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Blue Earth Products®

Stagnant Pipe Remediation Guidelines

Essential instructions for the planning and implementation of a fouled stagnant pipe remediation.

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Note:

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Stagnant Pipe Remediation

Why is it so difficult to remediate a stagnant pipe?

Stagnant or newly constructed and unused mains and piping are notoriously difficult to disinfect, largely due to the development of mature biofilms. In an active pipe, chlorine residuals are continuously restored and can limit the growth of these bacteria protecting films. Commonly used disinfectants effectively "burn" the surface of these films but have difficulty penetrating deep enough to kill bacteria protected by the layers of slime.

Why does this method work when standard methods fail?

Unlike a primary disinfectant, Clearitas is effective at breaking up the slime, removing the road block to effective disinfection. In this way, Clearitas and bleach work hand in hand to solve the problem. Clearitas carves the path for chlorine to penetrate deeply and do what it does best: kill microorganisms.

What is involved in the remediation?

An effective treatment is similar in nature to the standard AWWA procedures for main disinfection. The difference is that Clearitas is added along with the bleach and both are added at a higher concentration than what is traditionally called for. Additional treatment enhancements can also be used along with to improve results, such as: acidifying, air scour, throttling, and direction reversal.

Work Site Preparation

Preparation of the Pipe:

1. Read the "Important Safety Notice" at the end of this manual.
2. If confined space entry is required: check access/escape routes and verify that ladders and hatches are safe and secure.

    - **NOTE: IT IS CRITICAL YOU ALWAYS COMPLY WITH OSHA CONFINED SPACE AND FALL PROTECTION PROCEDURES IF APPLICABLE**

3. Verify that electrical power is available for running a compressor, pumps and safety equipment.

    - Use GFCI (ground fault circuit interrupter) connectors for electrical equipment.

4. Ensure all power cables are clear of standing liquids.
5. Safety Assessment Form finalized and posted if required.
6. Make sure related equipment has been locked out/tagged out if applicable.
7. Ensure run-off from pipe flushing can be treated or captured if required.

Personal Protective Equipment (depending on work environment)

- Chemical coverall - wear legs and sleeves outside boots and gloves
- Rubber boots - no lace-ups
- Respirator with chlorine cartridge in areas without adequate ventilation
- Rubber gloves
- Chemical eye protection

Equipment

- Oil-less electrical or gas powdered compressor
- Chemical pumps
- Appropriate pipe injection fittings
- Chemical handling equipment
- Confined space and/or fall protection equipment if needed

Pipe Remediation Procedure

Pre-Flush

Prior to performing a remediation on the water line, soak and unidirectionally flush the line with system water. If the system has been dry, soak for at least 24 hours prior to flush.

Inject and soak with Clearitas/Bleach/Glycolic

Ideally this treatment should include a mix of 500 mg/l of free chlorine from 12.5% bleach, 10,000 mg/L of Clearitas 101 (as product). Ensure all dead ends have solution. This can be determined with a chlorine test strip. The treatment once injected should be allowed to soak for at least 48 hours (see table 1 below for actual chemical dosage amounts).

These chemicals may be injected directly with pumps into the flowing system water of the pipe to ensure even distribution. Clearitas and Bleach may be combined prior to injection, however glycolic acid (if used) should be injected into the water line separately to avoid the safety hazard of chlorine gas generation.

Enhancement Techniques

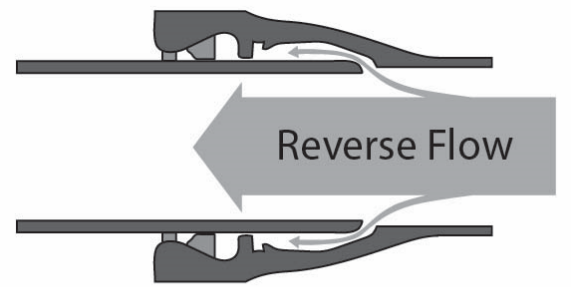
Acidifying:
Co-injecting a suitable acid to reduce the pH of the treated solution will greatly enhance the aggressiveness of the bleach at reacting with organic deposits and microorganisms. Glycolic acid is ideal for this application, as it is also aggressive toward organics. Acetic acid may be used as an alternative. Sufficient acid should be dosed into the treated water to lower the pH to 5 (see table 1 for dosage information). Depending on the source water quality, that amount of acid needed may vary. Acid should be injected into the water line using a separate injector from the Clearitas and bleach to avoid the safety hazard of chlorine gas generation (resulting from mixing).

