4. Baseline Conditions

4.1 Introduction

The proposed Revised Total Coliform Rule (RTCR) builds upon the 1989 Total Coliform Rule (TCR), promulgated under the Safe Drinking Water Act (SDWA). The TCR, which applies to all public water systems (PWS) in the United States, established a maximum contaminant level (MCL), monitoring requirements, and analytical requirements for total coliform bacteria (TC), which is an indicator of fecal (bacterial) contamination in drinking water. It also provides a way for PWSs to evaluate treatment effectiveness and distribution system integrity. Implementation of the current TCR began in 1991. By implementing the proposed RTCR, EPA seeks to increase the effectiveness of the current TCR in reducing public health risk in a way that is also economically efficient. To develop the Economic Analysis (EA) for the proposed RTCR, EPA first estimated the baselines for the level of contaminant occurrence; the number of systems and population exposed to this source of contamination; and the frequency of sampling under the current TCR, while accounting for expected effects of Ground Water Rule (GWR) implementation. This chapter describes the data sources used to develop the baselines and how the data were used.

4.1.1 Background & Purpose

The baseline analysis is a characterization of the water industry and its current operations in effect before systems make changes to meet requirements of the proposed RTCR. This chapter presents estimates of the number of systems, the population affected, water quality measures, and subpopulations affected. The data collected for this profile will serve as the baseline used in the proposed RTCR EA. The development of the baseline analysis consists of the following steps:

- Compilation of a profile of water systems – identifying and collecting information on all PWSs.

- Characterization of current monitoring requirements, including testing requirements, sample siting plans, routine and repeat sampling requirements, and sanitary surveys.

- Characterization of current PWS compliance information, including acute and monthly MCL violations, triggered monitoring, and public notification reporting.

4.1.2 Chapter Organization

The remainder of this document is organized into three general sections:

Section 4.2 Describes general information on data sources.

Section 4.3 Describes system, population, and water quality data used as inputs to the occurrence model. The occurrence model, as described in section 5.3 of this EA, predicts the changes in TC and *E. coli* (EC) occurrence under the regulatory alternatives proposed under the proposed RTCR as compared to the current TCR.

Section 4.4 Estimates baseline impact on sensitive populations

4.2 Data Sources

Several data sources were used to characterize the proposed RTCR baseline to create system and population baselines. Several primary data sources were used for the EA, including the Safe Drinking Water Information System-Federal Version (SDWIS/FED) (USEPA, 2007), the Six-Year Review of National Primary Drinking Water Regulations (Six-Year Review), the Ground Water Rule EA, and the U.S. Census. Each of these main data sources is further explained in Sections 4.2.1 – 4.2.3 below.

4.2.1 Background on SDWIS/FED Data

SDWIS/FED[1] is EPA's national regulatory compliance database for the drinking water program and is the main source of PWS inventory and violation data for the proposed RTCR baseline. SDWIS/FED contains information on each of the approximately 155,000 active PWSs as reported by primacy agencies[2], EPA Regions, and EPA headquarters personnel. SDWIS/FED does not include sample results, but does include identification of Maximum Contaminant Level (MCL) violations and monitoring and reporting violations (both routine and repeat and minor and major)[3]. It also contains information to characterize the U.S. inventory of PWSs, namely: system name and location; retail population served; source water type (i.e., ground water (GW), surface water (SW), or ground water under the direct influence of surface water (GWUDI)); whether or not systems disinfect the water; and PWS type, as described below.

---

[1] Further information on SDWIS/FED can be found on EPA's website: http://www.epa.gov/safewater/databases/sdwis/index.html.

[2] States and Indian Tribes are given primary enforcement responsibility (i.e. primacy) for regulations pertaining to public water systems in their State if they meet certain requirements specified under the primacy regulations at 40CFR142, Subpart B (revised most recently in 1998).

[3] A Maximum Contaminant Level (MCL) violation occurs when a PWS's assay for a regulated contaminant or contaminant indicator species (e.g. *E. coli or EC*) shows that the sample collected contains more than the maximum allowable concentration for this microbe. Under the current TCR, a monthly MCL violation occurs when >1 routine and/or repeat sample is TC+, or greater than 5% of monthly samples are TC+ for systems that take at least 40 samples. An acute MCL violation occurs when a repeat sample is FC+/EC+ or when a routine sample is FC+/EC+ and is followed by a TC+ repeat sample. Monitoring and reporting violations occur when a system 1) does not sample in accordance with its required schedule or 2) does not report the results of its monitoring program as required. A minor monitoring or reporting violation occurs when a system has one monitoring or reporting violation in a month; an acute violation occurs when 2 such violations occur within a month. Monitoring and reporting violations are based on consideration of all routine samples, additional routine samples, and repeat samples required under the TCR.

EPA defines a PWS as a system that provides water for human consumption through pipes or other constructed conveyances if such a system has at least 15 service connections or regularly serves an average of at least 25 individuals per day for at least 60 days per year. PWSs are categorized as follows:

- **Community Water Systems (CWS)** are PWSs that supply water to the same population year-round.

- **Noncommunity Water Systems (NCWS)** are PWSs that supply water to a varying population or one that is served less than year-round. They are sub-categorized as follows:

  - **Nontransient Noncommunity Water Systems (NTNCWS)** are public water systems that are not community water systems and that regularly supply water to at least 25 of the same people at least six months per year, for example, schools.

  - **Transient Noncommunity Water Systems (TNCWS)** are NCWSs that provide water in places such as gas stations or campgrounds where people do not remain for long periods of time.

Additionally, PWS are analyzed in this EA according to categories defined by the number of people they serve. The following eight categories of populations served by PWSs are used throughout this document:

- 500 and under
- 501-1,000
- 1,001-4,100
- 4,101-33,000
- 33,001-96,000
- 96,001-500,000
- 501,001-1 Million
- Over 1 Million

These population categories are mostly consistent with those analyzed for other rules and consider the distinctions in cost and system operation that are meaningful when considering the economic effects of rule requirements. In particular, under the current TCR, PWSs serving more than 1,000 people all test for TC monthly; PWSs serving fewer than 1,000 people may reduce monitoring frequency to quarterly or even annually and (assuming that they collect fewer than 5 samples per month) must have a sanitary survey every 5 years. The 33,000 threshold is significant as it corresponds with sampling requirements (at least 40 samples per month are taken) that affect how compliance with the rule is calculated. (PWSs with >33,000 persons served must take 40 or more samples in a month, and may trigger an MCL violation based on the percentage of TC+ samples, in this case, >5.0 percent.) Finally, the size category thresholds of

1,000; 4,100; 33,000; and 96,000 are consistent with the size categories used in the TCR to determine the monitoring regimen.

