sadoensis</i>										x				Ashford and Crewe, 2003
<i>Paragonimus siamensis</i>										x				Palmer et al., 1998, p. 736
<i>Paragonimus skrjabini</i>										x				Ashford and Crewe, 2003
<i>Paragonimus uterobilateralis</i>										x				Ashford and Crewe, 2003
<i>Paragonimus westermani</i>										x				Ashford and Crewe, 2003
<i>Parascaris equorum</i>							x							Ashford and Crewe, 2003

Helminths	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Page Reference
<i>Parastrongylus cantonensis</i>										x				Ashford and Crewe, 2003
<i>Parastrongylus costaricensis</i>							x							Ashford and Crewe, 2003
<i>Pearsonema plica</i>							x							MCM-8, p. 1134
<i>Pelodera strongyloides</i>										x				Ashford and Crewe, 2003
<i>Phaneropsolus bonnei</i>										x				Ashford and Crewe, 2003
<i>Philophthalmus lacrymosus</i>										x				Ashford and Crewe, 2003
<i>Pseudoterranova decipiens</i>							x							Ashford and Crewe, 2003
<i>Physaloptera caucasica</i>							x							Ashford and Crewe, 2003
<i>Physaloptera transfuga</i>										x				Ashford and Crewe, 2003
<i>Plagiorchis harinasutai</i>										x				Ashford and Crewe, 2003
<i>Plagiorchis javensis</i>										x				Ashford and Crewe, 2003
<i>Plagiorchis muris</i>										x				Ashford and Crewe, 2003
<i>Plagiorchis philippinensis</i>										x				Ashford and Crewe, 2003
<i>Poikilorchis congolensis</i>										x				Ashford and Crewe, 2003
<i>Procerovum calderoni</i>										x				Ashford and Crewe, 2003
<i>Prohemistomum vivax</i>										x				Ashford and Crewe, 2003
<i>Prosthodendrium molenkampi</i>										x				Ashford and Crewe, 2003
<i>Pseudamphistomum aethiopicum</i>										x				Ashford and Crewe, 2003
<i>Pseudamphistomum truncatum</i>										x				Ashford and Crewe, 2003
<i>Psilorchis hominis</i>							x							Ashford and Crewe, 2003
<i>Pygidiopsis summa</i>										x				Ashford and Crewe, 2003
<i>Pyramicocephalus anthrocephalus</i>							x							Ashford and Crewe, 2003

Helminths	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Page Reference
<i>Raillietina celebensis</i>										x				Ashford and Crewe, 2003
<i>Raillietina demerariensis</i>							x							Ashford and Crewe, 2003
<i>Rhabditis elongata</i>										x				Ashford and Crewe, 2003
<i>Rhabditis inermis</i>										x				Ashford and Crewe, 2003
<i>Rhabditis niellyi</i>							x							Ashford and Crewe, 2003
<i>Rhabditis pellioiditis</i>							x							Ashford and Crewe, 2003
<i>Rictularia</i> sp.							x							Ashford and Crewe, 2003
<i>Schistocephalus solidus</i>							x							Ashford and Crewe, 2003
<i>Schistosoma bovis</i>										x				Ashford and Crewe, 2003
<i>Schistosoma haematobium</i>										x				Ashford and Crewe, 2003
<i>Schistosoma intercalatum</i>										x				Ashford and Crewe, 2003
<i>Schistosoma japonicum</i>										x				Ashford and Crewe, 2003
<i>Schistosoma malayensis</i>										x				Ashford and Crewe, 2003
<i>Schistosoma mansoni</i>							x							Ashford and Crewe, 2003
<i>Schistosoma mattheei</i>										x				Ashford and Crewe, 2003
<i>Schistosoma mekongi</i>										x				Ashford and Crewe, 2003
<i>Schistosoma rodhaini</i>										x				Ashford and Crewe, 2003
<i>Schistosoma spindale</i>										x				Ashford and Crewe, 2003
<i>Schistosomatium douthitti</i>							x							Ashford and Crewe, 2003
<i>Setaria equina</i>				x										Ashford and Crewe, 2003
<i>Spirocerca lupi</i>										x				Ashford and Crewe, 2003
<i>Stellantchasmus falcatus</i>							x							Ashford and Crewe, 2003
<i>Stictodora fuscata</i>										x				Ashford and Crewe, 2003
<i>Strongyloides fuelleborni</i>										x				Ashford and Crewe, 2003

Helminths	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Page Reference
<i>Strongyloides papillosus</i>							x							Ashford and Crewe, 2003
<i>Strongyloides ransomi</i>							x							Ashford and Crewe, 2003
<i>Strongyloides stercoralis</i>							x							Ashford and Crewe, 2003
<i>Strongyloides westeri</i>							x							Ashford and Crewe, 2003
<i>Syphacea obvelata</i>										x				Ashford and Crewe, 2003
<i>Taenia crassiceps</i>							x							Ashford and Crewe, 2003
<i>Taenia saginata</i>							x							Ashford and Crewe, 2003
<i>Taenia solium</i>							x							Ashford and Crewe, 2003
<i>Taenia taeniaeformis</i>										x				Ashford and Crewe, 2003
<i>Teladorsagia circumcincta</i>										x				Ashford and Crewe, 2003
<i>Ternidens deminutus</i>										x				Ashford and Crewe, 2003
<i>Thelazia californiensis</i>				x										Ashford and Crewe, 2003
<i>Thelazia callipaeda</i>										x				Ashford and Crewe, 2003
<i>Thelazia rhodesi</i>										x				MCM-8, p. 363
<i>Toxascaris leonina</i>							x							Ashford and Crewe, 2003
<i>Toxocara canis</i>							x							Ashford and Crewe, 2003
<i>Toxocara cati</i>							x							Ashford and Crewe, 2003
<i>Trichinella britovi</i>										x				Ashford and Crewe, 2003
<i>Trichinella nativa</i>							x							Ashford and Crewe, 2003
<i>Trichinella nelsoni</i>										x				Ashford and Crewe, 2003
<i>Trichinella pseudospiralis</i>										x				Ashford and Crewe, 2003
<i>Trichinella spiralis</i>							x							Ashford and Crewe, 2003
<i>Trichinella T5</i>							x							Ashford and Crewe, 2003
<i>Trichobilharzia brevis</i>										x				Ashford and Crewe, 2003
<i>Trichobilharzia ocellata</i>							x							Ashford and Crewe, 2003
<i>Trichobilharzia stagnicola</i>							x							Ashford and Crewe, 2003
<i>Trichostrongylus affinis</i>							x							Ashford and Crewe, 2003

Helminths	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Page Reference
<i>Trichostrongylus axei</i>							x							Ashford and Crewe, 2003
<i>Trichostrongylus brevis</i>										x				Ashford and Crewe, 2003
<i>Trichostrongylus calcaratus</i>										x				Ashford and Crewe, 2003
<i>Trichostrongylus capricola</i>										x				Ashford and Crewe, 2003
<i>Trichostrongylus colubriformis</i>							x							Ashford and Crewe, 2003
<i>Trichostrongylus instabilis</i>										x				Ashford and Crewe, 2003
<i>Trichostrongylus lerouxi</i>										x				Ashford and Crewe, 2003
<i>Trichostrongylus orientalis</i>										x				Ashford and Crewe, 2003
<i>Trichostrongylus probolurus</i>										x				Ashford and Crewe, 2003
<i>Trichostrongylus skrjabini</i>										x				Ashford and Crewe, 2003
<i>Trichostrongylus vitrinus</i>										x				Ashford and Crewe, 2003
<i>Trichuris suis</i>							x							Ashford and Crewe, 2003
<i>Trichuris trichiura</i>							x							Ashford and Crewe, 2003
<i>Trichuris vulpis</i>							x							Ashford and Crewe, 2003
<i>Uncinaria stenocephala</i>							x							Ashford and Crewe, 2003
<i>Watsonius macaci</i>										x				Ashford and Crewe, 2003
<i>Wuchereria bancrofti</i>				x										Ashford and Crewe, 2003
<i>Wuchereria lewisi</i>				x										Ashford and Crewe, 2003

Fungi	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Page Reference
<i>Absidia corymbifera</i>									x					MCM-12 th Edition
<i>Acremonium kiliense</i>									x					MCM-12 th Edition
<i>Acremonium potronii</i>									x					MCM-12 th Edition
<i>Acremonium recifei</i>									x					MCM-12 th Edition
<i>Acremonium strictum</i>									x					MCM-12 th Edition
<i>Acrophialophora fusispora</i>									x					MCM-12 th Edition
<i>Actinomadura madurae</i>									x					MCM-12 th Edition
<i>Actinomadura pelletieri</i>									x					MCM-12 th Edition
<i>Alternaria alternata</i>									x					MCM-12 th Edition
<i>Alternaria caespitosa</i>									x					Howard p. 575
<i>Alternaria chlamydospora</i>									x					MCM-12 th Edition
<i>Alternaria dianthicola</i>									x					MCM-12 th Edition
<i>Alternaria infectoria</i>									x					MCM-12 th Edition
<i>Alternaria longipes</i>									x					MCM-12 th Edition
<i>Alternaria stemphyloides</i>									x					http://www.doctorfungus.org/tefungi/Alternaria.htm
<i>Alternaria tenuissima</i>									x					MCM-12 th Edition
<i>Aphanoascus fulvescens</i>									x					MCM-12 th Edition
<i>Apophysomyces elegans</i>									x					MCM-12 th Edition
<i>Arachnomyces nodosetosus</i>									x					MCM-12 th Edition
<i>Arthrrium phaeospermum</i>									x					http://www.doctorfungus.org/tefungi/Arthrrium.htm
<i>Arthroderma uncinatum</i>									x					MCM-12 th Edition
<i>Arthrographis kelrae*</i>									x					Warris et al., 2001
<i>Aspergillus candidus</i>									x					MCM-12 th Edition
<i>Aspergillus clavatus</i>									x					MCM-12 th Edition

Fungi	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Page Reference
<i>Aspergillus fisherianus</i>									x					MCM-12 th Edition
<i>Aspergillus flavipes</i>									x					MCM-12 th Edition
<i>Aspergillus flavus</i> group									x					MCM-12 th Edition
<i>Aspergillus fumigatus</i> group													<i>Aspergillus fumigatus</i>	
<i>Aspergillus glaucus</i>									x					MCM-12 th Edition
<i>Aspergillus nidulans</i> group									x					MCM-12 th Edition
<i>Aspergillus niger</i>									x					MCM-12 th Edition
<i>Aspergillus oryzae</i>									x					MCM-12 th Edition
<i>Aspergillus terreus</i> group									x					MCM-12 th Edition
<i>Aspergillus versicolor</i>									x					MCM-12 th Edition
<i>Aspergillus wentii</i>									x					MCM-12 th Edition
<i>Aureobasidium pullulans</i>									x					MCM-12 th Edition
<i>Basidiobolus ranarum</i>									x					MCM-12 th Edition
<i>Beauveria bassiana</i>									x					MCM-12 th Edition
<i>Bipolaris australiensis</i>									x					MCM-12 th Edition
<i>Blastomyces dermatitidis</i>									x					MCM-12 th Edition
<i>Botryosphaeria subglobosa</i>									x					http://newportal.gbif.org/species/14373513 and http://www.cabri.org/CABRI/srs-bin/wgetz?-newId+-e+-page+qResult+[CABI_FIL-id:'IMI%20287616']
<i>Botrytis cinerea</i>						x								Hashimoto et al., 2017
<i>Byssosclamyces spectabilis</i>									x					MCM-12 th Edition

Fungi	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Page Reference
<i>Candida acidothermophilum</i>									x					MCM-12 th Edition
<i>Candida albicans</i>									x					MCM-12 th Edition
<i>Candida catenulata</i>									x					MCM-12 th Edition
<i>Candida famata</i>									x					MCM-12 th Edition
<i>Candida fimetaria</i> var. <i>fimetaria</i>									x					MCM-12 th Edition
<i>Candida glabrata</i>					x									MCM-12 th Edition
<i>Candida haemulonii</i>									x					MCM-12 th Edition
<i>Candida intermedia</i>									x					http://www.doctorfungus.org/tefungi/Candida_spp.htm
<i>Candida lusitanae</i>									x					MCM-12 th Edition
<i>Candida mycoderma</i> var. <i>annulata</i>									x					MCM-12 th Edition
<i>Candida parapsilosis</i>									x					MCM-12 th Edition
<i>Candida tropicalis</i>									x					MCM-12 th Edition
<i>Cephalophora irregularis</i>									x					http://www.doctorfungus.org/imageban/synonyms/Cephalophora.htm
<i>Cerinostera cyanescens</i>									x					http://www.doctorfungus.org/tefungi/Sporothrix.htm
<i>Chaetomium atrobrunneum</i>									x					MCM-12 th Edition
<i>Chaetomium funicola</i>									x					http://www.doctorfungus.org/tefungi/Chaetomium.htm
<i>Chaetomium globosum</i>									x					MCM-12 th Edition
<i>Chaetomium perpulchrum</i>									x					http://www.doctorfungus.org/tefungi/Chaetomium.htm
<i>Chaetomium strumarium</i>									x					MCM-12 th Edition

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<i>Chaetophoma dermo-unguis</i>									x					http://www.doctorfungus.org/imageban/synonyms/Chaetophoma.htm
<i>Chlamydoabsidia padenii</i>									x					http://www.doctorfungus.org/imageban/synonyms/Chlamydoabsidia.htm
<i>Chlorella protothecoides</i>									x					http://pcp.oxfordjournals.org/cgi/content/abstract/9/1/87
<i>Chrysosporium zonatum*</i>									x					Arvanitidou et al., 1999
<i>Cladophialophora arxii</i>									x					MCM-12 th Edition
<i>Cladophialophora bantiana</i>									x					MCM-12 th Edition
<i>Cladophialophora boppii</i>									x					MCM-12 th Edition
<i>Cladophialophora carrionii</i>									x					MCM-12 th Edition
<i>Cladophialophora devriesii</i>									x					MCM-12 th Edition
<i>Cladorrhinum bulbiliosum</i>									x					http://uwadmnweb.uwyo.edu/botany/Soil%20Microfungal%20Collection/RMF%20collection%20(Rocky%20Mountain%20Fungi)partII.htm
<i>Cladosporium cladosporioides</i>									x					MCM-12 th Edition
<i>Cladosporium elatum</i>									x					http://www.doctorfungus.org/tefungi/Cladosporium.htm
<i>Cladosporium oxysporum</i>									x					http://www.doctorfungus.org/tefungi/Cladosporium.htm
<i>Cladosporium sphaerospermum</i>									x					MCM-12 th Edition

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<i>Clavispora lusitaniae</i>									x					MCM-12 th Edition
<i>Coccidioides immitis</i>									x					MCM-12 th Edition
<i>Cochliobolus pallescens</i>									x					Howard p. 584-586
<i>Cokeromyces recurvatus</i>									x					MCM-12 th Edition
<i>Colletotrichum coccodes</i>									x					Howard p. 662-664
<i>Colletotrichum gloeosporioides</i>									x					Howard p. 662-664
<i>Conidiobolus coronatus</i>									x					MCM-12 th Edition
<i>Conidiobolus incongruus</i>									x					MCM-12 th Edition
<i>Conidiobolus lamprauges</i>									x					Howard p. 133-137
<i>Coniochaeta hoffmannii</i>									x					MCM-12 th Edition
<i>Coniochaeta mutabilis</i>									x					MCM-12 th Edition
<i>Coniothyrium fuckelii</i>									x					http://www.doctorfungus.org/imageban/synonyms/Coniothyrium.htm
<i>Coprinopsis cinerea</i>									x					MCM-12 th Edition
<i>Cryptococcus neoformans</i>									x					MCM-12 th Edition
<i>Cunninghamella bertholletiae</i>									x					MCM-12 th Edition
<i>Curvularia brachyspora</i>									x					Howard p. 584-586
<i>Curvularia clavata</i>									x					Howard p. 584-586
<i>Curvularia geniculata</i>									x					MCM-12 th Edition
<i>Curvularia hawaiiensis</i>									x					MCM-12 th Edition
<i>Curvularia lunata</i>									x					MCM-12 th Edition
<i>Curvularia senegalensis</i>									x					Howard p. 584-586
<i>Curvularia spicifera</i>									x					MCM-12 th Edition

Fungi	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Page Reference
<i>Curvularia veruculosa</i>									x					Howard p. 584-586
<i>Dichotomophthora portulacae</i>									x					http://www.doctorfungus.org/imageban/synonyms/Dichotomophthora.htm
<i>Dichotomophthoropsis nympheum</i>									x					http://www.doctorfungus.org/imageban/synonyms/Dichotomophthoropsis.htm
<i>Dissitimurus exedrus</i>									x					Howard p. 588
<i>Diutina rugosa</i>									x					MCM-12
<i>Doratomyces stemonitis</i>									x					http://www.doctorfungus.org/imageban/synonyms/Doratomyces.htm
<i>Emmonsia crescens</i>									x					MCM-12 th Edition
<i>Emmonsia parva</i>									x					MCM-12 th Edition
<i>Epiccocum purpurascens</i>						x								https://www.inspq.qc.ca/en/moulds/fact-sheets/epicocum-purpurascens
<i>Epidermophyton floccosum</i>									x					MCM-12 th Edition
<i>Exophiala dermatitidis</i>									x					MCM-12 th Edition
<i>Exophiala jeanselmei</i>													<i>Exophiala jeanselmei</i>	
<i>Exophiala moniliae</i>									x					Howard p. 590-596
<i>Exophiala pisciphila</i>									x					Howard p. 590-596
<i>Exophiala psychrophila</i>									x					http://www.doctorfungus.org/tehefungi/exophiala.htm
<i>Exophiala salmonis</i>									x					Howard p. 590-596
<i>Exophiala spinifera</i>									x					MCM-12 th Edition
<i>Exosporium dematium</i>									x					Howard p. 662-664
<i>Exserohilum longirostratum</i>									x					MCM-12 th Edition

