AROMA-UPW

Real-Time Speciated VOC Water Analyzer

Model #AR-V-191-OM

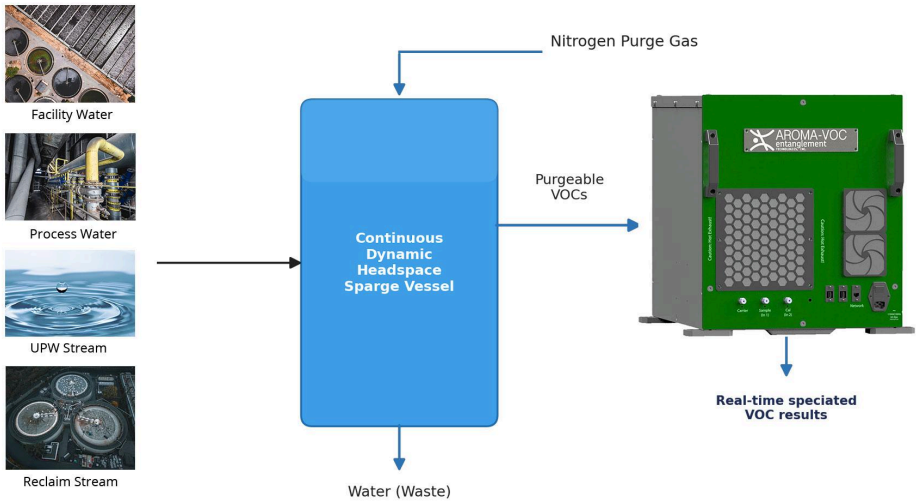
UPW / Semiconductor

Entanglement Technologies' AROMA-UPW analyzer provides real-time, online speciated VOC monitoring of ultrapure water (UPW), reclaim, and wastewater streams in advanced semiconductor manufacturing.

A direct sparge (continuous, dynamic headspace) provides a minimum intervention and sample prep interface to multiple process streams, allowing the analyzer to provide speciated, ng/L analysis online—filling critical gaps in the analytical capabilities provided by TOC analyzers and periodic laboratory GC analysis.

AROMA-UPW integrates automated thermal desorption with broadband cavity ring-down spectroscopy (CRDS) to identify dozens of VOCs (solvents, oxygenated species, chlorinated compounds, and disinfection byproducts) as they evolve across treatment trains.

The intrinsic stability of the CRDS core minimizes maintenance and calibration overhead, enabling long-term unattended operation across semiconductor UPW, reclaim, and water treatment infrastructure. in fab utility environments. AROMA-UPW provides laboratory-grade performance, online.



Continuous Dynamic Headspace Apparatus. Optimized direct sparge interface for online analysis of VOCs from water. RO-Feed, RO-Permeate, and calibration/blank lines feed the sparge vessel; ultrapure N2 purges headspace VOCs to the AROMA-UPW for speciated, real-time analysis.

- Real-time **part-per-trillion** or ng/L speciated VOC analysis of UPW, reclaim, and wastewater
- Direct sparge (continuous dynamic headspace) interface for online water sampling, **reagent-free**
- Water and air measurement modes capture AMC-driven air-to-water transfer pathways
- Speciated identification supports contamination source tracking across reclaim and UPW loops
- Unattended online operation with automatic reporting and supported integration with multiple automation technologies
- Patented high-performance CRDS system; intrinsic stability, minimal calibration
- Easy to use and reliable "Ph.D. Free" operation

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Speciated Analysis Mode: Analytical Performance

Performance Parameter	Specification
Speciated VOCs (water)	Up to 27 compounds per cycle (expanding)
Water Detection Limits*	Low-ng/L to sub-µg/L (compound dependent)
Best-case Water MDL*	< 10 ng/L (0.009 µg/L, MTBE)
Air Detection Limits	Single-digit pptv to low ppbv (compound dependent)
Cycle Time (water)	45-75 minutes (method dependent)
Zero level drift (per analyte)	< MDL
Analytical Precision (per analyte)††	greater of 25% of measured value or MDL
Analytical Accuracy (per analyte)††	greater of 30% or MDL
Reference Methods	Comparable to EPA 5030B / 8260B; TO-15 equivalent (air)

*Detection limits shown are from initial method development and full-scale field deployment, and can be optimized for a given application; substantially lower limits are achievable where required.