4.2.1.1 Data Used from SDWIS/FED

To create the system and population baseline, EPA obtained the most current PWS inventory data downloading data from the 4th quarter of 2007 from SDWIS/FED (USEPA, 2007). These data represent all current, active PWSs and the population served by these systems. This information composes the PWS inventory baseline for this EA, and is summarized in Section 4.3.

4.2.1.2 Data Cleaning

Data obtained from SDWIS/FED comprised PWS inventory data for the 4th quarter of 2007, including the number of each type of PWS and the retail population served by each system for all active PWSs. This data was used verbatim from SDWIS/FED and was not manipulated for the purpose of this analysis. The data set taken from the Six-Year Review database was cleaned as described in Section 4.2.2 of this EA.

4.2.1.3 Representativeness and Quality of SDWIS/FED Data

As noted above, SDWIS/FED is the source of PWS inventory data, and includes information on all of the approximately 155,000 PWSs to the extent that such data was entered by primacy agencies, EPA Regions, and EPA headquarters personnel. In 1998, EPA began a major effort to assess the quality of the drinking water data in SDWIS, including performance of a data quality assessment that has been published triennially since 2002. The most recent such report, the 2006 Drinking Water Data Reliability Analysis and Action Plan (2006 report) (USEPA, 2008a) evaluated data for 2002 – 2004 and found the PWS inventory data quality to be "high" and the TCR violations data to be "moderately high." For the PWS inventory data used in this analysis, EPA found specifically that:

> …The overall data quality of the eight inventory (water system identification) parameters assessed was 87%. In other words, 87% of PWSs from Data Verification[4] (DV) States between 2002 and 2004 had consistent data for all eight inventory data elements between their State files and SDWIS/FED database, or 13% of PWSs had at least one data element reported with a discrepancy. The highest discrepancy rate was for the administrative contact address element.

The assessment indicates a high degree of completeness and accuracy in data submitted by states to SDWIS/FED, and that the information is largely representative of the PWSs in the United States. Although the proposed RTCR EA uses inventory data from 2007, the assessment above applies to the most recent period analyzed in this report (2002-2004); thus EPA believes that the

[4] EPA routinely evaluates state programs by conducting Data Verification (DV) audits, which evaluate the accuracy of a state's decisions regarding PWS compliance with SDWA regulations and the accuracy with which inventory and compliance data is reported (entered or uploaded into) SDWIS/FED.

inventory data from SDWIS/FED in 2007 is also likely to be representative of the approximately 155,000 PWSs and that uncertainty in the data with respect to numbers of systems, water source type[5], and size classification is low.

4.2.2 Background on Six-Year Review Data

The 1996 amendments to the SDWA [Section 1412(b)(9)] require the EPA Administrator to review and revise, as appropriate, each national primary drinking water regulation not less than every six years. Through an Information Collection Request (USEPA, 2006b), EPA requested that States voluntarily submit monitoring data (sample results) that were collected between January 1998 and December 2005 that were available electronically for specified chemical, radiological, and microbiological contaminants. This request included data collected in compliance with the TCR regarding the presence/absence of TC, EC, and/or fecal coliforms (FC) and any disinfection data collected at TCR monitoring sites. (Surface water systems are required to monitor for the presence of a disinfectant residual when collecting coliform samples in the distribution system.)

These data are an important component in supporting EPA's second Six-Year Review of NPDWRs. EPA encouraged each primacy agency to submit its contaminant occurrence information because these data directly contribute to EPA's understanding of national contaminant occurrence, populations exposed to regulated contaminants, and exposure reductions associated with the current regulations.

EPA requested the TCR monitoring results with the intent of conducting analyses and developing models to assess the potential impacts of changes to the rule. Models of the occurrence of TC and EC were developed using the TCR data to assess revisions to monitoring requirements and compliance decisions for different types of PWSs as suggested by the stakeholders during the TCR Distribution System Advisory Committee (TCRDSAC) process, described further in Chapter 3 of this EA. The occurrence of TC is thought to be affected by seasonal influences, and so at least 12 consecutive months of data would be needed for an analysis.

4.2.2.1 Six-Year Review Data Used

As described in the Total Coliform Rule Compliance Monitoring Data Quality and Completion Report (USEPA, 2009b) (Data Quality Report) prepared during the TCRDSAC process prior to this EA, the Six-Year Review data is based on coliform monitoring data voluntarily provided to EPA by 37 primacy agencies (35 states and 2 tribes). The data consist of over nine million TCR records collected between 1998 and 2005. The data elements include the following:

[5] In particular, in the 2006 report the source water type (disinfecting, nondisinfecting, or status unknown) inventory item was assessed at 99.3%, indicating that less than 1% of DV states analyzed between 2002 and 2004 had a discrepancy in this information between State files and SDWIS/FED. For the purpose of the RTCR EA, systems with status listed as "unknown" were included in the nondisinfecting group.

- PWS information - system type, population, source water type.

- Sampling types- routine, repeat, special, unknown.

- Sampling locations - entry point, distribution system and, for repeat samples, original location, downstream, upstream, and other.

- Methods - for testing for TC and EC.

- Monitoring results – presence/absence for total coliforms, fecal coliforms, and *E. coli*.

EPA prepared a tool that States using the SDWIS/State database system could use to easily extract data from their databases and submit it to EPA. The data extraction tool was a query that collected the data elements requested in the letter to the States. The States that used this extraction tool are categorized as Tier 1 States. States submitting data in formats not compatible with the EPA extraction tool are categorized as Tier 2 States. States that submitted incomplete or problematic data are categorized as Tier 3, and States that did not provide data are categorized as Tier 4 (e.g., California, Florida, and Pennsylvania).

EPA used 2005 data exclusively in developing this EA. This decision was made for several reasons:

- The 2005 data, being the most recent in the Six-Year Review, were judged to be more representative of the current situation than the less recent data, especially in terms of the percent of TC records that were positive.

- There were fewer data in the years before 2005, especially 2001 and earlier, and therefore data in earlier years was judged to be too sparse to be comparable with the 2005 data. The difference in the base of PWSs studied year-to-year might have introduced an unknown bias.

- As noted earlier, the 2005 data had more records than other years, and enough to represent the full spectrum of PWSs within States that provided the data.

