PURGE & TRAP analyzer

Chromatotec® solution for VOC contaminants detection in water

Introduction

- Very small amount of VOCs can be dissolved in water
- Contamination in water (drinking water, rivers…) must be monitored to avoid water contamination
- Chromatotec® is well known worldwide for its leading-edge technology for the analysis of VOCs at ppt/ppb/ppm levels
- Purge and Trap system is used to extract VOCs from the water and provide analysis using autoGC analyzers to identify & quantify contaminants

Introduction

- Water sample
  - Automatic sampling

- Gas extraction using the Chromatotec® Purge & Trap system.

- Gas analysis with our analyzers

Outline

- VOC extraction using Purge & Trap system (US EPA 502.2) Method
  - Sampling system for Soil water (very polluted)
  - Sampling system for Wastewater before treatment (polluted)
  - Sampling system for Finished drinking water (clean)
- Compounds tables
  - Method 502.2: 60 compounds
- Applications

Principle

- Glass purging device is designed to allow 5 ml samples with water column at least 5 cm deep.
- Dead volume must be less than 15 ml
- **Inert gas** is needed to purge **5 ml water sparger with bubbles (created by the frit) less than 3 mm at the base of the sample.**
  - N_2 generator is delivered with this automatic sparger.
- Automatic water rinsing for surveillence with liquid pump and injection system for 5 ml.

Soil water sample preparation

- Very polluted water such as soil water may contain a lot of pollutants:
  - Oil
  - Suspended Particles
  - Bacteria

- Chromatotec proposes its specific water preparation systems (up to 5 different systems) to remove the pollution before analysis by Purge&Trap

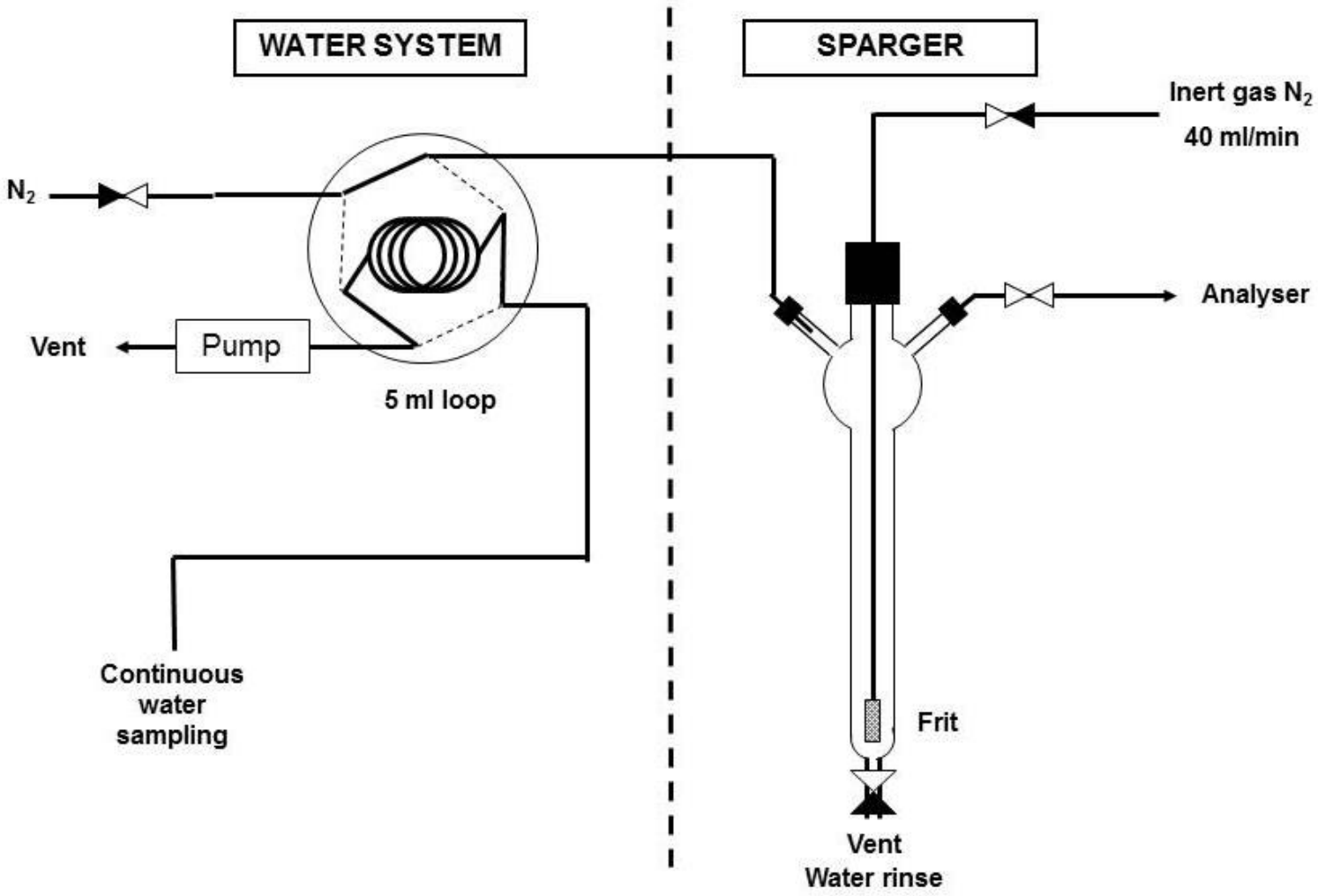
Wastewater before treatment

- Polluted water such as Wastewater may contain a lot of pollutants:
  - Suspended Particles
  - Bacteria
- Then, Chromatotec proposes its specific water preparation systems (filters, separators, …) to provide solid-free and bacteria-free samples to the analytical system

