



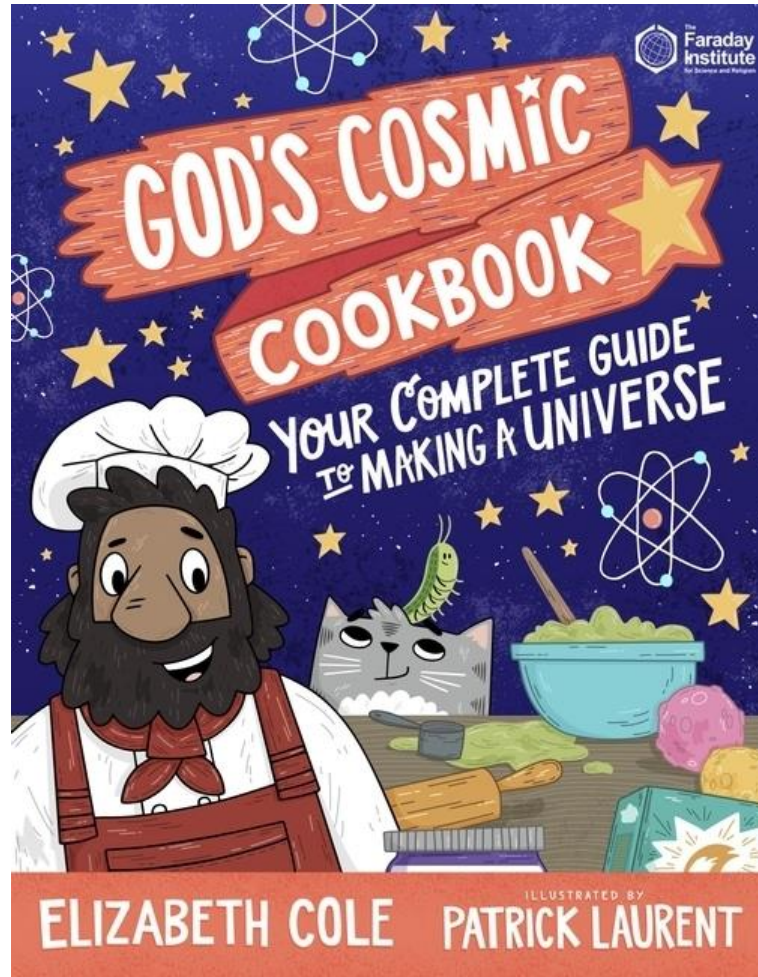
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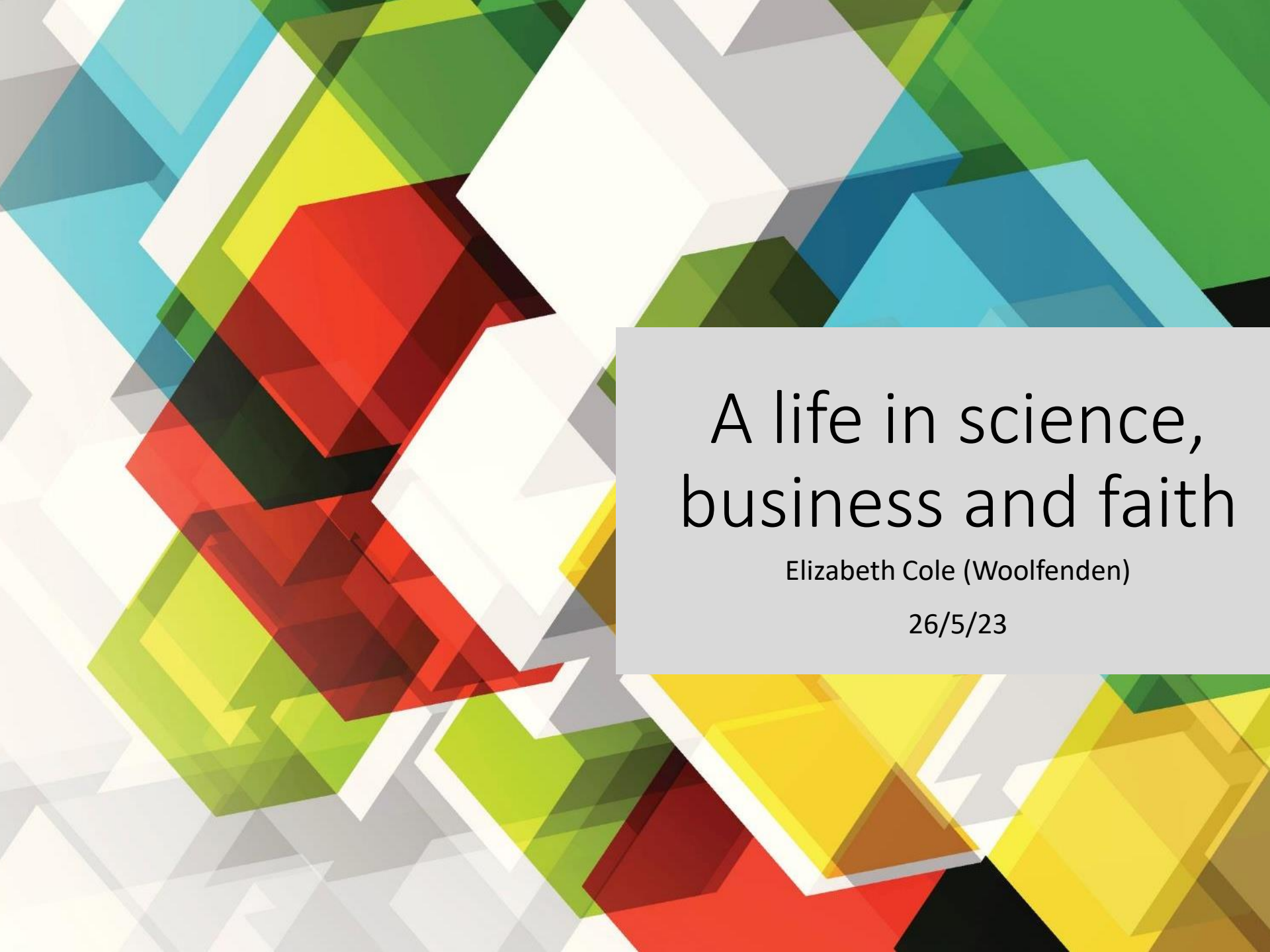
TM



# **Tonight's Talk**

**Dr Elizabeth Cole**  
*Working in Science,  
Business and Faith*

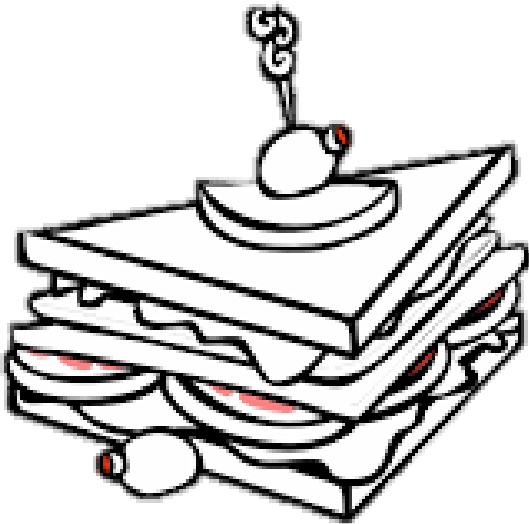
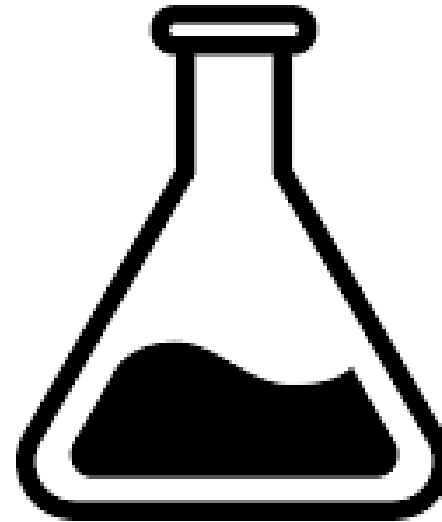




# A life in science, business and faith

Elizabeth Cole (Woolfenden)

26/5/23



### **Lessons learnt:**

1. Loved working in a scientific/technical company – Variety, part of a team
2. Cancer Research: Scientific research isn't what I thought it would be
3. The Met Lab: Great team & work BUT...
  - a. Never commute into central London
  - b. Don't work for the civil service



When I graduated, I became a ***Thermal Desorption Product Specialist*** for the UK sales department of major US Instrument company... ???

