



**TOWN OF
NEW HAVEN**

**Phosphate Program
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Subject: Phosphate Program

Phoenix Solutions was contacted by Chapman Technical Group to complete a site survey and discussions of a phosphate program start up at your Town of New Haven well site. The purpose of the site survey was to determine the proper treatment protocol for metals removal, particularly lowering and maintaining your iron and manganese through a sequestering phosphate at your influent well site. Discussions focused on sequestering iron and manganese at the influent well site for resolving New Haven's colored water issues. The phosphate program, along with budgetary numbers, understanding of the programs procedures, feed rate levels, is presented in the following report.

The survey was conducted systematically using a standard bench test method. The results are shown in this report.

It has been a pleasure working to develop a customized metals sequestering and phosphate solution for the Town of New Haven, West Virginia; thank you for the opportunity to be of service to the Town of New Haven. After our site survey, we are confident that we can provide a water management solution that improves your overall operation.

Should you have any questions regarding our findings, please do not hesitate to contact our team at Phoenix Solutions.

Sincerely,

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Program Overview

Blended Phosphates

Advantages:

- broad pH range of application, 7 – 8 pH
- stabilizes calcium and prevents scaling
- effective sequestering of iron and manganese, particularly in high TDS water
- modest lead protection

Bridging both corrosive and scaling waters, orthophosphate polyphosphate blends provide sequestering, moderate corrosion control, and limited lead and copper protection without zinc.

Ortho vs. Poly

Very simply put, 'ortho' phosphate in water treatment formulas is used to treat corrosive water, whereas the 'poly' phosphate portion is primarily used to sequester iron, manganese, and hardness. Many water treatment formulas contain varying blends of both forms to provide a multiple use product that offers sequestering and corrosion control.

Testing

Orthophosphate Testing Methods; Analytical tests are only able to detect orthophosphate in water samples. The common test for orthophosphate is called a "Reactive Phosphorus (Orthophosphate)" test, where phosphate in the water reacts with reagents to produce a blue color which is measured and reported as _____mg/L PO₄. (Note, many laboratories when asked to analyze a sample for phosphate will report the sample results as phosphorus. When results are reported as mg/L of phosphorous, multiply the results by 3.06 to get results as mg/L orthophosphate, PO₄.)

Total Phosphate Testing Methods: If organic phosphates, condensed inorganic or long chain linear polyphosphates are present, they must be converted to orthophosphate before it can be measured. The sample is treated with heat and acid plus reagents to break apart the condensed or linear chain forms of polyphosphate to the basic reactive orthophosphate before analysis. Water sample + acid + heat + reagents changes the condensed polyphosphate PO₄ present to orthophosphate PO₄ which can be measured by the reactive phosphorous method. Results are reported as total phosphorous PO₄. Polyphosphates are thus determined indirectly by subtracting the result of the



basic reactive phosphorus test from the total (acid hydrolyzable) phosphorus test. When you subtract the ortho PO₄ from the total PO₄ the difference is Poly phosphate, PO₄.

In lab testing is completed with DR 900 and PhosVer 3 Phosphate Reagent Powder Pillow, 10-ml pillow packets.

Method 8048 Phosphorus Reactive, 0.00 – 2.50 mg/L PO₄, is the recommended method for ensuring proper PO₄ is being maintained within the system for the success of the program.

Testing is recommended once daily to ensure your plant's effluent is carrying the recommended phosphate residual for your system.

Sample testing in your system is recommended to ensure all lines are allowing the effectiveness of the program.

Total phosphate as PO₄ – ortho phosphate as PO₄ = Polyphosphate as PO₄. Always do both test if you need to determine the polyphosphate concentration.

Dosing

The threshold effect with these blended phosphates allows for their use at dosages far below the expected molecule to molecule level. General factors of the treated water to consider are the basic chemicals of iron, manganese and hardness, and physical concerns like temperature and pH. Most sequestering and corrosion problems can be handled by dosages less than 3 mg/L. Scale control and cleaning of the distribution system in conjunction with a thorough flushing program may require up to 5 mg/L initially but can usually be reduced and maintained at doses of 1mg/L after the passivation of the system.

Each water quality and treatment situation is different, some general guidelines on calculating feed rates:

Feed 1 to 2 mg/l as product as base feed rate, add 1 mg/l as product for each .25 mg/l of iron, add 1 mg/l as product for each 0.1 mg/l of manganese.



For water that contains high levels of total hardness, it is generally recommended that 1 mg/L of product be fed for every 171 mg/L of hardness. The 1 to 2 mg/L product fed as part of the base feed rate will treat most waters for their hardness.

General recommendation on orthophosphate levels for corrosion control is to achieve a 1.0 mg/L orthophosphate residual in the distribution system.

