THE FOLLOWING CHANGES ARE PRESENTED HERE FOR APPLICATION COVER

1. Replace the Application Cover with that included here.

WESTMORELAND SANITARY LANDFILL LLC.
SANITARY LANDFILL

PERMIT NUMBER 100277
ROSTRAVER TOWNSHIP
WESTMORELAND COUNTY, PENNSYLVANIA

MINOR PERMIT MODIFICATION (ON-SITE LEACHATE TREATMENT)

PREPARED BY

Civil Design Solutions, Inc.

1331 State Avenue • Coraopolis, Pennsylvania 15108
Phone (412) 299-2700 • Fax (412) 299-2922
Project Number 2024-098

Submitted February 2025
Addendum #1 May 05, 2025
Revised October 31, 2025

VOLUME 1 OF 1

October 31, 2025

Ihab Abdulfatah, P.E., Environmental Engineer
Pennsylvania Department of Environmental Protection
Southwest Regional Office
Bureau of Waste Management
400 Waterfront Drive
Pittsburgh, Pennsylvania 15222-4739

Subject: Sanitary Landfill – Minor permit Modification Application
Leachate Treatment Trial Project
Response to Technical Deficiency Letter Dated September 2, 2025
Rostraver Township, Westmoreland County, Pennsylvania
PADEP Permit No. 100277
Authorization No.1516469
Civil Design Solutions Project 2024-098

Civil Design Solutions, Inc. (Design Solutions) and Westmoreland Sanitary Landfill, LLC. are pleased to submit this response to the PADEP September 2, 2025 technical deficiency letter regarding the Minor Permit Modification Application for the Westmoreland Sanitary Landfill, LLC – Sanitary Landfill located in Rostraver Township, Westmoreland County, Pennsylvania. This letter has been prepared in a comment-response format where each PADEP comment is identified and a written response is provided.

Technical Deficiencies

1. The submitted application does not include the information required by 25 Pa. Code Section 271.503. Please revise the application to include the following.

a. An economic analysis indicating benefits to both the Commonwealth and the applicant from the proposed facility, including an economic analysis of the benefits of alternative methods of leachate treatment. The economic analysis should include capital costs, operations and maintenance (O&M) costs, project lifespan, cost per gallon treated, costs savings if any, impact on landfill operation, compliance and liability costs, environmental benefits, job creation, impact on long-term compliance, and impact on public infrastructure. The analysis should be supported by documentation.

Response: See the attached Supplemental Information narrative prepared by Westmoreland Sanitary Landfill addressing information required by 25 Pa. Code Section 271.503.

b. A technical analysis comparing the proposed leachate treatment facility to the existing state-of-the-art technologies for processing and treatment of landfill leachate generated at the facility. Please provide a detailed side-by-side technical comparison between the proposed facility and the existing state of the art alternatives. The comparison should focus on treatment effectiveness, system reliability, operational complexity, and environmental performance. The information should be supported by documentation from vendors, technical literature, pilot study data, or EPA reports.

Response: See the attached Supplemental Information narrative prepared by Westmoreland Sanitary Landfill addressing information required by 25 Pa. Code Section 271.503.

c. A complete operational plan, including but not limited to design details and a timetable for completing various phases of the facility from initiation of construction to completion of the project (start dates for each phase, construction duration, closure/removal duration), site preparation, tanks construction, installation of various equipment, detailed description of each unit/component, manufacturer/model number for each unit/component, process flow and treatment objective of each unit (including design flow rate, residence time, and removal efficiencies); flow control and system monitoring; addition of chemicals and control of doses; sludge handling; redundancy and bypass procedures; sampling and data collection; emergency response and contingency plans; operator qualifications; closure; removal of the units and site restoration in case of project failure; staffing plan; staff training; monitoring and reporting plan; sampling plan; and obtaining the required permits. Please include all relevant calculations and attach equipment specification sheets.

Response: See the attached Supplemental Information narrative prepared by Westmoreland Sanitary Landfill addressing information required by 25 Pa. Code Section 271.503.

d. An evaluation of the anticipated contribution of the demonstration facility to the field of solid waste management and landfill leachate treatment. Please discuss what is novel or improved about the proposed facility, the contribution to environmental protection, the impact on landfill operations and compliance. The evaluation narrative must include supporting documentation.

Response: See the attached Supplemental Information narrative prepared by Westmoreland Sanitary Landfill addressing information required by 25 Pa. Code Section 271.503.

e. An evaluation of the potential applicability of this new or unique treatment technology at other landfills in Pennsylvania. In the evaluation, please indicate if the proposed technology is demonstrated elsewhere but new to Pennsylvania and clarify whether this is a pilot demonstration or full-scale installation. Please discuss the applicability/inapplicability of this new technology at other landfills considering leachate composition constraints; flow rate range requirements; site space constraints; integration with existing infrastructure; climatic constraints; operational and cost constraints; and any regulatory and environmental restrictions.

Response: See the attached Supplemental Information narrative prepared by Westmoreland Sanitary Landfill addressing information required by 25 Pa. Code Section 271.503.

f. A demonstration that the applicant has the financial ability to remove the facility and cleanup the affected area in the event of pollution. Please submit the cost estimates along with documentation for worst-case cleanup using DEP Bonding Worksheets.

Response: The facility's financial assurance – DEP Bonding Worksheets have been updated to include cleanup of the proposed facility upon closure. It is assumed that the building and tank will remain on-site at the time of closure. The Revised Worksheets included here have a "10/2025" revision date, all revisions have been identified with a revision marker. The total of revised Bonding Worksheets presented here is $22,732,146, this total is below the currently funded bond amount of $23,202,716 for Sanitary Landfill, a bond reduction is not being requested.

g. A plan for corrective action in the event of pollution. The plan must describe how Sanitary Landfill will respond to and remediate any release to the environment. The plan should identify potential pollution scenarios and include monitoring plan, pollution containment measures, long-term remediation methods, implementation procedures, remediation cost availability, DEP notification, and site restoration. Please include relevant drawings.

Response: See the attached Supplemental Information narrative prepared by Westmoreland Sanitary Landfill addressing information required by 25 Pa. Code Section 271.503.

h. A statement of the optimal size and capacity for a facility using the proposed technology. Please provide documentation and engineering calculations showing how the proposed leachate treatment facility's size and capacity were determined to be optimal for the site-specific conditions. In the statement, please include leachate flow rate, leachate characteristics, hydraulic and pollutant loading rates, storage volumes, equalization volume, optimal operating range, and removal efficiencies for each unit. In addition, please demonstrate that the proposed facility can handle expected leachate volumes and produce desired effluent qualities. The statement must include all relevant calculations to justify the optimal size and capacity.

Response: See the attached Supplemental Information narrative prepared by Westmoreland Sanitary Landfill addressing information required by 25 Pa. Code Section 271.503.

i. A plan for assessing the effectiveness and environmental impact of the proposed facility, including monitoring parameters; sampling and testing methods; analytical data evaluation/interpretation methods; and decision criteria (including effluent targets and unit processes removal efficiencies); impacts and monitoring of air, soil, and groundwater; HAP emissions; odor emissions; noise generation; residuals management; and a complete sampling/monitoring plan. Please attach all relevant documentation.

Response: See the attached Supplemental Information narrative prepared by Westmoreland Sanitary Landfill addressing information required by 25 Pa. Code Section 271.503.

2. The design and operational information presented does not include specific justification regarding the current limitations with existing POTWs acceptance. Please explain why the leachate generated at the facility is rejected by the POTWs and include the maximum permissible concentration levels for all leachate constituents acceptable to the POTWs.

Response: The facility currently has two permitted direct connections to POTW facilities included in the facility's approved Landfill Permit; the Belle Vernon Municipal Authority (BVMA) and the Mon Valley Sewer Authority (MVSA). Until approximately Q2 2019, Westmoreland Sanitary Landfill discharged all leachate via

a direct sewer connection to the BVMA sewer system. On May 17, 2019, a Court Order was issued to stop sending leachate to BVMA. Since this date, Westmoreland Sanitary Landfill personnel have reached out to BVMA and MVSA on numerous occasions to work towards an agreement to send leachate to these facilities.

For several years, MVSA has indicated that once Westmoreland installs a pre-treatment facility, MVSA would then consider accepting the leachate. However, no limits would be provided until a pre-treated leachate sample is tested and provided to MVSA for their review. A copy of a sample letter received from MVSA is attached for reference. Similar telephone conversations have occurred with the same messaging since the date of this later.

Westmoreland Sanitary Landfill has attended several monthly meetings at BVMA to discuss the potential of the facility accepting leachate. The conversation was very similar to those with MVSA in that BVMA would be willing to review pre-treated leachate data and would consider accepting but not until a pre-treatment system is installed and operating. Additionally, BVMA is not willing to provide discharge limits until they are able to review pre-treated leachate data from the facility.

3. **Attachment 28-8 and Keystone report narratives lack justification regarding the basis for the 40,000 gpd as the design capacity. Please provide calculations demonstrating the system's ability to manage peak daily leachate generation and provide documentation showing the seasonal leachate generation rates, and historical data on daily generation rates.**

Response: Westmoreland Sanitary Landfill prepared Supplementary Information included with this submittal, a response to this inquiry is provided under Comment 1.h. The Supplementary Information includes a justification for a design basis of 90,000 gallons per day and an initial proposed processing for the trial project of approximately 40,000 gallons per day to evaluate the system. As shown in the Supplementary Information, the overall average generation at the site for the last few years is approximately 42,600 gallons per day with historical seasonal increases several years ago upwards of 77,000 gallons per day.

4. **The information presented in the application indicates that the submission of the quarterly report will be within 60 days of the end of the quarter. Quarterly reports should be submitted within 30 days after the end of each calendar quarter to allow the Department to closely monitor the performance of the treatment facility.**

Response: The Form 25 – Attachment 25-8 narrative and the Design Report prepared by Keystone presented in Form 25, Attachment 25-8 has been revised to

identify that quarterly reports will be submitted within 30-days of the end each quarter.

5. **The reporting plan described in the application is lacking several important elements. Please revise the plan to include a list with all parameters that will be monitored at each sampling point and their associated analytical methods; sampling methods; sampling frequency; and describe the quality assurance/quality control procedures that will be followed to ensure data reliability. In addition, each report must include:**

    a. **30-day influent and effluent flow average.**
    b. **Influent/effluent concentrations and mass loadings for COD/BOD; TSS; ammonia;**
    c. **Chemical usage rates.**
    d. **Sludge/residual volume, characterization, and disposal destination.**
    e. **Equipment runtime, downtime, maintenance, and calibration logs.**

    Response: The On-Site Leachate Treatment Trial Project Narrative presented in Form 25, Attachment 25-8 was revised to include additional information on the monitoring, testing and reporting of the pre-treatment components. The testing summary has been presented in Form 25, Attachment 25-8 in a tabular format to more clearly identify the proposed monitoring. The revised document is included with this submission. The project is a trial project that's purpose is to evaluate the treatment systems effectiveness. There will be routine downtime, maintenance and adjustments. Major equipment downtime or maintenance (including extended, multiple day downtime or equipment failure) will be documented.

6. **The information presented lacks defined effluent quality targets aligned with the POTWs standards or NPDES discharge requirements. Please revise the narrative to include information regarding the anticipated effluent limits or treatment goals that the facility aims to achieve to be acceptable to the POTWs for sewer discharge (e.g., <10 mg/L ammonia-N, <30 mg/L COD, etc.) and/or for discharge under an NPDES permit.**

    Response: As identified in several locations of the application and this response letter, target limits for the POTW facilities to accept the pre-treated leachate have not been provided. However, Westmoreland Sanitary Landfill has added target limits to the On-Site Leachate Treatment Trial Project Narrative presented in Form 25, Attachment 25-8 which parallel a draft NPDES Part 1 permit that was issued to Westmoreland Sanitary Landfill on February 12, 2025 and is still pending issuance. It should be noted, that this project is a trial project with the goal of being able to discharge leachate to an existing onsite sewer connection to one of two POTW

facilities and likely, the limits (once provided by the POTW) will be less stringent than these targets limits.

7. **The MBBR, DAF, and HRT solvent stage can produce ammonia and VOC emissions. Please provide calculations quantifying these emissions and submit a Request for Determination (RFD) to the Department's Air Quality Program. If tanks will be used for storage of treatment chemicals, determine if a PADEP tank registration and installation permit is required.**

   Response: Following approval of this Minor Permit Modification, Westmoreland Sanitary Landfill will have a Request for Determination submitted to the Department's Air Quality Program. The facility will ensure any required air permitting is obtained before a potential source is installed. At this time, the Applicant is unsure if the Permit Modification will be issued with the equipment included in the Application. Additionally, in the past, Westmoreland Sanitary Landfill pursued a Solid Waste Minor Permit Modification and an Air Permit Plan Approval for a leachate treatment system. The air permit was issued prior to the solid waste permit, and the waste permit was not issued. This caused significant extra work for facility, their consultants as well as additional follow-up work to track and then ultimately terminate the permit. There are no proposed chemical tanks that would require PADEP tank registration.

8. **The leachate's total suspended solids (TSS) amount listed in Appendix A - Table 1.1 (Design Basis Table) is 10,600 mg/L while it is listed as 100 mg/L in Appendix D – Table 1. Please explain this inconsistency and provide a single TSS amount to act as a basis for the design of the MBBR and the other units.**

   Response: The 10,600 mg/l value was a maximum value during testing over the years and an outlier likely from sediment after a storm event. The 100 mg/l is the design TSS influent value for the MBBR. The OWS is the primary process and will remove TSS as well as the storage tanks during rain events.

9. **No calculation is provided to demonstrate that the media volume and the hydraulic residence times associated with the MBBR are sufficient to treat the influent loading rates (COD, bCOD, Ammonia). Please provide relevant mass loading rate calculations and sizing justification for the selected media volume and the hydraulic residence time values (90 hours for Phase 1, and 40 hours for Phase 2) associated with the MBBR unit. Please include expected removal efficiencies for each contaminant.**

   Response: BioprocessH20 has provided an updated submission package which includes calculations for the MBBR unit. This updated package is included in Form 25 – Attachment 25-8.

10. The report indicates that the process may require additions of nutrients to support biological oxidation in the MBBR. Please provide a nutrient management plan that includes target C:N:P ratio, dosing rates, monitoring and amounts adjustment procedures.