Fungi	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Page Reference
<i>Exserohilum macginnisii</i>									x					Howard p. 596-597
<i>Falciformispora senegalensis</i>									x					MCM-12 th Edition
<i>Falciformispora tompkinsii</i>									x					MCM-12 th Edition
<i>Fonsecaea compacta</i>									x					http://www.doctorfungus.org/tefungi/Fonsecaea.htm
<i>Fusarium aquaeductuum</i>									x					Howard p. 402
<i>Fusarium chlamydosporum</i>									x					MCM-12 th Edition
<i>Fusarium dimerum</i>									x					MCM-12 th Edition
<i>Fusarium falciforme</i>									x					MCM-12 th Edition
<i>Fusarium moniliforme</i>									x					MCM-12 th Edition
<i>Fusarium napiforme</i>									x					MCM-12 th Edition
<i>Fusarium neocosmosporiellum</i>									x					Howard p. 434-436
<i>Fusarium nivale</i>									x					Howard p. 431
<i>Fusarium oxysporum</i>									x					MCM-12 th Edition
<i>Fusarium pallidroseum</i>									x					Howard p. 320, 418-421
<i>Fusarium proliferatum</i>									x					MCM-12 th Edition
<i>Fusarium sacchari</i>									x					MCM-12 th Edition
<i>Fusarium solani</i>													<i>Fusarium solani</i>	
<i>Fusarium subglutinans</i>									x					MCM-12 th Edition
<i>Fusarium ventricosum</i>									x					http://www.doctorfungus.org/tefungi/fusarium.htm
<i>Fusarium verticillioides</i>									x					MCM-12 th Edition
<i>Geotrichum candidum*</i>									x					Rosenzweig et al., 1986
<i>Gliomastix roseogrisea</i>									x					Howard, p. 384
<i>Hansenula anomala</i>									x					MCM-12 th Edition

Fungi	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Page Reference
<i>Histoplasma capsulatum</i>									x					MCM-12 th Edition
<i>Hortaea werneckii</i>									x					MCM-12 th Edition
<i>Humicola lanuginosa</i>									x					Howard p. 623
<i>Hypocrea pseudokoningii</i>									x					MCM-12 th Edition
<i>Kiflimonium curvulum</i>									x					MCM-12 th Edition
<i>Kluyveromyces marxianus</i>									x					MCM-12 th Edition
<i>Lasiodiplodia theobromae</i>									x					MCM-12 th Edition
<i>Lophophyton gallinae</i>									x					MCM-12 th Edition
<i>Madurella ikedae</i>									x					MCM-12 th Edition
<i>Magnusiomyces capitatus</i>									x					MCM-12 th Edition
<i>Malassezia globosa</i>					x									MCM-12 th Edition
<i>Malassezia obtusa</i>					x									MCM-12 th Edition
<i>Malassezia pachydermatis</i>					x									MCM-12 th Edition
<i>Malassezia restricta</i>					x									MCM-12 th Edition
<i>Malassezia slooffiae</i>					x									MCM-12 th Edition
<i>Malassezia sympodialis</i>					x									MCM-12 th Edition
<i>Meyerozyma guilliermondii</i>									x					MCM-12 th Edition
<i>Microascus cinereus</i>									x					MCM-12 th Edition
<i>Microascus cirrosus</i>									x					MCM-12 th Edition
<i>Microsporum audouinii</i>									x					MCM-12 th Edition
<i>Microsporum canis</i>									x					MCM-12 th Edition
<i>Microsporum equinum</i>									x					MCM-12 th Edition
<i>Microsporum ferrugineum</i>									x					MCM-12 th Edition

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<i>Microsporium nanum</i>									x					MCM-12 th Edition
<i>Microsporium praecox</i>									x					MCM-12 th Edition
<i>Moniliella suaveolens</i>									x					http://www.doctorfungus.org/imageban/synonyms/Moniliella.htm
<i>Mucor circinelloides</i>									x					MCM-12 th Edition
<i>Mucor hiemalis</i>									x					MCM-12 th Edition
<i>Mucor indicus</i>									x					Howard p. 70, 98-99, 101
<i>Mucor racemosus</i>									x					MCM-12 th Edition
<i>Mucor ramosissimus</i>									x					MCM-12 th Edition
<i>Myceliophthora thermophila</i>									x					MCM-12 th Edition
<i>Mycocentrospora acerina</i>									x					Howard p. 602-603
<i>Mycocleptodiscus indicus</i>									x					Howard p. 602-603
<i>Myriodontium keratinophilum</i>									x					MCM-12 th Edition
<i>Nannizzia cajetani</i>									x					Howard p. 155
<i>Nannizzia fulva</i>									x					MCM-12 th Edition
<i>Nannizzia gypsea</i>									x					MCM-12 th Edition
<i>Nannizzia persicolor</i>									x					MCM-12 th Edition
<i>Nannizzia racemosa</i>									x					MCM-12 th Edition
<i>Nattrassia mangiferae</i>									x					MCM-12 th Edition
<i>Neocosmospora cyanescens</i>									x					MCM-12 th Edition
<i>Neocosmospora keratoplastica</i>									x					Howard p. 394
<i>Neocosmospora lichenicola</i>									x					MCM-12 th Edition

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<i>Neoscytalidium hyalinum</i>									x					MCM-12 th Edition
<i>Neotestudina rosatii</i>									x					MCM-12 th Edition
<i>Neurospora sitophila</i>									x					http://www.doctorfungus.org/imageban/synonyms/Chrysonilia.htm
<i>Nigrospora sphaerica</i>									x					http://www.doctorfungus.org/tehefungi/Nigrospora.htm
<i>Ochroconis gallopava</i>									x					MCM-12 th Edition
<i>Ochroconis tshawytschae</i>									x					Howard p. 617
<i>Oidiodendron cereale</i>									x					http://www.doctorfungus.org/imageban/synonyms/Oidiodendron.htm
<i>Oidium chartarum</i>									x					Doggett, 2000
<i>Oospora sulphureo-ochracea</i>									x					Howard p. 230-232
<i>Ovadendron ochraceum</i>									x					http://www.catalogueoflife.org/show_species_details.php?record_id=3330913
<i>Paecilomyces farinosus</i>									x					http://www.doctorfungus.org/tehefungi/Paecilomyces.htm
<i>Paecilomyces fumosoreus</i>									x					Howard p. 361-362
<i>Paecilomyces javanicus</i>									x					MCM-12 th Edition
<i>Paecilomyces lilacinus</i>									x					MCM-12 th Edition
<i>Paecilomyces marquandii</i>									x					MCM-12 th Edition
<i>Paecilomyces viridis</i>									x					Howard p. 357-359
<i>Paracoccidioides brasiliensis</i>									x					http://www.doctorfungus.org/tehefungi/Lacazia.htm

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<i>Paracoccidioides brasiliensis</i>									x					MCM-12 th Edition
<i>Parendomyces zeylanoides</i>									x					MCM-12 th Edition
<i>Parengyodontium album</i>									x					MCM-12 th Edition
<i>Penicillium chrysogenum</i>									x					MCM-12 th Edition
<i>Penicillium citrinum</i>									x					MCM-12 th Edition
<i>Penicillium commune</i>									x					MCM-12 th Edition
<i>Penicillium decumbens</i>									x					MCM-12 th Edition
<i>Penicillium expansum</i>									x					MCM-12 th Edition
<i>Penicillium marneffei</i>									x					MCM-12 th Edition
<i>Penicillium purpurogenum</i>									x					MCM-12 th Edition
<i>Phaeoanellomyces elegans</i>									x					Howard p. 605-606
<i>Phaeoanellomyces werneckii</i>									x					MCM-12 th Edition
<i>Phaeosclera dematioides</i>									x					http://www.doctorfungus.org/imageban/synonyms/Phaeosclera.htm
<i>Phaeotrichoconis crotalariae</i>									x					Howard p. 606-607
<i>Phanerochaete chrysosporium</i>									x					Doggett, 2000
<i>Phialemoniopsis curvata</i>									x					MCM-12 th Edition
<i>Phialemonium obovatum</i>									x					MCM-12 th Edition
<i>Phialophora bubakii</i>									x					Howard p. 607-612

Fungi	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Page Reference
<i>Phialophora pedrosoi</i>									x					http://www.doctorfungus.org/tefungi/Fonsecaea.htm
<i>Phialophora richardsiae</i>									x					MCM-12 th Edition
<i>Phialophora verrucosa</i>									x					MCM-12 th Edition
<i>Phoma cava</i>									x					http://www.doctorfungus.org/tefungi/phoma.htm
<i>Phoma cruris-hominis</i>									x					Howard p. 666-668
<i>Phoma eupyrena</i>									x					Howard p. 666-668
<i>Phoma glomerata</i>									x					Howard p. 666-668
<i>Phoma herbarum</i>									x					http://www.doctorfungus.org/tefungi/phoma.htm
<i>Phoma hibernica</i>									x					Howard p. 666-668
<i>Phoma minutella</i>									x					Howard p. 666-668
<i>Phoma oculo-hominis</i>									x					Howard p. 666-668
<i>Phyllosticta citricarpa</i>									x					http://www.doctorfungus.org/tefungi/phoma.htm
<i>Piedraia hortae</i>									x					MCM-12 th Edition
<i>Pityrosporum orbiculare</i>					x									MCM-12 th Edition
<i>Pleurophoma pleurospora</i>									x					Howard p. 666-668
<i>Pleurostoma repens</i>									x					MCM-12 th Edition
<i>Pneumocystis carinii</i>						x								MCM-12 th Edition
<i>Prototheca wickerhamii</i>									x					MCM-12 th Edition
<i>Prototheca zopfii</i>									x					MCM-12 th Edition
<i>Pseudoallescheria boydii</i>									x					MCM-12 th Edition
<i>Pseudomicrodochium suttonii</i>									x					MCM-12 th Edition
<i>Pyrenochaeta mackinnonii</i>									x					MCM-12 th Edition
<i>Pyrenochaeta romeroi</i>									x					MCM-12 th Edition

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<i>Pyrenochaeta unguis-hominis</i>									x					Howard p. 666-668
<i>Pyrenophora bisepitata</i>									x					Howard p. 588-589
<i>Pythium insidiosum</i>									x					MCM-12 th Edition
<i>Ramichloridium obovoidea</i>									x					http://www.doctorfungus.org/i mageban/synonyms/Ramichlor idium.htm
<i>Rhinocladiella aquaspersa</i>									x					MCM-12 th Edition
<i>Rhinocladiella schulzeri</i>									x					http://www.doctorfungus.org/i mageban/synonyms/Ramichlor idium.htm
<i>Rhinosporidium seeberi</i>									x					MCM-12 th Edition
<i>Rhizomucor miehei</i>									x					MCM-12 th Edition
<i>Rhizomucor pusillus</i>									x					MCM-12 th Edition
<i>Rhizopus azygosporus</i>									x					MCM-12 th Edition
<i>Rhizopus microsporus</i>									x					MCM-12 th Edition
<i>Rhizopus oryzae</i>									x					MCM-12 th Edition
<i>Rhizopus stolonifer</i>									x					MCM-12 th Edition
<i>Rhodotorula glutinis</i>					x									MCM-12 th Edition
<i>Rhodotorula minuta</i>					x									MCM-12 th Edition
<i>Rhodotorula mucilaginosa</i>					x									MCM-12 th Edition
<i>Rhodotorula rubra</i>					x									MCM-12 th Edition
<i>Saccharomyces cerevisiae</i>									x					MCM-12 th Edition
<i>Saksenaia vasiformis</i>									x					MCM-12 th Edition
<i>Sarcinomyces phaeomuriformis</i>									x					MCM-12 th Edition
<i>Scedosporium prolificans</i>									x					MCM-12 th Edition

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<i>Schizophyllum commune</i>									x					MCM-12 th Edition
<i>Scolecobasidium humicola</i>									x					Howard p. 617
<i>Scopulariopsis acremonium</i>									x					MCM-12 th Edition
<i>Scopulariopsis asperula</i>									x					MCM-12 th Edition
<i>Scopulariopsis brevicaulis</i>									x					MCM-12 th Edition
<i>Scopulariopsis brumptii</i>									x					MCM-12 th Edition
<i>Scopulariopsis candida</i>									x					MCM-12 th Edition
<i>Scopulariopsis flava</i>									x					MCM-12 th Edition
<i>Scopulariopsis fusca</i>									x					MCM-12 th Edition
<i>Scytalidium infestans</i>									x					http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0036-46651999000500009&lng=pt&nrm=iso&tlng=pt
<i>Septonema exile</i>									x					Howard p. 621
<i>Setosphaeria rostrata</i>									x					MCM-12 th Edition
<i>Sporothrix schenckii</i>									x					MCM-12 th Edition
<i>Stemphylium macrosporoideum*</i>									x					West 1986
<i>Stenella araguata</i>									x					http://www.doctorfungus.org/imagesban/synonyms/Stenella.htm
<i>Streptomyces somaliensis</i>									x					MCM-12 th Edition
<i>Taeniolella stilbaspora</i>									x					Howard p. 621
<i>Tetraploa aristata</i>									x					Howard p. 621-623
<i>Thermomyces dupontii</i>									x					Howard p. 340-346

Fungi	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Page Reference
<i>Thielavia terrestris</i>									x					MCM-12 th Edition
<i>Torulopsis magnoliae</i>									x					http://www.doctorfungus.org/imagesban/synonyms/Torulopsis.htm
<i>Trematosphaeria grisea</i>									x					MCM-12 th Edition
<i>Trichoderma viride</i>									x					MCM-12 th Edition
<i>Trichomarix invadens</i>									x					http://www.pac.dfo-mpo.gc.ca/sci/shelldis/pages/chitfdb_e.htm
<i>Trichophyton concentricum</i>									x					MCM-12 th Edition
<i>Trichophyton equinum</i>									x					MCM-12 th Edition
<i>Trichophyton gallinae</i>									x					MCM-12 th Edition
<i>Trichophyton gourvilii</i>									x					MCM-12 th Edition
<i>Trichophyton megninii</i>									x					MCM-12 th Edition
<i>Trichophyton mentagrophytes</i>									x					MCM-12 th Edition
<i>Trichophyton rubrum</i>									x					MCM-12 th Edition
<i>Trichophyton schoenleinii</i>									x					MCM-12 th Edition
<i>Trichophyton simii</i>									x					MCM-12 th Edition
<i>Trichophyton soudanense</i>									x					MCM-12 th Edition
<i>Trichophyton tonsurans</i>									x					MCM-12 th Edition
<i>Trichophyton verrucosum</i>									x					MCM-12 th Edition
<i>Trichophyton violaceum</i>									x					MCM-12 th Edition
<i>Trichosporon asahii</i>									x					MCM-12 th Edition
<i>Trichosporon beigelii</i>									x					MCM-12 th Edition
<i>Trichosporon cutaneum</i>									x					MCM-12 th Edition
<i>Trichosporon inkin</i>									x					MCM-12 th Edition

Fungi	1	2	3	4	5	6	7	8	9	10	11	12	PCCL	Page Reference
<i>Trichosporon mucoides</i>									x					MCM-12 th Edition
<i>Trichosporon ovoides</i>									x					MCM-12 th Edition
<i>Tritirachium oryzae</i>									x					http://www.doctorfungus.org/imageban/synonyms/Tritirachium.htm
<i>Tubercularia vulgaris</i>									x					Howard p. 448-449
<i>Ulocladium chartarum</i>									x					Howard p. 623-624
<i>Veronaea botryosa</i>									x					http://www.doctorfungus.org/imageban/synonyms/Veronaea.htm
<i>Verticillium nigrescens</i>									x					Howard p. 449-450
<i>Volutella cinerescens</i>									x					Howard p. 451
<i>Yarrowia lipolytica</i>									x					MCM-12 th Edition

Appendix C: PCCL 5 Pathogen Scores

Pathogen	WBDO	Occurrence	Normalized health score	Total score
<i>Naegleria fowleri</i>	5	3	5.0	10.0
<i>Legionella pneumophila</i>	5	3	3.6	8.6
<i>Escherichia coli</i> (O157)	5	3	3.2	8.2
<i>Pseudomonas aeruginosa</i>	5	3	3.2	8.2
<i>Helicobacter pylori</i>	1	3	5.0	8.0
<i>Campylobacter jejuni</i>	5	3	2.5	7.5
<i>Mycobacterium abscessus</i>	4	3	3.2	7.2
<i>Shigella sonnei</i>	4	3	3.2	7.2
Caliciviruses	5	3	2.1	7.1
<i>Mycobacterium avium</i>	4	3	2.9	6.9
Adenovirus	2	3	3.6	6.6
Enterovirus	2	3	3.6	6.6
<i>Pantoea agglomerans</i>	4	3	2.5	6.5
Hepatitis A virus	3	2	3.2	6.2
<i>Fusarium solani</i>	1	3	2.9	5.9
Nontuberculous Mycobacteria (NTM)	3	3	2.9	5.9
Hepatitis E virus	2	1	3.6	5.6
<i>Cyclospora cayentanensis</i>	3	3	2.5	5.5
Rotavirus	2	3	2.5	5.5
<i>Salmonella enterica</i>	3	3	2.5	5.5
<i>Toxoplasma gondii</i>	2	1	3.2	5.2
<i>Aspergillus fumigatus</i> group	1	3	2.1	5.1
<i>Entamoeba histolytica</i>	3	3	2.1	5.1
<i>Exophiala jeanselmei</i>	1	3	2.1	5.1
<i>Vibrio cholerae</i>	3	3	2.1	5.1
<i>Aeromonas hydrophila</i>	1	3	1.8	4.8
<i>Plesiomonas shigelloides</i>	3	3	1.8	4.8
<i>Blastocystis hominis</i>	4	1	0.7	4.7
<i>Acinetobacter baumannii</i>	1	2	2.5	4.5
<i>Comamonas testosteroni</i>	1	2	2.5	4.5
<i>Yersinia enterocolitica</i>	3	3	1.4	4.4
Astrovirus	2	2	1.4	3.4
Microsporidia	1	2	1.4	3.4
<i>Isospora belli</i>	2	1	1.1	3.1

Appendix D: The Draft CCL 5 for Microbes

Microbe	Final CCL 3	Final CCL 4	Draft CCL 5 ¹
Adenovirus	X	X	X
Caliciviruses	X	X	X
<i>Campylobacter jejuni</i>	X	X	X
Enterovirus	X	X	X
<i>Escherichia coli</i> (O157)	X	X	X
<i>Helicobacter pylori</i>	X	X	X
<i>Legionella pneumophila</i>	X	X	X
<i>Mycobacterium abscessus</i>			X
<i>Mycobacterium avium</i>	X	X	X
<i>Naegleria fowleri</i>	X	X	X
<i>Pseudomonas aeruginosa</i>			X
<i>Shigella sonnei</i>	X	X	X

¹Hepatitis A and *Salmonella enterica* were listed on CCL 3 and CCL 4 but are not listed on CCL 5.

