PFAS Treatment Alternatives Analysis for Doylestown Borough

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PFAS BACKGROUND

- Per and Polyfluoroalkyl substances, referred to as PFAS throughout this presentation, are man-made chemicals that have been used in industry and consumer products worldwide since the 1940's.
- PFAS have been used to make products more resistant to stains, grease, and water.
  - Used in carpeting, furniture fabrics, clothing, non-stick cookware, paper packaging for food products.
  - PFAS compounds have been widely used in firefighting foams at airports, factories, and military installations.
- The most commonly studied PFAS are perfluorooctanoic acid (PFOA) and perfluorooctane sulfonic acid (PFOS). PFOA and PFOS have been phased out of production and use in the United States, but other countries may still manufacture and use them.
- During production and use, PFAS can migrate into the soil, water, and air. Most PFAS (including PFOA and PFOS) do not break down, so they remain in the environment. Because of their persistence in the environment, PFAS are referred to as "forever chemicals".

CHANGING PFAS REGULATIONS

- As the health effects of PFAS chemicals become more well known, regulatory agencies such as the EPA and PADEP have enacted regulations on the levels of PFAS permitted within drinking water.
  - In 2016, the EPA issued a Health Advisory Limit (HAL) of 70 parts per trillion (ppt) for the combined level of Perfluorooctanoic Acid (PFOA) and Perfluorooctyl Sulfonate (PFOS).
  - On January 14, 2023, the PADEP issued a Maximum Contaminant Level (MCL) of 14 ppt for PFOA and 18 ppt for PFOS. Testing and reporting requirements for these limits will begin in January 2024.
  - On March 14, 2023, the EPA announced a proposed MCL of 4 ppt each for PFOA and PFOS, and additional regulation on four other PFAS compounds. These regulations are anticipated to be enacted by the end of 2023.
  - If the EPA regulation is enacted, the PADEP will be required to adopt the new lower standard.

BOROUGH'S SOURCE OF WATER

- Water for consumption within the Borough is supplied through five (5) groundwater wells.
- The Borough also has interconnections with Doylestown Township Municipal Authority for a source of supply if needed.
- Yearly water supply is as follows:

Well #	Location	Flow Rate (gpm)	Average Flow (gpd) 2022
7	East Street	350	208,830
8	West Street	250	75,679
9	Maplewood Park	350	218,375
10	Sandy Ridge Drive	350	174,701
12	Chapman Park	200	111,397
Total Well Production			789,000
Water Purchased from DTMA			24,477
Average Daily Water Usage			813,477

WELL SAMPLE RESULTS RELATIVE TO CURRENT & PROPOSED PFAS REGULATIONS

- USEPA: Water quality testing of the Borough's water supply wells has shown levels of PFAS below the current USEPA Health Advisory Limit. However, this limit is proposed to be lowered to 4 Parts Per Trillion (ppt) for both PFOS and PFOA as early as the end of 2023. This new USEPA limit is proposed as a Maximum Contaminant Level (MCL).
- PADEP: The Borough wells are within current PADEP Maximum Contaminant Level (MCL) limits, but again, would exceed proposed USEPA MCL.

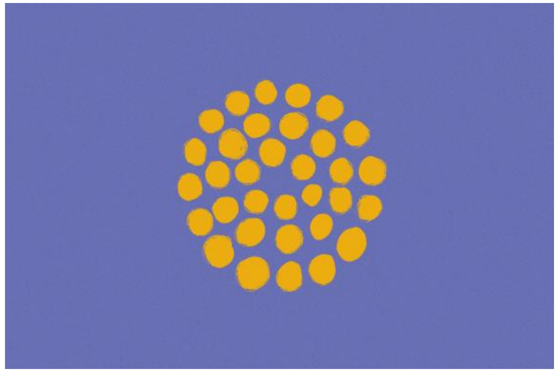
Well #	Sample Results*		Regulatory Limits				
	PFOS (ppt)	PFOA (ppt)	USEPA Health Advisory PFOS + PFOA (ppt)	PADEP MCL PFOS (ppt)	PADEP MCL PFOA (ppt)	Proposed USEPA PFOA (ppt)	Proposed USEPA PFOS (ppt)
7	10	11	70	18	14	4	4
8	10	11	70	18	14	4	4
9	13	13	70	18	14	4	4
10	10	14	70	18	14	4	4
12	7	11	70	18	14	4	4

* All results are from 2022.