Response: Extensive CNP monitoring is not typically required for landfill leachate treatment. If it is noted through routine monitoring that the system is not nitrifying all the ammonia, then subsequent testing will be conducted on the root cause. This testing and any related investigation will be included with the trial project reporting to allow for further refinement of the treatment process.

The MBBR vendor made a conservative assumption that nitrogen and phosphorous concentrations are insufficient for supporting biological oxidation and therefore, included nutrient and chemical addition systems. While not expected to be necessary, Westmoreland Sanitary Landfill will purchase the MBBR system with these upgrades. As also noted in the MBBR vendor package, the MBBR will come with equipment drawings, IO&M manuals, detailed functional descriptions and narratives, full control panel schematics and operating guides. This information will be provided to Westmoreland Sanitary Landfill after the units are purchased and fully engineered by the vendors. This equipment has not been purchased by Sanitary Landfill. All equipment will be purchased following approval of this Minor Permit Modification Application.

11. The report does not propose an oxidation-reduction potential (ORP) monitoring plan. Since ORP is critical for metal oxidation and in the nitrification/denitrification processes, an ORP sensors and control plan must be incorporated in the design of the MBBR. Please revise the design report to include this missing item.

Response: The ideal ORP range for nitrification and/or removal of BOD is +100 to +250 mV. The removal of metals will occur after activated sludge treatment stage where the ORP should be indirectly maintained in this positive range or higher. With a relatively small system residence time after biological treatment, it is anticipated that ORP will remain positive throughout. If during the monthly sampling it is noted metals removal efficiencies are not acceptable, further investigation will be conducted and an oxidant such as hydrogen peroxide or potassium permanganate may be added. This testing and any related investigation will be included with the trial project reporting to allow for further refinement of the treatment process.

Further the KDF media is noted for neutralizing ORP to facilitate metals removal. One key objective of this trial project is to fully treat the leachate system with

limited chemical additions whereby reducing operational costs and overall 'cleaner' treated effluent. As noted in the MBBR vendor package (Form 25 – Attachment 25-8), the MBBR will come with equipment drawings, IO&M manuals, detailed functional descriptions and narratives, full control panel schematics and operating guides. This information will be followed to properly operate the MBBR, including BOD removal, which will be most effective with an ORP in the range of +100 to 250. Therefore, monitoring of ORP for the metals removal stage is not necessary.

12. Sanitary Landfill indicates that the project involves a construction activity that results in earth disturbance of 2.4 acres. Provide an updated Form I to address Erosion and Sedimentation controls for construction and if applicable, operation for the facility. Also include details on proper stormwater management to prohibit contamination of stormwater or alternately, collection and proper management of contaminated stormwater.

Response: A revision to the site's Form I is included here to add channels to collect runoff from the project area, confirmation that the existing channels and culvert leading to the downstream sedimentation pond along with analysis of the sedimentation pond watershed are included here.

13. The information presented does not include a plan for managing backwash water from the KDF units. Please provide an estimate of the backwash water flow rate and describe how the backwash water from the KDF units will be managed, treated and disposed of.

Response: The KDF units can be backwashed, or operators can choose to replace the media (typically every 9 to 12 months). For this application, with a short proposed operational period (2 years), the Applicant has decided to replace the media as an alternative to backwashing. The KDF media will be managed as described in the residual waste management plan addressed further under comment 14.

The GAC vessels shall be backwashed to reduce or eliminate scaling. As shown in the vendor documentation, backwashing of the GAC vessels is performed by reversing flow direction with carbon backwash headers which allows for a continuously closed system and no waste byproduct.

14. Sanitary landfill indicates that the residues generated from the treatment of the leachate will be disposed in the landfill. Please provide a residual waste sampling plan for residues resulting from the treatment processes, including robust sampling frequency covering the full Form U parameter list, as well as radiological sampling to confirm proper waste characterization and acceptability for disposal at the landfill as required by 25 Pa. Code Section 273.276(b). Also include an odor screening and mitigation plan for operation of

the facility, storage, and disposal of residuals at the landfill. Residual waste generated by the process must be properly stored, tested, and analyzed with results submitted to the Department for approval before disposal.

Response: A Residuals Waste Sampling Plan has been developed and is included with this response.

15. **Submit a Sampling and Analytical Plan that identifies sample points; sample type (grab/composite); frequency; preservation/holding time requirements; analytical methods and detection limits; QA/QC procedures; and data validation protocols. Include chain of custody forms and laboratory accreditation certificates.**

Response: The design report and Form 25 include information on the sampling and testing proposed for this leachate pre-treatment trial project. As mentioned in the documentation, a National Environmental Laboratory Accreditation Program (NELAP) accredited laboratory will be utilized for testing. Once selected, the laboratory provided chain of custody forms will be utilized.

16. **No information is provided for PFAS, chlorides, sulfates, or VOC concentrations in the raw leachate. Please provide complete influent characterization, including but not limited to: PFAS, 1,4-dioxane, chlorides, sulfates, alkalinity, hardness, and full priority pollutant VOCs—as required for POTW pretreatment review and Clean Streams Law WQM permitting.**

Response: This project is proposing a trial project to pretreat landfill leachate for ultimate disposal at POTW facilities. Following completion of the testing, a full suite of testing (pre-treatment effluent / POTW influent) will be available that can be used to provide to the POTW facilities for future marketing, treatability and contract discussions. The influent concentrations included in a recent NPDES Part 1 application for this facility have been included with this response. Note that this is a parallel and independent application.

17. **Provide proof of contracts for leachate trucking pursuant to 25 Pa. Code § 273.273 (Relating to leachate transportation) meeting the following requirements:**

    a. **The landfill operator has a valid contract for the treatment of leachate at an offsite treatment facility for up to 3 years. The contract shall prohibit the treatment facility operator from refusing to treat leachate without six months advance written notice to the landfill operator.**

b. The offsite treatment facility to which the leachate would be transported is operating in compliance with The Clean Streams Law and regulations thereunder and is otherwise authorized and capable of accepting and treating leachate from the landfill.

Response: Contracts with leachate disposal facilities that accept leachate trucking from Westmoreland Sanitary Landfill are currently required to be submitted to the Department as part of an approved Form 25 Minor Permit Modification as well as through a current Consent Order. In addition, as part of the Consent Order, Westmoreland Sanitary Landfill is required to notify the Department of plans to haul to a new facility for the Department's review and approval.

18. The content of Form A - Attachment A-1 does not include a certificate of publication issued by the newspaper in which the notice appeared. Please provide the missing documentation.

Response: On May 8, 2025 an addendum was submitted through PADEP GreenPort which provided an updated Form A – Attachment A-1 (Proof of Publication. The reference number for this submission is 316674.

A revised Form A and updated Forms B and B1 are included with this submission. A Form B and B1 is included by CDS certifying all work completed. Keystone has included a corrected Form B certifying all work completed. Westmoreland Sanitary Landfill has included a Form B certifying work completed.

If you have any questions concerning this Minor Permit Application, please do not hesitate to contact Mr. Mike Zucatti of Sanitary Landfill, at (717) 448-5613 or our office at (412) 299-2700.

Sincerely,
Civil Design Solutions, Inc.

Kyle A. Fitzroy
Staff Consultant, Ext. 152

David W. Murray, P.E.
Principal Engineer, Ext. 151

Distribution: Mike Zucatti, P.E., Sanitary Landfill – 1 Copy
Tamira Spedaliere, Rostraver Township

Jason Rigone, Westmoreland County
Brian Stewart, Westmoreland Sanitary Landfill, LLC

Mon Valley Sewage Authority

20 South Washington Street Donora, PA 15033
Phone 724-379-4141 Fax 724-379-4690

May 5, 2020

Westmoreland Sanitary Landfill
Attn: Richard Walton
111 Conner Lane
Belle Vernon, PA 15012

Re: Request for leachate treatment

Dear Mr. Walton:

I am responding to your letter that we received on April 27, 2020 regarding Mon Valley Sewage Authority treating leachate from the Westmoreland Sanitary Landfill. At this current time, M.V.S.A. is not interested in accepting the leachate. At our monthly board meeting held on August 12, 2019 which Westmoreland Sanitary Landfill (WSL) employees attended, it was stated that WSL was going to install a pre-treatment facility. After that is done, we will entertain if M.V.S.A. wants to treat and analyze the leachate at WSL's expense.

Sincerely:

Thomas A. Salak
General Manager
Mon Valley Sewage Authority

LEACHATE DEMONSTRATION PROJECT
MINOR PERMIT MODIFICATION

Supplemental Information Prepared by:

Westmoreland Sanitary Landfill, LLC
111 Conner Lane
Belle Vernon, PA 15012

Introduction

The Applicant (Westmoreland Sanitary Landfill, LLC) has prepared this supplemental information to address comments 1a. through 1i. in the Technical Deficiency Letter dated September 2, 2025, from the Pennsylvania Department of Environmental Protection. The comments presented under 1a. through 1i. reference 25 Pa. Code Section 271.503 but require information beyond the extent of 271.503. From The Pennsylvania Code website, this code includes the following.

§ 271.503. Application requirements.

In addition to applicable application requirements in this article, an application for a demonstration facility permit shall include the following:

(1) An economic analysis indicating benefits to the Commonwealth and the applicant from the proposed facility, including an economic analysis of the benefits of alternative methods of processing or disposal.

(2) A technical analysis of the proposed facility in comparison to the existing state-of-the-art for processing or disposal of the waste that shall be received by the facility.

(3) A complete operational plan, including design details and a timetable for completing various phases of the facility from initiation of construction to completion of the project.

(4) An evaluation of the anticipated contribution of the facility to the field of solid waste management.

(5) An evaluation of the potential applicability to this Commonwealth of the technology to be demonstrated.

(6) A demonstration that the applicant has the financial ability to remove the facility and clean up the affected area in the event of pollution.

(7) A plan for corrective action utilizing conventional technology in the event of pollution.

(8) A statement of the optimal size and capacity for a facility using the proposed technology.

(9) A plan for assessing the effectiveness and environmental effect of the proposed facility.

In an effort to satisfy the Department's Comment Letter to further the review of the Application and work towards the approval of the proposed leachate pre-treatment system, which is a significant improvement to the environment, the Applicant will address the full extent of the comments which exceed the requirements of the regulations under 25 Pa. Code Section 271.503.

Comment 1.a. Economic Analysis

Existing Leachate Management
The existing method of disposal includes trucking all leachate to publicly owned treatment works (POTW) facilities. The landfill is actively hauling leachate to Alliance, Ohio, Johnstown, PA, and Altoona, PA. This existing method of disposal includes wear on public roadways as well as potential safety concerns with the amount of tanker trucks on the road.

Proposed Leachate Management
The proposed method of leachate management would include the onsite pre-treatment of leachate for the goal of directly discharging through one of the existing leachate lines to a POTW facility. At a minimum, if the POTW facilities would not accept the leachate, the pre-treated leachate would be more marketable to closer POTW facilities for shorter hauling distances.

Economic Analysis of Trucking Compared with Pre-Treatment
As shown in the calculation spreadsheet in Attachment 1, existing trucking of leachate costs approximately $0.19 / gallon. The proposed pre-treatment costs were estimated assuming a 10-year equipment life to be $0.018 / gallon including a POTW cost of $0.02 / gallon, this brings the proposed option of pre-treatment and POTW disposal to $0.038 / gallon. In addition to costs, the project was also evaluated in terms of compliance and liability, environmental benefits, job creation, and public infrastructure as follows.

Summary of Existing and Proposed Treatment

	Existing Method Trucking Leachate	**Proposed Method** Pre-treatment and Direct Disposal
Treatment Costs	$0.19 / Gallon	$0.038 / Gallon
Compliance and Liability	Each truck poses a spill potential while loading, unloading and while travelling on the public roadways.	Direct discharge removes liabilities from multiple sources (each truck).
Environmental Benefits	No Benefit	Leachate is being pre-treated prior to then being treated again at the POTW.
Job Creation	Leachate hauling requires several drivers. These drivers will continue to work but will work on different hauling projects.	Several new positions will be required for the pre-treatment facility. During construction, contractors from the Commonwealth will be hired to perform the work.
Public Infrastructure	Existing public roadways experience wear from the leachate trucking as well as additional truck traffic.	Reduced truck traffic, reduced wear on public roads and additional revenue for local POTWs.

Comment 1.b. Technical Analysis

Summary

The proposed leachate treatment system will include a combination of an oil / water separator (OWS), Moving Bed Biofilm Reactor (MBBR), Dissolved Air Flotation (DAF), Hydrocarbon Recovery Technology (HRT) for filtration, KDF and GAC. A more in-depth discussion of the proposed equipment and processes is included in the Design Report prepared by Keystone Engineering Group. This analysis will summarize the proposed technologies as well as the current state-of-the-art alternatives.

It should be noted that the proposed system includes a combination of state-of-the-art technologies that are known to be effective at treating certain components of landfill leachate and when combined present a multi-barrier, membrane-centric treatment train built for landfill leachate and potentially PFAS expectations. A copy of the analysis is presented as Attachment 2 as well as technical literature on some of the proposed components.

Comment 1.c. Operational Plan

Introduction

This Operational Plan will present a discussion and estimated schedule of construction of each component. This plan will also include a discussion of operations and sampling of each component of the proposed system as well as the decommissioning of the system should it be abandoned.

Estimated Construction Schedule

Following PADEP approval of the demonstration project, the sitework, utility work and foundation construction will begin. Following approval, the wastewater design engineer will perform an in-depth design of integral pumps and piping and issue a set of construction drawings. Some of the equipment procurement has already begun and the remaining procurement will occur. Once the equipment is delivered, each component will be installed and connected with integral pumps, pipes and sampling. An estimated construction schedule is included in Attachment 3.

Design Report

The Design Report prepared by Keystone Engineering Group presents design information for each component, process flow and treatment objective, chemical information, sampling, monitoring and reporting and calculations. As described above, a further in-depth design of integral pumps and piping will be prepared and provided for completion and issuance of the construction drawings.

Emergency Response Plans

Upon approval and installation of this system, the facility's PPC and SPCC plans will be updated to include the pretreatment system.