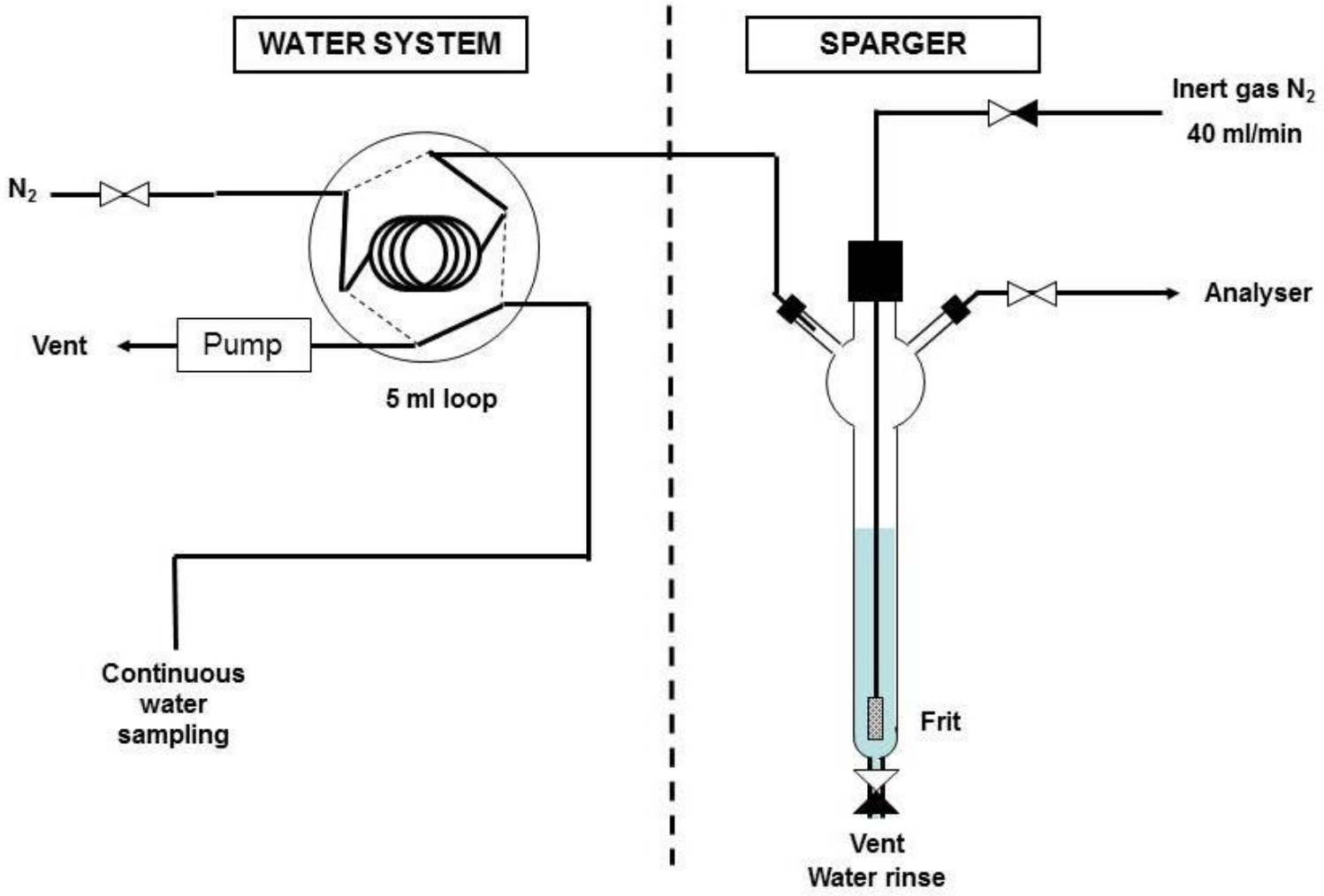
Finished drinking water preparation

- This sample is supposed to be clean as it will be used for human consumption
- Therefore, no specific sampling systems are required before analysis
- A complete overview of VOC concentrations in the sample will be given by Chromatotec's Purge&Trap system

