

# Coliform Monitoring and Sampling Plans

## Meaning of Acroynms

- ADWR = Aircraft Drinking Water Rule
- TC+ = Total coliform-positive
- EC+ = *E. coli*-positive
- D&F = Disinfection and Flushing
- CSP = Coliform Sampling Plan



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## Compliance Dates

- ◉ Existing aircraft
  - Coliform sampling plan – April 19, 2011
  - Monitoring begins – October 19, 2011
- ◉ New aircraft
  - Coliform sampling plan – within the first calendar quarter of initial operation of the aircraft
- ◉ Changes to the monitoring frequency
  - Report to EPA no later than 10 days following the calendar month in which the change occurred



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For **existing** aircraft, both the sampling frequencies (addressed later in this presentation) and the DATE the coliform sampling plan was completed must be reported to EPA by April 19, 2011. Coliform monitoring must begin on or by October 19, 2011.

For **new** aircraft placed into operation after April 19, 2011, the aircraft inventory, sampling frequencies, and plan completion must be reported within the first calendar quarter of initial operation of the aircraft.

Any **changes** in coliform sampling frequencies must be reported to EPA no later than 10 days following the calendar month in which the change occurred. Such changes must also be incorporated in the coliform sampling plan, although the plan itself need not be submitted. PLEASE NOTE: Changes to coliform sampling frequencies and coliform sampling plans require changes to disinfection and flushing frequencies (D&F) and operations and maintenance (O&M) plans.

## Required Coliform Sampling

Three types of coliform samples required by the ADWR

- Routine sampling
- Repeat sampling
- Follow-up sampling
  
- Replacement sampling

Voluntary sample type:

- Special purpose sampling



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There are 3 types of coliform samples required by the rule

- 1) Routine
- 2) Repeat
- 3) Follow-up

Replacement samples may be required if any of the above three types of samples are not acceptable and another sample must be collected.

Special samples may also be collected by the air carrier on a voluntary basis.

The next few slides provide the details for each of these sample types.

## Routine Coliform Monitoring

- Collected on a specified schedule
  - Based on frequency of routine D&F
- Can be taken any time during monitoring period except within 72 hours *after* routine D&F



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Routine samples are collected on a specified schedule, which is determined by the frequency of routine D&F of the aircraft public water system and must be described in the coliform sampling plan. Routine samples may be collected at any time during each monitoring period, except that they cannot be collected within 72 hours after completing routine D&F procedures.

## Routine Coliform Monitoring, cont.

- Collect two 100-mL samples – one galley tap, one lavatory tap
  - If only one tap, collect two samples from that tap
  - If more than two taps, ok to rotate sample locations
- Exception – only one 100 mL sample required if aircraft has only one tap and uses a removable/portable container drained everyday of passenger service

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For routine sampling, two samples of 100 milliliters (mL) each must be collected, one from a galley and one from a lavatory tap during each monitoring period.

If the aircraft has only one tap, two 100-mL samples must be collected from that tap. Aircraft with multiple sampling locations (e.g., two galleys and two lavatories) should adjust the sample locations each monitoring period, when necessary, to collect representative samples throughout the system.

An exception to the requirement for two routine samples each monitoring period is allowed by the ADWR for aircraft PWSs consisting of only one tap and a removable/portable tank that is drained every day of passenger service. These systems must collect only one 100-mL routine sample from the available tap.

## Repeat Coliform Monitoring

- Option if one or more routine samples are TC+/EC-
- Samples must be collected with 24 hours of being notified of the results – no exceptions
- Collect three 100 mL samples – one at the tap with the TC+ result, one galley tap, one lavatory tap
  - If <3 sample taps, collect three samples from available taps

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When one or more routine samples are TC+/EC-, air carriers have the option to collect repeat samples instead of performing corrective D&F of the system or restricting public access. Repeat samples provide information on the extent of the contamination event that resulted in the presence of coliform organisms in the routine samples. If the option to collect repeat samples is selected, three repeat samples (of 100 mL each) must be collected no later than 24 hours after the laboratory notifies the air carrier of the routine TC+ sample results. If the carrier cannot collect the repeat samples within 24 hours, no extensions to this timeframe are allowed. The air carrier must proceed with another option.

The three repeat samples must be collected and analyzed from three taps within the aircraft as follows: the tap that resulted in the TC+ routine sample, one other lavatory tap, and one other galley tap. If fewer than 3 taps exist, then a total of three 100-mL samples must be collected and analyzed from the available taps within the aircraft water system. For example, if an aircraft only has two taps, two 100-mL samples would be collected from one of the taps, and one 100-mL sample would be collected from the other tap.

## Follow-up Coliform Monitoring

- Collected after corrective D&F due to:
  - TC+ and/or EC+ sample result
  - Failure to perform routine D&F
  - Failure to conduct routine coliform monitoring
  - Failure to collect repeat or follow-up samples
  - Failure to board water from a safe watering point
- Collect two 100-mL samples at the same locations as routine samples
  - *Exception:* Aircraft with 1 tap, portable tank, drained everyday, collect one 100 mL sample.
- Timeframe not specified in ADWR, but they must be collected prior to providing water to the public

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Now the last type of required sample – FOLLOW-UP samples.

Follow-up samples are used to indicate the effectiveness of corrective D&F procedures. They must be collected when:

- 1) Corrective D&F is performed in response to a TC+ or EC+ sample.
- 2) Corrective D&F is triggered by failure to: perform routine D&F or routine coliform monitoring; failure to collect repeat samples or follow-up samples; or failure to board water from a safe watering point.

Follow-up samples consist of two samples of 100-mL each that must be collected at the same locations as the routine samples – that is, a galley and a lavatory sample must be collected. Of course, for aircraft that have only one tap, and use a removable/portable container that is drained every day of passenger service, only one 100-mL sample is collected from that tap.

The ADWR does not specify a timeframe by which follow-up samples must be collected, but they must be collected prior to providing water to the public.



## Specialized Coliform Sampling

- Replacement samples
  - Required when a routine, repeat, or follow-up sample is *invalidated* by the EPA or certified laboratory
  - Must be collected in the monitoring period applicable to the original sample
  - Must be collected from the same location



Now that we've gone over the required ADWR sample types, let me bring your attention to another type of sample, known as Replacement samples.

Replacement samples are collected in the RARE event a sample is INVALIDATED by EPA or the certified laboratory.

Replacement samples are required when a routine, repeat, or follow-up sample is INVALIDATED. There is an emphasis on INVALIDATED because it applies to very specific scenarios (which we'll cover in detail in the next few slides).

Replacement samples must be collected within the monitoring period applicable to the original sample. Therefore, EPA recommends routine monitoring be performed early enough in the monitoring period to allow notification of the need for replacement samples and their collection before the monitoring period is over.

