Technical Seminar: Ceramic Membrane Filtration and Micro-Sorbent PFAS Removal for Drinking Water

Agenda and Supporting Course Information for Drinking Water CEU Review

Document purpose. This document is intended to be copied into Aqua-Aerobic Systems, Inc. corporate letterhead and submitted as the supporting course outline, agenda, and educational summary for the proposed in-person drinking water seminar. Required OESAC forms, instructor bios, attendee roster forms, and final slide decks will be completed or attached separately by the seminar sponsor.

1. Course Identification

Item	Prepared Information
Course title	Technical Seminar: Ceramic Membrane Filtration and Micro-Sorbent PFAS Removal for Drinking Water
Delivery format	In-person classroom seminar
Requested CEU discipline	Drinking Water only
Requested instructional credit	4.0 contact hours / 0.4 CEU, excluding breaks and lunch
Proposed date	August 2026 or fall of 2026
Venue option 1	Hilton Garden Inn Lake Oswego, 14850 Kruse Oaks Dr, Lake Oswego, OR 97035
Venue option 2	Embassy Suites Tigard, 9000 SW Washington Square Rd, Tigard, OR 97223
Course sponsor	Goble Sampson Associates, 22526 SE 64th Place, #240, Issaquah, WA 98027 – John Darch – jdarch@goblesampson.com, Mobile: (206) 914-1535
Technical content support	Aqua-Aerobic Systems, Inc.
Primary audience	Municipal drinking water utilities, drinking water operators, utility managers, consulting engineers, regulatory agency personnel, and selected industrial customers with drinking water treatment relevance
Presenters	Dave Lamphere - C-Series ceramic membrane modules; John D. Dyson - PFAS/AquaPRS modules
Instructor biographies	Separate corporate bios will be provided as attachments by Aqua-Aerobic Systems, Inc. and/or the course sponsor
Primary AquaPRS case-study focus	Chatsworth / Eton Spring / Eton Water Treatment Plant PFAS treatment evaluation, supplemented with additional pilot studies conducted at other locations

2. Educational Positioning for CEU Review

The seminar is structured as a technical drinking water education program, not as a product demonstration. Product and system names are used to identify the technologies and case-study systems being discussed; however, the instructional emphasis is on treatment fundamentals, design considerations, operating terminology, regulatory context, technology comparison, pilot testing, case-study interpretation, and operator implications.

The C-Series ceramic membrane portion will focus on membrane filtration basics, ceramic membrane functionality, operating terminology, physical separation performance, cleaning approaches, and drinking water case-study experience. This portion will not be presented as dissolved PFAS removal by ceramic microfiltration alone.

The AquaPRS portion will explain how PFOS and other PFAS are removed by adsorption onto suspended micro-sorbent in a mixed reactor, with the ceramic membrane acting as the physical separator that retains spent sorbent and produces clarified effluent. This distinction is important for technical credibility and regulatory review.

At the end of each instructional module, the presenter will reserve time for technical questions and answers. The Q&A portions are intended to reinforce learning, clarify terminology, and support operator/engineer understanding of how the concepts apply to drinking water treatment planning.

3. Course Summary and Training Goal

Training goal. The goal of this four-hour in-person drinking water seminar is to provide utility personnel, consulting engineers, and regulatory stakeholders with a practical technical understanding of C-Series ceramic membrane filtration and micro-sorbent PFAS removal as applied to municipal drinking water treatment. Participants will learn membrane fundamentals, ceramic membrane operating concepts, PFAS chemistry and federal regulatory drivers, available PFAS treatment technologies, adsorption fundamentals, AquaPRS process design concepts, pilot testing requirements, case-study results, and operator considerations for implementation.

