

Aircraft Public Water System Operations and Maintenance (O&M) Plans



Chapter 6 of the *Guidance Manual for the Aircraft Drinking Water Rule – Interim Guidance*, October 2010 [EPA 816-R-10-020], includes information and requirements pertaining to the operations and maintenance (O&M) plans for aircraft public water systems.

Aircraft Public Water System O&M Plans: Coverage

- Developed for each aircraft in an air carrier's inventory that meets the definition of a public water system (PWS)
- More than one aircraft can be covered by the same O&M plan
- Does not need to be submitted to EPA
 - Air carriers must report completion to EPA
 - Must be available upon request
- Must be included in FAA-accepted air carrier O&M program

An O&M plan must be developed for each aircraft listed in an air carrier's inventory. A separate plan does not need to be developed for each aircraft – more than one aircraft may be covered by the same plan. Air carriers do not need to submit the O&M plans to EPA but must make such plans available for review by EPA upon request, including during compliance audits.

The ADWR also requires air carriers to include the O&M plans in their FAA-accepted O&M programs [40 CFR 141.804(a)].

O&M Plan Compliance Dates

- Existing Aircraft

- Complete O&M Plan and report completion to EPA by April 19, 2011



- New Aircraft (added after April 19, 2011)

- Complete a new O&M plan or add the aircraft to an existing O&M plan
- Report to EPA by the end of the first calendar quarter after aircraft is placed into operation as a public water system

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For existing aircraft, an O&M plan must be developed and its completion reported to EPA by April 19, 2011 [40 CFR 141.806(a)(1)]. New aircraft added to the inventory after April 19, 2011 must be either added to an existing plan or to a new plan developed and reported to EPA by the end of the first calendar quarter during which the aircraft is placed into operation as a public water system.

Aircraft Public Water System O&M Plans: Format

- Format and content determined by the air carrier
- Required ADWR elements must be included
- Intended to be compatible with and incorporated into other O&M activities for the aircraft

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Required Elements of an Aircraft Water System O&M Plan

- Watering Point Selection
- Procedures for Disinfection and Flushing
- Procedures for Follow-up Sampling
- Training Program Elements
- Self-Inspection Procedures
- Procedures for Boarding Water
- Coliform Sampling Plan
- Aircraft Water System Disconnect/Shut-off/Flow Prevention Statement

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In order to ensure that the appropriate multiple barriers to contamination are in place, each aircraft water system O&M plan must include these required elements [40 CFR 141.804(b)].

Watering Point Selection

Procedures for Disinfection and Flushing

Procedures for Follow-up Sampling

Training Program Elements

Self-Inspection Procedures

Procedures for Boarding Water

Coliform Sampling Plan

Aircraft Water System Disconnect/Shut-off/Flow Prevention Statement

Additional details for each element are provided in the following slides.

Watering Point Selection

- Boarded water must come from a watering point that conforms with FDA regulations [21 CFR 1240.80]
 - FDA regulations state the water must be potable and from a watering point approved by the Commissioner of the FDA
- Meeting this requirement must be specified in the O&M plan
- A list of watering points in conformance with FDA regulations is anticipated to be available on the FDA Web site by October 19, 2011
 - FDA anticipates updating the list quarterly

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The O&M plan must specify that all water that is boarded onto the aircraft will be from a watering point that conforms with FDA regulations at 21 CFR 1240.

The FDA regulations require that, *“Only potable water shall be provided for drinking and culinary purposes by any operator of a conveyance engaged in interstate traffic. . .”* FDA’s definition of potable water requires that the water meet EPA’s National Primary Drinking Water Regulations (NPDWRs).

The FDA regulation goes on to state that *“...such water shall either have been obtained from watering points approved by the Commissioner of Food and Drugs, or, if treated aboard a conveyance, shall have been subjected to treatment approved by the Commissioner of Food and Drugs.”* It is important to emphasize that the treatment option does not apply to the ADWR because air carriers can only board finished water under the ADWR. If less than finished water quality is boarded then the aircraft must have a complete water treatment system onboard, not just supplemental treatment, and the aircraft water would have to meet all of the applicable NPDWRs including: monthly sampling for total coliform and disinfectant residual, annual sampling for nitrate/nitrite, daily turbidity measurements.