Replacement samples must be collected from the same location from which the initial sample was taken.

## Sample Invalidation

- Samples can only be invalidated by EPA or by the State- or EPA-certified laboratory
- Three scenarios when EPA may invalidate a TC+ sample

### (1) The laboratory establishes that improper sample analysis caused the TC+ result.

- A replacement **routine** sample must be collected and analyzed before the end of the monitoring period
- A replacement **repeat** sample must be collected within 24 hours of being notified of the invalidated repeat sample, which is consistent with the requirements for collecting repeat samples within 24 hours of notification under the ADWR
- A replacement **follow-up** sample must be collected as soon as possible to ensure compliance.

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In terms of INVALIDATION, there are three specific scenarios when EPA may invalidate a TC+ sample

- (1) The laboratory establishes that improper sample analysis caused the TC+ result. When this occurs,
  - (a) For an invalidated routine sample - replacement routine samples must be collected and analyzed before the end of the monitoring period to avoid a violation for failure to collect the required routine samples.
  - (b) For a repeat sample that is invalidated - replacement repeat samples must be collected within 24 hours of being notified of the invalidated repeat sample. EPA may grant a 24 hour waiver for this (as you will see shortly.)
  - (c) And, For a follow-up sample that is invalidated - replacement follow-up sample must be collected as soon as possible. Remember, under the rule, no water can be provided for human consumption until follow-up sample collection is completed.

## Sample Invalidation, cont.

(2) The second scenario, which is not readily applied to aircraft PWSs, allows EPA to determine that the TC+ sample resulted from a domestic or other non-distribution system plumbing problem.

Specifically...

- Aircraft water systems are closed systems, they do not have “domestic” or “other non-distribution system plumbing” that would justify the invalidation of a TC+ sample.
- All of the onboard water system plumbing is the responsibility of the air carrier from the storage tank filler neck to the tap.
- Also, this invalidation scenario requires that all repeat samples collected within five service connections of the original tap are TC-

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(2) The second scenario, which is not readily applicable to aircraft PWSs, allows EPA to determine that the TC+ sample resulted from a domestic or other non-distribution system plumbing problem.

This scenario, although referenced in the rule, does not apply because,

-- Aircraft PWSs are closed systems; they do not have “domestic” or “other non-distribution system plumbing” that would justify the invalidation of a TC+ sample.

-- Also, ALL of the onboard water system plumbing is the responsibility of the air carrier from the storage tank filler neck to the tap, so there is no domestic plumbing connection.

-- Lastly, this invalidation scenario would require all repeat samples collected within five service connections of the original tap to be TC- .

## Sample Invalidation, cont.

(3) EPA has substantial grounds to believe that a TC+ result is due to a circumstance or condition which does not reflect water quality in the distribution system.

- The system must still collect all required repeat samples and use them to determine compliance.\*
- To invalidate a TC+ sample under this scenario, EPA must document the decision and its rationale in writing and make the decision available to the public.
- EPA may not invalidate a TC+ sample solely on the grounds that all repeat samples are TC-.

\*NOTE: There is no replacement sample required since the system has collected all repeat samples that are required and used them to determine compliance.

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(3) The third and final invalidation scenario is when EPA has substantial grounds to believe that a TC+ result is due to a circumstance or condition which does not reflect water quality in the distribution system.

When this occurs,

-- The air carrier must still collect all required repeat samples and use them to determine compliance.\*

\*NOTE: Since you are collecting the required repeat samples and those will be used to determine compliance, no replacement sample is necessary

Under this scenario to invalidate a TC+ sample, EPA must document the decision, and its rationale, in writing, and make the decision available to the public.

And, as further reference by rule, EPA may not invalidate a TC+ sample solely on the grounds that all repeat samples are TC-.

## Sample Invalidation, cont.

- Under the only laboratory-invalidation scenario,
  - The laboratory must invalidate a TC sample (unless TCs are detected) if the sample produces a turbid culture in the absence of gas production using an analytical method where gas formation is examined.
  - A replacement sample must be collected from the same location as the original sample within 24 hours of being notified of the interference problem and have it analyzed for the presence of TC.
  - The system must continue to re-sample within 24 hours and have the samples analyzed until it obtains a valid result.\*

\*NOTE: This is the only scenario where EPA may waive the 24-hour time limit on a case-by-case basis.

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This is the final and only scenario, under which a Certified Laboratory may officially invalidate a sample:

The laboratory must invalidate a TC sample (unless TCs are detected) if the sample produces a turbid culture in the absence of gas production using an analytical method where gas formation is examined.

A replacement sample must be collected from the same location as the original sample within 24 hours of being notified of the interference problem and the sample must be analyzed for the presence of TC.

The system must continue to re-sample within 24 hours of notification, and have the samples analyzed, until it obtains a valid result.\*

\*NOTE: This is the only scenario where EPA may waive the 24-hour time limit on a case-by-case basis.

## Coliform Sampling Plans



- Plans must include
  - Coliform sample collection procedures
  - Sample tap location(s)
  - Frequency and number of routine samples
  - Frequency of routine D&F
  - Procedures for communicating sample results

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Now that we have defined the different types of samples, let's delve into what is included in a Coliform Sampling Plan (CSP).

As mentioned earlier, the rule requires the development of a CSP for each aircraft PWS. That plan can represent an individual aircraft PWS or a specific make and model of aircraft. And, the CSP must be included in the O&M plan (which will be covered in another session).

To help you in developing a CSP, EPA created a TEMPLATE for air carriers to use that covers all the information that will now be presented. This template is in Appendix C of *the Guidance Manual for the Aircraft Drinking Water Rule – Interim Final*, which was published in October 2010. This guidance may look familiar to many air carriers because it is similar, in many ways, to the Comprehensive Representative Monitoring Plan (CRMP) that many air carriers submitted under their Administrative Orders on Consent (AOCs).

Now back to the slides: At a minimum, all CSPs must include the following [as noted in 40 CFR 141.802(a)]:

- Coliform sample collection procedures.
- Sample tap location(s) representative of the aircraft PWS.
- Frequency and number of routine samples to be collected.
- Frequency of routine D&F as specified in the O&M plan.
- Procedures for communicating sample results to ensure that all required actions are conducted in a timely manner.

Each of these elements of a CSP will be discussed in the next slides.

## Coliform Sampling Plans, cont.

- Coliform Sample Collection Procedures
  - Proper procedures ensure:
    - Samples are representative of water provided to passengers and crew
    - Sample collection bottles do not become contaminated
    - Faucets and fixtures will not contribute to contamination
  - Communication with the laboratory necessary
    - Gives them a “heads up” that samples are coming  
*Sample holding time 30 hours from the time sample is collected*
    - Details such as sample bottles and return shipping coolers can be discussed

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Critical steps in the sample collection procedure include ensuring the sample is representative of water provided to passengers and crew (including any supplemental treatment), that the sample collection bottle does not become contaminated, and that the faucet or fixture to be sampled will not contribute contamination from its external surface.