- Using only a single year of data was beneficial in that is simplified the analysis to include a fairly static set of PWSs, and did not require interpretation of the meaning of differences in occurrence data observed across multiple years. Understanding these types of differences would involve analysis of changing environmental factors, program participation and administration factors, and possibly other factors before the data could be used as a baseline in the model. Additionally, a full year (and not less) of observed data was required for consistency with the basic unit of time in occurrence estimates, which is one year; and a period of 12 consecutive months is assumed to capture seasonal variation normally experienced in water quality.

- A single year of data would allow for use of a single database to store all the data for easier analysis.

4.2.2.2 Data Cleaning of Six-Year Review Data

The Data Quality Report (USEPA, 2009b) describes how TCR monitoring data were obtained, evaluated, and modified where necessary to make the database internally consistent and usable for analysis. Exhibit 2.1 in the Data Quality Report provides a complete list of states or territories that submitted data and a description of the use of these data.

To determine whether a PWS's sampling data were complete in the Six-Year Review dataset, a representative month for a system was defined as having at least 50 percent of the number of samples expected based on the size of system and current TCR requirements. Using this 50% criterion, months that were not representative of a PWS were excluded; this cleaning resulted in a decrease of only 2% of submitted data, and is unlikely to have skewed occurrence results, as shown by Exhibits 3.1 and 3.2, respectively, of the Data Quality Report. EPA determined that a 50% criterion eliminated systems that were only reporting positive results or otherwise not reporting many of its samples, while retaining data for systems which had increased from one size category to the next (and were therefore expected to have, for example, 15 samples per month instead of 10). The Technical Work Group of the Federal Advisory Committee agreed with this approach, which is explained further in section 3.2 of the Data Quality Report.

4.2.2.3 Representativeness of Six-Year Review Data

In the course of cleaning the Six-Year Review data, EPA examined data from the 10 largest PWSs in each State and found, by matching with SDWIS inventory information, that many larger systems were not included in the data submitted by the States. For the largest systems that are represented in the Six-Year Review data, EPA also compared the expected number of samples based on population served (i.e., the TCR requires a system serving a million people to sample 300 times per month) to the number of samples in the actual data to evaluate completeness. In some cases it was found that only data from the State laboratory were included. Since many large PWSs have their own laboratory and do not use the State laboratories, data for these large systems were not available. In many cases, States handled large PWSs with negative samples in a special way, and those data were not captured by the data extraction tool. The end result was that large PWSs had a lower percentage of samples included in the data than did smaller systems; therefore, data for systems serving more than 4,100 were not used from this database. Instead, as described in Section 4.3.4.2, EPA used SDWIS/FED violations data to model changes in risk of contamination (as an indicator of risk to public health) and incremental costs for the proposed RTCR for PWSs serving 4,100-33,000 people. For systems serving >33,000 people, EPA did not quantify any changes in contamination risk based on violation data due to the low violation rates and overall high level of operational expertise generally found at systems in this size category.

Based on the number of smaller PWSs (serving fewer than 4,101 people) in States whose data were excluded for data quality/quantity issues or for non-submittal of data, approximately 30 percent of systems were excluded from the analysis. Specifically, the following states or territories submitted data but were excluded because of issues with the quality or quantity of data submitted: AL, American Somoa, DC, ME, MD, NJ, SC, SD, TN, and the Navajo Nation. Additionally, the following states/territories did not submit data: CA, Guam, HA, LA, MA, MS, Northern Mariana Islands, PA, Puerto Rico, TX, Virgin Islands, and WA. The remaining 70 percent of PWSs' data were used to simulate occurrence of TC and EC under the current TCR and proposed RTCR regulatory alternatives and to develop parameters for use in the RTCR predictive model, described in Chapter 5 of this EA. Although approximately 70 percent of the systems are represented in the analysis, only an estimated 50% of the population served by PWSs is represented due to the omission of some large population States (i.e., CA, PA, and TX). However, since EPA is not predicting changes in ocurrence for the largest systems (i.e., the majority of the population is served by very large CWSs) the under-representation of population served in the data is not expected to have a significant impact on the analyses performed.

4.2.3 Background on Other Data and Information Used

SDWIS/FED data and Six-Year Review data represent the largest portion of information used for the proposed RTCR baseline analysis. In addition, EPA incorporated information from the GWR, the U.S. Census, and the current TCR to develop assumptions for the model.

4.2.3.1 Current TCR

Under the current TCR, PWSs experienced reduced occurrence of fecal indicator contamination after the effective date in 1989 as a result of increased sampling, reporting, and to some degree corrective actions. In recent years under the TCR, the occurrence of fecal indicators has reached a steady state, as reflected in SDWIS/FED violation data (see section 4.3.4.2 for discussion). Additional reductions in occurrence are expected prior to proposed RTCR implementation that reflect water quality improvements due to implementation of the GWR. Because the water quality data used in this analysis is the Six-Year Review data for 2005, adjustments are made to the 2005 data in the modeling to reflect this GWR impact. Further reductions in occurrence of fecal indicators under the proposed RTCR can then be properly modeled based on more focused assessments and corrective actions in response to TC+ or EC+ samples.

4.2.3.2 GWR data

The GWR was promulgated to address microbial contamination of ground water sources used to supply drinking water and, specifically, to address the concern about potential adverse health risks that may be associated with fecal contamination. Before the GWR was promulgated, there were no federal regulations to require filtration or disinfection of ground water sources to remove microbial contaminants. The GWR requirements include sanitary surveys, triggered monitoring in response to TCR samples testing positive for contaminant indicators, source water

monitoring for indicators of fecal contamination such as EC, and corrective actions which may include disinfection.

Both the GWR and the proposed RTCR seek to decrease the level of fecal contamination in drinking water. Since the proposed RTCR applies to all public water systems including systems that use ground water sources, the implementation of the GWR (requiring compliance by December 1, 2009) in advance of the proposed RTCR is expected to modify the TCR baseline (see Sections 4.3.1 – 4.3.2 below) taken from the 2007 SDWIS/FED (4th quarter) and 2005 Six Year Review data (see sections 4.2.1 and 4.2.2 for discussion of SDWIS/FED and Six Year Review data, respectively). The number of disinfecting and non-disinfecting public groundwater systems prior to the start of GWR implementation in October 2009 (based on 4th quarter 2007 SDWIS/FED data) is 54,469 and 85,999, respectively. By October 2012 when the GWR is fully implemented, EPA predicts that the number of systems disinfecting will have increased from the 2007 4th quarter baseline. The proposed RTCR occurrence model estimates and incorporates the estimated change in the number of systems with disinfection into this EA baseline (Section 5.3.1).

