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AECOM

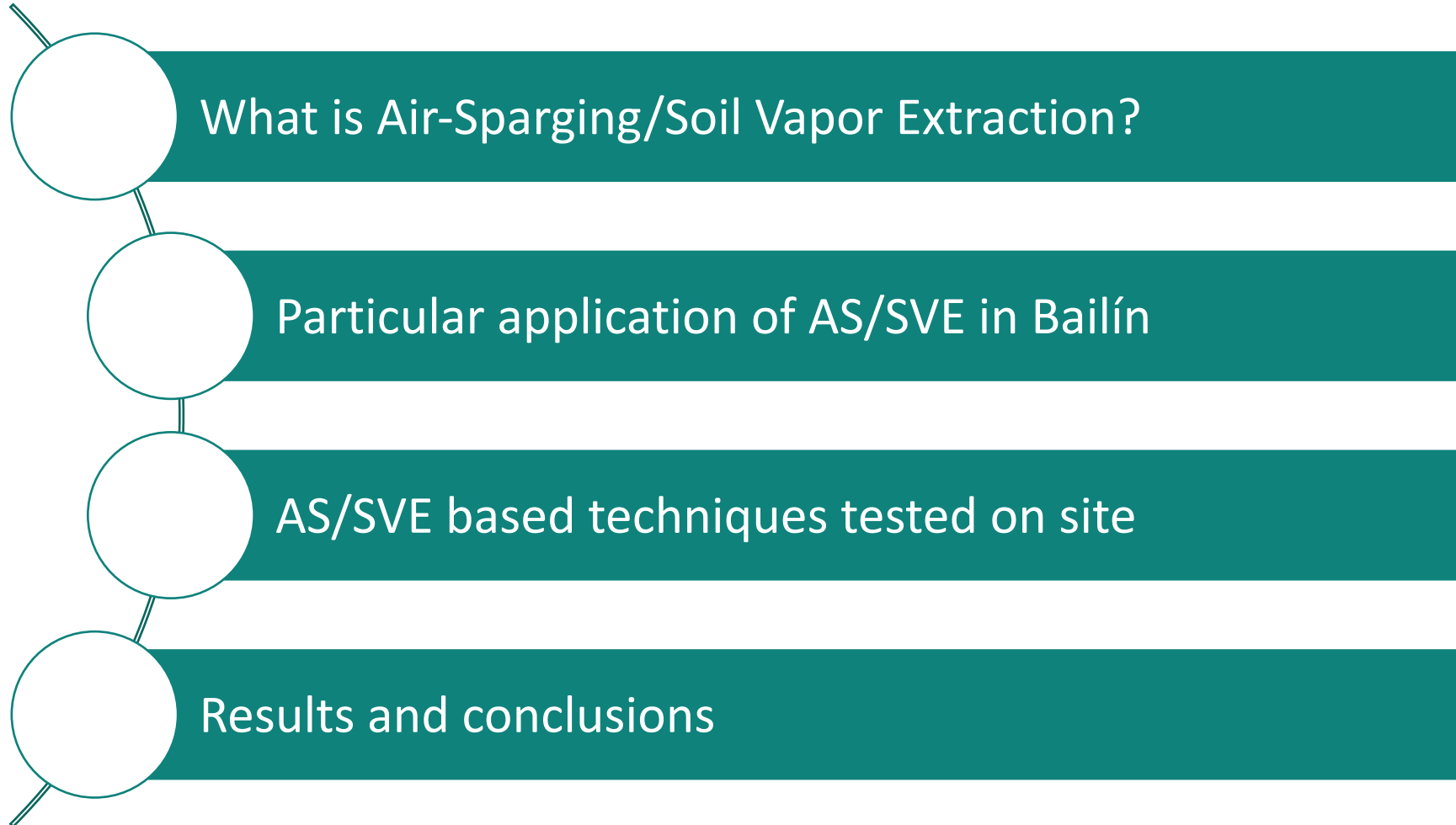
AIR SPARGING AND SOIL-VAPOR EXTRACTION PILOT TESTS IN BAILIN LANDFILL, SABIÑANIGO (HUESCA)

