WITHYHEDGE LANDFILL

AIR QUALITY MONITORING INTERIM SUMMARY REPORT 3

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Record of updates to report

Date	**Issues and Updates**
17 June 2024	Draft Issued

Executive Summary

This interim report summarises the data gathered from the ongoing monitoring around Withyhdege Landfill. The monitoring now includes diffusion tubes for the assessment of Hydrogen Sulphide and Volatile Organic Compounds (VOCs) that provide averaged concentrations over a defined period and instantaneous measurements of Hydrogen Sulphide using a Jerome analyser. The monitoring programme is primarily aimed at gathering quantitative data to provide lines of evidence to help assess risks from the exposure to off-site air quality that is impacted by the landfill.

Comparison of the Hydrogen Sulphide concentrations detected using diffusion tubes with health-based criteria indicates that the concentrations continue to fall below these guidance values for intermediate/lifetime exposure.

For the first time, monitoring of Volatile Organic Compounds (VOC) has been undertaken during the latest exposure period. The testing has revealed many VOCs to be present at very low levels and below evaluation criteria, where available.

Using a hand-held instrument, known as a Jerome, Hydrogen Sulphide concentrations have been logged at different locations. In combination with an assessment of the odour perceived at the time of sampling, this monitoring has revealed variations in the concentration of Hydrogen Sulphide, but the dataset is complex and many readings are close to the detection limit of the instrument. Higher values of Hydrogen Sulphide reported by the instrument are typically associated with the presence of odour and several different types of odour have been observed. At times, the Hydrogen Sulphide concentration has been found to be higher than 5ppb with almost 15ppb detected in the community areas for short durations (<30 minutes) and higher concentrations at the landfill site. Concentrations above 5ppb have been found associated with different odour sources including landfill gas and agricultural activities. The highest concentrations of Hydrogen Sulphide tend to be found when odorous landfill gas is suspected to be present.

1 SCOPE

The operator of Withyhedge Landfill is implementing a series of measures agreed with NRW to address odours emanating from the site, including re-profiling, capping and additional landfill gas extraction. Alongside these measures, the operator is funding a scheme of air quality monitoring in the communities surrounding the site and also within the site.

The monitoring programme is primarily aimed at gathering quantitative data to provide lines of evidence to help assess risks from the exposure to off-site air quality that is impacted by the landfill.

This interim report summarises the data gathered from the ongoing monitoring. The monitoring now includes diffusion tubes for the assessment of Hydrogen Sulphide and Volatile Organic Compounds (VOCs) that provide averaged concentrations over a defined period and instantaneous measurements of Hydrogen Sulphide using a Jerome analyser. This report includes measurements of Hydrogen Sulphide made at different heights above ground level.

The concentrations recorded by the diffusion tubes are obtained by laboratory analysis of the tubes. The data reported by the laboratories is shared with the operator, Pembrokeshire Council and NRW.

2 MONITORING

Landfill gas is typically dominated by methane and carbon dioxide. Numerous other compounds may, however, also be present and some of these can be detected as odour. Such compounds are often sulphur based and can include hydrogen sulphide. As hydrogen sulphide can give rise to odour and can be readily measured, it is being used as a surrogate for the potential presence of landfill gas, whilst recognising that there are a wide range of compounds and sources that can also generate odorous compounds like hydrogen sulphide.

To try and better understand what other compounds may also be present, TENAX diffusion tubes designed to allow the analysis of Volatile Organic Compounds are also being used with this monitoring starting 8 March 2024 at the same positions as the Hydrogen Sulphide tubes. This data is presented in this report alongside the Hydrogen Sulphide monitoring which has been ongoing since February 2024.

3 DIFFUSION TUBE MONITORING

3.1 Hydrogen Sulphide Monitoring

Diffusion tubes monitoring Hydrogen Sulphide have been set at ten off-site locations at various compass directions around Withyhedge Landfill with additional tubes on-site, as shown on Figures 3-1 and 3-2. The tubes are positioned to take into account the need for free air movement, safety during maintenance and consideration of potential damage, theft or vandalism. The suitability of the current positions is being reviewed as the programme develops. Details of each position are summarised in Table 3-1.

Table 3-1 Monitoring positions

Figure 3-1 & 3-2 reference	Location Description	Position	Height above ground
Community monitoring locations			
D1	Spittal Cross cross-roads west of Spittal	Street furniture at cross-roads	0.6 (old & new)
D2	Adjacent Spittal School	Lamp post	2.1
D3	Corner of spring gardens and Castle Rise, Spittal. Adjacent farm.	Lamp post	2.1
D4	Cross-roads of B4329 and Spring Gardens East of Spittal	Street furniture	2
D5	B4329 between Scolton and Bethlehem	Street furniture	2.2
D6	B4329 at Bethlehem	Lamp post	2.2
D7	On road heading west out of Poyston Cross	Lamp post	2.2
D8	Adjacent properties at Poyston Water	Lamp post	2.1
D9	Rudbaxton Water Bridge	Northern side of bridge	1.2
D10	Adjacent Junction with A40 near Corner Piece Inn	Lamp post	1.9
On-site monitoring locations			
Access ramp (WL1)	Eastern side of access ramp	Metal post	2.1
Fence posts (WL2)	Fence post close to edge of permanent capping	Fence post	1.1
Litter skids (WL3)	Metal post close to edge of permanent capping	Metal post	2.2
Field fence post (WL4)	Fence post west of temporary capping	Fence post	0.9
CCTV tower (WL5)	Metal post south of active Cell 8	Metal post	2.2
IBC cell 8 (WL6)	Metal post west of active Cell 8	Metal post	1.65
Cell 7 IBC corner (WL7)	Metal post south of Cell 7	Metal post	1.9

Figure 3-1 Community monitoring positions D1- D10

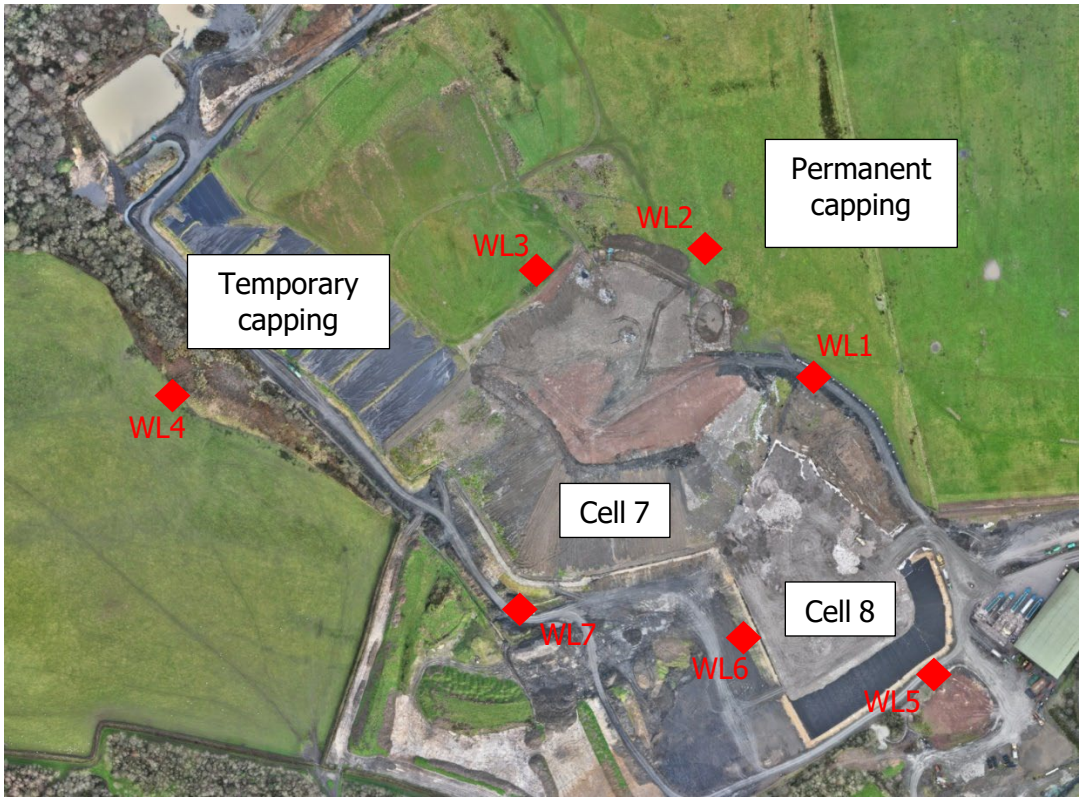


Figure 3-2 On-site monitoring positions

On 26 April 2024, the metal post that the diffusion tubes had been attached to was no longer present and the tubes could not be found on the ground (see Plate 3-1). As a consequence, there is no data for position D10 for this exposure period. A different signpost, closer to the A40 and directly adjacent the Inn is being used for ongoing monitoring.

