A GLOBAL LEADER IN PUBLIC HEALTH & SAFETY

NSF INTERNATIONAL
789 N. Dixboro Road, Ann Arbor, Michigan 48105 USA

OVERVIEW

WHO WE ARE
AND WHAT WE DO

CERTIFICATION PROCESS
HOW ITS DONE

NSF/ANSI 53
LEAD REDUCTION TESTING

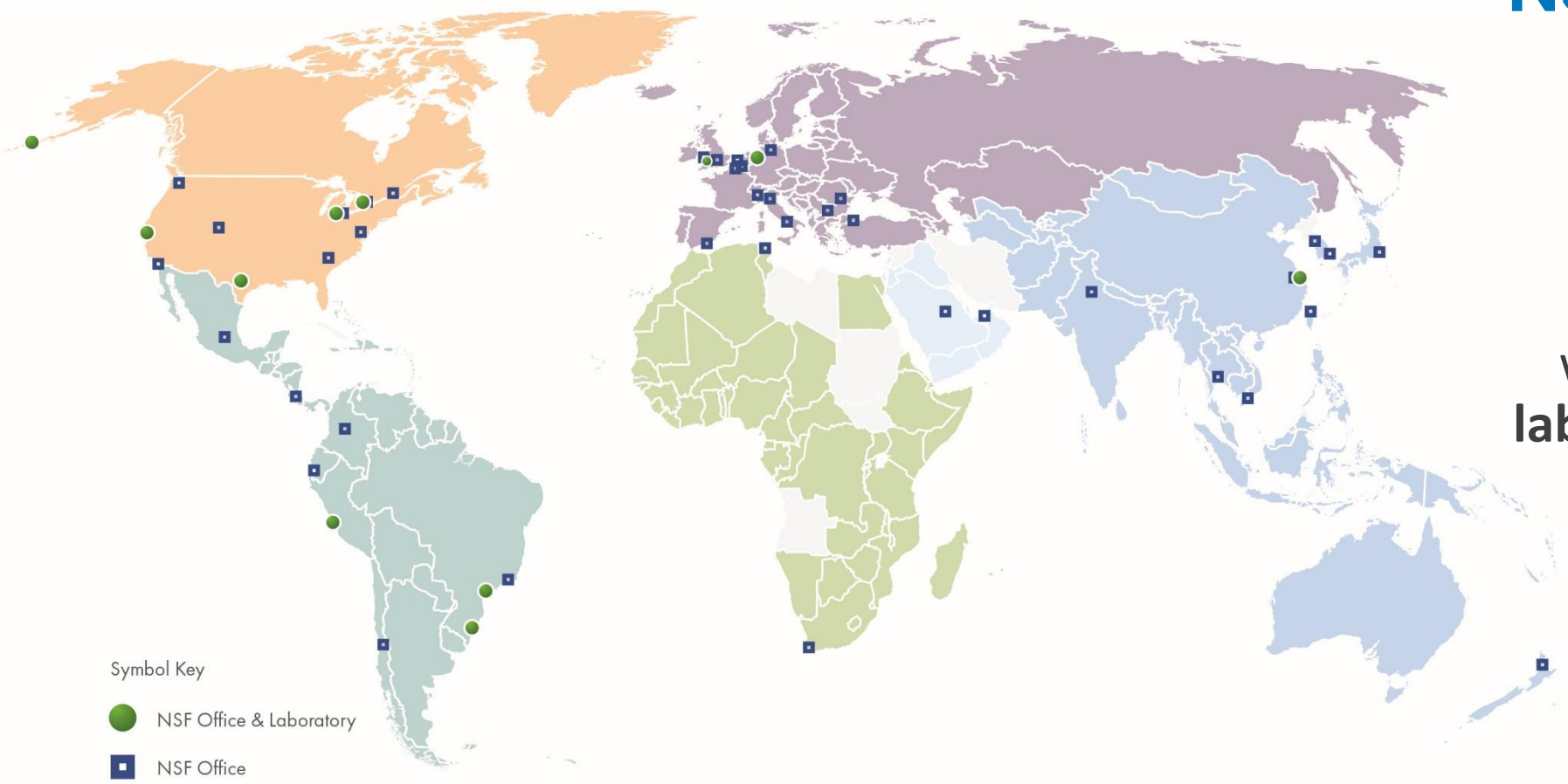
CURRENT ASSESSMENT
FILTERS IN THE FIELD AND NEXT STEPS

NSF International is an independent, not-for-profit, non-governmental public health and safety organization. Our mission and focus have always been protecting and improving human health.

NSF HELPS PEOPLE LIVE SAFER.

STANDARDS	TESTING	CERTIFICATION	AUDITING	ADVISORY	TRAINING
Facilitating the development of standards to protect food, drinking water, indoor air, dietary supplements, consumer products and environmental safety	Testing products to these and other standards	Certifying products to these standards	Conducting safety and quality audits for a wide range of industries	Providing strategic and technical consulting for the dietary supplement, pharmaceutical, medical device, food and beverage industries	Developing training and education programs