Air Scour:
After the treatment soak, begin unidirectional flushing from the system through both ends of the line (if multiple dead ends are in the isolated system, create additional flushing points). Maximize the flushing rate (5.0 ft/s is ideal). A lower rate (such as 4.2 ft/s) can be effective if air scouring is also implemented. Use a large capacity oil-less compressor to inject air at the beginning of the main. At each step in this procedure, use caution to avoid unintended mechanical stress on the system. Inject air slowly,

observe the productivity of the scouring, as the water begins to run clear, increase air flow, and repeat.

Throttling:
Throttling can be used to create "air pigs" to improve the productivity of the air scouring. This can be especially helpful if flushing velocities of 5.0 ft/s cannot be obtained. DO NOT ATTEMPT WITHOUT CONSENT OF AN ENGINEER FAMILIAR WITH THE STRESS LIMITATIONS OF YOUR SYSTEM. Constrict the outlet to reduce flow from 4.2 ft/s to 3.7 ft/s, then quickly release back to 4.2 ft/s. Observe productivity, once the water clears, consider increasing the throttling by constricting the flow to 3.4 ft/s, and repeat. Continue the process of constriction and release until maximum productivity is achieved without damaging or overstressing the system.

Reverse Flow:
In general, it is easiest to flush mains in the direction pointing away from the distribution system, however, reversing direction can help to penetrate pipe joints and assist in removing the hard to get biofouling in these crevices. A tank and pump may be required to flush an end line back toward the system. This method is also useful when several branches need to be treated. The treatment may be initiated at the end of each branch.



Bell and Spigot Joint

Evaluate treatment effectiveness

The next day compare residuals, if they continue to drop, repeat the treatment with enhancement techniques if possible until the line sufficiently maintains residuals.

System Wide Treatment

After the main is cleaned up, the system should be treated with Clearitas 101 or Clearitas 110 on an ongoing basis to prevent the buildup of additional deposits and to slowly remove any deposits remaining after the remediation treatment. Using Clearitas as a continual treatment is easy to manage and will result in water quality and system performance benefits system wide. Clearitas is compatible with all forms of chlorine distribution residuals and is NSF 60 compliant.

Dosing Tables:

The following tables provide single treatment dosing suggestions according to the volume of water to be treated.

Vol. of Water to Treat (gal)	Clearitas 101	Bleach (12.5%)	Glycolic Acid (70%)
1,000	10 gal	4.3 gal	1.0 gal
5,000	50 gal	21.5 gal	5.0 gal
10,000	100 gal	43.0 gal	10.0 gal
15,000	150 gal	64.5 gal	15.0 gal
20,000	200 gal	86.0 gal	20.0 gal
25,000	250 gal	107 gal	25.0 gal
30,000	300 gal	129 gal	30.0 gal
35,000	350 gal	150 gal	35.0 gal
40,000	400 gal	172 gal	40.0 gal
45,000	450 gal	193 gal	45.0 gal
50,000	500 gal	215 gal	50.0 gal

Table 1 – Dosing suggestions for Clearitas 101

Vol. of Water to Treat (gal)	Clearitas 110	Bleach (12.5%)	Glycolic Acid (70%)
1,000	3.3 gal	4.3 gal	1.0 gal
5,000	16.7 gal	21.5 gal	5.0 gal
10,000	33.3 gal	43.0 gal	10.0 gal
15,000	50.0 gal	64.5 gal	15.0 gal
20,000	66.7 gal	86.0 gal	20.0 gal
25,000	83.3 gal	107 gal	25.0 gal
30,000	100 gal	129 gal	30.0 gal
35,000	117 gal	150 gal	35.0 gal
40,000	133 gal	172 gal	40.0 gal
45,000	150 gal	193 gal	45.0 gal
50,000	167 gal	215 gal	50.0 gal