# What is analytical thermal desorption (TD)

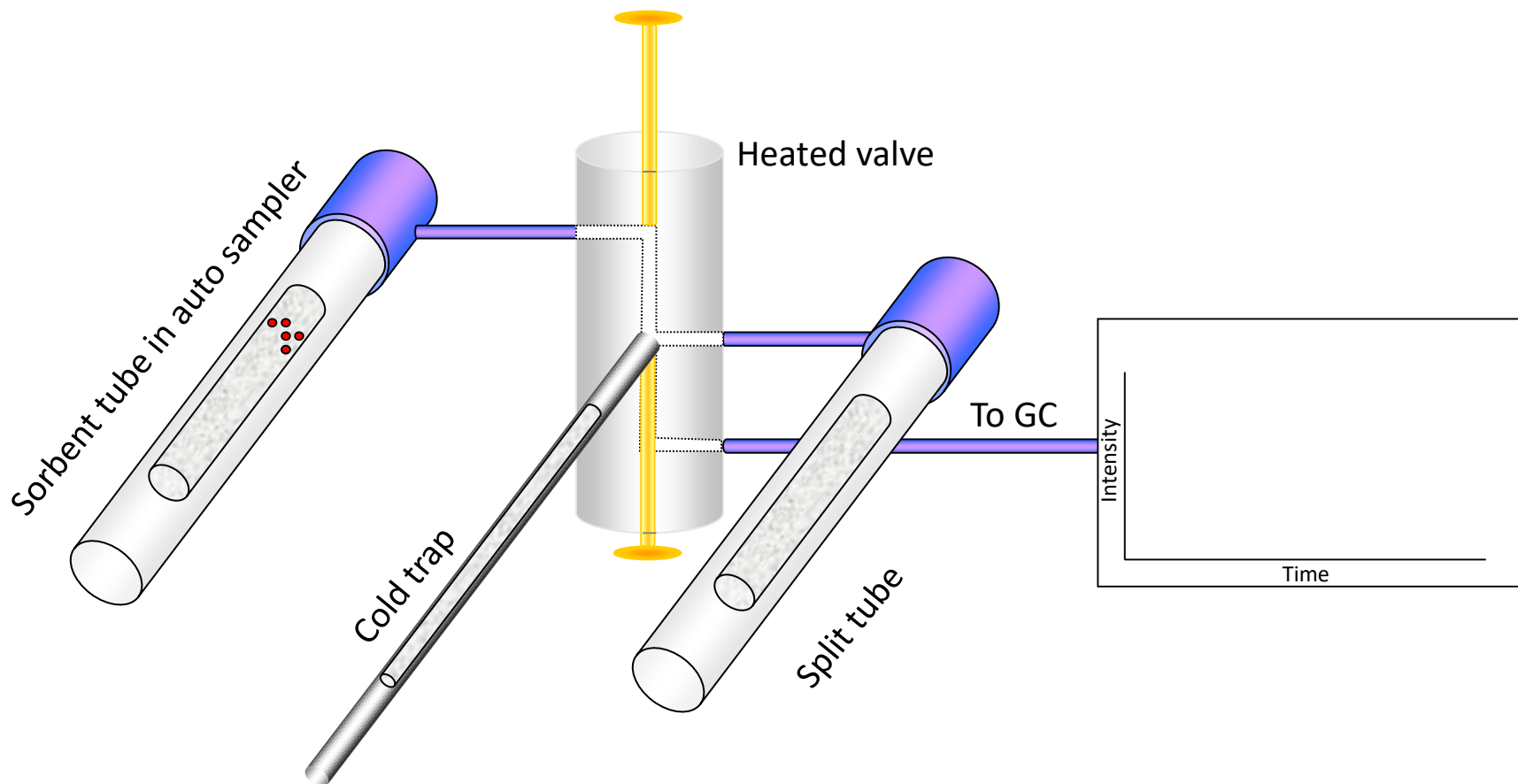
A sample introduction method for gas chromatography (GC) and GC-mass spectrometry (GC-MS)

The process of using heat and a flow of inert (carrier) gas to extract (desorb) volatile and semi-volatile organic chemicals ((s-)VOCs) from a sorbent or sample matrix and transfer them into a GC column for separation and analysis.

An automated tool for extracting and selectively concentrating (s-)VOC before injecting them into a GC(-MS)

How does it work??

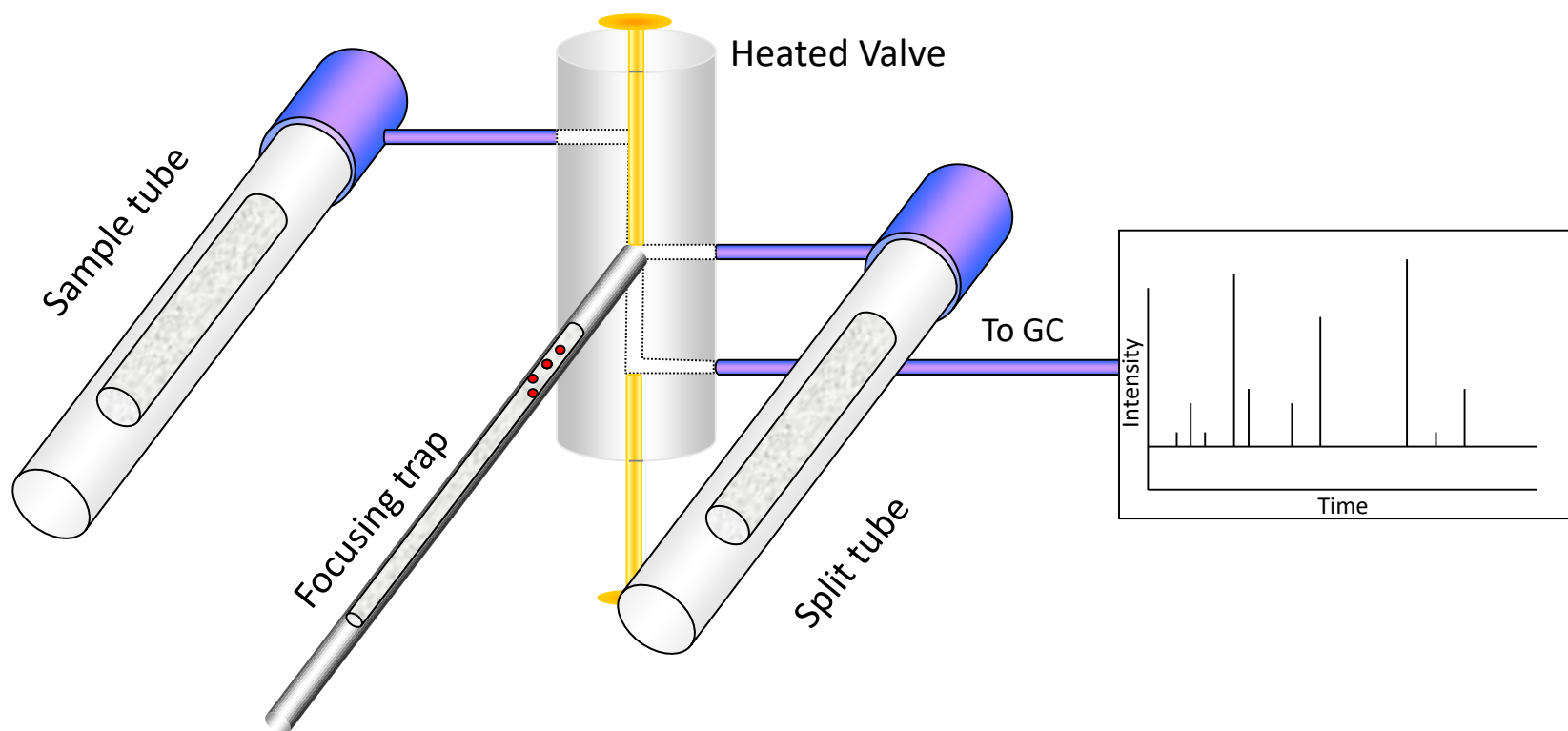
# Analytical thermal desorption TD



- Sample transferred from tube to cold trap, using heat & flow of inert carrier gas (in the opposite direction to sampling flow)
- Split available at this point for high concentration samples



# Analytical thermal desorption TD – Stage 2

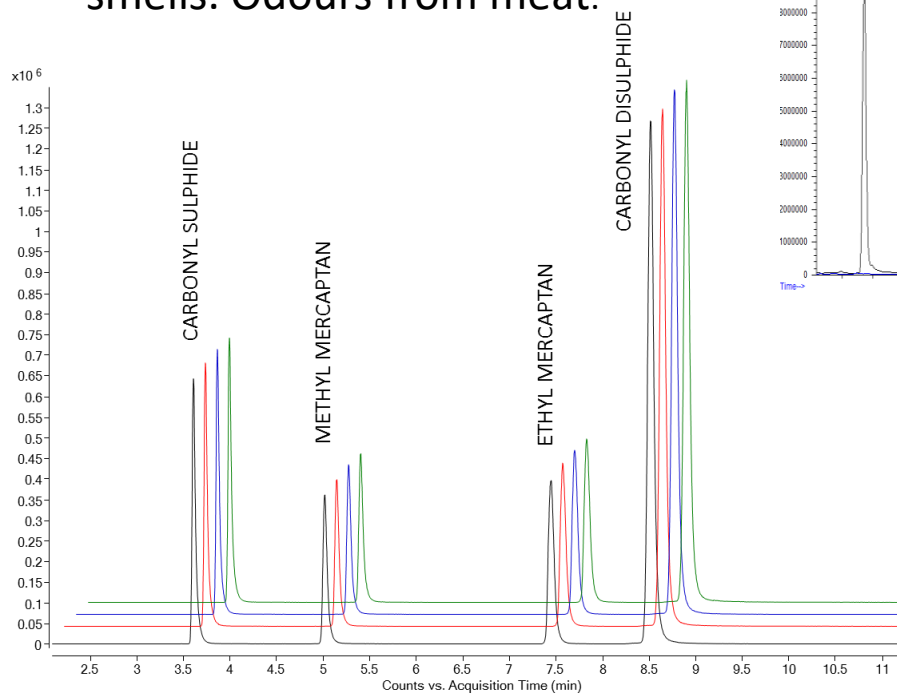


- Cold trap heated rapidly (up to 100°C/second)
- Dimensions of cold trap allow splitless desorption for trace (ppt) analysis
- Reciprocating heated valve pins do not allow flow back to the sample tube