In advance, it should be determined if the laboratory will provide sample bottles and, if so, how many will be needed. Additionally, it should be determined whether the laboratory will provide a return shipping cooler and ice packs. It is recommended that the samples be shipped on wet-ice (not dry ice) to obtain a shipping temperature of 10 degrees Celsius or less without freezing. Using dry ice will likely freeze the samples, which would render the samples invalid and require the collection of replacement samples.

The analysis of the samples by the laboratory must begin within 30 hours of sample collection or the sample will not be accepted by the laboratory and replacement samples will be required [40 CFR 141.803(a)(4)].

## Coliform Sampling Plans, cont.

- Sample tap location(s)
  - Must be identified in the Coliform Sampling Plan
  - Should be representative of water consumed by passengers and crew
  - Must include (at least) one galley tap & one lavatory tap
    - If only a single tap, collect two 100mL samples from that tap
      - *Exception: If Aircraft has 1 tap, portable tank, drained everyday, collect one 100mL sample from that tap*
    - If more than one galley and lavatory tap are available, rotate locations each monitoring period
  - Cold water taps preferred
    - Warm and hot water taps can mask microbial contamination
    - If only a hot water tap in galley/lavatory, must sample that tap

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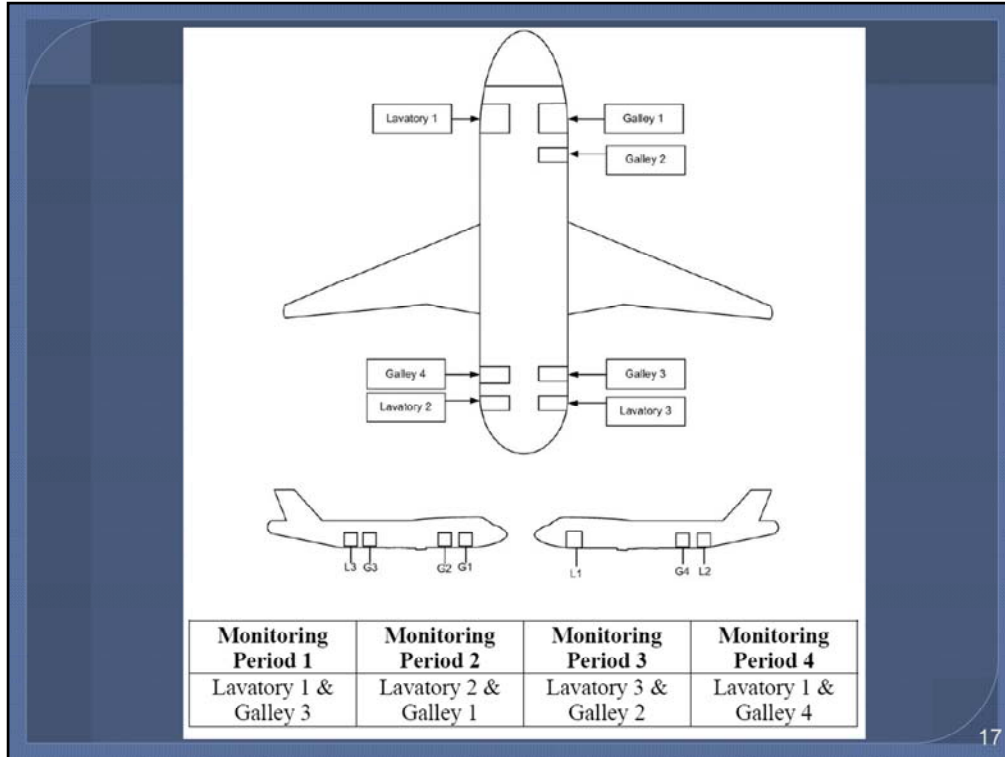
The ADWR requires that sample collection locations be identified in the CSP (e.g., fore or aft, lavatory or galley) to help identify the specific location from which a sample was collected.

Coliform sample locations should be most representative of the water used for human consumption by passengers and crew. As stated earlier, human consumption is not limited to water used only for drinking or beverage preparation. Because passengers may access water in the lavatory for hand washing, teeth brushing, drinking, or preparing dehydrated foods, lavatories must be sampled to represent water provided to the public. Therefore, routine coliform samples must be collected from a lavatory tap and a galley tap during each monitoring period if the aircraft has taps in these locations.

REMEMBER: If more than one galley and lavatory tap are available, EPA recommends that the sample collection locations be rotated each monitoring period to ensure the entire aircraft water system is sampled periodically. The next slide will illustrate this point further. If an aircraft has a single tap, the two 100 ml sample(s) must be collected from that tap regardless of the temperature of the water provided by that tap (i.e., a hot or a cold water tap). The exception of course is an aircraft that has only one tap, with a portable/removable tank that is drained every day of passenger service. In this case, only one 100-ml sample is collected from the available tap.

Since there is a potential for the water temperature in hot water taps to be high enough to kill existing microorganisms in the sample, thus, masking any microbiological contamination in the aircraft PWS, samples should be collected from cold water taps when they are available. However, if there is only a warm or hot water tap available in the galley/lavatory, then the warm or hot water tap must be used for the galley/lavatory sample. If a sample is collected from a hot water tap, it is suggested (not required) that you record the temperature of the water. The temperature of the water may be useful in diagnosing problems in the water system.





This graphic is used to further emphasize the recommendation to collect from sample locations that are representative of the water used for human consumption by rotating the location each monitoring period. This graphic shows an aircraft with three lavatories and four galleys.

As an example, if the aircraft PWS was on a quarterly sampling frequency,  
 During monitoring period 1 = sample from Lav 1 and Galley 3  
 In monitoring period 2 = sample from Lav 2 and Galley 1  
 In monitoring period 3 = sample from Lav 3 and Galley 2; and  
 In monitoring period 4 = sample from Lav 1 and Galley 4

In this way all sample locations are periodically tested.

## Coliform Sampling Plans, cont.

- Frequency and number of routine samples
  - Based on frequency of D&F
  - Can be monthly, quarterly, semi-annually, or annually
- Frequency of routine D&F
  - Based on manufacturer recommendations
  - If manufacturer does not specify frequency, air carrier must choose a D&F frequency and corresponding monitoring frequency

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CSPs must include the required frequency and number of samples to be collected. This helps to ensure personnel responsible for this task will collect the correct number of samples during the required monitoring period(s).

The frequency of sample collection can be either monthly, quarterly, semi-annually, or annually. It is determined by the routine D&F frequency recommended by the manufacturer of the aircraft PWS. If the manufacturer does not recommend a frequency, the air carrier must choose a frequency and a corresponding routine coliform sampling frequency as specified in the ADWR.