Alonso T.¹, Alcalde D.¹, Escobar-Arnanz J.¹, Encinas R.¹, Fernández J.²

¹ AECOM. Environment and Sustainability Department. Remediation Area. Spain

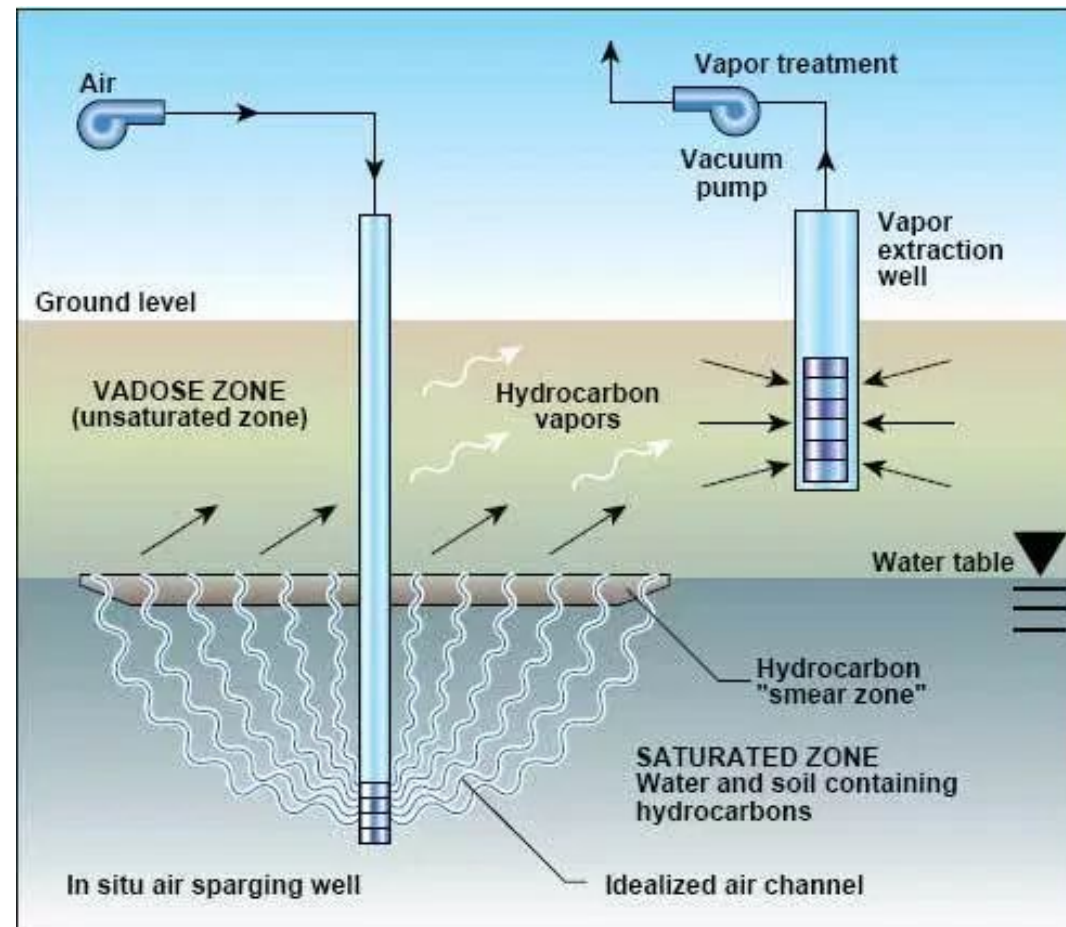
² Department of Agriculture. Livestock and Environment. Aragón's Government. Zaragoza. Spain

ROADMAP



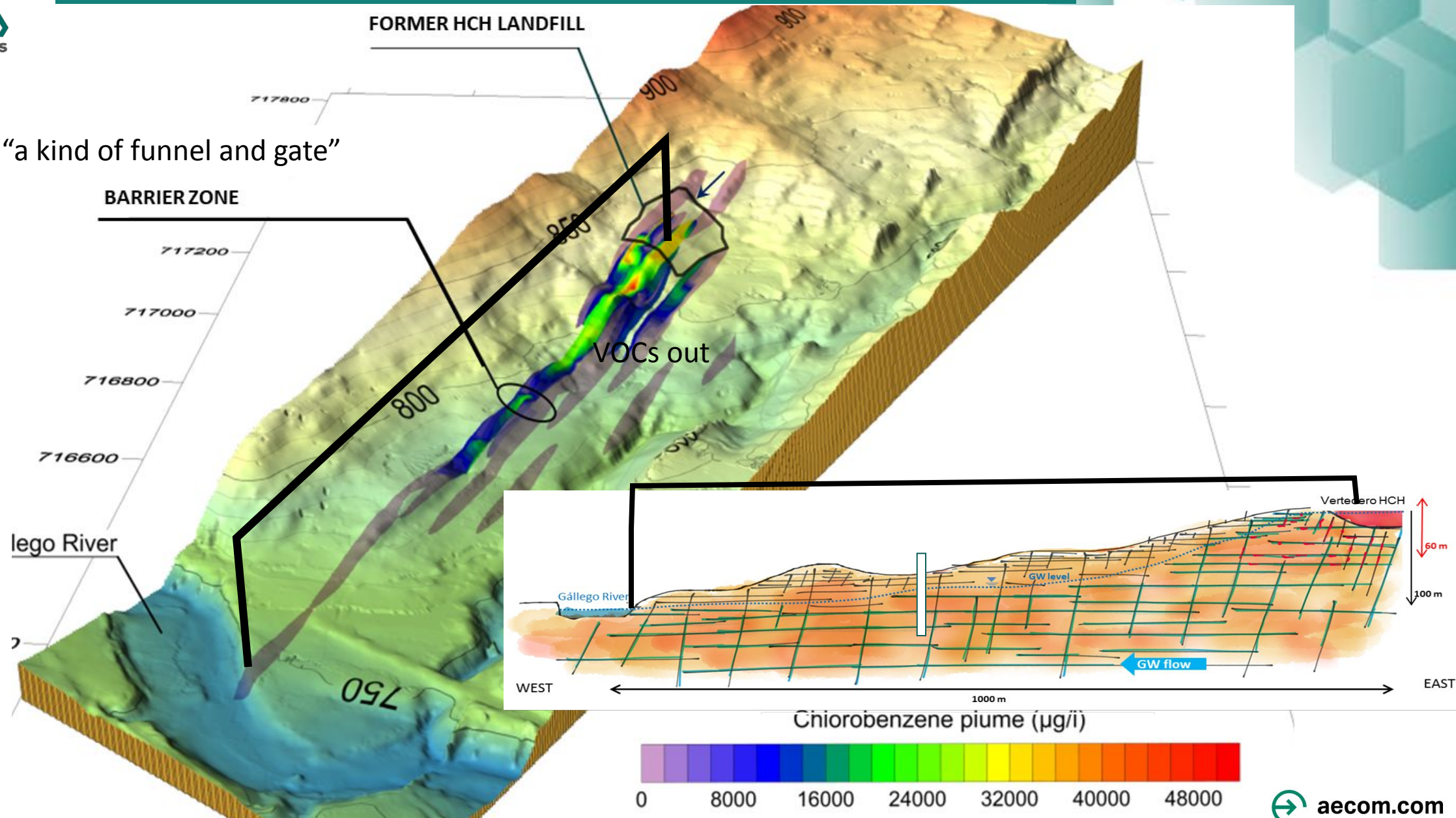
WHAT IS AIR-SPARGING/SOIL VAPOR EXTRACTION?