Operating Training

Operators will be trained on all equipment by the design engineers and qualified treatment plant operators currently employed by facility and other parent facilities which own / operate leachate treatment facilities. It is estimated that one (1) plant lead will be onsite full-time during normal business hours with the potential of one (1) additional part-time employee as needed.

Comment 1.d. Industry Contribution

Introduction

The proposed leachate pre-treatment system will improve operations at the landfill facility, contribute to environmental protection, and improve compliance. The proposed leachate treatment system will include a combination of an oil / water separator (OWS), Moving Bed Biofilm Reactor (MBBR), Dissolved Air Flotation (DAF), Hydrocarbon Recovery Technology (HRT) for filtration, KDF and GAC. This proposed unique system includes a combination of state-of-the-art technologies that are known to be effective at treating certain components of landfill leachate and when combined present a multi-barrier, membrane-centric treatment train built for landfill leachate and potentially PFAS expectations. The following sections present additional information on the site improvements as well as the contribution to the field of solid waste management and landfill leachate treatment.

Industry Contribution

The proposed leachate pre-treatment system will be put in place at the landfill facility that will treat leachate onsite that will then be sent to a publicly owned treatment works (POTW) facility. The level of pre-treatment performed onsite will result in additional polishing a the POTW facility which will ultimately yield a cleaner discharge product through the POTW facility's permitted outfall.

The proposed system includes readily available equipment that can be shipped and installed at landfill facilities in a relatively quick timeframe to fast track treatment. As shown in Attachment 3, the system is estimated to be operational within four months of permit approval. Onsite treatment at other facilities have been known to take multiple years.

Lastly, one of the components proposed as part of this project include the use of GAC which is known as a widely used technology for the removal of PFAS. This study will test the effectiveness of GAC as an end treatment technology for final polishing.

Landfill Operations and Compliance

The facility currently trucks all leachate to one of several POTWs located within several hundred miles of the landfill. The proposed system and ultimate discharge to an existing POTW facility through the existing piping network at the facility could lead to the elimination of trucking leachate. This will reduce truck traffic as well as environmental impacts associated with truck traffic and spill potential. This will also improve landfill operations by reducing the amount of leachate tanker trucks entering the site daily to load leachate. As detailed in the last quarterly progress report (Q2 2025) submitted to the PADEP, over 4.9 million gallons of leachate were hauled offsite to a POTW facility. This is equivalent to approximately 800 to 1200 trucks per quarter or about 10 leachate tanker trucks per day entering and leaving the site.

Comment 1.e. Statewide Applicability

Introduction
The proposed leachate treatment system will include a combination of an oil / water separator (OWS), Moving Bed Biofilm Reactor (MBBR), Dissolved Air Flotation (DAF), Hydrocarbon Recovery Technology (HRT) for filtration, KDF and GAC. This proposed unique system includes a combination of state-of-the-art technologies that are known to be effective at treating certain components of landfill leachate and when combined present a multi-barrier, membrane-centric treatment train built for landfill leachate and potentially PFAS expectations.

Uniqueness and Applicability to Other Facilities
The combination of the technologies is unique to landfills in Pennsylvania and outside the Commonwealth as well. This new combination of technology for leachate treatment could be implemented at other landfill facilities that are currently trucking leachate, or that are having difficulty meeting their discharge limits with POTW facilities. One of many unique features of this system is the scalability such that the components could be increased or decreased to meet landfill flow requirements. Additionally, the system is essentially plug and play with the current leachate system with some minor adjustments to piping and pump stations to meet the need of other facilities.

Comment 1.f. Financial Ability

Introduction
A set of PADEP Bonding Worksheets have been prepared by the Consultant and are included with this Application.

Comment 1.g. Pollution Corrective Action Plan

Environmental Plans
Following approval by the PADEP and construction of the facility, the site's PPC and SPCC will be updated to include the pre-treatment facility. These Plans include but are not limited to; potential pollution scenarios, monitoring plan, pollution containment measures, long-term remediation methods, implementation procedures, remediation cost availability, emergency notifications, site cleanup and applicable site drawings.

Comment 1.h. Capacity Analysis

Design Capacity

The proposed leachate pre-treatment system has a target design capacity of 90,000 gallons per day or 63-gpm. Since this system includes a combination of individual treatment technologies, the proposed overall design capacity of 90,000-gallons per day was discussed with each vendor and components were sized to meet this capacity. The following table summarizes the capacity of each treatment component.

Component	Capacity (gpm)	Capacity (gpd)
OWS	300	432,000
MBBR	63	90,000
DAF	70	100,800
HRT	63	90,000
KDF	72	103,680
GAC	220	316,800

Leachate Generation and Disposal Data

The quantity of leachate trucked offsite for disposal at a POTW facility has been tracked for several years and reported to the PADEP as part of quarterly progress reports required by a Consent Order and Assessment. The following table presents a summary of quarterly leachate volumes trucked offsite for disposal from Q1 2023 to current. As demonstrated by this table, the maximum daily leachate generation as determined by taking the total leachate generation during a quarter divided by the total calendar days during a quarter is 76,658 gallons per day. The overall average daily leachate disposal during this time period is 42,619 gallons per day.

Quarter	Trucked Leachate (gal)	Avg Daily (gpd)
Q1 2023	6,995,068	76,658
Q2 2023	3,196,144	35,026
Q3 2023	2,349,025	25,743
Q4 2023	3,433,402	37,626
Q1 2024	5,115,335	56,058
Q2 2024	5,614,008	61,523
Q3 2024	857,829	9,401
Q4 2024	3,364,233	36,868
Q1 2025	4,296,562	47,086
Q2 2025	4,937,673	54,111
Q3 2025	2,619,350	28,705
Overall Average Daily Leachate (gpd)		42,619

System Design and Demonstration Project Design

As described above, the total system was designed to meet a minimum capacity of 90,000 gallons per day. The average daily leachate generation for the last several years is 42,619 gallons per day with the peak back in 2023 being 76,658 gallons per day. Therefore, the system design is more than adequate to handle anticipated daily leachate generation as well as peak seasonal generation.

As outlined in the Minor Permit Modification as well as the Design Report, the proposed installation and operation will include processing approximately 40,000 gallons per day (on average) to evaluate the effectiveness of the system and market the pre-treated leachate from this system to POTWs.

Comment 1.i. Performance Evaluation

Introduction

The performance of the proposed leachate pre-treatment system will be evaluated by obtaining samples of raw leachate as well as during interim treatment steps throughout the multi-phased pre-treatment process. The Design Report presents additional information on where the samples will be obtained, the frequency of sampling and the contaminants that will be tested.

Sampling

As outlined in the design report, samples will be obtained from the raw leachate and from a minimum of 5 effluent locations within the pre-treatment system. Samples will be obtained monthly, and the complete results of sampling will be provided to the PADEP in the form of quarterly reports. The quarterly reports will present a summary and comparison of the results which will evaluate the effectiveness of contaminant removal from each phase of the treatment system.

Performance Goals

The performance goal of the system is to successfully operate a pre-treatment system that is capable of produced pre-treated leachate to be accepted at a POTW facility directly connected via pipeline to the existing landfill facility. A secondary goal would be to successfully treat leachate to full NPDES discharge standards. The system will be evaluated according to the sampling and monitoring plan outlined in the Design Report and results will be presented to the PADEP on a quarterly basis for review. At the completion of the demonstration project, a final report will be prepared which will present quantitative and qualitative analyses of the system performance with recommendations for subsequent use or decommissioning.

Attachments

Attachment 1 – Economic Analysis Spreadsheet Calculation
Attachment 2 – Technical Analysis Summary
Attachment 3 – Estimated Construction Schedule

WESTMORELAND SANITARY LANDFILL, LLC
LEACHATE DEMONSTRATION PROJECT
SUPPLEMENTAL INFORMATION

ATTACHMENT 1
ECONOMIC ANALYSIS SPREADSHEET CALCULATION

Westmoreland Sanitary Landfill - Leachate Treatment Cost Analysis

Current Leachate Trucking and Disposal Costs					
Work	**Item**		**Estimated**	Unit	Extended
Item	**Description**	**Unit**	**Quantity**	Price	Price
1	Leachate Hauling (Average of Johnstown, Alliance and Altoona)	Gal	1	$0.14	$0.14
2	Leachate Disposal (Average of Johnstown, Alliance and Altoona)	Gal	1	$0.05	$0.05
				Current Leachate Trucking and Disposal Costs ($/gal)	**$0.1900**

Proposed Leachate Pre-Treatment System					
Work	**Item**		**Estimated**	Unit	Extended
Item	**Description**	**Unit**	**Quantity**	Price	Price
A	Permitting	LS	1	$50,000.00	$50,000
B	Engineering Design	LS	1	$125,000.00	$125,000
C	Earthwork	LS	1	$325,000.00	$325,000
D	Equipment	LS	1	$1,800,000.00	$1,800,000
E	Certifications	LS	1	$25,000.00	$25,000
				Subtotal Design, Construction, and Certification	$2,325,000
				Design, Construction and Certification Price Per Gallon	$0.0159
F	Operations - personnel wages and expenses	LS	2	$85,000.00	$170,000
G	Annual Electricity	LS	1	$30,000.00	$30,000
H	Sludge Management	LS	1	$18,000.00	$18,000
I	Sampling and Testing	LS	1	$30,000.00	$30,000
J	Consumables (filters, media, etc.)	LS	1	$24,000.00	$24,000
K	Equipment Maintenance (Assume 10-year service life with 2% Annual)	LS	1	$36,000.00	$36,000
				Operation and Maintenance Subtotal	$308,000
				Operation and Maintenance per gallon	$0.0021
				Proposed Leachate Pre-Treatment total ($/gal)	**$0.0180**
				Pre-Treatment and Disposal (assume local connection) ($/gal)	**$0.0380**

WESTMORELAND SANITARY LANDFILL, LLC
LEACHATE DEMONSTRATION PROJECT
SUPPLEMENTAL INFORMATION

ATTACHMENT 2
TECHNICAL ANALYSIS SUMMARY

Proposed Leachate Pre-Treatment Methods Summary

Treatment System	Category	Description
Oil Water Separator	Treatment Effectiveness	Moderately effective for oil / hydrocarbon removal
	System Reliability	High due to simple equipment
	Operational Complexity	Low to moderate, periodic oil removal
	Environmental Performance	Good for removal of floatable oils. Low energy footprint
MBBR	Treatment Effectiveness	Effective for removing organics and ammonia, overall moderate for leachate treatment
	System Reliability	Moderate: biosystems can be sensitive to shock loading and quality changes
	Operational Complexity	Low: aeration needed, media retains activated sludge
	Environmental Performance	Good: low chemical use, effective when paired with downstream polishing
Dissolved Air Flotation	Treatment Effectiveness	Moderately effective at removing suspended solids, fats, oils and greases and color.
	System Reliability	Moderate: well proven solids removal
	Operational Complexity	Moderate: chemical dosing and sludge removal
	Environmental Performance	Good for removal of solids and reduced downstream loads
Hydrocarbon Recovery Technology	Treatment Effectiveness	Variable: effective at removing hydrocarbon fractions, TDS and TSS.
	System Reliability	High with consistent filter changeout
	Operational Complexity	Moderate: requires media changeout
	Environmental Performance	Good: upstream polishing improves effectiveness of downstream treatment
Kinetic Degradation Fluxion	Treatment Effectiveness	Effective at removing chlorine, heavy metals, mercury, nickel and hydrogen sulfide.
	System Reliability	Moderate: absorption systems are reliable when media is monitored and maintained
	Operational Complexity	Moderate: requires monitoring and replacement of media beds
	Environmental Performance	Very good at removing contaminants, low chemical usage
Granular Activated Carbon	Treatment Effectiveness	GAC is effective at removing man-made and natural organics like TCE, PFAS and VOCs
	System Reliability	Moderate to high: mechanically simple, dependent on media changeout.
	Operational Complexity	Moderate: requires monitoring and replacement of media beds
	Environmental Performance	Very good at removing contaminants, low chemical usage