Appendix E: Microbial Contaminant Information Sheets (CISs)

Microbes Infographics

Selection of microbes from the CCL Universe for placement on the PCCL is based upon exclusionary screening criteria that assess the potential of water-related transmission (occurrence) and the plausibility of causing waterborne disease by ingestion, inhalation, or dermal contact (health effects). Microbes that met any of the exclusionary criteria were not included on the PCCL.

The pages below provide examples of the CCL decision making process Adenovirus, which was included on the CCL 5. Following the example are CISs for each of the PCCL 5 and nominated microbes.

This infographic shows **Adenovirus** as an example of a contaminant that was listed on the CCL 5.

The graphic shows a box for each of the three attributes (Occurrence, WBDO, and Health Effects) that serve as input to the scoring model.

The attribute boxes show:

- The data used for scoring each attribute, in bold, and indicated by a “yes” in the right hand column.
- The score the contaminant received for that particular attribute (in the left hand column).
- The occurrence score (of 3) for Adenovirus was chosen, as shown in the upper left hand corner, because it is greater than the WBDO score (of 2).
- The health effects scores for the general population (of 6) and the sensitive population (of 4) are added together (equaling 10) and multiplied by 5/14 (the health effects score equalizing value), which equals 3.6.
- The occurrence score is added to the adjusted health effects score for a total score for Adenovirus of 6.6,

$$\text{Pathogen Total Score} = \text{Highest Score between WBDO and Occurrence} + \left(\left(\begin{array}{l} \text{General Population} \\ \text{Score} + \text{Highest} \\ \text{Sensitive} \\ \text{Population} \end{array} \right) \times 5/14 \right)$$

Example: Calculation of Adenovirus Total Score

Adenovirus Total Score = **3** (Occurrence Score) + ((**6** (General Population Score) + **4** (Children/CD) x 5/14); *Adenovirus Total Score* = 3 + 3.6;

Adenovirus Total Score = **6.6**

Adenovirus: Microbe Included on the CCL 5

Scoring Summary			Adenovirus		
Occurrence		3	Total Score: 6.6		
Health Effects					
General population		6	Waterborne Disease Outbreaks		
Sensitive population		4	Score	Data Element	Scoring Data
Occurrence			5	Multiple WBDOs in US (2009-2017)	
Score	Data Element	Scoring Data	4	At least one WBDOs in US (2009-2017)	
3	Detected in drinking water in the US	Yes ^{2,3}	3	Caused WBDOs at any time in US	
2	Detected in Source water in the US		2	Caused WBDOs in countries other than US	Yes: Europe ¹
1	Not detected in the US		1	Never caused WBDOs, associated w/ water related disease	
Health Effects					
Score	Data Element		Scoring Data		
7	Does the organism cause significant mortality (> 1/1,000 cases)				
6	Does the organism cause pneumonia, meningitis, hepatitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term hospitalization (> week)?		[General population] A frequent cause of pneumonia among (unvaccinated) military recruits. Two deaths in previously-healthy adults. ⁴ ARD is still significant problem in military. Less common		
5	Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?				
4	Does the illness require short term hospitalization (< week)?		[Chronic Disease] Children with chronic disease required respiratory ventilation. ⁶ [Children] Young adults may contract acute respiratory disease. ⁷		
3	Does the illness require physician intervention?				
2	Is the illness self-limiting within 72 hours (without requiring medical intervention)?				
1	Does the illness result in mild symptoms with minimal or no impact on daily activities?				

Pathogen Total Score = Highest Score between WBDO and Occurrence + ((General Population Score + Highest Sensitive population Score) x 5/14)

Adenovirus Total Score = 3 (Occurrence Score) + ((6 (General Population Score) + 4 (Children/CD) x 5/14); Adenovirus Total Score = 3 + 3.6 = 6.6

¹ Kukkula, M., Arstila P., Klossner M.L., Maunula L., Bonsdorff C.H., and P. Jaatinen. 1997. *Scandinavian Journal of Infectious Disease*, 29(4): 415-418.

² O'Reilly, C.E., A.B. Bowen, E.P. Nytzia, J.P. Sarisky, C.A. Shepherd, M.D. Miller, B.C. Hubbard, M. Herring, S.D. Buchanan, C.C. Fitzgerald, V. Hill, M.J. Arrowood, L.X. Xiao, R.M. Hoekstra, E.D. Mintz, M.F. Lynch, and the Outbreak Working Group. 2007. A Waterborne Outbreak of Gastroenteritis with Multiple Etiologies among Resort Island Visitors and Residents: Ohio, 2004. *Clinical Infectious Diseases*, 44:506-512.

³ Fong, T., L. Mansfield, D. Wilson, D. Schwab, S. Molloy and J. Rose. 2007. Massive Microbiological Groundwater Contamination Associated with a Waterborne Outbreak in Lake Erie, South Bass Island, OH. *Environmental Health Perspectives*. 115(6): 856-864.

⁴ Gray, G.C., P.R. Goswami, M.D. Malasig, A.W. Hawksworth, D.H. Trump, M.A. Ryan and D.P. Schnurr. 2001. Adult Adenovirus Infections: Loss of Orphaned Vaccines Precipitates Military Respiratory Disease Epidemics. *Clinical Infectious Diseases*, 31: 663-70.

⁵ Robinson, C. and M. Echavarria. 2007. Adenoviruses. In Murray, P.R., E.J. Baron, J.H. Jorgensen, M.L. Landry, and M.A. Pfaller (ed.) *The Manual of Clinical Microbiology*, 9th. edition, American Society for Microbiology, Washington, DC. Vol. 2: p. 1592.

⁶ CDC, 1983. Adenovirus type 7 outbreak in a pediatric chronic-care facility – Pennsylvania. 1972. *MMWR*, 1983;32:258-60.

⁷ CDC, 1998. Surveillance for Waterborne-Disease Outbreaks Associated with Drinking Water --- United States, 1995—1996. *MMWR Surveillance Summaries*, 47(SS-5); 1-33.

***Acinetobacter baumannii* Scoring Data**

Scoring Summary^{1,2}	
Occurrence	2
Health Effects	
General population	1
Sensitive subpopulation(s) [CD, P]	6

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease

Score²	Data Element	Scoring Data	Reference³
	<i>Waterborne Disease Outbreaks</i>		
5	Has caused multiple (2 or more) documented WBDOs in the U.S. reported by CDC between 2009-2017	No	CDC-NORS, 2020
4	Has caused at least one documented WBDOs in U.S. reported by CDC between 2009-2017	No	CDC-NORS, 2020
3	Has caused documented WBDOs at any time in the U.S.?		
2	Has caused WBDOs in countries other than the U.S.?		
1	Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?	Yes. Outbreaks occur most commonly in hospitals to very ill patients by person to person contact or via contaminated surfaces. However, it is still can occur and be transmitted in water.	CDC, 2010

Score ²	Data Element	Scoring Data	Reference ³
<i>Occurrence</i>			
3	Detected in drinking water in the U.S.?		
2	Detected in source water in the U.S.?	Yes. It was detected in untreated groundwater used as drinking water in Preston County, W. VA.	Bifulco, 1989
1	Not detected in the U.S.?		
<i>Health Effects</i>			
7	Does the organism cause significant mortality (> 1/1,000 cases)		
6 [CD, P]	Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term hospitalization (> week)?	People with weakened immune systems due to chronic diseases or serious illnesses are the most susceptible. It causes various diseases including pneumonia and serious blood or wound infections. <i>Acinetobacter baumannii</i> infection during pregnancy can lead to premature contractions and chorioamnionitis. it can also cause septic complications in the puerperium associated with long duration of hospitalization.	CDC, 2010 Aivazova, 2009 Cools et al., in MCM, 2019

Score ²	Data Element	Scoring Data	Reference ³
5	Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?		
4	Does the illness require short term hospitalization (< week)?		
3	Does the illness require physician intervention?		
2	Is the illness self-limiting within 72 hours (without requiring medical intervention)?		
1 [G, C, E]	Does the illness result in mild symptoms with minimal or no impact on daily activities?	[G, C, E] <i>Acinetobacter baumannii</i> poses a very limited health threat to individuals without a health condition. Most studies only report outbreaks in hospitals with patients that have a health condition.	CDC, 2010

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease.

²See *Final Contaminant Candidate List 3 Microbes: PCCL to CCL Process*. EPA 815-R-09-009. Final. August 2009 for a detailed description on how to calculate the total pathogen score.

³EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2017 and then collected occurrence citations if there were no CDC WBDOs.

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Adenovirus Scoring Data

Scoring Summary^{1,2}	
Occurrence	3
Health Effects	
General population	6
Sensitive subpopulation(s) [CD, C]	4

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease

Score²	Data Element	Scoring Data	Reference³
<i>Waterborne Disease Outbreaks</i>			
5	Has caused multiple (2 or more) documented WBDOs in the U.S. reported by CDC between 2009-2017	No	CDC-NORS, 2020
4	Has caused at least one documented WBDOs in U.S. reported by CDC between 2009-2017	No	CDC-NORS, 2020
3	Has caused documented WBDOs at any time in the U.S.?		
2	Has caused WBDOs in countries other than the U.S.?	Yes Europe; S. Korea	Kukkula et al., 1997 Lee et al., 2002
1	Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?		
<i>Occurrence</i>			
3	Detected in drinking water in the U.S.?	Yes	O'Reilly et al., 2007 Fong et al., 2007

Score ²	Data Element	Scoring Data	Reference ³
		PCR in connection with an outbreak.	
2	Detected in source water in the U.S.?	Yes 38% of surface water samples collected as part of the Information Collection Rule contained Adenovirus 40 and Adenovirus 41.	USEPA, 2007
1	Not detected in the U.S.?		
	<i>Health Effects</i>		
7	Does the organism cause significant mortality (> 1/1,000 cases)?		
6 [G]	Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term hospitalization (> week)?	[G] A frequent cause of pneumonia among (unvaccinated) military recruits. Two deaths in previously-healthy adults. ARD is still a significant problem in military. Less common manifestations include fatal neonatal disease, meningoencephalitis and myocarditis.	Gray et al., 2001 Robinson in Murray, 2010 Heim in Carroll, 2019
5	Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?	None reported	

Score ²	Data Element	Scoring Data	Reference ³
4 [C, CD]	Does the illness require short term hospitalization (< week)?	[CD] Children with chronic disease required respiratory ventilation. [C] Young adults may contract acute respiratory disease.	CDC, 1983 CDC, 1998
3	Does the illness require physician intervention?	Physician office visits are indicated for ocular infections.	Robinson in Murray, 2010
2 [E, P]	Is the illness self-limiting within 72 hours (without requiring medical intervention)?	[E, P] Approximately 50% of cases are asymptomatic, symptomatic cases usually present as upper respiratory infections similar to the common cold.	Robinson in Murray, 2010
1	Does the illness result in mild symptoms with minimal or no impact on daily activities?		

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease.

² See *Final Contaminant Candidate List 3 Microbes: PCCL to CCL Process*. EPA 815-R-09-009. Final. August 2009 for a detailed description on how to calculate the total pathogen score.

³ EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2017 and then collected occurrence citations if there were no CDC WBDOs.

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***Aeromonas hydrophila* Scoring Data**

Scoring Summary^{1,2}	
Occurrence	3
Health Effects	
General population	2
Sensitive subpopulation(s) [C]	3

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease

Score²	Data Element	Scoring Data	Reference³
	<i>Waterborne Disease Outbreaks</i>		
5	Has caused multiple (1 or more) documented WBDOs in the U.S. reported by CDC between 2009-2017	No	CDC-NORS, 2020
4	Has caused at least one documented WBDOs in U.S. reported by CDC between 2009-2017	No	CDC, 1991 – CDC, 2017
3	Has caused documented WBDOs at any time in the U.S.?	No	
2	Has caused WBDOs in countries other than the U.S.?	No	
1	Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?	Yes	Gavriel et al., 1998
	<i>Occurrence</i>		
3	Detected in drinking water in the U.S.?	Yes	

Score ²	Data Element	Scoring Data	Reference ³
		EPA found <i>A. hydrophila</i> in the distribution systems of 42 public water systems out of 293 systems tested.	EPA, 2006 and EPA, 2003
2	Detected in source water in the U.S.?	Yes	Holmes et al., 1996 EPA, 2006
1	Not detected in the U.S.?		
	<i>Health Effects</i>		
7	Does the organism cause significant mortality (> 1/1,000 cases)?	Wound infections are usually preceded by injury that occurs in contact with water. These infections range from cellulitis to myronecrotic infections with a poor prognosis.	Horneman et al. in Murray, 2010
6	Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term hospitalization (> week)?	Septicemia occurs rarely in immunocompetent hosts. Can cause HUS.	Horneman et al. in Murray, 2010
5	Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?		
4	Does the illness require short term hospitalization (< week)?		
3 [C]	Does the illness require physician intervention?	[C] Children may require hospitalization due to dehydration.	Horneman and Ali in Murray, 2010

Score ²	Data Element	Scoring Data	Reference ³
2 [G, P, E, CD]	Is the illness self-limiting within 72 hours (without requiring medical intervention)?	[G, P, E, CD] Acute watery disease is the most common form as well as abdominal pain, vomiting, fever.	Horneman and Ali in Murray, 2010
1	Does the illness result in mild symptoms with minimal or no impact on daily activities?		

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease.

²See *Final Contaminant Candidate List 3 Microbes: PCCL to CCL Process*. EPA 815-R-09-009. Final. August 2009 for a detailed description on how to calculate the total pathogen score.

³EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2017 and then collected occurrence citations if there were no CDC WBDOs.

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***Arcobacter butzleri* Scoring Data**

Scoring Summary^{1, 2}	
Waterborne Disease Outbreak	4
Health Effects	
General population	3
Sensitive subpopulation(s) [CD, C, P, E]	3

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease

Score²	Data Element	Scoring Data	Reference³
	<i>Waterborne Disease Outbreaks</i>		
5	Has caused multiple (1 or more) documented WBDOs in the U.S. reported by CDC between 2009-2017	No	CDC-NORS, 2020
4	Has caused at least one documented WBDOs in U.S. reported by CDC between 2009-2017	Yes Not listed in CDC's MMWR, however, linked to outbreak and drinking water. Symptom severity also suggests <i>Arcobacter</i>.	Fong et al., 2007
3	Has caused documented WBDOs at any time in the U.S.?		
2	Has caused WBDOs in countries other than the U.S.?		
1	Has never caused WBDOs in any country, but has been epidemiologically		

Score ²	Data Element	Scoring Data	Reference ³
	associated with water related disease?		
	Occurrence		
3	Detected in drinking water in the U.S.?	Yes	Fong et al., 2007
2	Detected in source water in the U.S.?	Yes <i>Arcobacter butzleri</i> was isolated from ground water in Idaho after a WBDO.	Rice et al., 1999
1	Not detected in the U.S.?		
	Health Effects		
7	Does the organism cause significant mortality (> 1/1,000 cases)?	Unknown	
6	Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term hospitalization (> week)?	Persons with underlying disease such as liver disease, cirrhosis, or alcoholism may be at increased risk of complications. Has been isolated from patients with bacteremia, endocarditis, peritonitis and diarrhea. Clinical significance unknown.	Hsueh et al., 1997 Lerner et al., 1994 Yan et al., 2000 Fitzgerald in Murray, 2010
5	Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?		

Score ²	Data Element	Scoring Data	Reference ³
4	Does the illness require short term hospitalization (< week)?		
3 [G, C, P, E, CD]	Does the illness require physician intervention?	[All populations] Displays clinical features similar to <i>Campylobacter jejuni</i>, however is more frequently associated with a persistent diarrhea. Twenty-six percent of Belgian patients required antibiotics.	Vandenberg et al., 2004
2	Is the illness self-limiting within 72 hours (without requiring medical intervention)?	Usual symptoms are diarrhea, abdominal pain, vomiting, and nausea resolving in < 3 days.	Wybo et al., 2004 Rice et al., 1999
1	Does the illness result in mild symptoms with minimal or no impact on daily activities?		

