Final Contaminant Candidate List 3 Microbes: PCCL to CCL Process

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Contents

Exhibits

Abbreviations and Acronyms

CCL - Contaminant Candidate List
CCL 3 - EPA's Third Contaminant Candidate List
CDC - Centers for Disease Control and Prevention
CSTE - Council of State and Territorial Epidemiologists
EPA - United States Environmental Protection Agency
MMWR - Morbidity and Mortality Weekly Report
NPDWR - National Primary Drinking Water Regulation
NRC - National Research Council
PWS - Public Water System
PCCL - Preliminary Candidate Contaminant List
SDWA - Safe Drinking Water Agency
USEPA - United States Environmental Protection Agency
WBDO - Waterborne Disease Outbreak
U.S. - United States of America (includes territories)

CCL 3 Microbes: PCCL to CCL Process

1.0 Final CCL 3

EPA is including twelve pathogens on the final Candidate Contaminant List 3 (CCL 3), one more than the eleven pathogens on the draft CCL 3. The Agency is adding Adenovirus, Enterovirus, and *Mycobacterium avium*, and is removing *Vibrio cholerae* and *Entamoeba histolytica* from the final CCL 3 (see Exhibit 1).

The scoring process described in this document remained the same as the Draft CCL 3 (73 FR 9645, February 21, 2008) with two exceptions: dropping the early Center for Disease Control and Prevention (CDC)-Waterborne Disease Outbreaks (WBDO) (before 1990) and the health effects of *Mycobacterium avium* (both discussed in detail later).

Most of the pathogens currently listed on the Final CCL 3 were also included on the preceding CCLs (1 and 2) with the exception of four pathogens. The four pathogens on the previous CCLs that are not included on the Final CCL 3 are: *Acanthamoeba,* which was on CCL 1 (63 FR 10275; March 2, 1998), and cyanobacteria, *Aeromonas hydrophila* and Microsporidia, which were included in both CCL 1 and CCL 2 (63 FR 10275; March 2, 1998 and 70 FR 9072; February 24, 2005).

Acanthamoeba was not included on the final CCL 3 because EPA made the determination not to regulate *Acanthamoeba*. EPA made this determination because regulation did not present a meaningful opportunity for health risk reduction for the people served by public drinking water systems (PWSs) (68 FR 42903; July 18, 2003). Furthermore, EPA in collaboration with CDC developed a guidance document for *Acanthamoeba* directed mainly to contact lens wearers and addresses the risks of *Acanthamoeba* eye infection associated with improper care of contact lenses (http://www.epa.gov/waterscience/health/acanthamoeba/#canprevent).

EPA also decided to include the cyanotoxins produced by cyanobacteria on the Final CCL 3 chemicals list rather than the cyanobacteria which were listed on CCL 1 and 2 microbial contaminants. Cyanobacteria are not considered pathogens themselves and the production of their cyanotoxins is determined by specific environmental conditions. Thus, they were not included on the microbes list but the toxins they produce were listed on the chemicals CCL 3. Both *Aeromonas hydrophila* and Microsporidia were included on the Preliminary Candidate Contaminant List (PCCL); however, because of their low health effects scores (general population score of 2 and sensitive subpopulation scores of 3 and 2, respectively) and low WBDOs score (score of 1) their total scores were not high enough to place them on the CCL 3. For detailed information see Exhibit 6 and each pathogen's Scoring Data Sheet.

Exhibit 1. Draft CCL 3 Microbes

- *Adenovirus*
- Caliciviruses
- *Campylobacter jejuni*
- *Enterovirus*
- *Escherichia coli* (O157)
- *Helicobacter pylori*
- Hepatitis A virus
- *Legionella pneumophila*
- *Mycobacterium avium*
- *Naegleria fowleri*
- *Salmonella enterica*
- *Shigella sonnei*

2.0 Background and Scope

The scoring process discussed in this document is the last step in a three-step process designed to select microbial contaminants for the CCL. The first step of the process is identification of a universe of potential drinking water contaminants. The document titled *Final CCL 3 Microbes: Identifying the Universe* provides a summary of the statutory and regulatory background leading to development of a microbial CCL and describes the activities required to develop a microbial CCL universe as the initial step in a transparent and scientifically sound CCL process. No changes were made to the universe for the final CCL 3.

A second document, titled *CCL 3 Microbes: Screening to the PCCL*, describes a process to screen human pathogens from a universe of microbiological contaminants for placement on the Preliminary Contaminant Candidate List (PCCL) as the second step in the CCL process. The Universe of microbes is screened based on the likelihood to be present in drinking water and that are associated with illness attributable to drinking water exposure. No changes were made to the screening document for the final CCL 3.

In this third step of the CCL process the PCCL, microbes are evaluated for their occurrence in drinking water and their ability to produce adverse health effects in humans. Pathogens on the PCCL were scored for placement on the CCL. EPA devised a scoring system to assign a numerical value to each pathogen on the PCCL. Pathogens receiving high scores are considered for placement on the CCL.

This document describes the set of scoring protocols used to relatively rank pathogens on the PCCL to produce a CCL. EPA derived this scoring process in part from recommendations of the National Research Council (NRC) and an expert workgroup established by the National Drinking Water Advisory Council, and two external workshops (June 2006 and March 2007). This document describes the rationale for using scoring protocols to rank pathogens based upon their occurrence, health effects, and waterborne disease outbreaks.

3.0 Rationale Used to Develop Scoring Protocols

Section 1412(b) (1) of SDWA, as amended in 1996, specifies that the list must include contaminants that are not subject to any proposed or promulgated NPDWRs, are known or anticipated to occur in PWSs, and may require regulation under SDWA (adverse health effects). The objective is to target microorganisms with the highest potential for exposure and the most serious adverse health effects.

Each of the pathogens on the PCCL was scored using three scoring protocols, one protocol each for waterborne disease outbreaks (WBDO), occurrence in drinking water, and health effects. The higher of the WBDO score or the occurrence score is added to the normalized health effects score to produce a composite pathogen score. Pathogens receiving high scores were considered for placement on the CCL.

Occurrence data are based on analytical methods to determine presence and concentrations of drinking water contaminants. Occurrence data can be collected as part of public health surveillance or in connection with research efforts and can include data based on molecular techniques, culture-based methods and response to a disease outbreak. Evaluating these many types of information is a major challenge in developing the CCL selection process.

Public health surveillance programs and the scientific literature provided a range of exposure information from documented microbial outbreaks for microbes with limited associations to these outbreaks. The sources of information ranged from Centers for Disease Control and Prevention (CDC) (i.e., Morbidity and Mortality Weekly Reports (MMWR)) to studies identified from the scientific literature.

The CCL selection process considered pathogens causing recent waterborne outbreaks more important than pathogens detected in drinking water without documented disease. Direct detection of pathogens indicates the potential for waterborne transmission of disease. Documented waterborne disease outbreaks provide an additional weight of evidence that illness was transmitted and that there was a waterborne route of exposure. EPA developed protocols to define a hierarchy of the relevance that each of these types of data provide in evaluating microbes for the CCL. Combining these two sources of occurrence information enabled EPA to consider both emerging pathogens that should be considered and are not yet tracked by public health surveillance programs and WBDO data. This hierarchy also acknowledges that organisms identified as agents in WBDO are a higher priority for the CCL.

The combination of documented WBDO data and direct detection data identifies and compares organisms that should be considered for the CCL based on occurrence. Pathogens causing outbreaks of moderate illness (i.e., self-limiting gastrointestinal illness) as well as pathogens that could cause debilitating disease (i.e., hepatitis) or death from drinking water exposure are considered for the CCL.

The assumptions used to develop the CCL scoring process were:

- Waterborne disease outbreak data and direct detection of microbes provides occurrence data that can and should be organized into a hierarchy to evaluate microbes, and
- Combining health effects data with the WBDO/occurrence data provides a system that evaluates both the severity of potential disease and the potential magnitude of exposure through drinking water.

3.1 Waterborne Disease Outbreaks

Waterborne disease outbreaks (WBDOs) are the documentation of occurrence of pathogens in drinking water by public health officials through adverse health effects in a population and are direct evidence of exposure. For a WBDO to occur pathogens must be present in water and a person must be exposed resulting in clinical manifestations of disease. Recognition of pathogens causing WBDOs is important to the CCL selection process. This criterion was used if the source of a pathogen was traced to a public drinking water system and an epidemiological investigation implicated a drinking water source as the probable cause of the outbreak. Recreational water settings were included if they were filled with drinking water from a community water system. EPA excluded non-drinking water sources such as marine and estuarine water bodies from consideration under the CCL.

