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Small System Regulatory Requirements Under the Safe Drinking Water Act as Amended 1996

Fact Sheets for Existing and Future Rules

Case Studies:
Cost Estimates of Small System Compliance

Small System Regulatory Requirements Under the Safe Drinking Water Act as Amended in 1996

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Case Studies: Cost Estimates of Small System Compliance

This document was prepared to support the deliberations of
the National Drinking Water Advisory Council's
Small Systems Implementation Working Group

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Fact Sheet:
Stage 1 Disinfection By-Products Rule

- **Effective Date**—
  - Published November 16, 1998
  - Finalized December 16, 1998
  - EPA is publishing an additional *Federal Register* notice making minor alterations to the rule including changing the compliance dates to January 1st, therefore:
    - Surface water and GWUDI systems serving 10,000 or more persons must comply by January 1, 2002 (three years from promulgation)
    - Surface water and GWUDI systems serving fewer than 10,000 persons and ground water systems must comply by January 1, 2004 (five years from promulgation)
- **Affected Systems**—All CWSs and NTNCWSs that treat their water with a chemical disinfectant for either primary or residual treatment. Certain requirements for chlorine dioxide also apply to TNCWSs.
- **Basic Provisions**—
  - Maximum residual disinfectant level goals (MRDLGs) and maximum residual disinfectant levels (MRDLs) for disinfectants
    - Chlorine
      - MRDLG: 4 mg/L (as Cl_2)
      - MRDL: 4 mg/L (as Cl_2)
    - Chloramine
      - MRDLG: 4 mg/L (as Cl_2)
      - MRDL: 4 mg/L (as Cl_2)
    - Chlorine dioxide (applies to TNCWSs)
      - MRDLG: 0.8 mg/L (as Cl_2)
      - MRDL: 0.8 mg/L (as Cl_2)
  - Maximum contaminant level goals (MCLGs) and maximum contaminant levels (MCLs) for disinfection byproducts
    - Total trihalomethanes (TTHMs) MCL: 0.080 mg/L (sum of the concentrations of the following)
      - Chloroform MCLG: 0 mg/L
      - Bromodichloromethane MCLG: 0 mg/L
      - Dibromochloromethane MCLG: 0.06 mg/L
      - Bromoform MCLG: 0 mg/L
    - Haloacetic acids (HAA5) MCL: 0.060 mg/L (sum of the concentrations of mono-, di-, and trichloroacetic acids and mono- and dibromoacetic acids)
      - Dichloroacetic acid MCLG: 0 mg/L
      - Trichloroacetic acid MCLG: 0.3 mg/L
    - Chlorite
      - MCLG: 0.8 mg/L
      - MCL: 1.0 mg/L
    - Bromate
      - MCLG: 0 mg/L
      - MCL: 0.010 mg/L

Fact Sheet:
Stage 1 Disinfection By-Products Rule (continued)

- Treatment technique for disinfection byproduct precursors
  - Systems that use surface water or GWUDI and use conventional filtration must remove specified percentages of organic materials (measured as total organic carbon (TOC)), using either enhanced coagulation or enhanced softening
    The removal percentage for each system depends upon its source water TOC concentration and alkalinity:
    - if the system's source water contains >2.0-4.0 mg/L TOC:
      - ›› it must remove 35% of TOC if alkalinity (as $CaCO_3$) is 0-60 mg/L
      - ›› it remove 25% of TOC if alkalinity (as $CaCO_3$) is >60-120 mg/L
      - ›› it must remove 15% of TOC if alkalinity (as $CaCO_3$) is >120 mg/L
    - if the system's source water contains >4.0-8.0 mg/L TOC:
      - ›› it must remove 45% of TOC if alkalinity (as $CaCO_3$) is 0-60 mg/L
      - ›› it must remove 35% of TOC if alkalinity (as $CaCO_3$) is >60-120 mg/L
      - ›› it must remove 25% of TOC if alkalinity (as $CaCO_3$) is >120 mg/L
    - if the system's source water contains >8.0 mg/L TOC:
      - ›› it must remove 50% of TOC if alkalinity (as $CaCO_3$) is 0-60 mg/L
      - ›› it must remove 40% of TOC if alkalinity (as $CaCO_3$) is >60-120 mg/L
      - ›› it must remove 30% of TOC if alkalinity (as $CaCO_3$) is >120 mg/L
    - the rule provides alternate performance criteria when it is technically infeasible for systems to meet these TOC removal requirements
      - ›› for systems practicing enhanced coagulation, alternative TOC removal percentages are determined, based upon jar tests performed at least quarterly for one year
      - ›› systems practicing enhanced softening must meet one of the following three performance criteria: 1) produce finished water with a specified ultraviolet absorbence (SUVA) of $\leq$ 2.0 L/mg-m; 2) remove a minimum of 10 mg/L magnesium hardness (as $CaCO_3$); or 3) lower alkalinity to less than 60 mg/L (as $CaCO_3$).
    - the rule also provides alternative compliance criteria for systems that meet certain water quality and other criteria
- Operator Certification: all systems regulated under this rule must be operated by an individual who meets State-specified qualifications.
- Monitoring Requirements:
  - TOC and alkalinity paired samples, at a frequency of 1 sample/month/plant, required only for surface water and GWUDI systems with conventional filtration treatment
    - reduced to 1 sample/quarter/plant if:
      - ›› average TOC < 2.0 mg/L for 2 years
      - ›› average TOC < 1.0 mg/L for 1 year
  - TTHMs and HAA5:
    - Surface water systems serving 10,000 or more persons: 4 samples/plant/quarter
      - ›› reduced to 1 sample/quarter/plant if: 1) system has completed at least one year of routine monitoring and 2) both TTHM and HAA5 running annual averages are no more than 40 µg/L and 30 µg/L respectively
      - ›› revert to routine monitoring if TTHM concentration exceeds 0.060 mg/L or HAA5 concentration exceeds 0.045 mg/L

Fact Sheet:
Stage 1 Disinfection By-Products Rule (continued)

  - Surface water systems serving 500-9,999 persons: 1 sample/plant/quarter
    - ›› reduced to 1 sample/plant/year 1) system has completed at least one year of routine monitoring; 2) both TTHM and HAA5 running annual averages are no more than 40 µg/L and 30 µg/L respectively; and 3) annual average source water TOC level is no more than 4.0 mg/L prior to treatment
  - Surface water systems serving less than 500 persons: 1 sample/plant/year
    - ›› increase monitoring to 1 sample/plant/quarter if the annual sample exceeds the MCL
    - ›› return to routine monitoring if the annual average of quarterly samples is no more than 0.060 mg/L for TTHM and 0.045 mg/L for HAA5
  - Ground water systems serving 10,000 or more persons: 1 sample/plant/quarter
    - ›› reduced to 1 sample/plant/year if 1) system has completed at least one year of routine monitoring; 2) both TTHM and HAA5 running annual averages are no more than 40 µg/L and 30 µg/L respectively; and 3) annual average source water TOC level is no more than 4.0 mg/L prior to treatment
  - Ground water systems serving less than 10,000 persons: 1 sample/plant/year
    - ›› if the annual monitoring result exceeds the MCL, the system must increase monitoring to 1 sample/plant/quarter
    - ›› return to routine monitoring if the annual average of quarterly samples is no more than 0.060 mg/L for TTHM and 0.045 mg/L for HAA5
    - ›› reduced to 1 sample/plant/3 years if: 1) system has completed at least 2 years of routine monitoring and both the TTHM and HAA5 running annual averages are no more than 40 µg/L and 30 µg/L respectively or 2) system has completed at least one year of routine monitoring and both TTHM and HAA5 annual samples are no more than 20 µg/L and 15 µg/L respectively
- Bromate: 1 sample/month/plant, required only for systems using ozone for oxidation or disinfection
  - reduced to 1 sample/quarter/plant if the system can demonstrate average raw water bromide concentration < 0.05 mg/L (based on annual average of monthly samples)
- Chlorite samples required for systems using chlorine dioxide for oxidation or disinfection:
  - 1 sample/day/plant at entrance to distribution system
  - 1 set of 3 samples/month at specified points in distribution system
    - ›› reduced to 3 samples/quarter if the chlorine concentration in all samples taken in the distribution system is < 1.0 mg/L
- Chlorine and chloramines must be monitored at the same location and frequency as total coliform under the total coliform rule
- Chlorine dioxide: 1 sample/day/plant, required only for systems using chlorine dioxide for oxidation or disinfection

Fact Sheet:
Surface Water Treatment Rule

- **Effective Date**—December 31, 1990
- **Affected Systems**—all Public Water Systems (PWSs) using surface water sources or groundwater sources under the direct influence of surface water
- **Basic Provisions**—
  - Establishes criteria under which filtration and disinfection are required—systems must either provide filtration or comply with the requirements to avoid filtration
    - Criteria for avoiding filtration
      - Source water quality conditions
        - Low coliform
        - Low turbidity
      - Site-specific requirements
        - Must have a watershed control program
        - Annual on-site inspection
        - Must not be the source of a water-borne disease outbreak
        - Must comply with total coliform MCL
    - Disinfection requirements for PWSs that do not provide filtration
      - Treatment standards
        - Treatment must be sufficient to ensure 99.9% inactivation or removal of *Giardia lamblia* cysts
        - Treatment must be sufficient to ensure 99.99% inactivation or removal of viruses
      - Disinfection system must have either redundant components or an automatic shut-off
      - Residual disinfectant concentration must be maintained above a certain level
    - Disinfection requirements for PWSs that provide filtration
      - Treatment standards
        - Treatment must be sufficient to ensure 99.9% inactivation of *Giardia lamblia* cysts
        - Treatment must be sufficient to ensure 99.99% inactivation of viruses
      - Residual disinfectant concentration must be maintained above a certain level
    - Filtration—if the criteria to avoid filtration are not met, PWSs must provide one of the following filtration treatments by June 29, 1993, or within 18 months of the failure to meet any of the criteria to avoid filtration
      - Conventional filtration treatment or direct filtration
      - Slow sand filtration
      - Diatomaceous earth filtration
      - Other filtration technology, if the PWS demonstrates to the State that the alternative technology is as effective as the technology listed above

Fact Sheet:
Surface Water Treatment Rule (continued)

