

Contaminant Reduction Testing for Carafe-Style POU Systems

By Rick Andrew

Carafe- or jug-style POU systems continue to be a popular option for consumers. Relatively inexpensive, widely available and easy to operate, these systems can also have considerable treatment capabilities. The budget-friendly price point and the fact that the system does not connect to plumbing, however, can cause skepticism for consumers regarding these treatment capabilities. One of the most common questions I hear from consumers is: "Do those carafes with the filters in them really work?" My reply to this question is: "I can assure you that the carafe-style POU systems that have been independently certified will definitely perform as certified." I am confident in this reply because I understand the rigorous test requirements for these products to achieve certification. Products not meeting these requirements cannot display independent certification marking.

Two standards

NSF/ANSI 42 Drinking water treatment units – Aesthetic effects and *NSF/ANSI 53 Drinking water treatment units – Health effects* are the applicable standards for evaluation of carafe-style POU systems. Both of these standards require that material safety be evaluated through information gathering regarding materials in contact with drinking water, followed by extraction testing to assess any contaminant leaching from the product into drinking water. The same information gathering and extraction test will cover the requirements of both standards.

Aesthetic contaminant reduction claims, such as reduction of taste and odor or reduction of particulates, are covered under *NSF/ANSI 42*; health-related contaminant reduction claims, such as reduction of volatile organic contaminants or reduction of lead, are addressed by *NSF/ANSI 53*. Many POU systems are certified to both standards because they carry both aesthetic and health claims.

Carafe-style systems are categorized under these standards as 'Non-plumbed, pour-through-type batch systems.' The test methods for this category of products have been developed specifically for systems not connected to a pressurized water supply, and that could be operated by filling, allowing the water to flow through the filter due to gravity, and either pouring treated water out or dispensing treated water through a valve.

Contaminant reduction testing

NSF/ANSI 42 and *NSF/ANSI 53* contaminant reduction tests are separated into two broad categories: chemical reduction and

mechanical reduction. Chemical reduction involves adsorption or absorption of contaminants from water by media within the tested system. Mechanical reduction is a physical separation of contaminants from the water by the system. Because most POU carafe systems are designed primarily for chemical reduction performance, we'll focus on chemical reduction testing in this discussion.

NSF/ANSI 42 and *NSF/ANSI 53* require chemical reduction testing to be conducted to an end point based on the manufacturer's rated capacity for the system. The rated capacity is the amount of water that can be treated prior to replacement of the filter. Under *NSF/ANSI 42*, the test ends at 100 percent of the manufacturer's rated capacity. Under *NSF/ANSI 53*, systems without a volume-based end-of-life indicator (called a performance indication device or PID in *NSF/ANSI 53*), the test must continue until 200 percent of the manufacturer's rated capacity. For systems with a PID, tests end at 120 percent of the manufacturer's rated capacity.



Contaminant reduction testing carafe-style POU system

NSF/ANSI 53 specifies the following protocol for chemical reduction testing of non-plumbed, pour-through-type batch systems: "Two systems shall be tested using the appropriate challenge and influent water after establishment of the manufacturer's recommended use pattern, with automatic cycling. If there is not a recommended use pattern, the systems shall be operated on the basis of four times the bed volume per batch. The cycle shall include a rest period of 15 to 60 seconds between batches, timed from the cessation of streamed flow."

The key to interpreting the above-referenced section of the standard is "manufacturer's recommended use pattern". Manufacturers usually advise consumers to process a maximum

amount of water per day through their system. For a carafe-type system, this maximum recommended daily throughput is typically in the range of two to five gallons.

The number of batches processed per day is determined by dividing the daily throughput by the size of the untreated water reservoir, or hopper, as referred to by several manufacturers. For example, a carafe-type system with a two-gallon-per-day (7.57 liters) use pattern and a one-quart hopper would have eight batches processed per day during laboratory testing.

The standard directs that a rest period of 15 to 60 seconds shall be included between batches. This language stipulates that complete batches must be processed. This requirement rules out testing with a continuous influent challenge feed system that maintains a certain level in the hopper and lets the water drip through constantly. Continuous feed is not a normal consumer usage pattern. Depending on product design and function, continuous-feed testing could result in either better or poorer contaminant reduction performance than would be obtained by testing with complete batches.

Considering the 15- to 60-second rest period relative to actual consumer usage, in the real world, batches would likely be processed at random intervals. Sometimes, a batch might be processed immediately after the previous batch has finished. At other times, several hours may pass between batches. The likely actual usage does not align well with the standard requirement of 15 to 60 seconds between batches.

NSF has interpreted that testing with a typical usage pattern is more appropriate than testing strictly with 15 to 60 seconds between batches. Therefore, the organization incorporates random time intervals between batches when testing carafe-style batch systems. These intervals are driven by practical considerations. Another batch is processed when required by the

use pattern and as the technicians have time. NSF also utilizes completely manual operation of carafe-style POU systems when conducting contaminant reduction tests, in order to be as faithful as possible to actual consumer usage. The result is varying manual batch processing patterns each day of testing, which ultimately is representative of actual consumer use patterns.

This issue of the 15- to 60-second rest period versus varying rest periods was raised at the November 2011 meeting of the NSF Joint Committee on Drinking Water Treatment Units. Likely, this language and possibly other language in the test method for non-plumbed, pour-through-type batch systems will be revised soon to help ensure that testing is reflective of typical consumer usage patterns, as opposed to the 15 to 60 seconds.

Consumer-friendly solution

Carafe-style, batch POU systems enjoy popularity because of their relatively low cost, ease of operation, and wide availability. Additionally, some of them have considerable contaminant reduction capability. Because consumers and other buyers can tend to be skeptical of the capability of relatively low-cost, easy-to-operate systems such as these, third-party certification based on rigorous testing requirements can add tremendous value for manufacturers of high-quality carafe-style batch POU treatment systems.

About the author

◆ *Rick Andrew is the General Manager of NSF's Drinking Water Treatment Units (POU/POE), ERS (Protocols), and Biosafety Cabinetry Programs. He has previously served as the Operations Manager, and prior to that, Technical Manager for the program. Andrew has a Bachelor's Degree in chemistry and an MBA from the University of Michigan. He can be reached at (800) NSF-MARK or email: Andrew@nsf.org.*