Since 1971, CDC, EPA and the Council of State and Territorial Epidemiologists (CSTE) maintain a collaborative surveillance system for collecting and periodically reporting data related to occurrences and causes of WBDOs. These reports from the CDC system are published periodically in the MMWR. For the draft CCL 3 EPA used CDC's MMWR summaries as the source for the WBDO scoring protocol.

EPA requested comments from the public on the Draft CCL 3. Two commenters recommended using only the more recent WBDOs based on the implementation of the SDWA. EPA decided for the Final CCL 3, to use only the CDC surveillance data within the period of 1990 through 2004, as the source of data for the waterborne disease outbreaks protocol.

For the revised WBDO protocol, a pathogen is scored as having a WBDO(s) in the U.S. only if that pathogen is listed in a CDC waterborne disease drinking water surveillance summary (i.e., in the MMWR) during 1990 and 2004. A pathogen with multiple WBDOs (i.e. 2 or more), within 1990 and 2004, listed by CDC is given the highest score under this protocol (see Exhibit 2 and 3 for more detailed information).

EPA used the following assumptions for the WBDO scoring protocol:

- Used only WBDOs reported in CDC's MMWR from 1990 through 2004;
- Only etiologic agents reported on CDC's MMWR under the table "Waterborne-disease outbreaks associated with drinking water" in the column labeled "Etiologic Agent" were used. Pathogens associated with any given outbreak which were listed on the footnotes of the tables and not on the "Etiologic Agent" column were not considered in EPA's WBDO scoring protocol (e.g., *Blastocystis hominis*, CDC, 2002; p. 17);

- Only used drinking water related outbreaks in community and non-community systems as reported in the MMWR. MMWR outbreaks reported as "individual" (Ind) were not used for WBDO scoring;
- Only used pathogens reported at the species level. Outbreaks for which the etiologic agent was reported at the genus level or species that were not the one considered for CCL 3 (e.g., *Entamoeba* spp. (CDC, 2006; p. 42), *Helicobacter canadensis* (CDC, 2006; p. 40)) were not counted for *Helicobacter pylori* in the WBDO protocol; and
- Each outbreak is counted on the year the outbreak occurred and not the year of the MMWR where the outbreak was reported (i.e., previously unreported outbreaks). EPA scored WBDOs outside the U.S. (non-U.S. territories) as well; however these were given lower scores than CDC-WBDOs. WBDOs outside the U.S. were scored when information was available from other peer-reviewed publications.

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 (CDC, 2004). The surveillance information does not include endemic waterborne disease risks, nor are reliable estimates available of the number of unrecognized WBDOs and associated cases of illness.

EPA also considered data as indicating a WBDO (even though CDC does not list a WBDO in their MMWR) if the non-CDC data showed a link between human illness defined by a common water source, a common time period of exposure and/or similar symptoms. EPA also considered the use of molecular typing methods to link patients and environmental isolates. Only *Mycobacterium avium* and *Arcobacter butzlerei* were given a WBDO score based on data not listed in CDC's MMWR.

The WBDO scoring protocol also uses the CDC definition for outbreak as two or more persons epidemiologically linked by location of exposure to water, time, and illness (CDC, 2006). CDC excludes single cases of illness from the definition of WBDO except for single cases of *Naegleria fowleri* and *Vibrio cholerae.*

Exhibit 2. Waterborne Disease Outbreak Scoring Protocol

Category	Score
Has caused multiple (2 or more) documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004	5
Has caused at least one documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004	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

Exhibit 3. CDC Reported WBDOs (1990 – 2004)

	1990[a]	1991[b]	1992[b, c]	1993[c]	1994[c, d]	1995[d]	1996[d, e]	1997[e, f]	1998[e]	1999[f]	2000[f, g]	2001[g]	2002[g, h]	2003[h]	2004[h]	Total
PCCL Pathogen (Etiologic Agent)																
Adenovirus																0
Aeromonas hydrophila																0
Arcobacter butzleri																0
Aspergillus fumigatus																0
Astrovirus																0
Blastocystis hominis																0
Caliciviruses[1]							1[e]	1[f]			4[g]	2	3		2	13
Campylobacter jejuni				2	1					1	1	1	1[h]		3	10
Cyclospora																0
Entamoeba histolytica													1[h]			1
Enterovirus																0
Escherichia coli (O157)					1[d]	1		1	1	2	1					7
Exophiala jeanselmei																0
Fusarium solani																0
Helicobacter pylori																0
Hepatitis A virus	1		1[c]													2
Hepatitis E virus																0
Isospora belli																0
Legionella pneumophila												1	3[h]	1	6	11
Microsporidia																0
Mycobacterium avium																0
Naegleria fowleri													1			1
Plesiomonas shigelloides							1									1
Rotavirus																0
Salmonella enterica[2]				1						1					1	3
Shigella sonnei			2[c]		1	2			1							6
Toxoplasma gondii																0

	1990[a]	1991[b]	1992[b, c]	1993[c]	1994[c, d]	1995[d]	1996[d, e]	1997[e, f]	1998[e]	1999[f]	2000[f, g]	2001[g]	2002[g, h]	2003[h]	2004[h]	Total
PCCL Pathogen (Etiologic Agent)																
Vibrio cholerae					1											1
Yersinia enterocolitica												1				1

[1] Caliciviruses include Norwalk-like viruses and Noroviruses.
[2] *Salmonella enterica* includes *Salmonella typhimurium.*

References

[a] CDC. 1991. Waterborne Disease Outbreaks, 1989-1990. MMWR 40(SS-3):1-42 (Table 1, p. 14; Table 2, p. 15).
[b] CDC. 1993. Surveillance for Waterborne Disease Outbreaks – United States, 1991-1992. MMWR 42(SS-05):1-22 (Table 2, p. 6; Table 3, p. 7; Table 8, p. 15).
[c] CDC. 1996. Surveillance for Waterborne Disease Outbreaks – United States, 1993-1994. MMWR 45(SS-1):1-33 (Table 2, p. 7; Table 3. p. 8; Table 8, p. 19).
[d] CDC. 1998. Surveillance for Waterborne Disease Outbreaks – United States, 1995-1996. MMWR 47(SS-5):1-33 (Table 2, p. 27; Table 3, p. 28; Table 9, p. 33).
[e] CDC. 2000. Surveillance for Waterborne Disease Outbreaks – United States, 1997-1998. MMWR 49(SS-4):1-35 (Table 2, p. 23; Table 3, p. 24; Table 10, p. 28).
[f] CDC. 2002. Surveillance for Waterborne Disease Outbreaks – United States, 1999-2000. MMWR 51(SS-8):1-48 (Table 2, p. 8; Table 3, p. 9; Table 11, p. 17).
[g] CDC. 2004. Surveillance for Waterborne Disease Outbreaks Associated with recreational Water –United States, 2001-2002 and Surveillance for Waterborne Disease Outbreaks Associated with Drinking Water – United States, 2001-2002. MMWR 53(SS-8):1-46 (Table 3, p. 29; Table 4, p. 30; Table 5, p. 30; Table 9, p. 34).
[h] CDC. 2006.Surveillance for Waterborne Disease Outbreaks Associated with recreational Water –United States, 2003-2004 and Surveillance for Waterborne Disease Outbreaks Associated with Drinking Water – United States, 2003-2004. MMWR 55(SS-12):1-66 (Table 4, p. 39; Table 5, p. 40; Table 7, p. 42).

3.2 Occurrence

The occurrence attribute is the direct detection of microbes using cultural, immunochemical, or molecular detection of pathogens in water. It 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 produce illness in persons exposed to water by ingestion, inhalation, or dermal contact.

Pathogen occurrence is considered broadly to include public drinking water, and all waters (e.g., recreational, ground water, surface water) used as drinking water. This attribute does not characterize the extent to which pathogen's occurrence poses a public health threat from drinking water exposure. Because viability and infectivity cannot be determined by non-cultural methods, the public health significance of non-cultural detections is unknown.

Exhibit 4. Occurrence Scoring Protocol for Pathogens

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

3.3 Health Effects

The health effects scores (i.e., 5) and the protocol remains the same in the Final CCL 3 as in the Draft CCL3 with one exception. Based on public comment, EPA re-evaluated *Mycobacterium avium's* health effects information and increased the health effects score for one of the sensitive subpopulations, specifically, the elderly. The health effects score was increased based on the severity and treatment duration on the elderly as described in Murray, 2005 (see Exhibit 5 and Scoring Sheet for more detailed information).