Measurement

Analysis Time (water)	45-75 Minutes
Sampling Duration	1-45 Minutes
Calibration	As required by testing protocol
Data Reporting	Attached PC, WAN gateway compatible
Data Format options	json, csv, kml
Global Positioning System	Built-In
Sample Volume Range	5-5000 scc
Sampling Flow Range	2-500 sccm

†† Equivalent Performance to EPA TO-15 laboratory requirements. Additional species available upon request and via software updates.

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Water Sampling & Sparge Interface

Sampling Interface	Direct sparge / continuous dynamic headspace
Input streams	Up to 20 linesRO-Feed, RO-Permeate, Calibration / Blank (multi-port)
Purge Gas	Ultrapure N2 (reagent-free headspace sampling)
Measurement Modes	Continuous online and automated periodic sampling
Speciated Coverage	Up to 27 VOCs per cycle (expanding)
Cycle Time (water)	45-75 minutes (method dependent)
Co-deployment	Operates alongside online NPOC (TOC) analyzers

Fluid Parameters & Operating Conditions

Purge Gas	Ultrapure (UHP) N2
Purge Gas Supply Pressure	40-80 psig
Water Inlet Pressure Range	0-120 psi
Gas Connections	Swagelok® 1/8" compression

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Physical Specifications

Gas Connections	Swagelok® 1/8"
Analyzer Approximate Dimensions	18" w x 20" h x 23" d
Installation	Benchtop or 19" Rack
Analyzer Weight	50 kg (110 lbs)
Power Consumption	175W ave, 120 W Standby, Peak 450W (< 10 seconds)
Power Source	105-120 VAC, 60 Hz
Warm-up Time	< 45 minutes
Temperature Range	5°C - 30°C
Humidity Range	5%-85% RH, noncondensing
Power and Gas Connections	Front Panel

Consumables

Ultrapure N2 consumption	< 2.5 standard L/h
Sorbent Collector Lifetime	> 5000 measurements
Column	> 5000 measurements
Front-end Filter (for dust/smoke)	Condition dependent

Compound Library: Speciated Water Method (47 compounds)

Broad-spectrum analysis of volatile and semi-volatile compounds in aqueous matrices via direct sparge interface. Boiling points at 101.3 kPa. Water MDLs from full-scale OCWD deployment; dash where the compound was added to the species list after the original calibration set.

Compound	CAS Number	Formula	BP (°C)	Water MDL (µg/L)*	Category
Acetone	67-64-1	C_3H_6O	56.1	0.106	Ketone
Isopropanol	67-63-0	C_3H_8O	82.6	—	Alcohol
tert-Butanol	75-65-0	$C_4H_{10}O$	82.4	0.349	Alcohol
Isoprene	78-79-5	C_5H_8	34.1	0.025	Diene
1,1-Dichloroethylene	75-35-4	$C_2H_2Cl_2$	31.7	0.025	Chlorinated alkene
Dichloromethane	75-09-2	CH_2Cl_2	39.6	0.020	Halomethane
1,1-Dichloroethane	75-34-3	$C_2H_4Cl_2$	57.3	0.020	Chlorinated alkane
MTBE	1634-04-4	$C_5H_{12}O$	55.2	0.009	Ether
Bromochloromethane	74-97-5	CH_2BrCl	68	0.019	Halomethane
Chloroform	67-66-3	$CHCl_3$	61.2	0.018	Trihalomethane
1,2-Dichloroethane	107-06-2	$C_2H_4Cl_2$	83.5	0.011	Chlorinated alkane
Benzene	71-43-2	C_6H_6	80.1	0.020	Aromatic
Trichloroethylene	79-01-6	C_2HCl_3	87.2	0.023	Chlorinated alkene
1,2-Dichloropropane	78-87-5	$C_3H_6Cl_2$	96.4	0.016	Chlorinated alkane

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Compound Library: Speciated Water Method (47 compounds)

Broad-spectrum analysis of volatile and semi-volatile compounds in aqueous matrices via direct sparge interface. Boiling points at 101.3 kPa. Water MDLs from full-scale OCWD deployment; dash where the compound was added to the species list after the original calibration set.