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease.

² See *Final Contaminant Candidate List 3 Microbes: PCCL to CCL Process*. EPA 815-R-09-009. Final. August 2009 for a detailed description on how to calculate the total pathogen score.

³ EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2017 and then collected occurrence citations if there were no CDC WBDOs.

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***Aspergillus fumigatus* Scoring Data**

Scoring Summary^{1,2}	
Occurrence	3
Health Effects	
General population	3
Sensitive subpopulation(s) [C, P, E, CD]	3

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease

Score²	Data Element	Scoring Data	Reference³
<i>Waterborne Disease Outbreaks</i>			
5	Has caused multiple (1 or more) documented WBDOs in the U.S. reported by CDC between 2009-2017	No	CDC-NORS, 2020
4	Has caused at least one documented WBDOs in U.S. reported by CDC between 2009-2017	No	CDC, 1991 – CDC, 2017
3	Has caused documented WBDOs at any time in the U.S.?	No	
2	Has caused WBDOs in countries other than the U.S.?	No	
1	Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?	Yes Study on two bone marrow transplantation units at a Little Rock, AR hospital.	Anaissie et al., 2002 Anaissie et al., 2003 Warris et al., 2003
<i>Occurrence</i>			

Score ²	Data Element	Scoring Data	Reference ³
3	Detected in drinking water in the U.S.?	Yes	Anaissie et al., 2002 Anaissie et al., 2003 Nagy and Olson, 1982 Rosenzweig et al., 1986 Doggett, 2000 Vesper et al., 2007
2	Detected in source water in the U.S.?	Yes	Nagy and Olson, 1982
1	Not detected in the U.S.?		
Health Effects			
7	Does the organism cause significant mortality (> 1/1,000 cases)?	Invasive infections caused by <i>Aspergillus</i> species are associated with high rates of morbidity and mortality, especially in immunosuppressed patients.	Verweij and Brandt in Murray, 2010 Chen in Carroll, 2019
6	Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term hospitalization (> week)?	Sporadic cases of invasive aspergillosis have been reported in immunocompetent hosts (chronic meningitis, endocarditis, pericarditis, osteomyelitis). Invasive aspergillosis is primarily an infection of severely immunocompromised patients. Serious infection can also occur in patients with	Bodey and Vartivarian, 1989

Score ²	Data Element	Scoring Data	Reference ³
		more modest impairments of host immune system such as diabetics.	Nagy and Olson, 1982
5	Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?	None reported.	
4	Does the illness require short term hospitalization (< week)?	Requirement for hospitalization depends upon the manifestation of disease (e.g., superficial skin and ear infections do not require hospitalization).	Bodey and Vartivarian, 1989
3 [G, C, P, E, CD]	Does the illness require physician intervention?	[All populations] Most infections and allergies caused by this organism require physician intervention.	Bodey and Vartivarian, 1989 CDC, 2019
2	Is the illness self-limiting within 72 hours (without requiring medical intervention)?		
1	Does the illness result in mild symptoms with minimal or no impact on daily activities?	<i>Aspergillus</i> spores are allergens and persons who become sensitized experience symptoms of allergy and asthma.	Horner et al., 1995

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease.

²See *Final Contaminant Candidate List 3 Microbes: PCCL to CCL Process*. EPA 815-R-09-009. Final. August 2009 for a detailed description on how to calculate the total pathogen score.

³EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2017 and then collected occurrence citations if there were no CDC WBDOs.

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recovered from water, air, and patients shows two clusters of genetically distinct strains. *Journal of Clinical Microbiology*. 41(9): 4101-4106.

Astrovirus Scoring Data

Scoring Summary ^{1, 2}	
Waterborne Disease Outbreak	2
Health Effects	
General population	2
Sensitive subpopulation(s) [C, P, E, CD]	2

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease

Score ²	Data Element	Scoring Data	Reference ³
<i>Waterborne Disease Outbreaks</i>			
5	Has caused multiple (1 or more) documented WBDOs in the U.S. reported by CDC between 2009-2017	No	CDC-NORS, 2020
4	Has caused at least one documented WBDOs in U.S. reported by CDC between 2009-2017	No	CDC, 1991 – CDC, 2017
3	Has caused documented WBDOs at any time in the U.S.?	No	
2	Has caused WBDOs in countries other than the U.S.?	Yes England and Wales	Smith et al., 2006
1	Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?	Yes	Gofti-Laroche et al., 2003
<i>Occurrence</i>			
3	Detected in drinking water in the U.S.?	No	

Score ²	Data Element	Scoring Data	Reference ³
2	Detected in source water in the U.S.?	Yes Astrovirus was detected in 15 of 29 samples collected under the Information Collection Rule.	Chapron et al., 2000
1	Not detected in the U.S.?		
<i>Health Effects</i>			
7	Does the organism cause significant mortality (> 1/1,000 cases)?	No	
6	Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term hospitalization (> week)?	No	
5	Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?	No	
4	Does the illness require short term hospitalization (< week)?	No	
3	Does the illness require physician intervention?	No	
2 [G, C, P, E, CD]	Is the illness self-limiting within 72 hours (without requiring medical intervention)?	[All populations] Asymptomatic infections common. Moderate self-limiting gastroenteritis (vomiting and diarrhea).	Farkas in Murray, 2010

Score ²	Data Element	Scoring Data	Reference ³
1	Does the illness result in mild symptoms with minimal or no impact on daily activities?		

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease.

²See *Final Contaminant Candidate List 3 Microbes: PCCL to CCL Process*. EPA 815-R-09-009. Final. August 2009 for a detailed description on how to calculate the total pathogen score.

³EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2017 and then collected occurrence citations if there were no CDC WBDOs.

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***Blastocystis hominis* Scoring Data**

Scoring Summary^{1,2}	
Waterborne Disease Outbreak	4
Health Effects	
General population	1
Sensitive subpopulation(s) [C, P, E, CD]	1

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease

Score²	Data Element	Scoring Data	Reference³
<i>Waterborne Disease Outbreaks</i>			
5	Has caused multiple (1 or more) documented WBDOs in the U.S. reported by CDC between 2009-2017	No	CDC-NORS, 2020
4	Has caused at least one documented WBDOs in U.S. reported by CDC between 2009-2017	Yes 2012: 1 Transient noncommunity (suspected)	CDC-NORS, 2020
3	Has caused documented WBDOs at any time in the U.S.?	No	
2	Has caused WBDOs in countries other than the U.S.?	No	
1	Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?	Yes Drinking untreated water has been associated with infection.	Leelayoova et al., 2004 Stenzel and Boreham, 1996 Taamasri et al., 2000

Score ²	Data Element	Scoring Data	Reference ³
<i>Occurrence</i>			
3	Detected in drinking water in the U.S.?	No	
2	Detected in source water in the U.S.?	No	
1	Not detected in the U.S.?	Yes	Karanis, 2006
<i>Health Effects</i>			
7	Does the organism cause significant mortality (> 1/1,000 cases)?	No	
6	Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term hospitalization (> week)?	No	
5	Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?	No	
4	Does the illness require short term hospitalization (< week)?	No	
3	Does the illness require physician intervention?	No	
2	Is the illness self-limiting within 72 hours (without requiring medical intervention)?	Symptoms may be more pronounced and prolonged in immunocompromised; neoplasia and abnormal intestinal tract function.	Leber in Murray, 2010
1 [G, C, P, E, CD]	Does the illness result in mild symptoms with minimal or no impact on daily activities?	[All populations] Pathogenicity of <i>B. hominis</i> is controversial. Symptoms may include	Leber in Murray, 2010; Novak-Weekly, 2019

Score ²	Data Element	Scoring Data	Reference ³
		diarrhea, vomiting and abdominal pain.	

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease.

²See *Final Contaminant Candidate List 3 Microbes: PCCL to CCL Process*. EPA 815-R-09-009. Final. August 2009 for a detailed description on how to calculate the total pathogen score.

³EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2017 and then collected occurrence citations if there were no CDC WBDOs.

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Calicivirus Scoring Data

Scoring Summary ^{1,2}	
Waterborne Disease Outbreak	5
Health Effects	
General population	2
Sensitive subpopulation(s) [C, E, CD]	4

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease

Score ²	Data Element	Scoring Data	Reference ³
	<i>Waterborne Disease Outbreaks</i>		
5	Has caused multiple (2 or more) documented WBDOs in the U.S. reported by CDC between 2009-2017	Yes 2010: 1 Nontransient noncommunity 2012: 1 Transient noncommunity 2014: 2 Transient noncommunity 2015: 1 community	CDC-NORS, 2020
4	Has caused at least one documented WBDOs in U.S. reported by CDC between 2009-2017		
3	Has caused documented WBDOs at any time in the U.S.?	1971-2008: 11 Community 30 Noncommunity	CDC-NORS, 2020
2	Has caused WBDOs in countries other than the U.S.?		
1	Has never caused WBDOs in any		

Score ²	Data Element	Scoring Data	Reference ³
	country, but has been epidemiologically associated with water related disease?		
	<i>Occurrence</i>		
3	Detected in drinking water in the U.S.?	Yes Detection by PCR.	Huffman et al., 2003
2	Detected in source water in the U.S.?	Yes Detected in ground water by PCR.	Borchardt et al., 2003 Fout et al., 2003
1	Not detected in the U.S.?		
	<i>Health Effects</i>		
7	Does the organism cause significant mortality (> 1/1,000 cases)?		
6	Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term hospitalization (> week)?	No long term sequelae have been reported.	CDC, 2001
5	Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?	No	CDC, 2001
4 [C, E, CD]	Does the illness require short term	[E, CD] (Norovirus) Although rare, severe dehydration can be fatal, with this outcome	CDC, 2019

Score ²	Data Element	Scoring Data	Reference ³
	hospitalization (< week)?	occurring among susceptible persons (e.g., older persons with debilitating health conditions). [C] Sappoviruses cause disease mainly in children.	Farkas in Murray, 2007
3	Does the illness require physician intervention?		
2 [G, P]	Is the illness self-limiting within 72 hours (without requiring medical intervention)?	[G, P] Acute gastroenteritis. Highly contagious, able to cause large outbreaks and environmentally stable.	Farkas in Murray, 2007
1	Does the illness result in mild symptoms with minimal or no impact on daily activities?		

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease.

²See *Final Contaminant Candidate List 3 Microbes: PCCL to CCL Process*. EPA 815-R-09-009. Final. August 2009 for a detailed description on how to calculate the total pathogen score.

³EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2017 and then collected occurrence citations if there were no CDC WBDOs.

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***Campylobacter jejuni* Scoring Data**

Scoring Summary^{1,2}	
Waterborne Disease Outbreak	5
Health Effects	
General population	3
Sensitive subpopulation(s) [C, E]	4

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease

Score²	Data Element	Scoring Data	Reference³
	<i>Waterborne Disease Outbreaks</i>		
5	Has caused multiple (2 or more) documented WBDOs in the U.S. reported by CDC between 2009-2017	Yes 2009: 1 Community 2010: 3 Community 1 Nontransient Noncommunity 2012: 1 Community (Campylobacter unknown) 2015: 2 Community 2017: 1 Community	CDC-NORS, 2020
4	Has caused at least one documented WBDOs in U.S. reported by CDC between 2009-2017		
3	Has caused documented WBDOs at any time in the U.S.?	Yes 1971-2008: 13 Community and 15 Noncommunity	CDC-NORS, 2020

Score ²	Data Element	Scoring Data	Reference ³
2	Has caused WBDOs in countries other than the U.S.?	Yes Finland, New Zealand	Kuusi, 2005; waterandhealth.org
1	Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?		
<i>Occurrence</i>			
3	Detected in drinking water in the U.S.?	Yes	Sacks et al., 1986 O'Reilly, 2007
2	Detected in source water in the U.S.?	Yes	Carter et al., 1987
1	Not detected in the U.S.?		
<i>Health Effects</i>			
7	Does the organism cause significant mortality (> 1/1,000 cases)?	Death is uncommon.	Fitzgerald in Murray, 2007
6	Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term hospitalization (> week)?	Complications include hepatitis, bacteremia, cholecystitis, pancreatitis, nephritis, abortion and neonatal sepsis, urinary tract infection, meningitis and septic arthritis. Bacteremia occurs in 0.15% of intestinal infections with elderly mostly affected.	Fitzgerald in Murray, 2007
5	Does the illness result in long term or permanent dysfunction		

Score ²	Data Element	Scoring Data	Reference ³
	or disability, i.e. sequelae?		
4 [C, E]	Does the illness require short term hospitalization (< week)?	<p>[C, E] Most cases do not require hospitalization, pediatric cases and elderly are more likely to require hospitalization than normal adult cases.</p> <p>The highest incidence is in children and infants.</p> <p>Bacteremia occurs at 1.5 per 1,000 cases with the highest rate occurring in the elderly.</p>	Fitzgerald in Murray, 2007
3 [G, P, CD]	Does the illness require physician intervention?	<p>[G, P, CD] Guillain-Barré syndrome, reactive arthritis.</p> <p>Guillain-Barré 1/1000 cases.</p> <p>Reactive arthritis 1/100 cases.</p>	<p>Fitzgerald in Murray, 2007</p> <p>Altekruse et al., 1999</p>
2	Is the illness self-limiting within 72 hours (without requiring medical intervention)?	<p>Duration 2-5 days, usually self-limiting.</p> <p>Several days to more than 1 week, self-limiting, relapse in 5-10% cases.</p>	<p>Heymann, 2005</p> <p>Fitzgerald in Murray, 2007</p> <p>CDC, 2019</p>
1	Does the illness result in mild symptoms with minimal or no impact on daily activities?	Asymptomatic to acute diarrhea, abdominal pain, malaise, and fever.	Fitzgerald in Murray, 2007

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The

higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease.

²See *Final Contaminant Candidate List 3 Microbes: PCCL to CCL Process*. EPA 815-R-09-009. Final. August 2009 for a detailed description on how to calculate the total pathogen score.

³EPA based the WBDO scores on the CDC NORS reports from 1971 – 2017 and then collected occurrence citations if there were no CDC WBDOs.

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***Comamonas testosteroni* Scoring Data**

Scoring Summary^{1,2}	
Occurrence	2
Health Effects	
General population	1
Sensitive subpopulation(s) [CD]	6

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease

Score²	Data Element	Scoring Data	Reference³
<i>Waterborne Disease Outbreaks</i>			
5	Has caused multiple (2 or more) documented WBDOs in the U.S. reported by CDC between 2009-2017	No	CDC-NORS, 2020
4	Has caused at least one documented WBDOs in U.S. reported by CDC between 2009-2017	No	CDC-NORS, 2020
3	Has caused documented WBDOs at any time in the U.S.?		
2	Has caused WBDOs in countries other than the U.S.?		
1	Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?		
<i>Occurrence</i>			

Score ²	Data Element	Scoring Data	Reference ³
3	Detected in drinking water in the U.S.?		
2	Detected in source water in the U.S.?	<i>Comamonas testosteroni</i> is often found in freshwater, soil, plants, and in hospital devices such as intravenous lines and the reservoir water in the humidifiers of respiratory therapy equipment.	Tiwari and Nanda, 2019
1	Not detected in the U.S.?		
	<i>Health Effects</i>		
7	Does the organism cause significant mortality (> 1/1,000 cases)?		
6 [CD, G]	Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term hospitalization (> week)?	<i>Comamonas testosteroni</i> has been shown to cause pneumonia in patients with AIDS. (Franzetti et al., 1992). It has also been documented causing meningitis in a patient that had recurrent cholesteatoma (Arda et al., 2008). It also been shown to infect those who were previously healthy.	Franzetti et al., 1992 Arda et al., 2008 Arda et al., in MCM, 2019
5	Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?		

Score ²	Data Element	Scoring Data	Reference ³
4	Does the illness require short term hospitalization (< week)?		
3	Does the illness require physician intervention?		
2	Is the illness self-limiting within 72 hours (without requiring medical intervention)?		
1 [G]	Does the illness result in mild symptoms with minimal or no impact on daily activities?	Infrequently cause human infections on healthy individuals	Arda et al., in MCM, 2019

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease.

² See *Final Contaminant Candidate List 3 Microbes: PCCL to CCL Process*. EPA 815-R-09-009. Final. August 2009 for a detailed description on how to calculate the total pathogen score.

³ EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2017 and then collected occurrence citations if there were no CDC WBDOs.

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***Cyclospora cayetanensis* Scoring Data**

Scoring Summary^{1, 2}	
Waterborne Disease Outbreak	3
Health Effects	
General population	3
Sensitive subpopulation(s) [C]	4

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease

Score²	Data Element	Scoring Data	Reference³
<i>Waterborne Disease Outbreaks</i>			
5	Has caused multiple (1 or more) documented WBDOs in the U.S. reported by CDC between 2009-2017	No	CDC-NORS, 2020
4	Has caused at least one documented WBDOs in U.S. reported by CDC between 2009-2017	No	CDC-NORS, 2020
3	Has caused documented WBDOs at any time in the U.S.?	Yes 1971-2008: 2 Community	CDC-NORS, 2020
2	Has caused WBDOs in countries other than the U.S.?		
1	Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?	Yes	Huang et al., 1995
<i>Occurrence</i>			

Score ²	Data Element	Scoring Data	Reference ³
3	Detected in drinking water in the U.S.?	Yes	CDC, 2011
2	Detected in source water in the U.S.?	No	
1	Not detected in the U.S.?	Detected in drinking water in Guatemala.	Dowd et al., 2003
Health Effects			
7	Does the organism cause significant mortality (> 1/1,000 cases)?	No	
6	Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term hospitalization (> week)?	No	
5	Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?	Guillain-Barré and Reiter's syndromes have been reported.	Connor et al., 2001
4 [C]	Does the illness require short term hospitalization (< week)?	[C] Most cases do not require hospitalization, infants may require hospitalization for rehydration therapy.	Fisk et al., 2005
3 [G, P, E, C, CD]	Does the illness require physician intervention?	[All populations] Can cause diarrhea and biliary disease. In patients not treated, illness can be protracted with relapsing symptoms.	Lindsay in Murray, 2010 Heymann, 2005 CDC, 2019
2	Is the illness self-limiting within 72 hours (without	.	