Course summary. This technical seminar is organized into four instructional modules. Module 1 introduces membrane treatment basics and C-Series ceramic membrane fundamentals. Module 2 provides PFAS basics, federal drinking water regulatory updates, PFAS chemistry, and other federal regulatory considerations relevant to drinking water utilities. Module 3 reviews C-Series ceramic membrane case studies, pilot results, and project applications. Module 4 presents AquaPRS micro-sorbent PFOS/PFAS removal case studies, pilot results from multiple locations, the Chatsworth/Eton Spring drinking water case study, and future R&D work. The course emphasizes engineering evaluation, water-quality-specific testing, and practical implementation considerations rather than one-size-fits-all treatment claims.

4. Learning Objectives

1. Define the role of membrane filtration in drinking water treatment and distinguish microfiltration, ultrafiltration, nanofiltration, and reverse osmosis by particle or contaminant separation range.
2. Explain key membrane operating terms, including flux, transmembrane pressure, permeability, recovery, backwash, chemically enhanced backwash, clean-in-place, and membrane integrity.
3. Compare ceramic and polymeric membrane systems in terms of materials of construction, pressure/vacuum configuration, fouling resistance, cleaning tolerance, membrane life, redundancy, and operational resilience.
4. Describe common C-Series drinking water applications such as surface water treatment, groundwater treatment, RO pretreatment, spent filter backwash recovery, and difficult-to-treat waters.
5. Explain PFAS chemistry, including hydrophobic tail groups, ionized head groups, chain-length effects, sulfonate versus carboxylate behavior, and why short-chain PFAS can be more difficult to remove.
6. Summarize federal drinking water PFAS regulatory concepts, including MCLs, compliance monitoring, and Hazard Index principles, while recognizing that implementation deadlines and guidance should be checked before presentation delivery.
7. Compare major PFAS treatment technologies, including granular activated carbon, ion exchange, reverse osmosis, foam fractionation, emerging destruction technologies, and micro-sorbent adsorption with membrane separation.
8. Describe how AquaPRS combines micro-sorbent adsorption, mixed reactor contact, ceramic membrane retention, backpulse operation, automated sorbent replacement, and residual volume reduction.
9. Interpret pilot and case-study data from Chatsworth/Eton Spring and other pilot locations, including PFOS/PFAS removal performance, Hazard Index reduction, sorbent loading, operator tasks, and the rationale for using pilot data to inform full-scale design.
10. Identify practical implementation considerations, including water-quality characterization, co-contaminants, NOM/TOC impacts, sampling plans, waste/residual handling, operator workload, and future research areas.

5. Four-Module Agenda and Instructional Schedule

The schedule below provides a 9:00 AM to 2:00 PM in-person program with 4.0 hours of instructional content, two 15-minute breaks, and one 30-minute lunch break. Breaks and lunch are excluded from instructional credit. Each instructional module includes a technical Q&A period.

Time	Minutes	Credit?	Topic	Lead Presenter	Technical Learning Focus

9:00 - 9:55 AM	55	Yes	Module 1 - C-Series Ceramic Membrane Basics	Dave Lamphere	Membrane terms, functionality, ceramic/polymeric comparison, and module Q&A.
9:55 - 10:10 AM	15	No	Morning Break	N/A	Break; no CEU credit.
10:10 - 11:05 AM	55	Yes	Module 2 - PFAS Basics and Federal Drinking Water Regulatory Update	John D. Dyson	PFAS chemistry, federal regulatory concepts, treatment drivers, and module Q&A.
11:05 AM - 12:00 PM	55	Yes	Module 3 - C-Series Membrane Case Studies on Projects and Pilots	Dave Lamphere	Drinking water applications, project/pilot data, operating lessons, and module Q&A.
12:00 - 12:30 PM	30	No	Lunch	N/A	Lunch break; no CEU credit.
12:30 - 1:25 PM	55	Yes	Module 4 - AquaPRS PFOS/PFAS Removal Case Studies, Pilot Results, and Future R&D	John D. Dyson	Chatsworth/Eton Spring, other pilots, process operation, R&D areas, and module Q&A.
1:25 - 1:40 PM	15	No	Afternoon Break	N/A	Break; no CEU credit.
1:40 - 2:00 PM	20	Yes	Integrated Technical Q&A and Course Wrap-Up	John D. Dyson / Dave Lamphere	Cross-module discussion, pilot testing considerations, and technical wrap-up.
Total	300	240 min credit	4.0 hours instruction + 1.0 hour breaks/lunch		Requested Drinking Water credit: 0.4 CEU.