- Establishes monitoring requirements for PWSs that use surface water or ground water under the direct influence of surface water
  - Monitoring requirements for systems that do not provide filtration
    - Fecal or total coliform density
      - ›› Systems serving ≤ 500 people—1 sample/week
      - ›› Systems serving 501 to 3,300 people—2 samples/week
      - ›› Systems serving 3,301 to 10,000 people—3 samples/week
    - Turbidity must be monitored every four hours
    - Total inactivation ratios must be calculated daily
    - Residual disinfectant concentration must be monitored continuously
  - Monitoring requirements for systems that provide filtration
    - Turbidity must be monitored every four hours
    - Residual disinfectant concentration must be monitored continuously
- Reporting and record keeping requirements
  - PWSs that do not provide filtration must report the following to the State on a monthly basis
    - Source water quality data
    - Disinfection information
    - Annual summaries of its watershed control program
    - Waterborne disease outbreaks potentially attributable to the system
    - Incidents of high turbidity
    - Incidents of low disinfectant residual concentration
  - PWSs that provide filtration must report the following to the State on a monthly basis
    - Turbidity measurements
    - Disinfection information
    - Waterborne disease outbreaks potentially attributable to the system

Fact Sheet:
Total Coliform Rule

- **Effective Date** —December 31, 1990
- **Affected Systems** —all PWSs
- **Basic Provisions** —sets monitoring and compliance requirements for coliforms
  - Sampling—all systems must have a written sample siting plan
    - For Community Water Systems (CWSs), the number of samples is based on minimum service population
      - 25 to 1,000—1 sample/month*
      - 1,001 to 2,500—2 samples/month
      - 2,501 to 3,300—3 samples/month
      - 3,301 to 4,100—4 samples/month
      - 4,101 to 4,900—5 samples/month
      - 4,901 to 5,800—6 samples/month
      - 5,801 to 6,700—7 samples/month
      - 6,701 to 7,600—8 samples/month
      - 7,601 to 8,500—9 samples/month
      - 8,501 to 12,900—10 samples/month

** CWSs serving 25 to 1,000 people with no history of total coliform contamination and a sanitary survey conducted in the past five years that shows that the system is supplied solely by a protected groundwater source and is free of sanitary defects may, at the discretion of the State, reduce their monitoring (in no case may the State reduce the monitoring frequency to less than 1 sample/quarter).*

    - Noncommunity water systems (NCWSs)
      - Groundwater systems serving ≤ 1,000 people must monitor once each calendar quarter
        - ›› The State may reduce this monitoring frequency to no less than 1 sample/year if a sanitary survey indicates that the system is free of sanitary defects
      - Ground water systems serving >1,000 people must monitor at the same frequency as like-sized CWSs
        - ›› The State may reduce this monitoring for any month the system serves fewer than 1,000 people (monitoring must occur at least annually)
      - Surface water systems must monitor at the same frequency as like-sized CWSs, regardless of size
      - Ground water under the influence of surface water is treated as surface water
    - Repeat samples
      - Systems that collect > 1 sample/month must collect, within 24 hours, at least 3 repeat samples for each total coliform-positive sample found
      - Systems that collect ≤ 1 sample/month must collect, within 24 hours, at least 4 repeat samples for each total coliform-positive sample found
      - Systems must continue to collect repeat samples as specified above until all samples are negative or it is determined that the system has violated the MCL
      - If a system that normally collects less than five routine samples/month has a positive sample, it must collect at least five samples during the month immediately following the positive sample
      - Any sample that tests total coliform positive must be analyzed for *E. coli* or fecal coliforms

Fact Sheet:
Total Coliform Rule (continued)

- Sanitary surveys—
  - PWSs that collect fewer than five routine samples/month must undergo an initial sanitary survey by June 29, 1994, for CWSs and June 29, 1999, for NCWSs
  - Thereafter, systems must undergo another sanitary survey every five years, except that NCWSs using only protected and disinfected ground water, as defined by the State, must undergo subsequent sanitary surveys at least every 10 years after the initial sanitary survey
- Public notification—systems that violate the total coliform MCL must undertake public notification
  - All violations must be reported to the State no later than the end of the next business day

Fact Sheet:
Lead and Copper Rule

- **Effective Date**—December 7, 1992
- **Affected Systems**—all CWSs and Nontransient Noncommunity Water Systems (NTNCWSs)
- **Basic Provisions**—establishes a treatment technique that includes requirements for corrosion control treatment, source water treatment, lead service line replacement, and public education; these requirements are triggered by lead and copper action levels measured in samples collected at consumers' taps
  - Monitoring and analytical requirements
    - Number of sampling sites (1 sample per site)
      - Standard monitoring (by population served)
        - 3,301 to 10,000—40 sites
        - 501 to 3,300—20 sites
        - 101-500—10 sites
        - 100—5 sites
      - Reduced monitoring (by population served)
        - 3,301 to 10,000—20 sites
        - 501 to 3,300—10 sites
        - 101-500—5 sites
        - 100—5 sites
    - Initial tap sampling—the first 6-month monitoring period for small (3,300 or fewer people) and medium (3,301 to 10,000 people) systems shall begin on the following dates
      - Medium—July 1, 1992
      - Small—July 1, 1993
    - Small and medium-size systems shall monitor during each 6-month monitoring period until
      - The system exceeds the lead or copper action level and is therefore required to implement corrosion control treatment
      - The system meets the lead and copper action levels during two consecutive 6-month monitoring periods, in which case the system may reduce monitoring
    - Reduced monitoring—a small or medium-size water system that meets the lead and copper action levels during each of two consecutive 6-month monitoring periods may reduce the number of samples (see above) and reduce the frequency to 1 sampling or sample set per year taken in June, July, August, or September
    - Systems that exceed the lead or copper action level must monitor water quality parameters in addition to lead and copper during the same period of exceedance

Fact Sheet:
Lead and Copper Rule (continued)

- Corrosion control treatment requirements
    - Systems must complete corrosion control treatment steps unless they are deemed by the State to have optimized corrosion control (i.e., been under the action level for two consecutive six-month monitoring periods)
    - Systems that exceed the action level must undertake corrosion control treatment steps, even if they have been deemed to have optimized corrosion control
- Source water treatment requirements—any system exceeding the lead or copper action level must implement source water monitoring and treatment
- Lead service line replacement requirements—any system that fails to meet the lead action level in tap samples after installing corrosion control and/or source water treatment (whichever sampling occurs later), must replace the lead service lines that continue to exceed the standard
- Public education requirements—any system exceeding the lead action level must deliver public education materials
    - The requirements for NTNCWSs are not as stringent as those for CWSs
- Record keeping requirements
    - Systems must maintain original records on their premises for no less than 12 years

Fact Sheet:
Chemical Monitoring: Phase II/V

- **Effective Dates**—
  - Phase II—January 30, 1991
  - Phase V—July 17, 1992
- **Affected Systems**—
  - In general, requirements apply only to CWSs and NTNCWSs
  - Nitrate and nitrite requirements apply to all PWSs
  - Fluoride requirements apply only to CWSs
- **Basic Provisions**—Establishes monitoring and MCL or treatment techniques for 66 chemicals
  - Phase II
    - Effective 1/30/91
    - Regulates 9 IOCs, 10 VOCs, 15 SOCs
    - Promulgated Standardized Monitoring Framework (SMF)
      - Standardized monitoring requirements for VOCs, IOCs, and SOCs
      - 9 year compliance cycle comprised of three 3-year compliance periods
      - First period: 1993-1995
        - ›› Phase II and IIB initial monitoring for all systems
      - Second period: 1996-1998
      - Third period: 1999-2001
        - ›› States specify year in which monitoring will be required
    - SMF initial requirements
      - IOCs
        - ›› Ground water–1 sample/3 years
        - ›› Surface water–1 sample/year
      - VOCs/SOCs
        - ›› Surface water and ground water–four consecutive quarterly samples
    - Subsequent monitoring
      - IOCs
        - ›› Below MCL–same as initial monitoring
        - ›› Equal to or above MCL–quarterly samples until reliably and consistently below MCL
      - VOCs
        - ›› If detects–1 sample/quarter
        - ›› If no detects and ground water system–1 sample/3 years
        - ›› If no detects and surface water system–1 sample/year
      - SOCs
        - ›› If detects–sample quarterly
        - ›› If no detects and service population > 3,300–sample twice in three years
        - ›› If no detects and service population ≤ 3,300–sample once in three years

Fact Sheet:
Chemical Monitoring: Phase II/V (continued)

- Exceptions
  - Asbestos–one sample every nine years
    - ›› If ≤ MCL–monitor during first three years of next 9-year cycle
    - ›› If > MCL–monitor quarterly until reliably and consistently below MCL
  - Nitrite–one sample for all PWSs
    - ›› If < 50% of MCL–State discretion
    - ›› If ≥ 50% of MCL–1 sample/quarter until reliably and consistently below MCL, then 1 sample/year
  - Nitrate
    - ›› CWS/NTNCWS
      - --ground water–1 sample/year
      - --surface water–1 sample/quarter
    - ›› TNCWS–1 sample/year
    - ›› Increase from 1 sample/year to 1 sample/quarter if ≥ 50% of MCL
    - ›› Reduce from 1 sample/quarter to 1 sample/year if four consecutive quarterly samples are < 50% of MCL
- SMF allows waivers for contaminants other than nitrate and nitrite

– Phase V
- Regulated 5 IOCs, 3 VOCs, 15 SOCs
- Adopted Phase II SMF requirements
  - Standardized monitoring requirements for VOCs, IOCs, and SOCs
  - 9 year compliance cycle comprised of three 3-year compliance periods
    - ›› First period: 1993-1995
      - -- Phase V initial monitoring for systems having m 150 service connections
    - ›› Second period: 1996-1998
      - -- Phase V initial monitoring for systems having < 150 service connections
    - ›› Third period: 1999-2001
      - -- States specify year in which monitoring will be required