Plate 3-1 Tubes on post at D10 (left) prior to removal of posts (right)

In addition to the data gathered from D10-D10, Hydrogen Sulphide tubes have also been set up at different heights during the exposure period. These tubes were positioned at Treffgarne, Spittal, just North of Poyston Cross, Crundale and adjacent Withyhedge landfill site office car park. Details of these monitoring positions are summarrised in Table 3-2 and Figure 3-3.

Table 3-2 Details of tubes at different heights

Position ID	Location	Height of tubes above ground level/m	Description of position
DP1	Treffgarne (upper)	0.5, 1.0, 1.5, 2.0, 2.5	Tubes attached to drainpipe of garage adjacent house. Gravel driveway.
DP2	Treffgarne (lower)	0.5, 1.0, 1.5, 2.0	Tubes attached to metal clothesline on grass
DP3	Spittal	0.5, 1.0, 1.5, 2.0	Tubes attached to metal pole attached to wooden fencepost on grass.
DP4	North of Poyston Cross	0.5, 1.0, 1.5, 2.0	Tubes attached to trunk of tree surrounded by grass
DP5	Crundale	0.5, 1.0, 1.5, 2.0	Tubes attached to wooden post of pergola on patio
DP6	Withyhedge Landfill Car Park	0.5, 1.0, 1.5, 2.0	Tubes attached to metal post on grass verge adjacent car park

At each position, separate tubes were positioned between 0.5m and 2.0m above ground level with an additional tube at 2.5m at one position. Apart from the tubes located at the Withyhdedge landfill site office car park, the tubes at Treffgarne, Spittal, North of Poyston Cross and Crundale were all located in residents gardens. Each resident was offered the opportunity of independently returning the tubes directly to the laboratory at the end of the exposure period in pre-paid envelopes and this was taken up by the resident where tubes labelled DP1 were located.

Figure 3-3 Location of diffusion tubes at different heights

3.1.1 Review of Hydrogen Sulphide Results

There are now three sets of diffusion tube results available for Hydrogen Sulphide and these are summarised in Tables 3-4 and 3-5. The original laboratory certificates from the latest monitoring are included in Appendix 1. The term exposure period is used to define the sampling period when air was able to diffuse into the tubes before the tubes were taken down, sealed and returned to the laboratory for analysis. Analysis has been performed at Gradko International which is a UKAS accredited testing laboratory (No. 2187).

Some tubes were not available for analysis due to the following reasons:

- On 26 April 2024, the street furniture at D10 and the attached tubes from the ongoing third exposure period were found to have been removed.

Table 3-3 Hydrogen Sulphide results from Community Monitoring Positions

	Exposure Period		
	5 Feb - 1 Mar	**1 Mar - 3 Apr**	**3 Apr - 7 May**
	H_2S	**H_2S**	**H_2S**
Location	**ppb**	**ppb**	**ppb**
Laboratory Blank	0.05	0.04	0.05
Junction west of Spittal - D1	<0.08	Removed	0.12
Spittal School - D2	<0.08	<0.06	0.14
Spittal - D3	<0.08	<0.06	0.07
Upper Scolton - D4	<0.08	<0.06	0.14
Scolton Road - D5	<0.08	<0.06	<0.06
Bethlehem - D6	<0.08	<0.06	<0.06
Poyston Cross - D7	<0.08	<0.06	<0.06
Poyston Water - D8	<0.08	<0.06	0.06
Rudbaxton - D9	0.1	0.07	0.07
A40 Junction - D10	<0.08	0.07	Removed

Table 3-4 On-site Hydrogen Sulphide monitoring results

	Exposure Period		
	8 Feb - 1 Mar	**1 Mar - 3 Apr**	**3 Apr - 7 May**
	H_2S	**H_2S**	**H_2S**
Location	**ppb**	**ppb**	**ppb**
Laboratory Blank	0.05	0.04	
Access ramp (WL1)	1.48	Lost	
Fence posts (WL2)	1.82		
Litter skids (WL3)	2.04		
Field fence post (WL4)	0.29	1.38	0.31
CCTV tower (WL5)	0.6	4.4	9.24
IBC cell 8 (WL6)	1.04		
Cell 7 IBC corner (WL7)	1.8	6.54	3.97

During the first exposure period wastes were being removed from the crest of the site, gas wells were being drilled into the waste mass and temporary capping of the west facing flank was in progress. During the second and third exposure periods capping works were continuing and gas extraction extending to newly capped areas.

The average concentration of hydrogen sulphide measured in each diffusion tube during the first and second exposure periods has been below the limit of detection (less than 0.08ppb or 0.06 part per billion), with the exception of D9 at Rudbaxton Bridge and D10 near junction with A40. During the third exposure period, Hydrogen Sulphide was also detected at D1-D4 and D8.

Comparison of the concentrations detected using diffusion tubes with the health-based evaluation criteria in Table 3-5 indicates that the concentrations fall below these guidance values for intermediate/lifetime exposure.

Table 3-5 Referenced health based guidance values

	Intermediate exposure criteria (up to 1 year)	Lifetime exposure criteria
Hydrogen Sulphide concentration	20 ppb (30 µg/m^3)	1 ppb (2 µg/m^3)

Values taken from references 1 and 2

Higher concentrations (upto 9.24 ppb) of hydrogen sulphide have been reported from the tubes exposed on site. These concentrations are below the workplace exposure limit of 5000 ppb for an 8-hour time-weighted average reference period (Ref 3).

3.1.2 Monitoring at Different Heights

The results from the monitoring undertaken at different heights is summarrised in Table 3-6.

Table 3-6 Hydrogen sulphide concentration (ppb) at different heights

Height of tube above ground level/metres	DP1	DP2	DP3	DP4	DP5	DP6
0.5m	0.08	0.10	0.08	0.08	0.08	0.49
1.0m	0.08	0.33	0.08	0.13	0.08	0.59
1.5m	0.08	0.10	0.08	0.10	0.08	0.57
2.0m	0.09	0.08	0.12	0.11	0.08	0.43
2.5m	0.08	No data	No data	No data	No data	No data

The variation in concentration between each height at each position is small with all concentrations falling below the thresholds summarrised in Table 3-5. The comparable concentration levels of Hydrogen Sulphide detected at different heights at each location suggests that the height of the monitoring tube above ground level does not appear to significantly influence the results obtained.

3.2 Volatile Organic Compound Monitoring

Monitoring of Volatile Organic Compounds (VOC) in air using diffusion tubes commenced 8 March 2024. The diffusion tubes used for this monitoring are called TENAX tubes and were provided by the same laboratory providing the Hydrogen Sulphide tube analysis. These tubes were positioned alongside the Hydrogen Sulphide tubes and work in the same way i.e. during the exposure period air is free to circulate into the tube and at the end of the period the tube is sealed and returned to the laboratory for analysis.

As noted in relation to the Hydrogen Sulphide tubes, some tubes were not available for analysis due to the following reasons:

- On 26 April 2024, the street furniture at D10 and the attached Hydrogen Sulphide and VOC tubes were found to have been removed.
- The wooden posts holding the tubes at D9 Rudbaxton Bridge also appear to have been recently stained. It is not precisely known when this work was done or the nature of the product used but it is sometime after 21 March based on review of photographs. Such wood stains can potentially contain and release VOCs to the air.

3.2.1 Review of VOC Results

Volatile organic compounds (VOCs) are a complex variety of chemical substances. Like Hydrogen Sulphide, they may be generated and released by a variety of natural processes and human activities. This large group of compounds is defined on the basis of their ability to exist as a vapour. Common examples include the recognisable odour associated with paint and petrol, the smell detectable from air fresheners and the smell of freshly cut grass – all these smells are due to the presence of a range of different VOCs, some of which produce a detectable odour.

The VOC laboratory certificate is presented in Appendix 2. Each of the tubes were analysed for the top 20 VOCs found to be present following full-scans on previous tubes. Readers will note that the certificate spans several pages and includes tables of data from each of the different monitoring positions. To aid understanding, visualisation and assessment of this data the concentration data expressed as microg/m^3 (micro grammes per cubic meter of air) has been extracted from the last column of the certificate and repeated in Table 3-7 which spans several pages. This same data is also graphically presented as a series of charts following the table.