Score ²	Data Element	Scoring Data	Reference ³
	requiring medical intervention)?		
1	Does the illness result in mild symptoms with minimal or no impact on daily activities?		

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease.

² See *Final Contaminant Candidate List 3 Microbes: PCCL to CCL Process*. EPA 815-R-09-009. Final. August 2009 for a detailed description on how to calculate the total pathogen score.

³ EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2017 and then collected occurrence citations if there were no CDC WBDOs.

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***Entamoeba histolytica* Scoring Data**

Scoring Summary^{1, 2}	
Waterborne Disease Outbreak	3
Health Effects	
General population	3
Sensitive subpopulation(s) [C, P, E, CD]	3

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease

Score²	Data Element	Scoring Data	Reference³
<i>Waterborne Disease Outbreaks</i>			
5	Has caused multiple (1 or more) documented WBDOs in the U.S. reported by CDC between 2009-2017	No	CDC-NORS, 2020
4	Has caused at least one documented WBDOs in U.S. reported by CDC between 2009-2017	No	CDC-NORS, 2020
3	Has caused documented WBDOs at any time in the U.S.?	1971-2008: 3 Community (one is “Entamoeba unknown”) 1 Noncommunity	CDC-NORS, 2020
2	Has caused WBDOs in countries other than the U.S.?		
1	Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?		
<i>Occurrence</i>			

Score ²	Data Element	Scoring Data	Reference ³
3	Detected in drinking water in the U.S.?	Found during WBDO.	CDC, 2006
2	Detected in source water in the U.S.?		
1	Not detected in the U.S.?		
	Health Effects		
7	Does the organism cause significant mortality (> 1/1,000 cases)?	500 million infected (<i>E. dispar</i> and <i>E. histolytica</i>) each year with approximately 50 million cases of colitis and liver abscess and 100,000 deaths worldwide.	Leber in Murray, 2010
6	Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term hospitalization (> week)?	Infections in the U.S. rarely progress to complications, amoebic colitis may result in perforation of the intestinal wall, resulting in peritonitis; dissemination to extraintestinal sites may involve the liver, lungs, or brain. Liver abscess is the most common complication.	Heymann, 2005
5	Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?	Abdominal perforations and peritonitis are rare complications. Up to 5% develop liver abscess.	Leber in Murray, 2010

Score ²	Data Element	Scoring Data	Reference ³
4	Does the illness require short term hospitalization (< week)?	Intestinal invasion can lead to lesions, ulcers.	Leber in Murray, 2010
3 [G, C, P, E, CD]	Does the illness require physician intervention?	[All populations] Clinical symptoms are dysentery, colitis or rarely amoeboma). Fulminant colitis occurs most often in children who present with diffuse abdominal pain, profuse bloody diarrhea and fever.	Leber in Murray, 2010 Marshall, 1997
2	Is the illness self-limiting within 72 hours (without requiring medical intervention)?	Most human infections (90%) are asymptomatic, symptomatic non-invasive strains cause gastrointestinal symptoms such as cramping and increased frequency of bowel movements, constipation may alternate with diarrhea, invasive strains may cause amoebic dysentery.	Heymann, 2005
1	Does the illness result in mild symptoms with minimal or no impact on daily activities?		

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease.

² See *Final Contaminant Candidate List 3 Microbes: PCCL to CCL Process*. EPA 815-R-09-009. Final. August 2009 for a detailed description on how to calculate the total pathogen score.

³EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2017 and then collected occurrence citations if there were no CDC WBDOs.

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Enterovirus Scoring Data

Scoring Summary^{1,2}	
Occurrence	3
Health Effects	
General population	4
Sensitive subpopulation(s) [C]	6

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease

Score²	Data Element	Scoring Data	Reference³
<i>Waterborne Disease Outbreaks</i>			
5	Has caused multiple (2 or more) documented WBDOs in the U.S. reported by CDC between 2009-2017	No	CDC-NORS, 2020
4	Has caused at least one documented WBDOs in U.S. reported by CDC between 1990-2009	No	CDC-NORS, 2020
3	Has caused documented WBDOs at any time in the U.S.?	No	
2	Has caused WBDOs in countries other than the U.S.?	Yes Switzerland and others.	Hafliger et al., 2000
1	Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?		
<i>Occurrence</i>			

Score ²	Data Element	Scoring Data	Reference ³
3	Detected in drinking water in the U.S.?	Yes	Mack et al., 1972 Lieberman et al., 2003 Keswick et al., 1984
2	Detected in source water in the U.S.?	Yes	Borchardt et al., 2003
1	Not detected in the U.S.?		
	Health Effects		
7	Does the organism cause significant mortality (> 1/1,000 cases)?		
6 [C]	Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term hospitalization (> week)?	<p>[C] Aseptic meningitis and neonatal sepsis are the most common complications.</p> <p>EVs are the most common cause of meningitis in the U.S., over 80% of all viral meningitides (estimated 30,000 to 50,000 hospitalizations for non-polio EV each year (principally echo and coxsackie)).</p> <p>Enterovirus causes myocarditis, viral meningitis, encephalitis and meningoencephalitis.</p> <p>Widespread illness in children with asthma.</p>	<p>Heymann, 2005</p> <p>Romero in Murray, 2007</p> <p>Khetsuriani et al., 2002</p> <p>Kim et al., 2001 Khetsuriani, 2003</p>

Score ²	Data Element	Scoring Data	Reference ³
			Midgely at al, 2015
5	Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?	Diabetes has been associated with enterovirus infection.	Heymann, 2005
4 [G]	Does the illness require short term hospitalization (< week)?	[G] Hospitalization may be required for severe manifestations of disease. Approximately 20-30% of meningitis outbreak cases in young adults require hospitalization. During the summer and fall, responsible for 50 – 60% of hospital admissions for evaluation of febrile illnesses for infants and children.	Sawyer, 2002 Romero in Murray, 2007
3	Does the illness require physician intervention?	Children with acute pharyngitis may be taken to a physician to differentiate between streptococcal and viral sore throat. Upper respiratory illness lasts 4-6 days, lower respiratory illness lasts 5-7 days, and meningitis lasts 7-10 days.	Romero in Murray, 2007 Heymann, 2005
2 [E, P, CD]	Is the illness self-limiting within 72 hours (without requiring medical intervention)?	[E, P, CD] Most cases are asymptomatic. Most common symptoms are acute nonspecific febrile illness.	Romero in Murray, 2007
1	Does the illness result in mild symptoms with		

Score ²	Data Element	Scoring Data	Reference ³
	minimal or no impact on daily activities?		

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease.

²See *Final Contaminant Candidate List 3 Microbes: PCCL to CCL Process*. EPA 815-R-09-009. Final. August 2009 for a detailed description on how to calculate the total pathogen score.

³EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2017 and then collected occurrence citations if there were no CDC WBDOs.

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Escherichia coli (O157)[†] Scoring Data

Scoring Summary^{1,2}	
Waterborne Disease Outbreak	5
Health Effects	
General population	3
Sensitive subpopulation(s) [C, E]	6

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease

Score²	Data Element	Scoring Data	Reference³
	<i>Waterborne Disease Outbreaks</i>		
5	Has caused multiple (2 or more) documented WBDOs in the U.S. reported by CDC between 2009-2017	Yes 2010: 1 Community 2011: 1 Transient Noncommunity 2013: 1 Transient Noncommunity 2014: 1 Nontransient Noncommunity 2016: 1 Community	CDC-NORS, 2020
4	Has caused at least one documented WBDOs in U.S. reported by CDC between 2009-2017		
3	Has caused documented WBDOs at any time in the U.S.?	1971-2008: 5 Community 5 Noncommunity	CDC-NORS, 2020
2	Has caused WBDOs in countries other than the U.S.?		

Score ²	Data Element	Scoring Data	Reference ³
1	Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?		
	<i>Occurrence</i>		
3	Detected in drinking water in the U.S.?	Yes	Bopp et al., 2003
2	Detected in source water in the U.S.?	Yes As a result of animal fecal contamination.	Kramer et al., 1996
1	Not detected in the U.S.?		
	<i>Health Effects</i>		
7	Does the organism cause significant mortality (> 1/1,000 cases)?	No Approximately 60 deaths per 73,000 cases per year (nearly >1/1,000) are reported due to <i>E. coli</i> (O157). A case fatality rate of 0.5 has been reported for outbreak-related cases caused by <i>E. coli</i> O157:H7	Nataro in Murray, 2007 Rangel et al., 2005 Buchan in Carroll, 2019
6 [C, E]	Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term hospitalization (> week)?	[C, E] Patients at extremes of age have an increased risk for infection and associated complications. Children under 5 are most frequently diagnosed with infection and are at greatest risk of developing HUS. The elderly also appear to be an increased risk of complications.	Chinyu, 1995

Score ²	Data Element	Scoring Data	Reference ³
		HUS develops in 10% of patients under the age of 10.	Nataro and Kaper, 1998 Heymann, 2005 CDC, 2019
5	Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?	25% of HUS survivors develop long term renal sequelae. 3.2% of children with diarrhea plus HUS develop diabetes. Adults have a greater likelihood of hypertension and reduced renal function.	Garg et al., 2003 Suri et al., 2005 Garg et al., 2005
4	Does the illness require short term hospitalization (< week)?		
3 [G, P, CD]	Does the illness require physician intervention?	[G, P, CD] Fluid replacement is the cornerstone of treatment for EHEC diarrhea; some clinicians choose to hospitalize all patients with E. coli O157:H7 for hydration to prevent HUS.	Heymann, 2005
2	Is the illness self-limiting within 72 hours (without		

Score ²	Data Element	Scoring Data	Reference ³
	requiring medical intervention)?		
1	Does the illness result in mild symptoms with minimal or no impact on daily activities?	Can present as mild nonbloody diarrhea.	Nataro in Murray, 2007

[†]The names *E. coli* O157 and *E. coli* O157:H7 are used interchangeably for CCL 5 due to ongoing taxonomical debate in the scientific literature.

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease.

²See *Final Contaminant Candidate List 3 Microbes: PCCL to CCL Process*. EPA 815-R-09-009. Final. August 2009 for a detailed description on how to calculate the total pathogen score.

³EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2017 and then collected occurrence citations if there were no CDC WBDOs.

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***Exophiala jeanselmei* Scoring Data**

Scoring Summary¹	
Occurrence	3
Health Effects	
General population	3
Sensitive subpopulation(s) [C, P, E, CD]	3

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease

Score²	Data Element	Scoring Data	Reference³
<i>Waterborne Disease Outbreaks</i>			
5	Has caused multiple (1 or more) documented WBDOs in the U.S. reported by CDC between 2009-2017	No	CDC-NORS, 2020
4	Has caused at least one documented WBDOs in U.S. reported by CDC between 2009-2017	No	CDC-NORS, 2020
3	Has caused documented WBDOs at any time in the U.S.?	No	
2	Has caused WBDOs in countries other than the U.S.?	No	
1	Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?	Yes	Nucci et al., 2002
<i>Occurrence</i>			
3	Detected in drinking water in the U.S.?	Yes	West, 1986

Score ²	Data Element	Scoring Data	Reference ³
2	Detected in source water in the U.S.?	Yes	Nucci et al., 2001
1	Not detected in the U.S.?		
<i>Health Effects</i>			
7	Does the organism cause significant mortality (> 1/1,000 cases)?	No	
6	Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term hospitalization (> week)?	Infections increase in severity in patients with impaired immunity and metabolic diseases such as diabetes.	De Hoog in Murray, 2007
5	Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?	No	
4	Does the illness require short term hospitalization (< week)?	No	
3 [G, C, P, E, CD]	Does the illness require physician intervention?	[All populations] A chronic spreading mycosis. The frequency of infection is low, yet potential severe outcome and high degrees of resistance to antifungal drugs requires medical attention.	Heymann, 2005 De Hoog in Murray, 2007
2	Is the illness self-limiting within 72 hours (without requiring medical intervention)?		

Score ²	Data Element	Scoring Data	Reference ³
1	Does the illness result in mild symptoms with minimal or no impact on daily activities?		

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease.

²See *Final Contaminant Candidate List 3 Microbes: PCCL to CCL Process*. EPA 815-R-09-009. Final. August 2009 for a detailed description on how to calculate the total pathogen score.

³EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2017 and then collected occurrence citations if there were no CDC WBDOs.

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***Fusarium solani* Scoring Data**

Scoring Summary^{1, 2}	
Occurrence	3
Health Effects	
General population	4
Sensitive subpopulation(s) [C, P, E, CD]	4

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease

Score²	Data Element	Scoring Data	Reference³
<i>Waterborne Disease Outbreaks</i>			
5	Has caused multiple (1 or more) documented WBDOs in the U.S. reported by CDC between 2009-2017	No	CDC-NORS, 2020
4	Has caused at least one documented WBDOs in U.S. reported by CDC between 2009-2017	No	CDC-NORS, 2020
3	Has caused documented WBDOs at any time in the U.S.?	No	
2	Has caused WBDOs in countries other than the U.S.?	No	
1	Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?	Yes Houston TX	Annaissie et al., 2001
<i>Occurrence</i>			
3	Detected in drinking water in the U.S.?	Yes	Nagy and Olson, 1982 Annaissie et al., 2001

Score ²	Data Element	Scoring Data	Reference ³
2	Detected in source water in the U.S.?	Yes	
1	Not detected in the U.S.?		
	<i>Health Effects</i>		
7	Does the organism cause significant mortality (> 1/1,000 cases)?	Mortality associated with cutaneous <i>Fusarium</i> infection is high in immunocompromised patients but low for immunocompetent hosts.	Nucci and Annaissie, 2002
6	Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term hospitalization (> week)?	Most severe disease occurs in severely immunocompromised. <i>Fusarium</i> has been associated with pneumonia and disseminated infections	Fridkin and Jarvis, 1996; Annaissie et al., 2001 Sutton and Brandt, in Murray, 2010
5	Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?		
4 [G, C, P, E, CD]	Does the illness require short term hospitalization (< week)?	[All populations] Can cause infections that may require hospitalization, particularly in immunocompromised patients (endophthalmitis, central nervous system infections, endocarditis)	Dignani and Anaissie, 2004
3	Does the illness require physician intervention?	Treatment and/or removal of the foreign body is usually	Dignani and Anaissie, 2004

Score ²	Data Element	Scoring Data	Reference ³
		required as well as antifungal therapy. In immunocompetent patients manifestations include keratitis, localized skin lesions, onychomycosis, and occasionally cellulitis and peritonitis.	
2	Is the illness self-limiting within 72 hours (without requiring medical intervention)?		
1	Does the illness result in mild symptoms with minimal or no impact on daily activities?		

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease.

²See *Final Contaminant Candidate List 3 Microbes: PCCL to CCL Process*. EPA 815-R-09-009. Final. August 2009 for a detailed description on how to calculate the total pathogen score.

³EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2017 and then collected occurrence citations if there were no CDC WBDOs.

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***Helicobacter pylori* Scoring Data**

Scoring Summary^{1,2}	
Occurrence	3
Health Effects	
General population	7
Sensitive subpopulation(s) [E]	7

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease

Score²	Data Element	Scoring Data	Reference³
<i>Waterborne Disease Outbreaks</i>			
5	Has caused multiple (2 or more) documented WBDOs in the U.S. reported by CDC between 2009-2017	No	CDC-NORS, 2020
4	Has caused at least one documented WBDOs in U.S. reported by CDC between 2009-2017.	No	CDC, 1991 – CDC, 2017
3	Has caused documented WBDOs at any time in the U.S.?	No	
2	Has caused WBDOs in countries other than the U.S.?	No	
1	Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?	Yes	Klein and Graham, 1991 Hulten et al., 1996 Rolle-Kampczyk, 2004 Aziz et al., 2015

Score ²	Data Element	Scoring Data	Reference ³
<i>Occurrence</i>			
3	Detected in drinking water in the U.S.?	Yes	Hegarty and Baker, 1999
2	Detected in source water in the U.S.?		
1	Not detected in the U.S.?		
<i>Health Effects</i>			
7 [G, E]	Does the organism cause significant mortality (> 1/1,000 cases)?	[G, E] 6500 deaths per year. 1.2 Million acute cases per year (>1/1,000 deaths). 46% of deaths occur before age of 64.	CDC, 1997 Stratton et al., 2000
6	Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term hospitalization (> week)?	40 – 50% infection rates in the elderly. More likely to suffer from gastric ulcer, gastric adenocarcinomas and MALT.	Fox in Murray, 2007 Couturier in Carroll, 2019
5	Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?	Main cause for peptic ulcers and a major risk factor for gastric cancer.	Fox in Murray, 2007
4	Does the illness require short term hospitalization (< week)?		
3 [C, P, CD]	Does the illness require physician intervention?	[C, P, CD] Many patients have recurrent abdominal symptoms; 16% develop duodenal ulcers. NIH (1994) recommends diagnosis and antimicrobial	Fox in Murray, 2007

Score ²	Data Element	Scoring Data	Reference ³
		treatment for anyone with peptic ulcers.	
2	Is the illness self-limiting within 72 hours (without requiring medical intervention)?	No Infection persists lifelong without treatment.	Fox in Murray, 2007
1	Does the illness result in mild symptoms with minimal or no impact on daily activities?		