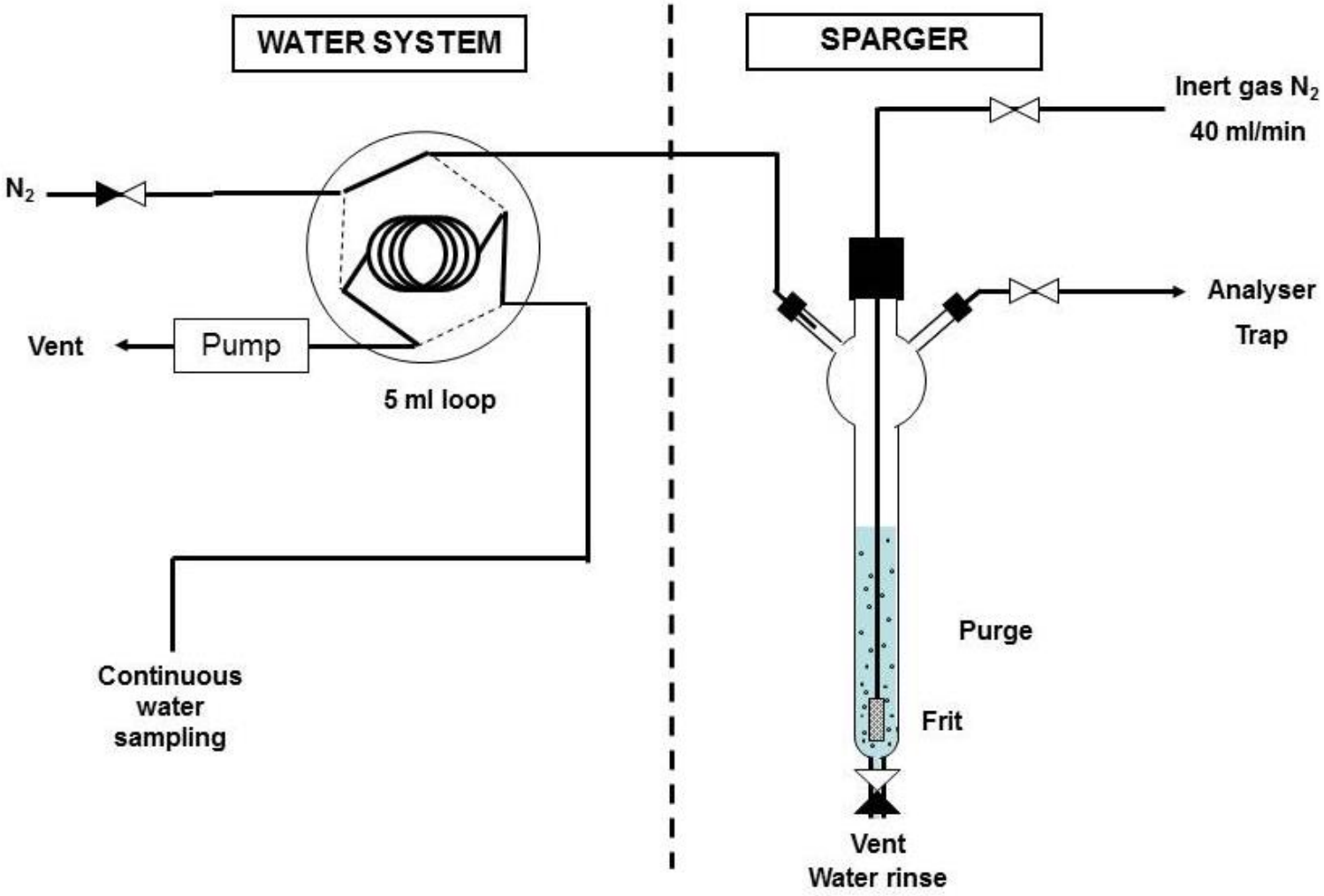
Water sampling



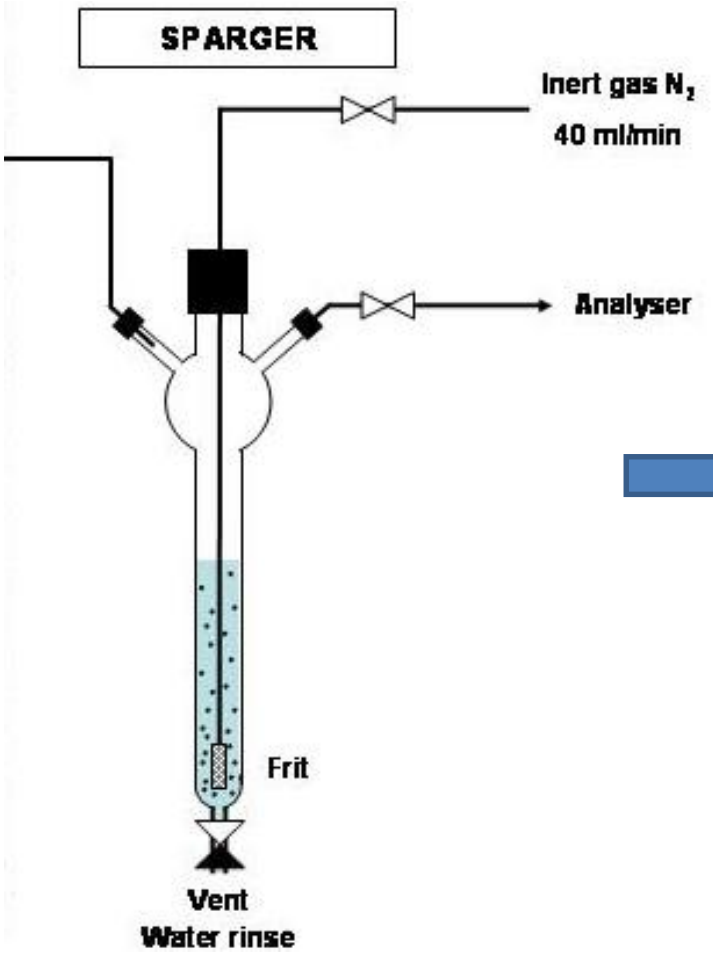
Water sampling



Water sampling



Water sampling



Chromatotec® Analyzer

- Continuous sampling
- Analysis and monitoring

Nitrogen

- N_2 generator: N_2 production contains less than
  - 2 ppm O_2
  - 100 ppt Total Hydrocarbon
  - Dew point < -18°C

- N_2 flow regulation for VOCs extraction: **40 ml/min**
  - Volume calculation is memorized in VISTACHROM
  - Unit display can be in mass (ng) or µg/L

Purge & Trap

- **11 minutes purge & trap extraction for:**
  - Range = 0,01 to 200 µg per liter (water) or m^3 (air)

- airmoCAL is used for
  - VOCs linearity
  - Zero validation with blank
  - Calibration / Inter calibration by liquid and gas

- Air analysis above surface water in sequence with water analysis for validation of results and water quality control with airmozone Purge & Trap

Display software &Data transfer

- VISTACHROM display
  - Pressure, flow, temperatures on the supervisor
  - Purge sampling temperature
  - Communicate sampling / analytical / calcul parameters to final end user

- For traceability Chromatotec® use a supervisor

Solution

- airmoPURE (Zero Air generator)
- N2 generator
- Hydroxychrom (H2 generator)
- airmoCAL (option: dilution)
- airmoVOC (C6-C12 model)
- Detectors: FID or PID or ELCD or Mass Detector
- Purge system for finishing drinking water (you need to complete with sampling system for non filtered water)

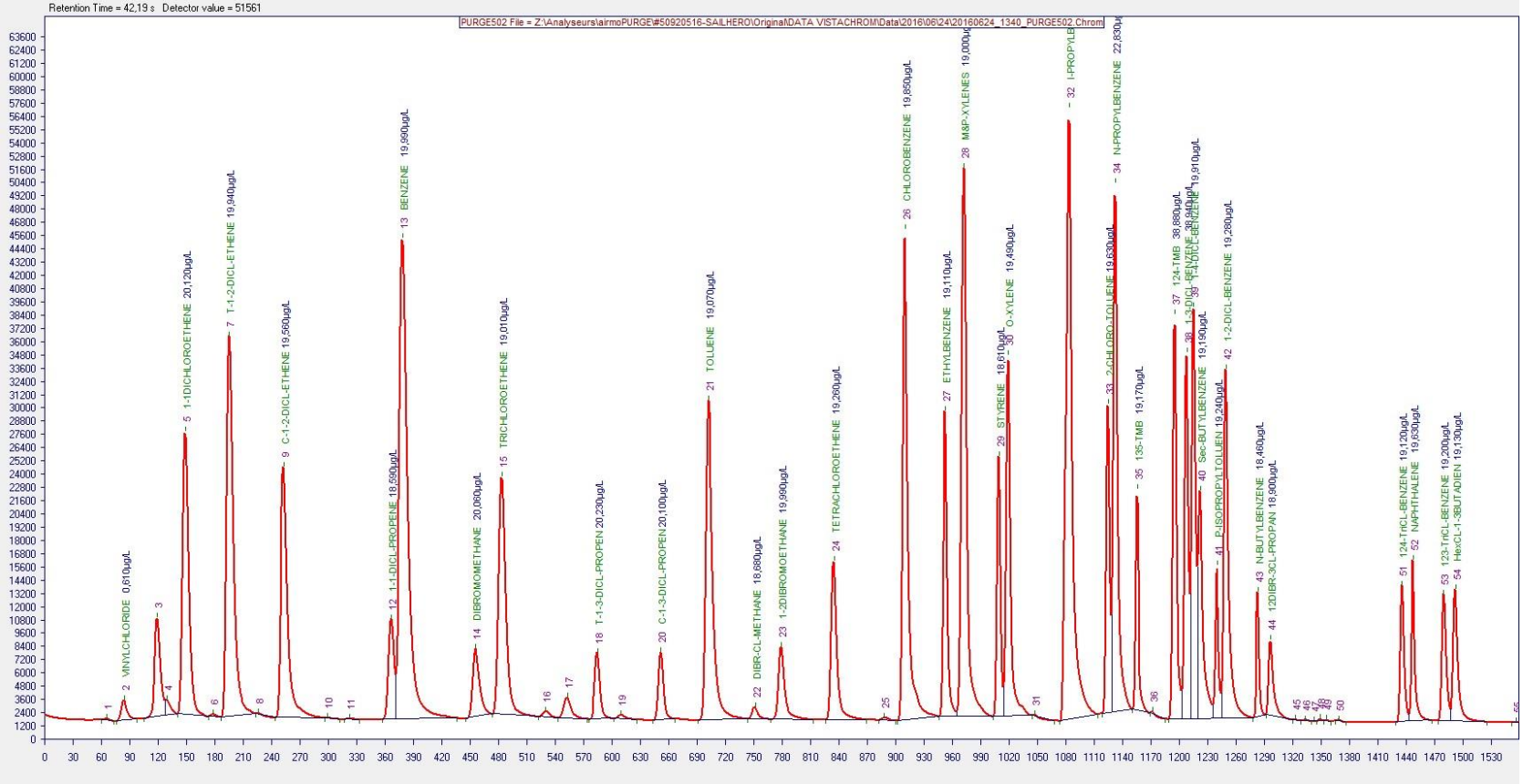
Outline

- VOC extraction using Purge & Trap system (US EPA 502.2 Method)
- Compounds tables
  - Method 502.2: 60 compounds
- Applications

