

# Occurrence of UCMR Contaminants in Drinking Water materials and Treatment Chemicals

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Blake Stark NSF International

# Agenda

**UCMR Contaminants**

**NSF/ANSI Standard 60: Drinking Water  
Treatment Chemicals – Health effects**

**NSF/ANSI Standard 61: Drinking Water  
System Components – Health Effects**

# UCMR Contaminants

## Unregulated Contaminant Monitoring Rule

- Required by US SDWA and EPA regulations
- Used to evaluate and prioritize contaminants for possible new drinking water standards.
- UCMR Round 1 – 2001 to 2003
- UCMR Round 2 – 2008 to 2010
- UCMR Round 3 – 2013 to 2015

# UCMR Contaminants

- Material ingredients
- Precursor Chemicals
- Degradation Products
- Herbicides
- Pesticides
- Hormones
- Explosives
- Radionuclides
- VOCs
- SVOCs
- Metals
- Viruses
- Bacteria

# Scope of Standards

## **NSF/ANSI Standard 60**

Establishes health based criteria for drinking water treatment chemicals and any associated contaminants.

## **NSF/ANSI Standard 61**

Establishes criteria for materials in contact with drinking water and contaminants that may leach into drinking water during treatment and distribution.

# NSF/ANSI Standard 60

## Drinking Water Treatment Chemicals

- Health Effects
- Developed to ensure treatment chemicals do not add unsafe levels of chemicals or contaminants to drinking water.
  - Chemical is safe at its maximum use level.
  - Contaminants associated with the chemical are below maximum allowable levels.
  - Also has requirements for good manufacturing practices, which now include Product Security (Tamper-Evident Packaging).

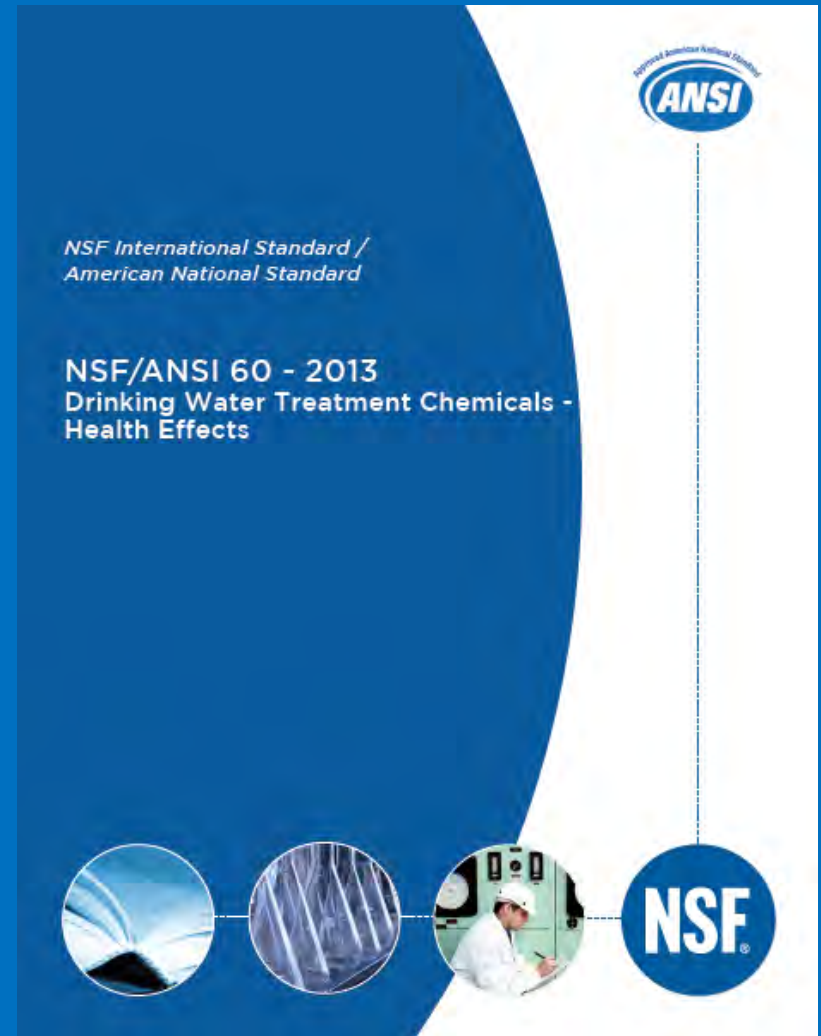
# NSF/ANSI Standard 60

- Covers all categories of treatment chemicals
  - Coagulation and flocculation
  - Corrosion and scale control
  - Disinfection and oxidation
  - Algicides, Fluoridation, Well drilling, Cleaning, well pump lubricants



# NSF/ANSI Standard 60 Certification Process

- Review of formulation and maximum use level.
- Inspection of manufacturing facility.
- Testing of chemical at 10 x Max use level.
- Evaluation against health based criteria.
- Regulated contaminants held to 1/10 MCL- SPAC.
- Criteria developed for unregulated contaminants with similar 1/10 factor.