The health effects protocol evaluates the extent of illness produced in humans from drinking water. The severity of disease manifestations produced by a pathogen is evaluated across a range of potential endpoints. The seven level hierarchy developed for this protocol begins with mild, self-limiting illness (Score of 1) and progresses to death (Score of 7). These scores reflect the most common clinical presentation and are based on data from recent clinical microbiology manuals.

The agency tried to evaluate the potency of an organism, i.e., the concentration of a pathogen during exposure that is necessary to cause illness in a susceptible host (infectious dose). Because infectious doses are not available for most pathogens, the Agency uses this health effect protocol to score both the severity of disease and the organisms' potency with the best available data.

The final outcome of a host-pathogen relationship resulting from drinking water exposure is a function of viability, infectivity, and pathogenicity of the microbe to which the host is exposed and the host's susceptibility and immune response. SDWA directs EPA to consider subgroups of the population at greater risk of adverse health effects (sensitive populations) in the selection of the CCL. Sensitive populations may have increased susceptibility and may experience increased severity of symptoms, compared to the general population. SDWA refers to several categories of sensitive populations including the following: children and infants, elderly, pregnant women, and persons with a history of serious illness.

Health effects for individuals with marked immunosuppression (primary or acquired severe immunodeficiency, transplant recipients, individuals undergoing potent cytoreductive treatments) are not included in this health effects scoring. While such populations are considered sensitive subpopulations, severely immunosuppressed individuals often have a higher standard of ongoing health care and protection required than the other sensitive populations under medical care. More importantly, nearly all pathogens have very high health effect scores for the markedly immunosuppressed individuals; therefore there is little differentiation between pathogens based on health effects for the immunosuppressed subpopulation. However, EPA tried to rescore the PCCL organisms for their health effects in the markedly immunosuppressed in response to public comments received. EPA found that health effects information on the severely immunosuppressed was not available for many (11 of 29) of the PCCL microorganisms which did not allowed for a uniform comparison among the PCCL pathogens.

This protocol scores the representative or common clinical presentation for the specific pathogen for the population category under consideration. Pathogens may produce a range of illness from asymptomatic infection to fulminate illness progressing rapidly to death. Scoring decisions are based upon the more common clinical presentation and clinical course for the population under consideration, rather than the extremes. EPA used recently published clinical microbiology manuals as the data source for the common clinical presentation. These manuals take a broad epidemiological view of health effects rather than focusing on narrow research investigations or single cases. The one exception to this approach was EPA's scoring of the health effects for *Helicobacter pylori*.

Helicobacter pylori is a pathogen that causes gastric cancer in addition to acute gastric ulcers. EPA placed this pathogen on the draft CCL. However, the analysis for *H. pylori* differs from the other pathogens due to the long term and/or chronic nature of its health effects rather than the more common acute effects of most waterborne pathogens. This organism is an emerging pathogen whose impact has only recently begun to be understood. Given the slow development of adverse health effects due to infection by *H. pylori*, it is more difficult to link contamination of drinking water and show a waterborne disease outbreak. Therefore, given the long timeframe of cancer and ulcer development (as opposed to the commonly acute gastrointestinal illness of nearly all the other pathogens on the PCCL) as well as the ongoing nature of the research, EPA used peer-reviewed scientific papers to score the health effects of *H. pylori*. The data used to score *H. pylori* is discussed in more detail in the appendix.

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 subpopulations for an overall health effects score. The resulting score acknowledges that sensitive populations have increased risk for waterborne diseases.

Exhibit 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					
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					

3.4 Combining Protocol Scores to Rank Pathogens

EPA ranked the PCCL pathogens for the Final CCL 3 exactly as was done for the Draft CCL 3. EPA used the three scoring protocols, occurrence, waterborne disease outbreaks, and health effects to score and rank the PCCL pathogens (see Exhibits 2, 4 and 5). A workgroup of EPA scientists scored pathogens on the PCCL using the scoring system. The score for each component of the protocols is provided to demonstrate how the total score and relative rankings were developed (see Exhibit 6). These protocols are designed in a hierarchical manner so that each pathogen is evaluated using the same criteria and the criteria range for each protocol

varies from high significance to low significance. The three attribute scores are then combined into a total score (see formula and example calculation below).

Pathogens are first scored using the WBDO and occurrence protocols, and then the highest score is selected. Selection of the higher score from the WBDO or occurrence protocol elevates pathogens that have been detected in drinking water or source water in the U.S. (occurrence score of 2 or 3) above pathogens that have caused WBDOs in other countries but not in the U.S. (WBDO score of 2) or pathogens that have not caused WBDOs in any country but have been epidemiologically associated with water-related disease (WBDO score of 1). This scoring protocol recognizes the importance of WBDO data in evaluating the public health risk posed by pathogens in drinking water, while ensuring that pathogens that have been detected in public water systems and have not been identified as causative agents WBDOs remain in the CCL process.

Next, pathogens are scored using the health effects protocol. This protocol scores the representative health effect characteristic of each pathogen for the general population, e.g., noroviruses characteristically cause gastrointestinal symptoms that are self-limiting within two days in otherwise healthy adults. All five population categories are scored for each pathogen using the most common clinical presentation for the specific pathogen for the population category under consideration. The pathogen's score for the general population is added to the highest score among the four sensitive populations to produce a sum score between 2 and 14.

Finally, EPA normalizes the Health Effects and WBDO/Occurrence score because the Agency believes they are of equal importance. The highest possible score for WBDO/Occurrence is 5 and the highest possible Health Effect score is 14. To equalize this imbalance, the Agency multiplies the combined health effects score by 5/14.

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

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**

Exhibit 6. WBDO, Occurrence and Health Effects Scores for PCCL pathogens

			Health Effects						
Pathogen	***WBDO***	***Occur.***	***General***	***Child***	***Elderly***	***Pregnant Women***	***Chronic Disease***	***Normalized Health***	**Total Score**
Naegleria fowleri	4	3	7	7	7	7	7	5.0	9.0
Legionella pneumophila	5	3	4	4	6	4	6	3.6	8.6
Escherichia coli (O157)	5	3	3	6	6	3	3	3.2	8.2
Shigella sonnei	5	3	3	6	6	3	3	3.2	8.2
Hepatitis A virus	5	2	3	3	6	3	3	3.2	8.2
Helicobacter pylori	1	3	7	3	7	3	3	5.0	8.0
Campylobacter jejuni	5	3	3	4	4	3	3	2.5	7.5
Salmonella enterica	5	3	3	4	4	3	3	2.5	7.5
Caliciviruses	5	3	2	4	4	2	4	2.1	7.1
Mycobacterium avium	4	3	3	3	5	3	4	2.9	6.9
Adenovirus	2	3	6	4	2	2	4	3.6	6.6
Enterovirus	2	3	4	6	2	2	2	3.6	6.6
Arcobacter butzleri	4	3	3	3	3	3	3	2.1	6.1
Entamoeba histolytica	4	3	3	3	3	3	3	2.1	6.1
Vibrio cholerae	4	3	3	3	3	3	3	2.1	6.1
Fusarium solani	1	3	4	4	4	4	4	2.9	5.9
Plesiomonas shigelloides	4	3	2	3	3	2	2	1.8	5.8
Hepatitis E virus	2	1	3	3	6	7	3	3.6	5.6
Rotavirus	2	3	1	6	1	1	1	2.5	5.5
Yersinia enterocolitica	4	3	2	2	2	2	2	1.4	5.4
Toxoplasma gondii	2	1	2	2	2	7	2	3.2	5.2
Aspergillus fumigatus group	1	3	3	3	3	3	3	2.1	5.1
Exophiala jeanselmei	1	3	3	3	3	3	3	2.1	5.1
Aeromonas hydrophila	1	3	2	3	2	2	2	1.8	4.8
Cyclospora	1	1	3	4	3	3	3	2.5	3.5
Astrovirus	2	2	2	2	2	2	2	1.4	3.4
Microsporidia	1	2	2	2	2	2	2	1.4	3.4
Isospora belli	2	0	1	2	1	1	1	1.1	3.1
Blastocystis hominis	1	1	1	1	1	1	1	0.7	1.7

4.0 Selecting the CCL from the Ranked PCCL

The scoring system involves selecting a pathogen and completing three scoring protocols, one protocol each for WBDOs and Occurrence, and one protocol for normal populations and four sensitive populations (children, elderly, pregnant women, and persons with chronic diseases). The higher of the WBDO score or the occurrence score is added to the normalized health effects score to produce a composite pathogen score. This process results in a ranked list of pathogens from which the Agency may select for placement on a CCL (see Exhibit 6).

