Preliminary Comments of Drinking Water Committee Members

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Comments of Dr. Joseph R. Landolph, Jr.:

Response to the EPA's Charge Questions Regarding the Proposed Aircraft Drinking Water Rule and Statistical Sampling

1. Statistical Sampling: EPA asks for SAB's recommendation on (1) the use of statistical sampling methodologies, specifically on what type of monitoring scheme would allow a statistical sample to be representative of the whole fleet, and whether such methodologies, if allowed, should only be used in conjunction with onboard or other supplemental treatment such as adding as disinfectant or ultraviolet light?

Firstly, statistical sampling can be tricky, because the contamination can be distributed with Poisson statistics. Hence, sampling only certain aircraft can lead to the microbiologist missing bacterial contamination, particularly low levels of contamination, in certain airplanes. I have personal experience testing cell culture media for bacterial contamination. At low levels of contamination, if you sample only every tenth bottle, you can easily miss low levels of microbial contamination. Of course, in an ideal world, the best thing to do would be to sample each and every airplane. This of course would be a huge job, almost certainly prohibitively expensive and time-consuming.

Therefore, as a starter, I recommend testing every tenth airplane to get some statistics, to see how bad the problem of contamination of aircraft water is. Once we have this data, then we would have a better idea of what to do. If there is frequent contamination of the water systems of many airlines, then I would recommend draining the water systems of the aircraft, flushing these systems with heavily chlorinated U. S. drinking water and then draining this water and rinsing the system with clean U. S. drinking water. Then, I could recommend finally adding back U. S. drinking water with a 1 ppm or 2 ppm chlorine residual, to maintain sterility of the water in the airplane. I would guess that we would not have too many problems with water from the NATO European countries. However, water from some Asian countries, from some African countries, and even from some Eastern European countries, would likely not be as pure as that from the U. S., and would likely need to be treated or better, purged, the system decontaminated with chlorine and rinsed, and fresh U. S. chlorinated water added. We know a large amount about chlorination as a disinfectant, and it is inexpensive and effective and relatively safe, except for DBPs in the treated water. Using drinking water from the U. S. to flush the water from other countries from the aircraft and then treating the U. S. water in these aircraft with chlorine, leaving a chlorine residual (1 or 2 ppm) would probably be the best way to maintain quality of the aircraft water in terms of minimization of microbial contamination.

Secondly, perhaps it might be wise to pick say three large airlines that fly frequently to the U. S., one from the U. S., one from say China, and one from an African country, do some detailed statistical testing on their water systems, and see what is needed to bring these airline into compliance. Then, this procedure could be replicated on all the other airlines once it was established. This would be a microbiology research project.

(2) If allowed, what should be the statistical sample occurrence triggers for total coliform and /or E. coli/fecal coliforms that would require follow-up action in the entire fleet and what should the follow-up action entail?

If one in twenty aircraft, had drinking water that was contaminated with total coliforms and/or E. coli/fecal coliforms, this certainly should be a trigger that would require follow-up action in the entire fleet. Follow-up action should entail draining the water systems, decontaminating the aircraft water supply system with high concentrations of chlorine, flushing out the high levels of chlorine, and adding back U. S. drinking water with a 1 ppm or 2 ppm residual of chlorine to the system. Once we established a baseline on the statistics of contamination, sampling one in twenty aircraft, we could take more stringent action to reduce this frequency of contamination.

2. Temperature of Sample Taps: **EPA asks for SAB's recommendations on (1) whether sampling should only be limited to cold taps when they are available; and (2) if a cold tap is not available in the galley, should the air carrier measure and provide sample temperature to EPA to provide some indication of whether the temperature achieved is high enough to alter the microbiology results.**

Response: (1) In my opinion, sampling should always be limited to cold taps when they are available, to enhance the sensitivity of detecting micro-organisms. This would be the best way to sample the water to detect micro-organisms. If possible, the temperature of the water in the tap should also be measured and recorded along with the sample taken.

(2) If a cold tap is not available in the galley, then my opinion would be that yes, the air carrier should measure and provide the temperature of the sample to the EPA to provide some indication of whether the temperature achieved is high enough to alter the microbiology results. This would help out, but of course, the best way to do things to maximize the sensitivity of detection of micro-organisms in the sample would be to take a sample from a cold tap when this is available. I am uncomfortable in sampling hot taps, because obviously, the high temperature will kill many of the organisms. In this case, when only a hot tap is available, perhaps the best thing to do would be to have the air carrier sample only when the water has been turned off for some time, and the temperature has reached room temperature, and then to sample this water. This would help to maximize the sensitivity of detecting micro-organisms.

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7/18/08

Comments of Dr. Richard Sakaji:

Statistical sampling of aircraft.