◀ *Separate from certification* ▶



NSF AROUND THE GLOBE

NSF provides services in **175+ countries** with **58 office and laboratory** locations and over **2,800 experienced** professionals.

WHAT GOES INTO GETTING CERTIFIED?

DRINKING WATER TREATMENT UNIT STANDARDS

1973	NSF/ANSI 42	Filters - Aesthetic Claims
1980	NSF/ANSI 53	Filters - Health Claims
1981	NSF/ANSI 58	Reverse Osmosis
1987	NSF/ANSI 44	Water Softeners
1989	NSF/ANSI 62	Distillation
1991	NSF/ANSI 55	Ultraviolet
2004	NSF/ANSI 177	Shower Filters
2014	NSF/ANSI 401	Emerging Compounds
2015	NSF P477/NSF 53	Microcystin Reduction*
2016	NSF P473/NSF 53	PFOS/PFOA Reduction*
2018	NSF/ANSI 244	Supplemental Microbiological Water Treatment - Filtration

*Included under NSF/ANSI 53

Municipal Standards

2015	NSF/ANSI 419	Public Drinking Water Equipment
		-EPA LT2 Rule for Cyst Reduction

NSF Joint Committee

Industry

Manufacturers of drinking water treatment systems, components, and parts. Only one representative per corporate.