Procedures for Disinfection and Flushing (D&F)

- Must be in accordance/consistent with manufacturer's recommendations, where available
- May use an FAA approved procedure if it meets the following requirements:
 - May conduct D&F more frequently, but not less frequently than the manufacturer recommends.
 - Air carrier must ensure the FAA approved procedures would not result in damage to the aircraft water system
- When not available, air carriers must choose a routine frequency listed in the ADWR
 - Air carrier's may conduct D&F more frequently, but not less frequently, than the manufacturer recommends.
 - Air carrier should ensure the selected frequency would not result in damage to the aircraft water system

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Procedures and Frequency of Routine Disinfection and Flushing

The O&M plan must include specific information on the procedures and frequency of disinfection and flushing for aircraft water systems. The procedures and frequency must be in accordance with the manufacturer's recommendations.

Based on stakeholder recommendations, EPA was not prescriptive in the rule with respect to routine D&F frequency or the chemicals to be used. This was done to avoid being inconsistent with the water system manufacturer recommendations and possibly detrimental to the materials used in the aircraft's water system. By requiring air carriers to be consistent with the manufacturer recommendations for disinfection and flushing, the rule will automatically evolve with technological improvements in aircraft water system components such as tank lining and piping materials, as well as with the development of new more effective disinfectants.

Where a recommended routine disinfection and flushing frequency is not provided by the aircraft water system manufacturer, the air carrier must choose a disinfection and flushing frequency and corresponding routine coliform sampling frequency from the four options published in the ADWR which were presented in the presentation on coliform monitoring.

Air carriers may conduct disinfection and flushing more frequently, but not less frequently, than the manufacturer recommends. However, it is the responsibility of the air carrier to ensure that an increase in frequency over that of the manufacturer would not result in damage to the aircraft water system's components.

Required Details of Disinfection and Flushing Practices

- Routine D&F frequency
 - Quarterly, 3x per year, semi-annually, annually or less
- Type of disinfecting agent
 - Chemical used as disinfectant
 - e.g., Chlorine dioxide, chlorine, ozone, etc.
- Disinfection concentration
 - Concentration of the disinfecting agent or the diluted disinfecting solution
 - e.g., milligrams per Liter (mg/L), parts per million (ppm)



Specifically, the ADWR requires that the O&M plan identify the following details of disinfection and flushing practices [40 CFR 141.804(b)(2)]. These are to be based on the water system manufacturer's recommendations, when available. The disinfection and flushing frequency may be quarterly, three times per year, semi-annually, or annually or less than annually. Of course, the less frequently that D&F is performed, the more frequently routine coliform samples must be sampled.

The procedures must specify the chemical used as the disinfecting agent such as chlorine, chlorine dioxide, or ozone.

The disinfectant concentration must also be included. The concentration is the amount of disinfecting agent mixed with water, for example, in milligrams per liter (mg/L), or parts per million (ppm).

Required Details of Disinfection and Flushing Practices, cont.

- Disinfectant contact time
 - Amount of time disinfecting agent or solution is in contact with aircraft water system components
 - e.g., 20 minutes, 1 hour, etc.
- The flushing volume or flushing time
 - Volume of potable water or length of time required to flush the disinfecting agent out of the aircraft water system
 - e.g., replace one tank volume, 5 minutes, etc.

Example procedure included on page 57 of the guidance manual

Also, specify the disinfectant contact time, which is the amount of time the disinfecting agent, at a specific concentration, must be in contact with the aircraft water system components to effectively disinfect the system.

And also specify the flushing volume or flushing time that is required to flush all of the disinfecting agent out of the aircraft water system. It is critical that the disinfectant is thoroughly flushed from the system.

