Implementation Actions Being Taken in Response to a TC+

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TCRDS Federal Advisory Committee Meeting
December 6, 2007

This Meeting's Presentations

Objectives

Provisions

System compliance

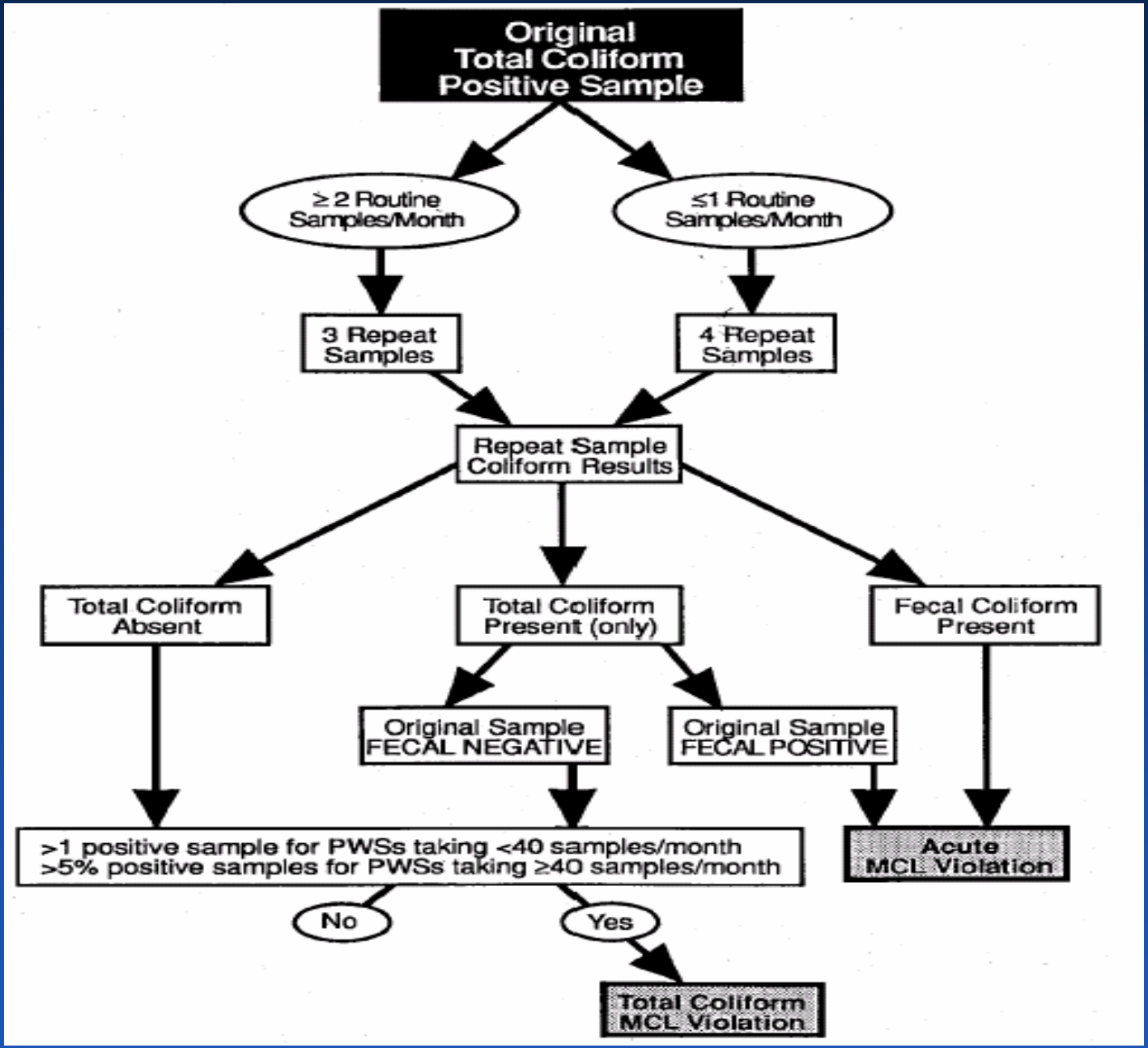
Improvement

Research

TC+ Response

Presentation Objectives

- Describe the actions taken by states and utilities in response to TC+ samples, FC+/EC+ positive samples and MCL violations
- Include both responses required by regulation and those chosen by utilities and states on their own
- Provide an indication of how often various actions are taken and why states and utilities chose these particular actions
- Provide the background information for the Advisory Committee to evaluate whether any of the current voluntary actions could be effective tools to improve implementation or increase public health protection in a revised TCR