- AS/SVE is a remediation technique used for the treatment of VOCs & SVOCs
- AS involves injecting clean air into the saturated zone to volatilize groundwater contaminants.
- SVE involves extraction of the vapor phase from the vadose zone

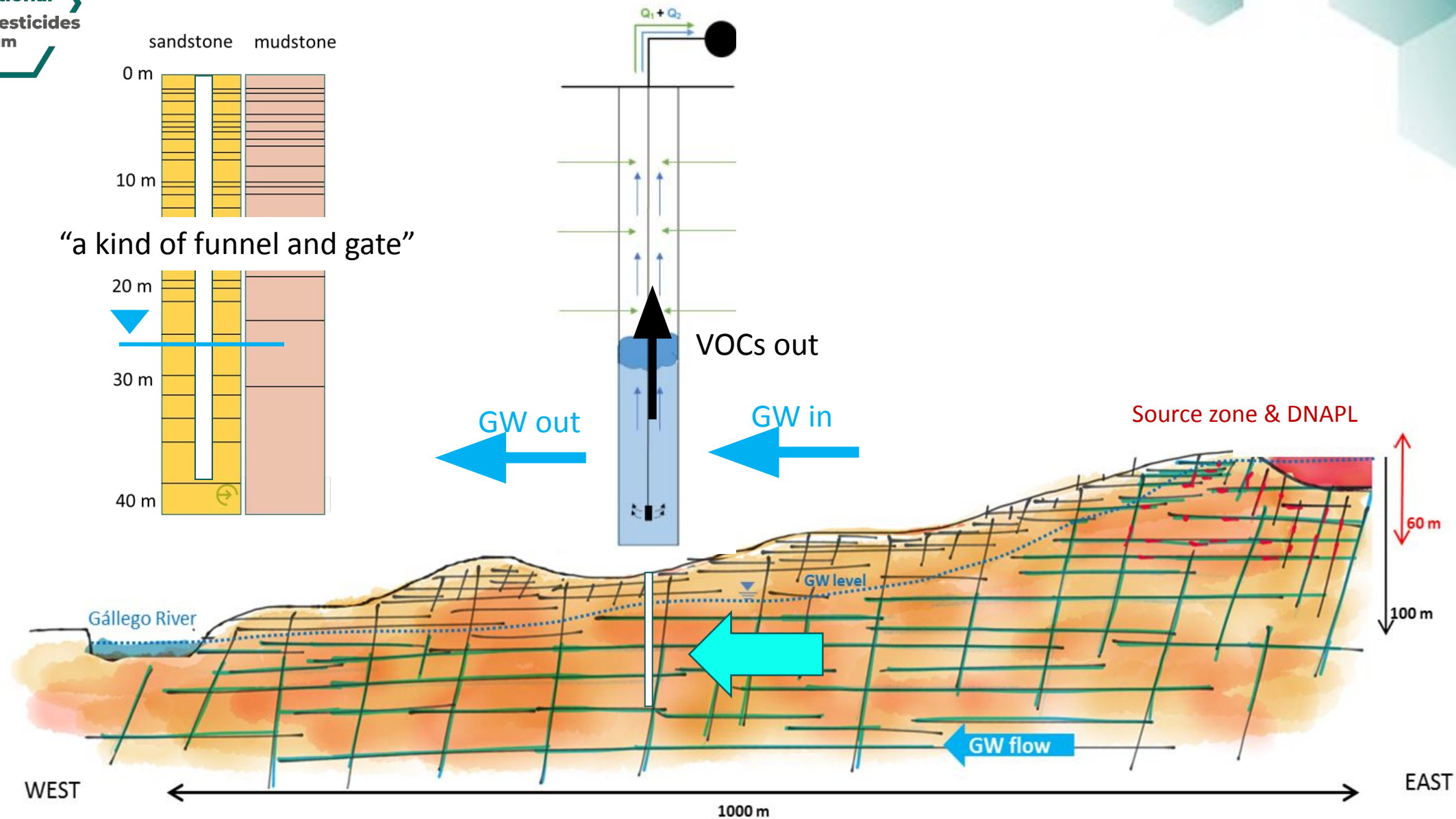


AS/SVE CUSTOMIZATION TO BAILIN'S CONCEPTUAL MODEL

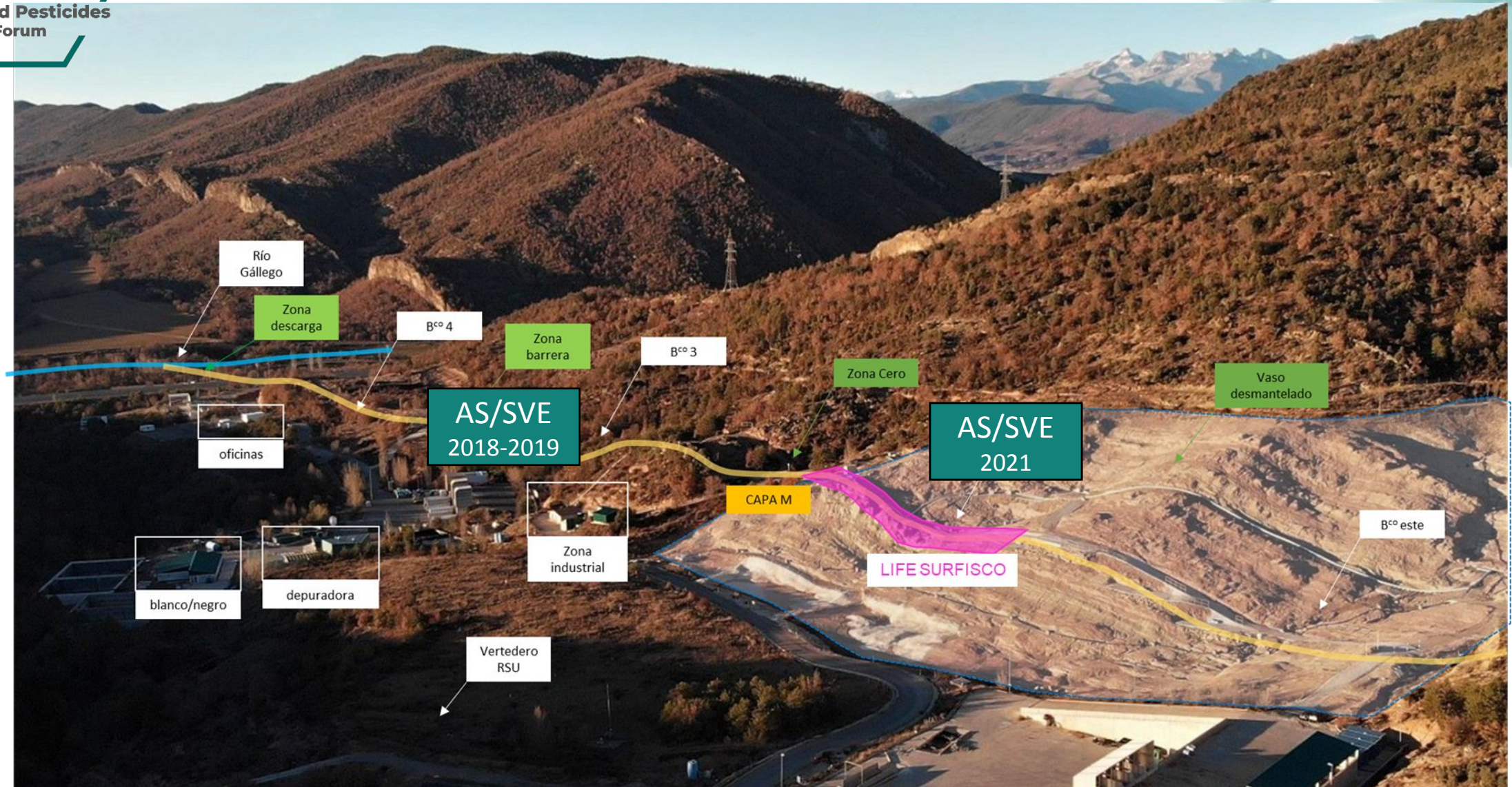
“a kind of funnel and gate”



AS/SVE CUSTOMIZATION TO BAILIN'S CONCEPTUAL MODEL



AS/SVE PILOT TESTS



AS/SVE PILOT TESTS: OBJECTIVES

Main goal: evaluate total mass removal rate (g/d)

2018

- Testing and adapting several configurations based on AS/SVE technique → 1 Monitoring well
 1. AS/SVE
 2. AS/SVE + IWAS
 3. AS/SVE + $\uparrow T^{\circ}C$