Compounds list with airTOXIC purge PID : 40 compounds

	Analytes	CAS Registry Number		Analytes	CAS Registry Number
1	Benzene	71-43-2	21	Ethylbenzene	100-41-4
2	Bromobenzene	108-86-1	22	Hexachlorobutadiene	87-68-3
3	n-Butylbenzene	104-51-8	23	Isopropylbenzene	98-82-8
4	sec-Butylbenzene	135-98-8	24	4(p)-IsopropylToluene	99-87-6
5	tert-Butylbenzene	98-06-6	25	Naphthalene	91-20-3
6	Chlorobenzene	108-90-7	26	(N) PropylBenzene	103-65-1
7	2-Chlorotoluene	95-49-8	27	Styrene	100-42-5
8	4-Chlorotoluene	106-43-4	28	Tetrachloroethene	127-18-4
9	1,2-Dibromoethane	106-93-4	29	Toluene	108-88-3
10	1,2-Dichlorobenzene	95-50-1	30	1,2,3-Trichlorobenzene	87-61-6
11	1,3-Dichlorobenzene	541-73-1	31	1,2,4-Trichlorobenzene	120-82-1
12	1,4-Dicholorobenzene	106-46-7	32	Trichloroethene	79-01-6
13	1,1-Dichloroethene	75-35-4	33	1,2,4-Trimethylbenzene	95-63-6
14	cis-1,2-Dichloroethene	156-59-4	34	1,3,5-Trimethylbenzene	108-67-8
15	trans-1,2-Dichloroethene	156-60-5	35	Vinyl Chloride	75-01-4
16	1,1-Dichloropropene	563-58-6	36	o-Xylene	95-47-6
17	Cis-1,3-Dichloropropene	10061-01-5	37	m-Xylene	108-38-3
18	Trans-1,3-Dichloropropene	10061-02-6	38	p-Xylene	106-42-3
19	Dibromochloromethane	124-48-1	39	Bromoform	75-25-2
20	1-2 DiBromo 3 Chloro Propane	96-12-8	40	DiBromoMethane	74-95-3

airTOXIC purge PID chromatogram: 502.2 standard containing 54 compounds



Analysis realized with a 40 minutes cycle.

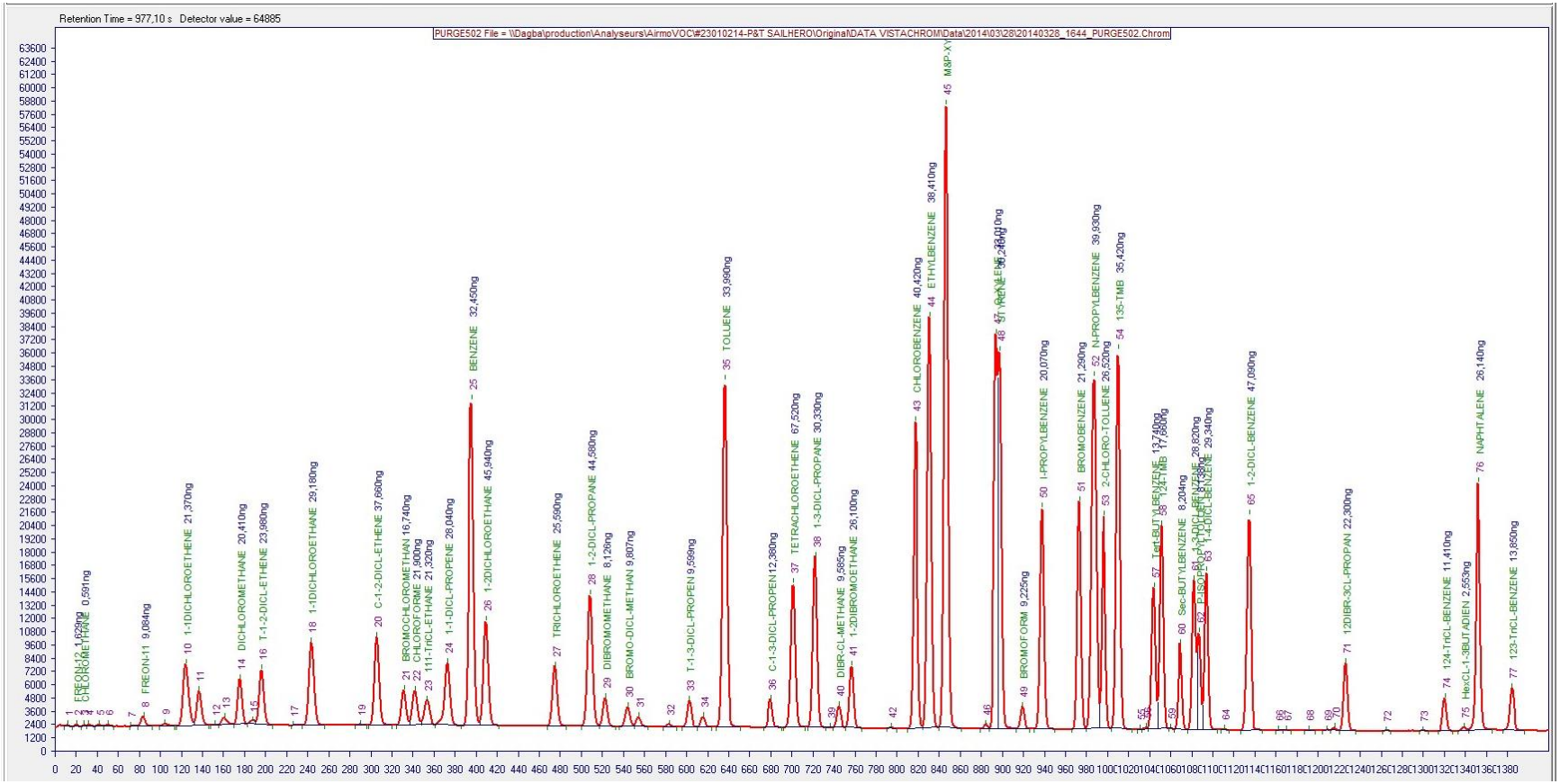
It exists another standard which contains 6 compounds: dichlorodifluoromethane, Chloromethane, Vinyl chloride, Bromomethane, Chloroethane, Trichlorofluoromethane.