The scoring process developed by EPA discriminates between microbial drinking water contaminants in a transparent and scientifically sound manner. The weighing of occurrence and health effects information closely mirrors the risk estimate methods used by EPA during drinking water regulation development. This scoring system will prioritize and restrict the number of pathogens on a CCL to only those that have been strongly associated with water-related diseases. Pathogens failing to meet these criteria will remain on the PCCL until additional occurrence data, epidemiological surveillance data, or health effects data support their reevaluation.

The 29 PCCL pathogens are 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 believes this ranking indicates the most important pathogens to consider for the CCL 3. To determine which of the 29 PCCL pathogens should be the highest priority for EPA's drinking water program and included on the CCL 3, the Agency considered both scientific and policy factors. The factors included the PCCL scores for WBDO, occurrence, and health effects; comments and recommendations from the various expert panels; the specific intent of SDWA; and the need to focus Agency resources on pathogens to provide the most effective opportunities to advance public health protection. After consideration of these factors, EPA has determined that the CCL 3 will include the 12 highest ranked pathogens.

Additionally, there are a few "natural" break points in the ranked scores for the 29 pathogens, with the top 12 forming the highest ranked group of pathogens. EPA believes that the overall rankings strongly reflect 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 3.

5.0 Scoring Data Sheets

This section contains a scoring sheet for each of the pathogens on the PCCL. The scoring sheets are arranged alphabetically by pathogen.

A score for each protocol (WBDOs and occurrence, and health effects) is determined. Bolded text in each protocol box indicates that is the protocol level that was scored for that pathogen. For example, if the question "Detected in drinking water in the U.S.?**"** under the

occurrence protocol is bolded then that organism received the associated occurrence score (i.e., 3). The higher of the WBDO score or the occurrence score is added to the normalized health effects score to produce a composite pathogen score. References for each scoring discussion are provided. Health effects scoring involved scoring for each of the 5 populations: General (G), Child/infants (C), Elderly (E), Pregnant Women (PW), and persons with Chronic Disease (CD).

Adenovirus Scoring Data

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

Score[2]	Data Element	Scoring Data	Reference[3]
	Waterborne Disease Outbreaks		
5	Has caused multiple (2 or more) documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004	No	CDC, 1991 – CDC, 2006
4	Has caused at least one documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004	No	CDC, 1991 – CDC, 2006
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 Europe**	**Kukkula et al., 1997**
1	Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?	N/A	
	Occurrence		
3	**Detected in drinking water in the U.S.?**	**Yes PCR in connection with an outbreak.**	**O'Reilly et al., 2007 Fong et al., 2007**
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 40/41.	USEPA, 2007

Score[2]	Data Element	Scoring Data	Reference[3]
1	Not detected in the U.S.?	N/A	
	Health Effects		
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, 2007**
5	Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?	None reported	
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, 2007
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, 2007

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]See section 3.4 for a detailed description on how to calculate the total pathogen score.
[2] 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.
[3]EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2006 and then collected occurrence citations if there were no CDC WBDOs. Two exceptions to this WBDO scoring criteria are *Arcobacter butzleri* and *Mycobacterium avium*.

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Aeromonas hydrophila Scoring Data

Scoring Summary[1]	
Occurrence	**3**
Health Effects	
General population	**2**
Sensitive subpopulation(s) [C]	**3**

Score[2]	Data Element	Scoring Data	Reference[3]
	Waterborne Disease Outbreaks		
5	Has caused multiple (2 or more) documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004?	No	CDC, 1991 – CDC, 2006
4	Has caused at least one documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004?	No	CDC, 1991 – CDC, 2006
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**
	Occurrence		
3	**Detected in drinking water in the U.S.?**	**Yes EPA found *A. hydrophila* 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

Score[2]	Data Element	Scoring Data	Reference[3]
1	Not detected in the U.S.?	N/A	
	Health Effects		
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, 2007
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, 2007
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 hopitalization due to dehydration.**	**Horneman et al. in Murray, 2007**
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 et al. in Murray, 2007**
1	Does the illness result in mild symptoms with minimal or no impact on daily activities?		

[1]See section 3.4 for a detailed description on how to calculate the total pathogen score.

[2] 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.
[3]EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2006 and then collected occurrence citations if there were no CDC WBDOs. Two exceptions to this WBDO scoring criteria are *Arcobacter butzleri* and *Mycobacterium avium*.

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Arcobacter butzleri Scoring Data

Scoring Summary[1]	
Waterborne Disease Outbreak	**4**
Health Effects	
General population	**3**
Sensitive subpopulation(s) [CD, C]	**3**

Score[2]	Data Element	Scoring Data	Reference[3]
	Waterborne Disease Outbreaks		
5	Has caused multiple (2 or more) documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004?	No	CDC, 1991 – CDC, 2006
4	**Has caused at least one documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004?**	**Yes Not listed in CDC's MMWR, however, linked to outbreak and drinking water. Symptom severity also suggests *Arcobacter*.**	**Fong et al., 2007**
3	Has caused documented WBDOs at any time in the U.S.?	N/A	
2	Has caused WBDOs in countries other than the U.S.?	N/A	
1	Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?	N/A	
	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 *Arcobacter butzleri* was isolated from ground water in Idaho after a WBDO.	Rice et al., 1999

Score[2]	Data Element	Scoring Data	Reference[3]
1	Not detected in the U.S.?	N/A	
	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, 2007
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, C, P, E, CD]	**Does the illness require physician intervention?**	**[All populations] Displays clinical features similar to *Campylobacter jejuni*, 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

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]See section 3.4 for a detailed description on how to calculate the total pathogen score.
[2] 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.
[3]EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2006 and then collected occurrence citations if there were no CDC WBDOs. Two exceptions to this WBDO scoring criteria are *Arcobacter butzleri* and *Mycobacterium avium*.

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Aspergillus fumigatus Scoring Data

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

Score[2]	Data Element	Scoring Data	Reference[3]
	Waterborne Disease Outbreaks		
5	Has caused multiple (2 or more) documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004?	No	CDC, 1991 – CDC, 2006
4	Has caused at least one documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004?	No	
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**
	Occurrence		
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**

Score[2]	Data Element	Scoring Data	Reference[3]
			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.?	N/A	
	Health Effects		
7	Does the organism cause significant mortality (> 1/1,000 cases)?	Invasive infections caused by *Aspergillus* species are associated with high rates of morbidity and mortality, especially in immunosuppressed patients.	Verweij and Brandt 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)?	Sporadic cases of invasive aspergillosis have been reported in immunocompetent hosts (chronic meningitis, endocarditis, pericarditis, osteomyelitys). Invasive aspergillosis is primarily an infection of severely immunocompromised patients. Serious infection can also occur in patients with more modest impairments of host immune system such as diabetics.	Bodey and Vartivarian, 1989 Nagy and Olson, 1982
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	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**
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?	*Aspergillus* spores are allergens and persons who become sensitized experience symptoms of allergy and asthma.	Horner et al., 1995

[1]See section 3.4 for a detailed description on how to calculate the total pathogen score.
[2] 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.
[3]EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2006 and then collected occurrence citations if there were no CDC WBDOs. Two exceptions to this WBDO scoring criteria are *Arcobacter butzleri* and *Mycobacterium avium*.

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Astrovirus Scoring Data

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

Score[2]	Data Element	Scoring Data	Reference[3]
	Waterborne Disease Outbreaks		
5	Has caused multiple (2 or more) documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004?	No	CDC, 1991 – CDC, 2006
4	Has caused at least one documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004?	No	CDC, 1991 – CDC, 2006
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
	Occurrence		
3	Detected in drinking water in the U.S.?	No	
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.?		

Score[2]	Data Element	Scoring Data	Reference[3]
	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?	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, 2007**
1	Does the illness result in mild symptoms with minimal or no impact on daily activities?		

[1]See section 3.4 for a detailed description on how to calculate the total pathogen score.
[2] 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.
[3]EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2006 and then collected occurrence citations if there were no CDC WBDOs. Two exceptions to this

WBDO scoring criteria are *Arcobacter butzleri* and *Mycobacterium avium*.

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Blastocystis hominis Scoring Data

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

Score[2]	Data Element	Scoring Data	Reference[3]
	Waterborne Disease Outbreaks		
5	Has caused multiple (2 or more) documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004?	No	CDC, 1991 – CDC, 2006
4	Has caused at least one documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004?	No	CDC, 1991 – CDC, 2006
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**
	Occurrence		
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**
	Health Effects		
7	Does the organism cause	No	

Score[2]	Data Element	Scoring Data	Reference[3]
	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	
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, 2007
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 *B. hominis* is controversial. Symptoms may include diarrhea, vomiting and abdominal pain.**	**Leber in Murray, 2007**

[1]See section 3.4 for a detailed description on how to calculate the total pathogen score.
[2] 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.
[3]EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2006 and then collected occurrence citations if there were no CDC WBDOs. Two exceptions to this WBDO scoring criteria are *Arcobacter butzleri* and *Mycobacterium avium*.