To the right-hand side of the monitoring data in Table 3-7 are criteria used to assess air quality. These come from a range of sources and are intended to provide an initial yardstick against which the reader can better appreciate the levels reported from the diffusion tubes. It is evident from this comparison that the concentration levels estimated from the tubes are lower than these criteria, where values have currently been found to be available.

Coupled with review of the charts it is evident that:

- the VOCs reported continue to be found at low levels just above the level of detection in many cases
- Some compounds are detected at higher concentration off-site compared to the tubes located on-site, and vice versa

Given the current low levels detected the intention is for future monitoring to focus on Hydrogen Sulphide monitoring.

Table 3-7 Results from VOC Diffusion Tubes (continues over several pages)

	Off-site diffusion tube data									On-site tube results			EAL & EA 2010	PHE IAQ
	D1	D2	D3	D4	D5	D6	D7	D8	D9	WL4	WL5	WL7		
1,4-Benzenedicarboxylic acid, bis(2-ethylhexyl) ester	5.8	49		23		26			16					
Benzoic acid	0.5	4.9	12	12		0.3	32		<0.2	5.9		12		
4-Amino-2-phenylnaphtho[2,1-d][1,3]oxazol-5-ol						17								
2-Phenacyl-quinoxaline			4.9	1.9			10							
Pentacosane	4.1		4.4	9.9	2.3					12				
Heptadecane, 9-octyl-									9.5					
Phenylmaleic anhydride		2.4	3.6	3.6			8.9					3.8		
Nonanal**	3.2	4.8	5.7	4.6	0.9	<0.3	2.6	1.4	<0.3		<0.3	0.5		
Docosane	3.9								5.3					
Tetracosane	1.2			4.2	0.8									
Cyclotrisiloxane, hexamethyl-	3.0	2.4	3.5	4.0	1.6	2.5	4.0	0.8	0.7		1.6	0.9		
Bis(2-ethylhexyl) phthalate				3.8										
Acetophenone**	0.5	1.4	1.8	2.0	1.3	0.4	3.4	0.6				2.8		
Benzenecarbothioic acid		0.6	1.3	0.9			2.9					1.1		
Benzoylformic acid			1.1	1.0			2.8							
Benzaldehyde**	0.9	1.5	1.9	2.3	0.4	0.5	2.6	0.5	<0.2		0.5	2.6		
Isopropyl myristate	0.8	2.5				<0.6			<0.6			1.5		
Benzene	0.4		0.3	2.2	1.3	0.3	0.3	<0.2	0.3		0.3	0.4	5/30	
Cyclotetrasiloxane, octamethyl-	1.0	1.1	1.1	1.7		0.7	1.1	<0.6			1.0			
1-Hexanol, 2-ethyl-	1.1	0.9	0.9	1.4	0.5	0.5	0.7	<0.3	0.7	0.4	<0.3	0.7		
Pentadecane		1.4												
Naphthalene			0.5	1.2	<0.3			<0.3	<0.3				3	
*Decanal**	0.5	1.0				<0.3								
Nonanoic acid		1.0	0.8				0.7					0.9		
Phenol	0.4	0.4	0.5	0.7		<0.2	1.0	<0.2				0.6	200/3900	

	Off-site diffusion tube data									On-site tube results			EAL & EA 2010	PHE IAQ
	D1	**D2**	**D3**	**D4**	**D5**	**D6**	**D7**	**D8**	**D9**	**WL4**	**WL5**	**WL7**		
Acetic acid	0.2	0.2	0.3	0.9	0.1	<0.1	0.2	0.6	<0.1	0.5		0.6	3700	
Benzenesulfonamide, N-butyl-		*0.8*							<0.4	0.5		0.7		
Cyclopentasiloxane, decamethyl-								<0.8						
Benzeneacetaldehyde							0.7	<0.2						
Ethanol, 2-phenoxy-		0.6												
Diethyl Phthalate								0.5			5.2			
5,9-Undecadien-2-one, 6,10-dimethyl-, (Z)-	0.5													
2,3-Benzofurandione							0.5							
Octanal**	0.4		0.5			<0.3		<0.3						
Phenyl-pentamethyl-disiloxane						<0.5								
Disulfide, dipropyl	0.5													
Octane	0.4	0.4	0.4						<0.2					
Benzothiazole							0.4	<0.3						
Benzophenone						<0.4								
Benzophenone					<0.4									
Dodecane									<0.3					
Dibenzofuran									<0.3					
Undecane									<0.3					
Acenaphthene								<0.3					210	
Biphenyl					<0.3									
2-Naphthalenol					<0.3									
Furan, 3-phenyl-					<0.3									
Decane									<0.3		0.3	0.5		
Benzofuran					<0.2									
1-Octene					<0.2									
Cyclopentanone, 2,3-dimethyl-						<0.2								
Heptane, 3-methylene-									<0.2					

	Off-site diffusion tube data									On-site tube results			EAL & EA 2010	PHE IAQ
	D1	D2	D3	D4	D5	D6	D7	D8	D9	WL4	WL5	WL7		
m/p-Xylene								<0.2			0.4	0.5	4410	100
Ethylbenzene									<0.2		<0.2	0.4	4410	100
Styrene					<0.2						0.3		260	850
Benzonitrile					<0.2							0.5		
*Hexanal***					<0.2			<0.2						
Toluene					<0.2	<0.2		<0.2			0.2		8000	2300/15000
Silanediol, dimethyl-						<0.2								
1,4-diazabicyclo[4.3.0]nonan-2,5-dione, 3-methyl										9.7				
2,5(1H,3H)-Pentalenedione, tetrahydro-, cis-										1.0				
2,5-Piperazinedione, 3-methyl-										2.0				
2-Octene											0.4			
3,6-Dimethylpiperazine-2,5-dione										1.4				
4-Piperidin-1-yl-oxazolidin-2-one														
5,10-Diethoxy-2,3,7,8-tetrahydro-1H,6H-dipyrrolo[1,2-a:1',2'-d]pyrazine										5.0				
Bicyclo[3.1.1]hept-2-ene, 3,6,6-trimethyl-											<0.3			
Carbon disulfide											0.3	0.3	100	
Cyclo(L-prolyl-L-valine)										1.3				
Cyclopentane											0.2			
Ethanol, 2-(cyclohexylamino)-										1.9				
Glycyl-L-proline										3.8				
Heptane, 3-methylene-											<0.2			
Hexathiane											1.0			
Limonene											0.3			
o-Xylene											0.2		4410	100
Pyrrolo[1,2-a]pyrazine-1,4-dione, hexahydro-3-(2-methylpropyl)-										2.5				

	Off-site diffusion tube data									On-site tube results			EAL & EA 2010	PHE IAQ
	D1	**D2**	**D3**	**D4**	**D5**	**D6**	**D7**	**D8**	**D9**	**WL4**	**WL5**	**WL7**		
Thymine										1.3				

NOTES
** Compounds may be an artefact due to reaction of ozone with Tenax sorbent.
Compounds with a quality match below 85% are noted as a tentative identity and shown in italics. These compounds are outside of the scope of laboratory UKAS accreditation.
Wooden posts at D9 Rudbaxton Bridge appear to have been recently stained. It is not precisely known when this work was done but it was not before 21 March 2024 based on review of photographs.

Evaluation Criteria:
EAL / EA 2010 – Environmental Assessment Level. EALs represent a pollutant concentration in ambient air at which no appreciable risks or minimal risks to human health are expected. EAL values taken from Air emissions risk assessment for your environmental permit available on gov.uk and EA 2010 values from Environment Agency Report: P1-396/R Table 5.2.
PHE IAQ – Criteria from Public Health England. Indoor Air Quality Guidelines for selected Volatile Organic Compounds (VOCs) in the UK. 2019.