## Coliform Sampling Plans, cont.

### *Coliform Sampling Frequencies Based on D&F Frequencies*

<b>Minimum Routine Disinfection &amp; Flushing Frequency</b>	<b>Minimum Routine Coliform Sampling Frequency</b>
At least 4 times per year = at least once within every 3-month period (quarterly)	At least 1 time per year = at least once within every 12-month period (annually)
At least 3 times per year = at least once within every 4-month period	At least 2 times per year = at least once within every 6-month period (semi-annually)
At least 2 times per year = at least once within every 6-month period (semi-annually)	At least 4 times per year = at least once within every 3-month period (quarterly)
At least 1 time or less per year = at least once within every 12-month period (annually) or less	At least 12 times per year = at least once every month (monthly)

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These are the frequencies, as noted in the rule, from which air carriers may choose. In the event no manufacturer recommendations exist, an air carrier may choose the D&F frequency with its corresponding sampling frequency that fits its operational needs.

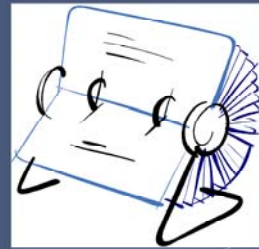
The intent of routine sampling is to evaluate “normal” operating conditions by taking samples that are representative of the aircraft’s water quality. Therefore, routine coliform samples cannot be collected within the first 72 hours after a routine D&F to allow conditions in the system to normalize.

And as you will notice, the TREND is the more you D&F the less you sample.

So, if you D&F at least four times per year (which is at least once within every three month period, or quarterly), the sample must be taken at least one time per year (which is at least once within 365 days or annually). In comparison, if the aircraft PWS is on a schedule to D&F one time per year or less, the routine sample(s) must be collected monthly.

## Coliform Sampling Plans, cont.

- Procedures for communicating sample results
  - Timely notification by laboratory essential to ensure required action is promptly implemented by air carrier
  - Laboratory needs to know who to notify
    - Communication procedures should include:
      - Specific contact personnel names and phone numbers
      - Secondary contact information



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Lastly, the CSP should include the procedures for communicating sample results between the certified laboratory and all of the applicable air carrier personnel tasked to manage sampling data and compliance.

The laboratory performing the coliform analyses needs to know whom to notify at the air carrier regarding the sample results.

EPA suggests that communication procedures include specific contact personnel names, phone numbers, and secondary contact information.

Notification of both positive and negative sample results in a timely manner is critical to ensure any required action is promptly implemented.

## Remaining slides will cover:

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- ◉ Certified Labs
- ◉ Sampling
- ◉ Exercises
  - Responding to positive results or failures

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## Certified Laboratories and Analytical Methods

### ○ Certified laboratories

- Under ADWR, samples are only valid if analyzed by a laboratory certified by the state or EPA
- [State] refers to a “State or Tribe that has received primacy for PWSs (other than aircraft water systems) under section 1413 of SDWA”
- NELAP Accreditation considered equivalent to Drinking Water certification

### ○ Analytical methods

- Must use EPA-approved methods for total coliform bacteria and *E. coli*
- Only analyzed for the presence or absence
- Maximum holding time – 30 hours
- From sample collection to initiation of the analytical method

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The ADWR specifies that samples will be considered valid only if they are analyzed by a laboratory certified by a state or by EPA [40 CFR 141.803(a)(6)].

[State] refers to a State or Tribe that has received primacy for implementing NPDWRs under section 1413 of SDWA (“State Primary Enforcement Responsibility”)

EPA’s laboratory certification manual, *Manual for the Certification of Laboratories Analyzing Drinking Water: Criteria and Procedures Quality Assurance, 5<sup>th</sup> Edition* (EPA 815-R-05-004, January 2005) indicates that EPA’s Office of Ground Water and Drinking Water (OGWDW) will accept National Environmental Laboratory Accreditation Program (NELAP) accreditation as equivalent to drinking water certification. There are some international laboratories that are accredited by the NELAP program (See <http://www.nelac-institute.org/accred-labs.php> or <http://www.nelac-institute.org/membership.php>).

EPA-approved analytical methods must be used for the analysis of total coliform bacteria and *E. coli*, as listed in 40 CFR 141.21(f)(3) and 141.21(f)(6). Each sample need only be analyzed for the presence or absence of the organisms; enumeration of the bacteria present is not necessary. The ADWR requires a maximum holding time between sample collection and analysis for coliform samples of 30 hours.

## Sampling: Scheduling Routine Coliform Sampling

- Option to minimize unscheduled flight disruptions
  - Collect routine samples immediately prior to a routine D&F
    - Assumes aircraft is already out of service for other regularly scheduled maintenance
  - If option selected, collect routine samples as soon as possible after taking aircraft out of service to avoid water quality deterioration (i.e., stagnant water)

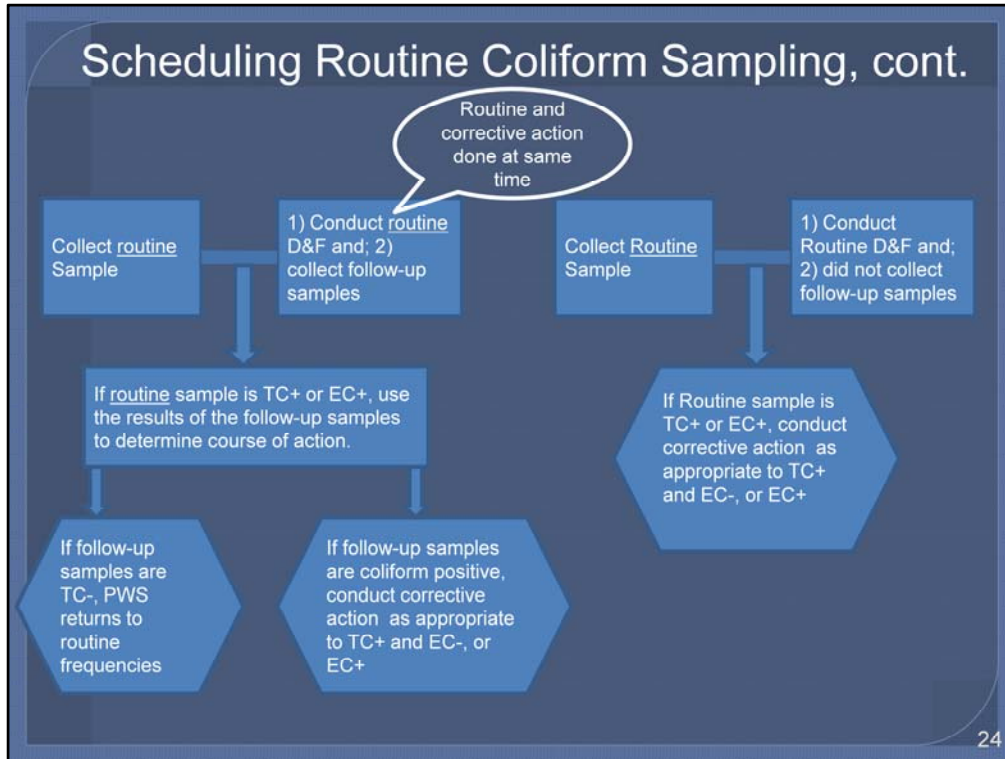
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As discussed earlier, routine samples are collected based on the routine D&F frequency. Routine samples may be collected at any time during each monitoring period, except within the first 72 hours after completing a routine D&F.