11 Members

Regulators

USDA, EPA, FDA, and International, National, State, Local Government Agencies

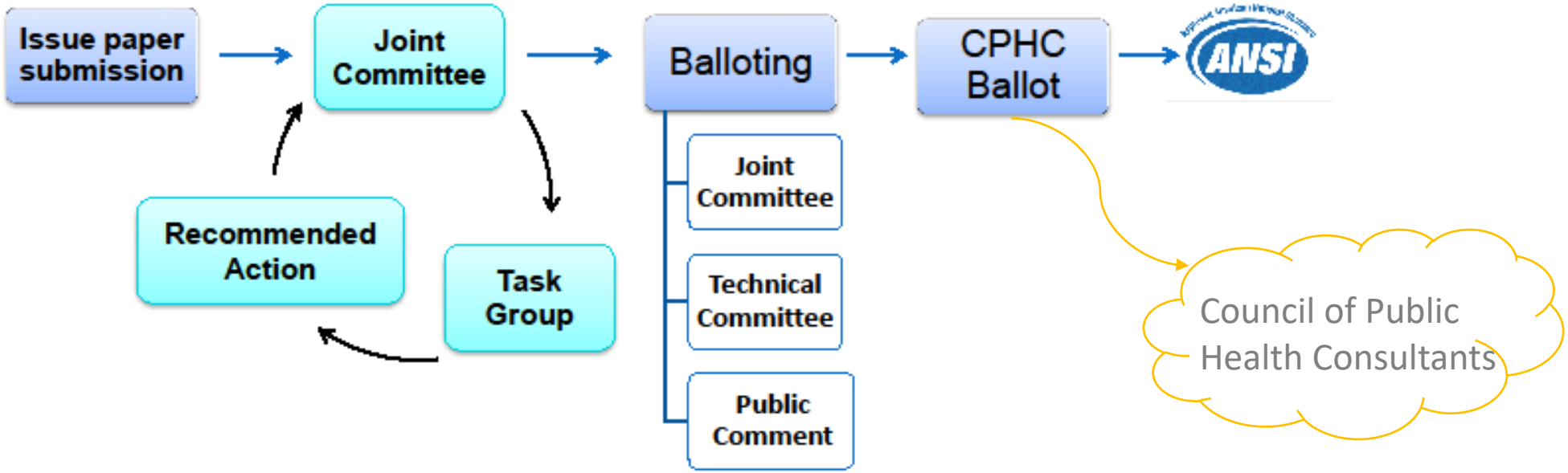
11 Members

Consumers

Educators, Consultants, Consumer Groups, labs, and other certification organizations

11 Members

ANSI-Based Consensus Process



CERTIFICATION PROCESS

WHAT YOU CAN EXPECT WHEN GETTING CERTIFIED

NSF/ANSI 53 – HEALTH CLAIMS

A summary of the Lead Reduction Test Method

NSF/ANSI 53 – REQUIREMENTS

> Scope of the standard covers POU & POE systems for health reduction performance claims

> Minimum Requirements

- Material Safety conformance
- Structural integrity (if pressurized)
- At least 1 reduction claim, for example Lead Reduction
  - For any heavy metal reduction testing, two pH levels are tested, pH 6.5 and pH 8.5

CONTAMINANT CONCENTRATIONS

> Contaminant Concentration Determination-

- Influent:
  - Based on 95th % of occurrence or 3X the regulated level
    - Rationale: Health contaminants
  - 150 ppb for lead
    - *When the Standard was originally published, the action level was 50ppb*

- Maximum Allowable Treated Water:
  - Based on Regulated Levels (USEPA MCLs, Health Canada MACs)
    - Rationale: Health contaminants
  - 10 ppb for lead
    - Soon to be lowered to **5 ppb** in accordance with new Health Canada MAC

TEST END POINT AND SAMPLING

> Test End Point and Sampling

- Chemical Reduction
  - *Chemical reduction definition*: The removal of a chemical contaminant contained in the influent water by a water treatment system or process
    - This is usually adsorption
    - Adsorptive medias have treatment capacities limiting the useful life of the media
  - Chemical reduction tests under NSF/ANSI 53 are conducted to an end point based on <u>manufacturer's rated capacity</u>
    - NSF/ANSI 53
      - 200% of rated capacity, or 120% if PID is present
        - Rationale: A safety margin is provided for health effects contaminants. Less safety margin is required if a PID is present. The PID must activate by 110%.