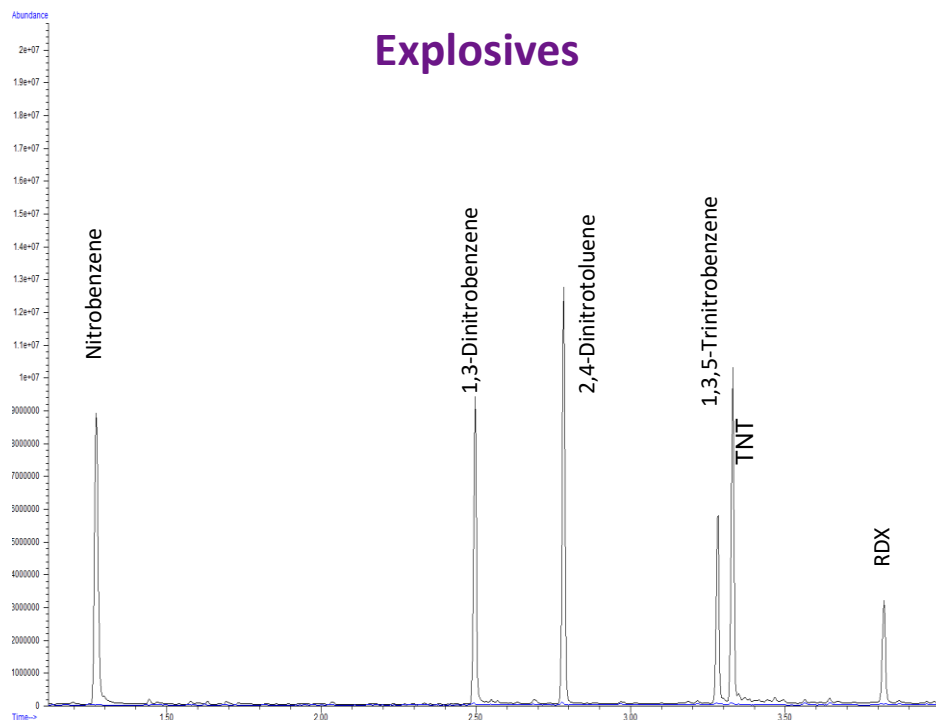
So what can you do with this wonderful tool??

# TD is used for trace-level toxic and smelly chemicals

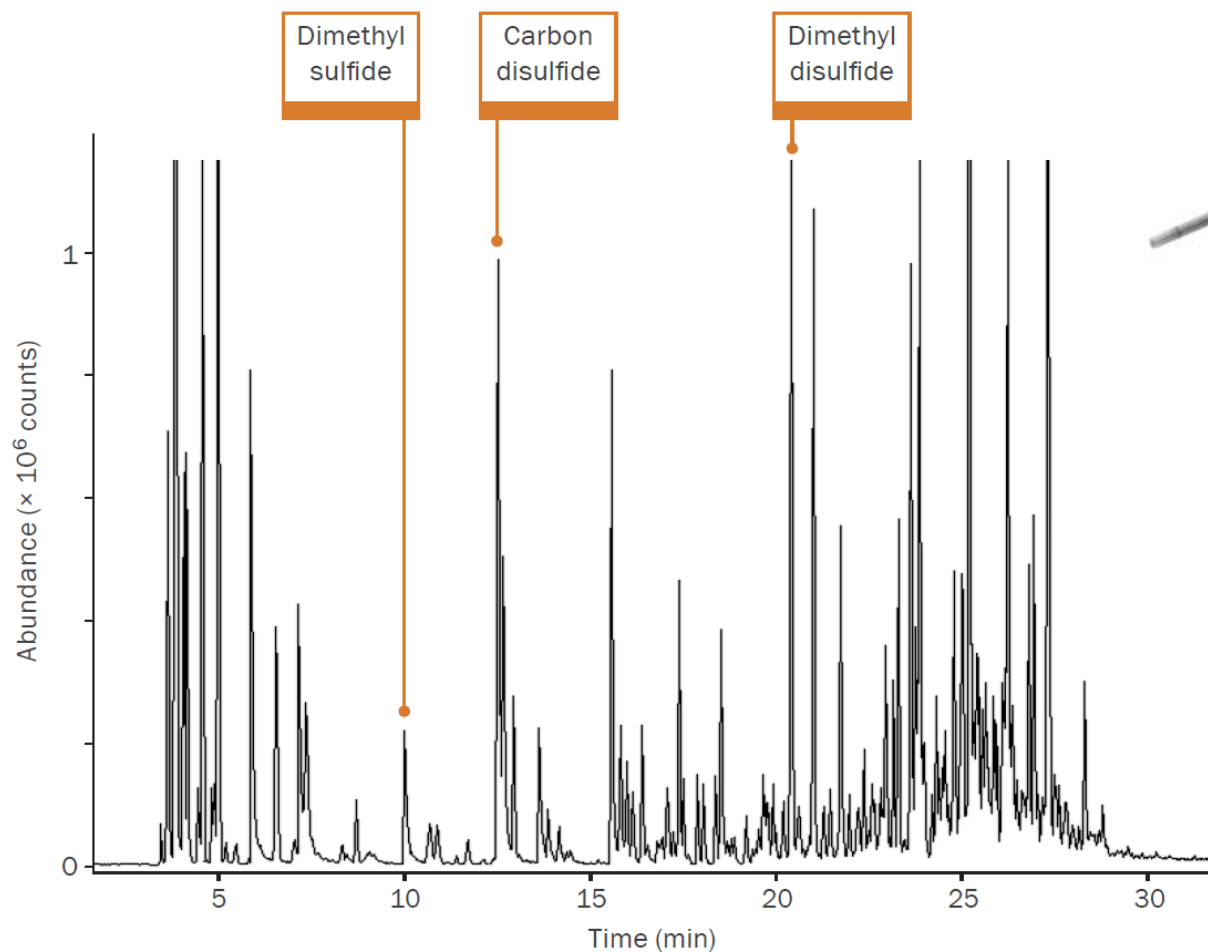
**Sulphurs** – Sewage / landfill smells. Odours from meat.



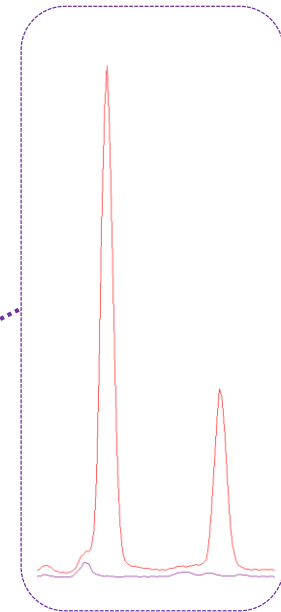
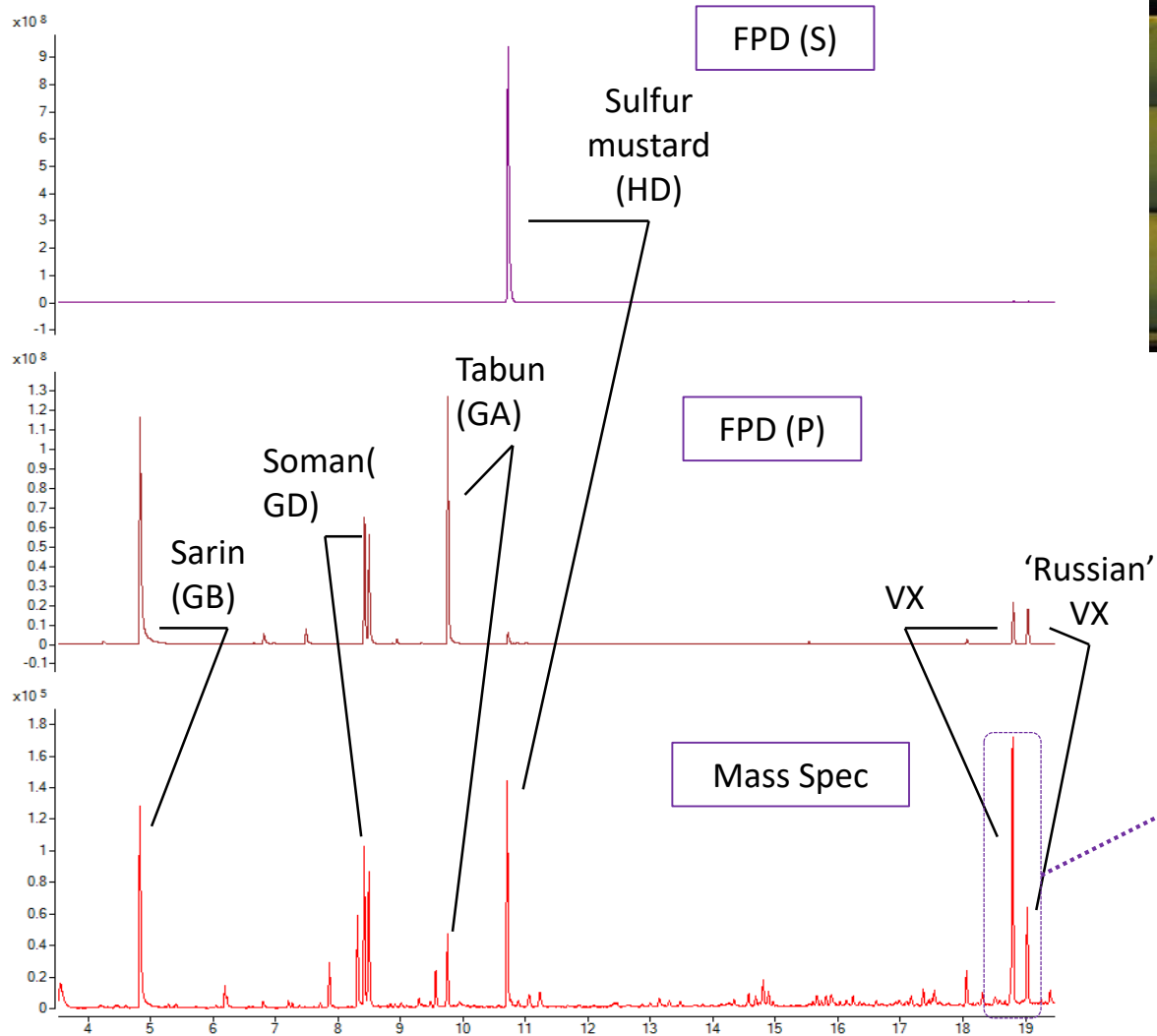
## Explosives