The RTCR occurrence model (described in further detail in section 5.3 of this EA) accounts for GWR implemention in the following ways:

- The baseline number of disinfecting systems in the 4th quarter 2007 data of SDWIS/FED will be increased to account for the additional systems that are estimated to begin disinfecting under the GWR.

- Sanitary surveys will be phased in for applicable PWSs in the model (over five years for systems on a five year sanitary survey cycle; and over three years for systems on a three year cycle), resulting in reduced occurrence for these systems indefinitely. Further detail on this component of the model is provided in Chapter 5 of this EA.

- GWR compliance monitoring will be incorporated with an additional decrease in probability of occurrence.

- The baseline estimates will account for the decreased levels of fecal contamination achieved under the GWR. This decrease will be reflected in model output for the following proposed RTCR rule components:

    - Repeat monitoring
    - Additional routine monitoring
    - Triggers for level 1 and 2 assessments
    - Corrective actions
    - Public notification

- Under the GWR, a public ground water system may be required to take five additional fecal indicator samples if system operators choose not to take corrective action immediately. Given this scenario, the proposed RTCR baseline level of repeat

monitoring is expected to increase for groundwater systems achieving less than 4-log treatment[6] for viruses from the pre-GWR level. Under the GWR, if a PWS experiences a TC positive under the monitoring of the TCR, the system must sample the source water for the presence of a fecal indicator (EC, enterococci, or coliphage, as determined by the State). Ground water PWSs that have a positive initial fecal indicator at the source are required to take five additional fecal indicator samples if they are not required by the State to take corrective action immediately. Under the proposed RTCR, PWSs having less than 4-log treatment and serving fewer than 1000 people would only be required to take 3 repeat samples. For these systems, an additional sample would need to be collected at the source to satisfy GWR requirements.

4.2.3.3 U.S. Census Data

The baseline analysis incorporates data from the U.S. Census that are publically available and include surveys of the U.S. population, economics, industry, and geography. Census 2000 data were used in the baseline analyses to estimate the sensitive subpopulations in the U.S. who may be more susceptible to illness as a result of poor drinking water quality, as explained in Section 4.4 of this EA. Additionally, the Census 2008 Annual Social and Economic Supplement was used in the estimates of household size as described in Section 4.3.2.

4.3 Baseline Profile

The proposed RTCR applies to all PWSs, regardless of their size, water source (ground water or surface water), or type (community, non-community non-transient, non-community transient). This section estimates the baseline number of PWSs and the size of the population subject to the proposed RTCR in each of these subcategories. EPA used 4th quarter 2007 data from SDWIS to develop this inventory baseline because, at the time when the TCRDSAC began discussing the proposed rule and its analysis, 2007 data were the most recent inventory data available. As described in Section 4.2, the best available occurrence data for smaller PWSs was collected in 2005. As Section 4.3.4.2 describes, EPA used SDWIS-FED violations data for modeling changes in benefits or costs for PWSs serving from 4,101 to 33,000 people because the Six-Year Review dataset for larger systems was not as robust. Third quarter 2007 SDWIS/FED data is used for the violation baseline since EPA compiles violation data in the 3rd quarter every year (as opposed to the 4th quarter freeze used for annual compilation inventory data) and was the most recently available data at the time that this analysis was begun. Use of the most recent year of data was deemed to be equivalent to an average of multiple years due to the steady numbers of violations seen in the data over the past several years.

The baseline described in the following sections is used as input to the benefit and cost models described in Chapters 6 and 7 of this report.

[6] 4-Log treatment removes 99.99% of viruses.

4.3.1 Pre-GWR Baseline

Estimates of the number of ground water PWSs subject to the proposed RTCR are presented in Exhibit 4.1 (below). These numbers reflect SDWIS/FED inventory from the fourth quarter of 2007, prior to implementation of the GWR. Ground water system inventories indicate disinfection status as disinfecting or unreported; since reporting is voluntary, the status of a system that did not report disinfection is actually unknown, although EPA assumes in this EA that the system is not disinfecting. The number of disinfecting PWSs includes those achieving less than 4-log disinfection, which matches the categorization of systems used to estimate the underlying distributions of occurrence of TC and EC modeled, as described in Chapter 5.

Exhibit 4.2 presents the number of surface water PWSs subject to the proposed RTCR, also derived from the SDWIS/FED database. GWR implementation does not affect the disinfection status of surface water systems.

Exhibit 4.3 presents the population associated with each PWS category of system size and type prior to incorporating the effects of the GWR into the model; this is the pre-GWR baseline affected population. After incorporating GWR effects, some number of systems shift into the disinfecting category, and some of the population shifts accordingly.

Lastly, Exhibit 4.4 presents the distribution of PWSs by frequency of sampling – monthly, quarterly, or annually – under the current TCR for those systems that qualify for reduced monitoring (all other systems are required to sample monthly). This is the baseline distribution of sampling frequencies used for analyses in this EA. This distribution was derived as part of the work done by the technical workgroup (TWG) supporting the TCRDSAC. Workgroup members analyzed Six Year Review and other readily available State data to derive the estimates shown in Exhibit 4.4.

Exhibit 4.1 Pre-GWR Baseline Number of GW Systems

System Size	CWS		NTNCWS		TNCWS	
	Disinfecting	Non-Disinfecting	Disinfecting	Non-Disinfecting	Disinfecting	Non-Disinfecting
500 & under	15,392	10,438	5,660	9,779	18,899	60,576
501-1000	3,502	965	868	850	673	1,290
1001-4,100	5,405	1,038	542	270	269	348
4,101-33,000	2,798	358	56	14	27	40
33.001-96,000	307	28	2	0	0	2
96,001-500,000	62	1	0	0	0	1
500,001-1 Million	4	0	0	0	0	1
Over 1 Million	3	0	0	0	0	0
Total	**27,470**	**12,828**	**7,128**	**10,913**	**19,868**	**62,258**
Combined Total	**40,298**		**18,041**		**82,126**	

Source: Data extracted from SDWIS/FED PWS Inventory, 2007 4th Quarter Data based on listed disinfection status. PWSs listed as "unknown" disinfection status in SDWIS/FED are counted as non-disinfecting.