TEST END POINT AND SAMPLING

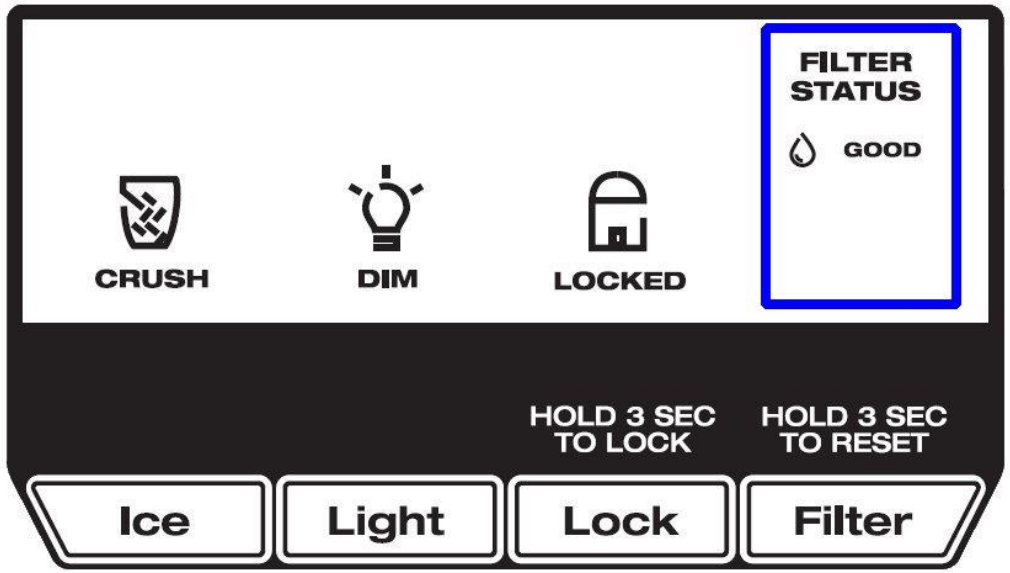
> Test End Point and Sampling

- Sampling
  - Samples of influent and treated water are collected at multiple points based on rated capacity throughout the test to assure performance
    - Without PID: start-up, 50%, 100%, 150%, 180%, 200%
    - With PID: start-up, 25%, 50%, 75%, 100%, 120%
      - Rationale: Collecting sufficient samples over life of replacement element to establish breakthrough pattern of contaminant and end of life of replacement element

TEST END POINT AND SAMPLING

> PID (Performance Indication Device)

- A device that warns the user to change the replacement element
- Audible or visible alarm, or both
- Based on volume of water treated
- Must be automatic except for manually resetting when filter is changed
- Must activate between 80% - 110% of rated capacity



TEST METHOD

> Test Method

- Two units are tested simultaneously
- Flow control for plumbed-in systems

  Flow is **not controlled** by the laboratory. Flow is the highest flow rate achieved with 60 psig dynamic pressure

  - Rationale: NSF/ANSI 53 addresses health effects. Testing at highest achievable flow rate provides added assurance of product function under use conditions
  - The product certified flow rate is the highest achieved flow from all NSF 53 performance testing conducted (assuming more than 1 performance claim)

- Flow control for pitcher/gravity fed systems
  - No pressure, flow is controlled by the system design and gravity
  - Tested to a daily production rate specified by the manufacturer

TEST WATER QUALITY

> Test Water Quality

- Metals Reduction
  - Testing for heavy metals reduction at pH 6.5 and pH 8.5
    - Rationale: Metals exist in different forms at low vs. high pH (Pourbaix Diagrams)
    - Media may have different adsorptive capabilities for different forms of metals

