

# Benzene: It's time for Continuous, Real-Time and Specific Monitoring



*Hatech Gasdetectietechniek B.V.*



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# Agenda

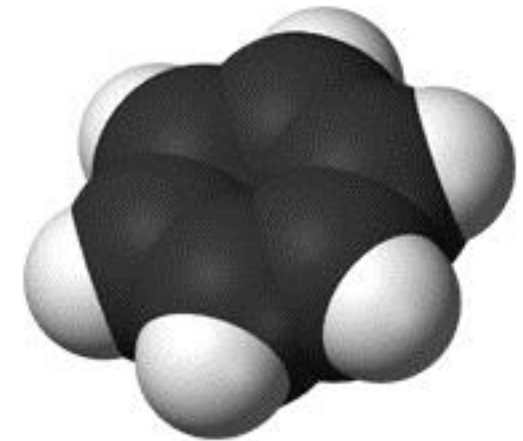
- Benzene and its uses
- Benzene health effects and regulatory history
- Monitoring methods

# Hatech

- Specialized in advising in, distributing and servicing of portable and fixed gas measurement equipment for flammable gases, toxic gases and oxygen
- Head office in Raamsdonksveer, The Netherlands
- 2012: 36% growth  
2013: 10% growth  
2014: 21% growth  
2015: 34% growth (so far)
- Detector Tubes: Excl. distributor of Benelux for Kitagawa
- Portable Instruments: Industrial Scientific, Crowcon and Ion Science
- Fixed systems: Steuma, Crowcon, Oldham, Ion Science, IMX and Honeywell
- CO2 for bear cellars: Kundo
- Biogas (portable and fixed): Geotech
- Disposable calibration and bump gasses: Private Label
- Other such as training courses, repair and calibration, accessoires, etc.

# Benzene

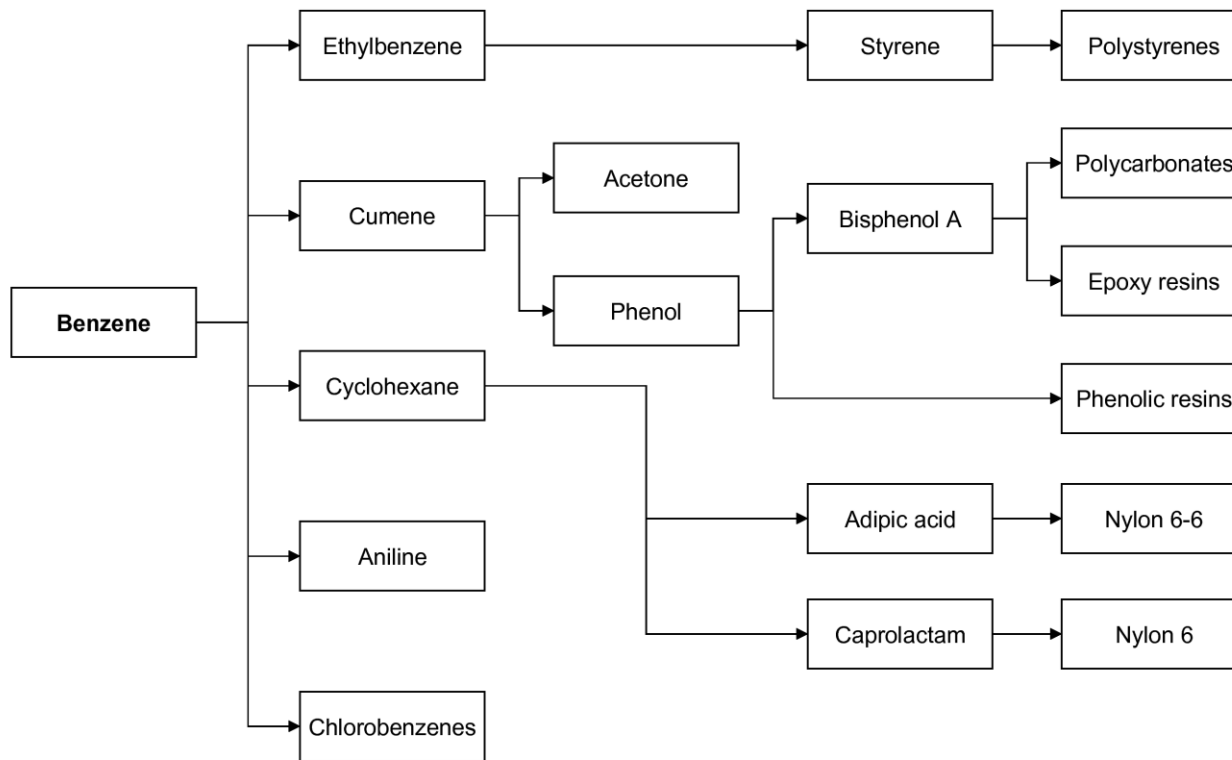
- Organic chemical compound with the chemical formula C<sub>6</sub>H<sub>6</sub>.
- Aromatic Hydrocarbon
- Natural constituent of crude oil
- Good solvent
- Colourless
- Sweet smell
- Highly flammable
- Toxic