CEU calculation. CEU Requested = Contact Hours / 10 = 4.0 / 10 = 0.4 CEU. In this formula, CEU Requested is the continuing education unit value requested for the course; Contact Hours are instructional hours excluding registration, breaks, meals, and non-educational time; 10 is the standard contact-hour conversion factor commonly used for CEU calculation; 0.4 CEU is the requested Drinking Water CEU value for full attendance.

6. Detailed Module Descriptions

Module	Detailed Content	Participant Takeaways
Module 1 - C-Series Ceramic Membrane Basics	This session introduces membrane filtration and the C-Series ceramic membrane platform. Content will include the filtration spectrum; microfiltration, ultrafiltration, nanofiltration, and reverse osmosis	Participants should be able to explain basic membrane terminology, describe how ceramic

	comparisons; feed, filtrate, and waste streams; flux; TMP; permeability; recovery; backwash; chemically enhanced backwash; clean-in-place; integrity concepts; low-pressure membrane configurations; pressure versus vacuum systems; ceramic versus polymeric material differences; C-Series construction; and operating functionality. The session will end with module-specific Q&A.	membrane systems function, and identify how ceramic membranes differ from polymeric membrane systems in drinking water applications.
Module 2 - PFAS Basics and Federal Drinking Water Regulatory Update	This session introduces per- and polyfluoroalkyl substances, with emphasis on PFOS and other drinking-water-relevant PFAS. Content will include PFAS molecular structure, carbon-fluorine bonds, hydrophobic/hydrophilic behavior, anionic charge, common sources, transport pathways, drinking water exposure concerns, long-chain versus short-chain behavior, sulfonate versus carboxylate behavior, EPA drinking water MCL concepts, Hazard Index concepts, monitoring/compliance concepts, and federal regulatory developments that may affect treatment planning. The session will end with module-specific Q&A.	Participants should be able to describe why PFAS are persistent, why chain length and functional group matter for treatment, and how federal drinking water requirements influence technology selection and pilot testing.
Module 3 - C-Series Membrane Case Studies on Projects and Pilots	This session reviews C-Series ceramic membrane applications and project/pilot examples in drinking water and related high-quality water applications. Content may include surface water treatment, groundwater treatment, RO pretreatment, spent filter backwash recovery, solids handling, high recovery operation, flux/TMP/permeability trends, cleaning frequency, operational reliability, and selected C-Series case-study experience. The session will end with module-specific Q&A.	Participants should be able to identify where ceramic membranes may fit in a drinking water treatment train and understand which operating parameters and pilot results are important for full-scale design.
Module 4 - AquaPRS PFOS/PFAS Removal Case Studies, Pilot Results, and Future R&D	This session explains the AquaPRS micro-sorbent PFOS/PFAS removal process and reviews case-study and pilot performance. Content will include micro-sorbent adsorption, mixed reactor contact, ceramic membrane retention of spent sorbent, recycle, backpulse, sorbent replacement, residual handling, operator tasks, the Chatsworth/Eton Spring case study, other pilot studies conducted at different locations, potential application ranges, short-chain PFAS research, hybrid operation, co-contaminant effects, NOM/TOC considerations, and future R&D. The session will end with module-specific Q&A.	Participants should be able to describe how AquaPRS combines adsorption and membrane separation, interpret pilot/case-study data, and understand why site-specific testing is needed to estimate sorbent life, treatment performance, and residual management requirements.