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease.

² See *Final Contaminant Candidate List 3 Microbes: PCCL to CCL Process*. EPA 815-R-09-009. Final. August 2009 for a detailed description on how to calculate the total pathogen score.

³ EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2017 and then collected occurrence citations if there were no CDC WBDOs.

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Hepatitis A Virus Scoring Data

Scoring Summary ^{1,2}	
Waterborne Disease Outbreak	3
Health Effects	
General population	3
Sensitive subpopulation(s) [E]	6

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease

Score ²	Data Element	Scoring Data	Reference ³
<i>Waterborne Disease Outbreaks</i>			
5	Has caused multiple (2 or more) documented WBDOs in the U.S. reported by CDC between 2009-2017	No	CDC-NORS, 2020
4	Has caused at least one documented WBDOs in U.S. reported by CDC between 2009-2017	No	
3	Has caused documented WBDOs at any time in the U.S.?	Yes 1 Community 1 Noncommunity (Previously unreported)/A 1971-2008: 10 Community 9 Noncommunity	CDC-NORS, 2020
2	Has caused WBDOs in countries other than the U.S.?		

Score ²	Data Element	Scoring Data	Reference ³
1	Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?		
	<i>Occurrence</i>		
3	Detected in drinking water in the U.S.?		
2	Detected in source water in the U.S.?	Yes	Abbaszadegan et al., 2003 Borchardt et al., 2004
1	Not detected in the U.S.?		
	<i>Health Effects</i>		
7	Does the organism cause significant mortality (> 1/1,000 cases)?	Reported case fatality is normally low, 0.1% – 0.3%; it can reach 1.8% for adults over 50.	Heymann, 2005
6 [E]	Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term hospitalization (> week)?	[E] Fulminant hepatitis may develop. Disease severity shows a general increase with age.	Anderson in Murray, 2007 CDC, 2019
5	Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?		
4	Does the illness require short term		

Score ²	Data Element	Scoring Data	Reference ³
	hospitalization (< week)?		
3 [G, C, P, CD]	Does the illness require physician intervention?	[G, C, P, CD] Commonly begins with “flu-like” symptoms. May develop jaundice. Physician office visit is common for diagnosis and/or vaccination.	Anderson in Murray, 2007
2	Is the illness self-limiting within 72 hours (without requiring medical intervention)?		
1	Does the illness result in mild symptoms with minimal or no impact on daily activities?		

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease.

²See *Final Contaminant Candidate List 3 Microbes: PCCL to CCL Process*. EPA 815-R-09-009. Final. August 2009 for a detailed description on how to calculate the total pathogen score.

³EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2017 and then collected occurrence citations if there were no CDC WBDOs.

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Hepatitis E Virus Scoring Data

Scoring Summary ^{1, 2}	
Waterborne Disease Outbreak	2
Health Effects	
General population	3
Sensitive subpopulation(s) [P]	7

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease

Score ²	Data Element	Scoring Data	Reference ³
<i>Waterborne Disease Outbreaks</i>			
5	Has caused multiple (1 or more) documented WBDOs in the U.S. reported by CDC between 2009-2017	No	CDC-NORS, 2020
4	Has caused at least one documented WBDOs in U.S. reported by CDC between 2009-2017	No	CDC-NORS, 2020
3	Has caused documented WBDOs at any time in the U.S.?	No	
2	Has caused WBDOs in countries other than the U.S.?	Yes Waterborne outbreaks have occurred in Asia and Africa.	Guthmann et al., 2006 Panda et al., 2006
1	Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?	Yes California camping.	Tsang et al., 2000
<i>Occurrence</i>			

Score ²	Data Element	Scoring Data	Reference ³
3	Detected in drinking water in the U.S.?	No	
2	Detected in source water in the U.S.?	No	
1	Not detected in the U.S.?	Yes India	Jothikumar et al., 2000
<i>Health Effects</i>			
7 [P]	Does the organism cause significant mortality (> 1/1,000 cases)?	[P] May progress to fulminant disease in pregnant women when infection occurs during the third trimester. High mortality (for fetus) when infection occurs during pregnancy. The case-fatality rate is similar to that of hepatitis A except in pregnant women, where it may reach 20% among those infected during the third trimester of pregnancy.	Anderson in Murray, 2010; Isopet and Kamar in MCM 2019 Heymann, 2005
6 [E]	Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term hospitalization (> week)?	[E] Fulminant hepatitis may develop. Disease severity shows a general increase with age.	Anderson in Murray, 2010
5	Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?		

Score ²	Data Element	Scoring Data	Reference ³
4	Does the illness require short term hospitalization (< week)?		
3 [G, C]	Does the illness require physician intervention?	[G, C] Commonly begins with “flu-like” symptoms. May develop jaundice. Physician office visit is common for diagnosis and/or vaccination.	Anderson in Murray, 2010
2	Is the illness self-limiting within 72 hours (without requiring medical intervention)?		
1	Does the illness result in mild symptoms with minimal or no impact on daily activities?		

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease.

² See *Final Contaminant Candidate List 3 Microbes: PCCL to CCL Process*. EPA 815-R-09-009. Final. August 2009 for a detailed description on how to calculate the total pathogen score.

³ EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2017 and then collected occurrence citations if there were no CDC WBDOs.

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***Isospora belli* Scoring Data**

Scoring Summary^{1, 2}	
Waterborne Disease Outbreak	2
Health Effects	
General population	1
Sensitive subpopulation(s) [C]	2

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease

Score²	Data Element	Scoring Data	Reference³
<i>Waterborne Disease Outbreaks</i>			
5	Has caused multiple (1 or more) documented WBDOs in the U.S. reported by CDC between 2009-2017	No	CDC-NORS, 2020
4	Has caused at least one documented WBDOs in U.S. reported by CDC between 2009-2017	No	CDC-NORS, 2020
3	Has caused documented WBDOs at any time in the U.S.?	No	
2	Has caused WBDOs in countries other than the U.S.?	Yes	Karanis, 2006
1	Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?	Yes	
<i>Occurrence</i>			

Score ²	Data Element	Scoring Data	Reference ³
3	Detected in drinking water in the U.S.?	No	
2	Detected in source water in the U.S.?	No	
1	Not detected in the U.S.?	No	
<i>Health Effects</i>			
7	Does the organism cause significant mortality (> 1/1,000 cases)?		
6	Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term hospitalization (> week)?		
5	Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?		
4	Does the illness require short term hospitalization (< week)?		
3	Does the illness require physician intervention?	Can cause serious and sometimes fatal disease in immunocompetent humans, more severe in immunocompromised patients.	Lindsay in Murray, 2010
2 [C]	Is the illness self-limiting within 72 hours (without requiring medical intervention)?	[C] Symptoms are more severe in infants and children.	Lindsay in Murray, 2010
1 [G]	Does the illness result in mild symptoms with	[G] Symptoms include diarrhea, steatorrhea, headache, fever,	Lindsay in Murray, 2010

Score ²	Data Element	Scoring Data	Reference ³
	minimal or no impact on daily activities?	malaise, abdominal pain, vomiting, dehydration, and weight loss.	

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease.

²See *Final Contaminant Candidate List 3 Microbes: PCCL to CCL Process*. EPA 815-R-09-009. Final. August 2009 for a detailed description on how to calculate the total pathogen score.

³EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2017 and then collected occurrence citations if there were no CDC WBDOs.

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***Legionella pneumophila* Scoring Data**

Scoring Summary^{1,2}	
Waterborne Disease Outbreak	5
Health Effects	
General population	4
Sensitive subpopulation(s) [E, CD]	6

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease

Score²	Data Element	Scoring Data	Reference³
	<i>Waterborne Disease Outbreaks</i>		
5	Has caused multiple (1 or more) documented WBDOs in the U.S. reported by CDC between 2009-2017	Yes 9 Community (2009) 12 Community (2010) 11 Community (2011) 12 Community (2012) 6 Community (2013) 17 Community (2014) 13 Community (2015) 24 Community (2016) 21 Community (2017)	CDC-NORS, 2020
4	Has caused at least one documented WBDOs in U.S. reported by CDC between 2009-2017		

Score ²	Data Element	Scoring Data	Reference ³
3	Has caused documented WBDOs at any time in the U.S.?	1971-2008: 30 Community 25 Noncommunity	CDC-NORS, 2020
2	Has caused WBDOs in countries other than the U.S.?		
1	Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?		
	<i>Occurrence</i>		
3	Detected in drinking water in the U.S.?	Yes	AwwaRF, 2004 Lin et al., 1998 Maier et al., 2000
2	Detected in source water in the U.S.?	Yes	Maier et al., 2000
1	Not detected in the U.S.?		
	<i>Health Effects</i>		
7	Does the organism cause significant mortality (> 1/1,000 cases)?	<p>Avg. 12% fatality rate; death rates of 15% (general pop.) up to 75% (immunocompromised) if untreated.</p> <p>Avg. 25% death rate (between 20-40% during an outbreak.</p> <p>10 – 15% death rate.</p> <p>Fatality rate has been as high as 39% in hospitalized cases; it is generally higher in those</p>	<p>Edelstein in Murray, 2007</p> <p>AWWARF, 2004</p> <p>CDC, 2005</p> <p>Heymann, 2005</p>

Score ²	Data Element	Scoring Data	Reference ³
		with compromised immunity.	
6 [E, CD]	Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term hospitalization (> week)?	[E, CD] Acute pneumonia may progress to respiratory collapse and death if diagnosis and effective antibiotic therapy are delayed. The elderly and individuals with chronic diseases are at higher risk.	Edelstein in Murray, 2007; Carroll. 2019 CDC, 2005
5	Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?	No	
4 [G, C, P]	Does the illness require short term hospitalization (< week)?	[G, C, P] Hospitalization is required for treatment of acute pneumonia.	Edelstein in Murray, 2007
3	Does the illness require physician intervention?		
2	Is the illness self-limiting within 72 hours (without requiring medical intervention)?	Pontiac fever resolves without treatment and has flu-like symptoms.	Edelstein in Murray, 2007 Heymann, 2005
1	Does the illness result in mild symptoms with minimal or no impact on daily activities?		

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease.

²See *Final Contaminant Candidate List 3 Microbes: PCCL to CCL Process*. EPA 815-R-09-009. Final. August 2009 for a detailed description on how to calculate the total pathogen score.

³EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2017 and then collected occurrence citations if there were no CDC WBDOs.

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Microsporidia Scoring Data

Scoring Summary^{1,2}	
Occurrence	2
Health Effects	
General population	2
Sensitive subpopulation(s) [CD, C, P, E]	2

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease

Score²	Data Element	Scoring Data	Reference³
	<i>Waterborne Disease Outbreaks</i>		
5	Has caused multiple (1 or more) documented WBDOs in the U.S. reported by CDC between 2009-2017	No	CDC-NORS, 2020
4	Has caused at least one documented WBDOs in U.S. reported by CDC between 2009-2017	No	CDC-NORS, 2020
3	Has caused documented WBDOs at any time in the U.S.?	No	
2	Has caused WBDOs in countries other than the U.S.?	No	
1	Has never caused WBDOs in any country, but has been epidemiologically	Yes	Cotte, et al., 1999 Enriquez et al., 1998 Hutin et al., 1998

Score ²	Data Element	Scoring Data	Reference ³
	associated with water related disease?		
	<i>Occurrence</i>		
3	Detected in drinking water in the U.S.?	No	
2	Detected in source water in the U.S.?	Yes	Didier et al., 2004 Dowd et al., 1998
1	Not detected in the U.S.?		
	<i>Health Effects</i>		
7	Does the organism cause significant mortality (> 1/1,000 cases)?		
6	Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term hospitalization (> week)?		
5	Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?		
4	Does the illness require short term hospitalization (< week)?		
3	Does the illness require physician intervention?	Antimicrobial therapy available for immunodeficient patients.	Weber in Murray, 2010
2 [G, C, P, E, CD]	Is the illness self-limiting within 72 hours (without requiring medical intervention)?	[All populations] Diarrhea and weight loss lasting in up to 2 – 3 weeks in	Weber in Murray, 2010

Score ²	Data Element	Scoring Data	Reference ³
		immunocompetent hosts. Has been identified among elderly persons with acute or chronic diarrhea.	
1	Does the illness result in mild symptoms with minimal or no impact on daily activities?		

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease.

²See *Final Contaminant Candidate List 3 Microbes: PCCL to CCL Process*. EPA 815-R-09-009. Final. August 2009 for a detailed description on how to calculate the total pathogen score.

³EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2017 and then collected occurrence citations if there were no CDC WBDOs.

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***Mycobacterium abscessus* Scoring Data**

Scoring Summary^{1,2}	
Waterborne Disease Outbreak	4
Health Effects	
General population	4
Sensitive subpopulation(s) [CD]	5

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease

Score²	Data Element	Scoring Data	Reference³
<i>Waterborne Disease Outbreaks</i>			
5	Has caused multiple (2 or more) documented WBDOs in the U.S. reported by CDC between 2009-2017		CDC-NORS, 2020
4	Has caused at least one documented WBDOs in U.S. reported by CDC between 2009-2017	2014: 1 Hospital	CDC-NORS, 2020
3	Has caused documented WBDOs at any time in the U.S.?		
2	Has caused WBDOs in countries other than the U.S.?		
1	Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?		
<i>Occurrence</i>			
3	Detected in drinking water in the U.S.?	Yes. Idaho public health officials and pediatric infectious	Baker et al., 2017

Score ²	Data Element	Scoring Data	Reference ³
		disease physicians investigated a US documented outbreak of <i>Mycobacterium abscessus</i> skin infections in children whose only common exposure was an indoor wading pool (Carter et al., 2019). Another outbreak occurred in the Duke University Hospital linked to the hospital tap water (Baker et al., 2017).	Carter et al., 2019
2	Detected in source water in the U.S.?		
1	Not detected in the U.S.?		
	Health Effects		
7	Does the organism cause significant mortality (> 1/1,000 cases)?		
6	Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term hospitalization (> week)?	.	
5 [CD]	Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?	[CD] <i>M. abscessus</i> complex can cause pulmonary disease, especially in vulnerable hosts with underlying structural lung disease, such as cystic fibrosis,	Griffith, 2007

Score ²	Data Element	Scoring Data	Reference ³
		bronchiectasis, and prior tuberculosis.	
4 [G]	Does the illness require short term hospitalization (< week)?	Yes. Prolonged intravenous (IV) therapy and side effects are often necessary to treat <i>Mycobacterium abscessus</i> infections.	Novosad, 2016
3	Does the illness require physician intervention?		
2	Is the illness self-limiting within 72 hours (without requiring medical intervention)?		
1	Does the illness result in mild symptoms with minimal or no impact on daily activities?		

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease.

²See *Final Contaminant Candidate List 3 Microbes: PCCL to CCL Process*. EPA 815-R-09-009. Final. August 2009 for a detailed description on how to calculate the total pathogen score.

³EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2017 and then collected occurrence citations if there were no CDC WBDOs.

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***Mycobacterium avium* Scoring Data**

Scoring Summary^{1,2}	
Waterborne Disease Outbreak	4
Health Effects	
General population	3
Sensitive subpopulation(s) [E]	5

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease

Score²	Data Element	Scoring Data	Reference³
<i>Waterborne Disease Outbreaks</i>			
5	Has caused multiple (2 or more) documented WBDOs in the U.S. reported by CDC between 2009-2017	No	CDC-NORS, 2020
4	Has caused at least one documented WBDOs in U.S. reported by CDC between 2009-2017	Yes 2016: 1 Community (Mycobacterium “other”)	CDC-NORS, 2020
3	Has caused documented WBDOs at any time in the U.S.?	Yes Not listed in CDC’s NORS however, data linking patient, outbreak and drinking water.	Tobin-D’Angelo et al., 2004
2	Has caused WBDOs in countries other than the U.S.?	No	
1	Has never caused WBDOs in any country, but has been	Yes	Glover et al., 1994 Aronson et al., 1999

Score ²	Data Element	Scoring Data	Reference ³
	epidemiologically associated with water related disease?		von Reyn et al., 1994
	<i>Occurrence</i>		
3	Detected in drinking water in the U.S.?	Yes	Glover et al., 1994 Covert et al., 1999 Falkinham et al., 2001
2	Detected in source water in the U.S.?	Yes	Covert et al., 1999 Falkinham et al., 2004
1	Not detected in the U.S.?		
	<i>Health Effects</i>		
7	Does the organism cause significant mortality (> 1/1,000 cases)?		
6	Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term hospitalization (> week)?	Disseminated MAC infections are a major problem in HIV-Infected individuals.	Heymann, 2005
5 [E]	Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?	[E] Most commonly immunocompetent patients develop a slowly evolving cavitary disease that resembles tuberculosis. Elderly non-smoking females, can develop “Lady Windermere’s syndrome” which has been associated with significant morbidity and mortality.	Murray et al., 2005 Carroll et al., 2019

Score ²	Data Element	Scoring Data	Reference ³
4 [CD]	Does the illness require short term hospitalization (< week)?	[CD] Tuberculosis-like upper lobe fibrocavitary disease occurs typically in men 45 – 60 who have preexisting lung disease.	Pfyffer in Murray, 2007
3 [G]	Does the illness require physician intervention?	[G] Symptoms of infection include pulmonary disease, lymphadenitis, post-traumatic wound infection. Diagnosis of disease and treatment requires physician intervention.	Pfyffer in Murray, 2007 Heymann, 2005
2	Is the illness self-limiting within 72 hours (without requiring medical intervention)?		
1	Does the illness result in mild symptoms with minimal or no impact on daily activities?		