Original Total Coliform Positive Sample
≥ 2 Routine Samples/Month
≤1 Routine Samples/Month
3 Repeat Samples
4 Repeat Samples
Repeat Sample Coliform Results
Total Coliform Absent
Total Coliform Present (only)
Fecal Coliform Present
Original Sample FECAL NEGATIVE
Original Sample FECAL POSITIVE
>1 positive sample for PWSs taking <40 samples/month
>5% positive samples for PWSs taking ≥40 samples/month
Acute MCL Violation
No
Yes
Total Coliform MCL Violation

States and Utilities Often Take Additional Follow-up Actions to Respond to Coliform Positive Samples

- Series of slides that follow show some of the State actions in response to different events
  - Routine TC+ / EC-
  - Routine TC+ / EC+
  - Nonacute MCL Violation

Routine TC+ / EC-

- Respond on case by case basis
- Response varies based on compliance history of public water system
- Examples of actions
  - Increase residual
  - Require additional samples
  - Boil Water Advisory (BWA)

Routine TC+ / EC+

- Higher level of initial concern
- Respond on case by case basis
- Response varies based on compliance history of public water system
- Examples of actions
  - Increase residual
  - Require additional samples
  - Boil Water Advisory (BWA) more likely
- States more likely to be directly notified by lab of results

Nonacute MCL Violations

Respond on case by case basis

- Response varies based on compliance history of public water system
- Examples of actions
  - Increase Routine samples required
  - Investigation by PWS report to State
  - Site visit by State staff

Acute MCL Violations

- Continue with previous responses
- Boil Water Advisory

States and Utilities Often Take Additional Follow-up Actions to Respond to Coliform Positive Samples

- Series of slides that follow show some of the Utility actions in response to different events
  - Routine TC+ / EC-
  - Routine TC+ / EC+
  - Nonacute MCL Violation
  - Acute MCL Violation

Routine TC+ / EC-

- Review sample collection
  - Sampler, Sample site
- Evaluate other water quality parameters
  - Chlorine residual, pH, Alkalinity
- Conduct additional TC sampling
- Initiate flushing
- Verify disinfection status

Routine TC+ / EC+

- Review sample collection
  - Sampler, Sample site
- Evaluate other water quality parameters
  - Chlorine residual, pH, Alkalinity
- Conduct additional TC sampling
- Initiate flushing
- Verify disinfection status
- Notify affected customers
- Contact State primacy agency

Nonacute MCL Violations

- Customize Public Notification
- Continue previous response

Acute MCL Violations

- Continue with previous responses
- Voluntary Boil Water Advisory

Case Studies of Individual Water System Experiences

- Another TWG subgroup is analyzing data from an AwwaRF case study project
- The details from the response actions in these case studies may provide additional insight into the use of various response tools by water systems.
- Some basic information on the tools that were used by the case study systems is presented here.
- Additional material on the effectiveness of the tools may be presented later to support the Advisory Committee's discussion of options.

Characteristics of Case Study Systems

- The case studies covered 8 large water systems
- Population range 80,000 – 2.2 million
- Many were addressing long term water quality problems and not isolated coliform incidents

In-Depth Questions used by Utilities to Investigate Coliform Occurrences

Issues to be Investigated	**Description**
Detection Method	Did the utility detect or confirm coliform positives because of a change or improvement in detection method?
Disinfectant	Did disinfectant residual concentration correspond to coliform positives?
Speciation	Did the utility apply speciation to better identify the cause of the coliform problems?
Monitoring / Analysis	Did the utility conduct additional monitoring and analysis?
Pipe Coupons	Did the utility analyze pipe coupons to identify presence/variability or coliform speciation?
Nutrients	Did the utility use AOC/BDOC levels to help identify the coliform problem and cause?
Corrosion rates	Did the utility measure corrosion rates to investigate a coliform occurrence?

