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MEDFIELD
BOARD OF HEALTH

MEMORANDUM

Date: February 24, 2022

To: Maurice Goulet, Director of Public Works, Town of Medfield

From: Eric Kelley, PE, Principal, Environmental Partners

CC: Dave O'Toole, Water Division, Town of Medfield

Subject Fluoridation Options for Medfield Water System

Introduction

Drinking water fluoridation is a public health measure used to prevent tooth decay and promote overall dental health in the United States. The Town of Medfield currently does not fluoridate their drinking water. The Department of Public Works and the Board of Water and Sewerage requested that Environmental Partners provide information regarding the guidelines, regulations, and water system operation considerations related to fluoridation of drinking water. This memorandum summarizes that conceptual evaluation for the Town's reference.

Drinking Water Fluoridation

Water Fluoridation Guidelines and Regulations

The optimal level for fluoride in drinking water is 0.7 mg/L, as recommended by the Center for Disease Control and Prevention (CDC) in 2015. Note that fluoride additions must be strictly controlled, as excessive concentrations of fluoride can cause fluorosis, a condition involving mottled or discolored teeth, in children aged 8 years and younger. The Massachusetts Department of Public Health (MassDPH) Office of Oral Health, in conjunction with the Massachusetts Department of Environmental Protection (MassDEP) oversees the monitoring and surveillance standards of adjusted community water fluoridation to ensure public water suppliers (PWS) adhere to the optimal level. A PWS must complete three (3) report forms and submit these to MassDPH, including: a daily fluoride monitoring form, a weekly distribution system fluoridation monitoring, and split sample

fluoridation monitoring. Fluoride monitoring and reporting forms are available at the following link: https://www.mass.gov/lists/fluoride-monitoring-reporting-forms.

Water Fluoridation Methods

Groundwater fluoridation can be performed at any convenient location prior to distribution. Drinking water fluoridation is typically performed using one of the following fluoride chemicals: sodium fluoride, sodium fluorosilicate, or fluorosilicic acid. Fluorosilicic acid is an acidic solution, administered into drinking water via liquid-feeding systems, and may slightly depress pH. It must be handled with care, as it is corrosive and can cause severe irritation to the skin and eyes. Direct liquid-feed systems require bulk storage and a day tank. Sodium fluoride and sodium fluorosilicate are both dry salt additives. Sodium fluoride must be dissolved and injected through a solution-feed system. In our experience sodium fluoride saturators are the most common fluoride systems installed in small and mid-size water treatment facilities similar to Medfield. Sodium fluorosilicate is fed through a dry feeder (gravimetric or volumetric), which are more complicated systems than saturators and more common at surface water treatment facilities/, and thus not recommended for the Town. Sodium fluoride solutions can be easily prepared and administered into a water supply using a saturator. Water is introduced to the bottom of the saturator, which contains a bed of sodium fluoride that saturates the water with fluoride ions as it travels upwards. Massachusetts regulations require an overflow system installed alongside a saturator system.

Conceptual Approach

Given the limited amount of floor space available at the existing well stations, the solution-feed system with sodium fluoride appears to be the most appropriate to consider as it avoids the need for bulk liquid storage tanks or dry feed systems. A solution-feed system should consist of a saturator unit, an overflow unit, a chemical feed pump, tubing, and operating and emergency valves. EP has attached product data sheets for the FluoroPro Fluoride Saturator and Overflow system by Northeast Pump & Instrument. The saturator is constructed of polyethylene (PE), with an internal baffle to reduce wave action. The tank cover houses the level control and chemical feed pumps. Sodium fluoride crystals are poured into the saturator tank through the hinged cover and filled to labelled levels on the exterior. The Overflow Assembly consists of a separate tank connected to the saturator, equipped with a float valve and mechanical valve to prevent overflow of the saturator. Product details for the saturator and overflow systems are included in the attachment.

Vendors also sell pre-assembled saturator systems, including a saturator, a separate solution tank, containment, tubing, a pump, and a local control panel, though these can be significantly more expensive.

The fluoride system design would be subject to review and approval by MassDEP under a Bureau of Resource Protection Water Supply 29 (BRP WS 29) application for a chemical addition retrofit of water systems serving more than 3,300 people. This application would also include completion of a sodium fluoride checklist to document compliance with the Drinking Water System guidelines for fluoridation systems (Chapter 5.7). The addition of a new chemical to the Town's treatment process may require additional water quality analysis to evaluate potential impacts to the Town's corrosion control practices and compliance with the Lead and Copper Rule. This would be confirmed with MassDEP during design and permitting.