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease.

²See *Final Contaminant Candidate List 3 Microbes: PCCL to CCL Process*. EPA 815-R-09-009. Final. August 2009 for a detailed description on how to calculate the total pathogen score.

³EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2017 and then collected occurrence citations if there were no CDC WBDOs.

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***Naegleria fowleri* Scoring Data**

Scoring Summary^{1,2}	
Waterborne Disease Outbreak	5
Health Effects	
General population	7
Sensitive subpopulation(s) [C, P, E, CD]	7

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease

Score²	Data Element	Scoring Data	Reference³
<i>Waterborne Disease Outbreaks</i>			
5	Has caused multiple (2 or more) documented WBDOs in the U.S. reported by CDC between 2009-2017	Yes, 1 Community (note an outbreak is only one case for <i>Naegleria</i>)	CDC, 2017
4	Has caused at least one documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2014?		
3	Has caused documented WBDOs at any time in the U.S.?	1971-2008: 1 Community	CDC-NORS, 2020
2	Has caused WBDOs in countries other than the U.S.?		
1	Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?		

Score ²	Data Element	Scoring Data	Reference ³
	<i>Occurrence</i>		
3	Detected in drinking water in the U.S.?	Yes Arizona storage - Sampled pre-treatment multiple-well study in Arizona. Louisiana	Gerba et al., 2007 Marciano-Cabral et al., 2003 LA, 2013
2	Detected in source water in the U.S.?	Yes	Schuster and Visvesvara, 2004
1	Not detected in the U.S.?		
	<i>Health Effects</i>		
7 [G, C, P, E, CD]	Does the organism cause significant mortality (> 1/1,000 cases)?	[All populations] Recovery from primary amoebic meningoencephalitis is rare.	Heymann, 2005 Cope and Ali, 2016.
6	Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term hospitalization (> week)?	Acute fulminating disease. Only a few patients have survived.	Visvesvara in Murray, 2010 Cope et al, in Carroll, 2019
5	Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?	No	

Score ²	Data Element	Scoring Data	Reference ³
4	Does the illness require short term hospitalization (< week)?	All cases are hospitalized for diagnosis and treatment.	Visvesvara in Murray, 2010
3	Does the illness require physician intervention?		
2	Is the illness self-limiting within 72 hours (without requiring medical intervention)?		
1	Does the illness result in mild symptoms with minimal or no impact on daily activities?		

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease.

² See *Final Contaminant Candidate List 3 Microbes: PCCL to CCL Process*. EPA 815-R-09-009. Final. August 2009 for a detailed description on how to calculate the total pathogen score.

³ EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2017 and then collected occurrence citations if there were no CDC WBDOs.

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Nontuberculous Mycobacteria (NTM) Scoring Data

Scoring Summary^{1,2}	
Occurrence	3
Health Effects	
General population	3
Sensitive subpopulation(s) [E]	5

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease

Score²	Data Element	Scoring Data	Reference³
<i>Waterborne Disease Outbreaks</i>			
5	Has caused multiple (2 or more) documented WBDOs in the U.S. reported by CDC between 2009-2017	No	CDC-NORS, 2020
4	Has caused at least one documented WBDOs in U.S. reported by CDC between 2009-2017	No	CDC-NORS, 2020
3	Has caused documented WBDOs at any time in the U.S.?	No	
2	Has caused WBDOs in countries other than the U.S.?	No	
1	Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?	Yes	Johnson and Odell, 1994
<i>Occurrence</i>			
3	Detected in drinking water in the U.S.?	Yes	Falkinham et al., 2011

Score ²	Data Element	Scoring Data	Reference ³
2	Detected in source water in the U.S.?	Yes	Covert et al., 1999 Falkinham et al., 2004
1	Not detected in the U.S.?		
<i>Health Effects</i>			
7	Does the organism cause significant mortality (> 1/1,000 cases)?		
6	Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term hospitalization (> week)?	Disseminated MAC infections are a major problem in HIV-Infected individuals.	Heymann, 2005
5 [E]	Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?	[E] Most commonly immunocompetent patients develop a slowly evolving pulmonary disease.	Murray et al., 2005
4	Does the illness require short term hospitalization (< week)?		
3 [G]	Does the illness require physician intervention?	[G] Symptoms of infection include pulmonary disease; diagnosis of disease and treatment requires physician intervention.	Pfyffer in Murray, 2007
2	Is the illness self-limiting within 72 hours (without requiring medical intervention)?		
1	Does the illness result in mild symptoms with minimal		

Score ²	Data Element	Scoring Data	Reference ³
	or no impact on daily activities?		

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease.

²See *Final Contaminant Candidate List 3 Microbes: PCCL to CCL Process*. EPA 815-R-09-009. Final. August 2009 for a detailed description on how to calculate the total pathogen score.

³EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2017 and then collected occurrence citations if there were no CDC WBDOs.

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***Pantoea agglomerans* Scoring Data**

Scoring Summary^{1,2}	
Waterborne Disease Outbreak	4
Health Effects	
General population	1
Sensitive subpopulation(s) [C, CD]	6

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease

Score²	Data Element	Scoring Data	Reference³
	<i>Waterborne Disease Outbreaks</i>		
5	Has caused multiple (2 or more) documented WBDOs in the U.S. reported by CDC between 2009-2017	No	CDC-NORS, 2020
4	Has caused at least one documented WBDOs in U.S. reported by CDC between 2009-2017	Yes. 2012: 1 Community Outbreak of <i>Pantoea agglomerans</i> bloodstream infection occurred in a health care facility linked to the drinking water system.	CDC-NORS, 2020
3	Has caused documented WBDOs at any time in the U.S.?		
2	Has caused WBDOs in countries other than the U.S.?		
1	Has never caused WBDOs in any country, but has been		

Score ²	Data Element	Scoring Data	Reference ³
	epidemiologically associated with water related disease?		
	<i>Occurrence</i>		
3	Detected in drinking water in the U.S.?	Yes. Outbreak of <i>Pantoea agglomerans</i> bloodstream infection occurred in a health care facility linked to the drinking water system.	CDC, 2015
2	Detected in source water in the U.S.?		
1	Not detected in the U.S.?		
	<i>Health Effects</i>		
7	Does the organism cause significant mortality (> 1/1,000 cases)?		
6 [C, CD]	Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term hospitalization (> week)?	<p>[C, CD] Yes. There are documented cases of long-term hospitalization and death in children with pneumonia <u>Büyükcım</u> (2018).</p> <p>It can also cause infections in cuts and in immunocompromised individuals in health care settings.</p> <p>Septic arthritis or synovitis appears as a common clinical outcome of exogenous infection with <i>P. agglomerans</i>, others include endophthalmitis, periostitis, endocarditis and osteomyelitis</p>	<p><u>Büyükcım</u>, 2018</p> <p>Dutkiewicz J, et al., 2016</p> <p>Forsythe et al., in MCM, 2019</p>

Score ²	Data Element	Scoring Data	Reference ³
		(Dutkiewicz J, et al. 2016).	
5	Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?		
4	Does the illness require short term hospitalization (< week)?		
3	Does the illness require physician intervention?		
2	Is the illness self-limiting within 72 hours (without requiring medical intervention)?		
1 [G]	Does the illness result in mild symptoms with minimal or no impact on daily activities?	<i>Pantoea agglomerans</i> is not generally an infections agent in healthy humans (Dutkiewicz J, et al. 2016).	Dutkiewicz J, et al., 2016

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease.

²See *Final Contaminant Candidate List 3 Microbes: PCCL to CCL Process*. EPA 815-R-09-009. Final. August 2009 for a detailed description on how to calculate the total pathogen score.

³EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2017 and then collected occurrence citations if there were no CDC WBDOs.

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***Plesiomonas shigelloides* Scoring Data**

Scoring Summary^{1,2}	
Waterborne Disease Outbreak	3
Health Effects	
General population	2
Sensitive subpopulation(s) [C, E]	3

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease

Score²	Data Element	Scoring Data	Reference³
<i>Waterborne Disease Outbreaks</i>			
5	Has caused multiple (1 or more) documented WBDOs in the U.S. reported by CDC between 2009-2017	No	CDC-NORS, 2020
4	Has caused at least one documented WBDOs in U.S. reported by CDC between 2009-2017	No	CDC-NORS, 2020
3	Has caused documented WBDOs at any time in the U.S.?	1971-2008: 2 Noncommunity	CDC-NORS, 2020
2	Has caused WBDOs in countries other than the U.S.?		
1	Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?		

Score ²	Data Element	Scoring Data	Reference ³
<i>Occurrence</i>			
3	Detected in drinking water in the U.S.?	Yes	CDC, 1998(a)
2	Detected in source water in the U.S.?	Yes	Abbott in Murray, 2010 Holmberg and Farmer, 1984 Holmberg et al., 1986
1	Not detected in the U.S.?		
<i>Health Effects</i>			
7	Does the organism cause significant mortality (> 1/1,000 cases)?	No	
6	Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term hospitalization (> week)?	No	
5	Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?	No	
4	Does the illness require short term hospitalization (< week)?	Hospitalization may be required for severe infections and/or underlying diseases.	Abbott in Murray, 2010
3 [C, E]	Does the illness require physician intervention?	[C, E] Physician office visit may be required for diagnosis and treatment of dysenteric form of the disease in children or the	Abbott in Murray, 2010

Score ²	Data Element	Scoring Data	Reference ³
		elderly. Bacteremia more common with advanced age.	
2 [G]	Is the illness self-limiting within 72 hours (without requiring medical intervention)?	[G] Diarrhea may persist up to two weeks.	Abbott in Murray, 2010; Forsythe in MCM, 2019
1	Does the illness result in mild symptoms with minimal or no impact on daily activities?	<i>Plesiomonas</i> is associated with travelers' diarrhea or a history of seafood consumption, most infections are self-limiting.	Abbott in Murray, 2010

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease.

² See *Final Contaminant Candidate List 3 Microbes: PCCL to CCL Process*. EPA 815-R-09-009. Final. August 2009 for a detailed description on how to calculate the total pathogen score.

³ EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2017 and then collected occurrence citations if there were no CDC WBDOs.

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***Pseudomonas Aeruginosa* Scoring Data**

Scoring Summary^{1,2}	
Waterborne Disease Outbreak	5
Health Effects	
General population	3
Sensitive subpopulation(s) [C, CD]	6

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease

Score²	Data Element	Scoring Data	Reference³
	<i>Waterborne Disease Outbreaks</i>		
5	Has caused multiple (2 or more) documented WBDOs in the U.S. reported by CDC between 2009-2017	Yes 2013: 1 Community 2016: 1 Community	CDC-NORS, 2020
4	Has caused at least one documented WBDOs in U.S. reported by CDC between 2009-2017	No	CDC-NORS, 2020
3	Has caused documented WBDOs at any time in the U.S.?	Yes; tap water in NICU	Kinsey et al., 2017
2	Has caused WBDOs in countries other than the U.S.?	NA	
1	Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?	NA	
	<i>Occurrence</i>		

Score ²	Data Element	Scoring Data	Reference ³
3	Detected in drinking water in the U.S.?	Yes	Kinsey et al., 2017
2	Detected in source water in the U.S.?		
1	Not detected in the U.S.?		
Health Effects			
7 [C]	Does the organism cause significant mortality (> 1/1,000 cases)?	Nosocomial pneumonia.	Henry and Speert in Murray, 2010
6 [C, CD]	Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term hospitalization (> week)?	Septicemia and meningitis occur rarely in immunocompetent hosts, but can occur in neonates and cystic fibrosis patients.	Henry and Speert et al. in Murray, 2010 CDC, 2019 Hoiby et al., in MCM, 2019
5	Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?		
4	Does the illness require short term hospitalization (< week)?		
3 [G]	Does the illness require physician intervention?	Antibiotics	Henry and Speert in Murray, 2010
2	Is the illness self-limiting within 72 hours (without requiring medical intervention)?		
1	Does the illness result in mild symptoms with minimal or no impact on daily activities?		

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The

higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease.

²See *Final Contaminant Candidate List 3 Microbes: PCCL to CCL Process*. EPA 815-R-09-009. Final. August 2009 for a detailed description on how to calculate the total pathogen score.

³EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2017 and then collected occurrence citations if there were no CDC WBDOs.

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Rotavirus Scoring Data

Scoring Summary^{1,2}	
Occurrence	3
Health Effects	
General population	1
Sensitive subpopulation(s) [C]	6

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease

Score²	Data Element	Scoring Data	Reference³
<i>Waterborne Disease Outbreaks</i>			
5	Has caused multiple (1 or more) documented WBDOs in the U.S. reported by CDC between 2009-2017	No	CDC-NORS, 2020
4	Has caused at least one documented WBDOs in U.S. reported by CDC between 2009-2017	No	CDC-NORS, 2020
3	Has caused documented WBDOs at any time in the U.S.?	Yes 1971-2008: 1 Community	CDC-NORS,2020
2	Has caused WBDOs in countries other than the U.S.?	Yes China and Sweden.	Hardy, 1987 Gerba et al., 1996
1	Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?		
<i>Occurrence</i>			

Score ²	Data Element	Scoring Data	Reference ³
3	Detected in drinking water in the U.S.?	Yes	USGS, 2001 Gerba et al., 1996
2	Detected in source water in the U.S.?	Yes	Abbaszadegan et al., 2003 Gerba et al., 1996
1	Not detected in the U.S.?		
	Health Effects		
7	Does the organism cause significant mortality (> 1/1,000 cases)?	No For children under 5 years of age: Estimated 37 deaths in 60,000 hospitalized cases per year in U.S. (1/1621 hospitalizations).	Fischer et al., 2007
6 [C]	Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term hospitalization (> week)?	[C] Rotavirus infects all children; causes severe gastroenteritis in infants. Significant numbers of physician visits and hospitalizations and high medical and societal costs. A sporadic, seasonal, often severe gastroenteritis of infants and young children, characterized by vomiting, fever and watery diarrhea. Rotaviral enteritis is occasionally associated with severe dehydration	Pang in Murray, 2010; Carroll, 2019 CDC, 2019

Score ²	Data Element	Scoring Data	Reference ³
		and death in young children. In developing countries, an estimated 600,000-870,000 diarrheal deaths each year.	Heymann, 2005
5	Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?		
4	Does the illness require short term hospitalization (< week)?		
3	Does the illness require physician intervention?		
2	Is the illness self-limiting within 72 hours (without requiring medical intervention)?		
1 [G, P, E, CD]	Does the illness result in mild symptoms with minimal or no impact on daily activities?	[G, E, P, CD] Self-limiting acute watery diarrhea, vomiting, fever.	Heymann, 2005

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease.

² See *Final Contaminant Candidate List 3 Microbes: PCCL to CCL Process*. EPA 815-R-09-009. Final. August 2009 for a detailed description on how to calculate the total pathogen score.

³ EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2017 and then collected occurrence citations if there were no CDC WBDOs.

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***Salmonella enterica* Scoring Data**

Scoring Summary^{1,2}	
Waterborne Disease Outbreak	3
Health Effects	
General population	3
Sensitive subpopulation(s) [C, E]	4

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease

Score²	Data Element	Scoring Data	Reference³
	<i>Waterborne Disease Outbreaks</i>		
5	Has caused multiple (2 or more) documented WBDOs in the U.S. reported by CDC between 2009-2017	No	CDC-NORS, 2020
4	Has caused at least one documented WBDOs in U.S. reported by CDC between 2009-2017	No	
3	Has caused documented WBDOs at any time in the U.S.?	Yes 1971-2008: 13 Community 7 Noncommunity	CDC-NORS, 2020 (some are “Salmonella unknown”)
2	Has caused WBDOs in countries other than the U.S.?		
1	Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?		
	<i>Occurrence</i>		

Score ²	Data Element	Scoring Data	Reference ³
3	Detected in drinking water in the U.S.?	Yes	Angulo et al., 1997 CDC, 1998(a).
2	Detected in source water in the U.S.?		
1	Not detected in the U.S.?		
	Health Effects		
7	Does the organism cause significant mortality (> 1/1,000 cases)?	Each year, 1.4 M cases of illness and 600 deaths are caused by non-typhoidal salmonellosis in the U.S. Estimated 800 cases per year of typhoid fever in the U.S., with fewer than 5 deaths/yr.; >70% of U.S. cases related to foreign travel.	Nataro et al. in Murray, 2007 Buchan in Carroll, 2019
6	Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term hospitalization (> week)?	Nontyphoidal salmonellosis usually causes intestinal infection; can cause extraintestinal infections in rare cases (bacteremia, urinary tract infection, osteomyelitis), especially in immunocompromised persons.	Nataro et al. in Murray, 2007
5	Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?	None reported.	

Score ²	Data Element	Scoring Data	Reference ³
4 [C, E]	Does the illness require short term hospitalization (< week)?	[C] Extra-intestinal infections highest in infants and young children. [E] Dehydration, especially among infants or in the elderly, may be severe. Deaths are uncommon, except in the young and old, the debilitated and immunosuppressed.	Nataro et al. in Murray, 2007 Heymann, 2005 CDC, 2019.
3 [G, P, CD]	Does the illness require physician intervention?	[G, P, CD] Antibiotic and rehydration may be necessary.	Heymann, 2005
2	Is the illness self-limiting within 72 hours (without requiring medical intervention)?	Non-typhoidal Salmonella usually cause intestinal infection that often lasts 1 week or longer.	Nataro et al. in Murray, 2007
1	Does the illness result in mild symptoms with minimal or no impact on daily activities?		