502.2 List: 60 compounds with airmoVOC 624 FID or (PID & ELCD)

	Analytes	CAS Registry Number		Analytes	CAS Registry Number
1	Benzene	71-43-2	31	1,3-Dichloropropane	142-28-9
2	Bromobenzene	108-86-1	32	2,2-Dichloropropane	590-20-7
3	Bromochlorometane	74-97-5	33	1,1-Dichloropropene	563-58-6
4	Bromodichloromethane	75-27-4	34	Cis-1,3-Dichloropropene	10061-01-5
5	Bromoform	75-25-2	35	Trans-1,3-Dichloropropene	10061-02-6
6	Bromomethane	74-83-9	36	Ethylbenzene	100-41-4
7	n-Butylbenzene	104-51-8	37	Hexachlorobutadiene	87-68-3
8	sec-Butylbenzene	135-98-8	38	Isopropylbenzene	98-82-8
9	tert-Butylbenzene	98-06-6	39	4-Isopropylbenzene	99-87-6
10	Carbon Tetrachloride	56-23-5	40	Methylene Chloride	75-09-2
11	Chlorobenzene	108-90-7	41	Naphtalene	91-20-3
12	Chloroethane	75-00-3	42	Propylbenzene	103-65-1
13	Chloroform	67-66-3	43	Styrene	100-42-5
14	Chloromethane	74-87-3	44	1,1,2,2-Tetrachloroethane	630-20-6
15	2-Chlorotoluene	95-49-8	45	1,1,1,2-Tetrachloroethane	79-34-5
16	4-Chlorotoluene	106-43-4	46	Tetrachloroethene	127-18-4
17	Dibromochloromethane	124-48-1	47	Toluene	108-88-3
18	1,2-Dibromo-3-Chloropropane	96-12-8	48	1,2,3-Trichlorobenzene	87-61-6
19	1,2-Dibromoethane	106-93-4	49	1,2,4-Trichlorobenzene	120-82-1
20	Dibromomethane	74-95-3	50	1,1,1-Trichloroethane	71-55-6
21	1,2-Dichlorobenzene	95-50-1	51	1,1,2-Trichloroethane	79-00-5
22	1,3-Dichlorobenzene	541-73-1	52	Trichloroethene	79-01-6
23	1,4-Dicholorobenzene	106-46-7	53	Trichlorofluoromethane	75-69-4
24	Dichlorodifluoromethane	75-71-8	54	1,2,3-Trichloropropane	96-18-4
25	1,1-Dichloroethane	75-34-3	55	1,2,4-Trimethylbenzene	95-63-6
26	1,2-Dichloroethane	107-06-2	56	1,3,5-Trimethylbenzene	108-67-8
27	1,1-Dichloroethene	75-35-4	57	**Vinyl Chloride**	75-01-4
28	cis-1,2-Dichloroethene	156-59-4	58	o-Xylene	95-47-6
29	trans-1,2-Dichloroethene	156-60-5	59	m-Xylene	108-38-3
30	1,2-Dichloropropane	78-87-5	60	p-Xylene	106-42-3

In bold: compounds with risk of co elution

airmoVOC 624 purge FID chromatogram: 502.2 standard containing 54 compounds



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It exists another standard which contains 6 compounds: dichlorodifluoromethane, Chloromethane, Vinyl chloride, Bromomethane, Chloroethane, Trichlorofluoromethane.

502.2 List: 60 compounds with airmoVOC 624 + DET QMS

	Analytes	CAS Registry Number		Analytes	CAS Registry Number
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2	Bromobenzene	108-86-1	32	2,2-Dichloropropane	590-20-7
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4	Bromodichloromethane	75-27-4	34	Cis-1,3-Dichloropropene	10061-01-5
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10	Carbon Tetrachloride	56-23-5	40	Methylene Chloride	75-09-2
11	Chlorobenzene	108-90-7	41	Naphtalene	91-20-3
12	Chloroethane	75-00-3	42	Propylbenzene	103-65-1
13	Chloroform	67-66-3	43	Styrene	100-42-5
14	Chloromethane	74-87-3	44	1,1,2,2-Tetrachloroethane	630-20-6
15	2-Chlorotoluene	95-49-8	45	1,1,1,2-Tetrachloroethane	79-34-5
16	4-Chlorotoluene	106-43-4	46	Tetrachloroethene	127-18-4
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18	1,2-Dibromo-3-Chloropropane	96-12-8	48	1,2,3-Trichlorobenzene	87-61-6
19	1,2-Dibromoethane	106-93-4	49	1,2,4-Trichlorobenzene	120-82-1
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22	1,3-Dichlorobenzene	541-73-1	52	Trichloroethene	79-01-6
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27	1,1-Dichloroethene	75-35-4	57	Vinyl Chloride	75-01-4
28	cis-1,2-Dichloroethene	156-59-4	58	o-Xylene	95-47-6
29	trans-1,2-Dichloroethene	156-60-5	59	m-Xylene	108-38-3
30	1,2-Dichloropropane	78-87-5	60	p-Xylene	106-42-3