Fact Sheet: Radionuclides

- **Effective Date**—original regulations promulgated in 1976, amended March 5, 1997
- **Affected Systems**—all CWSs
- **Basic Provisions**—
  - Specifies MCLs and monitoring requirements for combined radium-226 & 228, gross alpha particle activity, beta particle activity, and photon emitters
  - Monitoring requirements
    - For gross alpha particle activity, radium-226 & 228
      - Initial monitoring
        - ›› Four consecutive quarterly samples
        - ›› Initial sampling to start within two years of the effective date of the regulation and be completed within three years
        - ›› Gross alpha particle activity monitoring may be substituted for radium monitoring, provided the measured gross alpha particle activity does not exceed 5pCi/L at a 95% confidence level
      - Subsequent monitoring
        - ›› Four consecutive quarterly samples must be taken at least once every four years
        - ›› Analysis of a single sample is acceptable (at the discretion of the State) if prior sampling has established that the average annual concentration is less than half the MCL
        - ›› More frequent monitoring may be required by the State for systems near mines or other operations that may contribute alpha particle radioactivity
        - ›› CWSs must monitor as above within one year of the introduction of a new water source
      - Increased monitoring
        - ›› If the average annual MCL for gross alpha particle activity or total radium is exceeded, monitoring at quarterly intervals shall be conducted until the MCL is no longer exceeded
  - Public notification
    - If the average annual MCL for gross alpha particle activity or total radium is exceeded, the system must notify the public and the State within 48 hours

Fact Sheet:
Public Notification Rule

- **Effective Date**—April 28, 1989
- **Affected Systems**—all PWSs
- **Basic Provisions**—designed to keep the public informed of incidents that may affect drinking water quality
  - Requires systems to notify consumers when
    - Violation of any drinking water regulation occurs
      - MCL is exceeded
      - Treatment technique is not adhered to
      - Monitoring/reporting is not completed
    - Variance or exemption (V & E) is granted or conditions of V & E are violated
  - The system owner or operator must notify the public of an MCL violation
    - By publication in a daily newspaper of general circulation in the affected area as soon as possible, and no later than 14 days after the violation
    - By mail or hand delivery within 45 days of the violation or failure
      - The State may waive this requirement if it deems that sufficient action has been taken to correct the violation or failure
    - By mail every three months after the initial 45 day notification, for as long as the violation or failure continues
  - MCL violations for contaminants that may pose an acute risk to human health must be publicized through radio and television within 72 hours of the violation
  - Systems that fail to perform monitoring or comply with testing requirements under the SDWA, or are subject to V & Es must
    - Give notice in a daily newspaper of general circulation within three months of the violation
    - Give notice by direct mail or hand delivery every three months for as long as the V & E remains in effect
  - NCWSs in violation or granted a V & E must notify customers by hand delivery (every three months) or continuous posting in conspicuous places within the area served by the system (for as long as the violation continues or the V & E remains in effect)
  - A copy of the most recent public notice of any of the aforementioned topics must be given to new billing units or new hookups prior to or at the time service begins
  - The public notice must comply with certain requirements concerning appropriate content, language, and explanations regarding specific chemicals

Fact Sheet:
Consumer Confidence Reports

- **Effective Date**—first reports are due between April and October 1999, by July 1 annually thereafter
- **Affected Systems**—all CWSs
- **Basic Provisions**—requires annual drinking water quality reports for customers
  - Minimum requirements
    - Reports must contain
      - Identification of the water source
      - Summary of susceptibility to contamination
      - Instructions for obtaining the complete source water assessment
      - Level of any contaminant found in local drinking water, with appropriate MCL
      - Likely source of the contaminant
      - Potential health effects of contaminants detected in violation of EPA Health Standards, with description of system's actions to restore safe levels
      - Educational statement for vulnerable populations about avoiding Cryptosporidium
      - Educational information on nitrate, arsenic, and lead when detected > 50% of standard
      - Phone numbers, including system's and SDWA hotline
    - Report must be mailed to all customers
  - Systems serving fewer than 10,000 people
    - Need not mail their reports if the Governor of the State they are located in grants a waiver
    - Required to inform their customers if the system will not be mailing the report
    - Required to make the report available on request to the public
    - Required to publish the report annually in one or more local newspapers
  - CWSs that serve 500 people or fewer may meet their consumer confidence report obligations by
    - Preparing an annual report
    - Making it available upon request
    - Providing notice of its availability at least once per year to each customer by mail, by door-to-door delivery, by posting, or by any other authorized means

Future SDWA Requirements

- Ground Water Rule
- Long Term 1 Enhanced Surface Water Treatment Rule
- Arsenic (Amended)
- Radon
- Radionuclides (Amended)
- Filter Backwash Recycling

Fact Sheet:
Ground Water Rule

- **Effective Date**—
  - Proposed Ground Water Rule anticipated Spring, 1999
  - Final Ground Water Rule anticipated November, 2000
  - Ground Water Rule statutory deadline May, 2002
- **Potentially Affected Systems**—all public systems using a ground water source
- **Basic Provisions**—EPA is developing a ground water rule regulating disinfection and other components of ground water treatment systems
  - The ground water rule will probably address
    - Appropriate use of disinfection
    - Use of alternative approaches including
      - Best management practices
      - Control of contamination at its source
    - Special needs of small systems

Fact Sheet:
Long Term 1 Enhanced Surface Water Treatment Rule

- **Effective Date**—due by November, 2000
- **Potentially Affected Systems**—all CWS and NTNCWSs that add a disinfectant to the drinking water during any part of the treatment process
- **Basic Provisions**—proposed strengthening of microbial controls for small systems (those serving fewer than 10,000 people) by addressing the following
  - Filter performance baseline
  - Low-cost approaches to improve filter performance
  - Disinfection benchmarking
  - Cost and timing of implementation
  - Need for technical assistance

Fact Sheet:
Arsenic

- **Effective Date**—
  - Proposed Arsenic Rule due by January 1, 2000
  - Final Arsenic Rule due by January 1, 2001
- **Potentially Affected Systems**—currently, the arsenic MCL only applies to CWSs; the new MCL would also apply to NTNCWSs
- **Basic Provisions**—
  - The SDWA requires EPA to set the MCL as close to a public health goal as feasible, taking into account
    - Available treatment technologies
    - Regulatory costs and benefits
    - Sensitive subpopulations
  - For the new standard, EPA must identify affordable small system technologies
  - The carcinogenic and non-carcinogenic health effects of arsenic are currently being studied
    - The results of these peer-reviewed health studies will inform the rulemaking process

Fact Sheet:
Radon

- **Effective Date**—
  - MCL Goal and National Primary Drinking Water Standard for radon must be proposed by August, 1999
  - MCL Goal and Final MCL for radon must be published by August, 2000
- **Potentially Affected Systems**—all PWS; no systems are currently regulated (the withdrawn 1991 proposed rule applied to all PWSs)
- **Basic Provisions**—EPA must develop a standard for radon in drinking water
  - EPA does not currently regulate radon in drinking water
    - EPA is developing a proposed regulation to reduce radon in drinking water
    - The regulation is also likely to include provisions to reduce radon in indoor air
    - EPA must publish an assessment of health risks posed by radon and an analysis of costs for possible radon MCLs for public comment by February 1999
  - Alternative MCLs (AMCLs) and multimedia mitigation programs
    - If the MCL is "more stringent than necessary to reduce the contribution to radon in indoor air from drinking water to a concentration that is equivalent to the national average concentration of radon in outdoor air," EPA must establish an AMCL, linked to average outdoor radon levels
    - If an AMCL is established, EPA must publish guidelines for State multimedia radon mitigation programs
    - States may develop multimedia mitigation programs to reduce radon levels in indoor air; EPA shall approve these programs if they are expected to achieve equivalent or greater benefits than compliance with the MCL
    - If EPA approves a State program, PWSs within the State may comply with the AMCL
    - EPA shall evaluate multimedia mitigation programs every 5 years

Fact Sheet: Radionuclides

- **Effective Date**—
  - Radionuclide standards must be ratified by November, 2000
  - A final uranium standard must be in place by 2000
- **Potentially Affected Systems**—current radionuclide standards apply to CWSs
- **Basic Provisions**—EPA is revising the current radionuclides regulation and is setting a standard for uranium, as required by the 1986 Amendments to the SDWA
  - The SDWA calls for regulation of radionuclides and a review of regulations every 6 years
  - In setting the new standards EPA is reviewing
    - Health effects studies
    - Occurrence data
    - Treatment technology and analytical methods
  - Revised standards must maintain or provide for greater protection of public health than old standards

Fact Sheet:
Filter Backwash Recycling

- **Effective Date**—due by August 2000
- **Potentially Affected Systems**—all PWSs that backwash filters
- **Basic Provisions**—governs the recycling of filter backwash within the treatment process of PWSs
  - EPA has not developed specific regulatory options
  - Potential options may include
    - Banning the recycling of filter backwash
    - Requiring that recycle flows be equalized
    - Requiring that all recycle flows be treated to a specific level
    - Requiring that all recycle flows be treated with a specific technology

Case Studies:
Cost Estimates of Small System Compliance

Introduction

The following small system hypothetical case studies were developed by the National Drinking Water Advisory Council (NDWAC) Small Systems Working Group to estimate the costs small systems might incur to meet the requirements of the 1996 Amendments to the Safe Drinking Water Act (SDWA). The case studies are intended to accurately represent, to the extent possible, the universe of typical small systems, based upon type of system, size of system, treatment used, and contamination problems encountered.

After identifying the initial system characteristics, the workgroup helped to determine the regulations and corresponding requirements that affected each system based on its particular characteristics. The costs associated with these various requirements were then estimated using a variety of sources.

The systems described in this report range from a very small transient, noncommunity water system (TNCWS) to a community water system (CWS) serving 3,100 people. A nontransient, noncommunity water system (NTNCWS) serving 160 people is included, as are CWSs with service populations of 500, 750, and 2,500.

The summary table on the following page provides a clear overview of the hypothetical systems and the cost burden for each system based on its particular situation. The assumptions on which system costs are based are provided after the summary table. Most assumptions used in the cost analysis are explained under "General Assumptions." Specific treatment cost assumptions and additional assumptions related to Case 5 are found immediately after the "General Assumptions" page.

The cost estimates provided in this report are intended to be as accurate as possible at a national level and are based on the best available data sources. However, it should be noted that due to the unique characteristics of each small system, the difficulty and complexity of pricing treatment alternatives, and the embedded assumptions in the estimates used to determine final costs, the cost estimates should only be viewed as an approximation of the financial impact the 1996 Amendments to the SDWA will have on small systems.