The rule, however, allows for routine samples to be taken just before you complete a routine D&F. Under this scenario, if an aircraft is taken out of service to perform its routine D&F, and it is also due for routine coliform sampling, the air carrier may collect the routine coliform samples prior to initiating the routine D&F. Combining these two activities and performing them while the aircraft is already out of service for other regularly scheduled maintenance may help reduce disruption to flight service.

If this practice is implemented, the samples should be collected as soon as possible after taking the aircraft out of service to avoid water quality deterioration that may be caused by stagnant water.

This option may also minimize or eliminate the need to restrict public access to the water in the event sample results indicate repeat sampling or corrective disinfection and flushing is required. This is discussed in more detail in the next slide.



This slide illustrates how this option can minimize or eliminate the need to restrict public access to the water in the event sample results indicate repeat sampling or corrective disinfection and flushing is required.

If the routine sample(s) results are coliform-positive and follow-up samples were collected after the routine D&F procedure, the air carrier has already performed the “corrective action” and can use the results of the follow-up samples to determine the next course of action. For example, in most cases, the follow-up samples would be TC- and the PWS is then able to return to its routine frequencies of sampling and D&F.

On the other hand, if routine samples are coliform-positive, and the air carrier did NOT collect follow-up samples following the routine D&F, the air carrier would have to select from the options in the ADWR to conduct the “corrective action.” This would include disinfection and flushing with follow-up sampling either within 24 hours or 72 hours of learning of the sample result, depending on whether the results were EC+ or TC+ and EC-.



## CONTEXT: Events Requiring Corrective Action – 2 Broad Categories

### Non-fecal event = non-EC(+) event

- Routine sample TC(+) and EC(-)
- Failure to perform routine disinfection and flushing (D&F)
- Failure to collect routine samples
- Failure to collect repeat or follow-up samples due to TC(+) and EC(-) result
- Failure to board water from a safe watering point [known to be non-EC(+)]
- Not in accordance with FDA regulations
- Does not meet NPDWRs for TNCWSs
- Non-compliance with procedures specified in O&M plan

### Fecal event = EC(+) event

- Routine sample EC(+)
- Failure to collect repeat or follow-up samples due to EC(+) result
- Failure to board water from a safe watering point [known to be EC(+)]
- Not in accordance with FDA regulations
- Does not meet NPDWRs for TNCWSs
- Non-compliance with procedures specified in O&M plan

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Under the rule, corrective action options are split under two broad categories.

Air carriers choose an action based on whether the event is Non-fecal (meaning it is a non-EC+ event) or if the event is Fecal (meaning it is an EC+ event)

Non-Fecal events include: READ FROM SLIDE

Fecal Events include: READ FROM SLIDE

**CONTEXT: Events and Corrective Action (In Brief)**

**Fecal event = EC(+) event**

Within 24 hours:

1. Restrict Public access, AND
- 2a. D&F in 72 hours and collect follow-up samples, if system not shut-off; OR
- 2b. D&F when able and collect follow-up samples, if system shut-off.

**Non-Fecal Event = non-EC+ event**

Option 1: Within 72 hours, D&F and collect follow-up samples;<sup>3</sup> OR

Option 2: Within 72 hours, restrict public access; then D&F and collect follow-up samples when able; OR

Option 3: Within 24 hours, collect repeat samples.

**NOTE: For failures to perform a requirement related to a NON-EC+ event, only Option 2 applies.**

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Lastly, before we work through some specific scenarios, this slide provides a summary of how corrective options are dependent on the type of event.

In brief, if your situation is a EC+ EVENT, you have one option:

Within 24 hours of being notified of the result or discovery of the failure  
 Restrict Public Access and D&F and collect follow-up samples if the system is not shut-off or the flow of water prevented through the taps, OR  
 D&F and collect follow-up samples when able if the system is shut-off or the flow of water prevented through the taps

In brief, if your situation is a NON-EC+ EVENT, air carriers have three options to choose from:

- 1) Within 72 hours, D&F and collect follow-up samples; or
- 2) Within 72 hours restrict public access and D&F and collect follow-up samples when able; or
- 3) Within 24 hours collect repeat samples

For failure to perform a requirement related to a NON-EC+ event, only Option 2 applies.

Now, the presentation will go through some examples to further provide the details of these options, such as, when you can and when you can't serve water for human consumption.

## Responding to Coliform Test Results: Restricting Public Access

### • Three key requirements

- Physically disconnect or shut off the aircraft water system or otherwise prevent flow of water through the taps, where feasible
- Provide public notification
- Provide alternatives to water to maintain sanitary conditions
  - E.g., bottle water, antiseptic hand gels



- If the aircraft water system **can** be physically disconnected/shut off
  - Public notice required for crew only
- If the aircraft water system **cannot** be physically disconnected/shut off
  - Public notice required for passengers and crew

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There are three key requirements to restricting public access.

- The first is to physically shut off the water supply if possible.
- Second, if you are able to shut the water off, then public notice is only required to the crew. If not, public notice is required to passengers as well.
- Third, you must provide alternatives to water in order to maintain sanitary conditions. The alternatives can include bottled water and antiseptic hand gels or wipes.