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Calicivirus Scoring Data

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

Score[2]	Data Element	Scoring Data	Reference[3]
	Waterborne Disease Outbreaks		
5	**Has caused multiple (2 or more) documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004**	**Yes** **1 (Norwalk) Community outbreak (Previously unreported)** **4 (Norwalk) Noncommunity (1 Previously unreported)** **5 (Norovirus) Noncommunity** **1 (Norovirus) Community (1 Previously unreported)** **2 (Norovirus) Noncommunity**	**CDC, 2000** **CDC, 2002** **CDC, 2004** **CDC, 2006**
4	Has caused at least one documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004	N/A	
3	Has caused documented WBDOs at any time in the U.S.?	N/A	
2	Has caused WBDOs in countries other than the U.S.?	N/A	
1	Has never caused WBDOs in any country, but has been epidemiologically associated with water	N/A	

Score[2]	Data Element	Scoring Data	Reference[3]
	related disease?		
	Occurrence		
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.?	N/A	
	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)?	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 hospitalization (< week)?**	**[E, CD] (Norwalk) Although rare, severe dehydration can be fatal, with this outcome occurring among susceptible persons (e.g., older persons with debilitating health conditions). [C] Sappoviruses cause disease mainly in children.**	**CDC, 2001 Farkas in Murray, 2007**

Score[2]	Data Element	Scoring Data	Reference[3]
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]See section 3.4 for a detailed description on how to calculate the total pathogen score.
[2] 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.
[3]EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2006 and then collected occurrence citations if there were no CDC WBDOs. Two exceptions to this WBDO scoring criteria are *Arcobacter butzleri* and *Mycobacterium avium*.

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Campylobacter jejuni Scoring Data

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

Score[2]	Data Element	Scoring Data	Reference[3]
	Waterborne Disease Outbreaks		
5	**Has caused multiple (2 or more) documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004?**	**Yes** **2 Noncommunity** **1 Community** **2 Noncommunity** **1 Noncommunity** **2 Noncommunity** **2 Community (1 Previously unreported)**	**CDC, 1996** **CDC, 2002** **CDC, 2004** **CDC, 2006**
4	Has caused at least one documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004?	N/A	
3	Has caused documented WBDOs at any time in the U.S.?	N/A	
2	Has caused WBDOs in countries other than the U.S.?	Yes Finland	Kuusi, 2005
1	Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?	N/A	
	Occurrence		
3	**Detected in drinking**	**Yes**	**Sacks et al., 1986**

Score[2]	Data Element	Scoring Data	Reference[3]
	water in the U.S.?		**O'Reilly, 2007**
2	Detected in source water in the U.S.?	Yes	Carter et al., 1987
1	Not detected in the U.S.?	N/A	
	Health Effects		
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 or disability, i.e. sequelae?	N/A	

Score[2]	Data Element	Scoring Data	Reference[3]
4 [C, E]	**Does the illness require short term hospitalization (< week)?**	**[C,E] Most cases do not require hospitalization, pediatric cases and elderly are more likely to require hospitalization than normal adult cases.** **The highest incidence is in children and infants.** **Bacteremia occurs at 1.5 per 1,000 cases with the highest rate occurring in the elderly.**	**Fitzgerald in Murray, 2007**
3 [G, P, CD]	**Does the illness require physician intervention?**	**[G, P, CD] Guillain-Barré syndrome, reactive arthritis.** **Guillain-Barré 1/1000 cases.** **Reactive arthritis 1/100 cases.**	**Fitzgerald in Murray, 2007** **Altekruse et al., 1999**
2	Is the illness self-limiting within 72 hours (without requiring medical intervention)?	Duration 2-5 days, usually self-limiting. Several days to more than 1 week, self-limiting, relapse in 5-10% cases.	Heymann, 2005 Fitzgerald in Murray, 2007
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]See section 3.4 for a detailed description on how to calculate the total pathogen score.
[2] 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.
[3]EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2006 and then collected occurrence citations if there were no CDC WBDOs. Two exceptions to this WBDO scoring criteria are *Arcobacter butzleri* and *Mycobacterium avium*.

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Cyclospora cayetanensis Scoring Data

Scoring Summary[1]	
Waterborne Disease Outbreak	**1**
Health Effects	
General population	**3**
Sensitive subpopulation(s) [C]	**4**

Score[2]	Data Element	Scoring Data	Reference[3]
	Waterborne Disease Outbreaks		
5	Has caused multiple (2 or more) documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004	No	CDC, 1991 – CDC, 2006
4	Has caused at least one documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004	No	CDC, 1991 – CDC, 2006
3	Has caused documented WBDOs at any time in the U.S.?	N/A	
2	Has caused WBDOs in countries other than the U.S.?	N/A	
1	**Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?**	**Yes**	**Huang et al., 1995**
	Occurrence		
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.?**	**Detected in drinking water in Guatemala.**	**Dowd et al., 2003**
	Health Effects		
7	Does the organism cause	No	

Score[2]	Data Element	Scoring Data	Reference[3]
	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	
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 required hospitalization, infants may require hospitalization for rehydration therapy.**	**Fisk et al., 2005**
3 [G, P, E, 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, 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]See section 3.4 for a detailed description on how to calculate the total pathogen score.
[2] 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.
[3]EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2006 and then collected occurrence citations if there were no CDC WBDOs. Two exceptions to this WBDO scoring criteria are *Arcobacter butzleri* and *Mycobacterium avium*.

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Entamoeba histolytica Scoring Data

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

Score[2]	Data Element	Scoring Data	Reference[3]
	Waterborne Disease Outbreaks		
5	Has caused multiple (2 or more) documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004**?**	No	CDC, 1991 – CDC, 2006
4	**Has caused at least one documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004?**	**Yes 1 Noncommunity (Previously unreported)**	**CDC, 2006**
3	Has caused documented WBDOs at any time in the U.S.?	N/A	
2	Has caused WBDOs in countries other than the U.S.?	N/A	
1	Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?	N/A	
	Occurrence		
3	**Detected in drinking water in the U.S.?**	**Found during WBDO.**	**CDC, 2006**
2	Detected in source water in the U.S.?	N/A	
1	Not detected in the U.S.?	N/A	
	Health Effects		

Score[2]	Data Element	Scoring Data	Reference[3]
7	Does the organism cause significant mortality (> 1/1,000 cases)?	500 million infected (*E. dispar* and *E. histolytica*) each year with approximately 50 million cases of colitis and liver abscess and 100,000 deaths worldwide.	Leber 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)?	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, 2007
4	Does the illness require short term hospitalization (< week)?	Intestinal invasion can lead to lesions, ulcers.	Leber in Murray, 2007
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, 2007** **Marshall, 1997**
2	Is the illness self-limiting within 72 hours (without	Most human infections (90%) are	Heymann, 2005

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

[1]See section 3.4 for a detailed description on how to calculate the total pathogen score.
[2] 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.
[3]EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2006 and then collected occurrence citations if there were no CDC WBDOs. Two exceptions to this WBDO scoring criteria are *Arcobacter butzleri* and *Mycobacterium avium*.

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Enterovirus Scoring Data

Scoring Summary[1]	
Occurrence	**3**
Health Effects	
General population	**4**
Sensitive subpopulation(s) [C]	**6**

Score[2]	Data Element	Scoring Data	Reference[3]
	Waterborne Disease Outbreaks		
5	Has caused multiple (2 or more) documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004?	No	CDC, 1991 – CDC, 2006
4	Has caused at least one documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004?	No	CDC, 1991 – CDC, 2006
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?	N/A	
	Occurrence		
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.?	N/A	
	Health Effects		

Score[2]	Data Element	Scoring Data	Reference[3]
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)?**	**[C] Aseptic meningitis and neonatal sepsis are the most common complications.** **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)).** **Enterovirus causes myocarditis, viral meningitis, encephalitis and meningioencephalitis.**	**Heymann, 2005** **Romero in Murray, 2007** **Khetsuriani et al., 2002** **Kim et al., 2001** **Khetsuriani, 2003**
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**	**Sawyer, 2002** **Romero in Murray, 2007**

Score[2]	Data Element	Scoring Data	Reference[3]
		illnesses for infants and children.	
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 minimal or no impact on daily activities?		