Summary Table of Hypothetical Small System Case Studies

	System Type	Source	Population	Households	Contaminant Levels	Treatment Performed	Annual Household Cost[1, 2]		
							NA	*7% interest*	*10% interest*
Case 1	TNCWS	Ground Water	75	NA	All contaminants well below MCLs except for rads, which are above 50% of the MCL.	Treatment already in place. No additional treatment necessary.	$8.21		
Case 2A	CWS	Ground Water	750	250	Same as Case 1	Same as Case 1	$7.54		
Case 2B	CWS	Ground Water	500	167	Same as Case 1	Same as Case 1	$14.89		
Case 3	NTNCWS	Ground Water	160	NA	Same as Case 1	Same as Case 1	$19.72		
Case 4A	CWS	Surface Water	3,100	1,033	Same as Case 1	Same as Case 1	$6.87		
Case 4B	CWS	Surface Water	3,100	1,033	Same as Case 1	System has no existing filtration. System needs to install conventional filtration.		$128.95	$148.57
Case 5A	CWS	Surface Water	500	167	System detects atrazine at 1.5 times the MCL. System has corrosive water, causing lead and copper contamination.	System has conventional filtration. System needs to retrofit to remove atrazine and to install corrosion control.		$107.16	$108.25
Case 5B	CWS	Surface Water	500	167	System detects atrazine at 1.5 times the MCL. System has corrosive water, causing lead and copper contamination.	System has no existing filtration. System needs to install conventional filtration, remove atrazine, and control corrosion.		$454.86	$478.29
Case 6	CWS	GWUDISW	2,500	833	System detects nitrate levels moderately above the MCL. System also has excessively hard water.	System is currently using direct filtration. System needs to install treatment for nitrate and may choose to treat for hardness.		See below.	See below.
						SDWA Required Treatment		$89.19	$96.82
						SDWA Treatment + Hardness Treatment		$151.32	$165.49

[1] Since Case 1 and Case 3 are both noncommunity water systems (NCWSs), neither are serving households. Household costs are provided for comparative purposes only.

[2] Due to annual variances in sampling requirements and treatment implementation, household costs for Cases 5A, 5B, and 6 vary slightly from year-to-year. Due to this variance, costs for each of these case studies were estimated annually for four years after the system detected a contaminant a nd/or installed filtration. However, in order to present household cost information most clearly in this table, an average of the four annual household cost estimates for these specified systems was used. Interest rates are only applicable to those systems that installed some type of treatment (Cases 4B, 5A, 5B, 6).

Acronyms:
GWUDISW: Ground Water Under the Direct Influence of Surface Water
MCL: Maximum Contaminant Level

General Assumptions

1 Monitoring: It was assumed that all hypothetical systems in this study had achieved reduced monitoring status for most contaminants (exceptions include disinfection byproducts and total coliform). This reduced monitoring schedule was assumed to be in effect unless contamination was reported.

2 Contaminant Detects: If a system experiences contamination, it was assumed that the resulting treatment would successfully reduce the contaminant concentration in the system's water after one year, at which time the system would revert to the reduced monitoring schedule (except for systems faced with lead and copper contamination; see Cases 5A and 5B).

3 Laboratory Costs: No discount was built into laboratory analytical costs.

4 Sampling Wage: The labor rate for sampling conducted by all systems was assumed to be $14.50 per hour. This figure was taken from the *Engineering News Record* and was used after consultation with Cadmus staff experienced with small water system operation.

5 Sample Delivery: It was assumed that all systems would use the complimentary courier services offered by most laboratories or would mail samples in, thus avoiding travel costs associated with hand-delivering samples to a laboratory. Mailing fees were not accounted for in lab analysis costs.

6 Consumer Confidence Report (CCR): It was assumed that CCRs would be mailed separately from water bills since the workgroup expressed concern about whether systems would be allowed to post notices in papers or be able to include the CCR with the bill (at minimum extra cost). The current postal rate of $0.33 for first-class mail was used. Systems that have a business permit and pre-sort their mail, produce their own bar codes, and/or mail over 500 pieces may realize additional savings not reflected in this analysis.

7 Treatment Costs: Least-cost treatment method decisions were made by Cadmus staff and water treatment experts, often in consultation with available cost estimates provided by *Evaluation of Central Treatment Options as Small System Treatment Technologies*, SAIC, 1999. Capital, operation and maintenance, and disposal costs were considered in all least-cost treatment decisions. Final decisions were also designed to reflect the most likely treatment based upon system size, system type, and the available disposal options.

8 Disposal of Waste Residuals: Disposal methods for specific treatment options were chosen on a least-cost basis. Least-cost determinations were based on total capital and operation and maintenance costs. It should be noted that legal restrictions on disposal and site-specific limitations affect many treatment facilities and may necessitate the use of a more expensive disposal option for some systems.

9 Cases 5A and 5B: Several specific treatment and disposal assumptions apply to Case 5A and Case 5B. Please see "Case 5 Treatment Costs" for details.

Consumer Confidence Reports (CCRs)

Cost formula per system of developing and distributing a CCR, assuming the report is mailed separately from the bill.

Systems serving 500 or fewer	*Labor Hours*	*Cost*
Prepare report	14.00	$203.00
Submit annually to primacy agency	0.25	$3.63
Store and make one copy available	0.25	$3.63
Mail report as a separate item	1.00	$14.50
		$224.76

Systems serving 501 to 3,300	*Labor Hours*	*Cost*
Prepare report	12.50	$181.25
Submit annually to primacy agency	0.25	$3.63
Store and make one copy available	0.25	$3.63
Mail report as a separate item	1.00	$14.50
		$203.01

Per household CCR postage cost for systems serving 3,300 or less: $0.33

Sampling, Household, and Lifecycle Assumptions

CWS sampling time (hrs/sample)[1]	0.75
Noncommunity water system (NCWS) sampling travel time (hrs/sample)[2]	1.50
NCWS preparation and sampling time (hrs/sample)[3]	0.25
System wage rate for all sampling and for CCR development ($/hr)	$14.50
Water use per household per year (gpy/hh)	109,500
Number of people per household	3.00
Expected effective life of central water treatment plant (years)	20.00
Expected effective life of residuals monitor (years)	10.00
Expected effective life of turbidity meter (years)	10.00
Annualized cost for installation and maintenance of a residuals monitor[4]	$500.00
Annualized cost for installation and maintenance of a turbidity meter[5]	$278.40

Specific Lead & Copper Assumptions

Lead and Copper sampling time (hrs/sample)			2.50
Costs to meet additional requirements (WQP's, education, etc.)			
Year 1	$431.00	Year 3	$216.00
Year 2	$216.00	Year 4	$0.00

Laboratory Costs

Total Coliform	$20.00
Asbestos	$163.00
Nitrate	$20.00
Nitrite	NA
Phase II/V IOCs	$208.00
Phase II/V VOCs	$173.00
Phase II/V SOCs	$1,754.00
Lead and Copper	$27.00
Radionuclides	$234.00
Total Organic Carbon (TOC) & alkalinity	$55.00
TTHM & HAA5	$223.00
Chlorine/Chloramines[6]	$29.00

Unit Costs for Grouped Analytes

Radionuclides	
Gross Alpha and Beta	$70.00
Radium 226 & 228 combined	$164.00
Other	
TOC	$41.00
Alkalinity	$14.00
TTHM	$72.00
HAA5	$151.00
Atrazine (SOC)	$98.00

Important Note: While these laboratory costs are representative of national averages, analytical costs faced by water systems may be higher or lower depending upon the system's location.

[1] The sampling time for CWSs was determined after discussion with Cadmus staff familiar with small system operation. This sampling time reflects both preparation and sampling time necessary to sample finished water as well as a minimum amount of additional travel, preparation, and sampling time to sample raw water at entry points, when necessary. Due to variations in water quality, the number of entry points, and system type, actual sampling time will vary from system to system.

[2,3] Both the travel time and the preparation and sampling time for NCWS sampling was determined after discussion with Cadmus staff familiar with small system operation. The travel time estimate reflects the additional travel time necessary for non-CWS operations staff to take samples, as well as a minimum amount of additional travel time to sample raw water at entry points when necessary. While travel time can be minimized by taking multiple samples in one trip, it was assumed that the same amount of preparation and sampling time was needed for each sample. Due to variations in water quality, the number of entry points, and system type, actual sampling time will vary from system to system.

[4,5] While some small systems may need to install both meters, many already have such meters in place, according to Cadmus staff familiar with small system operation. While new regulations require continuous monitoring of turbidity and residuals, these meters also comply with such regulations. Thus, for some systems the additional costs imposed by these meters may not apply.

[6] Systems that disinfect may already have a chlorine residuals monitor installed (see notes 4 & 5). The monitor could allow the system to test its own chlorine, chloramine, and/or chlorine dioxide concentrations as part of normal operations, rather than sending samples to a laboratory. Thus, systems with residual monitors may not incur the laboratory costs for chlorine/chloramines accounted for in this analysis.

Treatment Costs

1. Costs include all capital, operation and maintenance, and disposal costs.
2. All treatment costs were derived from cost information contained in *Evaluation of Central Treatment Options as Small System Treatment Technologies*, SAIC, 1999 except for the filter media retrofit estimate used in Case 5A and the annual GAC media replacement estimate used in Case 5B. Please refer to specific case footnotes for additional underlying assumptions built into the treatment and disposal cost estimates provided by SAIC.
3. All treatment costs are in dollars per thousand gallons and were derived for service communities in three size categories: 25-500; 501-3,300; and 3,301-10,000.
4. All treatment costs were converted from 1996$ to 1998$ using the Producer Price Index-Commodities (Finished Goods) from the Bureau of Labor Statistics.
5. Since the costs faced by a system for a specific treatment vary by the size of the service population, the costs listed below are only applicable to the specific systems mentioned. Any change in population assumptions will alter the final treatment cost. Please see "Case 5 Treatment Costs" for specific information on additional treatments and how treatment costs for Cases 5A and 5B were altered to reflect the fact that they straddle two population categories.