Exhibit 4.2 Baseline Number of SW Systems

System Size	CWS	NTNCWS	TNCWS
500 & under	3,320	503	1,836
501-1,000	1,173	88	88
1,001-4,100	2,938	72	67
4,101-33,000	3,164	22	18
33,001-96,000	720	2	0
96,001-500,000	308	1	0
500,001-1 Million	31	0	0
Over 1 Million	17	0	1
Total	**11,671**	**688**	**2,010**

Source: Data extracted from SDWIS/FED PWS Inventory, 2007 4th Quarter Data. SW count includes GWUDI systems.

Exhibit 4.3 Pre-GWR Baseline Population Served by GW Systems

System Size	CWS		NTNCWS		TNCWS	
	Disinfecting	Non-Disinfecting	Disinfecting	Non-Disinfecting	Disinfecting	Non-Disinfecting
500 & under	2,763,065	1,427,798	876,906	1,274,842	1,877,026	5,145,232
501-1000	2,570,662	703,562	630,071	600,643	516,707	956,781
1001-4,100	11,307,740	2,074,139	991,971	456,985	449,757	599,171
4,101-33,000	29,346,057	3,627,365	418,368	122,865	194,136	353,290
33.001-96,000	15,587,186	1,527,861	89,405	0	0	119,700
96,001-500,000	9,935,500	107,323	0	0	0	100,000
500,001-1 Million	2,670,841	0	0	0	0	725,000
Over 1 Million	4,389,948	0	0	0	0	0
Total	**74,181,051**	**9,468,048**	**3,006,721**	**2,455,335**	**3,037,626**	**7,999,174**
Combined total	**83,649,099**		**5,462,056**		**11,036,800**	

Source: Data extracted from SDWIS/FED PWS Inventory, 2007 4th Quarter Data based on listed disinfection status. Populations for PWSs listed as "unknown" disinfection status in SDWIS/FED are counted as non-disinfecting.

Exhibit 4.4 Percent Distribution of Ground Water PWS Monitoring Frequencies by PWS Size and Type

Source Water	Disinf?	Sys Type	Size	Subsize	N Systems	Monthly	Quarterly	Annual
GW	Y	TNCWS	<100	<100	13,558	4.8%	62.9%	32.3%
GW	Y	TNCWS	101-1000	101-500	5,341	7.7%	66.5%	25.8%
				501-1000	673	9.4%	70.3%	20.3%
GW	Y	NTNCWS	<100	<100	2,907	19.3%	64.6%	16.0%
GW	Y	NTNCWS	101-1000	101-500	2,753	18.5%	66.4%	15.1%
				501-1000	868	18.6%	67.8%	13.6%
GW	Y	CWS	<100	<100	6,132	88.6%	13.4%	0.0%
GW	Y	CWS	101-1000	101-500	9,260	88.7%	11.3%	0.0%
				501-1000	3,502	88.1%	11.9%	0.0%
GW	N	TNCWS	<100	<100	46,642	4.8%	62.9%	32.3%
GW	N	TNCWS	101-1000	101-500	13,934	7.7%	66.5%	25.8%
				501-1000	1,290	9.4%	70.3%	20.3%
GW	N	NTNCWS	<100	<100	5,919	19.3%	64.6%	16.0%
GW	N	NTNCWS	101-1000	101-500	3,860	18.5%	66.4%	15.1%
				501-1000	850	18.6%	67.8%	13.6%
GW	N	CWS	<100	<100	5,806	86.6%	13.4%	0.0%
GW	N	CWS	101-1000	101-500	4,632	88.7%	11.3%	0.0%
				501-1000	965	88.1%	11.9%	0.0%

Note: All other system sizes and types are required to sample monthly.
Source:Based on EPA and TWG analysis of Six-Year data and individual State statutes during the TCRDSAC.

4.3.2 Post-GWR Baseline

PWSs must comply with requirements of the GWR by December 1, 2009, which will be approximately five years prior to the effective date of the proposed RTCR. To account for the impact of the GWR on baseline occurrence for those public water systems using a ground water source, EPA performed a number of adjustments to the 2005 data prior to its use in this EA.

Using 2007 SDWIS inventory data (as explained in Section 4.3.1) as a pre-GWR inventory baseline, EPA applied probabilities of p_{sample} and p_{well}[7] to determine the probability of a positive sample for a fecal indicator in non-disinfecting PWSs. A fraction of those systems with a positive sample is expected to move to a disinfecting status in the five years prior to proposed RTCR implementation. This modification ensured that systems in the analysis that disinfect drew from the appropriate probability distribution for TC+ and EC+, which is different from the distribution for those that do not disinfect. The model continues to apply p_{well} and p_{sample} throughout the proposed RTCR period of analysis (the 25 years following promulgation). The

[7] The term "P_{well}" refers to the probability that a randomly selected well across the United States will test positive in its source water for a virus or indicator species, such as TC; "P_{sample}" is the probability that given a contaminated well, a random sample at the well will test positive for a virus or indicator. The GWR EA (November 2006) (USEPA, 2006a), and in particular the Baseline Chapter of that document, provides a detailed explanation of the analysis used to generate these p_{well} and p_{sample} estimates.

application of this model parameter, as it is applied in the context of other aspects of the predictive occurrence model, is explained in further detail in Chapter 5 of this EA. Exhibit 4.5 shows the baseline inventory of ground water systems by disinfection status in model year 5, which is the year immediately prior to proposed RTCR promulgation. The estimates in Exhibit 4.5 of non-disinfecting PWSs include a number of systems that selected a corrective action other than converting to a disinfecting system in response to an acute violation. As explained in Chapter 5 of this EA, a number of PWSs will undertake sanitary surveys prior to implementation of the proposed RTCR; although the costs are not considered in this EA, the systems are assigned a reduced occurrence, which is reflected in the proposed RTCR baseline.