# Landfill gas (sulphur compounds)

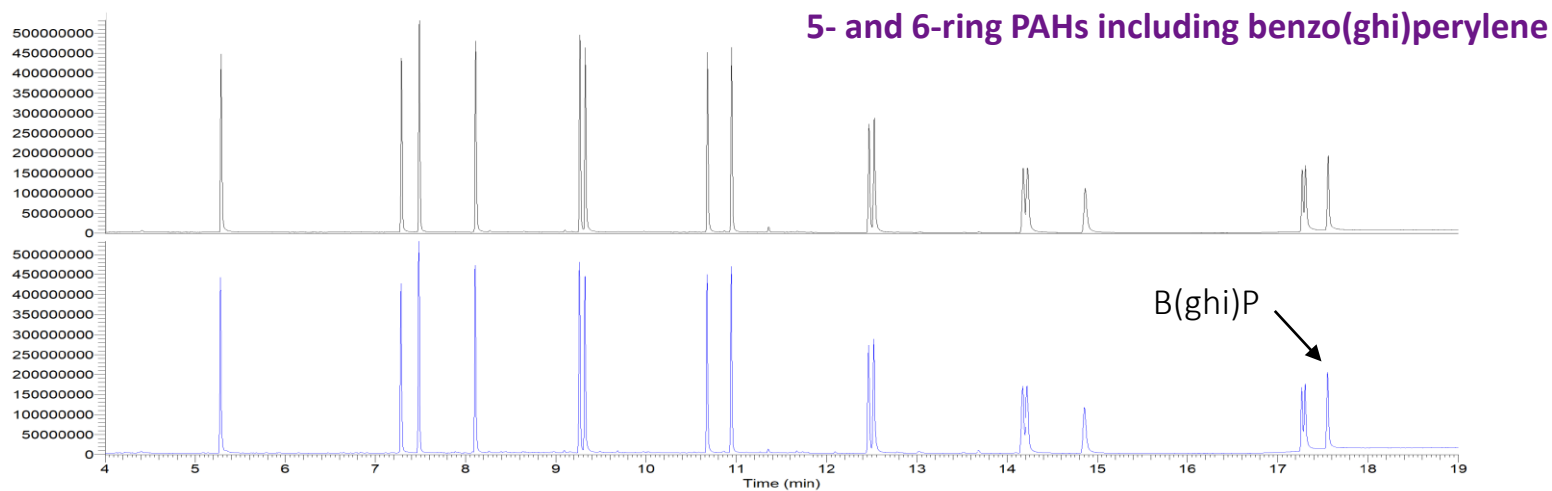
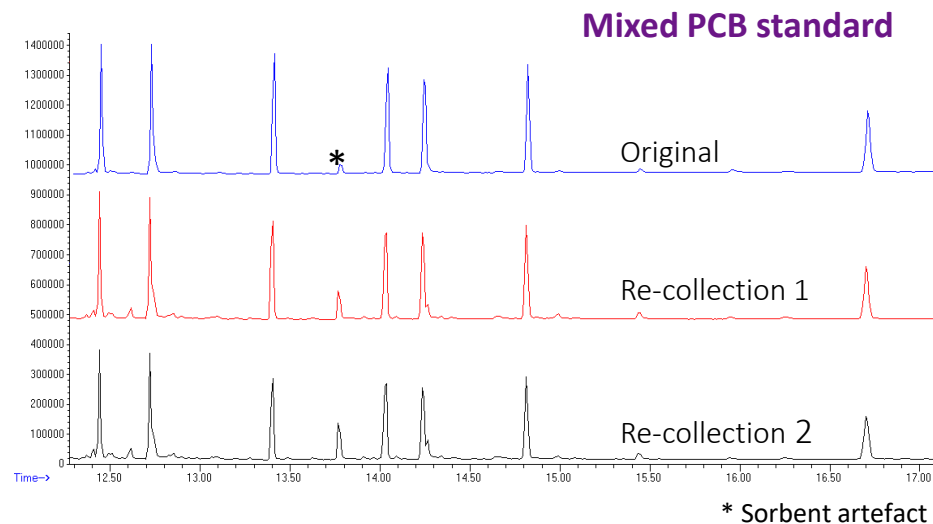


# Chemical defence and personnel protection during agent destruction



# High-boiling persistent organic pollutants (POPs)

Re-collection and repeat analysis confirms recovery of high-boiling analytes.

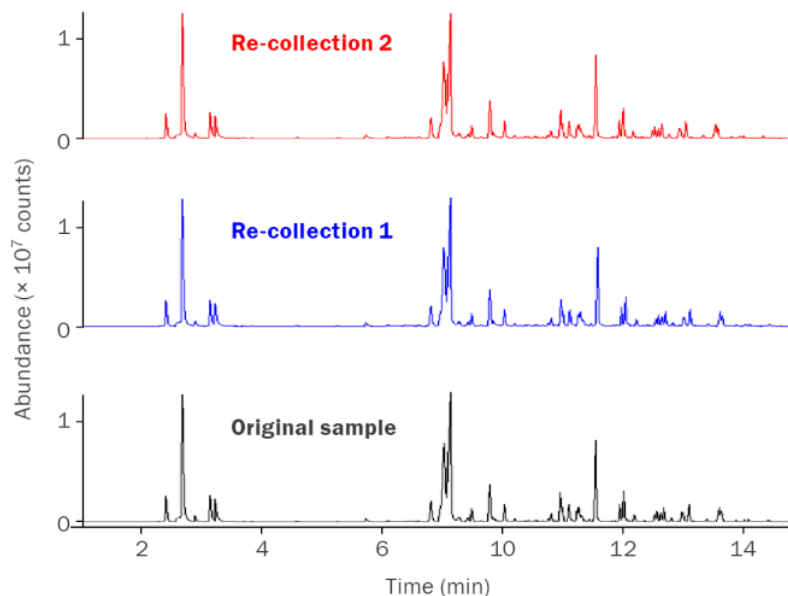


# Industrial emission testing (stack gas)

Stack gas can have high a level of contaminants  
(Look for higher chimneys!!)

How can analytical systems designed for trace  
ppb and ppt levels cope?