Potential State-of-the-Art Alternatives

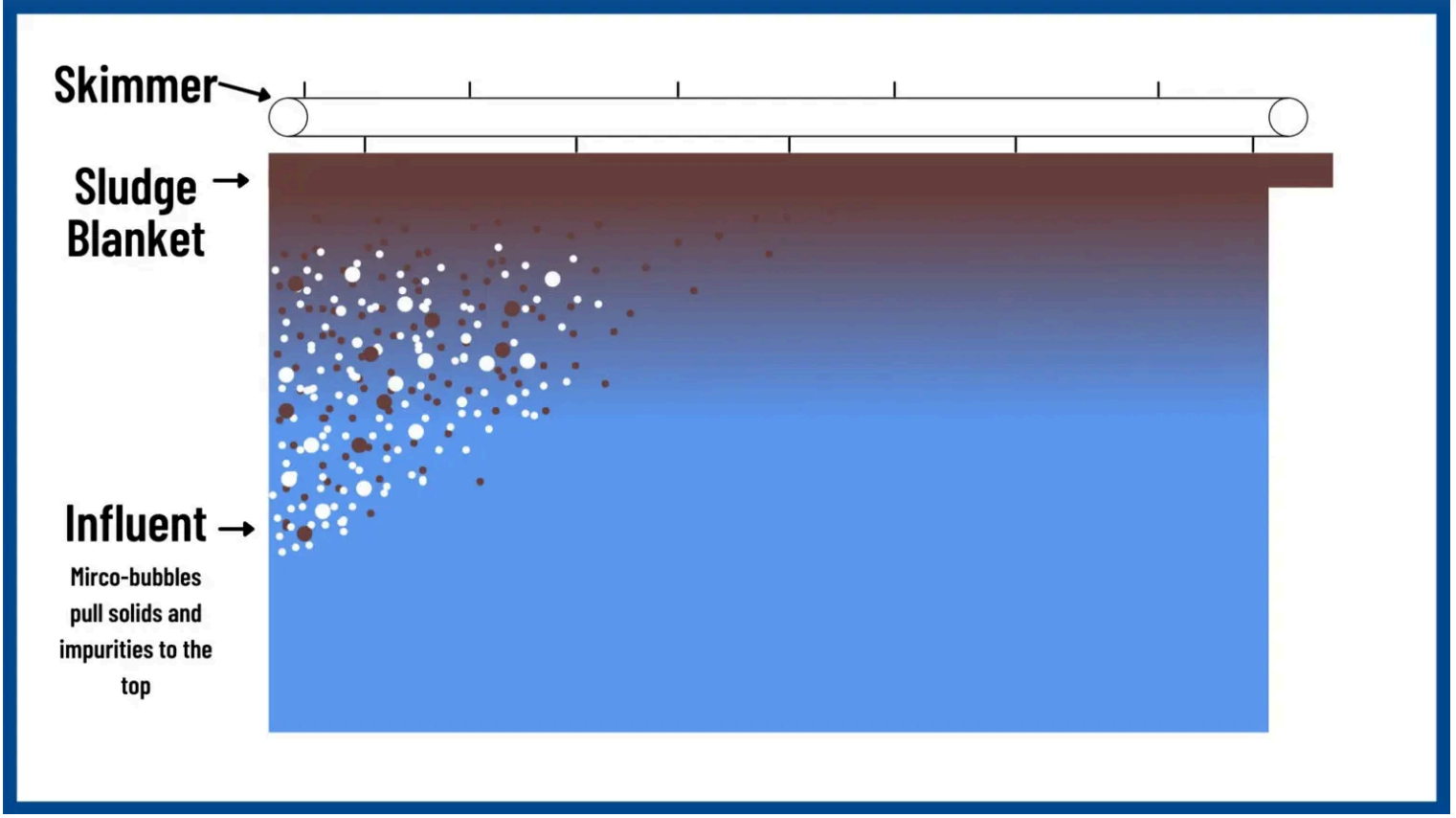
Treatment System	Category	Description
Membrane Bioreactor (MBR)	Treatment Effectiveness	Effective for removing organics and ammonia, overall moderate for leachate treatment
	System Reliability	Moderate: biosystems can be sensitive to shock loading, quality changes and sediment from landfill can damage membranes
	Operational Complexity	Moderate to high: need aeration and mixing to go with it
	Environmental Performance	Good: low chemical use, effective when paired with downstream polishing
Reverse Osmosis (RO)	Treatment Effectiveness	High: biological degradation with membrane filtration but only limited removal of PFAS
	System Reliability	High: high reliability and biological stability. Membranes can foul
	Operational Complexity	Moderate to High: require more control than traditional bio systems, periodic cleaning required.
	Environmental Performance	Good: eco-efficient, low chemical use, moderate energy usage

Dissolved Air Flotation (DAF): Is it the Best Way to Treat Your Wastewater?

Clearwater Industries manufactures dissolved air flotation (DAF) systems for industrial wastewater treatment. Remove FOG, TSS, BOD, COD, and pollutants from your wastewater. Review our DAF clarifiers below or contact us for more information.

CONTACT US

Dissolved air flotation (DAF) for industrial wastewater treatment is a water clarification process that uses micro-bubbles to remove impurities and solids. The process is ideal for removing light impurities and solids that tend to float and suspend in liquid.

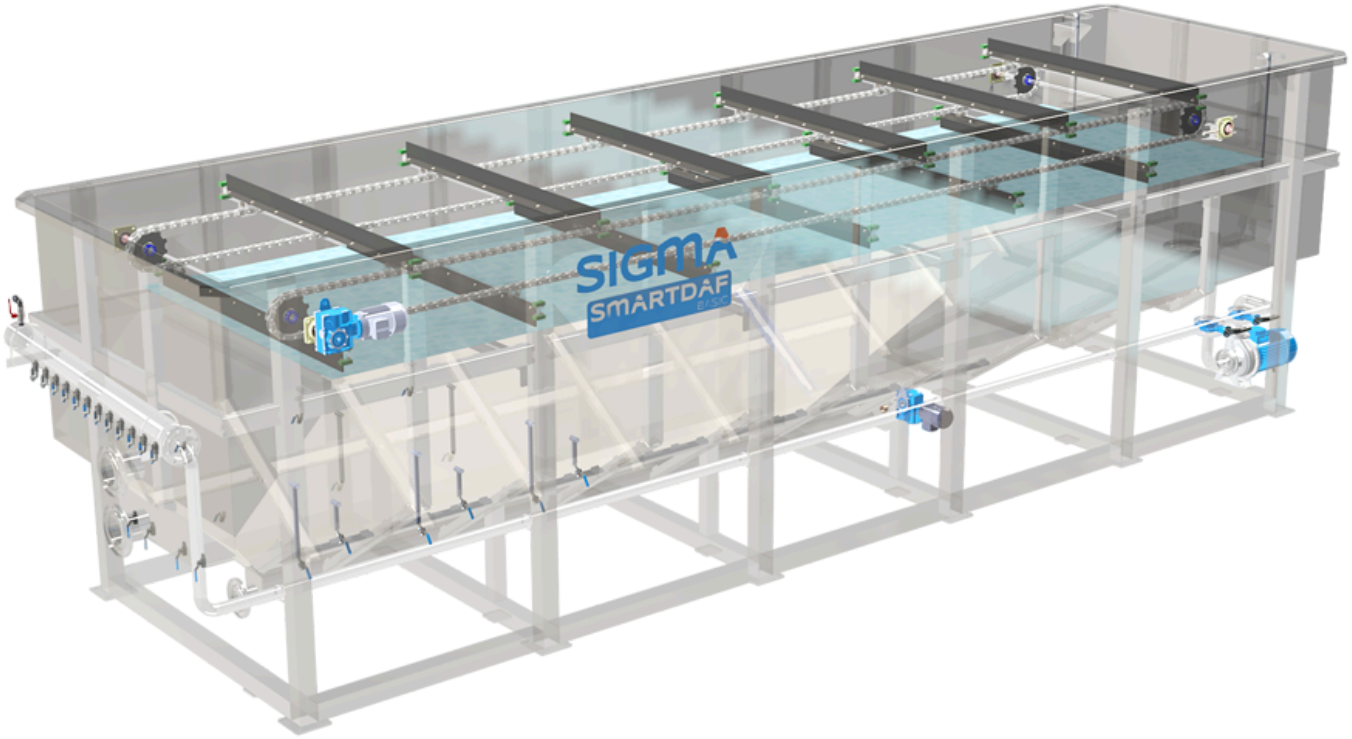


The DAF process contrasts water treatments focusing on sedimentation to remove settled solids. However, most DAF systems account for some sedimentation and settled sludge removal. We highlight this below.

DAF systems separate solids, oils, greases, and other impurities from water. The clean water can be reused or discharged. DAF systems treat for a variety of goals, including:

- Treatment to meet discharge regulations
- TSS Removal
- Water recovery and reuse
- Pretreatment to reduce loading on downstream biological treatment systems
- COD & BOD reduction
- Polishing of biologically treated effluent
- Sludge thickening
- Pretreatment for desalination plants utilizing reverse osmosis

The clean water can be reused for process or discharged, and some of it is recycled back to the DAF process.



DAF Clarification Steps

First, clean water must be accessible for a DAF system to start. Clean water is necessary because DAF systems pressurize the water and mix it with pressurized air. Under pressure, the air dissolves, and when de-pressured, micro-bubbles form. The micro-bubbles are necessary for the cleaning process.

The first step is to fill the DAF system with clean water. If you fill the DAF unit with wastewater, you'll likely discharge dirty and non-clarified water for a long time. Plus, you risk damaging the recirculation pump and air saturation system.

Once clean water is in the system, a recirculation pump pulls some of the clarified water to a pressurization-saturation system. Next, the water is pressurized by a pump and mixed with pressurized air. Under this pressure, the air dissolves in the water.

forms on top of the water within the clarifier.

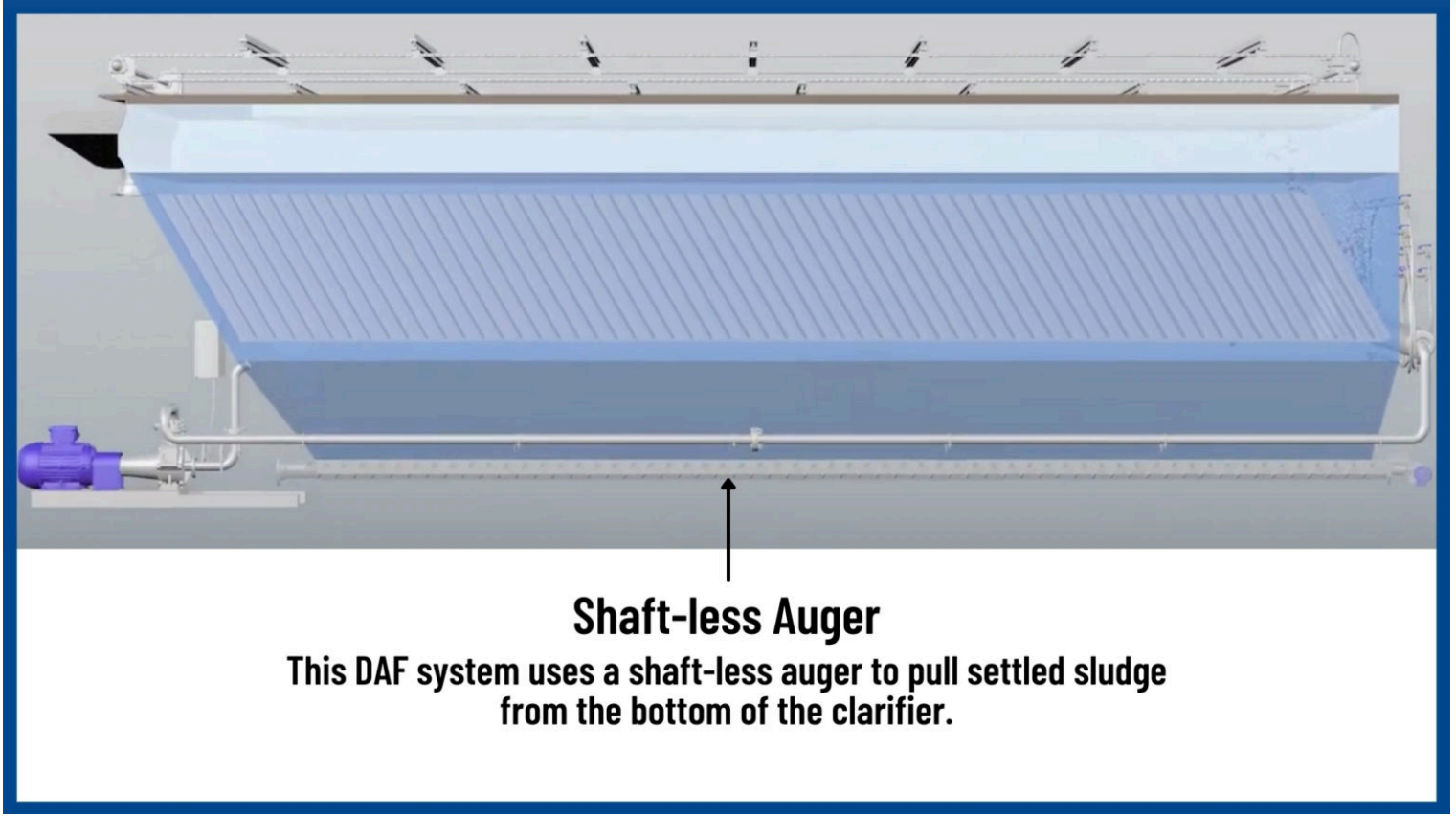
Next, a skimming system gently removes the sludge from the top of the water. In the video below, you'll see the skimmers pull sludge off the top and drop it into a collection trough.

Finally, clarified water is recovered through a supernatant system. Basically, the treated water comes out of a discharge point below the floating sludge and above the settled sludge.

Do DAF Systems Manage Settled Sludge?

Most systems account for and manage settled sludge. DAF systems are ideal for wastewater streams that contain solids that float and settle.

In general, you'll find most manufacturers include a sediment compartment or basin with a sludge extraction system.

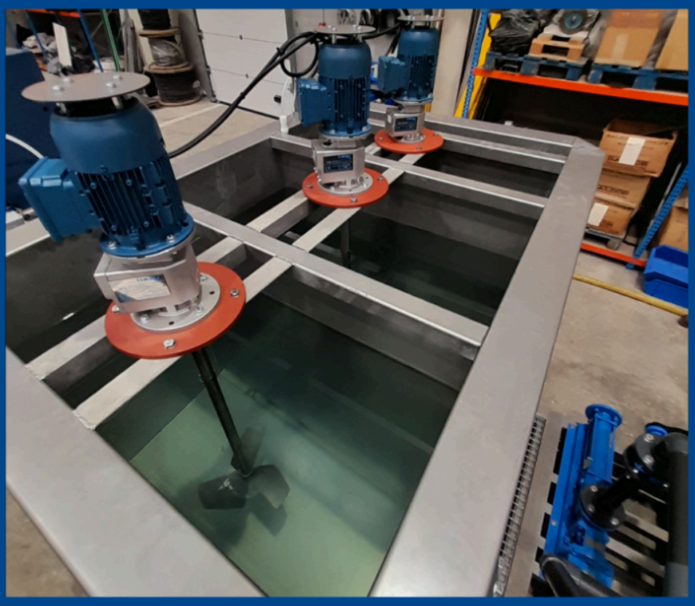


Chemical Treatment with DAF Systems

Coagulants and flocculants are regularly used to chemically condition wastewater before it enters a DAF system. Acids and bases are also used to adjust pH levels.

Like other wastewater clarification methods, coagulation and flocculation increase the efficiency of a DAF system's solids removal. The chemical condition process also creates a thicker, more dewatered sludge that may need little to no further dewatering.

Mixing the chemicals with the wastewater is done with flocculation tubes or chemical mix tanks.



Flocculation tubes are a series of pipes in a serpentine pattern that provide a flash-mixing process of 15-45 seconds. The tubes have dosing locations for a coagulant, pH adjustment, and polymer flocculant. You'll usually see a pH sensor for monitoring and sample collection valves to check the chemical condition process.

Mix tanks are a series of tanks that use impeller agitators to mix the chemicals with the wastewater for a longer period of time. Some chemicals require extended contact time with the wastewater to change the pH or achieve coagulation and flocculation. The number of tanks used depends on the chemicals required, and you'll usually see one tank per chemical being introduced. The amount of contact time is variable, and you'll need to perform jar testing to understand proper mixing time.