Mitigation Strategies Used by Utilities in the Case Studies

Mitigation Strategies	Description
Alter Disinfection	Alter the disinfection – disinfectant type, residual level, install booster chlorination, or adjust disinfection process or location.
Treatment Changes	Change source water treatment processes.
Water Quality Monitoring	Implement changes to water quality monitoring and management.
O&M Practices	Change or implement new O&M practices.
Source Monitoring	Establish additional source water monitoring.
Corrosion	Make adjustments or treatment changes to reduce corrosion in the distribution system.

Appendices

Even for Required Actions, State and System Responses are not Always Uniform

- All states will require Repeat samples to be taken.
- At least 5 states have staff collect Repeat samples.
- States can (and do) allow more than 24 hours to collect the Repeats depending on circumstances.
- For various reasons, not all systems will collect the full number of Repeat samples.

Variations in State and System Response (continued)

- Most states take advantage of the ability to cease continued Repeat sample collection once the MCL has been exceeded (if there have been no E. coli positives).
- States and utilities may not decide to exercise the options for positive sample invalidation unless the numbers are high enough to cause an MCL violation.
- Similarly, the work necessary to establish data to support the waiver provision may be more burdensome than accepting the violation and doing public notice.

Routine TC+ / EC-

State Response	Implementation Characterization	Rationale
Boil Water Advisory (BWA)	Required by 3 of 36 states surveyed. Required by at least one state if repeats are not collected and used as a tool by specific regional offices in another state.	Use of the BWA in cases where only total coliform is present may be dependent on the coliform history of the water system or other known problems such as low pressure or main breaks.
Require additional coliform monitoring	Required by 1 of 36 states surveyed.	States may increase the level of routine monitoring to help define the scope of a problem.
Require source monitoring	Required by 1 of 36 states surveyed – will be GWR requirement.	Used by states even before the GWR to try to identify the source of contamination.

Routine TC+ / EC- (Continued)

State Response	Implementation Characterization	Rationale
Require increased disinfectant residual or other disinfection action	Required by 6 of 36 states surveyed.	To established required disinfectant levels or provide increased residual above routine levels to increase the level of protection against microbial contamination.
Require “corrective action” (details determined case by case)	Required by 3 of 36 states surveyed.	Determined by the suspected cause of the problem and appropriate response.

Routine TC+ / EC- (Continued)

State Response	Implementation Characterization	Rationale
Specific state response action which may include sanitary survey or other site visits, treatment evaluation, assigning points to a state enforcement prioritization, etc.	Required by 4 of 36 states surveyed.	Determined by the suspected cause of the problem and appropriate response.
Require reporting by laboratory of TC+ sample results directly to the state		While not a response to a specific TC+, some states use this to get earlier notification and allow faster response.

Routine TC+ / EC+

State Response	Implementation Characterization	Rationale
Boil Water Advisory (BWA)	Required by at least one state until repeats are collected and by at least one other if repeats are not collected.	Due to the length of time until repeat samples can be collected to confirm a problem, a BWA may be requested during the interim period to insure public health protection. In cases where no repeats are collected the state cannot verify that a problem does not exist so a BWA is requested, again to insure public health protection.

Nonacute MCL Violation

State Response	Implementation Characterization	Rationale
Boil Water Advisory (BWA)	Required by 8 of 14 states surveyed.	Used under special circumstances like a history of non-acute MCLs or TC+ samples.
Require implementation of “corrective action” such as installation of disinfection or other treatment, improved O&M, fix sanitary defect	Implementation varies – less likely for a single violation, more likely when there is a history of MCL violations or TC+ samples.	Determined by the suspected cause of the problems and appropriate response to reedy existing problem and prevent future problems.