Cost Estimate

EP prepared a preliminary opinion of probable cost estimate to purchase the saturator system, including a saturator unit, an overflow system, external tubing, valves, and a chemical feed pump. The estimate was based on the FluoroPro Fluoride Saturator and Overflow Assembly by Northeast Pump & Instrument. The equipment costs do not include costs for the design and permitting of the systems, installation of equipment, and integration with the Town's SCADA system.

Equipment	Cost
Saturator Unit, including: 55-gallon PE tank (approx. 30-in diameter) Rigid PE tank cover Cover-mounted level control External Tubing Dual pump pickup strainers and siphon breaker Panel mounted control box and solenoid valve Secondary containment system	$3,500
Overflow System, including: 16-inch Overflow Tank Float valve Mechanical valve Tubing	$2,500
Chemical Feed Pump	$3,000*
Sub-Total per System	**$9,000**
Total for Three Treatment Systems	**$27,000**

*May vary between specific manufacturer and features

In regards to cost of treatment chemicals, sodium fluoride is sold in 50 pound bags and is typically bought by the pallet, which has 40 bags per pallet. The FY2022 bid price for sodium fluoride in the Northeast/Merrimack Valley Chemical Cooperative (NEMVCC) had an apparent low bid price of $1.1550 per dry pound ($2,310 per ton) and only foreign sources of sodium fluoride were available according to the bid results. Quantities purchased by the individual NEMVCC water system members ranged between 0.5 tons and 10 tons of sodium fluoride. For planning purposes Medfield could assume 2 tons (2 pallets) of chemical purchased annually. The average annual amount of chemical needed would be confirmed during design and permitting of the chemical feed systems.

Operation and Maintenance Considerations

EP recommends that the Town speak with neighboring communities that have implemented fluoridation systems to better understand their operation and maintenance requirements, since they pose unique challenges compared to the liquid chemical feed systems that the Town is familiar with.

The use of a solid-based chemical requires additional monitoring for potential build-up of solids within the saturator or chemical feed tubing that could reduce system performance. Health and safety concerns are primarily related to dust control during transfer of the dry product from bags to the saturator. Operators would be recommended to wear personal protective equipment such as gloves, particle respirators, and eye protection. Bulk quantities of sodium fluoride bags are typically

stored on pallets in a dry area of the treatment facility. During the past two years, the supply of sodium fluoride was heavily impacted by the COVID-19 pandemic, and many utilities reported difficultly with purchasing the chemical as a result of supply chain shortages.

Unlike other treatment chemicals, monitoring and reporting requirements for fluoridation systems are overseen by MassDPH. Operators are required to monitor fluoride levels daily at the treatment facility, using a fluoride analyzer. There are also weekly distribution monitoring requirements (at a minimum of four sites) and monthly water quality sample collection for laboratory analysis. The monitoring requirements are outlined in Chapter 5.7 of the drinking water system guidelines.

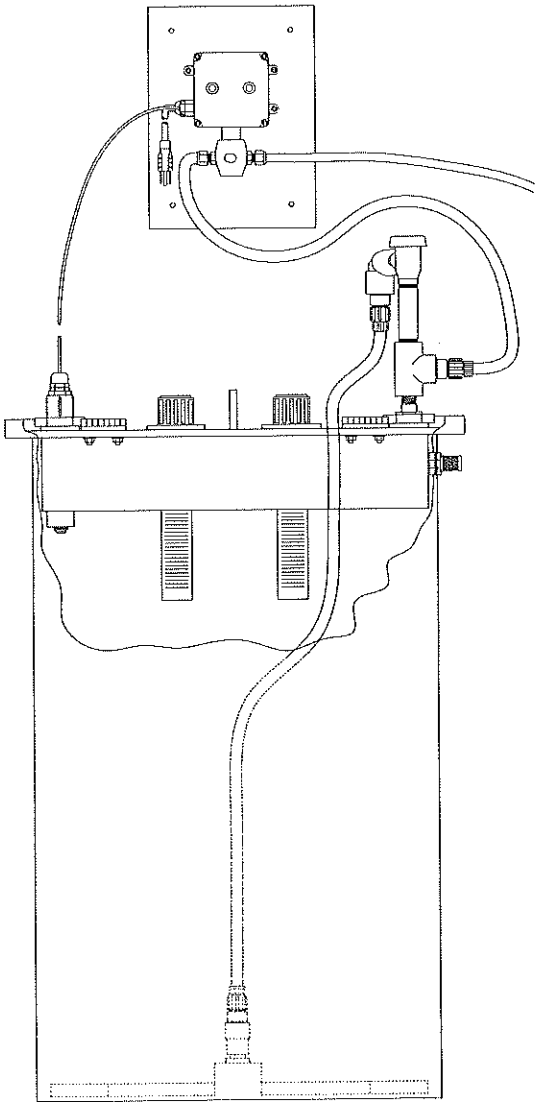
Fluoride Saturator

FluoroPro

The FluoroPro family of fluoride saturators is the latest in technology for drinking water operators who fluoridate their water systems using Sodium Fluoride.