Chart 3-1 VOC's at D1

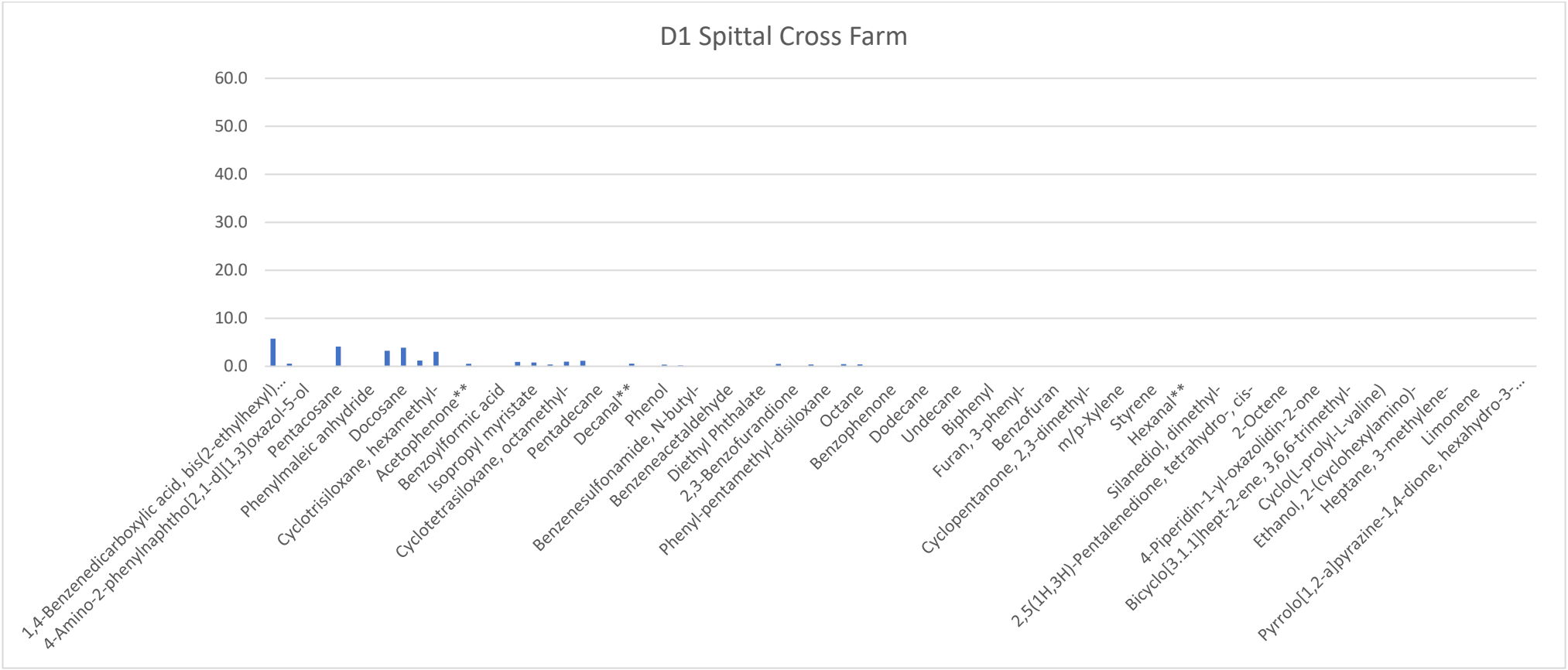


Chart 3-2 VOC's at D2

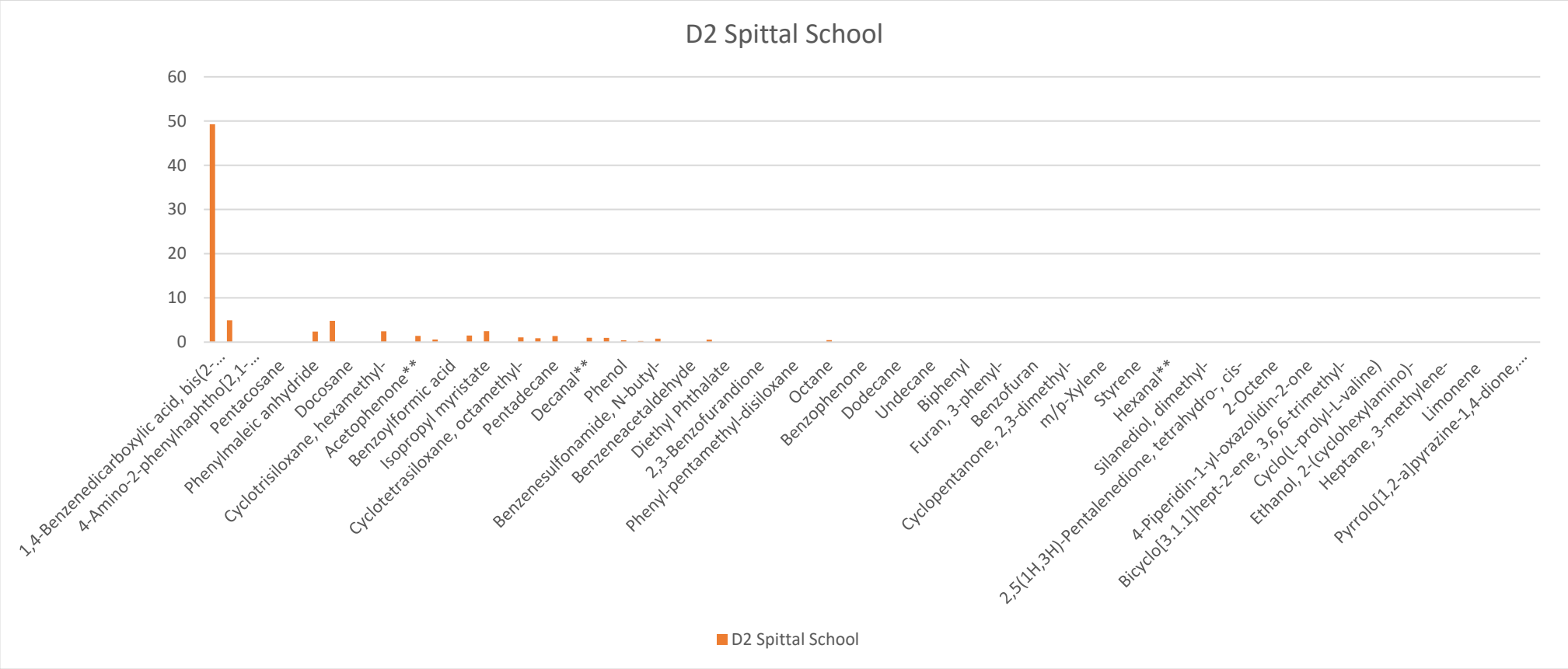


Chart 3-3 VOC's at D3

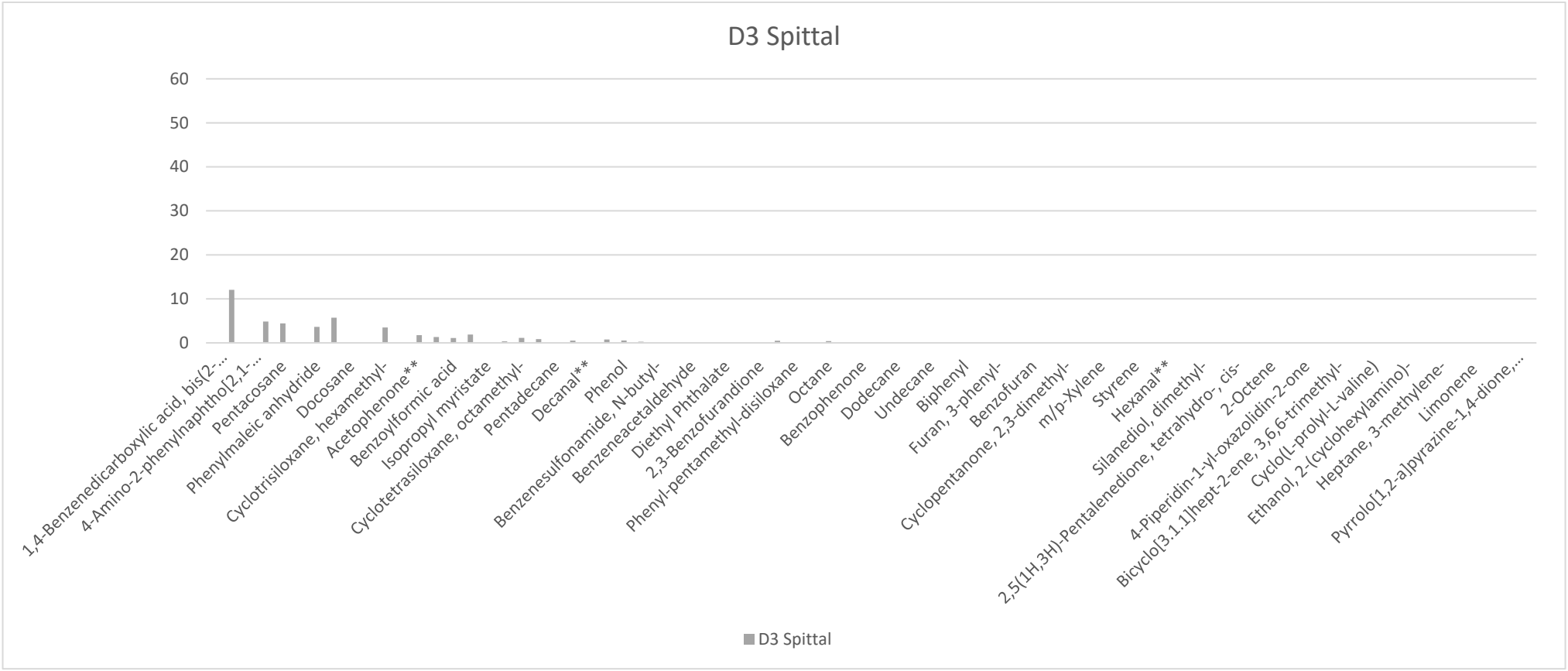


Chart 3-4 VOC's at D4

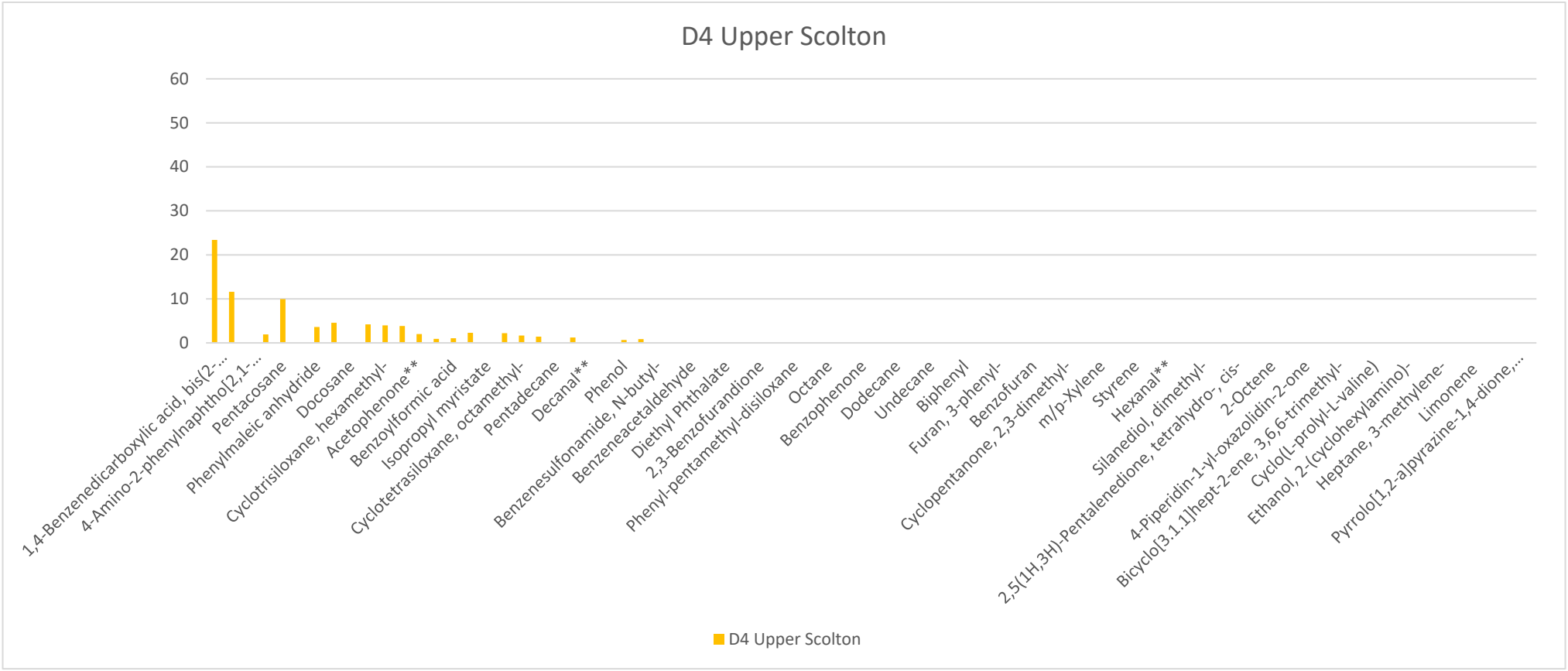


Chart 3-5 VOC's at D5

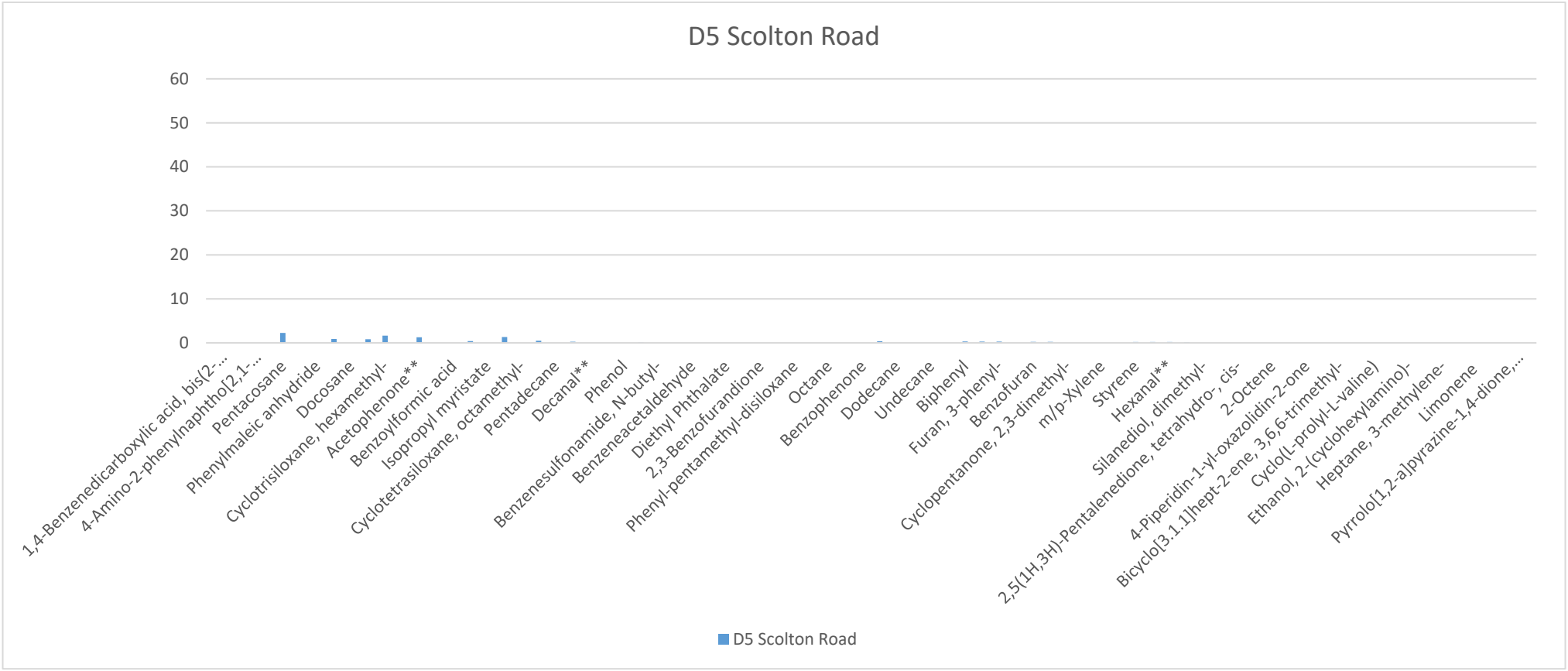