General recommendations on polyphosphate levels for sequestering metals is to achieve a 1.0 mg/L orthophosphate residual in the distribution system.

Injection of the phosphate placement is recommended before the placement of the treatment process chemicals by at least 10 feet, or 10x the diameter of the influent water line.

Following pages represent recommended injection points.



Injection point on well intake of the phosphate placement is recommended before entry into the well building to allow ample mixing energy.



Injection point inside well building intake of the phosphate placement is recommended before entry to the process treatment chemicals to allow ample mixing energy.



Orthophosphates are the most natural form of phosphate and are used to prevent corrosion of metals inside the water mains.

Polyphosphate ingredients in formulations generally provide scale control and the sequestering of minerals.

Blended phosphates use the ortho and poly forms of phosphate to produce products capable of corrosion control and sequestering and tend to be more stable than many single ingredient formulations. By blending various ortho and polyphosphate ingredients, it is possible to achieve a synergistic effect that produces better performance and stability over single ingredient.

Care should be taken when starting a system program. Assuming a desired treatment level is 1.0 ppm, the initial treatment level should be 0.5 x the desired treatment range and allowed to run for 7 days. Next step is to increase feed rate to the desired feed level x 1.25 and allow to run for a 10-day period. Upon the system pretreatment process, the feed rate can be decreased to the final control range of 1.0 ppm and maintaining 1.0 mg/L PO₄ in the distribution system, every system requires varying feed levels

Maintaining consistent pH between 7.5 – 8.0 is very important for the most effective use of the phosphate chemistry. This is can be easily maintained with sodium hydroxide pre-or post-filters. Recommendations are not to be below a pH of 7.5 but not over an 8.0 for maximum efficiency.

Consistent feed of the inhibitor is essential to the success of the program and any interruptions can result in the loss of the protective film that has been established within the systems piping.

Blended phosphates treatment levels for a successful treatment program are usually within 1.0 - 3.0 ppm and maintaining 1.0 mg/L PO₄ in the distribution system, every system requires varying feed levels. The film forming action develops a controlled filming treatment. The controlled film combining with the water chemistry and orthophosphate in the formulation. The key in controlling this filming action is to blend with polyphosphates that provides a scrubbing action on metal surfaces which limits the amount of protective coating being laid down. This



method provides a strong protective film while scrubbing away old deposits and biofilm formations and allows for the sequestering of metals.

Corrective Action

It should also be noted that the efficiency of phosphate does in fact decrease with lower pH values starting with values below 6.2 pH and above 8.0 pH.

Recommended to adjust the pH value of drinking water produced from the treatment facility is consistently near 7.5 – 7.8 there will be no issues with pH decreasing the efficiency of corrosion inhibitor, with the use of sodium hydroxide solution.

Recommended to feed 5 mg/L of phosphate in both wells as marked in the pictures for the injection points.

Recommended feeding at 5 mg/L until distribution system is stabilized at 1 mg/L PO₄, measured in your lab samples on Hach meter.

Take samples daily to ensure proper feed rate is utilized, adjust accordingly.

Rearrange inject points of chemicals as follows.

- Phosphate
- Injection point as shown in pictures
- Sodium Hypochlorite
- Hydrofluorosilicic Acid
- Caustic Soda

Financials

Cost analysis is provided showing treatment protocols for based on 200,000 gallons per day of water treated.

Feed rate calculations and financial information is based on 5 mg/l feed for program kick off.



Daily Usage	PSLP125-PHOS Feed Rate mg/L	Gals/Day Flow	Gallons/Day Feed Rate
Passivation Period	5	200,000	0.75

Daily Usage	Sodium Hydroxide Feed Rate mg/L	Gals/Day Flow	Gallons/Day Feed Rate
Passivation Period	10	200,000	1.50

Daily Cost	PSLP125-PHOS Daily Cost	Sodium Hydroxide 30% Daily Cost	Daily Treatment Cost
Passivation Period	\$ 18.00	\$ 7.44	\$ 25.44

Yearly Treatment Cost \$ 9,285.60

Chemical Cost	PSLP125-PHOS	Sodium Hydroxide 30%
Unit Cost	\$24.00 Gallon – 15 Gallon Pail	\$.48 lb - 155 lb / 15 Gallon Pail

We believe we have developed a great plan to help address the shortcomings of the current program. Our treatment protocols will in ultimately providing a higher quality water and an overall security of knowing you will be able to meet your effluent limits.

We trust we will earn an opportunity to present these results for you. Thank you again for the opportunity to further our business partnership.

Statement of Confidentiality

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This concludes the Phosphate Program

**For additional inquiries, please contact Phoenix Solutions
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