# Benzene Uses

- The main use of benzene is as starting material for manufacturing chemicals: cyclohexane, ethyl benzene (styrene), phenol...

# Benzene uses



# Benzene Uses

- Still used as a solvent but has in most cases been substituted for safer materials
- Additive in fuel
- Smaller amounts of benzene are used to make some types of rubbers, lubricants, dyes, detergents, drugs, explosives, and pesticides

# Industrial Exposure



- Oil refineries
- Chemical and petrochemical plants, and offshore installations
- Coke works
- The storage, distribution and use of petrol or benzene itself.
- Foundries, during casting where benzene sulphonic catalysts are used



# Threshold Values

- Netherlands: 1ppm
  - Value when you notice the substance: 30 ppm
  - Value in which immediate permanent damage occurs when exposed for an hour: 153ppm
  - Value in which death occurs when exposed for an hour: 1535ppm
- Belgium, Spain, Finland, France, UK, Norway, Austria, Sweden, USA : 1ppm
- Denmark, Switzerland: 0,5ppm

# Health effects

## Acute

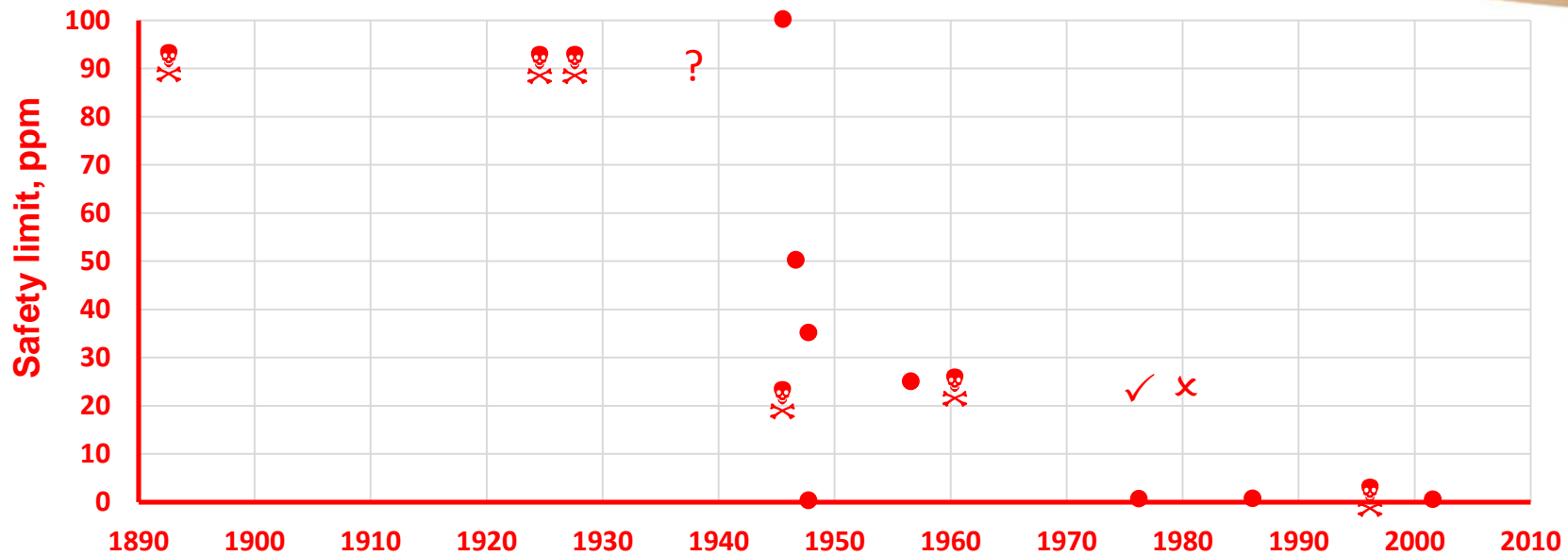
- Headache
- Dizziness
- Drowsiness
- Confusion
- Tremors
- Loss of Consciousness