Nonacute MCL Violation (Cont'd)

State Response	Implementation Characterization	Rationale
Require increased routine TC monitoring	Implementation varies – less likely for a single violation, more likely when there is a history of MCL violations or TC+ samples.	State may feel that increased monitoring will provide the utility with additional information about the status of their system and help detect future problems sooner.
Require investigation by the water system and report to the state of findings	Implementation varies – less likely for a single violation, more likely when there is a history of MCL violations or TC+ samples.	Investigation is necessary to identify the source of a problem or determine the appropriate response action.

Nonacute MCL Violation (Cont'd)

State Response	Implementation Characterization	Rationale
Site visit or other investigation by state staff	Implementation varies – less likely for a single violation, more likely when there is a history of MCL violations or TC+ samples.	A thorough review of the system may be necessary to identify the source of a problem or determine the appropriate response action. The utility may need state assistance to perform this investigative work.
Referral of system to third party TA provider for assistance	Implementation varies.	Resources may prevent the state from conducting this activity or they feel the utility may respond better to third party assistance.

Acute MCL Violation

State Response	Implementation Characterization	Rationale
Boil Water Advisory	Required by 14 of 14 states surveyed under nearly all circumstances.	This would only be waived when the state is confident the cause has been eliminated.
Drinking water agency notifies state and/or local health department	Partly dependent on organization of state drinking water program and whether it is already in the health agency.	State and local health departments need to be involved in determining appropriate steps to protect public health.

Routine TC+ / EC-

Utility Response	Implementation Characterization	Rationale
Laboratory notifies operator or other system official of positive sample which triggers standardized response	With an in-house laboratory, initiation of an SOP is not delayed by obtaining notification from commercial or state laboratory.	
Collect 3 or 4 Repeat Samples and if a small system, collect 5 samples the next month	Regulatory Requirement	Multi sample collection in building to determine if local issue (cross connection).

Routine TC+ / EC- (Cont'd)

Utility Response	Implementation Characterization	Rationale
Interview sample collector to determine possible causes of sampling problem		Notice any problems with the tap, was the water warm for a long time before collecting samples. Assists in determining if localized issue.
Review sample history at the sample site for any anomalies/red flags		If site has had multiple TCs over the past 1-2 years could lead to a small sporadic issue (HVAC backflow, cross connection). Review of other water quality parameters at site may also help identify local issue.

Routine TC+ / EC- (Cont'd)

Utility Response	Implementation Characterization	Rationale
Evaluate other water quality parameters such as chlorine residual, pH, turbidity, alkalinity, temperature, HPC, NO3, NO2, NH4, conductance	Practice more likely in larger systems with better laboratory capabilities.	Can be collected after a positive, routinely or when chlorine is low or HPC is high. Used to assist in tracking potential source of issue.
Conduct site investigation to determine potential contamination cause/source which may also include cross connection investigations/backflow device testing, shared hydrants, firefighting	Quality of the investigation, the validity of the results, and therefore the effectiveness of the remedial actions is very dependent on the skills of the operator. Small systems may rely on states or third parties like Rural Water.	

Routine TC+ / EC- (Cont'd)

Utility Response	Implementation Characterization	Rationale
Different, more highly trained, sample collectors collect repeat samples	Only practical in water systems large enough to have more than one employee.	Samplers may get careless over time. Other samples may notice something different about local sample site. Having a cross connection
Conduct additional monitoring	Practice more likely in larger systems with better laboratory capabilities.	

Routine TC+ / EC- (Cont'd)

Utility Response	Implementation Characterization	Rationale
Review water system conditions at time of original sample collection like pressure, treatment plant operation, construction in the DS, etc	Smaller systems may not have any records beyond the memory of the operator who might not even be on site full time.	Pressure changes, flow change, construction etc, may cause scale to break off in the main (especially cast iron) which may cause a temporary release of biofilm (HPC, total coliform). One time event.
Review source and source water treatment – can utility identify origin of distribution water (source well)	GWR will require some of this activity.	Sources could have changed. May be able to identify if it is an issue with a single source. Is treatment working?