I would recommend against developing a monitoring program based on a random statistical sampling of the whole fleet. This would be the same as a random statistical sampling of all noncommunity water systems. Like each noncommunity water system, each aircraft should be considered to be an independent entity with unique source waters. I would assume that no two aircraft fly the identical route and board water from the same locations, so I would assume that no two aircraft would be identical. Therefore the population is not homogenous and no single aircraft's water system would be representative of the overall population.

The idea of relating (inversely) the frequency of monitoring to the frequency with which the water system is flushed and cleaned also makes sense from a relative risk standpoint, assuming the frame (or boundary) of reference is the aircraft water system. As the introduction to the rule states, the aircraft water systems are storage reservoirs or distribution systems, unlike any typical noncommunity water system, as their source water can vary markedly over the course of a day, week, month, or even year. Unlike a traditional water system, an aircraft may take water from several different, surface or ground water sources within a given day, as aircraft move from airport to airport (some regulated; some not), depending on their flight schedules.

The concept of a minimum annual sampling is consistent with the current TCR in which noncommunity water systems are allowed to sample as infrequently as once per year. Given the variability in source water, as noted in the ADWR introduction, randomly selecting aircraft as being representative of the whole fleet would hardly be considered adequate, unless a large number were sampled. That number would depend on the number of aircraft closest to their next cleaning, in fact, those aircraft that are closest to their next water system are those that should be sampled.

The question of whether a random sampling program would provide a representative sampling of the fleet is an interesting one. Having the airplane water system sampled at least once a year is probably a minimum sampling frequency, but one must ask what the objective of the monitoring program might be. If the purpose of the monitoring program is to ensure compliance with the TCR objectives, then one should consider some of the discussions taking place in the current FACA negotiations for revising the current TCR.

The draft AIP has TC being used as a treatment technique which triggers an "assessment." TC is no longer being used as an MCL. Public notification is required only if the followup monitoring and assessments are not carried out. The more serious and recognized acute problem is with E. coli or fecal coliforms, which triggers almost immediate public notice. The triggers for aircraft should be the same as for the NCWS.

If the objective of the monitoring program is to ensure the safety of the aircraft water system, by monitoring the microbiological water quality, then maybe the monitoring program should focus on the efficacy of the maintenance practices, i.e., the samples should not be random, but should be collected just prior to maintenance (systematic). This will ensure the cleaning and maintenance intervals are sufficient to prevent a TC positive. It is my opinion that a systematic sampling

approach would provide much more protection of aircraft water supplies than a random sampling program and could easily be tied to aircraft maintenance schedules.

Since aircraft undergoing a level B, C, or D maintenance may not fly for 24 hours or more. Collecting a TC sample before the system is emptied and cleaned would provide an indication whether the maintenance practices are adequate to maintain the microbiological quality of the water system. If the sample comes back positive the plane will not be taking on passengers or crew and will be easily accessible for a repeat sample. Once that sample comes back clean the plane can be released. If the water system sample is still positive the aircraft water system can be recleaned and sampled.

If the water system showed signs of E. coli or fecal contamination, there would still be time to flush and clean the system (and resample) before returning the aircraft to flight status. Overall a systematic sampling program tied to the maintenance schedule would not only provide quantitative information on the efficacy of the water system maintenance schedule, but would minimize down time on the aircraft reducing the economic impact on the airlines and reduce public notification.

A random sampling program for a fleet of aircraft would probably not be likely to detect water systems with a TC+. Based on an annual sampling, the odds of selecting the aircraft to sample and to have that water system be TC+ would be very small. While the frequency of the TC+ was a sizeable percentage in the preliminary work conducted under the AOC, as the frequency of TC+ decreases, the odds of selecting or finding the aircraft that is TC+ becomes slimmer and the number of samples collected to be fairly confident the samples are representative increases in an exponential manner. Adding the confounding factor of aircraft water system maintenance only decreases the likelihood of finding a TC+. This does not preclude the possibility that aircraft water systems may not be safe, but that the sampling program, due to frequency, is masking the problem.

Another recommendation that could help is to recommend in guidance that airlines check to make sure there is a chlorine residual in the water being boarded. The airlines should probably consider only boarding water that contains a chlorine residual. If the chlorine residual is below detection, the airline has a choice of boarding the water or not. Lack of a chlorine residual indicates potential microbiological issues. A plane that boards water without a chlorine residual should be allowed to continue in service, like a distribution system reservoir, but the airline should consider itself at risk.

Hot or cold tap:

What is the purpose of sampling? If it is to characterize the water in the system, then sampling from the cooler tap would be more appropriate. If there are two separate water systems (fore and aft), these systems should be sampled separately and considered to be independent systems.