7. Key Technical Terms and Formulas to Be Covered

Term	Definition for Participant Understanding
PFAS	Per- and polyfluoroalkyl substances; a broad family of fluorinated organic compounds with high persistence and diverse chemical structures.
PFOS	Perfluorooctane sulfonate; an eight-carbon PFAS compound historically associated with AFFF and industrial uses and regulated in drinking water.
PFOA	Perfluorooctanoic acid; an eight-carbon PFAS compound historically associated with industrial uses and regulated in drinking water.
MCL	Maximum Contaminant Level; an enforceable drinking water limit at a compliance point.
Hazard Index	A mixture-risk calculation used for selected PFAS compounds where each compound concentration is divided by its health-based reference value and the quotients are summed.
Adsorption	Attachment of dissolved compounds to the surface or active sites of a solid sorbent.
Microfiltration	A low-pressure membrane process generally used for particle, turbidity, and microbial separation rather than direct dissolved contaminant removal.
Ceramic membrane	A durable inorganic membrane material with high chemical and thermal tolerance compared with many polymeric membranes.
TMP	Transmembrane pressure; the driving pressure across a membrane.
Flux	Flow rate normalized by membrane surface area.
Permeability	Flux normalized by TMP; used to trend membrane performance and fouling.
Backwash / backpulse	A short reverse-flow cleaning event used to restore membrane performance during operation.
CEB	Chemically enhanced backwash; a backwash event using cleaning chemicals to improve recovery.
CIP	Clean-in-place; a longer chemical cleaning procedure used to restore membrane performance.

Formula	Detailed Explanation and Definitions
Flux = Flow / Membrane Area	Flux is the production rate per unit membrane surface area. Flow is the filtrate or permeate flow rate through the membrane. Membrane Area is the active membrane surface area. Typical units include LMH (L/m²·h) or GFD (gal/ft²·day).
TMP = Feed Pressure - Filtrate Pressure	For a simple dead-end membrane system, TMP is the pressure difference across the membrane. Feed Pressure is the pressure on the influent side of the membrane. Filtrate Pressure is the pressure on the treated-water side.
TMP = ((Feed Pressure + Return Pressure) / 2) - Filtrate Pressure	For a recirculating or crossflow system, average feed-side pressure is often approximated by averaging Feed Pressure and Return Pressure. Filtrate Pressure is then subtracted to estimate membrane driving pressure.
Permeability = Flux / TMP	Permeability normalizes membrane production by pressure. Flux is the membrane production rate per membrane area. TMP is the transmembrane pressure. A declining permeability trend can indicate fouling, scaling, solids accumulation, or inadequate cleaning.

Hazard Index = (PFHxS / 10) + (PFNA / 10) + (HFPO-DA / 10) + (PFBS / 2000)	Hazard Index is the sum of hazard quotients for selected PFAS compounds. PFHxS, PFNA, HFPO-DA, and PFBS are measured concentrations in ng/L. The denominators are health-based reference values used in the federal drinking water Hazard Index calculation. Regulatory values should be verified before delivery.
CEU Requested = Contact Hours / 10	CEU Requested is the continuing education credit requested. Contact Hours are instructional hours excluding registration, breaks, meals, and non-educational time. For this seminar, 4.0 contact hours / 10 = 0.4 CEU.

8. Required Forms and Separate Attachments

The required forms will be completed separately by the course sponsor. This document should be used as the agenda/course outline attachment and should not replace the standard OESAC forms.

Form / Attachment	Use	Completion Notes
OESAC online Evaluation Request form	Complete separately by the sponsor	Use the selected course title, final date, final venue, 4.0 instructional hours, 0.4 Drinking Water CEU request, in-person format, sponsor information, and this document as the course outline/training goal attachment.
Instructor Background and Information Form or corporate bios	Attach separately	Provide separate corporate bios for John D. Dyson and Dave Lamphere. If OESAC requires the standard instructor form, complete it separately for each presenter.
OESAC CEU Roster Report Form	Use as-is after the class	Use the approved OESAC course number and exact approved course title. Collect attendee organization, full name, signature, Oregon certification number if applicable, CEUs earned, and sponsor/proctor signature.
Participant certificate or completion letter	Prepare after approval	Use the exact approved course title, OESAC assigned number, sponsor name/signature, course date, location, and CEUs earned based on actual attendance.