Routine TC+ / EC- (Cont'd)

Utility Response	Implementation Characterization	Rationale
Specialized response may occur if the sample location is at or near a storage tank. Response may include special tank monitoring, taking the tank out of service, tank inspection, tank cleaning, etc.	Response may involve outside contractors which adds to the cost and delays the response.	TC+ could be from tank due to infiltration (below ground tanks), poor circulation due to design or summer temperature/density stagnation.
Initiate flushing of the DS in the area around the original sample site		Especially for dead end areas. If a temporary biofilm/scale release occurs, poor quality water needs an exit from distribution system; otherwise it may linger for weeks.

Routine TC+ / EC- (Cont'd)

Utility Response	Implementation Characterization	Rationale
Increase level of DS disinfectant and/or increase disinfection of the source or in the treatment process	May apply even if system does not already disinfect. States will usually not approve increased disinfection before Repeat samples are collected.	May be used for far end of distribution due to reduce temporary high biofilm activity or low chlorine residuals. In GW systems, water levels may fluctuate and pull from further aquifers that may have poor WQ. Also used to reduce biofilm development at the well pump (slime/iron bacteria).
Provide report to the state on findings of investigations	Not all water systems are comfortable sharing information with the state that is not required by the regulations	System keeps state informed to maintain good working relationship and avoid last minute surprises.

Routine TC+ / EC- (Cont'd)

Utility Response	Implementation Characterization	Rationale
Change the sample site or install a dedicated sampling tap when unsanitary conditions at the sample site are determined to be a cause	All states do not fully support dedicated sample taps and smaller systems may not be able to afford the additional cost.	Service connection may contain a cross connection. This is done when system does not have control of site and site is not representative of mains.
Include information on TC+ samples in Consumer Confidence Report	Report the highest monthly count or % of TC+ samples. This is in addition to the CCR notice if a MCL violation results.	

Repeat TC+ / EC-

Utility Response	Implementation Characterization	Rationale
Most responses already initiated by TC+ Routine sample – special situations listed below		Most likely that there is a temporary or sporadic issue. Large systems will normally increase surveillance.
Collect additional 3 or 4 Repeat Samples	Regulatory Requirement	
Issue a Health Advisory that may or may not include a boil water requirement	Required by at least one state	
Inform state if system expects to exceed monthly TCR MCL	Reporting is inconsistent, especially for small systems.	

Routine or Repeat TC+ / EC+

Utility Response	Implementation Characterization	Rationale
Conduct responses as outlined for TC+, EC- samples		Most likely that there is a temporary or sporadic issue. Large systems will normally increase surveillance.
Contact state drinking water agency and local health agency (if available)		
Notify affected customers		Notification is made to protect health of the public. Utilities may also want to be able to limit the area covered by a BWA.

Routine or Repeat TC+ / EC+ (Cont'd)

Utility Response	Implementation Characterization	Rationale
Include information on EC+ samples in Consumer Confidence Report	In addition to TC+ information, report the total number of EC+ samples.	
The specific items listed here, are direct responses to violations. However, systems may be initiating additional responses from the tools already listed for coliform positive samples.		Just because a violation has been determined and formal responses taken, there is still a need to identify the cause of the problem and provide a solution.

Nonacute MCL Violation

Utility Response	Implementation Characterization	Rationale
Prepare and deliver boil advisory notification as directed by state or mandated by internal SOPs	Only a few systems will implement without state direction. Advisory may be system wide (small systems) or apply to only a portion of the DS (large systems if state allows).	

Acute MCL Violation

Utility Response	Implementation Characterization	Rationale
Prepare and deliver boil advisory notification	Advisory may be system wide (small systems) or apply to only a portion of the DS (large systems if state allows).	