If chlorine is used as the disinfectant, flushing should occur until the disinfectant residual in the potable water that is used for the flushing process is reached. In other words, whatever the level of chlorine is in the water used to flush the system, that level should be reached to determine when flushing is complete.

Note the example on page 57 of the *Guidance Manual for the Aircraft Drinking Water Rule – Interim Final*, October 2010, emphasizes disinfection of the water system piping and taps.

Procedures for Follow-Up Sampling

- Include written procedures for conducting follow-up sampling
 - e.g., two samples; collect at the same locations as routine samples; collect after disinfectant residual is not detectable in the aircraft water system after flushing; use sample collection methods for routine samples, etc.
- Follow-up samples indicate whether the D&F event was successful



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The O&M plan must include written procedures for conducting follow-up coliform sampling after a corrective disinfection and flushing event takes place. Follow-up samples indicate whether the disinfection and flushing event was successful.

Training Requirements

- Training required for all personnel involved with operating and maintaining the aircraft water system
 - Air carrier staff and contractors
- Format and delivery method at the discretion of the air carrier
 - Assumed will be integrated into existing FAA-regulated procedures and practices
- ALL personnel MUST be trained in the public health and safety reasons for the ADWR requirements

Training is required for all personnel involved with operating and maintaining the aircraft water system [40 CFR 141.804(b)(4)].

The aircraft water system O&M plan must describe the air carrier's program for training personnel involved with operating and maintaining the water system. The O&M plan can also serve as a training reference for personnel through inclusion of recommended operating procedures and guidance for making operational decisions.

The training should emphasize the use of sanitary practices in operating and maintaining the water system in order to maintain water quality and to protect public health. It should also address public notification, reporting, and recordkeeping requirements and procedures to ensure the air carrier complies with the ADWR.

Mandatory Training Topics

- ADWR training must include:
 - Procedures for boarding water
 - Sample collection procedures for coliform bacteria
 - Routine and corrective disinfection and flushing practices
 - The public health and safety reasons for the ADWR requirements

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The aircraft water system O&M plan must describe the air carrier's program for training personnel involved with operating and maintaining the water system.

This includes, but is not limited to:

- Procedures for boarding water,
- Sample collection procedures for coliform bacteria,
- Routine and corrective disinfection and flushing practices; and
- The public health and safety reasons for the ADWR requirements.

The training should emphasize the use of sanitary practices in operating and maintaining the water system in order to maintain water quality and to protect public health.

Other (not required) Training Topics

- Procedures for performing self-inspections
- Procedures pertaining to aircraft water systems when aircraft are taken out-of-service and returned to service (e.g., draining, disinfection, flushing)
- Backflow prevention and cross connection control
- Supplemental treatment equipment maintenance and replacement requirements, if applicable
- ADWR requirement details applicable to their duties
- Reporting and recordkeeping requirements

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Other elements of the ADWR that air carrier's should cover in their training requirements to help ensure compliance include:

- Procedures for performing self-inspections
- Procedures pertaining to aircraft water systems when aircraft are taken out-of-service and returned to service (e.g., draining, disinfection, flushing)
- Backflow prevention and cross connection control
- Supplemental treatment equipment maintenance and replacement requirements, if applicable
- ADWR requirement details applicable to their duties
- Reporting and recordkeeping requirements

Procedures for Conducting Self-Inspections

- Air carrier self-inspection procedures likely to be unique
 - Based on each carrier's unique FAA-accepted operation and maintenance program
- Procedures must include inspections of:
 - Storage tank
 - Distribution system
 - Supplemental treatment
 - Fixtures
 - Valves
 - Backflow prevention devices

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The purpose of the self-inspection is, basically, to make sure the aircraft water system is intact and not compromised or subject to contamination.

EPA recognizes that each air carrier's self-inspection procedures are likely to be unique since they will be based on each air carrier's unique FAA-accepted operation and maintenance program. Therefore, EPA has not developed a "one-size fits all" set of self-inspection procedures for the rule or for the guidance manual.

The self-inspection procedures for an aircraft water system must include inspection of the storage tank, distribution system, supplemental treatment, fixtures, valves, and backflow prevention devices.