What Applications are DAF Clarifiers Used to Treat?

Due to their design and technology, DAF clarifiers can service many industries. Different DAF clarifier designs and models treat water flows with low to high impurity levels. They're ideal for wastewater streams with oil, grease, and impurities that float or have a low specific gravity.

DAF systems can service but are not limited to the following industries & production processes:

- Meat & Poultry Processing
- Slaughterhouse Processing
- Fish & Crustacean Processing
- Dairy Industry
- Convenience Food
- Potato Processing
- Fruit Processing
- Vegetable Processing
- Bakeries & Confectionaries
- Brewing (Alcoholic & Non-Alcoholic Production)
- Textile Finishing and Dyeing
- Tannery Production
- Stone Processing
- Tar Sand & Oil Sand
- Heavy Metal Removal
- Industrial & Commercial Laundries
- Pulp & Paper Production
- Algae Removal & Desalination Pretreatment
- Pretreatment for Downstream Biological Treatment Systems

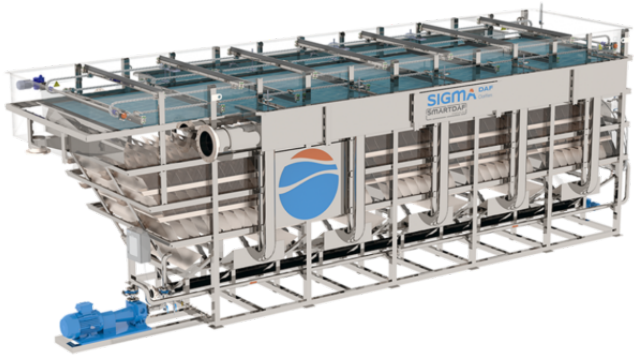
Sistema DAF (por Flotación de Aire Disuelto) para tratamiento de aguas residuales ...

Is a DAF System the Best Way to Treat Your Wastewater?

It's hard to say without knowing the details of your application. There are many different DAF system designs to treat variable wastewater solids content and flow rates.

We always recommend talking with an application engineer to determine the equipment and solutions for your application. They will want to understand your flow rates, plant operations, and production goals to recommend the best solution for your application.

A DAF Clarifier for Every Flow & Industrial Need

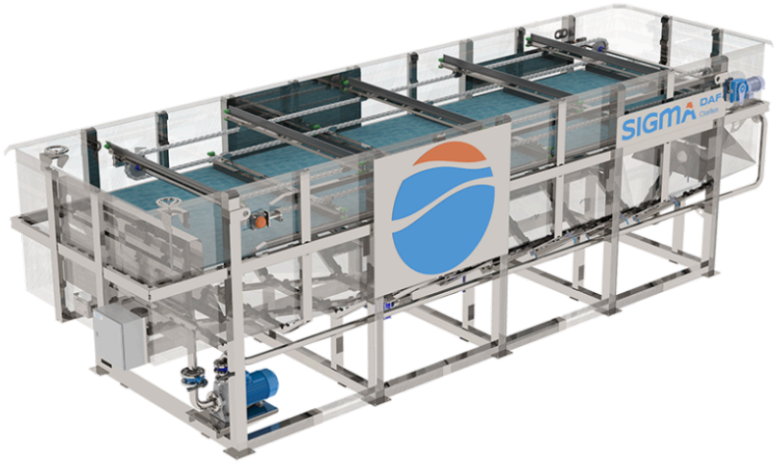


Clearwater Industries manufactures DAF Clarifiers for the United States market. We offer standard designs and custom modifications to meet the need of each industry & application.

- **DAF FPAC** (20 – 880 gpm)
- **DAF FPBC** (44 – 1100 gpm)
- **DAF FPHF** (1320 – 4400 gpm)
- **Compact DAF** (20-400 gpm, plug-and-play)

OUR DAF SYSTEMS

wastewater flotation area and cross-flow separation. The FPAC is a low-built cross-flow separator with a lot of free surface area for floated solids accumulation.



The FPAC treats small-to-medium flow rates with very high loads of contaminants (impurities, solids).

- Capacity: 20-880 gpm
- Achieve sludge with a dry solids content 3 to 4 times higher than a conventional system
- Large surface area for floating sludge accumulation (8 lbs of dry matter treated per sq ft)
- Floated and settled sludge discharge

DAF FPBC

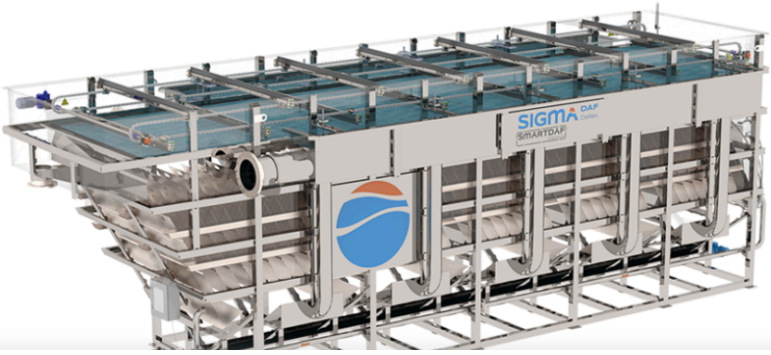
The DAF FPBC flotation system is a high-profile separator designed to treat wastewater with low-to-medium loads of contaminants,

model one of the most efficient dissolved air flotation clarifiers in the market.

- Capacity: 44-1,100 gpm
- Achieve sludge with a dry solids content 3 to 4 times higher than a conventional system
- Inclined plate pack increases surface area for solids separation
- Floated and settled sludge discharge

DAF FPHF

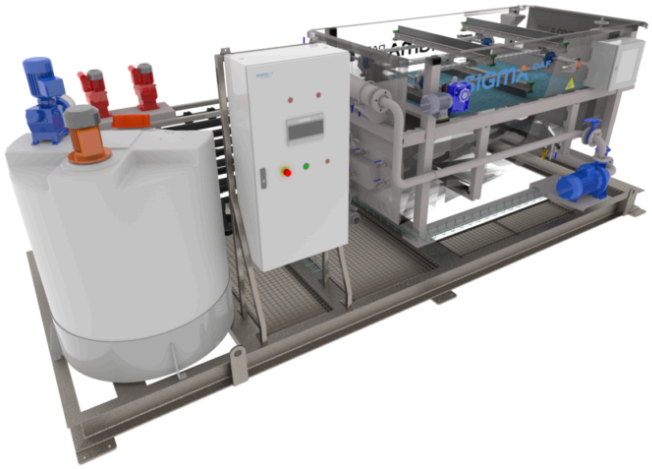
The DAF FPHF is a separation system that represents an improvement over the existing lamella plate technologies; it uses a combination of cross-flow and counter-current-flow for optimized separation. The FPHF treats large flows with medium-to-large loads of contaminants (impurities, solids).



Capacity: 1,320-4,400 gpm

COMPACT DAF

The COMPACT DAF is a pre-assembled turnkey system with chemical conditioning equipment, a DAF clarifier, sensors, instruments, and a control panel. It is robust, flexible, efficient, and easy to operate.



The plug-and-play system allows for easy installation and integration. Operation is easy with a PLC control screen, allowing the operator to adjust the chemical dosing pumps, skimmer speed, and sludge discharge.

The COMPACT DAF equipment has a high removal performance of organic load, solids, oils and fats, and other wastewater pollutants. Flows of 66 GPM or less are managed with a single skid design, while flows larger than 66 GPM are treated with a modular two-skid system.

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DEPARTMENT OF HEALTH

Water Treatment Using Carbon Filters (GAC)

A filter with granular activated carbon (GAC) is a proven option to remove certain chemicals, particularly organic chemicals, from water. GAC filters also can be used to remove chemicals that give objectionable odors or tastes to water such as hydrogen sulfide (rotten eggs odor) or chlorine.

However, other chemicals, like iron and nitrate, are not attracted to the carbon and are not removed and another type of filter, such as reverse osmosis (RO) or green sand may be needed. RO filters will also remove certain organic chemicals. This information sheet only addresses GAC filters.

What is granular activated carbon?

Granular activated carbon, or GAC, is made from organic materials (such as coconut shells or coal) that are high in carbon. Heat, in the absence of oxygen, is used to increase (activate) the surface area of the carbon; this is why these filters are sometimes referred to as "charcoal" filters. The activated carbon removes certain chemicals that are dissolved in water passing through a filter containing GAC by trapping (adsorbing) the chemical in the GAC.

It is very important that the type and concentration of contaminants, and average water use, be known in order to determine the correct size and components of the system. All treatment systems require proper installation and periodic maintenance. Eventually, the ability of the GAC to bind and remove chemicals is used up and the GAC needs to be changed. How often the GAC should be changed needs to be based on contaminant levels and water use. While some filters may last for several years if contaminant levels and/or water use are low, higher levels or use may require more frequent change-outs.

What kind of GAC filter systems are there?

There are two types of GAC filter systems:

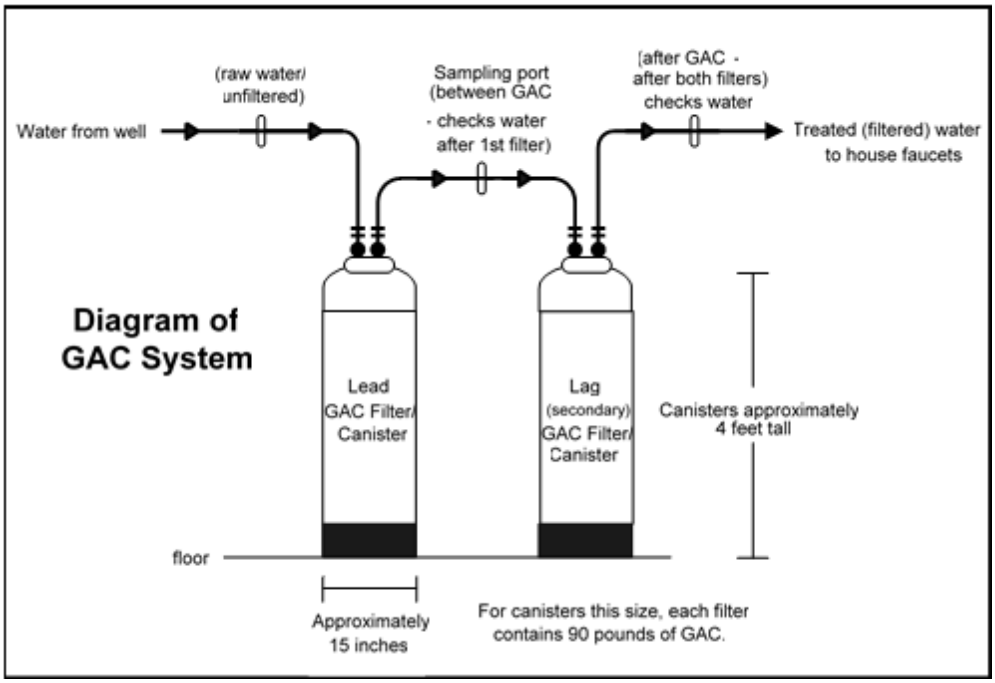
1.) Whole-House Filters (or Point of Entry):

A whole-house filter is installed at a point on the home's water supply plumbing that will result in treatment of all water that travels to any faucet or fixture in the home (but typically will exclude outside faucets to prolong the life of the carbon). It removes the chemicals before they can be swallowed, breathed in, or absorbed by the skin during washing or bathing.

The filters are usually cylindrical. The example shown in the photo is about 4-feet tall and 15 inches in diameter. The filters are usually installed as a pair, although more may be required in some situations. Two filters arranged in sequence ensure that any chemical that might get past the first filter is trapped by the second.

When the first filter is used up, the second filter is moved to the first position and a new filter is placed in the second position. Sample ports located before, between, and after the filters allow for testing of the water at each location (see diagram on the next page).

Most systems also have a bypass switch that allows the water flow to bypass the system when needed for chlorination or certain plumbing activities. When the system is bypassed, water entering the home is NOT filtered.



2.) Point of Use Filters:

A point of use (POU) filter is installed in the water supply pipe just before the faucet where people get water.

One example is an under-sink unit; water passes through the carbon filter and travels to a separate water tap, next to the main faucet. Water from the separate tap will be GAC-treated, and water from the main faucet (hot or cold) will be untreated.

Other examples of point of use filters are the GAC pitcher filters commonly sold in grocery stores or GAC filters that are a part of a refrigerator's icemaker.

Which type of GAC filter system do I need?

Which system you need depends on:

- The type and amount of contaminants in the water,
- Other chemicals in the water,
- Water use, and
- Exposure pathways to be controlled.

Exposure pathways are… the ways chemicals enter your body.

Some chemicals may cause harm if they are swallowed, some if they are breathed in, and some if they enter through the skin. Sometimes people are exposed through multiple exposure pathways.

An under-sink filter protects people from swallowing the chemical by treating the drinking or cooking water only from that tap. It will not protect other faucets to prevent people from inhaling the chemical while showering or bathing, or prevent the chemical from being absorbed through the skin. Inhalation is a concern when the chemical easily evaporates from the water into the air. Not all contaminants easily evaporate into the air or are absorbed through the skin.

A whole-house filter system treats all water traveling to any faucet or fixture in the home. It removes the chemical before it can be swallowed, breathed in, or absorbed by the skin during any use.

- For all work on your filter system, use only a licensed plumber or licensed water conditioning contractor.
- For either type of filter system, consistent maintenance and periodic filter replacement is essential to ensure effectiveness and to prevent bacterial build-up or conversion of nitrate to nitrite. For more information, see MPCA's Granular Activated Carbon Filters (PDF) (https://www.pca.state.mn.us/sites/default/files/c-s1-05.pdf).
- When choosing a filter, select devices certified by NSF International, Underwriters Laboratory, or the Water Quality Association. The active carbon in the filter should meet ANSD/ANSI Standards 61 and 53 (which ensure that the carbon removes volatile organic compounds [VOCs] and will not leach arsenic).
- The Minnesota Water Quality Association (www.mwqa.com/) also has information about water treatment systems.

Minnesota Department of Health - Site Assessment and Consultation Unit
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651-201-4897
health.hazard@state.mn.us
www.health.state.mn.us

This information sheet was prepared with partial support from the Agency for Toxic Substances and Disease Registry (ATSDR). This statement does not imply that ATSDR has endorsed this information sheet.