Sampling splitting up to **125,000:1**

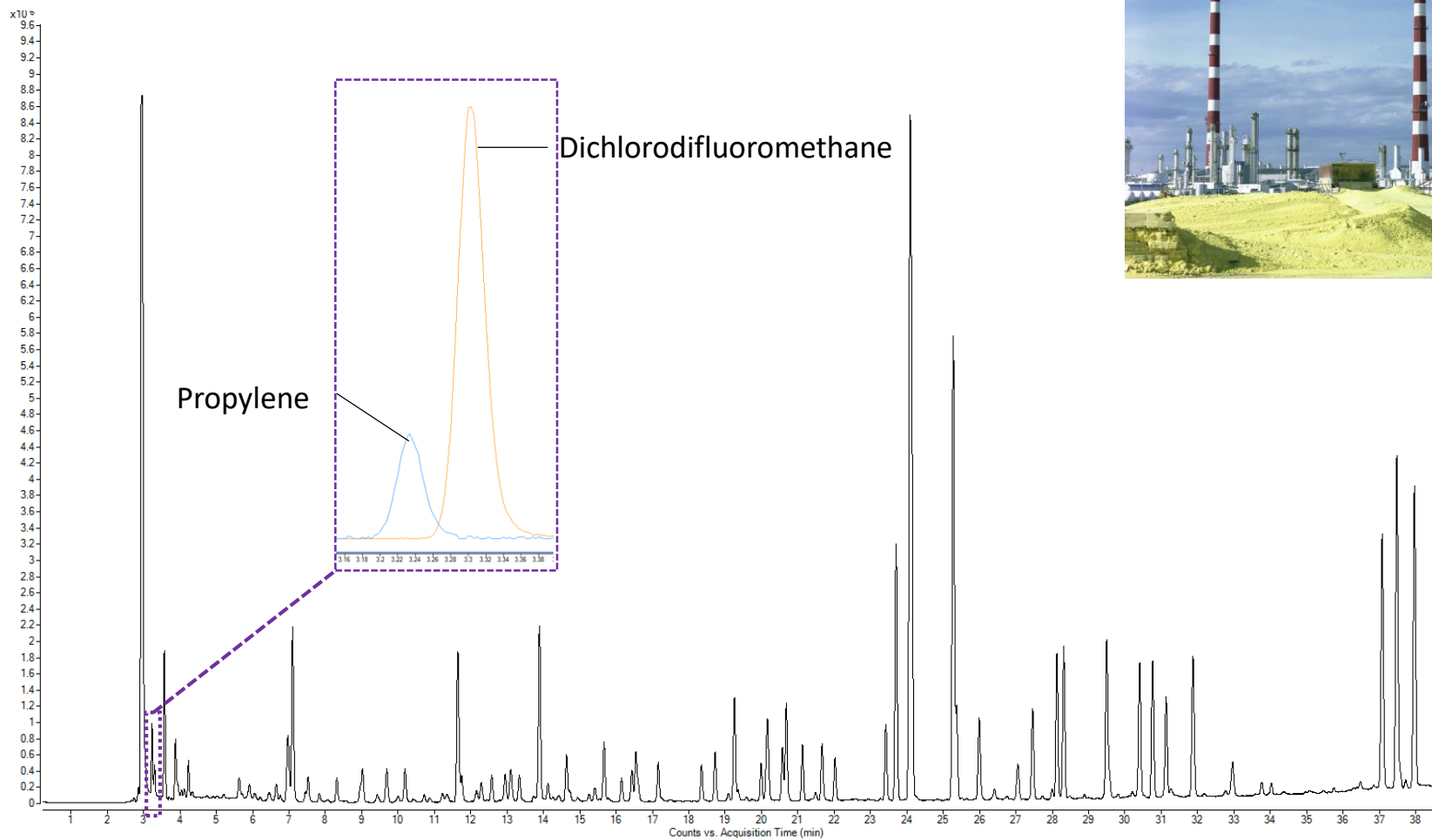


## Confirmed results:

Analysed with 3000:1 overall split ratio.

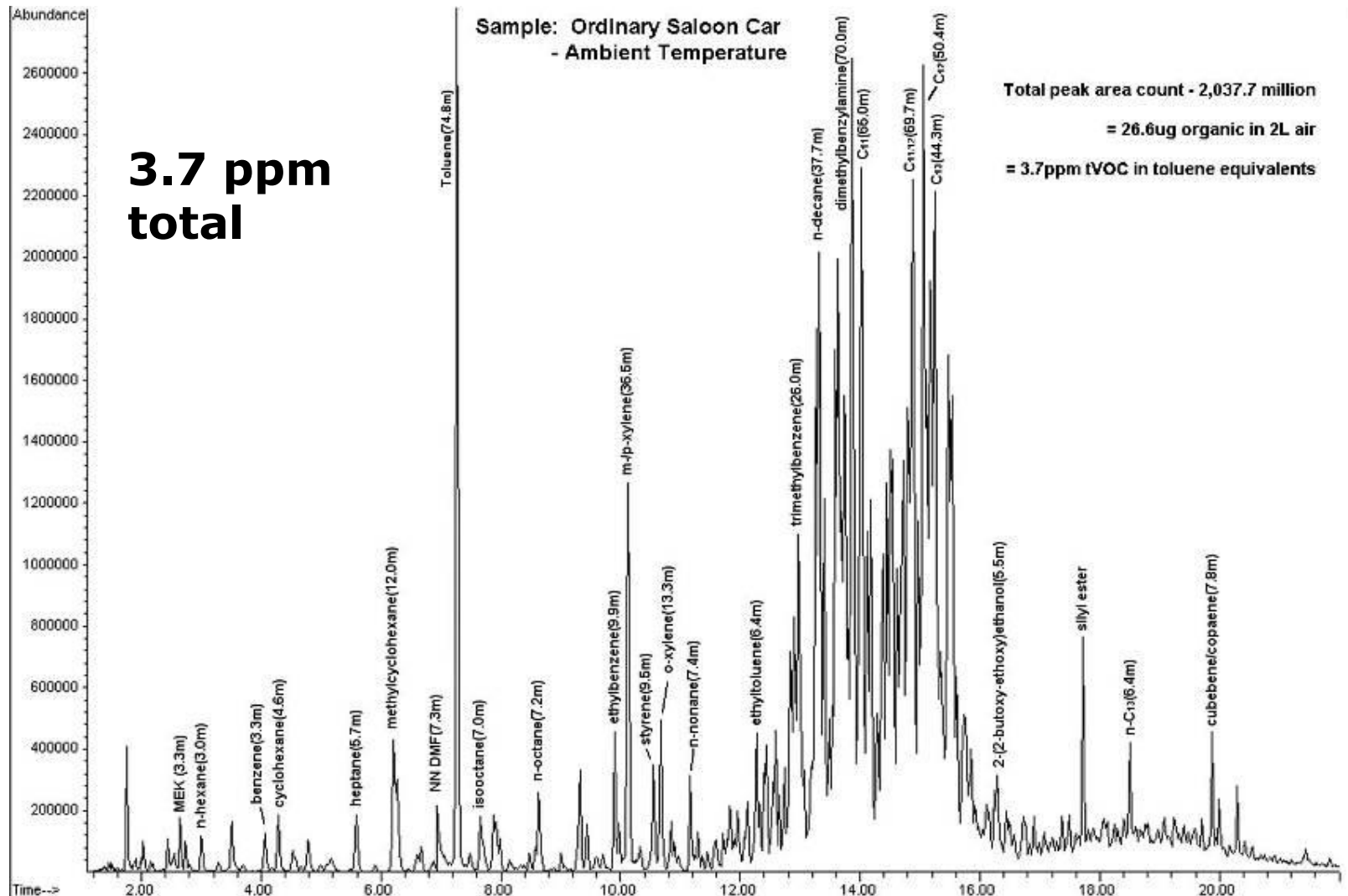
3 repeat analyses of a single sample of  
stack gas allowed confirmation of  
emission results.