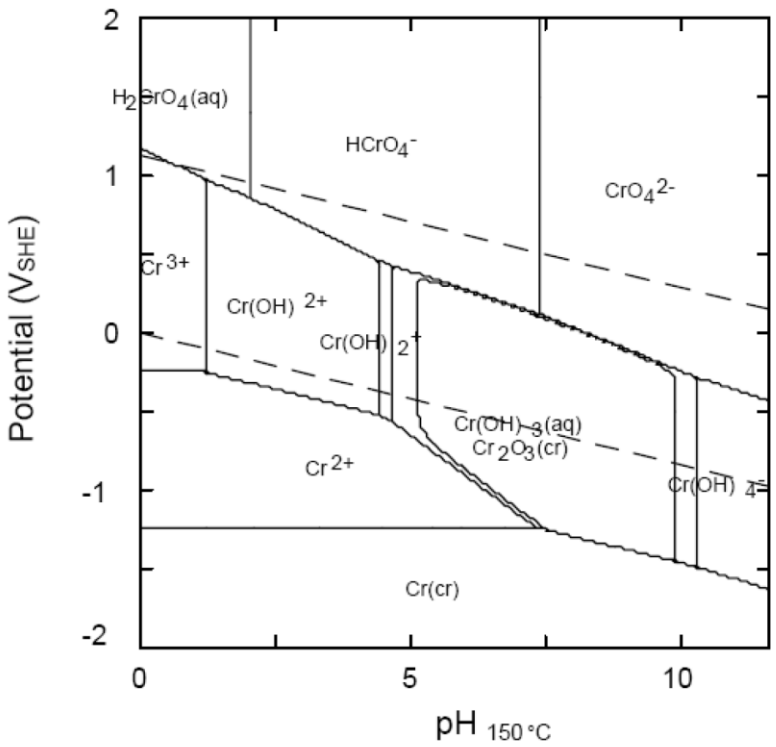
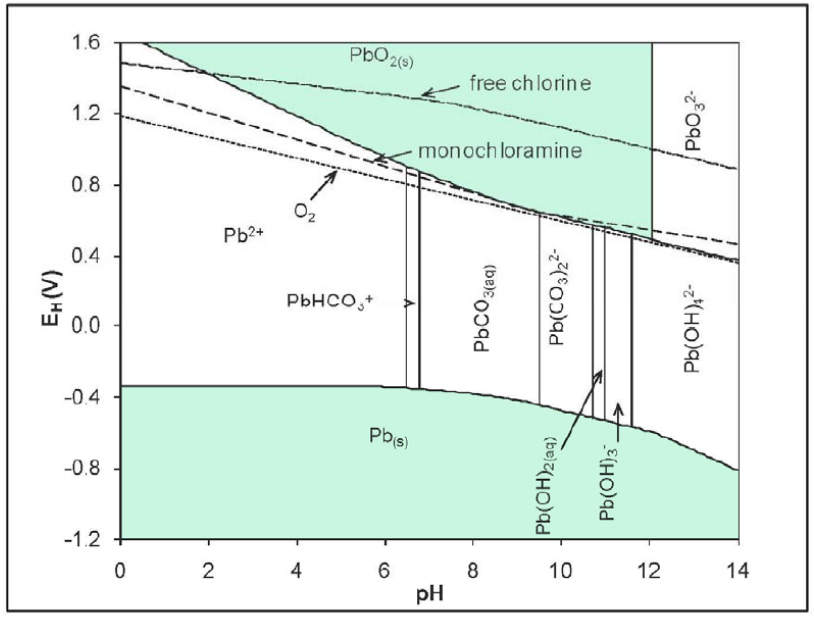


Figure 1.2. A simplified Pourbaix diagram for chromium species at 150 °C and $[Cr(aq)]_{tot}=10^{-8}$ (Source: Ball and Nordstrom 1998, Richard and Bourg 1991, Nieboer and Jusys 1988).

TEST WATER QUALITY

> Test Water Quality

- Lead
  - pH 8.5 test water specifically formulated to include 30% particulate lead in addition to soluble lead
    - Rationale: Lead can enter drinking water as particles through abrasion of lead pipes or fittings
  - pH 6.5 test water includes only soluble lead
  - Reference NSF/ANSI 53 7.4.3



Total Pb = 15 µg/L, DIC = 30 mg/L as C, no orthophosphate. Solid (insoluble Pb) species are shaded green. Non-shaded areas indicate soluble Pb species. $Pb_{(s)}$ or "elemental lead" has an oxidation state of zero [Pb(0)]. The lead in $PbO_{2\,(s)}$ (lead oxide solid) has an oxidation state of +4 [Pb(IV)]. All other lead species in diagram have an oxidation state of +2 [Pb(II)]. Note dashed lines represent the following conditions:

(a) O_2 (dissolved oxygen) = oxidation state (electron activity or E_H) provided by 1.26 µM dissolved oxygen, in equilibrium with 0.001 atm prior to distribution system and customer plumbing

(b) Monochloramine (NH_2Cl) = E_H provided by NH_2Cl at a concentration of 2 mg/L as Cl_2 with a free chlorine to nitrogen ratio of 0.79 mg Cl_2 / mg N