Table 2 – Dosing suggestions for Clearitas 110

Runoff Treatment and Disposal Procedure

In most cases, treatment runoff will be suitable for disposal on the ground provided the runoff is dechlorinated. In special cases, pipe cleaning treatments using Blue Earth Products chemical products produce runoffs that may require special handling, this should be performed in compliance with state, local, and federal safety and environmental requirements. It is very important to discuss the discharge procedures with the customer before scoping or pricing a job. Customers might have their own concerns in addition to regulatory issues, but in most cases operation personnel are helpful in determining the correct procedure.

The runoff consists of the chemicals used, the flush water and the dissolved and suspended solids that are dislodged from the surface and present in any residual sediment. To minimize the volume of runoff and thus make discharge easier, the pipe should be flushed with water before applying the cleaning treatment. Final disinfection, if required, must be performed after all runoff is removed. No further flushing is done after disinfection.

Discharge of the runoff to the sewer or a sludge lagoon is the preferred method of disposal if runoff treatment is required. Some remediation jobs have sewer manholes close enough to allow for pumping the runoff as a disposal point. If no such option is available, a pump truck can be used to collect the runoff and deliver it to the sewer plant. For discharge to the sewer, the pH of the runoff usually must be adjusted to 6-9.

Discharge to a ground or storm drain is less desirable than discharge to the sewer or sludge lagoon and usually requires approval from the city who must have a National Pollutant Discharge Elimination System (NPDES) permit in accordance with the Clean Water Act. If the customer approves, the runoff has to be neutralized, de-chlorinated and sometimes filtered through a sediment bag before draining or pumping it out of the tank.

Final Surface Disinfection

Disinfection according to AWWA Standard C 651-14

1. The main should be filled with chlorinated water maintained at 25 ppm Cl2
2. During injection the residual should be monitored at several times.
3. The main should be cleared of air and soak for 24 hr.
4. After 24 hours the residual should be greater than 10 mg/L
5. Collect bacterial samples as prescribed by the situation.

Quality Control Measures

1. Determine chlorine demand of pipe before and after cleaning.
2. Compare water quality data upstream and downstream of pipe before and after treatment.
3. Evaluate bacterial data before and after treatment.

Benefits and Results

1. Removal of surface deposits and biofilms from pipe surfaces:
    - Removes disinfectant demand and contribution to disinfection byproduct (DBP) generation and improves finished water quality
    - Water quality improvement from elimination of water-borne surface contamination
    - Reduction or elimination of risk of microbiological corrosion (MIC) and under deposit corrosion
2. Low labor and downtime for treatment
    - Improvement of water quality over repeated traditional methods
    - Reduces out of service time.

Important Safety Notice

You are working with corrosive chemicals. These can be acids, caustics or oxidants. The products used can do harm through contact with the skin and eyes, ingestion and inhalation. The products are certified for use in drinking water facilities under Standard NSF-60. This means that they do not pose a health risk for drinking water customers if applied properly. This does not mean they do not pose a risk for those who apply the products.

Flush immediately if you come in contact with any of the chemicals. The neutralizers other than pHaze can cause long-lasting, slow healing burns and severe eye damage. (The use of pHaze™ can help eliminate the hazards of handling hazardous caustic products). Avoid contact and flush extensively if you get splashed. Do not ignore any small contact even if it does not burn immediately.

1. Review all Safety Data Sheets (SDS) for the products to be used prior to starting.
2. Find out the local emergency phone number that is used at the water plant in case you need medical attention.
3. Install a garden hose equipped with a nozzle as an emergency water supply. Leave water turned on and place nozzle where it can be easily reached. Use this for rinsing if you come in contact with any chemicals.