The self-inspection is another area where EPA tailored the existing NPDWRs specifically for aircraft PWSs. Traditional stationary public water systems must have a sanitary survey conducted every five years by the State or an agent approved by the State, as opposed to a self-inspection allowed under the ADWR. The self-inspection again recognizes that aircraft operation and maintenance programs have been accepted by the FAA and are under FAA's oversight, and that aircraft are regularly inspected and maintained by trained mechanics.

Procedures for Conducting Self-Inspections, cont.

- Purpose is to make sure the water system is intact and not compromised or subject to contamination
- Must be completed no less frequently than once every five years
 - Full inspection may be conducted over the 5-years
 - Allows coordination with other aircraft maintenance and inspection activities
- First inspections must be completed by Oct. 19, 2016
 - For aircraft included in the inventory as of October 19, 2011

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A complete self-inspection of the entire aircraft water system must be conducted no less frequently than once every five years, with the first inspection completed by October 19, 2016, for aircraft that are included in the inventory as of October 19, 2011.

Another element of tailoring that provides additional flexibility in the rule is that a full self-inspection of an aircraft water system may be conducted over time rather than all at once. A complete self-inspection of the entire aircraft water system must occur no less frequently than once every five years.

This provision allows air carriers to develop their own unique self-inspection procedures that coordinate, to the maximum extent possible, water system self-inspections with the existing aircraft inspection and maintenance process. An air carrier's self-inspection plan may include references and explanations of those existing procedures.

Procedures for Conducting Self-Inspections, cont.

- A self-inspection should provide the degree of scrutiny necessary to identify potential public health risks and reliability issues associated with the aircraft water system.
- Level of inspection guidance (*refer to sect. 5.6, page 61*)
 - Generally, a visual inspection of the storage tank, distribution system, supplemental treatment, fixtures, valves, backflow prevention devices and fittings to detect cracks, leaks, corrosion, or damage, and to ensure that the distribution system piping is correctly attached with no cross-connections.

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Procedures for Conducting Self-Inspections, cont.

- Level of Inspection guidance (cont.)
 - A visual inspection - a visual examination of an interior or exterior area, installation, or assembly to detect obvious damage, failure, or irregularity. This level of inspection is made from within touching distance, unless otherwise specified by the manufacturer or determined to be necessary.
 - Also, a mirror may be necessary to enhance visual access to all exposed surfaces in the inspection area. This level of inspection is made under normally available lighting conditions such as daylight, hangar lighting, flashlight or drop-light and may require removal or opening of access panels or doors. Stands, ladders, or platforms may be required to gain proximity to the area being checked. (*refer to sect. 5.6, page 61*)

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[Read from Slide]

Procedures for Conducting Self-Inspections, cont.

◉ Level of Inspection guidance (cont.)

- An example of when inspection by visual observation at touching distance may not be adequate and an additional method may be “determined to be necessary”

A chronic onboard water quality problem (e.g., taste, odor, positive total coliform samples) identified that is not corrected by disinfection and flushing, and which requires an internal optical inspection of the water system to identify the source of the problem.

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[Read from Slide]

An example of what is meant by “determined to be necessary” is a situation in which an air carrier identifies the need to perform an internal optical inspection of an aircraft’s water tanks and piping. An example would be if there are chronic water quality problems (taste, odor, and/or positive sample results) that are not corrected by disinfection and flushing, or if water flow from taps has slowed.

Procedures for Boarding Water

- Procedures for ensuring water is boarded in the US from watering points in accordance with FDA requirements
- Procedures for transferring water from the watering point to the aircraft water system
 - Ensure contamination does not occur
 - Useful to personnel responsible for the transfer process
 - May be step-by-step procedures
 - Useful to ground crews responsible for maintaining the water transfer equipment



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The O&M plan must include a description of how the water will be transferred from the watering point to the aircraft in a manner that ensures it will not become contaminated during the transfer. This description may be provided in a step-by-step procedure format, or other means that is useful to personnel responsible for the transfer process. This information will also be helpful to ground crews responsible for maintaining the water transfer equipment used to supply the aircraft with finished water.