[1]See section 3.4 for a detailed description on how to calculate the total pathogen score.
[2] 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.
[3]EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2006 and then collected occurrence citations if there were no CDC WBDOs. Two exceptions to this WBDO scoring criteria are *Arcobacter butzleri* and *Mycobacterium avium*.

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Escherichia coli (O157)† Scoring Data

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

Score[2]	Data Element	Scoring Data	Reference[3]
	Waterborne Disease Outbreaks		
5	**Has caused multiple (2 or more) documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004?**	**Yes** **2 Noncommunity (1 Previously unreported)** **1 Noncommunity** **1 Community** **1 Noncommunity** **2 Community**	**CDC, 1998** **CDC, 2000** **CDC, 2002**
4	Has caused at least one documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004?	N/A	
3	Has caused documented WBDOs at any time in the U.S.?	N/A	
2	Has caused WBDOs in countries other than the U.S.?	N/A	
1	Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?	N/A	
	Occurrence		
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

Score[2]	Data Element	Scoring Data	Reference[3]
1	Not detected in the U.S.?	N/A	
	Health Effects		
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 *E. coli* (O157). A case fatality rate of 0.5 has been reported for outbreak-related cases caused by *E. coli* O157:H7	Nataro in Murray, 2007 Rangel et al., 2005
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 a increased risk of complications.** **HUS develops in 10% of patients under the age of 10.**	**Chinyu, 1995** **Heymann, 2005** **Nataro and Kaper, 1998**
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	Garg et al., 2003 Suri et al., 2005 Garg et al, 2005

Score[2]	Data Element	Scoring Data	Reference[3]
		hypertension and reduced renal function.	
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 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 3 due to ongoing taxonomical debate in the scientific literature.
[1]See section 3.4 for a detailed description on how to calculate the total pathogen score.
[2] 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.
[3]EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2006 and then collected occurrence citations if there were no CDC WBDOs. Two exceptions to this WBDO scoring criteria are *Arcobacter butzleri* and *Mycobacterium avium*.

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Exophiala jeanselmei Scoring Data

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

Score[2]	Data Element	Scoring Data	Reference[3]
	Waterborne Disease Outbreaks		
5	Has caused multiple (2 or more) documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004?	No	CDC, 1991 – CDC, 2006
4	Has caused at least one documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004?	No	CDC, 1991 – CDC, 2006
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**
	Occurrence		
3	**Detected in drinking water in the U.S.?**	**Yes**	**West, 1986**
2	Detected in source water in the U.S.?	Yes	Nucci et al., 2001
1	Not detected in the U.S.?	N/A	
	Health Effects		
7	Does the organism cause significant mortality (> 1/1,000 cases)?	No	

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

[1]See section 3.4 for a detailed description on how to calculate the total pathogen score.
[2] 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.
[3]EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2006 and then collected occurrence citations if there were no CDC WBDOs. Two exceptions to this

WBDO scoring criteria are *Arcobacter butzleri* and *Mycobacterium avium*.

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Fusarium solani Scoring Data

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

Score[2]	Data Element	Scoring Data	Reference[3]
	Waterborne Disease Outbreaks		
5	Has caused multiple (2 or more) documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004?	No	CDC, 1991 – CDC, 2006
4	Has caused at least one documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004?	No	CDC, 1991 – CDC, 2006
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**
	Occurrence		
3	**Detected in drinking water in the U.S.?**	**Yes**	**Nagy and Olson, 1982** **Annaissie et al., 2001**
2	Detected in source water in the U.S.?	Yes	
1	Not detected in the U.S.?	N/A	
	Health Effects		
7	Does the organism cause significant mortality (>	Mortality associated with cutaneous	Nucci and Annaissie, 2002

Score[2]	Data Element	Scoring Data	Reference[3]
	1/1,000 cases)?	*Fusarium* infection is high in immunocompromised patients but low for immunocompetent hosts.	
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. *Fusarium* has been associated with pneumonia and disseminated infections	Fridkin and Jarvis, 1996; Annaissie et al., 2001 Verweij and Brandt, in Murray 2007
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)?	**[G, C, P, E, CD] Can cause infections that may require hospitalization, particularly in immunocompromised patients (endophtalmitis, 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 required as well as antifungal therapy. In inmunocompentent patients manifestations include keratitis, localized skin lesions, onychomycosis, and occasionally cellulitis	Dignani and Anaissie, 2004

Score[2]	Data Element	Scoring Data	Reference[3]
		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]See section 3.4 for a detailed description on how to calculate the total pathogen score.
[2] 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.
[3]EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2006 and then collected occurrence citations if there were no CDC WBDOs. Two exceptions to this WBDO scoring criteria are *Arcobacter butzleri* and *Mycobacterium avium*.

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Helicobacter pylori Scoring Data

Scoring Summary[1]	
Occurrence	**3**
Health Effects	
General population	**7**
Sensitive subpopulation(s) [E]	**7**

Score[2]	Data Element	Scoring Data	Reference[3]
	Waterborne Disease Outbreaks		
5	Has caused multiple (2 or more) documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004?	No	CDC, 1991 – CDC, 2006
4	Has caused at least one documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004?	No	CDC, 1991 – CDC, 2006
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.**
	Occurrence		
3	**Detected in drinking water in the U.S.?**	**Yes**	**Hegarty and Baker, 1999**
2	Detected in source water in the U.S.?	N/A	
1	Not detected in the U.S.?	N/A	
	Health Effects		
7 [G, E]	**Does the organism cause**	**[G, E] 6500 deaths per**	**CDC, 1997**

Score[2]	Data Element	Scoring Data	Reference[3]
	significant mortality (> 1/1,000 cases)?	**year. 1.2 Million acute cases per year (>1/1,000 deaths). 46% of deaths occur before age of 64.**	**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
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 treatment for anyone with peptic ulcers.	Fox in Murray, 2007
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]See section 3.4 for a detailed description on how to calculate the total pathogen score.
[2] 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.
[3]EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2006 and then collected occurrence citations if there were no CDC WBDOs. Two exceptions to this WBDO scoring criteria are *Arcobacter butzleri* and *Mycobacterium avium*.

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Hepatitis A Virus Scoring Data

Scoring Summary[1]	
Waterborne Disease Outbreak	**5**
Health Effects	
General population	**3**
Sensitive subpopulation(s) [E]	**6**

Score[2]	Data Element	Scoring Data	Reference[3]
	Waterborne Disease Outbreaks		
5	**Has caused multiple (2 or more) documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004?**	**Yes** **1 Community** **1 Noncommunity (Previously unreported)**	 **CDC, 1991** **CDC, 1996**
4	Has caused at least one documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004?	N/A	
3	Has caused documented WBDOs at any time in the U.S.?	N/A	
2	Has caused WBDOs in countries other than the U.S.?	N/A	
1	Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?	N/A	
	Occurrence		
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.?	N/A	

Score[2]	Data Element	Scoring Data	Reference[3]
	Health Effects		
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**
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, 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]See section 3.4 for a detailed description on how to calculate the total pathogen score.
[2] 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.
[3]EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2006 and then collected occurrence citations if there were no CDC WBDOs. Two exceptions to this WBDO scoring criteria are *Arcobacter butzleri* and *Mycobacterium avium*.

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Hepatitis E Virus Scoring Data

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

Score[2]	Data Element	Scoring Data	Reference[3]
	Waterborne Disease Outbreaks		
5	Has caused multiple (2 or more) documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004?	No	CDC, 1991 – CDC, 2006
4	Has caused at least one documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004?	No	CDC, 1991 – CDC, 2006
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
	Occurrence		
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**
	Health Effects		
7 [P]	**Does the organism cause**	**[P] May progress to**	**Anderson in Murray,**

Score[2]	Data Element	Scoring Data	Reference[3]
	significant mortality (> 1/1,000 cases)?	**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.**	**2007** **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
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, 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, 2007**

Score[2]	Data Element	Scoring Data	Reference[3]
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]See section 3.4 for a detailed description on how to calculate the total pathogen score.
[2] 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.
[3]EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2006 and then collected occurrence citations if there were no CDC WBDOs. Two exceptions to this WBDO scoring criteria are *Arcobacter butzleri* and *Mycobacterium avium*.