		7% interest rate		10% interest rate	
Treatment Technology	**Disposal Method**	**$/kgal**	**Annual household cost ($/hh/yr)**	**$/kgal**	**Annual household cost ($/hh/yr)**
Anion Exchange (Case 6)	POTW	$0.75	$81.75	$0.82	$89.38
Cation Exchange (Case 6)	POTW	$0.57	$62.13	$0.63	$68.67
Conventional Filtration (Case 4B)[1]	Landfill after non-mechanical dewatering	$1.11	$122.08	$1.29	$141.70
Conventional Filtration (Case 5B)[1]	Landfill after non-mechanical dewatering	$3.28	$359.15	$3.48	$381.50
Soda Ash (Cases 5A and 5B)	No disposal necessary	$0.38	$41.96	$0.39	$43.05
Lime Softening (Case 6 (footnoted))	Landfill after non-mechanical dewatering	$1.21	$132.98	$1.38	$151.51

Treatment Cost Pricing Adjustment

Multiplier used to convert 1996$ to 1998$: 0.99543

[1] Costs vary between Cases 4B and 5B for conventional filtration due to the system population served. Case 4B serves 3,100 people while Case 5B serves 500 people.

POTW: Publicly Owned Treatment Works

Case 5 Treatment Cost Assumptions

CASE 5A: Atrazine Treatment Assumptions

From communication with an engineer experienced in retrofits for atrazine contamination and Cadmus staff experienced with small system design, the following train of assumptions were made:

1. Assuming the system treats approximately 109,500 gallons per household per year and serves a population of 500 (3 people per household), the number of gallons treated per day is: 109,500 * ((500/3)/365) = 50,100. Systems must be designed to meet peak flows, however. Doubling the amount treated per day is an accepted method to allow for peak flow. This results in the treatment of 100,200 gallons per day (69.6 gallons per minute).

2. Cost estimates for the capital and labor costs involved in installing granular activated carbon (GAC) and making necessary structural alterations to retrofit filter housings is priced by square footage of filter area, even though GAC media is priced in dollars per cubic foot. Assuming a filtration rate of 3 gal/min/square foot and with the system needing to treat 69.6 gallons per minute, the system has approximately 23.2 square feet of filter area (69.6 / 3 = 23.2). The cost range for retrofit of filters and GAC installation and replacement was quoted at $100 per square foot of filter area for basic adjustments to $250 per square foot for a GAC retrofit involving significant structural changes.

3. The consulted engineer stated that a system of this size would likely have to make moderate structural changes to its treatment system during the retrofit, such as replacement of the underdrains. As a result, an estimate of $150 per square foot of filter area was determined to be representative of the cost a system of this type would incur. This results in an annualized cost of $150 * 23.2 = $3,480 for filter retrofit and annual GAC media replacement (including removal of the spent media).

Assumption train leads to annual cost of: $3,480

CASE 5B: Addition of GAC Assumptions

The price for GAC for a system of this size is approximately $30 per cubic foot for the media itself. Larger systems that order more GAC pay lower prices for the media. The cost for a system of this type to have a supplier annually install and replace the GAC media and dispose of the spent GAC was estimated to be $45 per cubic foot. This estimate of $45 per cubic foot of GAC was used to develop the final annualized cost. To determine how many cubic feet of filter space a system of this type would have, it was assumed that filter depth was 2 feet. Using the filter area derived from the assumptions made for Case 5A, the amount of GAC needed would be 46.4 cubic feet (23.2 * 2 = 46.4). The resulting annualized cost amounts to $45 * 46.4 = $2,088 for GAC media replacement.

Assumption train leads to annual cost of: $2,088

CASE 5B: Conventional Filtration Assumptions

Conventional Filtration-Treatment

The cost estimates for conventional filtration were widely divergent for the two smaller population size categories; the community in Case 5B falls squarely between these two categories. It was decided that to use one or the other cost estimate would unfairly represent the cost burden for systems of this size. Systems with service populations of 25-500 incur a cost of $5.47 per 1,000 gallons of treated water (7% interest, 1996$) and those with populations of 501-3,300 incur a cost of $1.12 per 1,000 gallons (7% interest, 1996$). Due to the complexity and number of cost curves developed for the analysis of treatment and disposal costs, an analysis of printed cost curves or the use of equations was impractical. Therefore, the two values were simply averaged to obtain the value ultimately used, $3.30 (7% interest, 1996$). An identical procedure was used to obtain the cost estimate at 10% interest.

Conventional Filtration-Disposal

The least cost option for the disposal of conventional filtration residuals for most scenarios was to transport it directly to a landfill. However, while least-cost estimates were used where valid, it was determined through conversation with Cadmus staff that disposal of conventional filtration system sludge directly to a landfill without dewatering was unrealistic. Solids levels in the sludge would not be high enough for a landfill to accept it directly. Thus, the second lowest cost option, landfilling after non-mechanical dewatering, was chosen.

CASES 5A and 5B: Soda Ash Treatment

Similar to the above assumptions made regarding conventional filtration costs, an average of soda ash treatment estimates was taken. The cost at 7% interest for the population range of 25-500 was $0.66 per 1,000 gallons (1996 $) while the cost for systems in the 501-3,300 range was $0.11, for an average of approximately $0.39. The same process was used to calculate costs at a 10% interest rate. While it was assumed that 50% of the water was treated with soda ash (see footnotes for Cases 5A and 5B), systems may need to add soda ash to a smaller or larger portion of their source water to meet regulatory requirements, leading to correspondingly lower or higher chemical costs.

CASES 5A and 5B: Lead and Copper--Additional Requirements

Along with the increased monitoring requirements that are required after detection of lead and copper contamination, a system must comply with several other requirements as part of the Lead and Copper Rule. These additional requirements include public education, water quality parameters, and other activities. Cost estimates for all of these additional activities are listed on the "General Assumptions" page and were provided by Cadmus staff who wrote the 1999 *Lead and Copper Rule Draft Information Collection Request*.

CASE # 1

Type: TNCWS, ground water source
Treatment: No additional treatment necessary.
Characteristics: Total coliform levels are far enough below MCL to require minimal monitoring.
All chemical contaminant levels well below MCLs.
Radionuclides: above 50% of MCL, but not above MCL.
Population: 75 **Number of Households:** NA

Monitoring	Contaminant	Requirements	Lab cost per sample	Annual lab cost	Annual system labor cost[1]	**Annual Cost**
	Total Coliform	1 sample/quarter	$20.00	$80.00	$101.50	$181.50
Chemical Monitoring						
	Asbestos	NA				NA
	Nitrate	1 sample/year	$20.00	$20.00	$3.63	$23.63
	Nitrite	None performed				NA
	Phase II/V IOCs	NA				NA
	Phase II/V VOCs	NA				NA
	Phase II/V SOCs	NA				NA
	Lead and Copper	NA				NA
	Radionuclides	NA				NA
Disinfection Byproducts						
	TOC & alkalinity	NA				NA
	TTHM & HAA5	NA				NA
	Chlorine/Chloramines	NA				NA
						$205.13

Treatment	Cost per 1,000 gallons	Water Use (kgpy/hh)	Number of households	**Annual Cost**
Adequate treatment assumed to be in place				**$0.00**

Other	**Annual Cost**
	$0.00

TOTALS

Annual System Cost	**$205.13**
Annual Cost per Household[2]	**$8.21**

[1] NCWSs were assigned a higher per-sample system labor time than CWSs (see "General Assumptions"). After consultation with Cadmus staff familiar with small system operation, it was assumed that the nitrate sample could be taken during one of the quarterly samplings for total coliform. Since sampling frequency varies between the two contaminants, sampling travel time (and its related costs) were only allocated to total coliform (the contaminant requiring most frequent sampling). Thus, travel costs for nitrate were captured in the total coliform labor cost estimate; nitrate labor costs only account for preparation and sampling time.

[2] Household costs are presented here for comparative purposes only.

CASE # 2A

Type: CWS, ground water source
Treatment: No additional treatment necessary.
Characteristics: Total coliform levels are far enough below MCL to require minimal monitoring.
All chemical contaminant levels well below MCLs.
Radionuclides: above 50% of MCL, but not above MCL.
Population: 750 **Number of Households:** 250

Monitoring	Contaminant	Requirements	Lab cost per sample	Annual lab cost	Annual system labor cost	**Annual Cost**
	Total Coliform	1 sample/month	$20.00	$240.00	$130.50	$370.50
Chemical Monitoring						
	Asbestos	1 sample/9 years	$163.00	$18.11	$1.21	$19.32
	Nitrate	1 sample/year	$20.00	$20.00	$10.88	$30.88
	Nitrite	None performed				NA
	Phase II/V IOCs	1 sample/3 years	$208.00	$69.33	$3.63	$72.96
	Phase II/V VOCs	1 sample/3 years	$173.00	$57.67	$3.63	$61.30
	Phase II/V SOCs	1 sample/3 years	$1,754.00	$584.67	$3.63	$588.30
	Lead and Copper	1 sample at 10 taps/3 years	$27.00	$90.00	$120.83	$210.83
	Radionuclides	4 consecutive quarterly samples once every 4 years	$234.00	$234.00	$10.88	$244.88
Disinfection Byproducts						
	TOC & alkalinity	NA				NA
	TTHM & HAA5	NA				NA
	Chlorine/Chloramines	NA				NA
						$1,598.97

Treatment	Cost per 1,000 gallons	Water Use (kgpy/hh)	Number of households	**Annual Cost**
Adequate treatment assumed to be in place				**$0.00**

Other	**Annual Cost**
Consumer Confidence Report	$285.51
	$285.51

TOTALS

Annual System Cost	**$1,884.48**
Annual Cost per Household	**$7.54**

CASE # 2B

Type: CWS, ground water source
Treatment: System is currently disinfecting. No additional treatment is necessary.
Characteristics: Total coliform levels are far enough below MCL to require minimal monitoring.
All chemical contaminant levels well below MCLs.
Radionuclides: above 50% of MCL, but not above MCL.
Population: 500 **Number of Households:** 167