No risk of co elution or bad identification

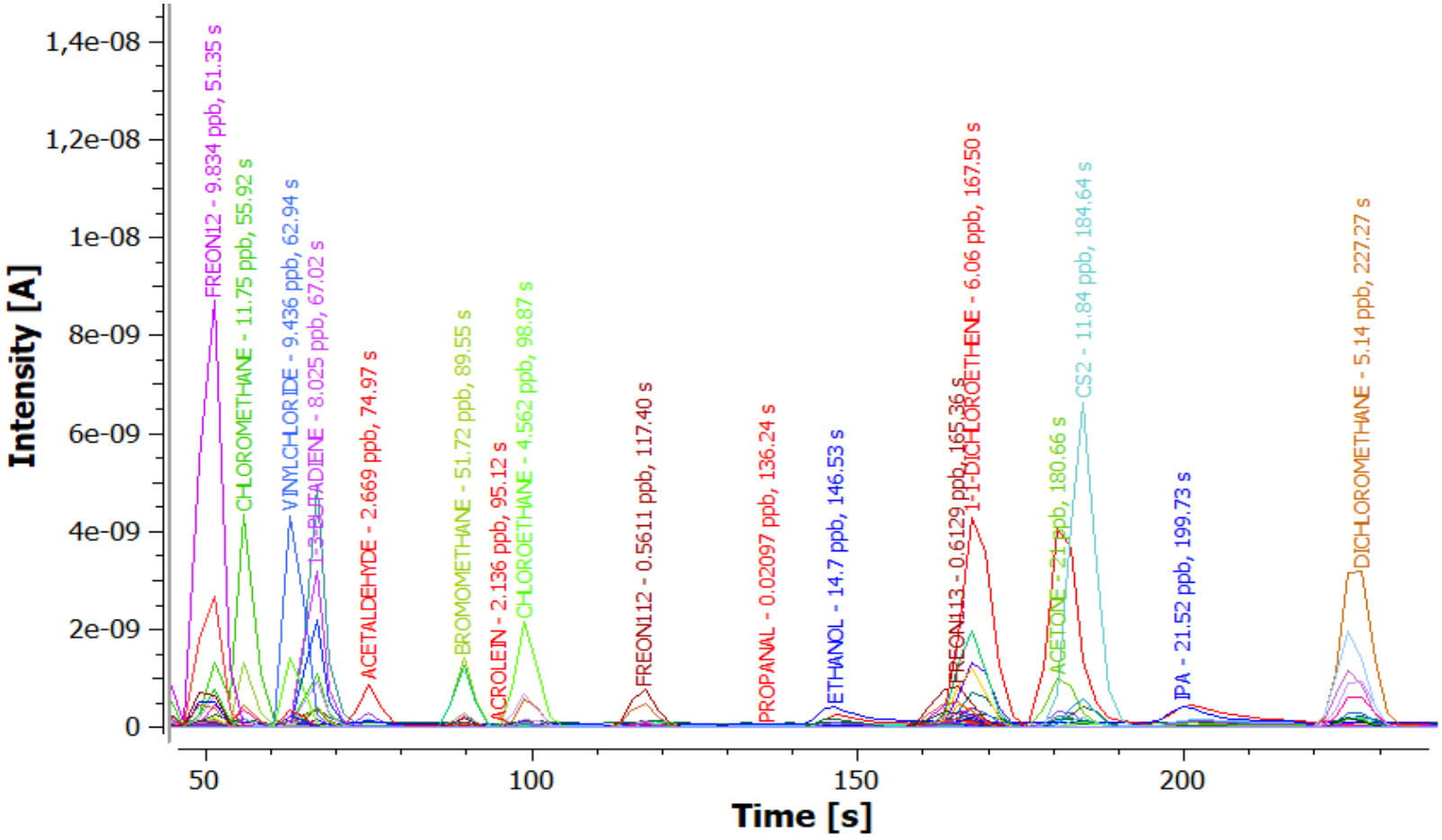
More sensitivity on Freon compounds

Other compounds analyzed
with airmoVOC 624 + DET QMS

	Analytes	CAS Registry Number
1	1-3 Butadiene	106-99-0
2	Acetaldehyde	75-07-0
3	Freon 112	76-13-1
4	Propanal	123-38-6
5	Ethanol	64-17-5
6	Freon113	76-13-1
7	Acetone	67-64-1
8	CS2	75-15-0
9	IPA	67-63-0
10	MTBE	1634-04-4
11	MPK	107-87-9
12	MVK	78-94-4
13	MEK	78-93-3
14	Ethyl Acetate	141-78-6
15	THF	109-99-9
16	Chloroforme	67-66-3
17	CCL4	56-23-5
18	1-4 Dioxane	123-91-1
19	MethylMetacrylate	80-62-6
20	MIBK	108-10-1
21	MBK	591-78-6
22	Benzylchloride	100-44-7

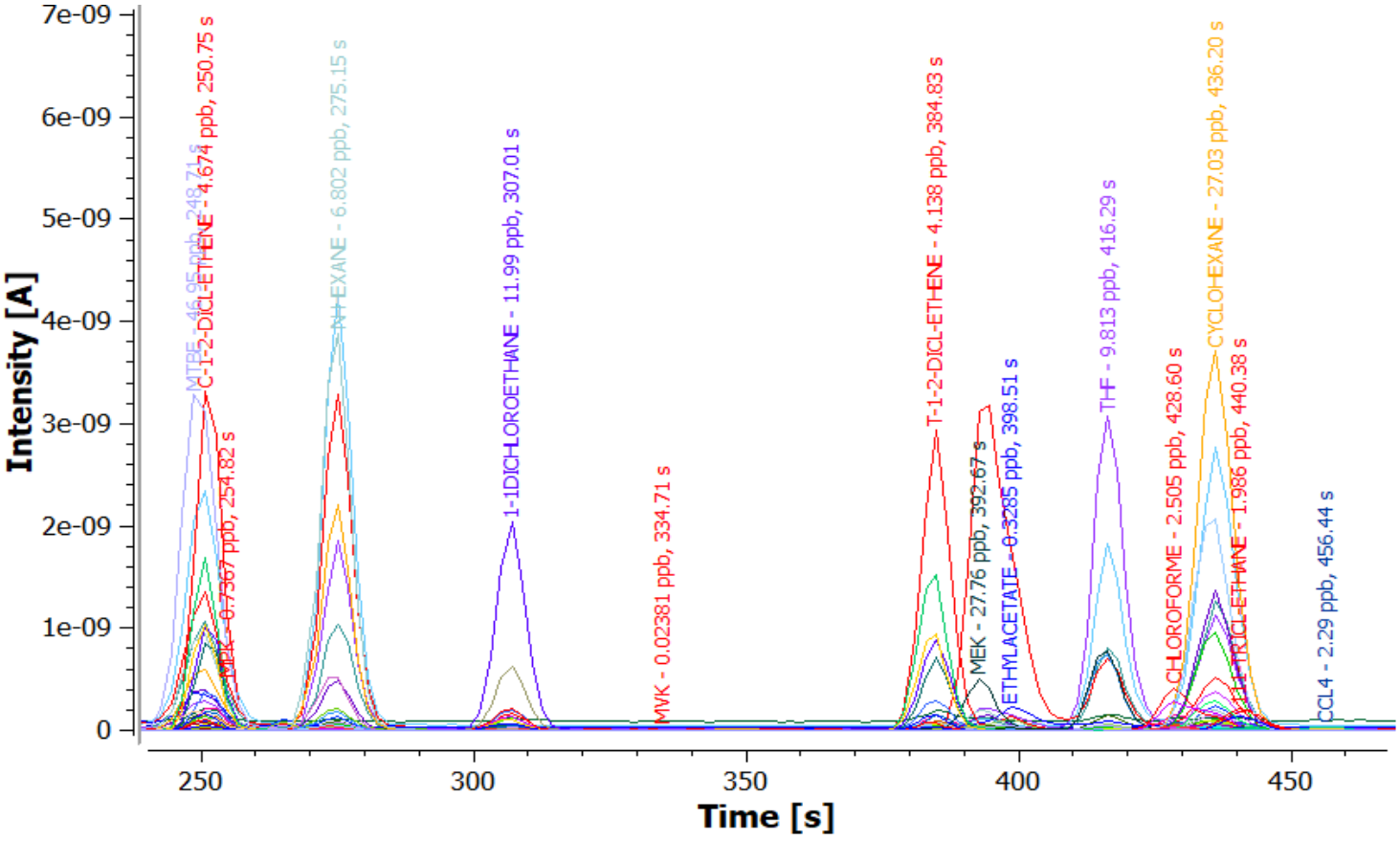
This VOCs compounds list is based on international standard TO15 and US EPA method 502-2 and other VOCs can be analyzed under request