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Isospora belli Scoring Data

Scoring Summary[1]	
Waterborne Disease Outbreak	**2**
Health Effects	
General population	**1**
Sensitive subpopulation(s) [C]	**2**

Score[2]	**Data Element**	**Scoring Data**	**Reference[3]**
	Waterborne Disease Outbreaks		
5	Has caused multiple (2 or more) documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004?	No	CDC, 1991 – CDC, 2006
4	Has caused at least one documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004?	No	CDC, 1991 – CDC, 2006
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	
	Occurrence		
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	
	Health Effects		
7	Does the organism cause		

Score[2]	Data Element	Scoring Data	Reference[3]
	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, 2007
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, 2007**
1 [G]	**Does the illness result in mild symptoms with minimal or no impact on daily activities?**	**[G] Symptoms include diarrhea, steatorrhea, headache, fever, malaise, abdominal pain, vomiting, dehydration, and weight loss.**	**Lindsay in Murray, 2007**

[1]See section 3.4 for a detailed description on how to calculate the total pathogen score.
[2] 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.

[3]EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2006 and then collected occurrence citations if there were no CDC WBDOs. Two exceptions to this WBDO scoring criteria are *Arcobacter butzleri* and *Mycobacterium avium*.

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Legionella pneumophila Scoring Data

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

Score[2]	Data Element	Scoring Data	Reference[3]
	Waterborne Disease Outbreaks		
5	**Has caused multiple (2 or more) documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004?**	**Yes** **1 Community** **1 Noncommunity** **7 Community** **1 Community (Previously unreported)** **1 Noncommunity (Previously unreported)**	**CDC, 2004** **CDC, 2006**
4	Has caused at least one documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004?	N/A	
3	Has caused documented WBDOs at any time in the U.S.?	N/A	
2	Has caused WBDOs in countries other than the U.S.?	N/A	
1	Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?	N/A	
	Occurrence		
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	Yes	Maier et al., 2000

Score[2]	Data Element	Scoring Data	Reference[3]
	the U.S.?		
1	Not detected in the U.S.?	N/A	
	Health Effects		
7	Does the organism cause significant mortality (> 1/1,000 cases)?	Avg. 12% fatality rate; death rates of 15% (general pop.) up to 75% (immunocompromised) if untreated. Avg. 25% death rate (between 20-40% during an outbreak. 10 – 15% death rate. Fatality rate has been as high as 39% in hospitalized cases; it is generally higher in those with compromised immunity.	Edelstein in Murray, 2007 AwwaRF, 2004 CDC, 2005 Heymann, 2005
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** **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

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]See section 3.4 for a detailed description on how to calculate the total pathogen score.
[2] 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.
[3]EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2006 and then collected occurrence citations if there were no CDC WBDOs. Two exceptions to this WBDO scoring criteria are *Arcobacter butzleri* and *Mycobacterium avium*.

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Microsporidia Scoring Data

Scoring Summary[1]	
Occurrence	**2**
Health Effects	
General population	**2**
Sensitive subpopulation(s) [CD, C]	**2**

Score[2]	Data Element	Scoring Data	Reference[3]
	Waterborne Disease Outbreaks		
5	Has caused multiple (2 or more) documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004?	No	CDC, 1991 – CDC, 2006
4	Has caused at least one documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004?	No	CDC, 1991 – CDC, 2006
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**	**Cotte, et al., 1999 Enriquez et al., 1998 Hutin et al., 1998**
	Occurrence		
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.?	N/A	
	Health Effects		
7	Does the organism cause		

Score[2]	Data Element	Scoring Data	Reference[3]
	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, 2007
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 immunocompetent hosts. Has been identified among elderly persons with acute or chronic diarrhea.**	**Weber in Murray, 2007**
1	Does the illness result in mild symptoms with minimal or no impact on daily activities?		

[1]See section 3.4 for a detailed description on how to calculate the total pathogen score.
[2] 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.
[3]EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2006 and then

collected occurrence citations if there were no CDC WBDOs. Two exceptions to this WBDO scoring criteria are *Arcobacter butzleri* and *Mycobacterium avium*.

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Mycobacterium avium Scoring Data

Scoring Summary[1]	
Waterborne Disease Outbreak	**4**
Health Effects	
General population	**3**
Sensitive subpopulation(s) [E]	**5**

Score[2]	Data Element	Scoring Data	Reference[3]
	Waterborne Disease Outbreaks		
5	Has caused multiple (2 or more) documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004?	No	CDC, 1991 – CDC, 2006
4	**Has caused at least one documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004?**	**Yes Not listed in CDC's MMWR however, data linking patient, outbreak and drinking water.**	**Tobin-D'Angelo et al., 2004**
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	Glover et al., 1994 Aronson et al., 1999 von Reyn et al., 1994
	Occurrence		
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.?	N/A	
	Health Effects		
7	Does the organism cause significant mortality (>		

Score[2]	Data Element	Scoring Data	Reference[3]
	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**
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 preexisiting lung disease.	Pfyffer in Murray, 2007

Score[2]	Data Element	Scoring Data	Reference[3]
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]See section 3.4 for a detailed description on how to calculate the total pathogen score.
[2] 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.
[3]EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2006 and then collected occurrence citations if there were no CDC WBDOs. Two exceptions to this WBDO scoring criteria are *Arcobacter butzleri* and *Mycobacterium avium*.

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Naegleria fowleri Scoring Data

Scoring Summary[1]	
Waterborne Disease Outbreak	**4**
Health Effects	
General population	**7**
Sensitive subpopulation(s) [C, P, E, CD]	**7**

Score[2]	Data Element	Scoring Data	Reference[3]
	Waterborne Disease Outbreaks		
5	Has caused multiple (2 or more) documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004?	No	CDC, 1991 – CDC, 2006
4	**Has caused at least one documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004?**	**Yes** **1 Community**	**CDC, 2004** **Marciano-Cabral et al., 2003**
3	Has caused documented WBDOs at any time in the U.S.?	N/A	
2	Has caused WBDOs in countries other than the U.S.?	N/A	
1	Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?	N/A	
	Occurrence		
3	**Detected in drinking water in the U.S.?**	**Yes** **Arizona storage - Sampled pre-treatment multiple-well study in Arizona.**	**Gerba et al., 2007**
2	Detected in source water in the U.S.?	Yes	Schuster and Visvesvara, 2004
1	Not detected in the U.S.?	N/A	
	Health Effects		

Score[2]	Data Element	Scoring Data	Reference[3]
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**
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, 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)?	All cases are hospitalized for diagnosis and treatment.	Visvesvara in Murray, 2007
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]See section 3.4 for a detailed description on how to calculate the total pathogen score.
[2] 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.
[3]EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2006 and then collected occurrence citations if there were no CDC WBDOs. Two exceptions to this WBDO scoring criteria are *Arcobacter butzleri* and *Mycobacterium avium*.

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Plesiomonas shigelloides Scoring Data

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

Score[2]	Data Element	Scoring Data	Reference[3]
	Waterborne Disease Outbreaks		
5	Has caused multiple (2 or more) documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004?	No	CDC, 1991 – CDC, 2006
4	**Has caused at least one documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004?**	**Yes** **1 Noncommunity**	**CDC, 1998(b)**
3	Has caused documented WBDOs at any time in the U.S.?	N/A	
2	Has caused WBDOs in countries other than the U.S.?	N/A	
1	Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?	N/A	
	Occurrence		
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, 2007 Holmberg and Farmer, 1984 Holmberg et al., 1986

Score[2]	Data Element	Scoring Data	Reference[3]
1	Not detected in the U.S.?	N/A	
	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?	No	
4	Does the illness require short term hospitalization (< week)?	Hospitalization may be required for severe infections and/or underlying diseases.	Abbott in Murray, 2007
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 elderly. Bacteremia more common with advanced age.**	**Abbott in Murray, 2007**
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, 2007**
1	Does the illness result in mild symptoms with minimal or no impact on daily activities?	*Plesiomonas* is associated with travelers' diarrhea or a history of seafood consumption, most	Abbott in Murray, 2007

Score[2]	Data Element	Scoring Data	Reference[3]
		infections are self-limiting.	

[1]See section 3.4 for a detailed description on how to calculate the total pathogen score.
[2] 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.
[3]EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2006 and then collected occurrence citations if there were no CDC WBDOs. Two exceptions to this WBDO scoring criteria are *Arcobacter butzleri* and *Mycobacterium avium*.