Chart 3-6 VOC's at D6

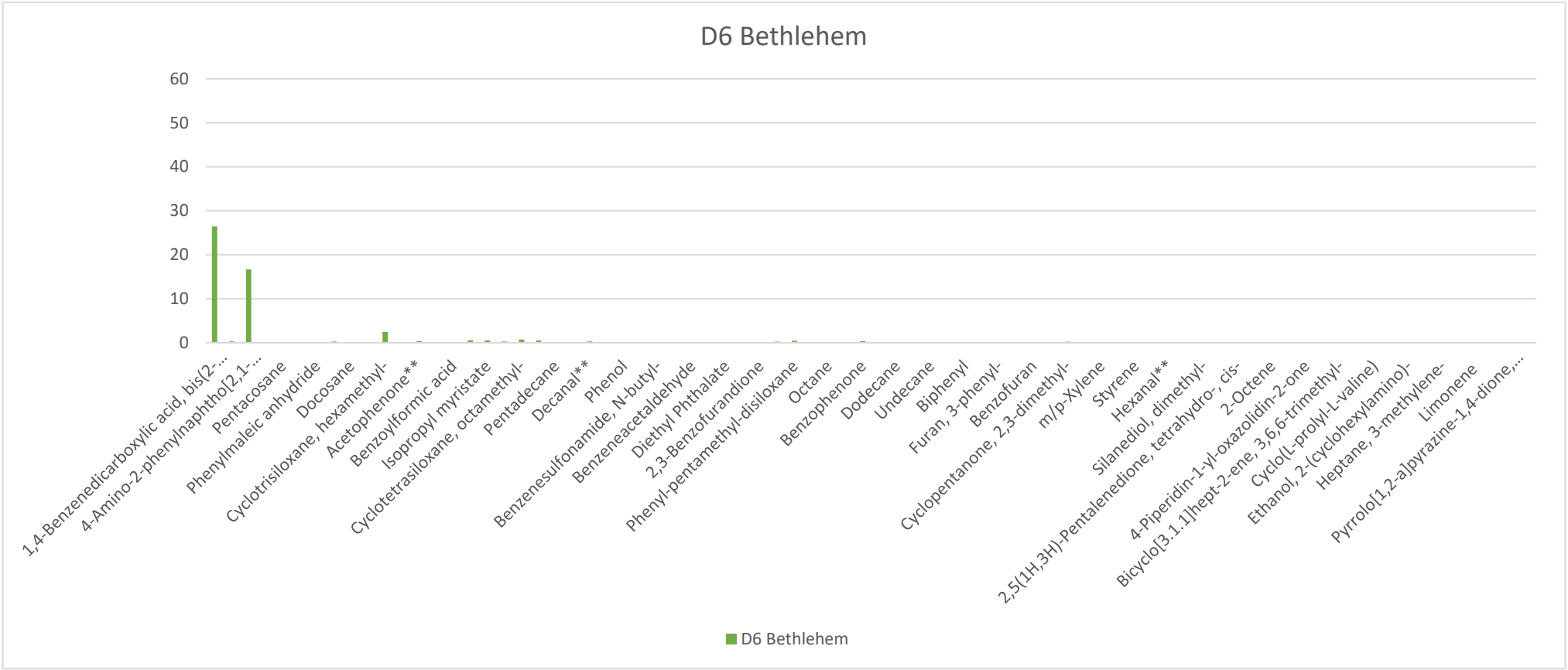


Chart 3-7 VOC's at D7

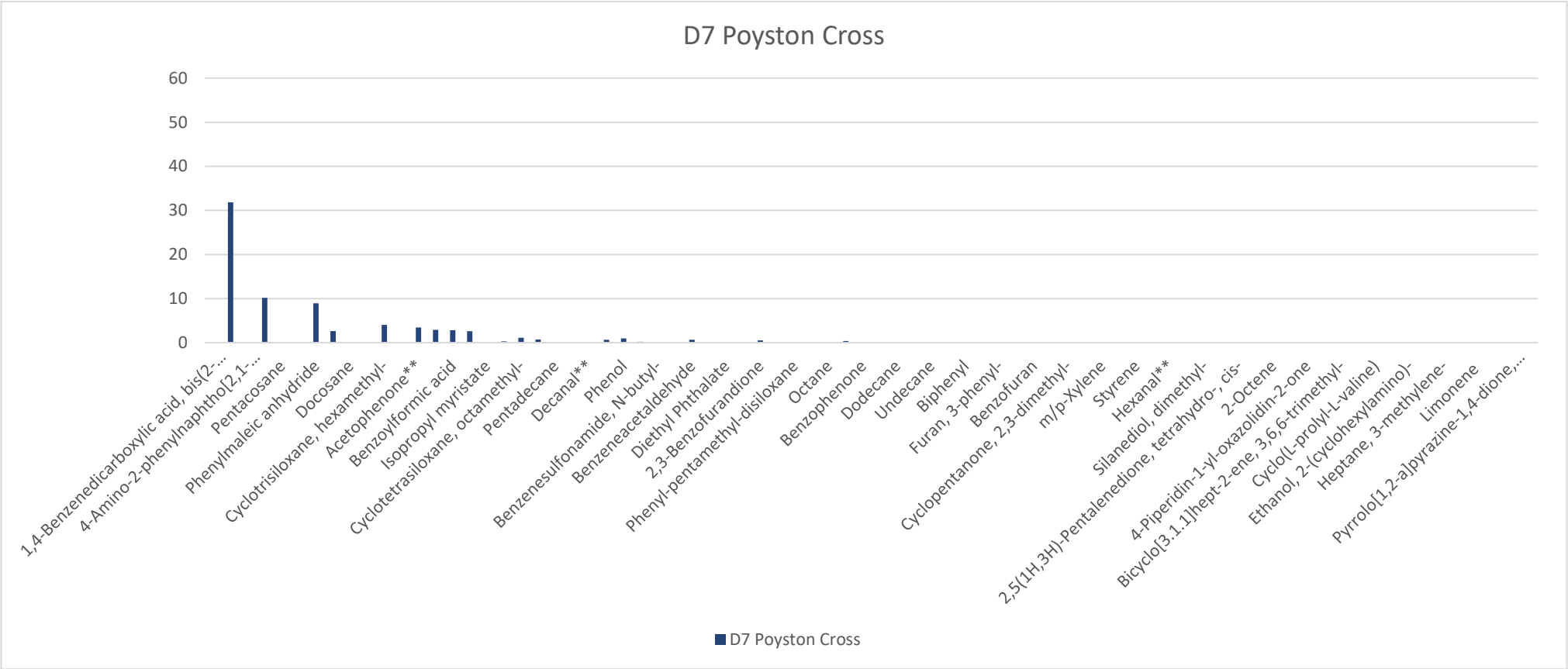


Chart 3-8 VOC's at D8

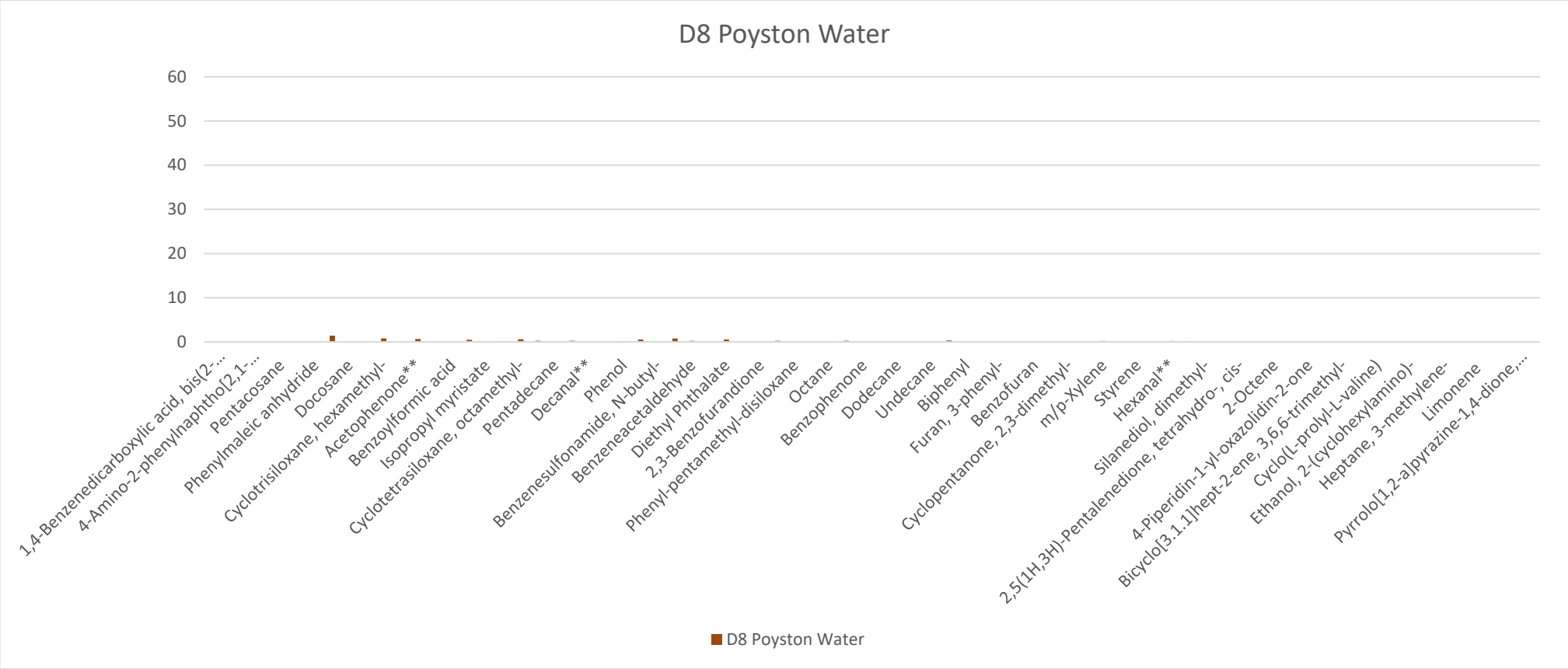


Chart 3-9 VOC's at D9

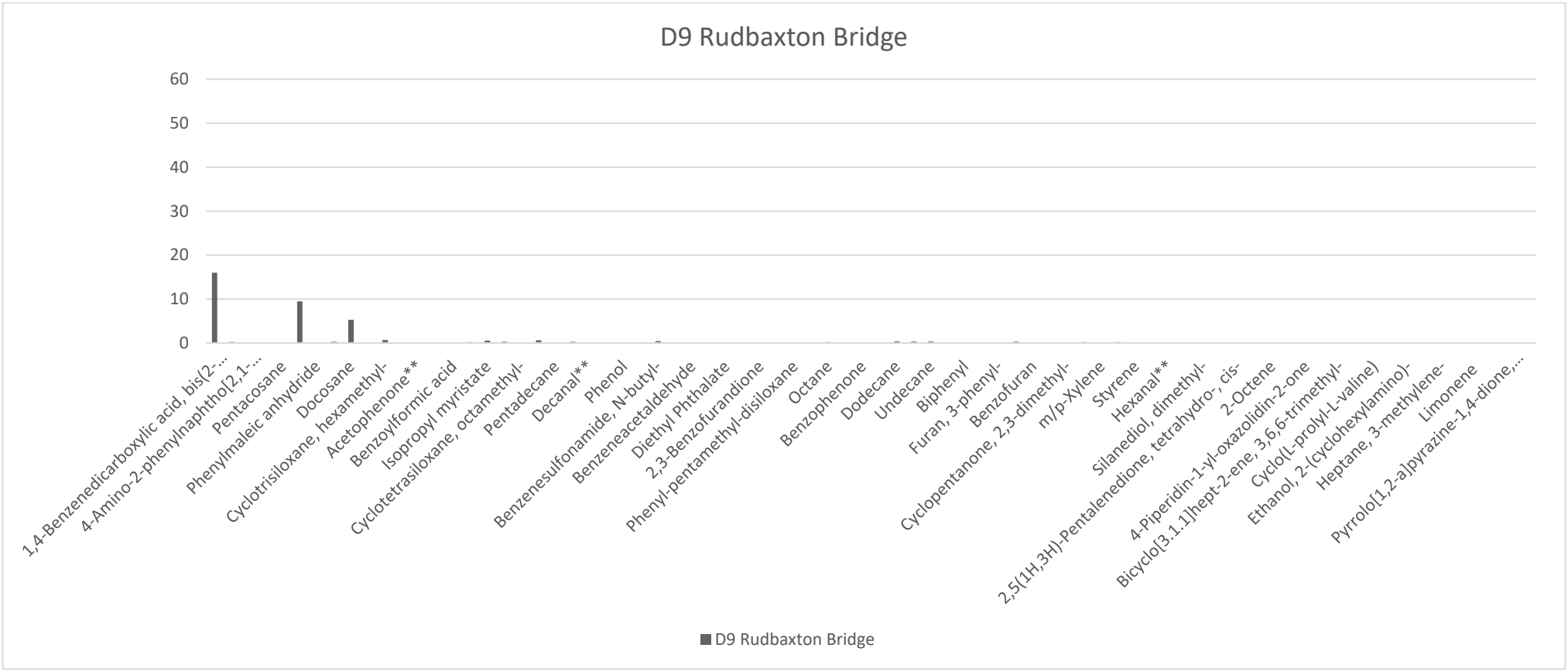
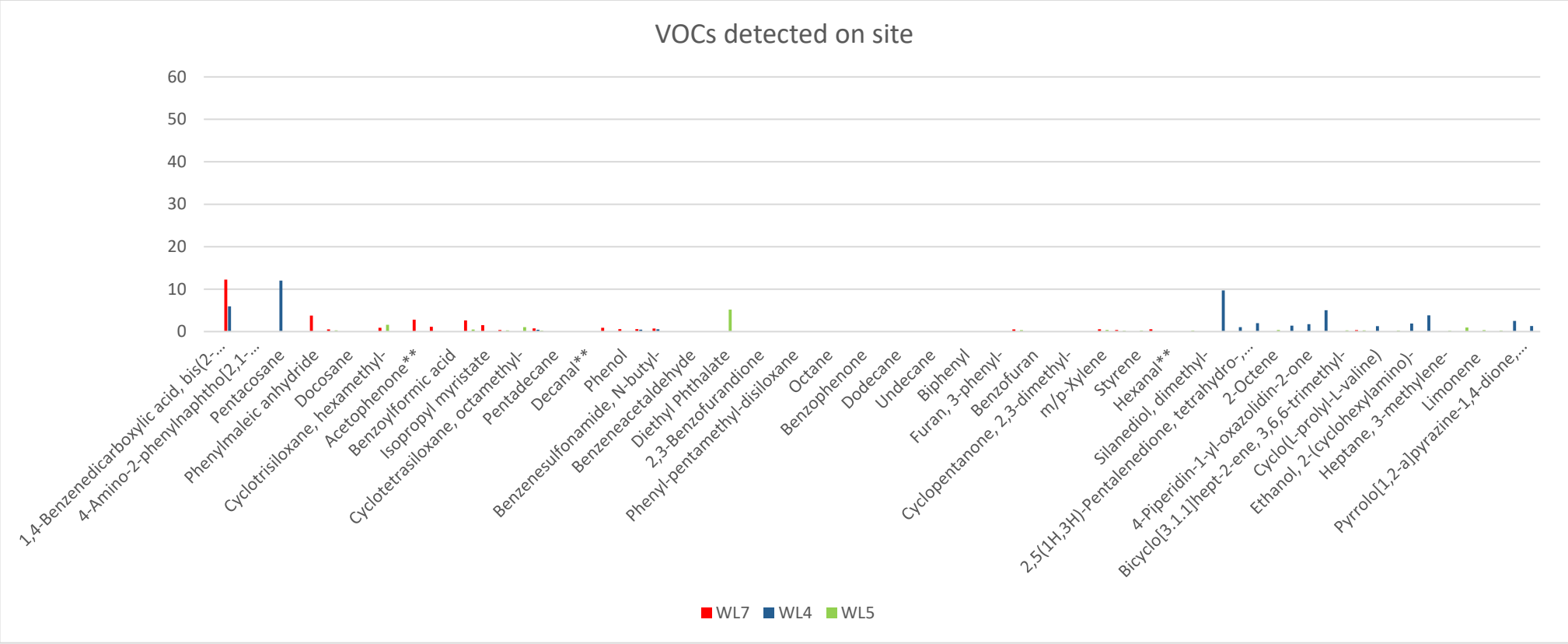


Chart 3-10 VOC's Detected on Site



4 INSTANTANEOUS MONITORING OF HYDROGEN SULPHIDE

4.1 Monitoring using a Jerome Analyser

To date, the recorded concentrations of hydrogen sulphide measured at each diffusion tube in the community has averaged 0.2ppb or less. However, it is suspected that the instantaneous concentration over the exposure period would have risen and fallen throughout the period for a number of reasons. To aid understanding of these potential shorter-term variations, and to utilise another method of hydrogen sulphide analysis Geotechnology has been using a Jerome® J605 Hydrogen Sulphide Analyzer analyser since 14 March 2024.