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease.

²See *Final Contaminant Candidate List 3 Microbes: PCCL to CCL Process*. EPA 815-R-09-009. Final. August 2009 for a detailed description on how to calculate the total pathogen score.

³EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2017 and then collected occurrence citations if there were no CDC WBDOs.

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***Shigella sonnei* Scoring Data**

Scoring Summary^{1,2}	
Waterborne Disease Outbreak	4
Health Effects	
General population	3
Sensitive subpopulation(s) [C, E]	6

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease

Score²	Data Element	Scoring Data	Reference³
<i>Waterborne Disease Outbreaks</i>			
5	Has caused multiple (2 or more) documented WBDOs in the U.S. reported by CDC between 2009-2017	No	CDC-NORS, 2020
4	Has caused at least one documented WBDOs in U.S. reported by CDC between 2009-2017	Yes 2015: 1 Community (suspected, not confirmed)	CDC-NORS, 2020
3	Has caused documented WBDOs at any time in the U.S.?	1971-2008: 15 Community 23 Noncommunity (some unknown)	CDC-NORS, 2020
2	Has caused WBDOs in countries other than the U.S.?		
1	Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?		
<i>Occurrence</i>			
3	Detected in drinking water in the U.S.?	Yes	Craun, 2003

Score ²	Data Element	Scoring Data	Reference ³
2	Detected in source water in the U.S.?	Yes	Black et al., 1978
1	Not detected in the U.S.?		
	Health Effects		
7	Does the organism cause significant mortality (> 1/1,000 cases)?	In U.S. approximately 450,000 cases occur each year with 70 deaths.	Nataro in Murray, 2007 Buchan in Carroll, 2019
6 [C, E]	Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term hospitalization (> week)?	[C, E] <i>S. dysenteriae</i> is associated with more serious symptoms than other species with complications such as toxic megacolon, hemolytic uremic syndrome and intestinal perforation. Cases may be severe in infants and the elderly and convulsions may occur in young children.	Heymann, 2005
5	Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?	Reiter's syndrome.	Heymann, 2005
4	Does the illness require short term hospitalization (< week)?	Hospitalization is usually required for intravenous antibiotic therapy due to bacteremia, which is uncommon.	Heymann, 2005
3 [G]	Does the illness require physician intervention?	[G] Most cases occur in children under 10 years, infants under 6 months rarely infected, increased severity in children and elderly, high secondary case rate in outbreaks,	Heymann, 2005

Score ²	Data Element	Scoring Data	Reference ³
		outbreaks occur in daycare centers, institutions, refugee camps, among homosexual men, 20% of U.S. cases result from international travel, specific antibiotic therapy available for prolonged or severe cases, multi-antibiotic resistance occurs.	
2	Is the illness self-limiting within 72 hours (without requiring medical intervention)?	Acute diarrhea, fever, nausea, vomiting, cramps and tenesmus, stools contain blood and mucus (dysentery), usually self-limiting in 4-7 days without treatment.	Heymann, 2005 CDC, 2019
1	Does the illness result in mild symptoms with minimal or no impact on daily activities?	<i>S. sonnei</i> causes most of the shigellosis cases in the U.S., cases may be asymptomatic or mildly symptomatic, but they are frequently acute.	Heymann, 2005

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease.

²See *Final Contaminant Candidate List 3 Microbes: PCCL to CCL Process*. EPA 815-R-09-009. Final. August 2009 for a detailed description on how to calculate the total pathogen score.

³EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2017 and then collected occurrence citations if there were no CDC WBDOs.

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***Toxoplasma gondii* Scoring Data**

Scoring Summary¹	
Waterborne Disease Outbreak	2
Health Effects	
General population	2
Sensitive subpopulation(s) [P]	7

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease

Score²	Data Element	Scoring Data	Reference³
<i>Waterborne Disease Outbreaks</i>			
5	Has caused multiple (1 or more) documented WBDOs in the U.S. reported by CDC between 2009-2017	No	CDC-NORS, 2020
4	Has caused at least one documented WBDOs in U.S. reported by CDC between 2009-2017	No	CDC-NORS, 2020
3	Has caused documented WBDOs at any time in the U.S.?	No	
2	Has caused WBDOs in countries other than the U.S.?	Yes Canada and Brazil.	Bowie et al., 1997 de Moura, 2006
1	Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?		

Score ²	Data Element	Scoring Data	Reference ³
<i>Occurrence</i>			
3	Detected in drinking water in the U.S.?	No	
2	Detected in source water in the U.S.?	No	
1	Not detected in the U.S.?	Yes Groundwater in Poland and Canada.	Sroka et al., 2006 Isaac-Renton et al., 1998
<i>Health Effects</i>			
7 [P]	Does the organism cause significant mortality (> 1/1,000 cases)?	[P] Congenital infection of neonates severe. Infection during early pregnancy may lead to fetal infection with death of the fetus or other severe manifestations. Later in pregnancy, maternal infection results in mild or subclinical fetal disease.	Wilson in Murray, 2007; McAuley and Singh in MCM, 2019 Heymann, 2005
6	Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term hospitalization (> week)?	Immunocompromised hosts may experience CNS, pneumonitis, and myocarditis.	Wilson in Murray, 2007
5	Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?		

Score ²	Data Element	Scoring Data	Reference ³
4	Does the illness require short term hospitalization (< week)?		
3	Does the illness require physician intervention?	Treatment is indicated only for pregnant women, infants and immunocompromised hosts.	Wilson in Murray, 2007
2 [G, C, E, CD]	Is the illness self-limiting within 72 hours (without requiring medical intervention)?	[G, C, E, CD] Infection is generally asymptomatic; however, 10 – 20% of patients with acute infection may develop cervical lymphadenopathy and/or flu-like symptoms.	Wilson in Murray, 2007
1	Does the illness result in mild symptoms with minimal or no impact on daily activities?		

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease.

² See *Final Contaminant Candidate List 3 Microbes: PCCL to CCL Process*. EPA 815-R-09-009. Final. August 2009 for a detailed description on how to calculate the total pathogen score.

³ EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2017 and then collected occurrence citations if there were no CDC WBDOs.

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***Vibrio cholerae* Scoring Data**

Scoring Summary^{1,2}	
Waterborne Disease Outbreak	3
Health Effects	
General population	3
Sensitive subpopulation(s) [C, E, P, CD]	3

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease

Score²	Data Element	Scoring Data	Reference³
	<i>Waterborne Disease Outbreaks</i>		
5	Has caused multiple (2 or more) documented WBDOs in the U.S. reported by CDC between 2009-2017	No	CDC-NORS, 2020
4	Has caused at least one documented WBDOs in U.S. reported by CDC between 2009-2017	No	CDC-NORS, 2020
3	Has caused documented WBDOs at any time in the U.S.?	1971-2008: 1 Bulk Water Purchase	CDC-NORS, 2020
2	Has caused WBDOs in countries other than the U.S.?		
1	Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?		
	<i>Occurrence</i>		
3	Detected in drinking water in the U.S.?	Yes (outbreak data)	CDC, 1996

Score ²	Data Element	Scoring Data	Reference ³
2	Detected in source water in the U.S.?	Yes	Rhodes et al., 1986 Kaper et al., 1982
1	Not detected in the U.S.?		
	Health Effects		
7	Does the organism cause significant mortality (> 1/1,000 cases)?	<i>V. cholerae</i> Non-O1: third most commonly isolated in U.S. - Septicemia case fatality rate from 47-65%.	Abbott in Murray, 2010; Tarr et al., in MCM 2019
6	Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term hospitalization (> week)?	<i>V. cholerae</i> O1: Extremely rare cases cause severe extraintestinal infection. If untreated, <i>V. cholerae</i> O1 infection causes severe dehydration which leads to hypovolemic shock, acidosis, circulatory collapse, and death. Unlike O1 strains, non-O1 isolates are commonly associated with extraintestinal infections such as septicemia.	Abbott in Murray, 2010
5	Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?		

Score ²	Data Element	Scoring Data	Reference ³
4	Does the illness require short term hospitalization (< week)?	In severely dehydrated cases (cholera gravis), death may occur within a few hours, and the case-fatality rate may exceed 50%. With proper and timely rehydration, this can be less than 1%.	Heymann, 2005
3 [G, C, P, E, CD]	Does the illness require physician intervention?	[All populations] In most cases infection is asymptomatic or causes self-limiting diarrhea. Treatment consists of fluid replacement by oral rehydration therapy and/or intravenous fluids.	Abbott in Murray, 2010
2	Is the illness self-limiting within 72 hours (without requiring medical intervention)?		
1	Does the illness result in mild symptoms with minimal or no impact on daily activities?		

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease.

² See *Final Contaminant Candidate List 3 Microbes: PCCL to CCL Process*. EPA 815-R-09-009. Final. August 2009 for a detailed description on how to calculate the total pathogen score.

³ EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2017 and then collected occurrence citations if there were no CDC WBDOs.

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***Yersinia enterocolitica* Scoring Data**

Scoring Summary^{1,2}	
Waterborne Disease Outbreak	3
Health Effects	
General population	2
Sensitive subpopulation(s) [C]	2

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease

Score²	Data Element	Scoring Data	Reference³
<i>Waterborne Disease Outbreaks</i>			
5	Has caused multiple (2 or more) documented WBDOs in the U.S. reported by CDC between 2009-2017	No	CDC-NORS, 2020
4	Has caused at least one documented WBDOs in U.S. reported by CDC between 2009-2017	No	CDC-NORS, 2020
3	Has caused documented WBDOs at any time in the U.S.?	1971-2008: 1 Noncommunity	CDC-NORS, 2020
2	Has caused WBDOs in countries other than the U.S.?		
1	Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?		
<i>Occurrence</i>			

Score ²	Data Element	Scoring Data	Reference ³
3	Detected in drinking water in the U.S.?	Yes	Highsmith et al., 1977 Eden et al., 1977
2	Detected in source water in the U.S.?	Yes	Meadows and Snudden, 1982
1	Not detected in the U.S.?		
Health Effects			
7	Does the organism cause significant mortality (> 1/1,000 cases)?	No	
6	Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term hospitalization (> week)?	An uncommon complication of gastroenteritis is septicemia for which the elderly and immunocompromised are at higher risk, particularly those with metabolic diseases associated with iron overload (hemochromatosis), cancer, liver disease and steroid therapy.	Wanger in Murray, 2010; Kingry et al, in MCM 2019
5	Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?	Uncommon sequelae include: reactive arthritis, inflammatory bowel disease, autoimmune thyroid disorders.	Wanger in Murray, 2010
4	Does the illness require short term hospitalization (< week)?		
3	Does the illness require physician intervention?	The elderly are at greater risk for septicemia.	Wanger in Murray, 2010

Score ²	Data Element	Scoring Data	Reference ³
2 [G, C]	Is the illness self-limiting within 72 hours (without requiring medical intervention)?	[G, C] (No information available for other populations) Young children most commonly develop gastroenteritis and present with fever, diarrhea, and abdominal pain. Symptoms typically resolve within 7 days. Infection typically manifested by acute febrile diarrhea with abdominal pain (especially in young children). Diarrhea may be absent in up to a third of <i>Y. enterocolitica</i> infections.	Wanger in Murray, 2010 Heymann, 2005
1	Does the illness result in mild symptoms with minimal or no impact on daily activities?		

¹ Bolded text indicates the highest score for that particular protocol. For the health effects protocol two scores were selected: the general population [G] and the highest score for a sensitive subpopulation. These 2 scores were added and normalized by multiplying by 5/14 for a final health effects score. The higher score between the WBDO and Occurrence protocols was used for total pathogen score calculation. Health Effects protocol: G - General, C - Child, E - Elderly, P - Pregnant Women, CD - Chronic Disease.

²See *Final Contaminant Candidate List 3 Microbes: PCCL to CCL Process*. EPA 815-R-09-009. Final. August 2009 for a detailed description on how to calculate the total pathogen score.

³EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2017 and then collected occurrence citations if there were no CDC WBDOs.

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Appendix F. CCL 5 Data Source Descriptions

Data Sources for Microbial Contaminants

<i>Data Source Name</i>	The National Outbreak Reporting System (NORS)
<i>Data Source Description</i>	Launched in 2009 for Health Departments to report to CDC cases of enteric disease outbreaks caused by bacterial, viral, parasitic, chemical, toxin, and unknown agents, as well as foodborne and waterborne outbreaks of non-enteric disease. NORS was designed to integrate data on waterborne as well as foodborne outbreaks, but for CCL only the waterborne data were used.
<i>Proprietor</i>	CDC
<i>Contact Information</i>	CDC, 1600 Clifton Road, N.E., MS C-9, Atlanta, GA 30333. Telephone: 404-639-1700; E-mail: healthywater@cdc.gov
<i>Type of Data Elements</i>	Waterborne outbreak data
<i>Relevance Explanation</i>	This source is considered relevant for the CCL process because it contains information on drinking water outbreaks caused by microbial contaminants which is a major component of the scoring process.
<i>Completeness Explanation</i>	It meets considerations because it is peer reviewed.
<i>Redundancy Explanation</i>	This source is not redundant.
<i>Retrievability Explanation</i>	This source meets retrievability criteria because it is in tabular format.
<i>Source URL</i>	https://www.cdc.gov/nors/index.html

<i>Data Source Name</i>	Center for Disease Control and Prevention's Morbidity and Mortality Weekly Reports (MMWR)
<i>Data Source Description</i>	Since 1971, CDC, EPA and the Council of State and Territorial Epidemiologists (CSTE) have maintained a collaborative surveillance system for collecting and periodically reporting data related to occurrences and causes of Water Borne Disease Outbreaks (WBDOs). These reports from the CDC are published periodically in the MMWR. For CCL EPA used CDC's MMWR summaries as the source for the WBDO scoring protocol. The summaries include data on outbreaks associated with drinking water, recreational water, water not intended for drinking

(excluding recreational water) and water use of unknown intent. Public health agencies are responsible for investigating outbreaks and reporting them voluntarily to CDC using a standard form. Only data on outbreaks associated with drinking water, water not intended for drinking (excluding recreational water) and water use of unknown intent are summarized in this report. CDC and EPA acknowledge that the WBDOs reported in the surveillance system represent only a portion of the burden of illness associated with drinking water exposure. The surveillance information does not include endemic waterborne disease risks. (Description adapted from website.)

Proprietor

Contact Information

CDC
Division of Foodborne, Waterborne, and Environmental Diseases,
National Center for Emerging and Zoonotic Infectious Diseases,
CDC, 1600 Clifton Road, N.E., MS C-9,
Atlanta, GA 30333.
Telephone: 404-639-1700;
E-mail: healthywater@cdc.gov

Type of Data Elements

Relevance Explanation

Waterborne outbreak data
This source is considered relevant for the CCL process because it contains information on drinking water outbreaks caused by microbial contaminants which is a major component of the scoring process.

Completeness Explanation

It meets considerations because it is peer reviewed.

Redundancy Explanation

This source is not redundant.

Retrievability Explanation

This source meets retrievability criteria because it is in tabular format.

Source URL

http://www.cdc.gov/mmwr/indss_2011.html

Data Source Name

EPA Literature Search for Supplemental Data for Microbial Contaminants

Data Source Description

As part of its ongoing assessment of microbes in drinking water, EPA conducted a literature review of peer-reviewed, published journal literature for health effects and occurrence data for nominated microbes from 2016-2019. EPA reviewed all relevant research reports found to identify papers that might present data for the nominated microbes that might help inform CCL 5. EPA also reviewed studies submitted and referenced by nominators.

Proprietor

Contact Information

U.S. EPA
Nicole Tucker

Email: Tucker.Nicole@epa.gov

Type of Data Elements	Health effects, drinking water occurrence data elements
Relevance Explanation	This source is considered relevant for the CCL process because it contains information on health effects and occurrence in water.
Completeness Explanation	It meets considerations because the studies were peer-reviewed.
Redundancy Explanation	This source is not redundant (though some, but not all, data may overlap among papers by the same authors).
Retrievability Explanation	Data not retrievable. This source contains written and tabulated data that can be copied and formatted.
Source URL	Not applicable
Data Source Name	Manual of Clinical Microbiology (MCM), 12th Edition
Data Source Description	The 12th edition of the MCM is the result of collaborative efforts of 22 editors and more than 267 authors from around the world, all experienced researchers and practitioners in medical and diagnostic microbiology. The manual has been brought fully up to date, resulting in 149 chapters containing the latest research findings, infectious agents, methods, practices and safety guidelines. Now entering its fifth decade the Manual strives to continue to be the leading, most authoritative reference for the “real-world” practice of clinical microbiology. This publication builds on the content of past editions. The process requires about 3 years of careful planning, design, writing and review of chapters before the final phases of copyediting, composition, printing and binding. (Description adapted from website.)
Proprietor	ASM Press, Washington, DC
Contact Information	James Versalovic Microbiology Laboratories Texas Children’s Hospital Houston, Texas
Type of Data Elements	Production Volume
Relevance Explanation	This source is considered relevant for the CCL Universe because it contains health effects and occurrence information on microbial pathogens.
Completeness Explanation	It meets considerations because it is peer reviewed.
Redundancy Explanation	This source is not redundant.
Retrievability Explanation	This source is not automatically retrievable. It is a book available for purchase.
Source URL	Not applicable