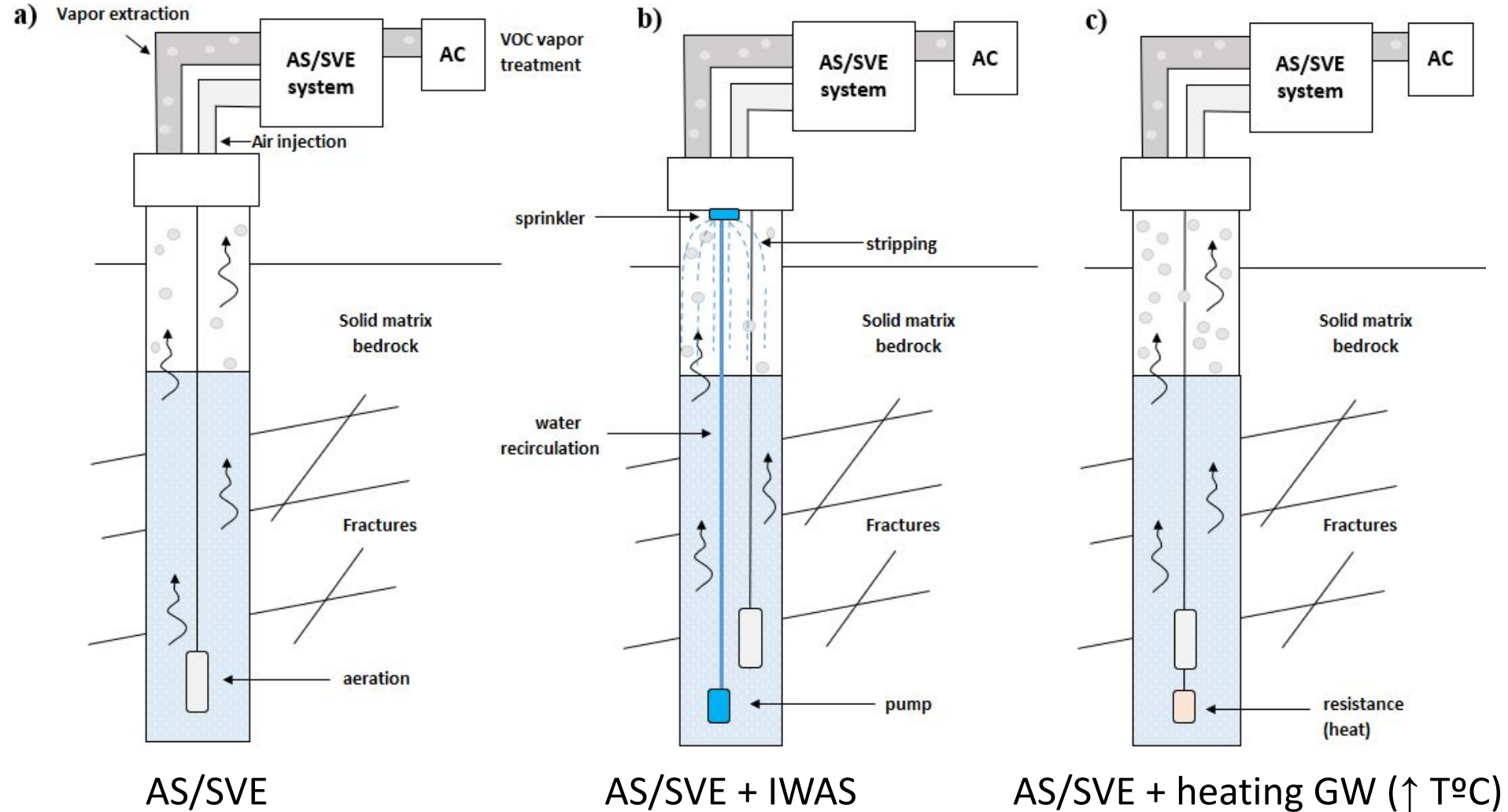
2019

- Testing the more convenient configuration of 2018 → 4 Monitoring well
- Try to couple AS/SVE + ISCO
- Control barrier: AS/SVE plant design

2021

- Testing more convenient configuration of 2018 → 3 Monitoring well in mudstones → former HCH landfill

2018: AS/SVE BASED TECHNIQUES DEPLOYED ON SITE



AS/SVE 2018



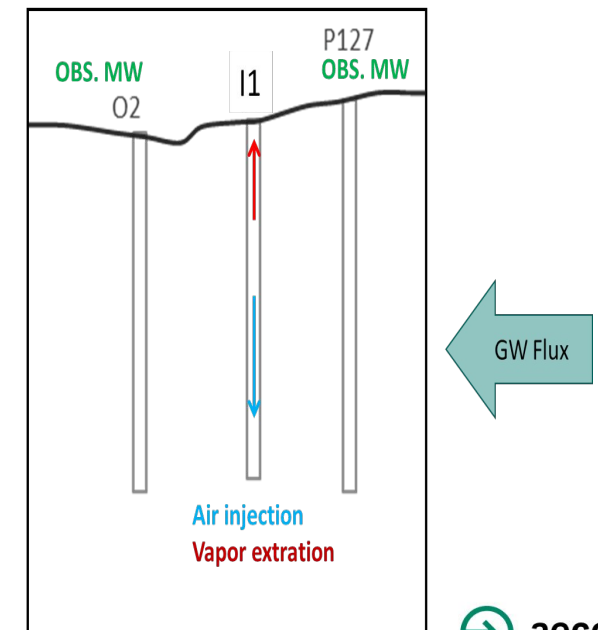
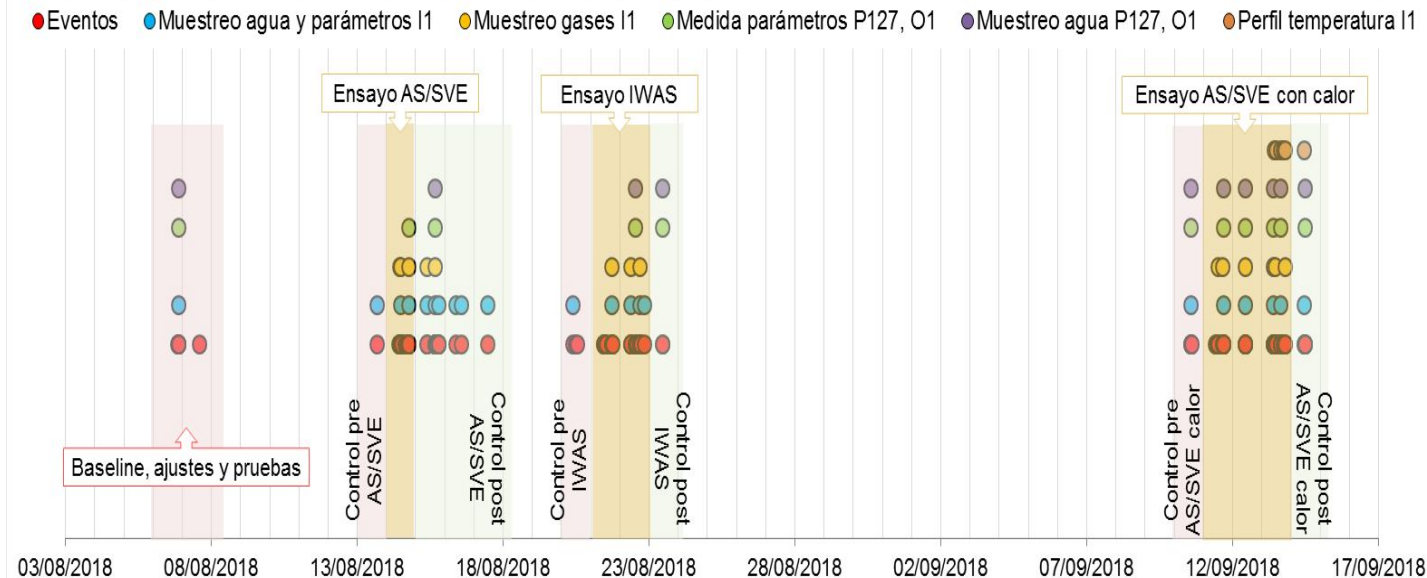
Injection and monitoring equipment designed by AECOM.
Real time visualization and recording.
Standard AS/SVE equipment is not suited to the needs of the
Bailín fractured media.