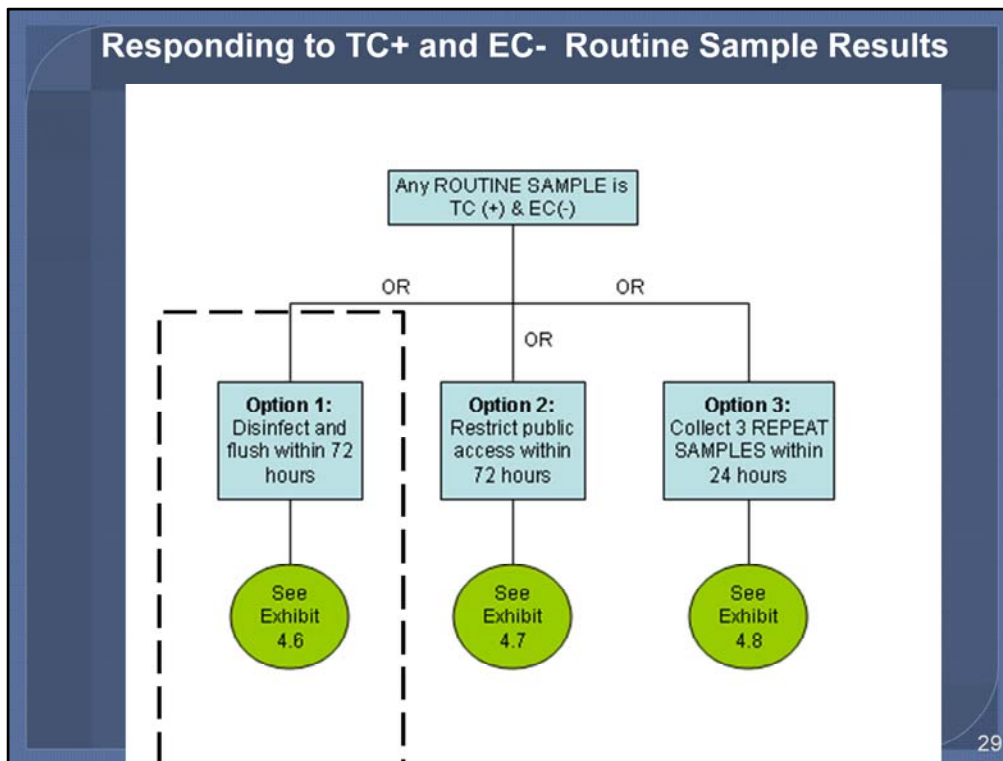
Refer to Exhibit 4.4, on page 37 of the *Guidance Manual* for the flow chart that describes these requirements.

## Responding to Coliform Test Results

- If coliform bacteria are detected, air carrier must take corrective action
- Actions and timeframes depend on sample result: TC+/EC- or TC+/EC+
- Due to imminent public health threat of an EC+ result, options and timelines are limited
- Follow-up action may include restricting public access to the aircraft water system

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If coliform bacteria are detected in any sample collected from an aircraft, the air carrier must take follow-up action but has some discretion regarding the activities to be performed [40 CFR 141.803(c)(3)]. However, due to the possible imminent public health threat if *E. coli* is present in any sample, options for follow-up activities and their timeframes are very limited [40 CFR 141.803(c)(2)].



If total coliform bacteria are not detected in any routine sample in a monitoring period, then the aircraft simply continues collecting routine samples at the frequency specified in the coliform sampling plan (TC- is considered EC-).

A routine coliform sample result that is TC+ but is *E. coli*-negative indicates the aircraft water system may be vulnerable to contamination by pathogens that can cause disease, such as - viruses, bacteria, or parasitic protozoa from fecal contamination.

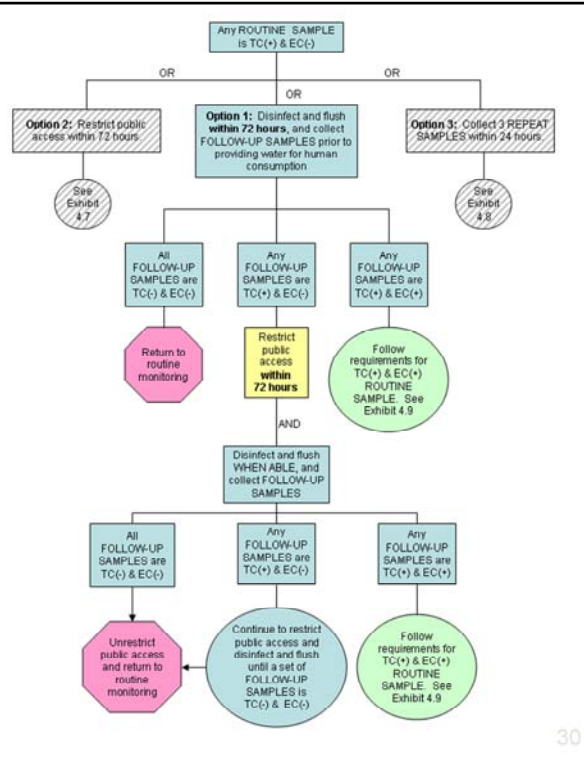
If any routine sample is TC+ and *E. coli*-negative, the aircraft has three options: 1) disinfect and flush the water system within 72 hours; 2) disinfect and flush on an alternative schedule if public access to the water system is restricted within 72 hours; or 3) collect repeat samples within 24 hours [40 CFR 141.803(c)(3)].

Note : The numbered exhibits are located in the *Guidance Manual for the Aircraft Drinking Water Rule – Interim Draft, October 2010* [EPA 816-R-10-020]

## Exhibit 4.6 TC+ and EC- Routine Samples

### Option 1: Disinfection and Flushing Details

TC(+) means total coliform-positive;  
 TC(-) means total coliform-negative;  
 EC(+) means *E. coli*-positive;  
 EC(-) means *E. coli*-negative



### Option 1: Disinfect and Flush Within 72 Hours and Collect Follow-up Samples

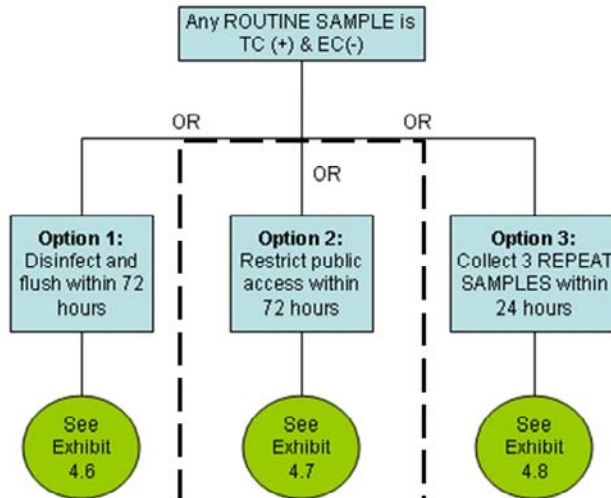
If Option 1 is selected, the air carrier must disinfect and flush the aircraft water system within 72 hours of being notified of the positive result and collect follow-up samples. After the follow-up samples are collected, water from the aircraft water system may be provided for human consumption.