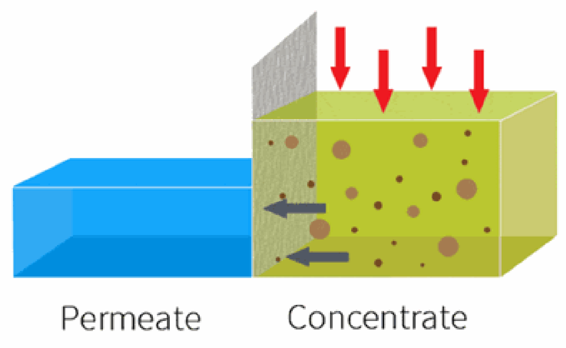
TREATMENT OPTIONS

- USEPA lists three Best Available Technology choices for removal of PFOS and PFOA from water. These technologies include:

Granular Activated Carbon (GAC)



Ion Exchange (IX)



Membrane Filtration/Reverse Osmosis (RO)

GRANULAR ACTIVATED CARBON (GAC)

- GAC treatment of drinking water has a proven record for removal of PFAS compounds.
  - Works by adsorbing and trapping PFAS compounds from the water into open pore spaces of the GAC.
  - GAC treatment occurs in large, pressurized tanks; a typical installation has two tanks per treatment train operating in a series or lead/lag configuration.
  - GAC treatment is used throughout the state to remove PFAS from drinking water sources and is readily permitted by the PADEP.

- Cost for Treatment
  - Capital Cost - Estimated capital cost for **all five wells is $9,149,524. (Average cost per well equaling $1,829,905)**
    - Capital Cost estimate includes the purchase of GAC treatment vessels, GAC media, building construction, electrical equipment, along with engineering, permitting, construction oversight, and contingencies.
  - Operational Cost - Estimated cost of roughly **$1,000** per month per well.
    - Includes regular testing of PFAS levels on the influent water, between the GAC vessels, and on the effluent water.
  - Carbon Replacement -Carbon purchase and disposal costs are currently **$4.00** per pound, or an annual cost of **$160,000** for treatment of all five wells. **(Average cost per well equaling $32,000)**
    - Estimated to be required every two years.
  - Total Annualized Operation and Maintenance Cost - **$220,000**.

GRANULAR ACTIVATED CARBON (GAC) EXAMPLE

GAC treatment system constructed in Warrington Township for the North Wales Water Authority

GAC treatment building constructed in Warrington Township for the North Wales Water Authority

ION EXCHANGE (IX)

- Ion Exchange treatment is listed as a Best Available Technology of drinking water by the USEPA and has been used in drinking water and industrial water treatment systems for many years.
  - Ion exchange (IX) resin removes PFAS by two mechanisms, ion exchange and adsorption.
  - IX treatment occurs in large, pressurized tanks very similar to the vessels used for GAC treatment.
  - IX treatment is currently considered an “innovative technology” by the PADEP, so before full scale implementing, a pilot test would be required.