# Hazardous volatile air pollutants ('Air Toxics')

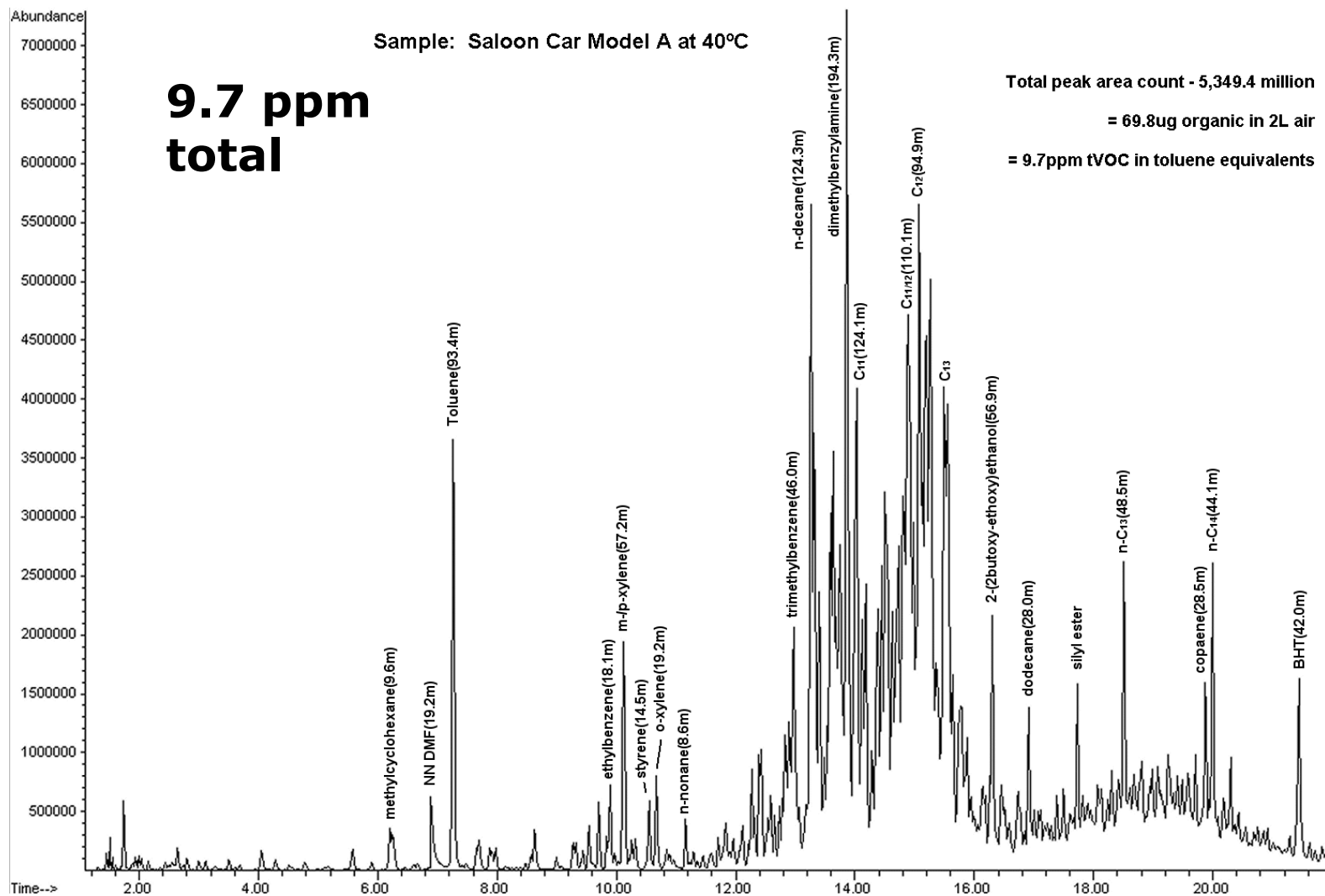




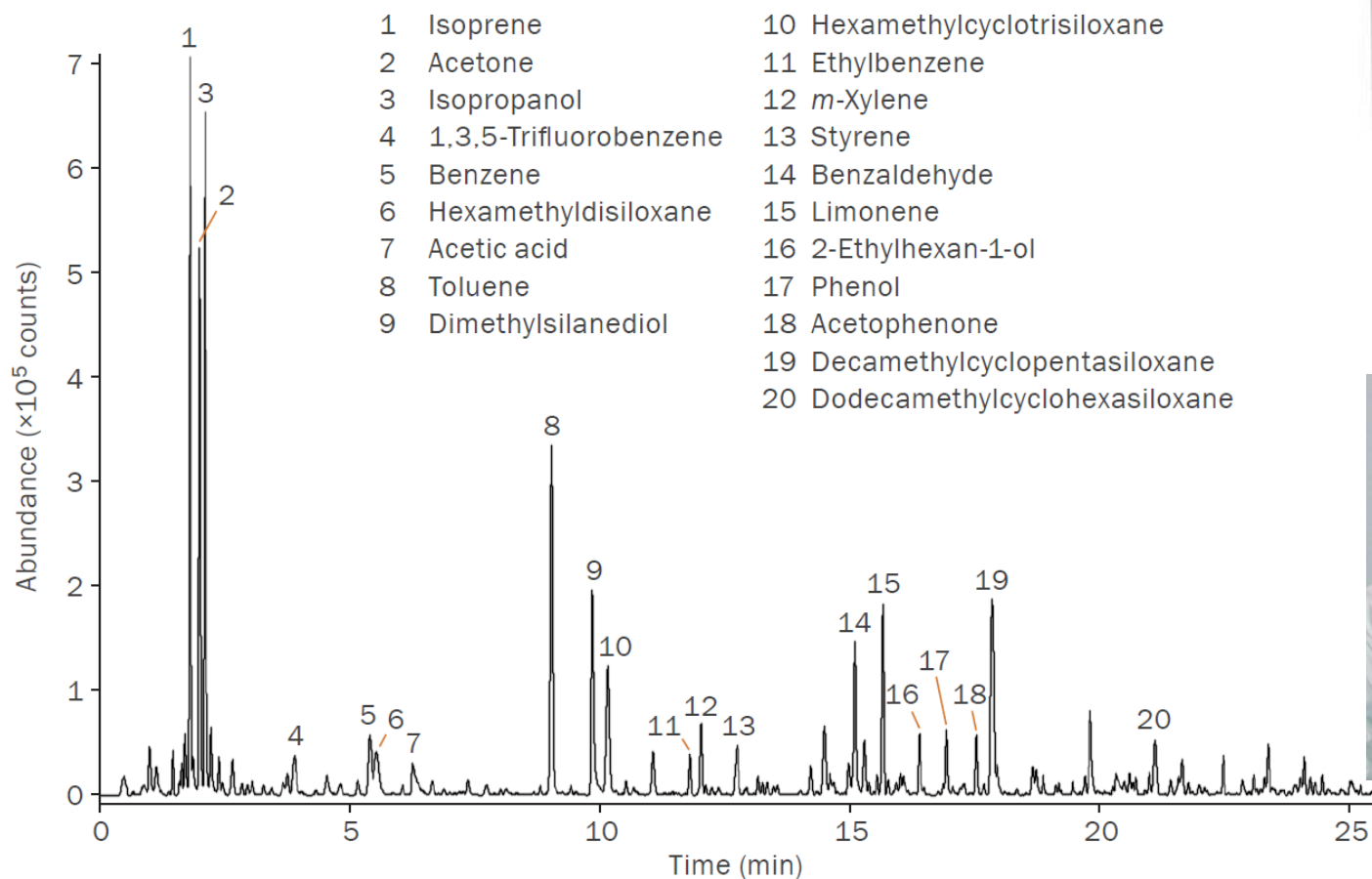
# The air inside a regular car ~20 years ago



# Even higher levels were found inside cars parked in the sun



# Breath monitoring – Occupational hygiene or disease diagnosis

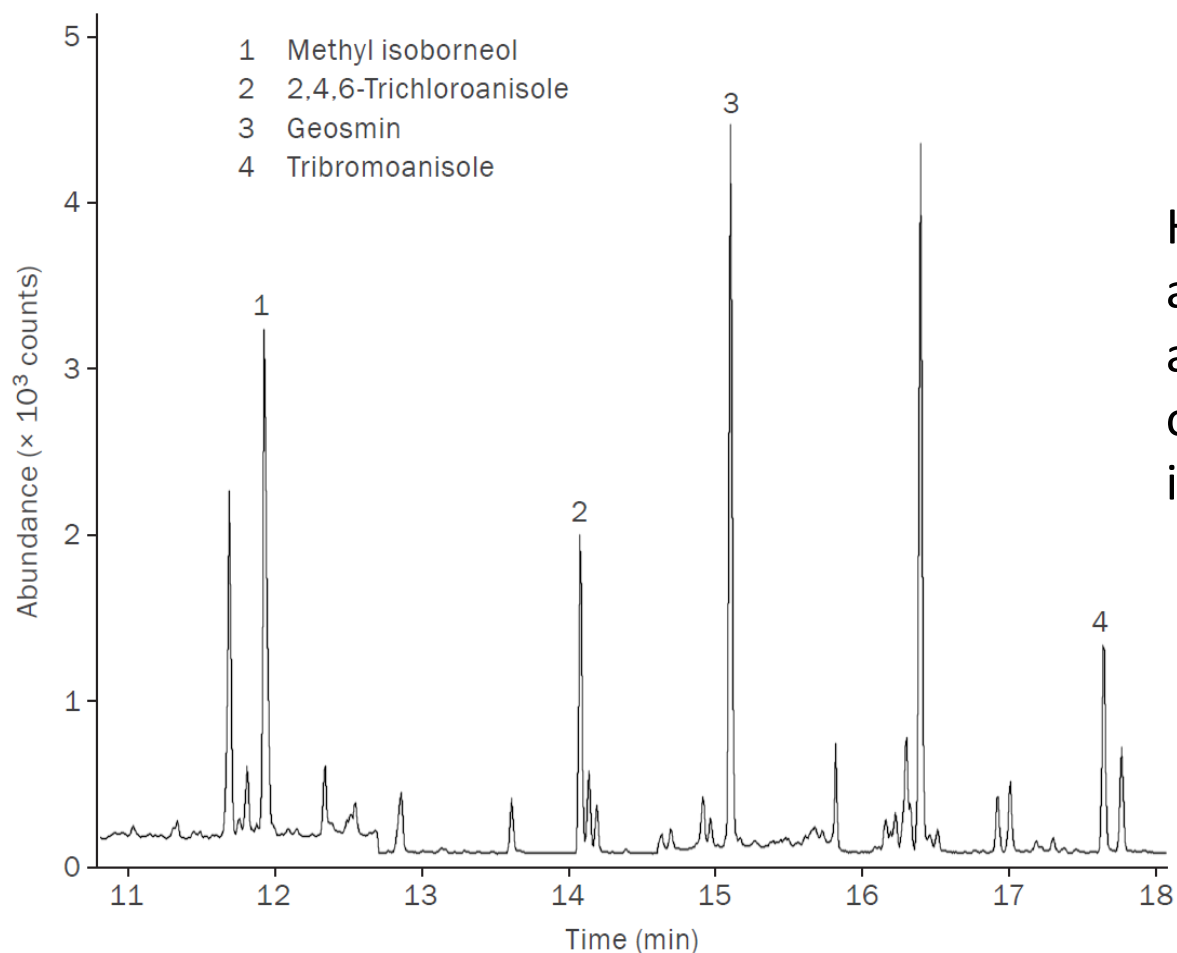




Whale breath ??

Photograph courtesy of: Dr. Rei Rasmussen,  
Oregon Graduate Institute, USA

# Water contamination



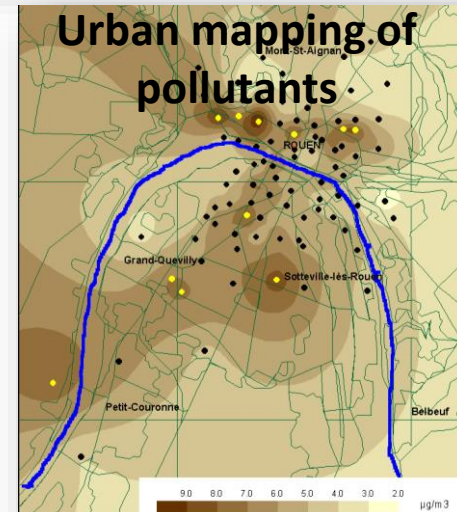
HiSorb sorptive cartridges are used for immersive and headspace sampling of semi-volatile odorants in ground water

20 mL water spiked with odorants

# Diffusive (passive) air monitoring (no pump)



*Monitoring guidelines (sorbents, uptake rates, sampling volumes, etc.) available from standard methods (and from Markes)*





