Securing Water Safety

By Dave Purkiss

New standards ensure protection against tampering & emerging contaminants

Protecting the quality and safety of our nation's drinking water is an important and never-ending task. NSF Intl., a global independent public health organization, works with government, industry and consumer groups to make sure harmful contaminants and chemicals are not added to drinking water. According to an independent survey conducted on behalf of NSF, 65% of consumers are concerned about the quality and safety of public drinking water, with emerging contaminants in drinking water as a top concern.

In efforts to further protect drinking water, NSF has updated an existing standard to incorporate tamper-evident packaging requirements for drinking water chemicals and is in the final stages of developing a standard for emerging compounds and incidental contaminants. This article will discuss new requirements for drinking water treatment chemicals and emerging drinking water contaminants and their impacts on the water industry.

Water Treatment Chemicals

NSF/ANSI Standard 60: Drinking Water Treatment Chemicals - Health Effects establishes requirements to verify that water treatment chemicals do not add unsafe levels of chemicals or contaminants to drinking water. This includes treatment chemicals for corrosion and scale control; coagulation and flocculation; disinfection and oxidation; pH adjustment, softening, precipitation and sequestering; and other specialty chemicals used for drinking water treatment. NSF certification includes:

- A review of the chemical's formulation and maximum use level;
- An inspection of the manufacturing facilities;
- Testing of the chemical at 10 times the maximum use level to determine any harmful contaminants that may be added to drinking water; and
- Coverage of regulated contaminants such as lead, as well as contaminants that are not regulated but have had health-based criteria established according to the standard.

Forty-eight states require treatment chemicals to comply with NSF/ANSI 60 to protect water supplies from harmful chemicals.

Tamper-Evident Packaging

The New York Department of Health raised an issue several years ago about a sodium hypochlorite solution that had been contaminated with a solvent. The NSF/ANSI 60 committee reviewed this issue and determined a need for tamper-evident packaging requirements for water treatment chemicals. That led to the development of new certification requirements for tamper-evident packaging. With these new requirements, buyers of chemicals now can have confidence that certified chemicals have not been tampered with during shipping and receiving.

The new tamper-evident packaging requirements are designed to ensure that any container that a treatment chemical (liquid chemicals, primarily) comes in has tamper-evident packaging so operators can tell if the package has been opened prior to use. This is key to preventing accidental or intentional contamination.

Utilities should be aware that all chemicals should come in tamper-evident packaging, and that if they are not in proper packaging, the utility should notify suppliers. Requirements include the following:

- Bags and super sacks must employ seals that are destroyed upon opening or that make resealing unlikely.
- Drums and small containers used for products should be constructed and properly sealed to make opening or substitution obvious to the purchaser.
- Bulk shipments should employ tamper-evident seals and chain of custody or an alternative method providing equivalent protection.

According to the standard, acceptable containers:

- Shall not contribute contaminants to the finished product;
- Shall be properly sealed to prevent contamination during shipping and storage; and
- Reused or recycled containers shall meet one of the following conditions: The container is dedicated to

Table 1. Testing Levels for Compounds Covered in NSF 401

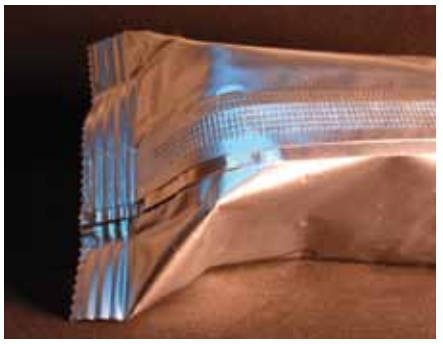
Substance	Individual Influent Sample Point Limits[1] (ng/L)	Average Influent Challenge[2] (ng/L)	Maximum Effluent Concentration (ng/L)	Recommended Methods of Analysis
Meprobamate	400 ± 40%	400 ± 20%	60	RP HPLC, LCMS
Phenytoin	200 ± 40%	200 ± 20%	30	HPLC, LCMS
Atenolol	200 ± 40%	200 ± 20%	30	HPLC-MS/MS, LCMS
Carbamazepine	1,400 ± 40%	1,400 ± 20%	200	HPLC-MS/MS, LCMS
TCEP	5,000 ± 40%	5,000 ± 20%	700	LCMS
TCPP	5,000 ± 40%	5,000 ± 20%	700	GC/MS, LCMS
DEET	1,400 ± 40%	1,400 ± 20%	200	GC/MS/MS, LCMS
Metolachlor	1,400 ± 40%	1,400 ± 20%	200	Gas LC, LCMS
Trimethoprim	140 ± 40%	140 ± 20%	20	HPLC-MS/MS, LCMS
Ibuprofen	400 ± 40%	400 ± 20%	60	HPLC, LCMS
Naproxen	140 ± 40%	140 ± 20%	20	ELC, LCMS
Estrone	140 ± 40%	140 ± 20%	20	HPLC-MS/MS, LCMS
Bisphenol A	2,000 ± 40%	2,000 ± 20%	300	SPE HPLC, LCMS
Linuron	140 ± 40%	140 ± 20%	20	HPLC, LCMS
Nonylphenol	1,400 ± 40%	1,400 ± 20%	200	LC ESI-MS, LCMS

[1]Suggested influent challenge concentration variability: To be amended based on other information available in the literature or as the laboratory develops experience with the analytical method.