If all follow-up samples are TC- [READ FROM SLIDE]

If any follow-up sample is TC+ and EC- [READ FROM SLIDE]

If any follow-up sample is EC+ [READ FROM SLIDE]

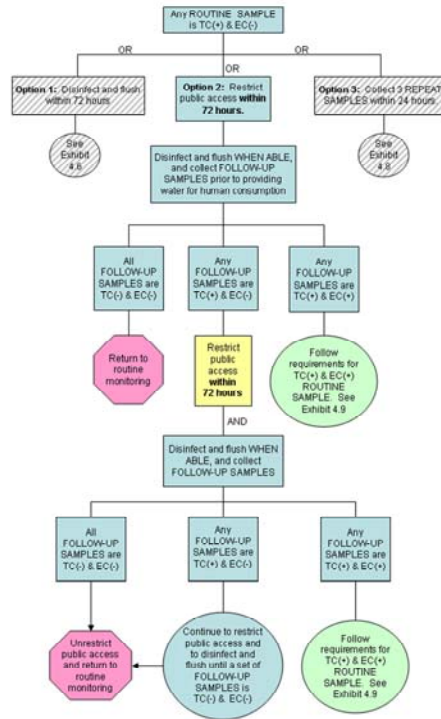
## Responding to TC+ and EC- Routine Sample Results



## Exhibit 4.7 TC+ and EC- Routine Samples

### Option 2: Restricting Public Access

**TC(+)** means total coliform-positive;  
**TC(-)** means total coliform-negative;  
**EC(+)** means *E. coli*-positive;  
**EC(-)** means *E. coli*-negative



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### Option 2: Restrict Public Access Within 72 Hours and Disinfect and Flush When Able

If Option 2 is selected, the air carrier must restrict public access to the aircraft water system within 72 hours of being notified of the positive result, provide public notice appropriately, and disinfect and flush the water system on an alternative schedule. Restricting public access enables the air carrier to delay the corrective disinfection and flushing procedure and follow-up sampling until the activity can be scheduled at a more convenient time.

After disinfection and flushing and follow-up samples are collected, the aircraft water system can resume providing water to passengers and crew.

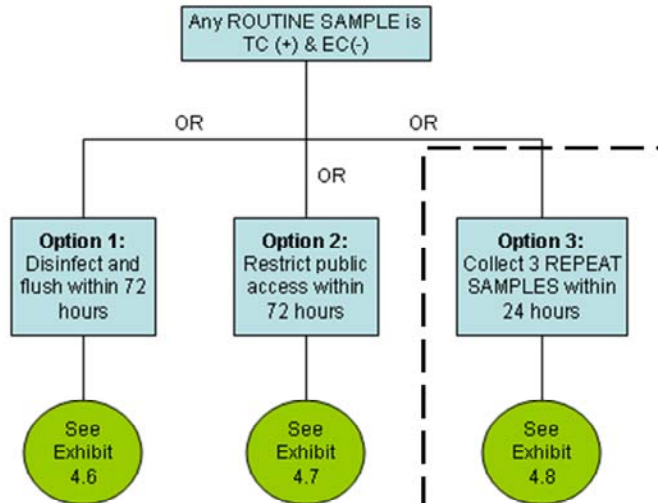
If all follow-up samples are TC- [READ FROM SLIDE]

If any follow-up sample is TC+ and EC- [READ FROM SLIDE]

If any follow-up sample is EC+ [READ FROM SLIDE]



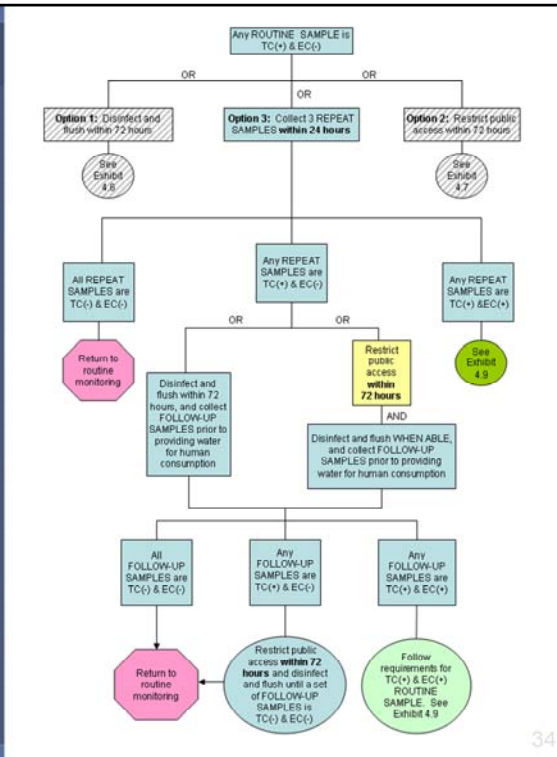
## Responding to TC+ and EC- Routine Sample Results



## Exhibit 4.8 TC+ and EC- Routine Samples

### Option 3: Repeat Sample Details

**TC(+)** means total coliform-positive;  
**TC(-)** means total coliform-negative;  
**EC(+)** means *E. coli*-positive;  
**EC(-)** means *E. coli*-negative



### Option 3: Collect 3 repeat samples within 24 hours

If Option 3 is selected, the air carrier must collect three repeat samples within 24 hours of learning of the result. One repeat sample must be collected from the same tap as the TC+ routine sample, one sample must be collected from another galley tap, and the third sample must be collected from another lavatory tap, if these types of taps are available. If less than three taps are available, then the samples must be collected from the available taps within the aircraft water system. It may be necessary for more than one sample to be collected from the same tap. If samples cannot be collected within 24 hours, the air carrier must choose option 1 or 2.

If *all* of the repeat samples are total coliform-negative, the aircraft returns to the routine monitoring frequency and need not restrict access to the water system or conduct corrective disinfection and flushing.

If *any* of the three repeat samples indicate the presence of total coliforms but *not* the presence of *E. coli*, the air carrier can choose one of the following response options: (1) Conduct disinfecting and flushing of the aircraft water system within 72 hours of being notified of the positive result and collect follow-up samples, or (2) Restrict public access to the aircraft water system within 72 hours after the laboratory notifies them of the positive test result, provide public notice appropriately, and disinfect and flush the water system on an alternative schedule.

If any of the repeat samples are positive for *E. coli*, the aircraft must meet the requirements for *E. coli* -positive routine or repeat samples (see subsequent slide).

## Responding to TC+ and EC- Routine Sample Results: Follow-up Samples

- For Options 1, 2, and 3:
  - If follow-up samples are **TC-/EC-**
    - Return to routine monitoring
  - If follow-up samples are **TC+/EC-**
    - Restrict public access within 72 hours with applicable PN
    - Perform D&F until follow-up samples are TC-/EC-
    - Follow-up samples must be TC-/EC- to un-restrict access and provide water for human consumption
  - If follow-up samples are **TC+/EC+**
    - Restrict public access within 24 hours
    - Perform D&F when able or within 72 hours if water cannot be physically disconnected
    - Follow-up samples must be TC-/EC- to un-restrict access and provide water for human consumption

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As a summary of these scenarios:

If all follow-up sample results are TC-: return to routine coliform monitoring and continue serving water to the public.