Monitoring	Contaminant	Requirements	Lab cost per sample	Annual lab cost	Annual system labor cost	**Annual Cost**
	Total Coliform	1 sample/month	$20.00	$240.00	$130.50	$370.50
Chemical Monitoring						
	Asbestos	1 sample/9 years	$163.00	$18.11	$1.21	$19.32
	Nitrate	1 sample/year	$20.00	$20.00	$10.88	$30.88
	Nitrite	None performed				NA
	Phase II/V IOCs	1 sample/3 years	$208.00	$69.33	$3.63	$72.96
	Phase II/V VOCs	1 sample/3 years	$173.00	$57.67	$3.63	$61.30
	Phase II/V SOCs	1 sample/3 years	$1,754.00	$584.67	$3.63	$588.30
	Lead and Copper	1 sample at 5 taps/3 years	$27.00	$45.00	$60.42	$105.42
	Radionuclides	4 consecutive quarterly samples once every 4 years	$234.00	$234.00	$10.88	$244.88
Disinfection Byproducts						
	TOC & alkalinity	NA				NA
	TTHM & HAA5	1 sample/year	$223.00	$223.00	$10.88	$233.88
	Chlorine/Chloramines	1 sample/month	$29.00	$348.00	$130.50	$478.50
						$2,205.94

Treatment	Cost per 1,000 gallons	Water Use (kgpy/hh)	Number of households	**Annual Cost**
Adequate treatment assumed to be in place				**$0.00**

Other	**Annual Cost**
Consumer Confidence Report	$279.87
	$279.87

TOTALS

Annual System Cost	**$2,485.81**
Annual Cost per Household	**$14.89**

CASE # 3

Type: NTNCWS, ground water source
Treatment: No additional treatment necessary.
Characteristics: Total coliform levels are far enough below MCL to require minimal monitoring.
All chemical contaminant levels well below MCLs.
Radionuclides: above 50% of MCL, but not above MCL.
Population: 160 **Number of Households:** NA

Monitoring	Contaminant	Requirements	Lab cost per sample	Annual lab cost	Annual system labor cost[1]	**Annual Cost**
	Total Coliform	1 sample/quarter	$20.00	$80.00	$101.50	$181.50
Chemical Monitoring						
	Asbestos	1 sample/9 years	$163.00	$18.11	$0.40	$18.51
	Nitrate	1 sample/year	$20.00	$20.00	$3.63	$23.63
	Nitrite	None performed				NA
	Phase II/V IOCs	1 sample/3 years	$208.00	$69.33	$3.63	$72.96
	Phase II/V VOCs	1 sample/3 years	$173.00	$57.67	$3.63	$61.30
	Phase II/V SOCs	1 sample/3 years	$1,754.00	$584.67	$3.63	$588.30
	Lead and Copper	1 sample at 5 taps/3 years	$27.00	$45.00	$60.42	$105.42
	Radionuclides	NA				NA
Disinfection Byproducts						
	TOC & alkalinity	NA				NA
	TTHM & HAA5	NA				NA
	Chlorine/Chloramines	NA				NA
						$1,051.62

Treatment	Cost per 1,000 gallons	Water Use (kgpy/hh)	Number of households	**Annual Cost**
Adequate treatment assumed to be in place				**$0.00**

Other	**Annual Cost**
	$0.00

Annual System Cost	**$1,051.62**
Annual Cost per Household[2]	**$19.72**

[1] NCWSs were assigned a higher per-sample system labor time than CWSs (see "General Assumptions"). After consultation with Cadmus staff familiar with small system operation, it was assumed that the total coliform, nitrate, and asbestos samples could be taken at the same time as one of the quarterly coliform samplings. Since sampling frequency is so varied among the three contaminants, sampling travel time (and its related costs) were only allocated to total coliform (the contaminant requiring most frequent sampling). Thus, system labor travel costs for the nitrate and asbestos tests were captured in the total coliform cost estimate. It was assumed that IOC, VOC, and SOC sampling could occur at the same time. Since these three tests have identical frequencies, the travel time was divided equally among them.

[2] Household costs are presented here for comparative purposes only.

CASE # 4A

Type: CWS, surface water source
Treatment: No additional treatment necessary.
Characteristics: Total coliform levels are far enough below MCL to require minimal monitoring.
All chemical contaminant levels well below MCLs.
Radionuclides: above 50% of MCL, but not above MCL.
Population: 3,100 **Number of Households:** 1,033

Monitoring	Contaminant	Requirements	Lab cost per sample	Annual lab cost	Annual system labor cost	**Annual Cost**
	Total Coliform	3 samples/month	$20.00	$720.00	$391.50	$1,111.50
Chemical Monitoring						
	Asbestos	1 sample/9 years	$163.00	$18.11	$1.21	$19.32
	Nitrate	1 sample/year	$20.00	$20.00	$10.88	$30.88
	Nitrite	None performed				NA
	Phase II/V IOCs	1 sample/year	$208.00	$208.00	$10.88	$218.88
	Phase II/V VOCs	1 sample/year	$173.00	$173.00	$10.88	$183.88
	Phase II/V SOCs	1 sample/3 years	$1,754.00	$584.67	$3.63	$588.30
	Lead and Copper	1 sample at 10 taps/3 years	$27.00	$90.00	$120.83	$210.83
	Radionuclides	4 consecutive quarterly samples once every 4 years	$234.00	$234.00	$10.88	$244.88
Disinfection Byproducts						
	TOC & alkalinity	1 sample/month	$55.00	$660.00	$130.50	$790.50
	TTHM & HAA5	1 sample/quarter	$223.00	$892.00	$43.50	$935.50
	Chlorine/Chloramines	3 samples/month	$29.00	$1,044.00	$391.50	$1,435.50
						$5,769.97

Treatment	Cost per 1,000 gallons	Water Use (kgpy/hh)	Number of households	**Annual Cost**
Adequate treatment assumed to be in place				**$0.00**

Other	**Annual Cost**
Consumer Confidence Report	$543.90
Install and maintain turbidity meter	$278.40
Install and maintain chlorine residuals monitor	$500.00
	$1,322.30

TOTALS

Annual System Cost	**$7,092.27**
Annual Cost per Household	**$6.87**

CASE # 4B

Type: CWS, surface water source
Treatment: No existing filtration system. Must install conventional filtration system. No additional disinfection necessary.
Characteristics: Total coliform levels are far enough below MCL to require minimal monitoring.
All chemical contaminant levels well below MCLs.
Radionuclides: above 50% of MCL, but not above MCL.
Population: 3,100 **Number of Households:** 1,033

Monitoring	Contaminant	Requirements	Lab cost per sample	Annual lab cost	Annual system labor cost	**Annual Cost**
	Total Coliform	3 samples/month	$20.00	$720.00	$391.50	$1,111.50
Chemical Monitoring						
	Asbestos	1 sample/9 years	$163.00	$18.11	$1.21	$19.32
	Nitrate	1 sample/year	$20.00	$20.00	$10.88	$30.88
	Nitrite	None performed				NA
	Phase II/V IOCs	1 sample/year	$208.00	$208.00	$10.88	$218.88
	Phase II/V VOCs	1 sample/year	$173.00	$173.00	$10.88	$183.88
	Phase II/V SOCs	1 sample/3 years	$1,754.00	$584.67	$3.63	$588.30
	Lead and Copper	1 sample at 10 taps/3 years	$27.00	$90.00	$120.83	$210.83
	Radionuclides	4 consecutive quarterly samples once every 4 years	$234.00	$234.00	$10.88	$244.88
Disinfection Byproducts						
	TOC & alkalinity	1 sample/month	$55.00	$660.00	$130.50	$790.50
	TTHM & HAA5	1 sample/quarter	$223.00	$892.00	$43.50	$935.50
	Chlorine/Chloramines	3 samples/month	$29.00	$1,044.00	$391.50	$1,435.50
						$5,769.97

Treatment		Cost per 1,000 gallons	Water Use (kgpy/hh)	Number of households	**Annual Cost**
Install & maintain conventional filtration[1]					
Total System Treatment Costs	7% interest	$1.11	109.50	1,033	**$126,108.20**
	10% interest	$1.29	109.50	1,033	**$146,375.59**

Other	**Annual Cost**
Consumer Confidence Report	$543.90
Install and maintain turbidity meter	$278.40
Install and maintain chlorine residuals monitor	$500.00
	$1,322.30

TOTALS

7% Interest	**Annual System Cost**	**$133,200.47**
	Annual Cost per Household	**$128.95**
10% Interest	**Annual System Cost**	**$153,467.86**
	Annual Cost per Household	**$148.57**

[1] Assumptions provided: centralized system, one treatment plant, one entry point, 100% of total flow treated, discharge to landfill with non-mechanical dewatering. Includes all capital, operation and maintenance, and disposal costs. Amortization based upon 7% and 10% interest over 20 years. Source: *Evaluation of Central Treatment Options as Small System Treatment Technologies,* SAIC, 1999.

CASE # 5A

Type: CWS, surface water source
Treatment: System needs to retrofit current conventional filtration system to remove atrazine and to undertake corrosion control. No additional disinfection necessary.
Characteristics: System detects atrazine, a Phase II/V SOC, at 1.5 times the MCL. System has corrosive water, leading to lead and copper contamination.
All other chemical contaminant levels well below MCLs.
Total coliform levels are far enough below MCL to require minimal monitoring.
Radionuclides: above 50% of MCL, but not above MCL.
Population: 500 **Number of Households:** 167