[2]Reason for influent challenge levels: Challenge concentrations should be selected to simulate what a system will be challenged with in the field and/or to provide an accurate and reproducible indicator of performace. The following sequence of criteria is used to select challenge concentrations:

1. The highest concentration of available occurrence date 10X. The occurrence data shall come from national monitoring programs administered by the U.S. Environmental Protection Agency or the U.S. Geological Survey or other accepted peer reviewed data source. Other occurrence data may be accepted by the Joint Committee on Drinking Water Treatment Units.
2. The concentration obtained by multiplying the method reporting limit by a factor of 10, as long as the minimum reduction requirement allows for a measurable maximum effluent concentration.

RP HPLC – Reverse phase high-performance liquid chromatography
HPLC – High-performance liquid chromatography
GC/MS – Gas chromatography-mass spectrometry
Gas LC – Gas-liquid chromatography
SPE HPLC – Solid phase extraction high-performance liquid chromatography
LCMS – Liquid chromatography-mass spectrometry
HPLC-MS/MS – High-performance liquid chromatography-tandem mass spectrometry
GC/MS/MS - Gas chromatography-tandem mass spectrometry
ELC – Exclusion liquid chromatography
LC ESI-MS – Liquid chromatography-electrospray ionization-mass spectrometry



Heat-sealed bags (top) and stitched bags (bottom) are two examples of tamper-evident packaging covered under NSF/ANSI 60.

one chemical type and under control of the company, or the container shall be washed prior to loading products for potable water treatment.

Emerging Compounds & Incidental Contaminants

In addition to making sure harmful chemicals are not added to drinking water, NSF is in the process of finalizing an American National Standard for emerging compounds/incidental contaminants in drinking water. The new NSF Standard 401: Drinking Water Treatment Units - Emerging Compounds/Incidental Contaminants establishes requirements for point-of-use (POU) and point-of-entry (POE) products designed to reduce emerging compounds, including pharmaceuticals, personal care products, chemicals and endocrine-disrupting compounds such as bisphenol A (BPA) in water. Emerging compounds/incidental contaminants are defined as compounds that have been detected in drinking water supplies at trace levels. These compounds can affect public acceptance and perception of drinking water quality.

NSF 401 was developed after several media reports focused on chemical compounds in the water supply, leading to consumer concerns. Manufacturers wanted a way to demonstrate the reduction of these compounds via independent testing.

The new standard focuses on claims being made for the reduction of 15 individual compounds: BPA, meprobamate, phenytoin, atenolol, carbamazepine, TCEP, TCPP, DEET, metolachlor, trimethoprim, ibuprofen, naproxen, estrone, linuron and nonylphenol. This initial list of contaminants represents pharmaceutical, personal care and endocrine-disrupting compounds that have been identified in published studies as occurring in drinking water, and the removal claims are based on testing the effectiveness of treating the actual compound in question. Products covered in the standard include POU and POE products such as faucet-mount, under-sink, countertop, plumbed-in, refrigerator, pour-through, mouth-drawn and hand-squeezed sports bottle type filtration systems; POU reverse osmosis systems; and traditional filtration systems.

Members of NSF's Joint Committee on Drinking Water Treatment and the NSF Task Group on endocrine-disrupting compounds and pharmaceuticals and personal care products developed the standard with the support of other industry experts. This process included extensive review of scientific literature about these compounds and their occurrence and detection in drinking water.

Traditionally, NSF/ANSI standards have placed contaminants into one of two categories: health effects for contaminants with known health effects if present in drinking water, such as NSF/ANSI 60, or aesthetic effects for contaminants not affecting health, but rather the taste, appearance or odor of drinking water, such as NSF/ANSI Standard 42: Drinking Water Treatment Units - Aesthetic Effects. Because emerging compounds/incidental contaminants are not aesthetic and there have been no documented health issues at this point at the concentrations being detected, the group decided a new standard should be developed for claims based on consumer preference. Given the choice, consumers may prefer to treat drinking water to reduce the concentration of these compounds in the water.

Levels for Testing

These compounds are being detected at low concentrations (parts per trillion) in drinking water. To provide results that are as "real world" as possible, levels as close to those being detected in drinking water were specified for testing in the standard (see Table 1). Testing to the draft standard while the standard is being finalized is available from NSF.

The NSF draft standard is currently being launched as NSF 401, and will be finalized through the American National Standards Institute's (ANSI) accredited consensus process to be designated as an American National Standard: NSF/ANSI 401. ANSI administers and coordinates the U.S. voluntary standardization and conformity assessment system and accredits NSF to develop national standards impacting public health. *wqp*

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