airmoVOC 624 + DET QMS purge chromatogram: first part



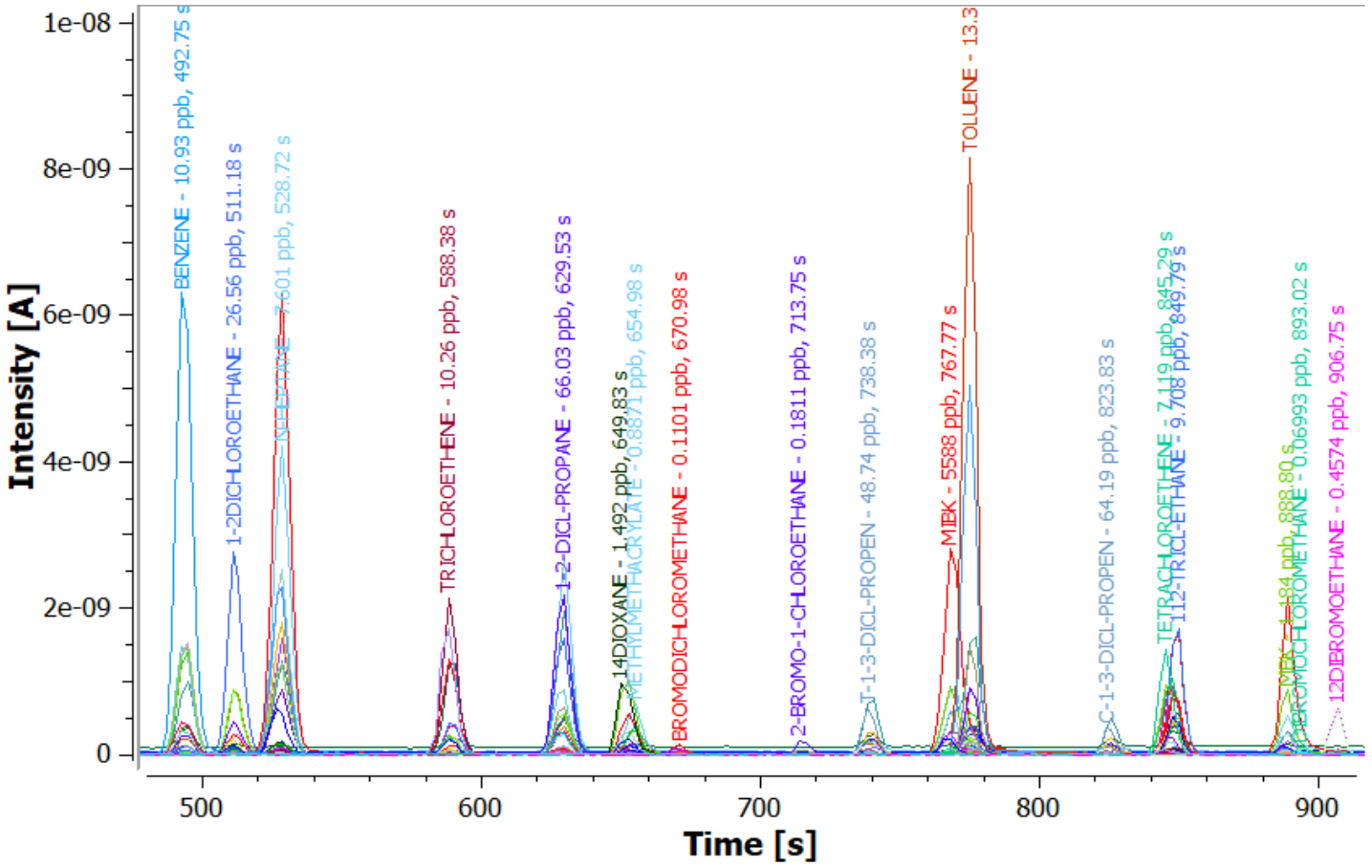
Analysis realized with a 40 minutes cycle on TO15

airmoVOC 624 + DET QMS purge chromatogram: second part



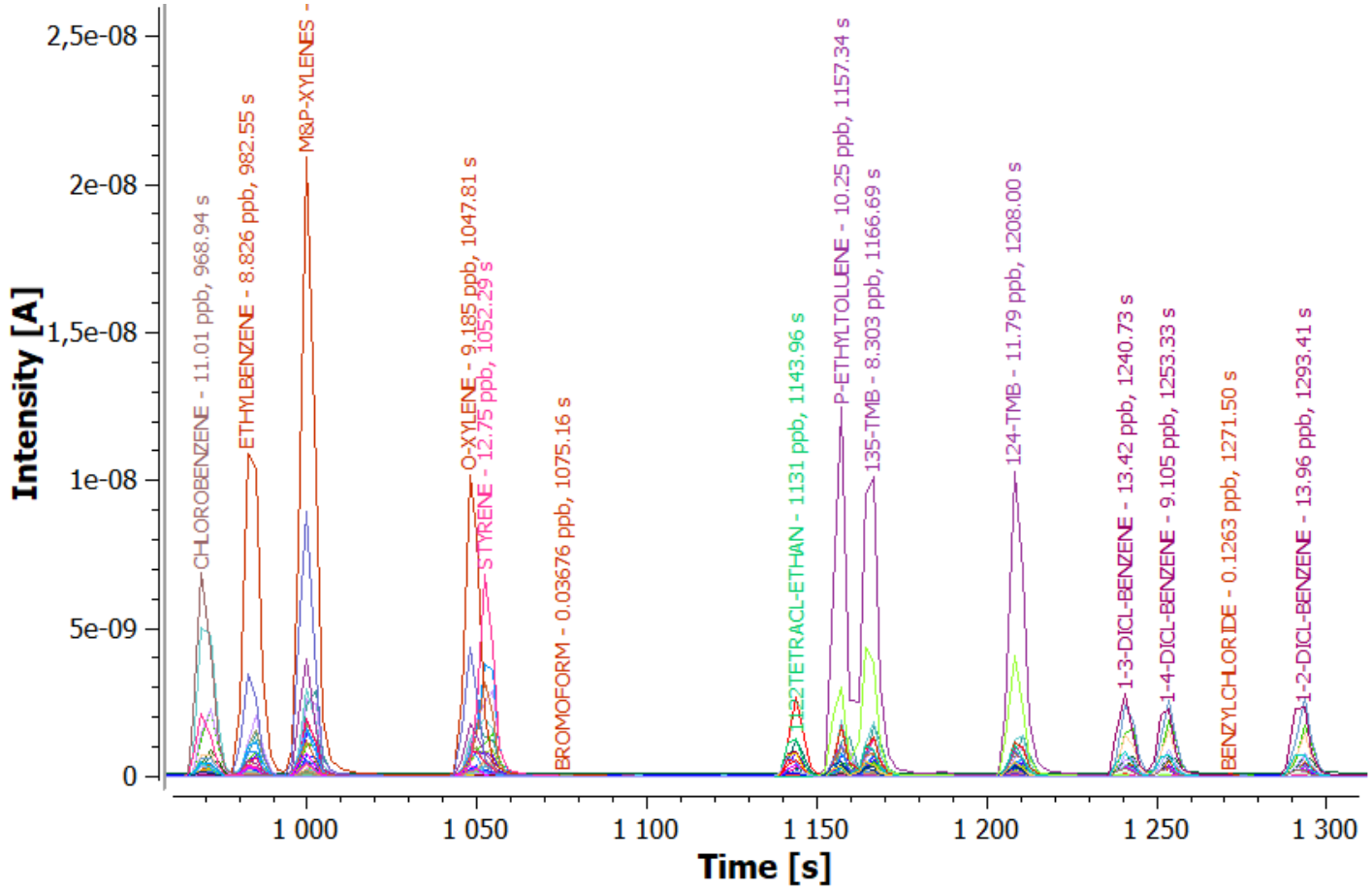
Analysis realized with a 40 minutes cycle on TO15