If either follow-up sample is TC+/EC-: the air carrier must restrict public access **within 72 hours** after receiving the sample results and disinfect and flush the water system again, with the process continuing until a complete set of follow-up samples is TC-. If the aircraft is returned to passenger service, all public access notification requirements must remain in-place until D&F occurs and a set of follow-up samples is TC-.

If any follow-up samples are EC+, the air carrier must restrict public access **within 24 hours** after receiving the sample results and disinfect and flush the water system when able and collect follow-up samples. Restrict access until follow-up samples are TC-. If the aircraft water system cannot be shut off or physically disconnected, or the flow of water otherwise prevented through the taps, then the corrective disinfection and flushing with follow-up sampling must be performed **within 72 hours** and restricted access must be maintained until follow-up samples are TC-.

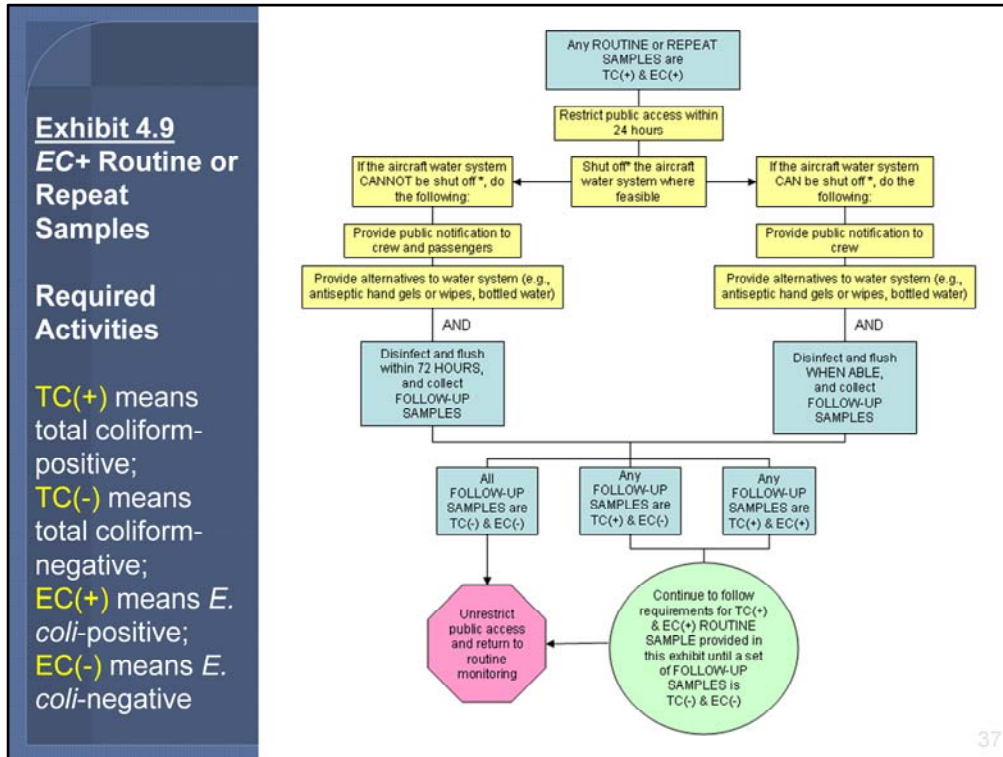
## Responding to EC+ Routine or Repeat Sample Results

**TC+/EC+ routine or repeat  
sample result**

**Indicates water may be contaminated  
with human or animal fecal waste**

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The presence of *E. coli* in a water sample indicates that the water may be contaminated with human or animal fecal waste. This is a serious situation and requires an immediate response (within 24 hours of notification of the sample result) by the air carrier.



If *E. coli* is present in any routine or repeat sample, the air carrier must restrict public access to the water system, **within 24 hours** of learning of the test result.

If the aircraft water system can be shut off or physically disconnected or the flow of water otherwise prevented through the taps, the air carrier must provide public notice to the **crew only** within 24 hours, and disinfect and flush the aircraft water system **when able** and collect follow-up samples.

If the aircraft water system cannot be shut off or physically disconnected or the flow of water otherwise prevented through the taps, the air carrier must provide public notice to the **passengers and crew** within 24 hours and disinfect and flush the aircraft water system **no later than 72 hours** after the laboratory notifies the air carrier of the *E. coli*-positive result and collect follow-up samples.

Restricted access must be maintained until a complete set of follow-up samples is total coliform-negative.

## Responding to Coliform Test Results

- Other violations or situations that require corrective action equivalent to an EC+ sample result:
  - Failure to collect follow-up samples after a corrective D&F triggered by an EC+ routine or repeat sample
  - Failure to board water from a safe watering point know to be EC+
    - Not in accordance with FDA regulations
    - Does not meet NPDWRs for TNCWS
    - Does not meet procedures specified in O&M plan

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As a reminder, there are other violations or situations that require the corrective actions shown in Exhibit 4.9 (previous slide). Examples of other situations include:

- Failing to collect follow-up samples after corrective disinfection and flushing that was triggered by an *E. coli*-positive routine or repeat sample;
- Becoming aware of an *E. coli*-positive event that resulted from failing to board water from a safe watering point; and
- Boarding water that is otherwise determined to be unsafe due to non-compliance with the procedures for boarding water that are included in the aircraft O&M plan.

ADWR Disinfection & Flushing and Coliform Sampling Frequencies		1-Jan-11	1-Feb-11	1-Mar-11	1-Apr-11	1-May-11	1-Jun-11	1-Jul-11	1-Aug-11	1-Sep-11	1-Oct-11	1-Nov-11	1-Dec-11
NOTE: Compliance data accepted from July 1, 2011, as long as air carriers followed full extent of the ADWR requirements.													
Option 1	At least 4 times per year (quarterly) D&F										Compliance data accepted from Oct. 1, 2011		
	At least 1 time per year (annually) Coliform Sampling												
Option 2	At least 3 times per year D&F										Compliance data accepted from Sept. 1, 2011		
	At least 2 times per year (semi-annual) Coliform Sampling												
Option 3	At least 2 times per year D&F (semi-annual)										Compliance data accepted from Jul. 1, 2011		
	At least 4 times per year (quarterly) Coliform Sampling												
Option 4	At least 1 time per year (annually) or less D&F										Compliance data accepted from Jul. 1, 2011		
	At least 12 times per year (monthly) Coliform Sampling												

For any given sampling frequency chosen, the ADWR Reporting and Compliance System (ARCS) will accept D&F and sampling conducted from July 1, 2011. In this way air carriers get credit for performing these procedures prior to the Oct. 19, 2011 compliance date.

Please note, air carriers would need to be also following the full extent of the rule at that time. Therefore, if sampling results were coliform-positive, corrective action would need to be reported as well.