PENTAIR

SEPARATION SYSTEMS

HIGH PERFORMANCE SEPARATION SYSTEMS

STARSCAN Analysis

Westmoreland
Belle Vernon, PA

Pentair Separation Systems

December 18, 2020

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www.pentairseparations.com

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SEPARATION SYSTEMS

STARSCAN ANALYSIS
4301 West Davis
Conroe, TX 77304

www.pentairseparations.com

TESTING DATE	December 14th, 2020
CLIENT	Westmoreland Sanitary Landfill Belle Vernon, PA
ATTENTION	Rich Walton (Noble Environmental) Nick Stork (Noble Environmental) Mike Zucatti (Civil Design Solutions)
REFERENCE	Landfill Leachate HRT System • Stage 1: FMV1904H03V-PRE • Stage 2: FMV1904H031V • Stage 3: FMC1904H031V • Stage 4: FCA1904H031V
ANALYSIS PERFORMED	1. HRT evaluation 2. ProcessOR evaluation 3. Total hydrocarbon content 4. Total suspended solids analysis 5. Photomicrographic analysis of gravimetric membranes 6. Particle size distribution 7. Elemental analysis

STARSCAN ANALYSIS
4301 West Davis
Conroe, TX 77304

www.pentairseparations.com

PROJECT SUMMARY

The HRT evaluations performed at Pentair's Conroe, TX laboratory were performed on leachate samples from the Westmorland site in order to validate that the system appropriate for leachate pre-treatment prior to disposal via evaporation. The testing confirmed that Pentair's HRT technology could remove the free and dispersed hydrocarbon content in the leachate down to the solubility limit. HRT effluent had a hydrocarbon concentration of 0.8-0.9 mg/L after being trialed with solutions of leachate with 500-1000 ppm of dispersed oil droplets, a reduction of 99.9% of all hydrocarbon content. The remaining trace hydrocarbon are believed to be dissolved in the water.

Particle size distribution analysis performed on the unfiltered indicated a broad range of particulate, with particulates ranging from sub-micron to more than 100 microns in size. Leachate filtered using the existing Grade MPXD glass microfiber media, followed by the HRT module had an overall efficiency at 2 microns of 99.73%, and an efficiency of 99.83% at 3 microns.

A second particle size distribution analysis performed with using the Pentair Grade MPXB glass microfiber media, provided an overall efficiency at 2 microns of 99.89%, and an efficiency of 99.97% at 3 microns.

Gravimetric analysis of the leachate as received had a total solids concentration of 86.4 mg/L when measured with a 1.2 micron membrane and 57.1 mg/L when measured with a 3.0 micron membrane.

STARSCAN ANALYSIS
4301 West Davis
Conroe, TX 77304

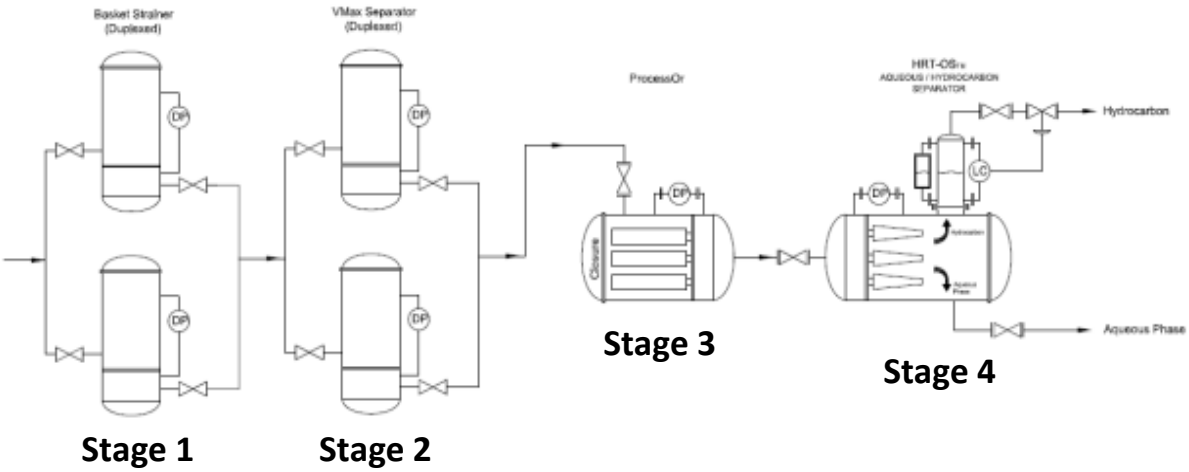
www.pentairseparations.com

PROJECT BACKGROUND

The Westmoreland Sanitary Landfill in Belle Vernon, Pennsylvania receives water from residential and industrial customers throughout the region. The leachate from the site landfill has historically been disposed of via local or regional water disposal facilities. In an effort to reduce disposal volumes, the Westmoreland facility has been evaluating Pentair filtration and separation technologies for the removal of both particulate and hydrocarbon contaminants.

In late 2019, a Hydrocarbon Recovery Technology package (HRT) utilizing four separation stages was installed on the leachate stream. The system utilizes three stages of solid particulate filtration: stage 1 utilizes VMAX PN: FMV1904H031V-PRE as a pre-filter, stage 2 utilizes VMAX PN: FMV1904H031V and stage 3 utilizes COMPAX PN: FMC1904H031V as a polishing filter. The HRT vessel is stage 4 of the system and utilizes PN: FCA1904H031V.

Figure 1. Process Flow Diagram of Rental Filtration System HRT



To demonstrate the performance of the overall HRT system, 3 gallons of leachate and hydrocarbon was sent to STAR Labs for use in evaluations of the Stage 3 glass microfiber filtration as well as the LiquiForm hydrocarbon separation in Stage 4 of the HRT. The results of the evaluation are presented in this report.

The target goals for the separation include:

- 99.97% removal of particulates larger than 3 microns and larger
- 99.9% removal of free hydrocarbons

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METHODS OF TESTING & ANALYSIS

The leachate received was placed in a refrigerator along with the oil sample received until being analyzed. Stage 3 and 4 were replicated in the lab using a bench-top filtration system with a current MPXD microfiber media solids filter followed by the HRT hydrocarbon separator. One gallon of leachate was prepared with a concentration of 1000 ppm oil using the oil sample received from Westmoreland. The gallon of material was processed through the bench-top system. Liquid samples of the effluent were collected for solid concentration, particle size distribution and total hydrocarbon concentration.

A second sample using a 500 ppm oil/leachate solution was prepared and processed through the same laboratory benchtop apparatus. A sample of the effluent was obtained for measurement of total hydrocarbon concentration.

A third leachate sample was processed using a bench-top filtration system featuring a single stage of particulate filtration using MPXB microfiber media (a higher efficiency grade of the glass microfiber media). The fluid was processed through the system and an effluent sample was analyzed for solid concentration and particle size distribution using an optical particle sizer.

A portion of the unfiltered leachate as received was saved and analyzed for solid concentration, total hydrocarbon concentration, particle size distribution and elemental analysis of solid contaminants. Note the particle size distribution of the leachate with 1000 ppm oil and 500 ppm oil was not performed as the dispersed oil could be false identified as a particulate in the particle sizer.

The total hydrocarbon content present in the leachate was analyzed via a GC-MS analyzer (Gas Chromatography with Mass Spectroscopy).

The total suspended solids were analyzed via the gravimetric method using both 1.2 micron Nylon membranes and 3.0 micron cellulose membranes. Photomicrographs of the solid contaminants collected on the gravimetric membranes were collected under a microscope. Elemental analysis was also performed on the contaminants from the leachate to determine their elemental composition. Please see the Appendix section for more method details.

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RESULTS OF TESTING & ANALYSIS

The data collected from the evaluations performed is summarized in Tables 1, 2. The following sections will go into more details of the analysis.

Table 1. Total Hydrocarbon Concentration: Stage 3 and 4 HRT Evaluation

Sample ID	C6-C12 (mg/L)	C13-C28 (mg/L)	C29-C35 (mg/L)	Total Hydrocarbon Content (mg/L)	Removal (%)
Unfiltered Leachate Received	44.6	111.3	6.6	162.5	
1000 ppm Leachate (UF Leachate + Oil)	N/A			1162.5	99.9%
1000 ppm HRT Evaluation Effluent	0.5	0.4	0.0	0.9	
500 ppm Leachate (UF Leachate + Oil)	N/A			662.5	99.9%
500 ppm HRT Evaluation Effluent	0.4	0.4	0.0	0.8	

Table 2. Particle Count Comparison:
Leachate Samples: Unfiltered, Stage 3 & 4 HRT Effluent and Stage 3 w/MPXB media Effluent

Micron Size	Unfiltered Particle Count (Part/mL)	MPXD + HRT Effluent Count (Part/mL)	Percent Removal (%)	MPXB ProcessOR Effluent (Part/mL)	Percent Removal (%)
>0.5	15,413,416	N/A			
>2.0	537,598.1	1,455.8	99.73%	589.9	99.89%
>3.0	289,102.1	502.0	99.84%	75.3	99.98%
>5.0	157,815.0	38.0	99.97%	12.6	99.99%
>10.0	50,525.9	0	100%	0	100%
>20.0	20,641.2	0	100%	0	100%
>100.0	25.1	0	100%	0	100%

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Stage 3 & 4 HRT Evaluation

A bench-top setup utilizing scaled down versions of Pentair's ProcessOR Particle Filter and HRT Separator was assembled to process the received Leachate. Two separate runs were performed using leachate with 1000 ppm and 500 ppm of oil added and fully mixed.

Starting with the 1000 ppm Leachate, the water was processed through the bench-top setup and effluent samples was collected and compared to the influent (Figure 2). The effluent is noticeably transparent with no haze from the presence of free hydrocarbons or large solids.

Figure 2. Leachate with 1000 ppm Oil Samples

Influent **Effluent** **HRT Vessel Effluent View**

The effluent was sampled and analyzed first for hydrocarbon content. The prepared 1000 ppm leachate has an approximate concentration of 1162.5 ppm as the unfiltered leachate received contained 162.5 ppm of oil prior to the addition of oil to make a 1000 ppm concentration. The effluent from the HRT system had a total hydrocarbon concentration of 0.9 ppm. A removal efficiency of 99.9% of dispersed and soluble hydrocarbon was obtained.

Next, the 500 ppm leachate solution was prepared and processed through the HRT system. Samples of the influent and effluent of the system is presented in Figure 3. Again, the effluent sample is noticeably haze free compared to the unfiltered prepared mixture.

The effluent was analyzed for total hydrocarbon concentration and compared to the 662.5 ppm present in the prepared sample, the prepared contained 162.5 ppm along with the 500 ppm added into the leachate solution. The effluent the bench-top system was measured to have a hydrocarbon concentration of 0.8 ppm. A removal efficiency of 99.9% of the total hydrocarbon content was calculated.

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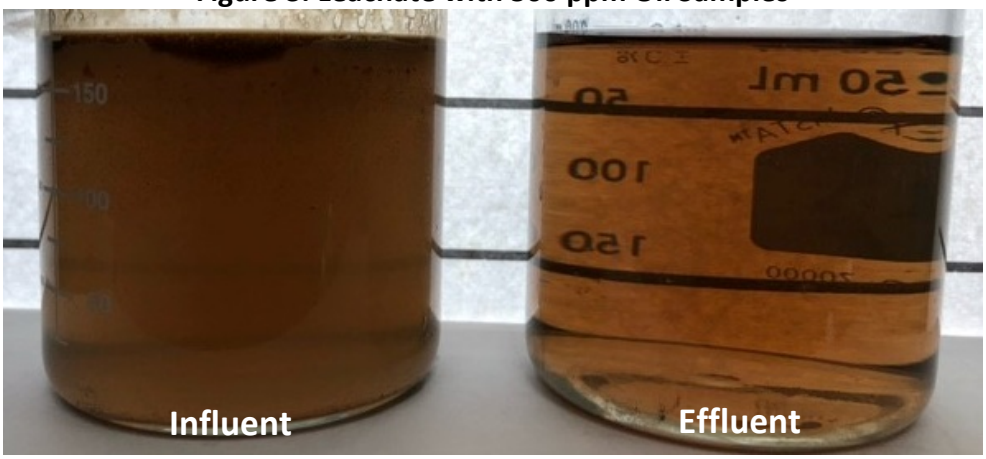
Figure 3. Leachate with 500 ppm Oil Samples



The hydrocarbon remaining in the HRT effluents was analyzed for specific Hydrocarbon components via GC-MS. The contaminants within the water include aromatic compounds such as toluene, benzene derivatives, and ketone compounds. Toluene in some applications can have a solubility in water up to 526 ppm at 25°C, as such the hydrocarbon contaminants remaining in the leachate are within the range of solubility.

The solid concentration of the unfiltered leachate was measured using the gravimetric procedure with 1.2 micron nylon membranes and 3.0 micron cellulose membranes. Using the 3-micron membranes, the unfiltered leachate had a solid concentration of 57.1 mg/L. Using 1.2 micron nylon membranes the solid concentration of unfiltered leachate was 86.4 mg/L.

Photomicrographs of the membranes are presented in Figure 4. Fine contaminants can be seen on the membrane of the unfiltered leachate. The contaminants display a unique organization, possibly caused by the fluid moving into the membrane and pushing some of the larger solids aside to plugged off areas of the membrane.