Exhibit 4.5 Post-GWR Baseline Number of GW Systems

System Size	CWS		NTNCWS		TNCWS	
	Disinfecting	Non-Disinfecting	Disinfecting	Non-Disinfecting	Disinfecting	Non-Disinfecting
500 & under	15,475	10,355	5,709	9,730	19,217	60,258
501-1000	3,512	955	873	845	683	1,280
1001-4,100	5,421	1,022	546	266	274	343
4,101-33,000	2,798	358	56	14	27	40
33.001-96,000	307	28	2	0	0	2
96,001-500,000	62	1	0	0	0	1
500,001-1 Million	4	0	0	0	0	1
Over 1 Million	3	0	0	0	0	0
Total	**27,579**	**12,719**	**7,186**	**10,855**	**20,201**	**61,925**
Combined Total	**40,298**		**18,041**		**82,126**	

Source: proposed RTCR Predictive Occurrence Model Output

4.3.3 Baseline Population Served

PWS population characteristics are important to this analysis for determining the number of people, both prior to and following implementation of the GWR, for which risk changes under each component of the rule, as indicated in Chapter 6 of this EA. These population estimates are based on SDWIS/FED 2007 4th quarter data as described in Section 4.2.1, and stratified by PWS size, type, whether the system disinfects or not and whether the system uses GW or SW sources. The estimates are of the number of systems which disinfect water and their population adjusted upward based on impacts of GWR just prior to proposed RTCR promulgation, as shown in Exhibits 4.6 and 4.7 below. (See Exhibits 4.1 and 4.3 for PWS counts and population served by disinfection status prior to affects of GWR).

Exhibit 4.6 Post-GWR Baseline Population Served by GW Systems

System Size	CWS		NTNCWS		TNCWS	
	Disinfecting	Non-Disinfecting	Disinfecting	Non-Disinfecting	Disinfecting	Non-Disinfecting
500 & under	2,774,483	1,416,380	883,270	1,268,478	1,904,002	5,118,256
501-1000	2,577,907	696,317	633,374	597,340	524,334	949,154
1001-4,100	11,338,884	2,042,995	998,871	450,085	458,103	590,825
4,101-33,000	29,346,057	3,627,365	418,368	122,865	194,136	353,290
33.001-96,000	15,587,186	1,527,861	89,405	0	0	119,700
96,001-500,000	9,935,500	107,323	0	0	0	100,000
500,001-1 Million	2,670,841	0	0	0	0	725,000
Over 1 Million	4,389,948	0	0	0	0	0
Total	**74,230,857**	**9,418,242**	**3,023,288**	**2,438,768**	**3,080,574**	**7,956,226**
Combined total	**83,649,099**		**5,462,056**		**11,036,800**	

Source: Estimates calculated based on the proportion of PWSs changing disinfection status, which is an output from the predictive occurrence model, as described in Chapter 5 of this EA.

Exhibit 4.7 Baseline Population Served by SW Systems

System Size	CWS	NTNCWS	TNCWS
500 & under	664,824	81,380	173,983
501-1,000	885,400	67,958	70,147
1,001-4,100	6,628,597	140,168	143,347
4,101-33,000	38,700,554	174,408	147,423
33,001-96,000	39,034,554	121,446	0
96,001-500,000	58,489,936	203,000	0
500,001-1 Million	22,327,506	0	0
Over 1 Million	37,363,275	0	2,000,000
Total	**204,094,646**	**788,360**	**2,534,900**

Source: Data extracted from SDWIS/FED PWS Inventory, 2007 4th Quarter Data. Population figures for SW systems include GWUDI systems.

Number of Households Served

Because PWS costs are often passed onto customers in the form of water rate increases, the proposed RTCR EA also includes analyses to assess the impact of the rule provisions at a household level. The number of households served by CWSs expected to be subject to the proposed RTCR is estimated by dividing the population for each PWS size category (Exhibits 4.6 and 4.7 above) by the average number of people per household, which was estimated as 2.56 for the year 2007 (*U.S. Census Bureau Annual Social and Economic Supplement*, 2008). Exhibit 4.8 below shows the number of households served in groundwater and surface water systems, respectively.

Exhibit 4.8 Household Baseline

System Size	Number of Households Served		
	GW CWS		SW CWSs
	Disinfecting	Non-Disinfecting	Disinfecting
500 & under	1,079,322	557,734	259,697
501-1000	1,004,165	274,829	345,859
1001-4,100	4,417,086	810,211	2,589,296
4,101-33,000	11,463,304	1,416,939	15,117,404
33,001-96,000	6,088,745	596,821	15,247,873
96,001-500.000	3,881,055	41,923	22,847,631
500,001-1 Million	1,043,297	0	8,721,682
Over 1 Million	1,714,823	0	14,595,029
Total	30,691,796	3,698,456	79,724,471

Sources: U.S. Census Bureau, Current Population Survey, 2008 Annual Social and Economic Supplement; SDWIS/FED PWS Inventory, 2007 4th Quarter Data

4.3.4 Baseline Water Quality

The following sections provide an overview of summary statistics relating to baseline water quality. The source data from which these summary statistics are derived form the basis of further analysis in the proposed RTCR occurrence and risk assessment models as described in later chapters of the EA.

4.3.4.1 Percent of TC and EC Positive Samples Based on Six-Year Review Data

Exhibit 4.9 (below) shows the percent of TC and EC positive samples (TC+ and EC+, respectively) based on PWS type and size. The TC+ rate was calculated by taking the total number of routine TC+ samples and dividing by the number of routine TC samples. For small PWSs, additional routine TC samples in the month following a TC+ were included in the denominator. To calculate the EC+ rate, the total number of EC+ samples was divided by the total number of TC- samples[8] plus the number of TC+ samples that were tested for EC. This EC+ computation did not include additional routine samples taken in the month following a TC+ because a significant number of PWSs did not provide data on EC+ or EC- samples, and some systems tested for FC and not EC.

[8] EPA assumes that a PWS will not test for EC if the TC assay is negative.

Exhibit 4.9 TC and EC Percent Positive (Using 50% Criterion) by System Size and Type