Monitoring	Contaminant	Requirements	Lab cost per sample	Annual lab cost	Annual system labor cost	**Year 1 Annual Cost**	**Year 2 Annual Cost**	**Year 3 Annual Cost**	**Year 4+ Annual Cost**
	Total Coliform	3 samples/month	$20.00	$720.00	$391.50	$1,111.50	$1,111.50	$1,111.50	$1,111.50
Chemical Monitoring									
	Asbestos	1 sample/9 years	$163.00	$18.11	$1.21	$19.32	$19.32	$19.32	$19.32
	Nitrate	1 sample/year	$20.00	$20.00	$10.88	$30.88	$30.88	$30.88	$30.88
	Nitrite	None performed				NA	NA	NA	NA
	Phase II/V IOCs	1 sample/year	$208.00	$208.00	$10.88	$218.88	$218.88	$218.88	$218.88
	Phase II/V VOCs	1 sample/year	$173.00	$173.00	$10.88	$183.88	$183.88	$183.88	$183.88
	Phase II/V SOCs	1 sample/3 years	$1,754.00	$584.67	$3.63	$555.63	$588.30	$588.30	$588.30
	Atrazine	1 sample/quarter	$98.00	$392.00	$43.50	$435.50	$0.00	$0.00	$0.00
	Lead and Copper	1 sample at 5 taps in Year 1, the year of exceedance	$27.00	$135.00	$181.25	$316.25	$0.00	$0.00	$0.00
		Sampling once at 20 taps after treatment installed (Year 3)	$27.00	$540.00	$725.00	$0.00	$0.00	$1,265.00	$0.00
		1 sample at 5 taps/year from Years 4-7, then reduced	$27.00	$135.00	$181.25	$0.00	$0.00	$0.00	$316.25
	Additional Req's	WQP, Public Ed., etc.	NA	NA		$431.00	$216.00	$216.00	$0.00
	Radionuclides	4 consecutive quarterly samples once every 4 years	$234.00	$234.00	$10.88	$244.88	$244.88	$244.88	$244.88
Disinfection Byproducts									
	TOC & alkalinity	1 sample/month	$55.00	$660.00	$130.50	$790.50	$790.50	$790.50	$790.50
	TTHM & HAA5	1 sample/quarter	$223.00	$892.00	$43.50	$935.50	$935.50	$935.50	$935.50
	Chlorine/Chloramines	3 samples/month	$29.00	$1,044.00	$391.50	$1,435.50	$1,435.50	$1,435.50	$1,435.50
						$6,709.22	**$5,775.14**	**$7,040.14**	**$5,875.39**

Treatment	Cost per 1,000 gallons	Water Use (kgpy/hh)	Number of households	**Year 1 Annual Cost**	**Year 2 Annual Cost**	**Year 3 Annual Cost**	**Year 4+ Annual Cost**
GAC retrofit and annual GAC replacement to remove atrazine[1]				$3,480.00	$3,480.00	$3,480.00	$3,480.00
Install corrosion control (CC)							
1. Addition of soda ash, 7% interest[2]	$0.38	109.50	167	$7,008.13	$7,008.13	$7,008.13	$7,008.13
2. Addition of soda ash, 10% interest[3]	$0.39	109.50	167	$7,190.16	$7,190.16	$7,190.16	$7,190.16
Total System Treatment Costs:		1. 7% interest		**$10,488.13**	**$10,488.13**	**$10,488.13**	**$10,488.13**
		2. 10% interest		**$10,670.16**	**$10,670.16**	**$10,670.16**	**$10,670.16**

Other	**Year 1 Annual Cost**	**Year 2 Annual Cost**	**Year 3 Annual Cost**	**Year 4+ Annual Cost**
Consumer Confidence Report	$279.87	$279.87	$279.87	$279.87
Install and maintain turbidity meter	$278.40	$278.40	$278.40	$278.40
Install and maintain chlorine residuals monitor	$500.00	$500.00	$500.00	$500.00
	$1,058.27	**$1,058.27**	**$1,058.27**	**$1,058.27**

TOTALS		**Year 1**	**Year 2**	**Year 3**	**Year 4 +**
Annual System Costs	Treatment Estimate 1, 7% interest	**$18,255.62**	**$17,321.54**	**$18,586.54**	**$17,421.79**
	Treatment Estimate 2, 10% interest	**$18,437.65**	**$17,503.57**	**$18,768.57**	**$17,603.82**
Annual Costs per Household	Treatment Estimate 1, 7% interest	**$109.32**	**$103.72**	**$111.30**	**$104.32**
	Treatment Estimate 2, 10% interest	**$110.41**	**$104.81**	**$112.39**	**$105.41**

[1] Estimate from communication with a P.E. from Howard R. Green Company, and from additional conversation with Cadmus staff familiar with small system design.

[2,3] Assumptions provided: one treatment plant, two entry points, 50% of total flow treated, 50% of total flow blended. Figure includes all capital, operation and maintenance, and disposal costs (it was assumed no waste would be produced by this process). Amortization based upon 7% and 10% interest over 20 years. The average of two cost estimates was used to more accurately estimate costs. See "Case 5 Treatment Costs" worksheet for more information. Source: *Evaluation of Central Treatment Options as Small System Treatment Technologies*, SAIC, 1999.

Note: Assuming the selected corrosion control treatment is effective, the system would return to a reduced monitoring schedule in Year 7. Reduced monitoring requires the system to take 1 sample at 5 taps every 3 years. From Year 5 until Year 7 however, the system must continue to take 1 sample at 5 taps per year.

CASE # 5B

Type: CWS, surface water source

Treatment: System has no filtration system in place. System must install conventional filtration, remove atrazine, and control corrosion. No additional disinfection necessary.

Characteristics: System detects atrazine, a Phase II/V SOC, at 1.5 times the MCL. System has corrosive water, leading to lead and copper contamination.
All other chemical contaminant levels well below MCLs.
Total coliform levels are far enough below MCL to require minimal monitoring.
Radionuclides: above 50% of MCL, but not above MCL.

Population: 500 **Number of Households:** 167

Monitoring	Contaminant	Requirements	Lab cost per sample	Annual lab cost	Annual system labor cost	**Year 1 Annual Cost**	**Year 2 Annual Cost**	**Year 3 Annual Cost**	**Year 4+ Annual Cost**
	Total Coliform	3 samples/month	$20.00	$720.00	$391.50	$1,111.50	$1,111.50	$1,111.50	$1,111.50
Chemical Monitoring									
	Asbestos	1 sample/9 years	$163.00	$18.11	$1.21	$19.32	$19.32	$19.32	$19.32
	Nitrate	1 sample/year	$20.00	$20.00	$10.88	$30.88	$30.88	$30.88	$30.88
	Nitrite	None performed				NA	NA	NA	NA
	Phase II/V IOCs	1 sample/year	$208.00	$208.00	$10.88	$218.88	$218.88	$218.88	$218.88
	Phase II/V VOCs	1 sample/year	$173.00	$173.00	$10.88	$183.88	$183.88	$183.88	$183.88
	Phase II/V SOCs	1 sample/3 years	$1,754.00	$584.67	$3.63	$555.63	$588.30	$588.30	$588.30
	Atrazine	1 sample/quarter	$98.00	$392.00	$43.50	$435.50	$0.00	$0.00	$0.00
	Lead and Copper	1 sample at 5 taps in Year 1, the year of exceedance	$27.00	$135.00	$181.25	$316.25	$0.00	$0.00	$0.00
		Sampling once at 20 taps after treatment installed (Year 3)	$27.00	$540.00	$725.00	$0.00	$0.00	$1,265.00	$0.00
		1 sample at 5 taps/year from Years 4-7, then reduced	$27.00	$135.00	$181.25	$0.00	$0.00	$0.00	$316.25
	Additional Req's	WQP, Public Ed., etc.	NA	NA		$431.00	$216.00	$216.00	$0.00
	Radionuclides	4 consecutive quarterly samples once every 4 years	$234.00	$234.00	$10.88	$244.88	$244.88	$244.88	$244.88
Disinfection Byproducts									
	TOC & alkalinity	1 sample/month	$55.00	$660.00	$130.50	$790.50	$790.50	$790.50	$790.50
	TTHM & HAA5	1 sample/quarter	$223.00	$892.00	$43.50	$935.50	$935.50	$935.50	$935.50
	Chlorine/Chloramines	3 samples/month	$29.00	$1,044.00	$391.50	$1,435.50	$1,435.50	$1,435.50	$1,435.50
						$6,709.22	**$5,775.14**	**$7,040.14**	**$5,875.39**

Treatment	Cost per 1,000 gallons	Water Use (kgpy/hh)	Number of households	**Year 1 Annual Cost**	**Year 2 Annual Cost**	**Year 3 Annual Cost**	**Year 4+ Annual Cost**
Install conventional filtration system with GAC as filter media[1]							
A. 7% interest	$3.28	109.50	167	$59,978.68	$59,978.68	$59,978.68	$59,978.68
B. 10% interest	$3.48	109.50	167	$63,710.28	$63,710.28	$63,710.28	$63,710.28
Additional cost of annual replacement of GAC[2]				$0.00	$2,088.00	$2,088.00	$2,088.00
Install corrosion control (CC)							
1. Addition of soda ash, 7% interest[3]	$0.38	109.50	167	$7,008.13	$7,008.13	$7,008.13	$7,008.13
2. Addition of soda ash, 10% interest[4]	$0.39	109.50	167	$7,190.16	$7,190.16	$7,190.16	$7,190.16
Total System Treatment Costs:		A.1. 7% interest		**$66,986.81**	**$69,074.81**	**$69,074.81**	**$69,074.81**
		B.2. 10% interest		**$70,900.44**	**$72,988.44**	**$72,988.44**	**$72,988.44**

Other	**Year 1 Annual Cost**	**Year 2 Annual Cost**	**Year 3 Annual Cost**	**Year 4+ Annual Cost**
Consumer Confidence Report	$279.87	$279.87	$279.87	$279.87
Install and maintain turbidity meter	$278.40	$278.40	$278.40	$278.40
Install and maintain chlorine residuals monitor	$500.00	$500.00	$500.00	$500.00
	$1,058.27	**$1,058.27**	**$1,058.27**	**$1,058.27**

TOTALS		**Year 1**	**Year 2**	**Year 3**	**Year 4 +**
Annual System Costs:	A.1. 7% interest	**$74,754.30**	**$75,908.22**	**$77,173.22**	**$76,008.47**
	B.2. 10% interest	**$78,667.93**	**$79,821.85**	**$81,086.85**	**$79,922.10**
Annual Costs per Household:	A.1. 7% interest	**$447.63**	**$454.54**	**$462.12**	**$455.14**
	B.2. 10% interest	**$471.07**	**$477.98**	**$485.55**	**$478.58**

[1] A conventional filtration system using granular activated carbon (GAC) can effectively remove atrazine while a conventional filtration system using mixed-media cannot. After consultation with Cadmus staff familiar with small system operation, the cost for installation and maintenance of a conventional filtration plant with GAC as the filter media was assumed to be the same as the cost for a similar system using mixed-media. See Note 2 for information on the additional cost due to annual GAC replacement. Assumptions provided: centralized system, one treatment plant, one entry point, 100% of total flow treated, discharge to landfill with non-mechanical dewatering. Includes all capital, operation and maintenance, and disposal costs. Amortization based upon 7% and 10% interest over 20 years. The average of two cost estimates was used to more accurately estimate costs (see "Case 5 Treatment Costs"). Source: *Evaluation of Central Treatment Options as Small System Treatment Technologies,* SAIC, 1999.