(c) Free chlorine (Cl_2) = E_H provided by 2 mg/L as Cl_2 free chlorine

Source: Adapted from Xie et al. 2010

Figure 1.3 Pourbaix diagram for the Pb(IV)-Pb(II)-Pb(0) system

TEST WATER QUALITY

> Test Water Quality, pH 6.5 Lead Reduction Test using a Public Water Supply

Parameter	Requirement
Alkalinity (as $CaCO_3$)	10 – 30 mg/L
Hardness (as $CaCO_3$)	10 – 30 mg/L
pH	6.5 ±0.25
Polyphosphate (as P)	< 0.5 mg/L
TDS	< 100 mg/L
Temperature	20 ±2.5 C
Turbidity	< 1 NTU

TEST WATER QUALITY

> Test Water Quality, pH 8.5 Lead Reduction Test using a RO/DI water

Parameter	Requirement
Alkalinity (as $CaCO_3$)	100 mg/L
Hardness (as $CaCO_3$)	100 mg/L
pH	8.5
Temperature	20 ±2.5 C
Total Chlorine	0.5 mg/L

> Water to be adjusted using reagent grade chemicals

> Add:

- Magnesium Solution, Calcium solution, Bicarbonate solution, Bleach solution
- Add soluble lead stock, followed by insoluble lead stock

TEST WATER QUALITY

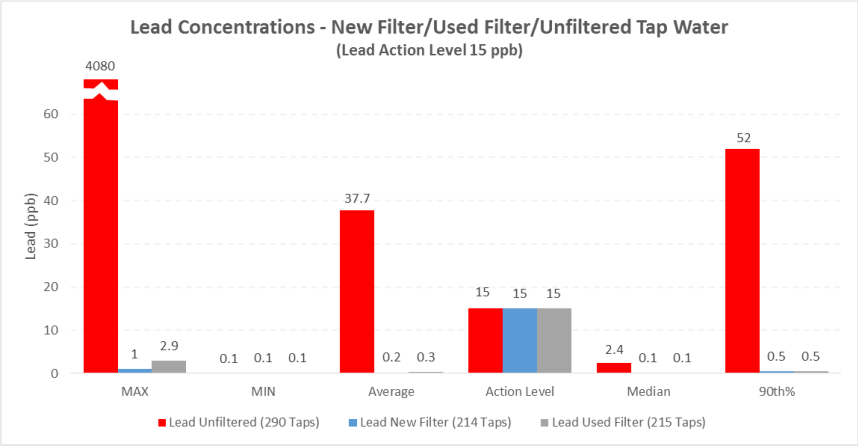
Sampling

- During Lead pH 8.5, analysis will be performed to calculate:
  - Total lead
  - Total % particulate
  - % fine particulate (cannot exceed 20%)
    - Particles between 0.1 and 1.2 microns
- Sample results must meet the 10ppb or lower criteria for two test units at every sample point

FILTER EFFECTIVENESS

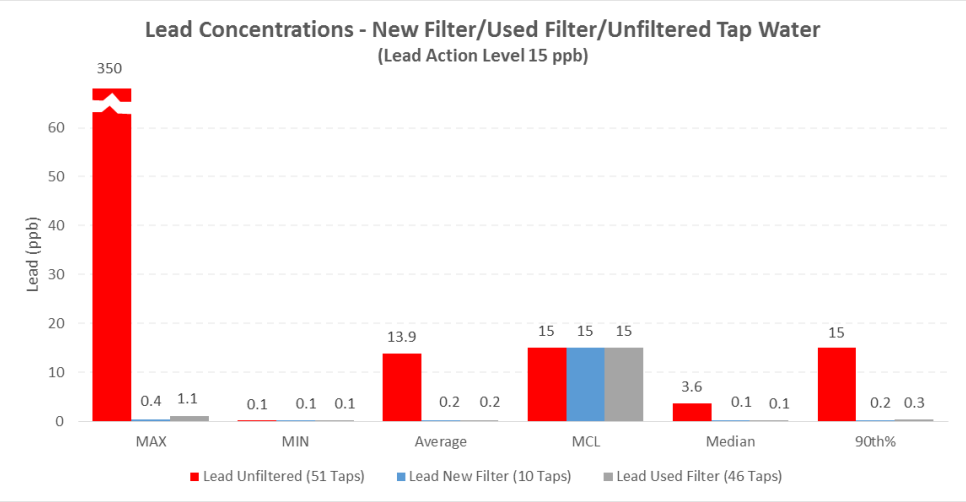
How are the filters performing in non-laboratory settings?