AS/SVE 2018

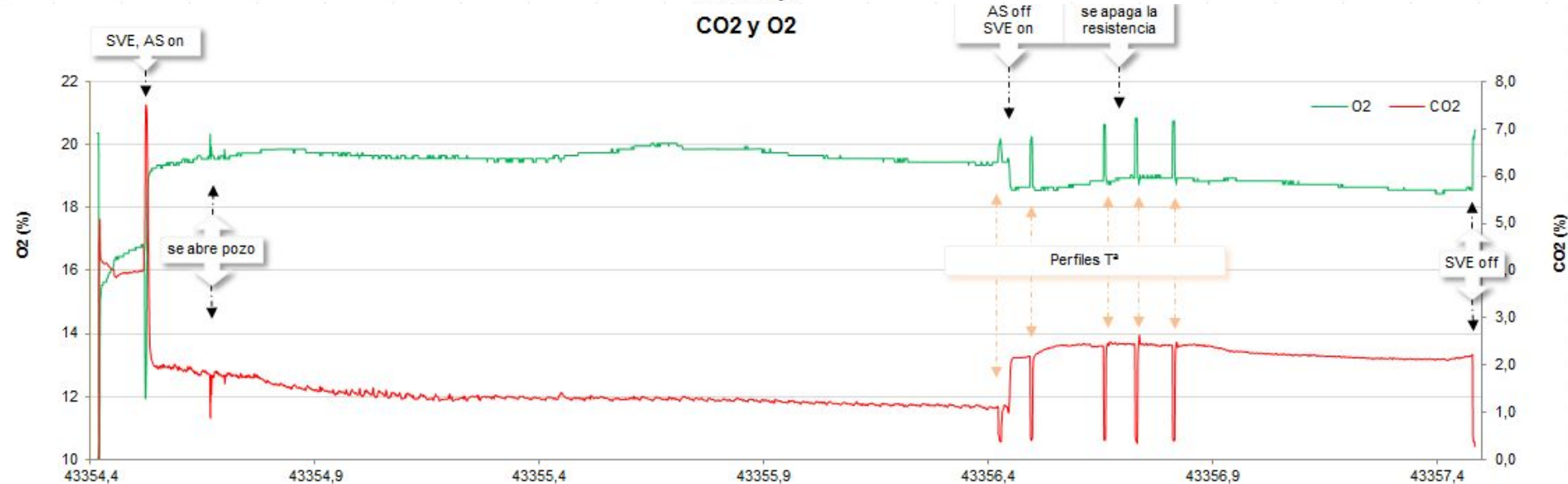
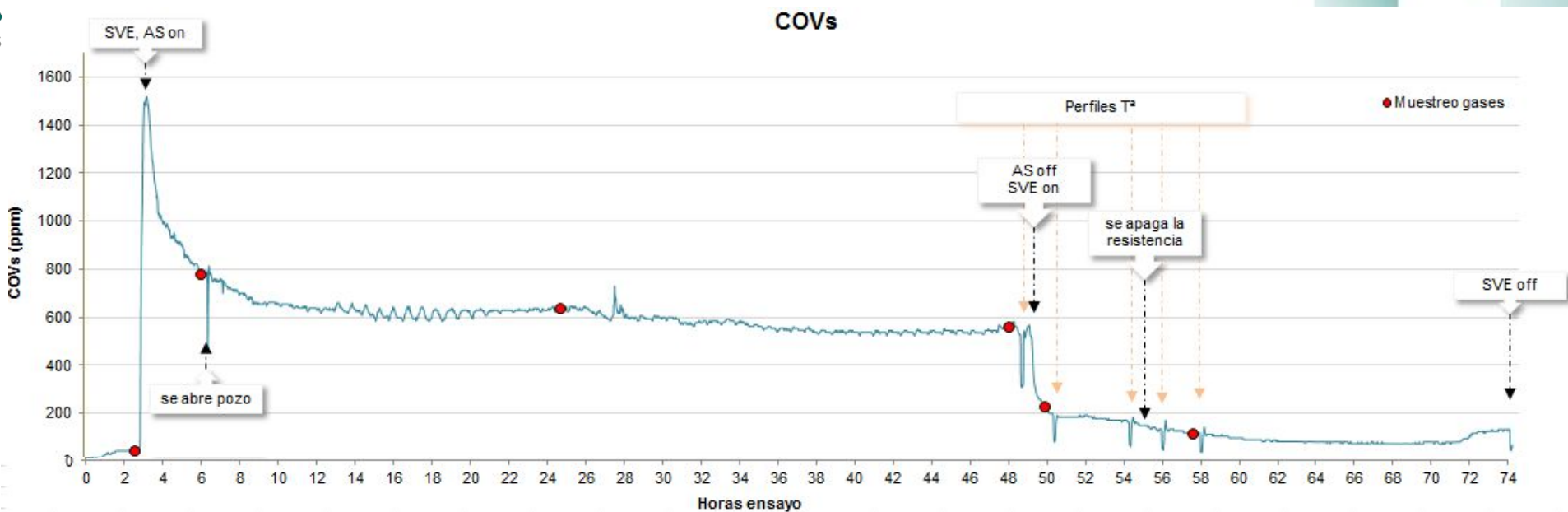


AS/SVE 2018: MONITORING PLAN:

- In the groundwater: VOC concentration (lab), GW levels, temperature, conductivity, (data loggers), pH, ORP, dissolved oxygen (probes)
- In the extracted vapor: VOC concentration (AC tubes)
- In the AS/SVE system: explosiveness, O₂, CO₂, CH₄, HS₂, air injection and extraction rates, air injection pressure (gauges)