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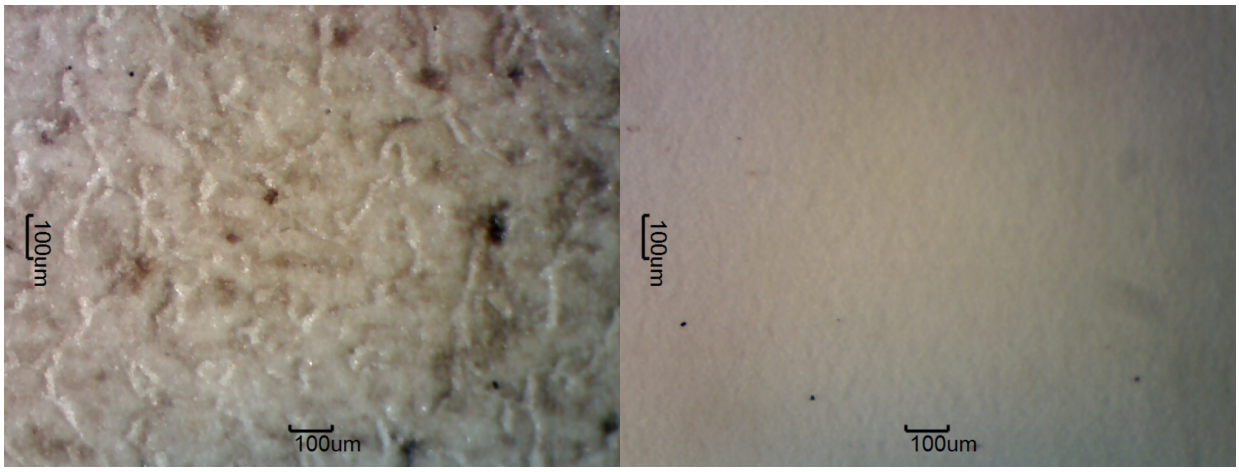
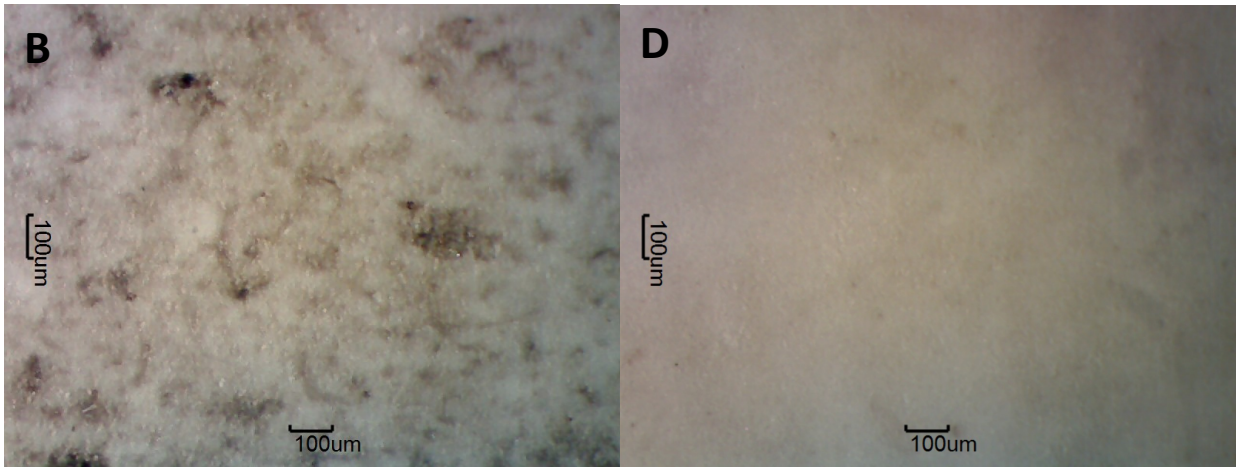
Figure 4. Photomicrographs of the Membranes @ 40X Magnification



Unfiltered Leachate
3.0 µm Membrane

HRT Effluent
3.0 µm Membrane



Unfiltered Leachate
1.2 µm Membrane

HRT Effluent
1.2 µm Membrane

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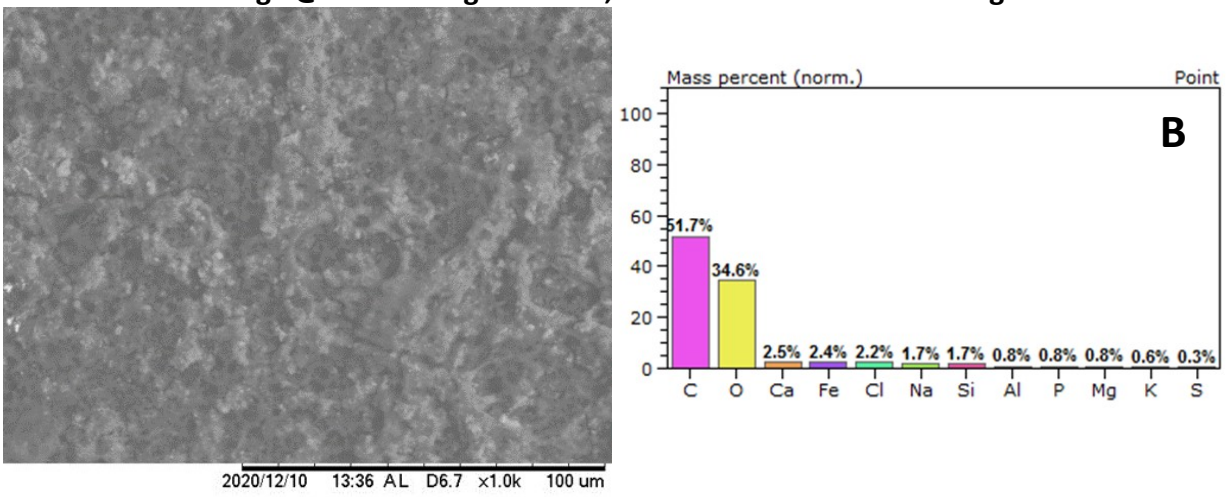
Elemental Analysis

Lastly, the elemental analysis of the solid contaminants removed by the 1.2 micron nylon membrane on the unfiltered leachate were analyzed under a scanning electronic microscope (SEM) with energy dispersion X-ray spectroscopy (EDS) to determine elemental composition. Solid contaminants on the membrane contain a high percentage of carbon and oxygen. Trace amounts of calcium, iron, chlorine, sodium, silicon, aluminum, phosphorous, magnesium, potassium and sulfur are also detected. These solids are likely organic material, some inorganic contaminants and some corrosion products.

Figure 8. SEM-EDS Analysis Results – Leachate Contaminants
A: SEM Image @ 1000X Magnification; B: Elemental Mass Percentage Chart



Please note that the sample collected during the test provides only a snapshot estimate of that which existed in the slipstream at the time that the test was conducted. Many processes experience a tremendous ingress of contamination during upset conditions that can vary in frequency and severity.

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APPENDIX

Solids Content - Gravimetric Analysis

Gravimetric analysis is used to determine the suspended solids (> 0.45 µm) concentration of a fluid stream. Bottle samples were collected from the system and delivered to Pentair's *STAR*® Laboratories for analysis. Bottle sample gravimetric analyses were performed on the system as per the procedures outlined below.

1) Use laboratory oven to dry a clean 47-mm 0.45 µm membrane. Weigh the membrane using an analytical balance with at least +/- 0.0001 g accuracy.
2) Place membrane into holder on pressure filtration vessel.
3) Mix bottle sample vigorously.
4) Quantitatively transfer sample into an appropriately sized graduated cylinder and record volume.
5) Quantitatively transfer sample into pressure filtration vessel.
6) Using a clean, dry gas, pressurize the vessel until the entire sample has flowed through the membrane.
7) Solvent rinse membrane with particle free Hexanes.
8) Remove membrane from holder and place in laboratory oven until dry.
9) Re-weigh membrane on balance used in step 1.
10) Determine the amount of contaminants captured on membrane.

Pressure Filtration Vessel

The gravimetric concentration is calculated from the difference of the initial weight from the final weight of the membrane and the sample volume.

Gravimetric Conc. (mg/L) = [Final Wt.(mg) – Initial Wt.(mg)]/Sample Volume (L)

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Gas Chromatogram -Mass Spectrometry (GC-MS)

Gas chromatography (GC)–mass spectrometry (MS) is an analytical method that combines the features of gas-liquid chromatography and mass spectrometry to identify unknown substances within a test sample. It has been widely heralded as a "gold standard" for forensic substance identification because it is used to perform a specific test that identifies the actual presence of a particular substance in a given sample.

The GC-MS instrument is composed of two major building blocks: the gas chromatograph and the mass spectrometer. The gas chromatograph utilizes a capillary column which depends on the column's dimensions (length, diameter, film thickness) as well as the phase properties (e.g. 5% phenyl polysiloxane). The difference in the chemical properties between different molecules in a mixture and their relative affinity for the stationary phase of the column will promote separation of the molecules as the sample travels the length of the column at the help of a carrier gas, usually helium, hydrogen or nitrogen. The molecules are retained by the column and then elute from the column at different retention times, and this allows the mass spectrometer downstream to capture, ionize, accelerate, deflect, and detect the ionized molecules separately. The mass spectrometer does this by breaking each molecule into ionized fragments and detecting these fragments using their mass-to-charge ratio. The most common type of mass spectrometer associated with a gas chromatograph is the quadrupole mass spectrometer, referred to by the Agilent "Mass Selective Detector" (MSD). The most common standard form of ionization is electron ionization (EI). The molecules enter into the MS (the source is a quadrupole or the ion trap itself in an ion trap MS) where they are bombarded with free electrons emitted from a filament, causing the molecule to fragments in a characteristic and reproducible way, therefore a unique fingerprint. The comparison of generated spectra of the test substance with library spectra using manufacturer-supplied software then tells what the unknown test substances are.

The GC-MS model used in the STAR Labs is 7890B GC -5977A MS, Agilent. It has an auto-sampler with 2 mL sample vials. The mass spec detector has an EI source, monolithic hyperbolic quadrupole mass filter, mass range 1.6-1050 u. Ion source temperature is 150 -350°C, quadrupole temperature is 106-200 C°. GC oven temperature is 5-450 °C. Ultra high purity helium is used as the carrier gas for the entire system. This GC-MS system is capable of both quantitative and qualitative analysis for volatile and semi-volatile substances.

A modified method – Texas Natural Resources Conventional Center (TNRCC) total petroleum hydrocarbons (TPH) 1005 is adopted for the determination of total hydrocarbon concentration in water, amine and glycol samples. The original TPH 1005 method is for a FID detector. In this method, the detected hydrocarbon range is C5-C36. In the modified method the detector is MS, the column selected is HP-5ms (5%-Phenyl)-methylpolysiloxane non-polar with very low bleed characteristics. Helium gas flow rate is 1.5 mL/min, temperature starts at 30 °C, holds or 2 minutes, then ramps up to 310 °C with a speed at 25 °C/min, then holds at 310 °C for 9.8 minutes. The total run time for each sample is 23 minutes. Inlet temperature is 310 °C, MS source temperature is 275 °C, MS quadrupole temperature is 180 °C.

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Sample preparation. Take 15 mL aqueous sample into a 40 mL vial, then add 3 mL GC grade n-pentane into the 40 mL vial, put the cap on, extract by vigorously vortexing the mixture for at least 2 minutes, then let it settle until a clear phase separation happens. Then transfer the upper extract into a 2 mL auto-sampler vial with a PTFE-lined cap, and then place the vial in the auto-sampler for analysis.

Calibration. Using n-pentane, prepare a minimum of five calibration standards from the Petroleum Product Calibration Standard ranging in concentration from 20 to 1000 mg/L. Inject each standard into the gas chromatograph using the same conditions, e.g., injection volume and technique, to be used during sample analysis. Integrate the peak areas for the nC6 to nC12 range, >nC12 to nC28 range and >nC28 to nC35 range, then tabulate peak area responses against the concentration injected to make a peak area Vs concentration curve. Use this calibration curve to calculate the unknown concentration of a test sample.
The TPH concentration calculation formula is:

$$Cs = (Cc \times Vt \times D)/Vs$$

Where Cs = Concentration of TPH in sample in mg/L.
Cc = Concentration of TPH in extract in mg/L.
Vt = Volume of final extract in L.
D = Dilution/concentration factor.
Vs = Volume of sample extracted in L.

For qualitative analysis only, such as net petroleum make-up analysis, unknown substance identification, just prepare the sample in , no calibration curve is needed.

The operation procedure of this GC-MS is as follows using the acquisition software:

1. Bake the column prior to each run
2. Tune the MS detector to check and optimize its performance
3. Make a sequence table for all the test samples and check standards. Choose the correct method for each sample
4. Start the run to acquire data
5. Analyze the data using the data analysis software for unknown substance identification and concentration calculation
6. Replace septum, liner, and gold plate regularly as routine maintenance

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Elemental Analysis/Identification – Scanning Electron Microscope (SEM) with Energy Dispersive X- Ray Spectroscopy (EDS)

A Hitachi Tabletop Microscope TM3000 with a Bruker Quanta 70 X-ray acquisition and detection system was used for this elemental composition analysis. In this system, the SEM has a magnification up to 30,000X and an acceleration voltage from 5 to 15 kV with variable current adjustment. No coating is required for non- conductive samples due to the charge reduction feature of TM3000.

A typical process of an EDS analysis is that first, a high-energy beam of X-rays is focused into the sample being studied to stimulate the emission of characteristic X-rays from this sample. Then a detector converts the X-ray energy into voltage signals, followed by a pulse signal processor to measure the voltage signals and pass them onto an analyzer for data display and analysis. The Hitachi TM3000 with a Bruker Quanta 70 X-ray includes a Bruker silicon drift detector (SDD) with elemental detection range from Boron to Americium. The energy resolution is 154 ev (for Copper Kα). It has three analysis moods: element mapping, line profile and spot mode. The operation procedure of this SEM-EDS instrument is as follows:

1. Start up the Microscope
2. Prepare a specimen
3. Place a specimen on the specimen stage
4. Find the right image and spot for EDS analysis
5. Acquire image on the EDS software
6. Select the analysis mode
7. Conduct EDS analysis

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Particle Size Distribution Analysis

A portion of the well-mixed bottle sample was utilized for particle count analysis. The particle count data was collected using the method of single-particle-light-obscuration using a dual sensor technique of light extinction and light scattering. This Optical Particle Counting (OPC) method counts individual particles. The test fluid is automatically diluted and then passed through the "photozone". The particles pass, one at a time, through the illuminated region avoiding coincidences (a situation where one particle obscures another particle thus resulting in lowered number counts, or erroneous measurement of a larger particle, or both). As the particle moves through the sensing zone, it causes a pulse, the magnitude of which depends on the mean diameter of the particle. The measurement technique allows for collection of a broad range of particle sizes for evaluation (0.5 – 500 micron).