[2] GAC needs to be replaced approximately once per year, while mixed media filtration media generally lasts for the life of the plant. Thus, the cost for replacement of GAC once per year was added to the conventional filtration cost estimate. It was assumed replacement would not begin until Year 2. Cost estimate based upon communication with a P.E. from Howard R. Green Company, and from additional communication with Cadmus staff familiar with small system operation.

[3,4] Assumptions provided: one treatment plant, two entry points, 50% of total flow treated, 50% of total flow blended. Includes all capital, operation and maintenance, and disposal costs (it was assumed no waste would be produced by this process). Amortization based upon 7% and 10% interest over 20 years. An average of two cost estimates was taken to more accurately estimate costs (see "Case 5 Treatment Costs"). Source: *Evaluation of Central Treatment Options as Small System Treatment Technologies,* SAIC, 1999.

Note: Assuming the selected corrosion control treatment is effective, the system would return to a reduced monitoring schedule in Year 7. Reduced monitoring requires the system to take 1 sample at 5 taps every 3 years. From Year 5 until Year 7 however, the system must continue to take 1 sample at 5 taps per year.

CASE # 6

Type: CWS, GWUDISW (alluvial wells along a major river)

Treatment: System is currently using direct filtration. System has recently experienced nitrate and hardness problems. It must treat for nitrate and may treat for hardness.

Characteristics: System detects levels of nitrate moderately above MCL and has excessively hard water.
All other chemical contaminant levels well below MCLs.
Total coliform levels are far enough below MCL to require minimal monitoring.
Radionuclides above 50% of MCL, but not above MCL.

Population 2,500 **Number of Households:** 833

Monitoring	Contaminant	Requirements	Lab cost per sample	Annual lab cost	Annual system labor cost	**Year 1 Annual Cost**	**Year 2 Annual Cost**	**Year 3 Annual Cost**	**Year 4 + Annual Cost**
	Total Coliform	2 samples/month	$20.00	$480.00	$261.00	$741.00	$741.00	$741.00	$741.00
Chemical Monitoring									
	Asbestos	1 sample/9 years	$163.00	$18.11	$1.21	$19.32	$19.32	$19.32	$19.32
	Nitrate	1 sample/quarter for 1 year	$20.00	$80.00	$43.50	$123.50	$0.00	$0.00	$0.00
		1 sample/year thereafter	$20.00	$20.00	$10.88	$0.00	$30.88	$30.88	$30.88
	Nitrite	None performed				NA	NA	NA	NA
	Phase II/V IOCs	1 sample/year	$208.00	$208.00	$10.88	$218.88	$218.88	$218.88	$218.88
	Phase II/V VOCs	1 sample/year	$173.00	$173.00	$10.88	$183.88	$183.88	$183.88	$183.88
	Phase II/V SOCs	1 sample/3 years	$1,754.00	$584.67	$3.63	$588.30	$588.30	$588.30	$588.30
	Lead and Copper	1 sample at 10 taps/3 years	$27.00	$90.00	$120.83	$210.83	$210.83	$210.83	$210.83
	Radionuclides	4 consecutive quarterly samples once every 4 years	$234.00	$234.00	$10.88	$244.88	$244.88	$244.88	$244.88
Disinfection Byproducts									
	TOC & alkalinity	1 sample/month	$55.00	$660.00	$130.50	$790.50	$790.50	$790.50	$790.50
	TTHM & HAA5	1 sample/quarter	$223.00	$892.00	$43.50	$935.50	$935.50	$935.50	$935.50
	Chlorine/Chloramines	2 samples/month	$29.00	$696.00	$261.00	$957.00	$957.00	$957.00	$957.00
						$5,013.59	**$4,920.97**	**$4,920.97**	**$4,920.97**

SDWA-Related Treatment		Cost per 1,000 gallons	Water Use (kgpy/hh)	Number of households	**Year 1 Annual Cost**	**Year 2 Annual Cost**	**Year 3 Annual Cost**	**Year 4 + Annual Cost**
Install anion exchange to treat for nitrate[1]								
SDWA System Treatment Cost	7% interest	$0.75	109.50	833	**$68,097.51**	**$68,097.51**	**$68,097.51**	**$68,097.51**
	10% interest	$0.82	109.50	833	**$74,453.28**	**$74,453.28**	**$74,453.28**	**$74,453.28**
Additional Treatment Not Currently Required Under SDWA								
Install cation exchange for hardness[2, 3]								
Additional System Cost	7% interest	$0.57	109.50	833	**$51,754.11**	**$51,754.11**	**$51,754.11**	**$51,754.11**
	10% interest	$0.63	109.50	833	**$57,201.91**	**$57,201.91**	**$57,201.91**	**$57,201.91**
Total Treatment Cost, with optional treatment		7% interest			**$119,851.62**	**$119,851.62**	**$119,851.62**	**$119,851.62**
Total Treatment Cost, with optional treatment		10% interest			**$131,655.19**	**$131,655.19**	**$131,655.19**	**$131,655.19**

Other	**Year 1 Annual Cost**	**Year 2 Annual Cost**	**Year 3 Annual Cost**	**Year 4 + Annual Cost**
Consumer Confidence Report	$477.90	$477.90	$477.90	$477.90
Install and maintain turbidity meter	$278.40	$278.40	$278.40	$278.40
Install and maintain chlorine residuals monitor	$500.00	$500.00	$500.00	$500.00
	$1,256.30	**$1,256.30**	**$1,256.30**	**$1,256.30**

TOTALS		**Year 1**	**Year 2**	**Year 3**	**Year 4 +**
7% interest	**SDWA-Related Annual System Cost**	**$74,367.40**	**$74,274.78**	**$74,274.78**	**$74,274.78**
	SDWA-Related Annual Cost per Household	**$89.28**	**$89.17**	**$89.17**	**$89.17**
	Annual System Cost, including treatment for hardness	***$126,121.51***	***$126,028.89***	***$126,028.89***	***$126,028.89***
	Annual Cost per Household, including treatment for hardness	***$151.41***	***$151.30***	***$151.30***	***$151.30***
10% interest	**SDWA-Related Annual System Cost**	**$80,723.17**	**$80,630.55**	**$80,630.55**	**$80,630.55**
	SDWA-Related Annual Cost per Household	**$96.91**	**$96.80**	**$96.80**	**$96.80**
	Annual System Cost, including treatment for hardness	***$137,925.08***	***$137,832.46***	***$137,832.46***	***$137,832.46***
	Annual Cost per Household, including treatment for hardness	***$165.58***	***$165.47***	***$165.47***	***$165.47***

[1, 2] Assumptions provided: one treatment plant, two entry points, 50% of total flow treated, 50% of total flow blended, discharge to POTW. Includes all capital, operation and maintenance, and disposal costs. Amortization based upon 7% and 10% interest over 20 years. Source: *Evaluation of Central Treatment Options as Small System Treatment Technologies,* SAIC, 1999.

[3] It was suggested that the cost for installing and operating lime softening for this system be compared to the cost for installing and operating cation exchange. According to the cost estimates based on the source and assumptions listed in the previous footnote, lime softening is $1.22 per 1,000 gallons at 7% interest (assuming least cost disposal). This cost is nearly twice that of cation exchange. For that reason, lime softening was ruled out as a treatment for hardness for a system of this size and type.

Note: The use of reverse osmosis can treat for both nitrate and hardness. However, according to the source and assumptions from footnote 1, the cost for this technology exceeds the combined cost associated with the use of both anion and cation exchange for a system of this size and type.

Sources

Treatment Costs

1. All treatment cost estimates were derived from *Evaluation of Central Treatment Options as Small System Treatment Technologies*, SAIC, 1999, except for the estimate for filter media retrofit in Case 5A and annual GAC media replacement in Case 5B.
2. Case 5A and Case 5B cost estimates concerning GAC filter media retrofit/replacement were supplied by Mark Dubin, P.E. (Howard R. Green Company), through personal communication.

Laboratory Costs

1. Except where noted below, chemical monitoring cost estimates derived from the *Draft Information Collection Request for Chemical Monitoring Reform,* Cadmus, April 1998.
2. Nitrate, total coliform, total organic carbon (TOC), alkalinity, TTHM, HAA5, lead and copper, chlorine/chloramines, and radionuclide analytical cost estimates derived by averaging costs listed in a number of recent laboratory price schedules from a variety of independent and State laboratories located across the country.

Other Costs

1. Lead and Copper Rule sampling time, public education, and water quality parameter cost estimates provided by Cadmus staff who wrote the *Lead and Copper Rule Draft Information Collection Request,* Cadmus, 1999.
2. Consumer Confidence Report (CCR) cost estimates derived from the *Consumer Confidence Report Information Collection Request,* Cadmus, August 1998, and from consultation with Cadmus staff experienced with CCR development.
3. Sampling times for CWSs and NCWSs estimated by Cadmus staff familiar with small system operation.
4. Wage rates for water treatment system staff from the *Engineering News Record.*
5. Effective life of turbidity monitor and its cost, including installation and operation, from Cadmus staff familiar with small system operation.
6. Effective life of residuals monitor based on the experience of Cadmus staff familiar with small system operation.
7. Cost estimate of residuals monitor, including installation and operating costs, from personal communication with a P.E. from Howard R. Green Company.
8. Effective life of central water treatment plant from *Cost Evaluation of Small System Compliance Options: Point-of-Use and Point-of-Entry Treatment Units,* Cadmus, September 1998. This assumption supported by the generally accepted life-cycle estimates made for water treatment plants.
9. Average number of people per household based on *Cost Evaluation of Small System Compliance Options: Point-of-Use and Point-of-Entry Treatment Units,* Cadmus, September 1998.
10. Estimate of household water use per year based on *Cost Evaluation of Small System Compliance Options: Point-of-Use and Point-of-Entry Treatment Units,* Cadmus, September 1998, which is in agreement with AWWA's Water Inventory Database (1992).
11. All cost conversions to 1998$ made using the Producer Price Index-Commodities (Finished Goods), Bureau of Labor Statistics, Series ID # WPUSOP3000, located at *http://www.bls.gov*.