- Cost for Treatment
  - Capital Cost - Estimated capital cost for **all <u>five</u> wells is $8,250,000. (Average cost per well equaling $1,650,000)**
    - Capital Cost estimate includes the purchase of resin treatment vessels, resin media, building construction, electrical equipment, along with engineering, permitting, construction oversight, and contingencies.
  - Operational Cost - Estimated cost of roughly **$1,000** per month per well.
    - Includes regular testing of PFAS levels on the influent water, between the ion vessels, and on the effluent water.
  - Resin Replacement -Resin purchase and disposal cost are currently **$450** per cubic foot of resin, or an annual cost of **$81,000** for treatment of all five wells. **(Average cost per well equaling $16,200)**
    - Estimated to be required every three years.
  - Total Annualized Operation and Maintenance Cost - **$141,000.**

REVERSE OSMOSIS (RO)

- Reverse Osmosis is a type of membrane filtration treatment which is a pressure-driven process that retains all ions on one side of an osmotic membrane and purified water passes through the membrane.
- RO treatment varies from GAC and IX treatment in that it is a physical separation type of treatment rather than a chemical adsorption-based treatment.
- Cost for Treatment
  - Capital Cost - Estimated capital cost for **all five wells is $9,336,250. (Average cost per well equaling $1,867,250)**
    - Capital Cost estimate includes the purchase of membrane systems, membrane material, building construction, electrical equipment, along with engineering, permitting, construction oversight, and contingencies.
  - Operational Cost - Estimated cost of roughly **$31,166** per month per well. Elevated operations cost are due to the high electricity demand needed to run the booster pumps for the RO systems
    - Includes regular testing of PFAS levels on the influent water, between the membrane systems, and on the effluent water, in addition to increased electrical energy requirements and hazardous waste removal.
  - Membrane Replacement - Membrane purchase and disposal cost are currently **$600** per membrane, or an annual cost of **$44,000** for treatment of all five wells. **(Average cost per well equaling $8,800**
    - Estimated to be required every five years.
  - Total Annualized Operation and Maintenance Cost - **$374,000.**

TREATMENT OPTIONS SUMMARY

- Although the total project costs for the three treatment options are relatively close, the operational and maintenance costs for each vary widely.
- From this study, it was concluded that all three treatment options evaluated are able to meet the Borough's treatment goals.
- In addition to the three treatment options outlined, CKS also evaluated the option to bulk purchase water from Doylestown Township Municipal Authority (DTMA), replacing the production of the Borough wells.
  - This option would result in a yearly cost of approximately **$1,355,390**.
  - The Borough would then become dependent on another public water system for water.

STUDY CONCLUSIONS

- Due to significantly higher dollar/gallon costs, the options of RO treatment and bulk water purchase from DTMA are not as desirable as GAC or IX treatment.
- The capital and operational cost of IX treatment is the lowest of all options presented, but this treatment has the longest implementation time.
  - Although the ability of IX treatment to remove PFAS from water is widely accepted, the PADEP considers this an “innovative technology”.
  - Pilot testing would need to be completed for PADEP to issue a permit.
  - As IX treatment becomes more widely implemented, the PADEP may change their requirements for issuing IX treatment permits.
- The capital and operational cost of GAC is similar to that of IX treatment, but GAC is readily permitted by the PADEP and would be the most expedient path to providing drinking water treated for PFAS.
  - This option also allows for the transition to IX treatment if desired.
- Construction of treatment systems at Wells 7 and 8 will be difficult due to site constraints.

HYDRAULIC MODEL OVERVIEW

- A hydraulic model of the Borough’s water distribution system is being developed.
- Once completed, this model will help in assessing current and future system needs, evaluating requests for capacity from potential customers, and investigating other hydraulic and water quality concerns.
- The model will be also help the Borough further understand their PFAS treatment needs.
  - The data will be used to determine if all five wells are needed for immediate water use demands or if the system can adequately operate on three wells, allowing the Borough to postpone the construction of a PFAS treatment system.
  - The model will evaluate system pressure and supply without Well Nos. 7 and 8 in operation (well supply from Nos. 9, 10, and 12).
  - Evaluate interconnection needs to address pressure and supply issues noted during operation without Wells 7 and 8.

ANY QUESTIONS?