FluoroPro saturators use a new design emphasizing simple, rugged construction, corrosion-resistant materials and long lasting components. The units offer a wall mounted solenoid valve to resist corrosion, due to the effect of NaF over time.

For additional options, including secondary shutoff assemblies and secondary containment systems are available to round out a proper fluoridation installation, please call NPI.



All aspects of these products have been developed in conjunction with AWWA and Massachusetts fluoridation standards and recommended practices.

Features of the New FluoroPro Fluoride Saturators

- ❑ Rugged 55, 70 and 110 Gallon PE tank.
- ❑ Cover Mounted Level Control.
- ❑ Upflow solution flow design for reduced maintenance.
- ❑ Rigid PE tank cover for supporting dual chemical feed pumps (main and backup pump).
- ❑ Sodium Fluoride (NaF) capacity of 200, 250 and 400 lbs.
- ❑ All thermoplastic construction for superior chemical resistance.
- ❑ Rugged hinged cover offers 50% opening area for easy filling with NaF powder.
- ❑ Internal baffle to reduce wave action and protect float assembly.
- ❑ Labelled 'fill' and 're-fill' levels for NaF replenishment.
- ❑ Single external tubing connection for easy disassembly.
- ❑ Flow Distribution Assembly has 50% greater area for more consistent solution generation.
- ❑ Dual pump pick-up strainers are easily top removable for maintenance.
- ❑ Equipped with siphon breaker to prevent overfeed due to siphoning.
- ❑ Easily retrofits to installations currently using other fluoride saturators.
- ❑ Remote, panel mounted, control box and solenoid valve.

Optional Components:

- ❑ CLA-VAL secondary shutoff control valve.
- ❑ Flooded suction pump mount
- ❑ Concentric secondary containment tank assembly.

800-378-1500 **Northeast Pump & Instrument**

www.npipump.com **190 Summer Street, Lunenburg, MA 01462**

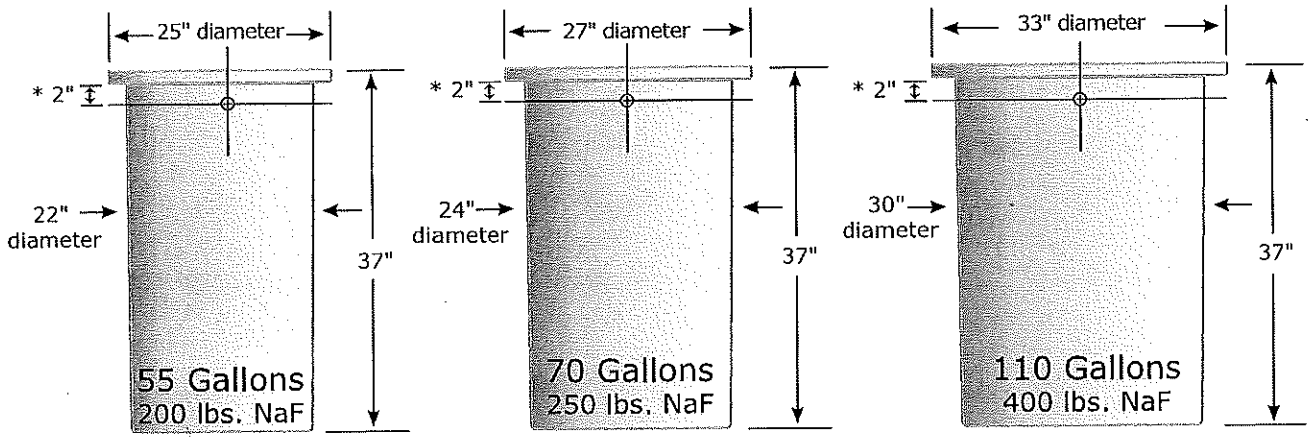
Engineering Specifications

- ❑ Saturator shall be of at least 55-gallon capacity of the up-flow design and constructed of all thermoplastic materials.
- ❑ Design shall include 6 distribution laterals for best disbursing of incoming water through the NaF crystals.
- ❑ Saturator shall be equipped with cover mounted float switch, remote mounted solenoid valve and control box.
- ❑ Cover assembly shall be flat for easy mounting of two chemical-feed pumps and should be equipped with an internal baffle to protect the float switch during addition of sodium fluoride (NaF) crystals.
- ❑ Cover assembly must have 50% of its area moveable for easy refilling with NaF and also for easier maintenance.
- ❑ Saturator must be equipped with a syphon breaker to prevent back-syphoning into the water source.
- ❑ Pump pick-up tubes shall be removable from the outside for easy cleaning.