# Underground contamination

Passive sampling of soil gas at industrial site

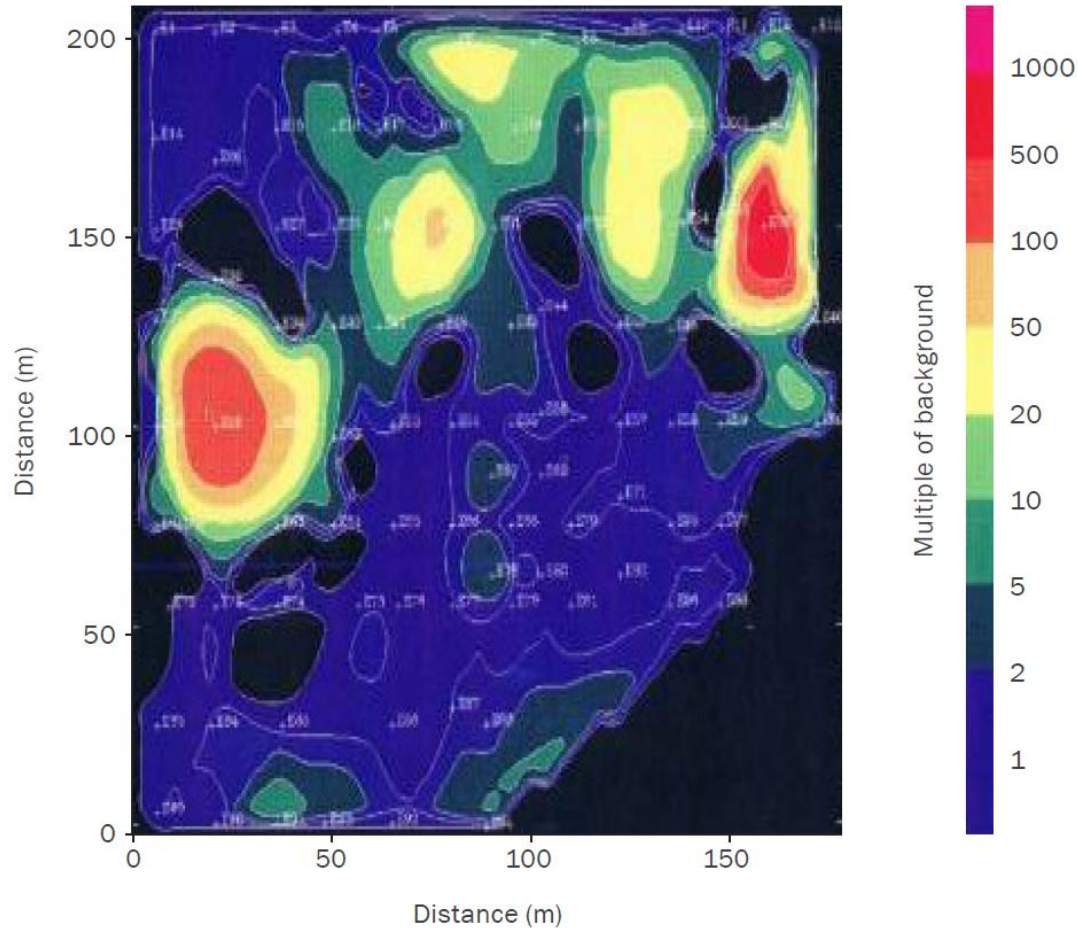
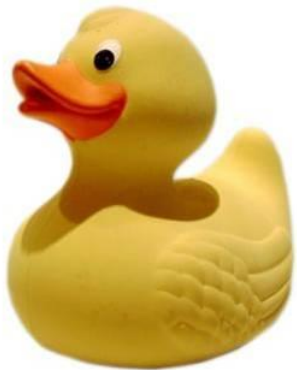


Image credit: Joe Roberts,  
Harper Adams University, UK.

# Material Emissions





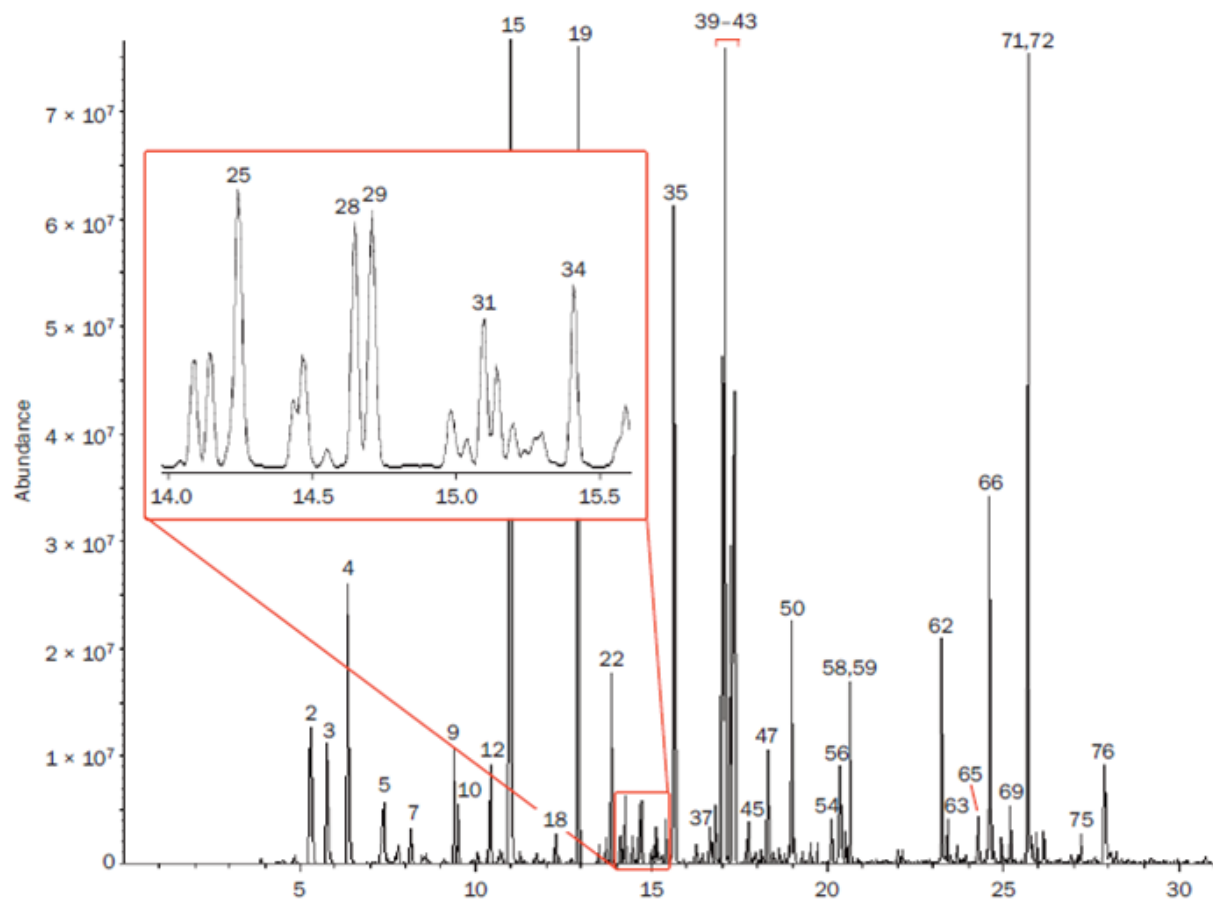
# Collecting the vapour profiles of 'stuff'

- Flooring
- Plastic toys
- Food and drink
- Tobacco/ Cannabis
- Human fluids and waste

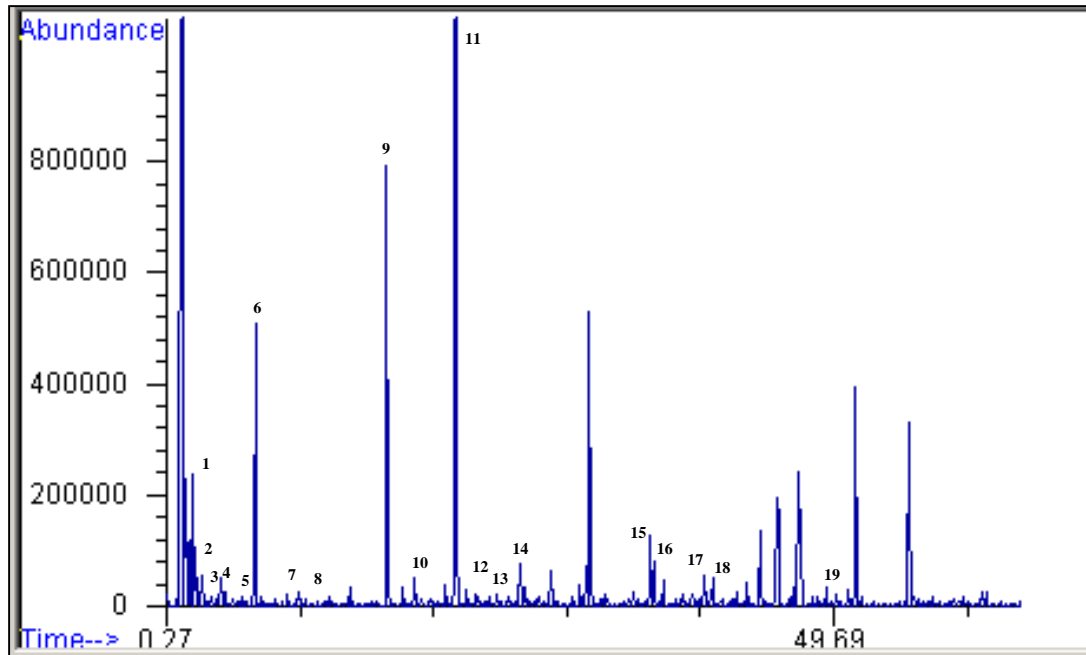




2 Ethanol	19 Ethyl butanoate	40 Ethyl hexanoate	59 Octyl acetate
3 Acetone	22 Isopropyl butanoate	41 Hex-3-enyl acetate	62 Octyl butanoate
4 Methyl acetate	25 Hex-3-en-1-ol	42 Hexyl acetate	63 Tetradecane
5 Acetic acid	28 3-Methylbutyl acetate	43 Hex-2-enyl acetate	65 $\beta$ -Farnesene
7 Ethyl acetate	29 2-Methylbutyl acetate	45 Isopropyl hexanoate	66 Decalactone
9 Butan-1-ol	31 Propyl butanoate	47 Furanol	69 Butylated hydroxy toluene
10 Benzene	34 Pentyl acetate	50 Linalool	71 Nerolidol
12 Methyl thioacetate	35 Methyl hexanoate	54 Benzyl acetate	72 Octyl hexanoate
15 Methyl butanoate	37 Benzaldehyde	56 Butyl hexanoate	75 Dodecalactone
18 Benzyl methyl ketone	39 Butyl butanoate	58 Dodecane	76 1,2,3,6,7,8,9,10,11,12- Decahydrobenzo[e]pyrene