# NSF Standard 60 Audit Requirements

- Verification of ingredients and supplier sources.
- Tour of plant location.
- Review of batch sheets (blended products).
- Review quality assurance processes.
- Collect samples for product testing.
- Review of product labeling (traceability).
- Review packaging (trace contamination control).
- Review product packaging for T/E compliance.

# ANSI Accredited Certification Organizations NSF/ANSI 60

- NSF <http://www.nsf.org>
- UL <http://www.ul.com>
- WQA <http://www.wqa.org>

# UCMR (1,2,3) Contaminants from Chemicals above TAC Levels

- Degradation products from sodium hypochlorite
  - Perchlorate
  - Chlorate

# Perchlorate

- 358 hypochlorite analyses in 2012-2013.
  - Hypochlorite degrades into chlorate -> perchlorate.
  - Increases with time, temperature, concentration.
  - pH and ionic strength effects.
  - Some metals catalyze reaction.
- Samples are quenched at sampling site.
  - 0 exceed TAC level of 15 ppb.
  - 78 samples were > ND but < 4ppb.
  - NSF SPAC is 5 ppb.

# Chlorate

- 127 hypochlorite analyses in 2013.
  - Hypochlorite degrades into chlorate.
  - Increases with time, temperature, concentration.
  - pH and ionic strength effects.
  - Some metals catalyze reaction.
- Samples are quenched at sampling site.
  - 0 exceed TAC level of 1 ppm.
  - 42 exceeded 200 ppb.
  - 9 manufacturers.
  - 33 repackagers.

# AWWA Tools to Control Chlorate and Perchlorate

**AWWA B-300 Hypochlorites** - revised to contain recommended storage and handling practices to limit bromate, chlorate and perchlorate formation.

AWWA Hypochlorite Calculator – On website at:  
<http://www.awwa.org/resources-tools/water-utility-management/hypochlorite-assessment-model.aspx>

To predict concentration of chlorate and perchlorate in hypochlorite based on storage conditions and age.

Problems can be avoided by using these tools.

- AFFORDABILITY ASSESSMENT**

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- BENCHMARKING**

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- COLLABORATION**

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- CYBERSECURITY GUIDANCE**

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- EFFECTIVE UTILITY MANAGEMENT**

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- ▶ HYPOCHLORITE ASSESSMENT MODEL**

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- ▶ PARTNERSHIP FOR SAFE WATER**

[Home](#) > [Resources & Tools](#) > [Water Utility Management](#) > Hypochlorite Assessment Model

## Hypochlorite Assessment Model

Initial Hypochlorite (OCl<sup>-</sup>) Concentration\*:  NaOCl (% w/w) Specific Gravity (S.G.):

pH (default 12.5):

Temperature 1\*:  Duration:  Days

Temperature 2 (optional):  Duration:  Days

Temperature 3 (optional):  Duration:  Days

Temperature 4 (optional):  Duration:  Days

Temperature Unit of measure:  °C(default)  °F

**Initial Concentration**

Initial Chlorate (ClO<sub>3</sub>):  g/L

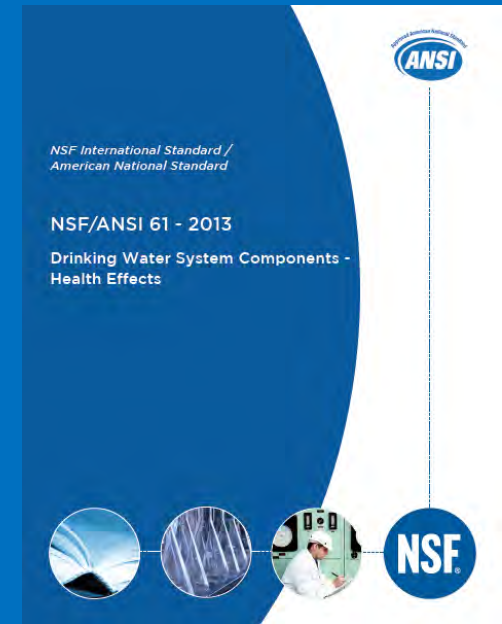
Initial Sodium Chloride (NaCl):  mol/L

Initial Perchlorate (ClO<sub>4</sub>):  mg/L

# NSF/ANSI Standard 61

## Drinking Water System Components

### – Health Effects



- Covers health effects of materials in treatment and distribution equipment.
- Covers all products with drinking water contact from source to tap.
- Does not evaluate product performance.
- Evaluates the amount of any contaminant added from a product to drinking water against health based criteria.