FLINT, MI - 2016



> The field data collected by EPA indicate that the use of distributed Brita and Pur point-of-use faucet filters, when installed and maintained properly, are effective at removing lead. <u>The resulting average concentration of filtered water is less than 1 ppb.</u>

> ATSDR reports that consuming filtered water at these lead levels would not cause significantly increased blood lead levels.



> ATSDR continues to support the multi-agency recommendation to use filtered water for cooking and drinking.

https://www.epa.gov/sites/production/files/2016-06/documents/filter_challenge_assesment_field_report_-_epa_v5.pdf

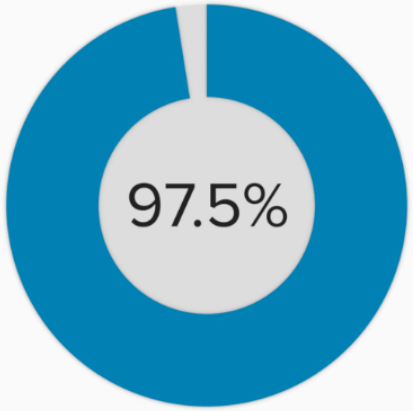
NEWARK, NJ - 2019

New Study Findings About Water Filter Effectiveness

November 22, 2019

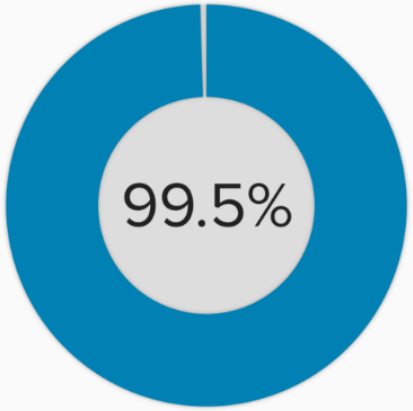
Newark conducted a study of the PUR filters in Newark between August and September 2019. The study showed that 97.5% of the filters, when properly installed and maintained, reduced lead to 10 parts-per-billion (ppb) or below. When the faucet was flushed for 5 minutes prior to filtering, 99.5% of the filters reduced lead to 10 ppb or below.

> **Until further notice, Newark recommends flushing for a minimum of 5 minutes prior to filtering to maximize filter performance in reducing lead in drinking water. Flush for a minimum of 8 minutes if you have a longer front yard or a service line over 75-feet.**



Properly used filters

When properly installed and maintained, 97.5% of the filters reduced lead to 10 parts-per-billion (ppb) or below



Properly used and flushed filters

When the faucet was flushed for 5 minutes prior to filtering, 99.5% of the filters reduced lead to 10 parts-per-billion (ppb) or below

https://www.newarkleadserviceline.com/updates/20191121-filter-study-announcement

> Despite initial media reports based on a small sample size, filters, when properly used, reduced lead levels effectively

CURRENT ASSESSMENT

> Filters are meeting the requirements of the standard when used correctly

> In many cases the filters are outperforming their capabilities (>150 ppb influents)

> *What Are Next Steps?*

- Joint Committee is evaluating the standard to determine if changes to the test method are warranted, such as:
  - Higher lead influent challenge
  - Addition of treatment chemicals such as orthophosphate
  - Pass/fail criteria is being lowered to 5ppb