airmoVOC 624 + DET QMS purge chromatogram: third part



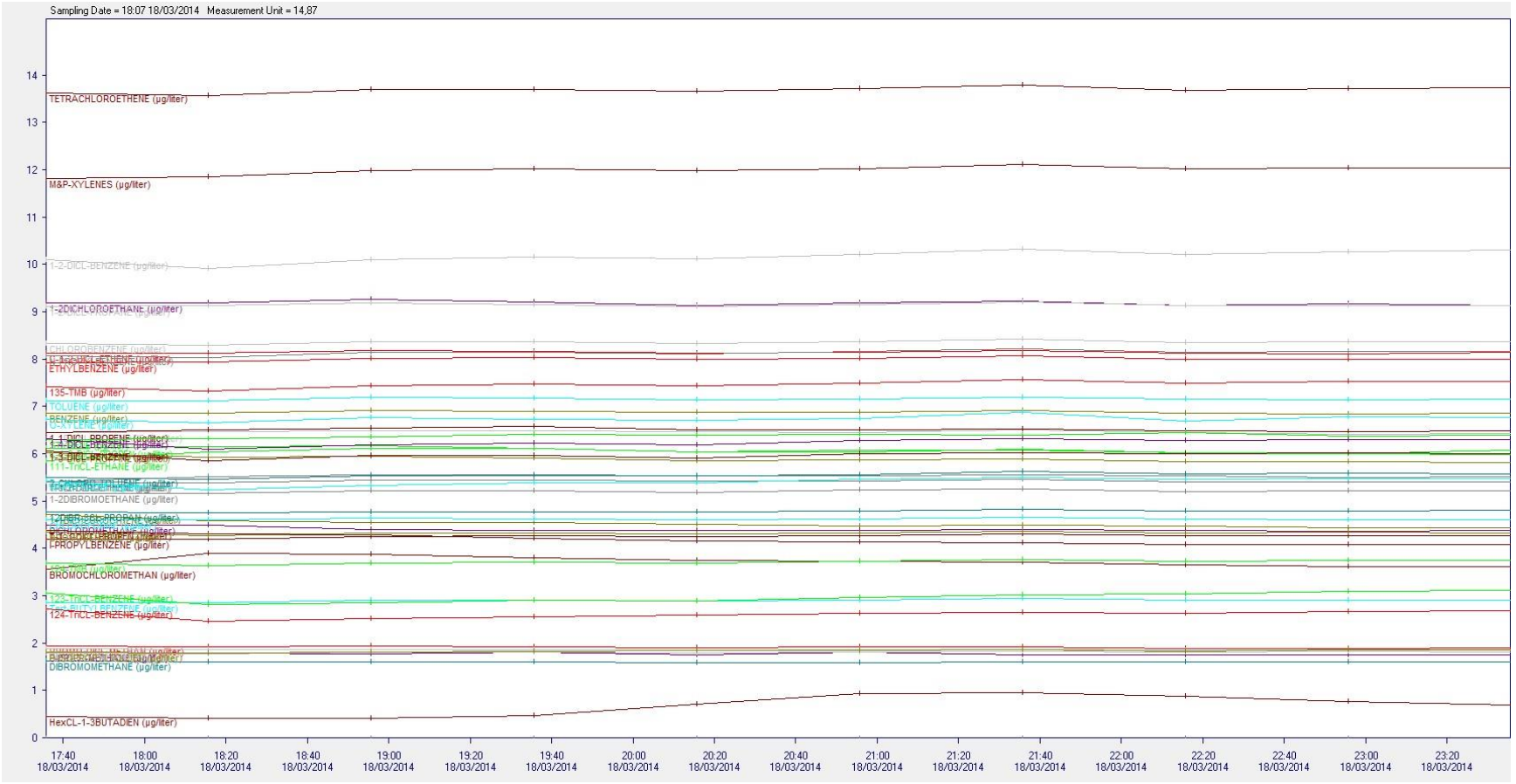
Analysis realized with a 40 minutes cycle on TO15

airmoVOC 624 + DET QMS purge chromatogram: fourth part



Analysis realized with a 40 minutes cycle on TO15

Stability of analysis
VOC standard in water



Analysis realized with a 40 minutes cycle.

Outline

- VOC extraction using Purge & Trap system (US EPA 502.2 Method

- Compounds tables
  - Method 502.2: 60 compounds

- Applications

Applications

- Environment
  - Raw source water
  - River water
  - Seawater
  - Rain water
- Drinking water
  - Finished drinking water
  - Bottled water

Main Benefits vs existing solution

- Combined solution with unique instrument :
  - Air
  - Water
- Capability to integrate ‘blank’ to be sure that no contaminants are presents on second analysis (no memory effect)
- On line analyzer without specific gases required (**no Argon** needed, use of standard air generators for simplified used)
- Recognized solution with standard detector
- Auto calibration with auto data validation

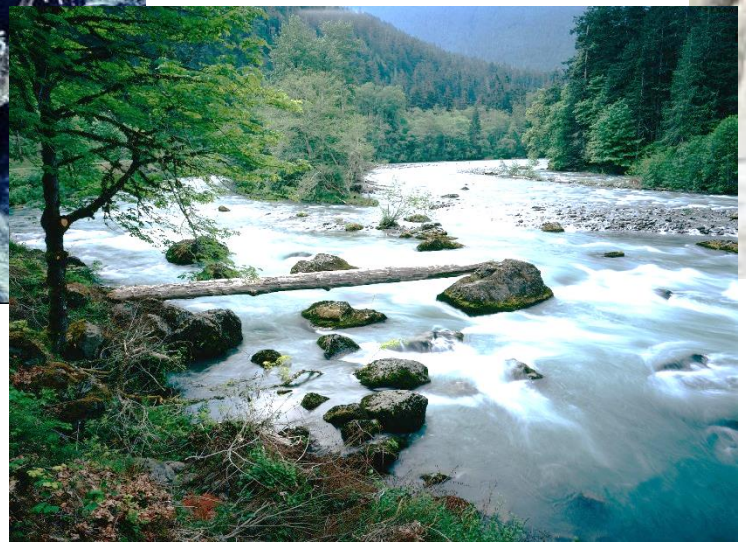
Conclusion

- All our competences and experiences on air quality monitoring (European Certifications, US EPA Test, Chinese National Certification…) allow us to develop water quality monitoring

- Specific and adequate sample conditioner systems are provided depending on customer and application needs

- Calibration is carried out with gas sample.

- Various & tunable detectors available :
  - FID (reference detector: linear and stable)
  - Other detectors: PID and ELCD (502.2 method),
  - Mass Detector (524 method).



Thank you for your attention !