The particle count information is then converted into a volumetric basis, assuming the particles are spherical in nature. This volumetric basis of the contaminant is reported as a fraction of the sample analyzed. The protocol utilized is referenced below:

1. Auto-rinse the particle counter sensor with a suitable solvent (such as hexane for hydrocarbons or deionized water for aqueous solutions).
2. Mix the bottle sample adequately to ensure a uniform, representative sample draw.
3. Use a disposable micro-pipette to draw the sample.
4. Inject the sample into the dilution flask containing the solvent.
5. Start collecting particle count data.
6. Particle number counts are converted to volume, assuming a spherical particle shape.
7. Auto-rinse the particle counter sensor with a suitable solvent (such as hexane for hydrocarbons or deionized water for aqueous solutions).
8. Mix the bottle sample adequately to ensure a uniform, representative sample draw.
9. Use a disposable micro-pipette to draw the sample.
10. Inject the sample into the dilution flask containing the solvent.
11. Start collecting particle count data.
12. Particle number counts are converted to volume, assuming a spherical particle shape.

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ABOUT STAR LABS

Advancing the Science of Separation

Pentair's STAR Labs, which stands for Scientific Testing Analysis and Research, are staffed with Ph.D scientists and engineers who are constantly innovating, creating unmatched value for our clients.

From research and development to client sampling, we work to achieve real world advances, like APEX®, a patented technology specifically intended to keep annular velocities constant across the entire height of the element.

Our client's critical processes and optimization are at the forefront of what we do. With that focus for more than 20 years, we have been able to lower their capital costs.

Our aggressive research and development efforts are supported by our lab, which is equipped with the most advanced scientific instruments for the development, testing and certification of filtration products and filter media.

We use state of the art equipment to develop and refine filter media, membranes and optimize the characteristics of a particular medium, device or system for individual applications. From concept to production, STAR™ Labs is an integral part of our business. It creates the mold of partnerships with our clients by being able test, analyze and research their critical products and processes.

If you are interested in speaking to someone about our lab capabilities, Contact us today through www.pentairseparations.com or call +1.936.788.1000.

Pentair Improved Filters to be utilized in Stage 3 of the HRT pre-treatment system at the WSL facility. These filters are referred to as MPXB in the Pentair Bench Scale Study Report.

COMPAX Coreless Element Specifications

Solutions that make dollars and sense.

Compared to conventional cartridge filters, COMPAX saves money by lowering operating costs and reducing disposal costs. When comparing filters with the same efficiencies or Beta ratings, nothing outperforms the cost/performance value achieved with COMPAX. In fact, we are so sure you will save money using COMPAX coreless filters, we guarantee it!

If you are currently using a conventional filter – pleated, depth, molded or string wound, nominal or Beta rated – you can have COMPAX performance without purchasing new filters or modifying existing housings. Whether it is for water, amines, chemicals, hydrocarbons, oils, coolants, inks, paints, or other fluids, for pre-filtration or final filtration, there is a COMPAX system that is right for the application.

Performance. Disposability. Cost effectiveness. Whether it is a new filtration application, or upgrading and optimizing a conventional cartridge filter application, COMPAX is the right choice.

The major innovation in COMPAX is its elegant simplicity. It consists of two parts: the COMPAX coreless filter and the reusable core. The reusable COMPAX core is semi-permanently installed into the existing filter vessel without the need for special tools. After installation of the cores, the open end of the COMPAX cartridge slides down over the length of the core and engages a positive sealing O-ring to integrally seal the filter and core together. The reusable cores have standard collapse ratings of 75 or 150 psi, depending on the series and material of construction. Higher collapse ratings are available upon request.

COMPAX coreless filters are available with a broad range of media types and micron ratings to match requirements of the application.

Unlike conventional string wound, sock, molded, spray spun, depth or pleated filter cartridges which have rigid cores, the COMPAX coreless filter system was engineered to combine Pentair's high performance media technology with its proven coreless filter design to deliver maximum disposability, high surface area and reliable performance while addressing today's environment needs.

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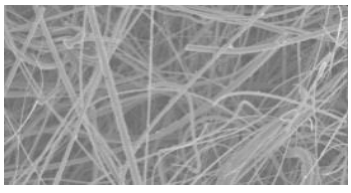
COMPAX Coreless Element Specifications

Many conventional cartridge filters are nominally rated. Nominal ratings are arbitrarily set by the manufacturer and are therefore, not consistent from one manufacturer to the next. Nominal ratings are widely being replaced with stated efficiency ratings, commonly expressed at a given particle size. Each PENTAIR grade of filter media is Beta rated to values up to 5,000 corresponding to 99.98% efficiency.

Above picture may not be the actual cartridge or components.

FMC1904H031V-MB

Element Type	COMPAX Coreless fluid process element
Separation Media	Proprietary MICROFORM media formulation comprised of borosilicate micro- and nanofibers cross-linked into a Locked Pore Structure specifically designed to separate particulate from high flow liquid (aqueous or hydrocarbon) streams.
Media Efficiency	β_1 = 5000 (99.98% efficiency at 1 micron)
End Caps	Nylon
Seals	*Buna
Components	Proprietary high temperature adhesives & polyester support layers
Configuration	Single Open End
Dimensions	Nominal Length: 40" (101.6cm) Nominal OD: 5.0" (12.7cm)
Ratings	Recommended change out 25-30 PSID (1.72-2.07 Bars) based on process limits. *Maximum Operating Temperature is 250°F. (121.1°C).



MicroForm Media

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January 2023

The Many Advantages of Kinetic Degradation Fluxion Media for Water Filtration

Kinetic degradation fluxion sounds like something the protagonists in a 1950s sci-fi movie would be very concerned about. Surely it would doom the ship if it couldn't be brought under control. While it's probably less exciting than that to most people, to water filtration nerds like us, KDF is one of the most exciting discoveries of the last 35 years.

KDF is not only interesting, it's one of the secrets that make HomeWater filters so effective. But what is kinetic degradation fluxion and how does it make your drinking water better?

What Is KDF Media?

KDF process media is a combination of high-purity copper-zinc granules that greatly improve water filters. The addition of KDF to our whole-house water filtration systems sets us apart from much of our competition. KDF media helps to extend the life of our whole-house water filters while making them more effective at removing contaminants from your home water supply.

through the reduction or addition of electrons.

As contaminants like heavy metals and hydrogen sulfide move through the media, an electrochemical process takes place that exchanges electrons between the filter media and the contaminant molecules. This renders the contaminants harmless by changing their chemical structure.

In case, like most people, that's not a language you speak fluently, an example of this is chlorine being transformed into harmless, water-soluble chloride after passing through a KDF filter.

source

What Does a KDF Filter Do?

KDF filters are great at reducing or removing a long list of water pollutants like:

- Free chlorine
- Lead
- Iron
- Chromium

Bacteria

Algae

Fungi

They even reduce hard water - causing minerals like calcium carbonate and magnesium, which will help save your pipes and water-using appliances.

KDF filters can be used in the primary treatment of water, but they're often used in the pretreatment phase of purification systems. They're great at pre-filtering large particles, which helps to remove the stress on your water filter system and extend its lifespan. Say goodbye to damaging silt and sediment in your pipes and hello to clearer and cleaner water.

Why Is It Important to Remove Chlorine?

There's no doubt that treating water with chlorine is a modern miracle that's saved thousands of lives. Chlorine allows water to travel safely through miles of pipes without becoming overly polluted by bacteria. Once it reaches your home though, it becomes more of a hazard than a miracle. Not only do some people think it gives your water an unpleasant taste and odor, but it may cause vomiting as well as skin, nose, and throat irritation.

Chlorine can also damage expensive filtration systems, shortening their lifespan. KDF media like that found in HomeWater's whole-home water filtration system protects the whole system. This means less expense and less maintenance for you.

How Is KDF Media Different From Silver?

Silver has antimicrobial properties, so some of our competitors use silver-impregnated systems in their water purification process instead of KDF. There are many differences between silver and KDF that we find important. Here are a few reasons we chose KDF over silver-impregnated water treatment systems.

- Silver permits bacteria and algae growth, while KDF controls both.
- Silver works through adsorption, so it doesn't last as long as KDF.
- Silver doesn't filter heavy metals; KDF does.
- Silver is more sensitive to pH levels in the water than KDF.
- Silver is considered hazardous waste, while KDF is recyclable.
- Silver usage in a filter must be reported to the EPA because it's considered toxic. The EPA doesn't consider KDF toxic, so there are no such rules.

Who Makes Kinetic Degradation Fluxion Media?

In 1987, the Three Rivers, Michigan company KDF Fluid Treatment, Inc., patented and began selling KDF media. It is NSF-42 and NSF-61 certified, which ensures a level of health and aesthetic quality of water treated with KDF.

The product is now used in point-of-entry, point-of-use, industrial, and commercial applications. KDF media is also very popular in showerhead filters because it's effective in hot water and it doesn't hurt your flow rate.

KDF is used for pretreating water, primary treatment, and even treating wastewater. Today there are several different types of KDF, including KDF 55 and KDF 85.

What Is KDF Material?

KDF water filter media is made from a blend of high-purity zinc and copper, which, when mixed together, create an electrochemical reaction in impurities that pass through it. The reactions often turn harmful contaminants into harmless byproducts. KDF material has no chemical additives and works well as a sediment filter.

What Is the Difference Between KDF 55 and KDF 85?

KDF 55 is NSF-42 certified. It's mainly used in home systems and is effective at removing chlorine and water-soluble heavy metals as well as scale-causing minerals from your home water.

also both remove up to 99% of dissolved metals like:

- Chromium
- Water-soluble lead
- Mercury
- Nickel
- And others

It does this without introducing harmful chemicals into your water, which is why KDF media is commonly added to point-of-use shower filters. Our USA-made shower filters remove 90% of chlorine. Each replacement cartridge filters out 10,000 gallons of water while allowing 2 satisfying gallons per minute to flow through.

How Long Does KDF 85 Media Last?

When handled properly, KDF 85 media can last more than six years without needing to be replaced. When compared to silver systems that last just six to 12 months, this means far less maintenance and cost to water treatment systems.

Does KDF 85 Remove Lead?

Yes! Both KDF 55 and KDF 85 can filter out up to 99% of water-soluble lead, as well as many other toxic heavy metals.

Does KDF Filter Media Remove Fluoride From Drinking Water?

To remove fluoride from drinking water, you either need a deionizer, activated alumina, or a reverse osmosis system. While KDF water filter media supports those types of systems to work better and last longer, KDF media by itself isn't effective at removing fluoride from your water. If you're interested in fluoride removal, check out our under-sink 4-stage reverse osmosis system.

Does KDF Remove Calcium From Drinking Water?

While not a traditional water softener, KDF does remove some calcium carbonate, magnesium, and other scale-causing minerals from your water. KDF will control microorganisms and remove contaminants like chlorine/chloramines and heavy metals more effectively than it will soften your water.

Does a KDF Filter Soften Water?

KDF filters do have a softening effect on water. If you have very hard water you'll see an improvement in your water quality, but it's still recommended that you get a traditional or salt-free

KDF filters aren't perfect. They don't filter out organic chemicals like pesticides or disinfectant byproducts. But that's why our whole-home systems rely on multiple technologies like catalytic carbon and specialty gravel to reduce turbidity and increase clarity.

HomeWater's 4-stage filtration system aims to give you the freshest and cleanest water possible.

Are KDF Filters Safe?

Kinetic degradation fluxion filters are safe. Not only are they certified by NSF international standards, but they also meet EPA and FDA standards for zinc and copper in water.

source

Should Your Whole-House Filter Use KDF Filtration Technology?

Well, we certainly think so. Kinetic degradation fluxion media has a 35-year track record of being a safe and effective way to keep your water fresh and delicious.

KDF filter technology is used in both home filtration systems as well as industrial, commercial, and municipal water treatment because it works. This technology increases the effectiveness and the longevity of these water treatment systems just like it does in your home.

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LEACHATE DEMONSTRATION PROJECT
SUPPLEMENTAL INFORMATION

ATTACHMENT 3
ESTIMATED CONSTRUCTION SCHEDULE

LEACHATE PRE-TREATMENT SYSTEM - ESTIMATED CONSTRUCTION SCHEDULE

Task	Category	Responsibility	Estimated Start Date	Estimated Completion Date
PADEP Approval of Minor Permit Modification	Engineering	Consultant	1/1/2024	12/15/2025
Final Design and Construction Drawing Package	Engineering	Consultant	12/15/2025	1/26/2026
Submit Construction Notification	Engineering	Consultant	12/15/2025	12/15/2025
Install Erosion and Sedimentation Controls	Soils	Contractor	12/15/2025	12/22/2025
Complete Earthwork	Soils	Contractor	12/15/2025	1/14/2026
Pump Order	Purchasing	Noble	12/15/2025	1/26/2026
Piping Order	Purchasing	Noble	12/15/2025	1/12/2026
OWS Order	Purchasing	Noble	12/15/2025	1/14/2026
MBBR Order	Purchasing	Noble	12/15/2025	1/14/2026
Tank (American Structures) Order	Purchasing	Noble	12/15/2025	2/23/2026
DAF Order	Purchasing	Noble	12/15/2025	1/14/2026
HRT (Pentair) Order	Purchasing	Noble	12/15/2025	1/14/2026
GAC Order	Purchasing	Noble	12/15/2025	1/14/2026
Manhole and Pump Station Order	Purchasing	Noble	12/15/2025	1/26/2026
Obtain Building Quotes and Vendor Selection	Purchasing	Noble	12/15/2025	12/29/2025
Utility Construction	Soils	Contractor	1/14/2026	1/28/2026
Concrete Construction	Concrete	Contractor	1/28/2026	2/25/2026
Building Construction	Builder	Contractor	2/25/2026	3/11/2026
Tank Installation	Builder	Contractor	2/23/2026	3/16/2026
Equipment Installation	Builder	Contractor	1/14/2026	3/25/2026
Pump and Piping Installation	Builder	Contractor	1/14/2026	4/22/2026
Sitework Completion and Stabilization	Soils	Contractor	4/22/2026	4/29/2026
Update Site PPC / SPCC	Engineering	Noble	3/23/2026	4/22/2026
Plant Commissioning	Eng / Ops	Noble / Engineer	4/22/2026	6/6/2026
Plant Operation	Operations	Noble	6/6/2026	6/5/2028