# Direct desorption of mushroom powder



- Broad range of flavour compounds identified
- Some representative compounds are listed

#	Compound
1	Acetaldehyde
2	Ethanol
3	Butanal
4	Hexanal
5	Heptanal
6	D-Limonene
7	Octanal
8	Nonanal
9	Acetic acid
10	Benzaldehyde
11	Propylene glycol
12	Butyrolactone
13	Butanoic acid
14	Phenylmethyl ester acetic acid
15	Phenol
16	2-Pyrrolidinone
17	2-Phenoxy-ethanol
18	Caprolactam
19	Benzophenone

This is the science, what about the commercial side??

## A potted history

- 14 years with big US Instrument Co; 10 years in UK, 4 in US
- Started our own business in the UK in 1997
  - There were 2 (4) of us
- First year we only sold sorbent tubes for collecting air samples while engineering and testing were completed on our first instrument
- Had originally planned to work in conjunction with our old employer – but that was not to be
- Now have 6 complementary product lines, ~200 staff and offices in Germany, US, China and UK

# What does an instrument company like ours do?

- Specify and design instruments from the drawing board to meet user needs as test requirements evolve
  - New regulations and certification requirements
  - New competitive or market requirements for the customer
  - New research priorities
  - New toxicity / consumer-safety concerns
- Make and test prototypes – do they meet/exceed the spec?  
Can we prove what we are saying with real examples?
  - Invite 1 or 2 key users to test the prototypes
- Prepare for market introduction:
  - Ensure you've got the message right – are we using the terminology the customers use??
  - Prepare all the promotional and technical support materials
  - Train all the Service and Sales specialists
  - Anticipate what your competitors will say and prepare answers

# What we do

Continued...

- Move the product from 'Engineering' to 'Production', with detailed assembly instructions and videos, all necessary final-test procedures and a solid supply chain
- Check all commercial aspects:
  - Competitive pricing (beware global mkt variations)
  - Reasonable margins
  - Accessories, spares and consumables
- Press GO – launch - and maximise awareness of your new product as quickly as possible across the target market, in all relevant geographies

## Don't be scared of sales – It is a partnership

- Put yourself in your customer's shoes
- Understand their work, their priorities, their day-to-day pressures and irritations
- Identify what they need from your kit (if they need it)
- Identify the technical innovations your company has brought that will help that customer do their work better (and that your competitor doesn't have)
- Always tell the truth. Always do what you promise
- Make sure the customer gets something useful out of each conversation/visit – don't waste their time



I was busy, busy, busy, but...

God had plans!

# Evangelical and Anglican roots



## *Concerns and doubts crept in...*

- Attitude to women
  - Leading
  - Working
- Right and wrong
  - The Jesus I knew seemed about as far from a 'right-wing Christian' as it was possible to be
- '6-day creationism'
  - Can I be a 'proper' Cristian without believing this
- Should I be in some form of full-time ministry to concentrate on what God wants me to do?
- Why is the church so often judgemental – leaping right in where the pharisees left off?

## The Royal Law (Example from Luke 10, 27)

“Love the Lord your God with all your heart and with all your soul and with all your strength and with all your mind’ and, ‘Love your neighbour as yourself.’”

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“Love the Lord your God with all your heart and with all your soul and with all your strength and *with all your mind*’ and, ‘Love your neighbour as yourself.’”

## I set to work...

- I began to read more widely
- I attended Lee Abbey courses on science and faith
- I discovered like-minded Christians in CiS plus the Science and Religion Forum
- I carried on reading

## Being a working woman

- Thankfully, this rarely seems to be an issue nowadays, but I found the epilogue in the last chapter of Proverbs (Ch 31: 10-31) provided all the answers if anybody squeaked.

## As a committed Christian, shouldn't I consider full-time ministry?

- God had put me where he wanted me
- Dorothy L Sayers once said the first duty of a Christian who makes tables is to glorify God by making good tables...
- Ps 90: 17 *May the favour of the Lord our God rest on us; establish the work of our hands for us— yes, establish the work of our hands.*
- When we first started the business, unemployment in our area was terrible...
  - >300 applicants for a single production job
  - Perfect motivation for GCSE students

# The Wordsof God

- Scripture
- Jesus
- Creation
  - We are walking in a miracle
  - It is shouting to us about the power, enormity, creativity and awesomeness of our God and God's purposes

Listening to all the words of God helps give us a clearer and more complete picture



## Don't put limits on the Royal Law

- None of us love God with all with all our heart and with all our soul and with all our strength and with all our mind
- None of us love all other people as ourselves

# The 'word of God' that is creation adds a lot to our understanding of suffering

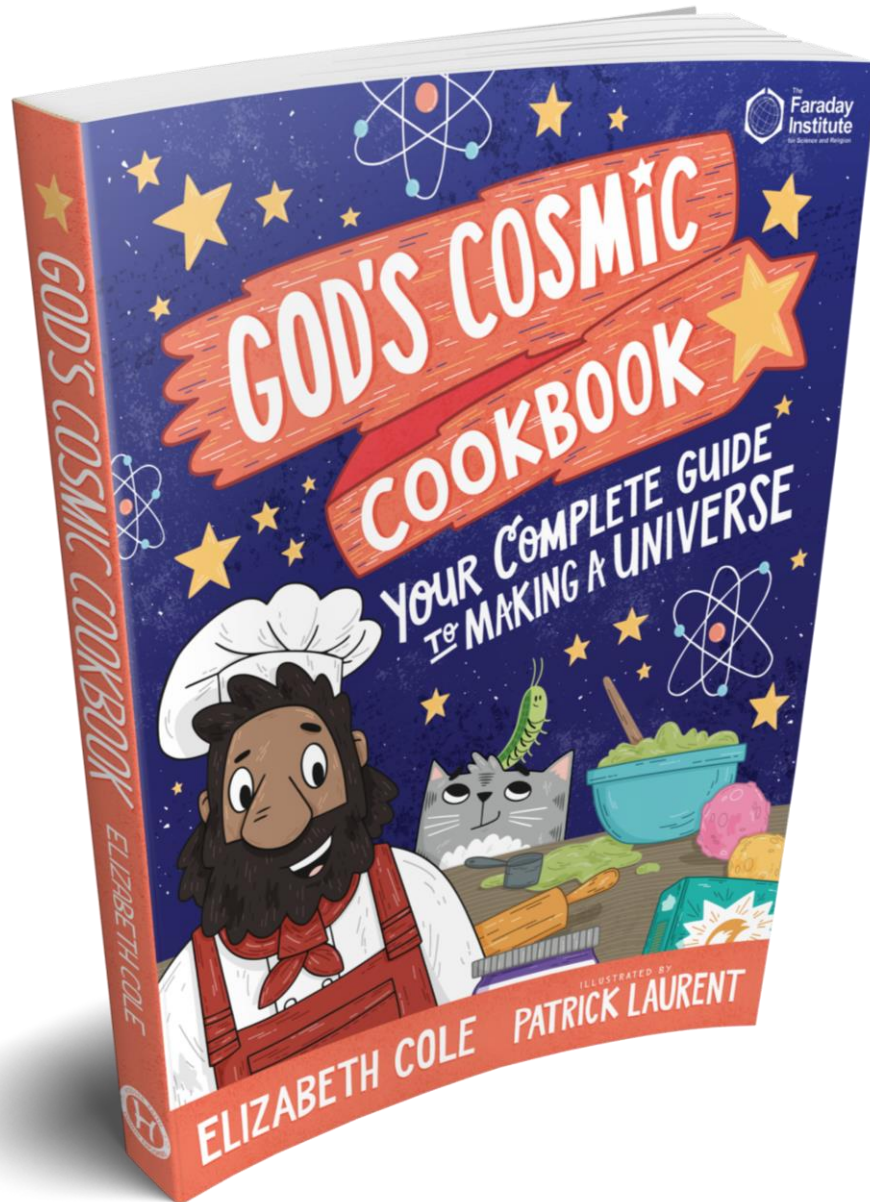
- Death and decay are an inherent part of a physical creation
  - This will inevitably entail suffering for sentient life – It is integral to the evolutionary process used by God; 'survival of the fittest means...'
- Evil and suffering are not the same
- Suffering shapes us – patience, trust, understanding of others, endurance
- Somehow suffering plays a part in salvation
  - The suffering of creation
  - Individual suffering
  - God's own suffering – Jesus was 'made perfect through suffering'

All this is still a mystery to me, but both science and scripture give us glimpses...

And having just opened a can of worms (!)

THANK YOU

and...



Shameless plug...

Coming soon to a  
book shop near  
you.

June 8<sup>th</sup> launch