Procedures for Boarding Water, cont.

- Procedures to ensure water boarded outside US is safe for human consumption
 - e.g., regulatory requirements and compliance information applicable to the source of water, and water provider information
- If water is boarded that is not in accordance with the aircraft water system O&M plan procedures...
 - The ADWR requires the air carrier to perform the appropriate corrective actions

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The plan must include a description of how the air carrier will ensure that water that is boarded outside the United States is safe for human consumption. This description could include information on the regulatory requirements and water provider applicable to the watering point.

Although when water is boarded outside of the US it is outside of the jurisdiction of EPA and FDA, these requirements of the ADWR are squarely within EPA's authority to ensure that the water that is brought back to US jurisdiction and served to passengers and crew is safe.

Procedures for Boarding Water, cont.

- ◉ Emergency Procedures for failure to board water from a safe watering point

- Recognizes boarding water may have been necessary to operate essential systems

Examples

- Watering point not in accordance with FDA regulations
- Water quality does not meet EPA drinking water standards for transient non-community water systems



The plan must also describe emergency procedures to be used in the event that water is boarded from a watering point that is not in accordance with FDA regulations or that does not meet EPA drinking water standards for transient non-community water systems. The ADWR recognizes such water may need to be boarded to operate essential systems, such as toilets.

Procedures for Boarding Water, cont.

- **Corrective Actions** (see Exhibits 4.5 & 4.9)
 - **Non-*E. coli*-positive event**
 - Boarded water is of unknown quality and situation not related to a known *E. coli*-positive result
 - Follow corrective action requirements for a TC+ but EC- routine coliform sample result
 - ***E. coli*-positive event**
 - Boarded water is known to have tested positive for *E. coli*
 - Follow corrective action requirements for an EC+ routine coliform sample result

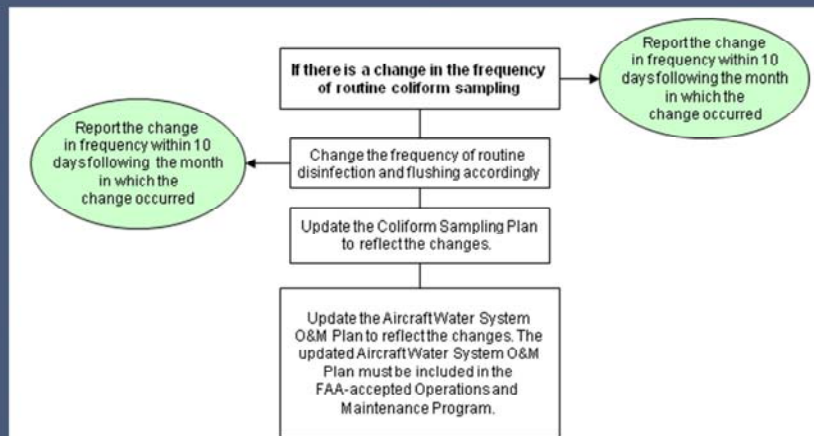
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A non-*E. coli*-positive event must follow the corrective action requirements for a TC+ but EC- sample result

An *E. coli*-positive event must follow the corrective action requirements for an EC+ sample result.

Coliform Sampling Plan

- Required to be included in O&M Plan (see Appendix C)
- Changes to Coliform Sampling Plans require changes to O&M Plans (and vice versa)



Coliform sampling plans must be included in aircraft water system O&M plans. Any changes made to coliform sampling plans require changes to O&M plans, and vice versa.

Aircraft Water System Disconnect/Shutoff/ Flow Prevention Statement

- Explanation of whether the aircraft water system...
 - can be physically disconnected/shut off, or
 - the flow of water through the taps prevented
- Plan could include procedures for shutting off the system and returning the water system to service

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The O&M plan must include an explanation of whether the aircraft water system can be physically disconnected/shut off or the flow of water through taps prevented.