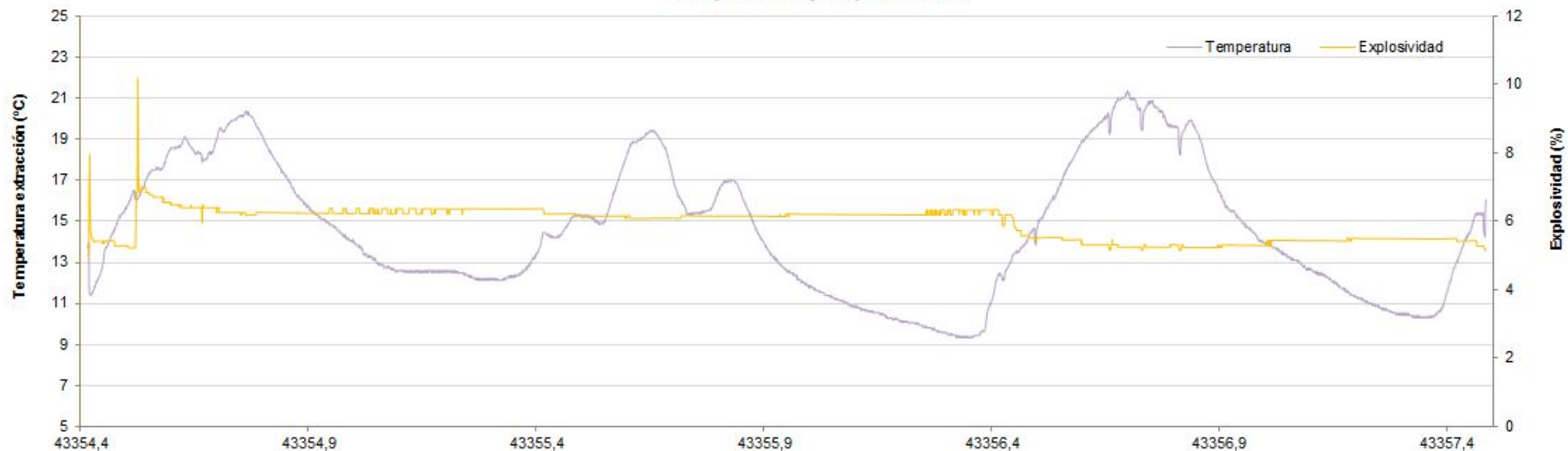


AS/SVE 2018

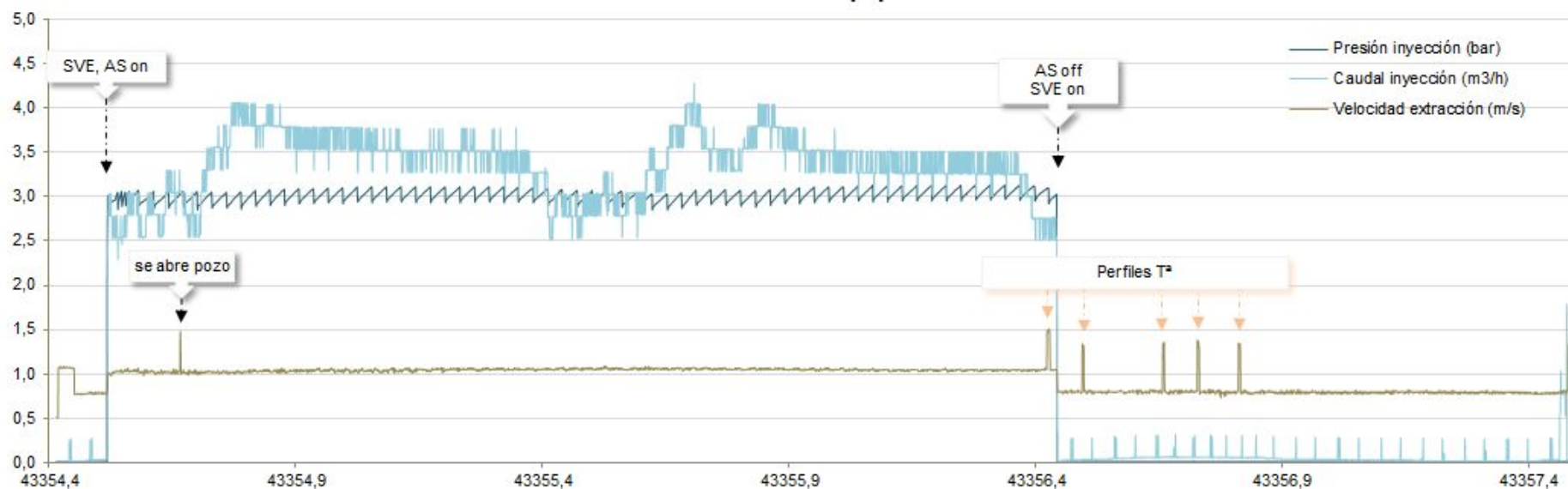


AS/SVE 2018

Temperatura y explosividad



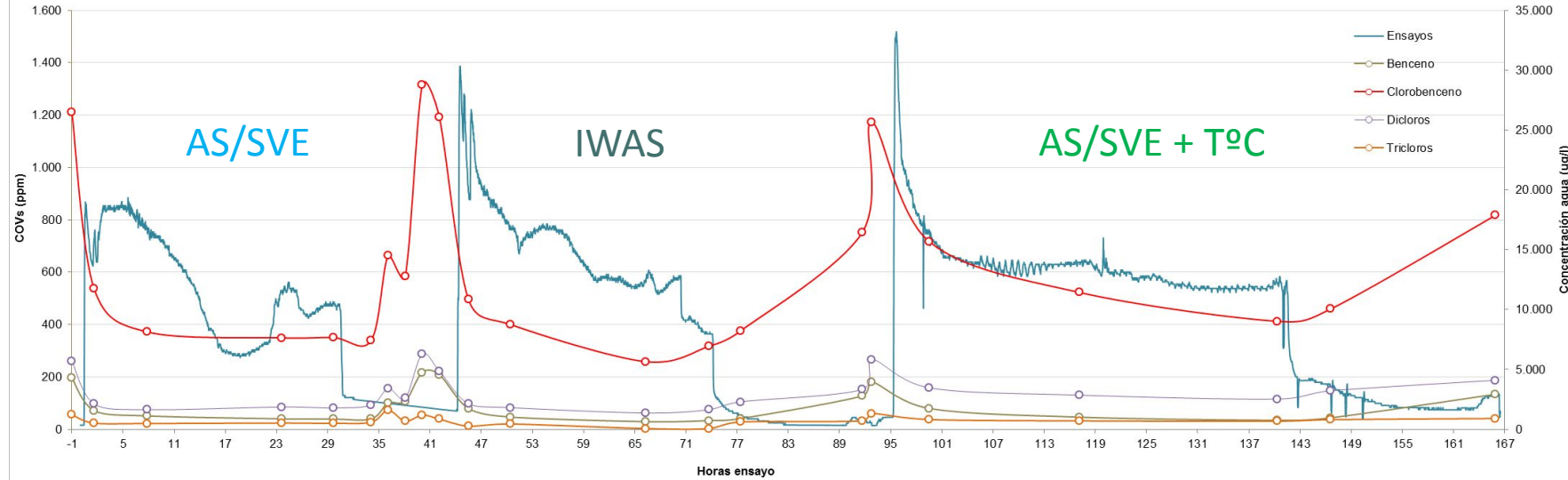
Parámetros equipo



AS/SVE 2018

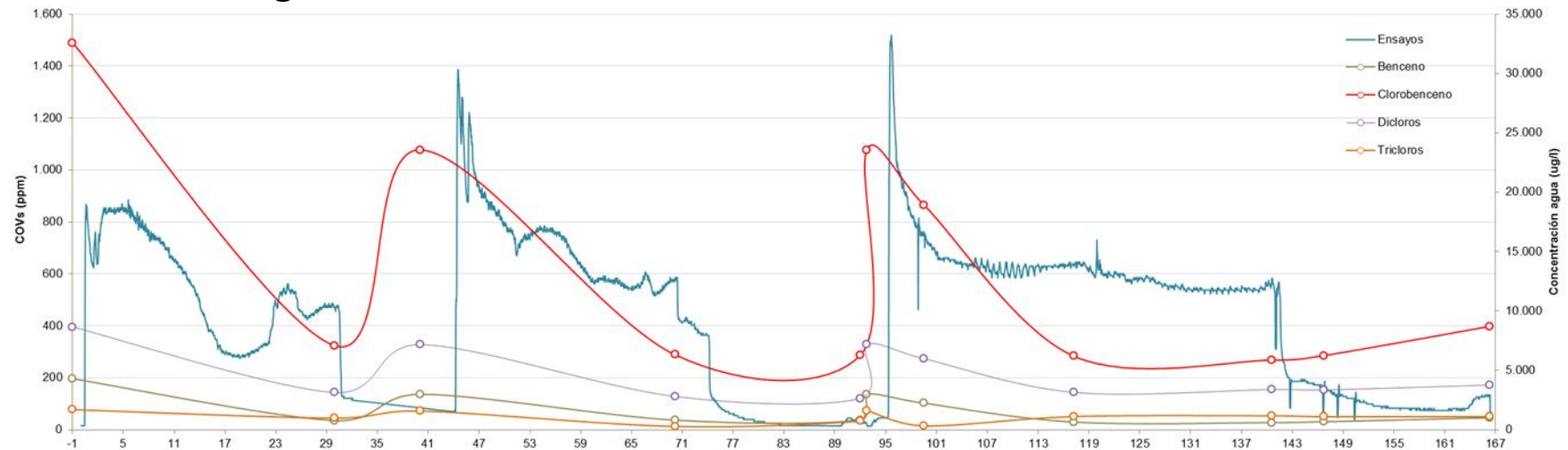
air injection piezometer

COVs vs Concentración agua



MW downgradient

COVs I1 vs Concentración agua O1



RESULTS: MASS REMOVAL RATES

Year / Area	Pilot test	Test well	Benzene (g/d)	<u>Monochloro-benzene</u> (g/d)	Sum of dichloro-benzenes (g/d)	Sum of trichloro-benzenes (g/d)	Total mass removal rate (g/d)
2018 / Zona Barrera	AS/SVE	I1	10	101	23	4	138
	IWAS	I1	16	128	35	7	186
	AS/SVE with T	I1	23	227	42	5	297

PARTICULAR APPLICATION OF AS/SVE IN BAILÍN

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2019 / Zona Barrera	AS/SVE	I1	18	163	30	3	215
		O1	16	128	26	4	174
		I2	6	71	17	2	96
		O2	14	115	21	2	153
	AS/SVE + ISCO	I1	12	107	17	2	137

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2021 / Former HCH landfill	AS/SVE	P162	4	26	2	0	32
		P166	1	8	1	0	10
		P184	10	43	4	0.2	57

NEW TREATMENT PLANT FOR GW PLUME (AS/SVE & ISCO)



NEW TREATMENT PLANT FOR GW PLUME (AS/SVE & ISCO)



RESULTS AND CONCLUSIONS

- Vapor mass removal rates are higher enough to use the AS/SVE technology for the GW plume control of the VOC & SVOC compounds
- All tests showed that, once the aeration began, the concentrations of COCs in the groundwater decreased significantly but not full reductions observed
- Once the tests were finished, the baseline concentrations were recovered rapidly, since the contaminant mass is constantly flowing from source zone upgradient
- Higher rates were obtained with the more complex configurations (AS/SVE + IWAS ; AS/SVE + $\uparrow T^{\circ}C$). However, the simplest configuration it is recommended for a full-scale application, due to all operation and maintenance work is easier, the associated costs are lower, and it is the most sustainable configuration.



THANK YOU FOR YOUR ATTENTION

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