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Rotavirus Scoring Data

Scoring Summary[1]	
Occurrence	**3**
Health Effects	
General population	**1**
Sensitive subpopulation(s) [C]	**6**

Score[2]	Data Element	Scoring Data	Reference[3]
	Waterborne Disease Outbreaks		
5	Has caused multiple (2 or more) documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004?	No	CDC, 1991 – CDC, 2006
4	Has caused at least one documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004?	No	CDC, 1991 – CDC, 2006
3	Has caused documented WBDOs at any time in the U.S.?	N/A	
2	**Has caused WBDOs in countries other than the U.S.?**	**Yes China and Sweden.**	**Hrdy, 1987 Gerba et al., 1996**
1	Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?	N/A	
	Occurrence		
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.?	N/A	
	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	Fischer et al., 2007

Score[2]	Data Element	Scoring Data	Reference[3]
		hospitalizations).	
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 and death in young children. In developing countries, an estimated 600,000-870,000 diarrheal deaths each year.**	**Farkas in Murray, 2007** **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?		

Score[2]	Data Element	Scoring Data	Reference[3]
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]See section 3.4 for a detailed description on how to calculate the total pathogen score.
[2] 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.
[3]EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2006 and then collected occurrence citations if there were no CDC WBDOs. Two exceptions to this WBDO scoring criteria are *Arcobacter butzleri* and *Mycobacterium avium*.

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Salmonella enterica Scoring Data

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

Score[2]	Data Element	Scoring Data	Reference[3]
	Waterborne Disease Outbreaks		
5	**Has caused multiple (2 or more) documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004?**	**Yes** **1 Community** **1 Community** **1 Noncommunity**	 **CDC, 1996** **CDC, 2002** **CDC, 2006**
4	Has caused at least one documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004?	N/A	
3	Has caused documented WBDOs at any time in the U.S.?	N/A	
2	Has caused WBDOs in countries other than the U.S.?	N/A	
1	Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?	N/A	
	Occurrence		
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.?	N/A	
1	Not detected in the U.S.?	N/A	
	Health Effects		
7	Does the organism cause significant mortality (>	Each year, 1.4 M cases of illness and 600 deaths	Nataro et al. in Murray, 2007

Score[2]	Data Element	Scoring Data	Reference[3]
	1/1,000 cases)?	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.	
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.	
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**
3 [G, P, CD]	**Does the illness require physician intervention?**	**[G,P,CD] Antibiotic and rehydration may be necessary.**	**Heymann, 2005**

Score[2]	Data Element	Scoring Data	Reference[3]
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]See section 3.4 for a detailed description on how to calculate the total pathogen score.
[2] 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.
[3]EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2006 and then collected occurrence citations if there were no CDC WBDOs. Two exceptions to this WBDO scoring criteria are *Arcobacter butzleri* and *Mycobacterium avium*.

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Shigella sonnei Scoring Data

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

Score[2]	Data Element	Scoring Data	Reference[3]
	Waterborne Disease Outbreaks		
5	**Has caused multiple (2 or more) documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004?**	**Yes** **1 Noncommunity** **2 Noncommunity (1 Previously unreported)** **2 Noncommunity** **1 Community**	**CDC, 1993** **CDC, 1996** **CDC, 1998** **CDC, 2000**
4	Has caused at least one documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004?	N/A	
3	Has caused documented WBDOs at any time in the U.S.?	N/A	
2	Has caused WBDOs in countries other than the U.S.?	N/A	
1	Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?	N/A	
	Occurrence		
3	**Detected in drinking water in the U.S.?**	**Yes**	**Craun, 2003**
2	Detected in source water in the U.S.?	Yes	Black et al., 1978
1	Not detected in the U.S.?	N/A	
	Health Effects		
7	Does the organism cause	In U.S. approximately	Nataro in Murray,

Score[2]	Data Element	Scoring Data	Reference[3]
	significant mortality (> 1/1,000 cases)?	450,000 cases occur each year with 70 deaths.	2007.
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] *S. dysentariae* 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, 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**	**Heymann, 2005**

Score[2]	Data Element	Scoring Data	Reference[3]
		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
1	Does the illness result in mild symptoms with minimal or no impact on daily activities?	*S. sonnei* 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]See section 3.4 for a detailed description on how to calculate the total pathogen score.
[2] 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.
[3]EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2006 and then collected occurrence citations if there were no CDC WBDOs. Two exceptions to this WBDO scoring criteria are *Arcobacter butzleri* and *Mycobacterium avium*.

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Toxoplasma gondii Scoring Data

Scoring Summary[1]	
Waterborne Disease Outbreak	**2**
Health Effects	
General population	**2**
Sensitive subpopulation(s) [P]	**7**

Score[2]	Data Element	Scoring Data	Reference[3]
	Waterborne Disease Outbreaks		
5	Has caused multiple (2 or more) documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004?	No	CDC, 1991 – CDC, 2006
4	Has caused at least one documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004?	No	CDC, 1991 – CDC, 2006
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?	N/A	
	Occurrence		
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**	**Sroka et al., 2006**

Score[2]	Data Element	Scoring Data	Reference[3]
		and Canada.	**Isaac-Renton et al., 1998**
	Health Effects		
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** **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?		
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,	**Is the illness self-**	**[G, C, E, CD] Infection**	**Wilson in Murray,**

Score[2]	Data Element	Scoring Data	Reference[3]
E, CD]	**limiting within 72 hours (without requiring medical intervention)?**	**is generally asymptomatic; however 10 – 20% of patients with acute infection may develop cervical lymphadenopathy and/or flu-like symptoms.**	**2007**
1	Does the illness result in mild symptoms with minimal or no impact on daily activities?		

[1]See section 3.4 for a detailed description on how to calculate the total pathogen score.
[2] 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.
[3]EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2006 and then collected occurrence citations if there were no CDC WBDOs. Two exceptions to this WBDO scoring criteria are *Arcobacter butzleri* and *Mycobacterium avium*.

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Vibrio cholerae Scoring Data

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

Score[2]	Data Element	Scoring Data	Reference[3]
	Waterborne Disease Outbreaks		
5	Has caused multiple (2 or more) documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004?	No	CDC, 1991 – CDC, 2006
4	**Has caused at least one documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004?**	**1 Community**	**CDC, 1996**
3	Has caused documented WBDOs at any time in the U.S.?	N/A	
2	Has caused WBDOs in countries other than the U.S.?	N/A	
1	Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?	N/A	
	Occurrence		
3	**Detected in drinking water in the U.S.?**	**Yes (outbreak data)**	**CDC, 1996**
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.?	N/A	
	Health Effects		
7	Does the organism cause significant mortality (> 1/1,000 cases)?	*V. cholerae* Non-O1: third most commonly isolated in U.S. - Septicemia case fatality rate from 47-65%.	Abbott in Murray, 2007

Score[2]	Data Element	Scoring Data	Reference[3]
6	Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term hospitalization (> week)?	*V. cholerae* O1: Extremely rare cases causes severe extraintestinal infection. If untreated, *V. cholerae* 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 extrainstestinal infections such as septicemia.	Abbott in Murray, 2007
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)?	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, 2007**

Score[2]	Data Element	Scoring Data	Reference[3]
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]See section 3.4 for a detailed description on how to calculate the total pathogen score.
[2] 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.
[3]EPA based the WBDO scores on the CDC MMWR reports from 1991 – 2006 and then collected occurrence citations if there were no CDC WBDOs. Two exceptions to this WBDO scoring criteria are *Arcobacter butzleri* and *Mycobacterium avium*.

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Yersinia enterocolitica Scoring Data

Scoring Summary[1]	
Waterborne Disease Outbreak	**4**
Health Effects	
General population	**2**
Sensitive subpopulation(s) [C]	**2**

Score[2]	Data Element	Scoring Data	Reference[3]
	Waterborne Disease Outbreaks		
5	Has caused multiple (2 or more) documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004?	No	CDC, 1991 – CDC, 2006
4	**Has caused at least one documented WBDOs in the U.S. as reported by CDC surveillance between 1990 and 2004?**	**Yes** **1 Noncommunity**	**CDC, 2004**
3	Has caused documented WBDOs at any time in the U.S.?	N/A	
2	Has caused WBDOs in countries other than the U.S.?	N/A	
1	Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?	N/A	
	Occurrence		
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	N/A	

Score[2]	Data Element	Scoring Data	Reference[3]
	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, 2007
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, 2007
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, 2007
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.**	**Wanger in Murray, 2007**

Score[2]	Data Element	Scoring Data	Reference[3]
		Infection typically manifested by acute febrile diarrhea with abdominal pain (especially in young children). Diarrhea may be absent in up to a third of *Y. enterocolitica* infections.	**Heymann, 2005**
1	Does the illness result in mild symptoms with minimal or no impact on daily activities?		

[1]See section 3.4 for a detailed description on how to calculate the total pathogen score.
[2] 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.
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