System Type	Source Water	Population Served	TC (# Samples)	TC (+ Samples)	TC (% Positive)	EC (# Samples) [1]	EC (+ Samples)	EC (% Positive)[2]
CWS	GW	<=500	218,595	4,979	2.28%	5,820	316	0.14%
		501-1,000	48,265	736	1.52%	483	20	0.04%
		1,001-4,100	110,391	1,176	1.07%	732	21	0.02%
		4,101-33,000	183,721	877	0.48%	458	22	0.01%
		33,001-100,000	96,361	214	0.22%	44	2	0.00%
		>100,000	64,965	289	0.44%	34	1	0.00%
		Total GW	722,298	8,271	1.15%	7,571	382	0.05%
	SW	<=500	26,451	322	1.22%	223	16	0.06%
		501-1,000	12,828	90	0.70%	70	7	0.05%
		1,001-4,100	55,310	314	0.57%	233	17	0.03%
		4,101-33,000	175,758	525	0.30%	399	41	0.02%
		33,001-100,000	112,894	157	0.14%	106	5	0.00%
		>100,000	112,143	235	0.21%	99	2	0.00%
		Total SW	495,384	1,643	0.33%	1,130	88	0.02%
	GW & SW	**Total CWS**	1,217,682	9,914	0.81%	8,701	470	0.04%
TNCWS	GW	<=500	216,621	10,238	4.73%	7,689	415	0.19%
		501-1,000	6,952	299	4.30%	217	4	0.06%
		>1,000	7,062	143	2.02%	85	2	0.03%
		Total GW	230,635	10,680	4.63%	7,991	421	0.18%
	SW	<=500	9,577	225	2.35%	210	30	0.31%
		501-1,000	523	19	3.63%	19	-	0.00%
		>1,000	988	6	0.61%	37	-	0.00%
		Total SW	11,088	250	2.25%	266	30	0.27%
	GW & SW	**Total TNCWS**	241,723	10,930	4.52%	8,257	451	0.19%
NTNCWS	GW	<=500	79,589	2,369	2.98%	1,689	53	0.07%
		501-1,000	9,531	166	1.74%	103	2	0.02%
		>1,000	13,138	177	1.35%	103	5	0.04%
		Total GW	102,258	2,712	2.65%	1,895	60	0.06%
	SW	<=500	3,972	41	1.03%	39	6	0.15%
		501-1,000	932	6	0.64%	5	-	0.00%
		>1,000	1,316	1	0.08%	1	-	0.00%
		Total SW	6,220	48	0.77%	45	6	0.10%
	GW & SW	**Total NTNCWS**	108,478	2,760	2.54%	1,940	66	0.06%

Source: Derived using Six-Year Review Data, which was filtered by including a State only if the State's PWSs as a group had submitted at least 50% of the expected sample-months of usable data. The Total Coliform Rule Compliance Monitoring Data Quality and Completion Report (USEPA, 2009b) includes a detailed description of this data cleaning process.

Notes: [1] "#EC samples" is the denominator of the EC% positive calculation, and includes # TC- samples plus #TC+ samples that were tested for EC.

[2] Percent EC+ was calculated as (# EC+ samples)/("# EC samples")

4.3.4.2 Violations Levels Based on SDWIS/FED Data

Non-acute violations are triggered under the current TCR by water quality violations. Non-acute violations are defined as >1 routine or repeat monitoring sample testing positive for TC in a given compliance period (month, quarter, or year) for small PWSs (serving fewer than 33,001 people), or by >5.0 percent of samples being positive for systems taking >40 samples per month (typically those systems serving greater than 33,000 people). Acute violations are triggered when any PWS has repeat sample with an EC+ or FC+ or has an FC+ or EC+ routine sample followed by a TC+ repeat sample in a given month.

Exhibit 4.10 below presents an assessment of water quality prior to RCTR rule promulgation in terms of the number of acute and non-acute violations received by PWSs. The number of violations from this data are directly input into the cost model for PWSs serving 4,101 to 33,000 people to derive estimates of the number of assessments and corrective actions that will be undertaken under the proposed RTCR. The most recent data available at the time this EA was undertaken is for samples collected in 2007. For violations analysis, only the most recent year of data (2007) was used in order to simplify analyses. This was deemed appropriate due to the relatively stable numbers of PWSs with violations seen in the data over the last several years as analyzed by the TWG supporting the TCRDSAC. Exhibit 4.11 presents the PWS violation data[9] evaluated by the TWG along with the two most recent years (2006 and 2007) of data. In addition to the acute and non-acute system violation data, Exhibit 4.11 also presents data on the numbers of PWSs with monitoring and reporting violations (minor and major for routine and repeat monitoring and reporting). Although PWS monitoring and reporting violation data is not used directly in the quantitative anlyses performed for the EA, they did play an important part in the TCRDSAC deliberations on the impact of the regulation. In particular, the TCRDSAC committee believes that the proposed revisions to the RTCR may significantly reduce the high numbers of monitoring and reporting violations and eliminate the associated burden incurred for dealing with them.

The data verification process was used to review individual States' data in comparison to SDWIS/FED data and to compare violations rates across states. This process revealed many differences between states in their implementation of the TCR, and allowed EPA to identify and review outliers in the national database. Specifically, EPA did not include violation data from Ohio, U.S. territories, or tribal PWSs in the summaries presented in Exhibits 4.10 and 4.11. Review of the data verification information revealed that Ohio's broad interpretation of what constitutes a violation lead to abnormally high violation counts compared (on average) to other states. For U.S. territories and tribal systems, it was established that unique environmental factors and operating conditions contribute to abnormally high TC+ results (and associated violations). Thus, inclusion of these results would skew the national averages used for analysis, and where therefore excluded.

[9] Exhibit 4.11 presents PWS counts (PWSs with at least one violation during the year) to be consistent with the metric evaluated by the TCRDSAC TWG. Exhibit 4.10 presents total violation counts, which are used as inputs to the predictive modeling for the EA.

Exhibit 4.10 Baseline Number of TCR Violations by System Size and Type (2007)

	GW Systems			SW Systems			All Systems Total
	Non-Acute	Acute	Total	Non-Acute	Acute	Total	
CWSs							
≤500	1,787	124	1,911	62	70	132	2,043
501-1,000	147	7	154	18	1	19	173
1,001-4,100	350	10	360	88	2	90	450
4,101-33,000	175	5	179	95	5	100	280
33,001-96,000	19	0	20	22	2	24	43
96,001-500,000	4	0	4	9	1	10	14
500,001-1 Million	-	1	1	-	-	-	1
> 1 Million	1	-	1	-	-	-	1
Subtotal	**2,483**	**147**	**2,630**	**294**	**81**	**375**	**3,005**
NTNCWSs							
≤500	881	65	946	3	-	3	949
501-1,000	46	8	54	2	-	2	56
1,001-4,100	51	4	55	9	-	9	64
4,101-33,000	5	0	5	2	-	2	7
33,001-96,000	0	-	0	-	-	-	0
96,001-500,000	-	-	-	-	-	-	-
500,001-1 Million	-	-	-	-	-	-	-
> 1 Million	-	-	-	-	-	-	-
Subtotal	**983**	**77**	**1,060**	**16**	**-**	**16**	**1,076**
TNCWSs							
≤500	4,027	391	4,418	41	13	54	4,472
501-1,000	118	8	126	3	-	3	129
1,001-4,100	44	3	47	1	-	1	48
4,101-33,000	4	0	4	0	-	0	4
33,001-96,000	-	-	-	-	-	-	-
96,001-500,000	-	-	-	-	-	-	-
500,001-1 Million	-	-	-	-	-	-	-
> 1 Million	-	-	-	-	-	-	-
Subtotal	**4,193**	**402**	**4,595**	**45**	**13**	**58**	**4,653**
Total	**7,659**	**626**	**8,285**	**355**	**94**	**449**	**8,734**

Source: SDWIS/FED 2007 3rd quarter data. OH, U.S. territories, tribal PWS data excluded.
Note: This EA uses violations data for only PWSs serving 4,101 to 33,000 people. Data for other system sizes is provided for reference only.