The Jerome is a hand-held instrument capable of measuring Hydrogen Sulphide. The instrument contains a gold film sensor that is sensitive to Hydrogen Sulphide. To take a sample, an internal pump pulls ambient air over the gold film sensor. The sensor absorbs the hydrogen sulphide present in the sample and undergoes an increase in electrical resistance proportional to the mass of Hydrogen Sulphide. This allows the instrument to calculate and display the measured concentration of hydrogen sulphide. Measurements below 3ppb are reported as zero and at 5 ppb the instrument has an accuracy of ±1 ppb and a precision of 10%. In practice, this means a displayed value of 0 ppb is <3ppb and a reported value of 5ppb is equivalent to an actual concentration of about 4-6 ppb. The current calibration certification for the Jerome instrument being used is provided in Appendix 3.

Using the Jerome, monitoring data has been gathered using several different approaches:

- 30 minute logging of airborne Hydrogen Sulphide at 5-minute intervals – in this mode the instrument takes a measurement automatically every 5 minutes.
- 24-hr (or more) of logging airborne Hydrogen Sulphide at 15-minute intervals
- Spot levels – where measurements have been made in real-time at different locations.

This data is presented in this report as parts per billion (ppb). The full dataset is included in Appendix 4.

For each approach the same protocol has been followed with the instrument undergoing a 45-minute 'Regeneration' process at the start and end of each day, and as dictated by the sensor saturation. At the start of each monitoring interval a 5-minute 'Warm-up' routine with a Zero Air Filter has also been undertaken.

4.2 Monitoring in Community

Appendix 5 contains the results of 30-minute logging undertaken around the Withyhedge Landfill site. This includes the positions referenced D1-D10 and also other positions which are identified. Also included is commentary related to the observation of odour at the time of monitoring including wind speed, wind direction, odour type/source and perceived intensity. The assessment of perceived intensity was initially based on descriptors but has more recently been assigned a score based on the criteria summarised in Table 4-1. Where there is no commentary presented this indicates that there was no odour discernible.

Table 4-1 Current Odour Intensity Scoring Criteria

Score	Description
1	Very Faint Odour
2	Faint Odour
3	Distinct Odour
4	Strong Odour
5	Very Strong Odour
6	Extremely Strong Odour

The dataset is complex with readings close to the detection limit reported at times when there was no discernible odour and similar values when an odour was discernible. There is, however, an increase in the reported concentration when odours are stronger and there are several good examples of this in the data set including 30 April and 17 May.

In addition to the 30-minute measurements, spot measurements have also been taken and this data is presented in Appendix 6.

4.3 Monitoring at Withyhedge Landfill

Alongside the measurement of Hydrogen Sulphide in the community areas, the Jerome has also been used to take spot measurements at positions around the landfill site. This data is also presented in Appendix 5. This monitoring confirms the presence of elevated levels of Hydrogen Sulphide on site measured using a Jerome.

4.4 Longer Duration Monitoring

With continued assistance from local residents, the Jerome has been used to monitor for extended periods of up to and over 24-hrs. This has been possible by positioning the Jerome in the open doorway of outbuildings that provided protection from direct rainfall (as the instrument is not waterproof) whilst still providing an opportunity for air sampling. During such monitoring, the Jerome automatically undertakes a 'Regeneration' of the sensor and at these times a zero value is reported.

The results from monitoring overnight between 22 and 23 May are presented in Figure 4-1.

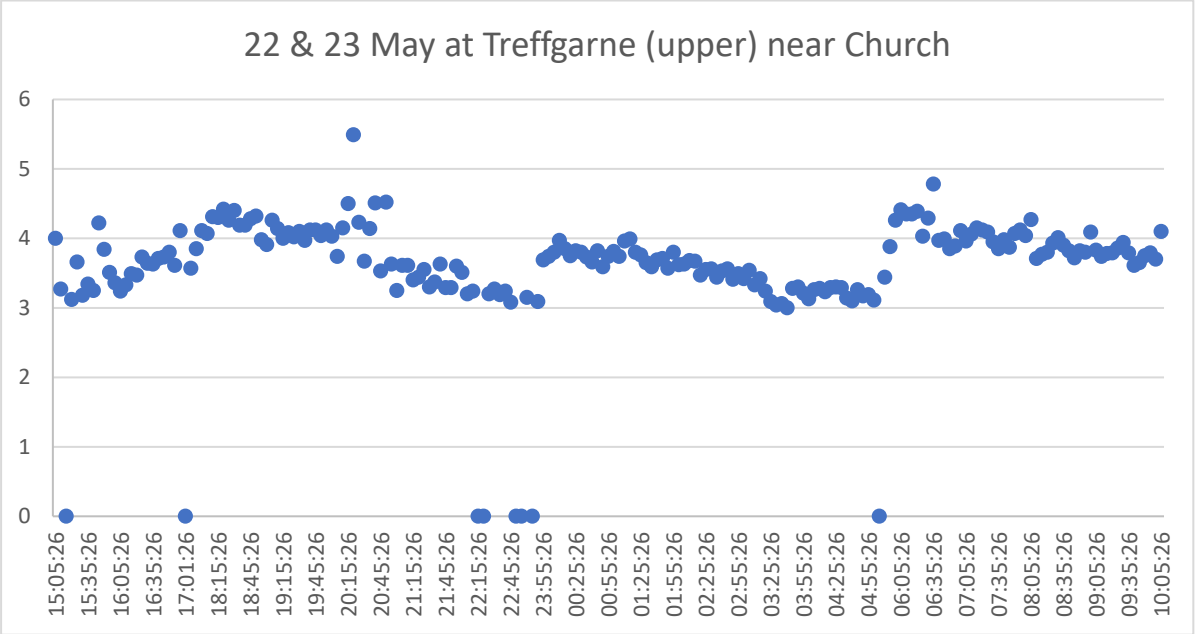


Figure 4-1 Overnight monitoring at Treffgarne

4.5 Summary

As the data from the Jerome monitor is gathered over short timescales, it is considered appropriate, at this stage, to evaluate the data against criteria intended to enable the assessment of such short-term exposure rather than the longer-term exposure criteria summarised in Table 3-5. Such short-term criteria are sometimes referred to as acute criteria. In the absence of specific UK criteria, an example of such criteria is presented in Table 4-2 which have been developed by the World Health Organisation (WHO).

Table 4-2 WHO Air Quality Guidelines

Short-term WHO air quality guideline	Hydrogen Sulphide guideline value/ppb	Note
30-minute (average)	5	Short-term odour value protective of odour annoyance. The guideline was developed by a panel of experts following a review of available information and consideration of the odour threshold for hydrogen sulphide which was reported to be in range 0.5 ppb – 130 ppb based on experimental studies at the time.
24-hour (average)	107	This value was derived from studies of eye irritation in humans.

Many readings reported by the Jerome are close to the detection limit of the instrument and also close to the 5ppb guideline value. Interestingly, values reported above and below the 5ppb guideline value have been recorded at times where there has not been an odour detectable/reported and at times when an odour has been detectable.

The monitoring indicates that there are several different types of odour present including odour suspected to be from the landfill and odours suspected to be related to a range of agricultural activities. The highest concentrations of Hydrogen Sulphide have been measured by the Jerome when odours have been detected with the highest readings reaching almost 15ppb. Values have, therefore, been found to be above the 30-minute threshold at times but all data falls below the 24-hr guideline average of 107 ppb.

5 SUMMARY

The recorded concentrations of hydrogen sulphide measured at each diffusion tube placed within surrounding communities have averaged 0.2ppb or less since the start of monitoring in early February 2024. These time integrated average concentrations are lower than the lifetime exposure criteria of 1ppb.

With the benefit of the data gathered from the Jerome monitor, it is now evident that the instantaneous concentration of Hydrogen Sulphide in the community settings varies although the dataset is complex and many readings are close to the detection limit of the instrument. Values of Hydrogen Sulphide above 5ppb have been found and at these times odour has typically been perceived with several different types of odour suspected including landfill gas and odour from agricultural activities. The highest concentrations of Hydrogen Sulphide tend to be found when odorous landfill gas is suspected to be present.

During this monitoring period, diffusion tubes have once again been used to assess for the presence of VOCs. Low concentration levels continue to be found and it appears that Hydrogen Sulphide is still a useful target compound for trying to detect the presence of odours.

Acknowledgements

Some of the monitoring would not have been possible without the ongoing support and access provided by local residents. Thank you for assistance.

References

Ref 1. U.S. Department of Health and Human Services, Agency for Toxic Substances and Disease Registry (ATSDR), Toxicological profile for Hydrogen Sulphide, 2006.
Ref 2. U.S. Environmental Protection Agency Reference Concentration for Hydrogen Sulphide.
Ref 3. EH40/2005 Workplace exposure limits (Fourth Edition 2020)