Product Specifications

Incoming Water Pressure:	20 to 80 PSI
Incoming Water Flow Rate:	2 GPM maximum
Maximum solution Feed Rate:	1 GPM
Water Quality Requirements:	< 2 Grains hardness (water softener required for hardness greater than 2 grains)
Electrical Requirements:	115 VAC
Incoming Water Connection:	6' of tubing with 3/8" NPT male fitting provided for supply connection
Tank Overflow Connection:	3/4" FNPT PVC Bulkhead Installed

Dimensions



* 3/4 FNPT PVC Bulkhead Installed

Ordering Information:

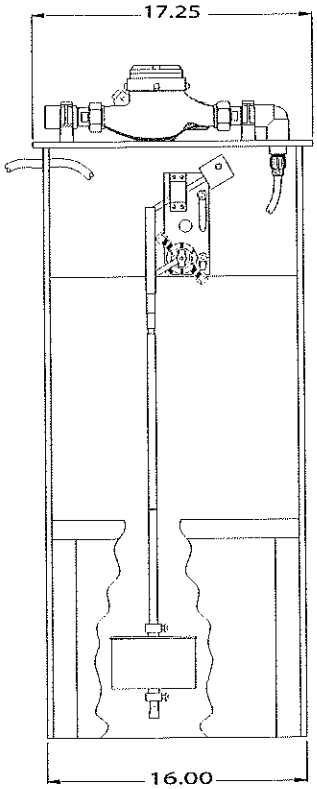
FluoroPro Fluoride Saturator

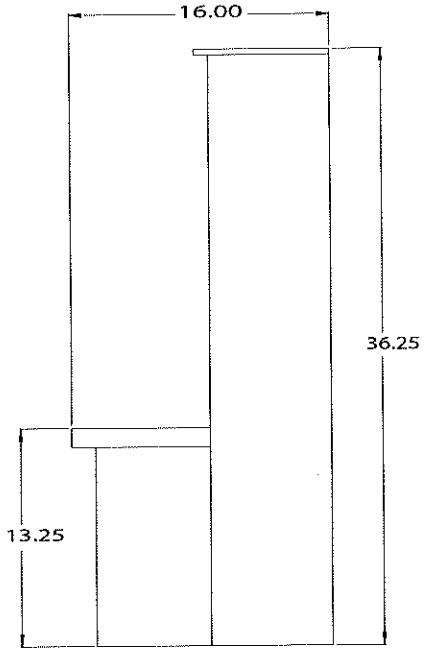
N-FPS1000 **N-FPS1070** **N-FPS1110**

800-378-1500 **Northeast Pump & Instrument**

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FluoroPro Overflow Assembly





Note: All dimensions are in inches.

Fluoride Saturators refill on a continuous, as needed, basis. Because of this, standard methods of secondary containment do not always provide adequate protection against overflows. The FluoroPro Overflow Assembly provides this extra measure of protection in a pre-engineered package.

The FluoroPro Overflow Assembly is piped directly to the saturator and in the event of an overflow will act as secondary containment and mechanical water shut-off. As the overflow tank fills, the float valve will rise. Once the level in the overflow tank is high enough the mechanical valve will shut off make-up water flow to the Saturator. This unit can also be fitted with audible or visual alarm indicators to provide operators with instant notification of an overflow condition.

The FluoroPro Overflow Assembly is available as a standalone unit or can be incorporated into a single prefabricated Saturator, Overflow and Containment assembly for the highest level of overflow protection.

Product Specifications

Piping Connections	1/8" NPT
Pressure Rating	0-300 psi
Temperature Rating	Water: to 180°F.
Materials	Brass, Stainless Steel, Monel Buna N® Float linkage and float rod: Brass and PVC Polypropylene
Adjustment Range Level Differential	1" min to 18" max. with PVC rod

Features

- **Accurate Liquid Level Control**
- **Fully Hydraulic Operation**
- **Simple Design, Easy Maintenance**
- **No Lubrication Necessary**
- **No Gears, No Mechanical Linkage Between Valve and Control**

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