Compound	CAS Number	Formula	BP (°C)	Water MDL (µg/L)*	Category
Bromodichloromethane	75-27-4	$CHBrCl_2$	90	0.031	Trihalomethane
Bromoform	75-25-2	$CHBr_3$	149.1	—	Trihalomethane
Toluene	108-88-3	C_7H_8	110.6	0.021	Aromatic
1,1,2-Trichloroethane	79-00-5	$C_2H_3Cl_3$	113.7	0.016	Chlorinated alkane
Dibromochloromethane	124-48-1	$CHBr_2Cl$	120	0.023	Trihalomethane
Ethylbenzene	100-41-4	C_8H_{10}	136.2	0.023	Aromatic
1,2,3-Trichloropropane	96-18-4	$C_3H_5Cl_3$	157	0.037	Chlorinated alkane
Dimethyl Sulfide	75-18-3	C_2H_6S	37.3	—	Sulfur compound
m+p-Xylene	108-38-3 / 106-42-3	C_8H_{10}	139 / 138	—	Aromatic
o-Xylene	95-47-6	C_8H_{10}	144.5	—	Aromatic
Styrene	100-42-5	C_8H_8	145	—	Aromatic
Isopropylbenzene (Cumene)	98-82-8	C_9H_{12}	152.4	—	Aromatic
alpha-Pinene	80-56-8	$C_{10}H_{16}$	156	—	Terpene
beta-Pinene	127-91-3	$C_{10}H_{16}$	166	—	Terpene
R-Limonene	5989-27-5	$C_{10}H_{16}$	176	—	Terpene
6-Methyl-5-hepten-2-one	110-93-0	$C_8H_{14}O$	173	—	Ketone
Hydroxyacetone	116-09-6	$C_3H_6O_2$	145	—	Ketone
Hexamethylcyclotrisiloxane (D3)	541-05-9	$C_6H_{18}O_3Si_3$	134	—	Siloxane
Decamethylcyclopentasiloxane (D5)	541-02-6	$C_{10}H_{30}O_5Si_5$	211	—	Siloxane
Hexanal	66-25-1	$C_6H_{12}O$	131	—	Aldehyde
Nonanal	124-19-6	$C_9H_{18}O$	191	—	Aldehyde
Phenol	108-95-2	C_6H_6O	181.7	—	Aromatic
1,3,5-Trimethylbenzene	108-67-8	C_9H_{12}	164.7	—	Aromatic
1,2,3,5-Tetramethylbenzene	527-53-7	$C_{10}H_{14}$	198	—	Aromatic
2-Hexanone	591-78-6	$C_6H_{12}O$	127.6	—	Ketone
2-Pentanone	107-87-9	$C_5H_{10}O$	102	—	Ketone
2-Heptanone	110-43-0	$C_7H_{14}O$	151	—	Ketone
3-Octanone	106-68-3	$C_8H_{16}O$	167	—	Ketone
Octamethyltrisiloxane (L3)	107-51-7	$C_8H_{24}O_2Si_3$	153	—	Siloxane
Decamethyltetrasiloxane (L4)	141-62-8	$C_{10}H_{30}O_3Si_4$	194	—	Siloxane
Hexamethyldisiloxane (L2)	107-46-0	$C_6H_{18}OSi_2$	100.5	—	Siloxane
Hexanoic acid	142-62-1	$C_6H_{12}O_2$	205	—	Carboxylic acid
gamma-Terpinene	99-85-4	$C_{10}H_{16}$	183	—	Terpene

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