Response Actions Required by Federal Rule for MCL Violations

- Require Public Notification
  - Tier 1 for acute violation
  - Tier 2 for non-acute violation
- Information in the Consumer Confidence Report is also required for violations and coliform positive samples

Public Notification and Reporting Requirements

- Monthly MCL violation
  - Non Acute - Notify public per Public Notification Rule: Tier 2 Public Notification (within 30 days of learning of a violation)
  - Acute - Notify public per Public Notification Rule: Tier 1 Public Notification (within 24 hours)
- Systems with routine or repeat samples that are fecal coliform or *E.coli* positive (regardless of violation determination) must notify State by the end of the day they are notified of the result
- Monitoring violations must be reported to the State within 10 days after the system discovers the violation
- Current PN language included in Appendix

Rationale for Public Notification and Reporting Requirements

- Non-acute (monthly) MCL violation
  - Alerts consumer of potential contamination to system
  - Non-acute violation does not require immediate notification since no immediate evidence of fecal contamination
- Acute MCL violation requires short term notification since fecal contamination indicates that pathogens posing acute risk may be present
  - If routine or repeat samples are fecal coliform or *E.coli* positive, system notifies State by end of the day notified of FC+/EC+ result to allow for appropriate State action
- Monitoring violations generally seen as less significant, so more time to report

Required Language for a Non-acute MCL (total coliform only)

"Coliforms are bacteria that are naturally present in the environment and are used as an indicator that other, potentially harmful, bacteria may be present. Coliforms were found in more samples than allowed and this was a warning of potential problems."

Required Language for an Acute MCL (total coliform plus E. coli/fecal)

- "Fecal coliforms and *E. coli* are bacteria whose presence indicates that the water may be contaminated with human or animal wastes. Microbes in these wastes can cause short-term effects, such as diarrhea, cramps, nausea, headaches, or other symptoms. They may pose a special health risk for infants, young children, some of the elderly, and people with severely compromised immune systems."

Repeat Sampling Requirements

- Within 24 hours of learning of a total coliform-positive ROUTINE sample result, at least 3 REPEAT samples must be collected and analyzed for every total coliform positive sample:
  1) One REPEAT sample must be collected from the same tap as the original sample.
  2) One REPEAT sample must be collected within five service connections upstream.
  3) One REPEAT sample must be collected within five service connections downstream.
- Systems that collect only 1 ROUTINE sample per month (NCWS with population ≤ 1,000) or fewer must collect a 4th REPEAT sample at an additional location.

Repeat Sampling Requirements

- If a sample site upstream or downstream does not exist, the State can waive the requirement for that location but not for the number of samples that need to be collected.
- If a system has only 1 service connection, that system can take the 4 repeat samples over 4 days (1 per day) rather than all on the same day.
- However, EPA prefers all repeat samples to be collected on the same day at either the same tap in succession or at taps at opposite ends of the facility where the NCWS has only one service connection.

If any Repeat Sample is TC+:

1) The system must analyze that total coliform-positive culture for fecal coliforms or *E.coli*.
2) The system must collect another set of REPEAT samples, as before, and until a complete set of repeat samples is negative, unless the MCL has been violated and the system has notified the State.

Invalidation of Positives

- EPA believed that if any repeat sample is total coliform-positive at the same tap as the original total coliform-positive sample, but all repeat samples at nearby service connections are total coliform-negative, this is a strong indication of a domestic or other non-distribution system plumbing problem.
- Therefore, in this case, the final rule allows the State to invalidate the original TC+ sample. This provision is used, but not frequently.
- In addition, invalidation is also possible due to documented laboratory error.

Waiver of Total Coliform MCL Violation

- The nonacute MCL may not apply if the system can demonstrate to the state that the violation of the MCL is due to persistent total coliform growth in the distribution system rather than fecal contamination, a lapse in treatment or O&M problem in the distribution system.
- Used infrequently.

Additional Routine Monitoring Requirements (Small Systems)

- For small systems collecting less than 5 samples per month, the Rule requires collection of a minimum of 5 Routine samples the month following a TC+ sample.