# Standard 61 Requirements

- Formulation disclosure by manufacturer.
- Formulation review of product.
- Inspection of manufacturing facility.
- Extract contaminants from product into water.
- Analyze extraction water for contaminants.
- Perform toxicology evaluation of contaminants.

# NSF/ANSI Standard 61 Certification Process

- Review of parts lists.
- Identify type of each water contact material.
- Minimum test batteries for common materials.
- Formulation review for uncommon materials.
- Products exposed to formulated waters.



# NSF/ANSI Standard 61 Certification Process

- Exposure waters: pH 5, 6.5, 8 (2 types), 10 exposure waters.
- Exposure water analyzed for any potential chemical contaminants.
- Contaminant concentrations mathematically adjusted to expected field concentrations.
- Concentrations compared to pass/fail criteria of standard.



# NSF 61 Cert Organizations

- NSF <http://www.nsf.org>
- UL <http://www.ul.com>
- WQA <http://www.wqa.org>
- CSA <http://www.csa-international.org>
- IAPMO <http://www.iapmo.org>

# Survey of NSF 61 Products for UCMR Contaminants

- Most products in 61 are held to Single Product Allowable Concentration (SPAC)
- SPAC is by default 1/10 of the total allowable concentration (TAC) allowed in drinking water.
- TAC = MCL for Regulated Contaminants

# UCMR (1,2,3) Contaminants from Materials above TAC Levels

- Metals
  - Cr VI
  - Co
  - Mo
- Precursor Chemicals
  - Nitrosamines (3 types)
- Reaction By-products
  - Perchlorate
- VOCs
  - Chloromethane

# Chromium VI

- 9800 analyses from 2009-2013
- 6 exceed TAC level of 20ppb
- 19 exceeded 10 ppb
- Materials included:
  - Brass – chrome plated products
  - Cement/Concrete
  - Stainless steel
  - Products w/ multiple materials (indeterminate)
- Exposure waters contain chlorine ( $\geq 12$  hrs) and some involved hot water 140F or 180F - which will convert Cr<sup>3+</sup> to Cr<sup>6+</sup>.

# Cobalt

- 317 analyses from 2009-2013
- 6 exceed TAC level of 3ppb
- 36 detections > ND
- Materials included:
  - Brass
  - Stainless Steel



# Molybdenum

- 329 analyses from 2009-2013
- 3 exceed TAC level of 40ppb
- 52 detections > ND
- Materials included:
  - SS
  - 1 from PVC

# Nitrosamines

- 128 analyses from 2012-2013
- 12 exceed TAC levels
  - 6 Nitrosodiethylamine (NDEA) TAC =  $6 \times 10^{-6}$
  - 4 Nitrosodimethylamine (NDMA) TAC =  $7 \times 10^{-6}$
  - 2 Nitrosodi-n-butylamine (NDBA) TAC =  $6 \times 10^{-5}$
- Materials included:
  - Elastomers: SBR, EPDM, NBR
  - Some secondary accelerators esp. in sulfur cured elastomers are known to be a source.

# Perchlorate

- 13 analyses from 2012-2013
  - 1 exceed TAC level of 15 ppb
  - 3 were above ND
- Materials included:
  - PVC
  - CPVC

# VOCs

- 11,500 analyses for VOC from 2009-2013
- Only 5 of the UCMR VOCs at detectable levels
  - Chloromethane
    - 365 hits above ND
    - 1 above TAC of 30 ppb
  - Bromomethane
    - 24 hits above ND
    - 0 above TAC of 10 ppb
  - 1,3 butadiene
    - 64 hits above ND
    - 0 above TAC of 100 ppb

# VOCs

- 1,2,3-trichloropropane
  - 1 hit above ND
  - 0 hits above TAC of 40 ppb
- 1,1 dichloroethane
  - 1 hit above ND
  - 0 hits above TAC of 3 ppb

# Conclusions

- NSF 60 and 61 are currently screening materials and chemicals for UCMR contaminants.
- In most cases NSF 60/61 Certification provides a 10x safety factor to likely regulated levels.
- Chlorate is a concern in Hypochlorite that is aged. Problems can be avoided by following AWWA recommendations, and using the hypochlorite tool on AWWA website.

# UCMR contaminants from materials

- Nitrosamines with very low health effects thresholds are a concern in some sulfur cured elastomers.
- Technology in this industry is addressing this issue with nitrosamine free accelerators.
- However industry is likely to only use the nitrosamine free technology where it is needed (i.e. NSF 61 products)
- So if you are not using NSF 61 certified gaskets nitrosamines could be an issue.

# Conclusions

Cobalt, Chromium VI and Molybdenum can be concerns from various products including plated products and stainless steel.

Make sure products are NSF 60 or NSF 61 Certified to avoid problems!



***Thanks....!***

Blake Stark

NSF

[stark@nsf.org](mailto:stark@nsf.org)

734-769-5480