Exhibit 4.11 Number of PWSs with Violations by System Type (2001 – 2007)

System Type	Year						
	2001	2002	2003	2004	2005	2006	2007
Acute MCL Violations							
CWS	143	144	196	177	156	185	180
NTNCWS	54	60	74	60	71	73	46
TNCWS	290	295	365	380	371	403	333
All	487	499	635	617	598	661	559
Non-Acute MCL Violations							
CWS	2,073	2,072	2,238	2,363	2,251	2,158	2,048
NTNCWS	652	729	777	833	835	806	679
TNCWS	2,941	2,980	3,330	3,458	3,361	3,546	3,419
All	5,666	5,781	6,345	6,654	6,447	6,510	6,146
Major Monitoring and Reporting Violations (Routine and Repeat)							
CWS	3,321	3,281	3,959	4,037	4,023	3,900	3,552
NTNCWS	1,543	1,590	1,765	1,798	1,691	1,620	1,471
TNCWS	10,957	11,192	12,229	12,134	12,091	12,062	11,402
All	15,821	16,063	17,953	17,969	17,805	17,582	16,425
Minor Monitoring and Reporting Violations (Routine and Repeat)							
CWS	1,255	1,295	1,443	1,472	1,337	1,359	1,287
NTNCWS	193	192	220	241	179	225	191
TNCWS	764	908	978	972	986	914	899
All	2,212	2,395	2,641	2,685	2,502	2,498	2,377

Note: PWSs counts are of systems that had at least one violation during the year.
Source: SDWIS/FED annual data for period ending 3rd quarter 2001 – 2007. OH, U.S. territories, tribal PWS data excluded.

4.4 Sensitive Sub-populations

Under the SDWA Amendments of 1996 (PL 104-182), EPA must analyze health impacts of rulemaking on sensitive subpopulations. Sensitive populations include "infants, children, pregnant women, the elderly, individuals with a history of serious illness, and other subpopulations that are identified as likely to be at a greater risk of adverse health effects due to exposure to contaminants in drinking water than the general population." (USEPA, 1996)

Exhibit 4.11 presents the EPA's estimates of the number of U.S. individuals who are at increased risk of developing more severe symptoms from illnesses caused by waterborne pathogens. Persons suffering from certain diseases and/or conditions are believed to be sensitive to microbes and chemicals in drinking water. These subgroups of the population include pregnant women, the very young, the elderly, and the immunocompromised. In total these subgroups represent approximately 20 percent of the current population of the United States.

Exhibit 4.11 Estimates of Sensitive Subpopulations in the United States

Sensitive Population	Individuals	Approximate Percent of U.S. Population[1]	Citation/Notes
Pregnant women and neonates			
Pregnant Women	6,240,000	2.2	Vital and Health Statistics, CDC (Ventura, 2000)
Neonates (under one month)[2]	317,137	0.1	U.S. 2000 Census (US Census Bureau, 2001a)
Age-based sensitive populations			
Children (< 5 years old)	19,175,798	6.8	U.S. 2000 Census (US Census Bureau, 2001a)
Elderly (> 65 years old)	34,991,753	12.4	U.S. 2000 Census (US Census Bureau, 2001a)
Compromised immune status			
Bone marrow transplant Recipients	20,000	0.01	National Marrow Donor Program http://.marrow.org/MEDIA/facts_figures.pdf
AIDS Patients	816,149	0.3	HIV/AIDS Surveillance Report, cases through 2001 (CDC, 2002)
Organ transplant recipients	23,143	0.01	U.S. Census Bureau, Statistical Abstract of the U.S., based on 1998 data (2001b)
Total	61,583,980	21.8	

[1] Based on U.S. Census estimate (July 2000).
[2] 1/12 of the 2000 census population for age <1 year.

References

Centers for Disease Control (CDC). 2002. *HIV/AIDS Surveillance Report: U.S. HIV and AIDS cases reported through December 2001*. Vol. 13. No. 2.

United States Census Bureau. 2001a. Households and Families: 2000. *Census 2000 Brief. C2KBR/01-8*.

United States Census Bureau. 2001b. *Statistical Abstract of the United States: 2001*. Washington, DC. Economics and Statistics Administration.

United States Census Bureau. 2008. *Current Population Survey. Annual Social and Economic Supplement.* Population Division, Education & Social Stratification Branch.

United States Environmental Protection Agency (USEPA). 1996. Amendments to the Safe Drinking Water Act. 63 *FR* 40585.

United States Environmental Protection Agency (USEPA). 2006a. *Ground Water Rule Economic Analysis. Office of Water*. EPA 815-R-06-014. October 2006.

United States Environmental Protection Agency (USEPA). 2006b. *Information Collection Request for Contaminant Occurrence Data in Support of EPA's Second Six-Year Review of National Primary Drinking Water Regulations*. EPA ICR Number 2231.01., OMB Control No. 2040.

United States Environmental Protection Agency (USEPA). 2007. *The Safe Drinking Water Information System – Federal Version (SDWIS/FED) data.* Available online: http://epa.gov/enviro/html/sdwis/ [29 Apr 2009].

United States Environmental Protection Agency (USEPA). 2008a. *2006 Drinking Water Data Reliability Analysis and Action Plan*, EPA 816-R-07-010. March 2008. Available online: www.epa.gov/safewater.

United States Environmental Protection Agency (USEPA). 2009b. *Total Coliform Rule Compliance Monitoring Data Quality and Completion Report, Draft Report.* April 2009.

Ventura, S. J., Mosher, W.D., Curtin, S.C., Abma J.C., and S. Henshaw. 2000. *Trends in pregnancies and pregnancy rates by outcome: estimates for the United States, 1976-96.* Vital and health statistics. Series 21, Data on natality, marriage, and divorce 2000;(56):1-47.