# Health effects

## Chronic

- Classed by the International Agency for Research on Cancer as *carcinogenic to humans* Group 1
- Leukaemia
- Aplastic anaemia (benzene poisoning)
- Immune deficiencies (decreased resistance to infection)
- Birth defects

# Regulatory History



2001 A public exposure risk is raised against benzene in petrol

# Health effects

- In May 2014, the US Environmental Protection Agency (EPA) estimated that some five million Americans, not counting those with workplace exposures, face heightened cancer risks from benzene and 68 other carcinogens released into the air by the nation's 149 oil refineries. This is greater than a one in one million lifetime cancer risk (Table 10 pg.277).

# Health effects

<i>Activity</i>	<i>Benzene Released (lbs per year)</i>
Average car traveling 15,000 miles	4
Lawn mower	5
Residential wood stove	16
Snowmobile	37
Traffic on a Mile of Main Street in Reedsburg	1,854
Traffic on a Mile of Interstate 43 in Green Bay	3,015
Traffic on a Mile of Highway 51 in Stevens Point	3,406
Traffic on a Mile of Interstates 90/94 in Madison	4,260
Typical Iron Foundry Emissions	6,140
Traffic on a Mile of Interstate 94 in Milwaukee	16,208

# Health effects

*“There is probably no safe level of exposure to benzene, and all exposures constitute some risk in a linear, if not supralinear, and additive fashion”*

Martyn T. Smith: **Advances in Understanding Benzene Health Effects and Susceptibility**, Annual Review of Public Health, Vol. 31: 133-148 (Volume publication date April 2010)

# Monitoring

- monitoring and control of benzene concentration levels around the perimeter of all US oil refineries has been proposed by the US EPA under the 'Residual Risk Program'
- The proposed rule would revise emission control requirements for flares, storage tanks and coking units at petroleum refineries and require monitoring around refineries to ensure that neighbouring communities are not being exposed to hazardous air pollution.
- Recommendations range from placing samplers every 15° around the plant (25 sampling locations) to every 22.5° (16 sampling locations and every 40° (nine sampler locations). Additional sampling locations may also be required around satellite installations



# Monitoring

- The new EPA proposals under the Residual Risk Program and ever increasing awareness of the dangers of benzene exposure means that there is an urgent need for 24/7 continuous, benzene specific monitoring to ensure real-time protection of workforce, environment and plant.

# Methods

- Gas Detector tubes (for example: Kitagawa or Dräger tubes)
- Portable PID (for example: Ion Science Tiger Select or Dräger Multi PID 2)
- Fixed PID (for example: Ion Science TVOC or Detcon DM-700)
- Gas Chromatograph analysers
- Fixed Selective for Benzene (Ion Science Titan)

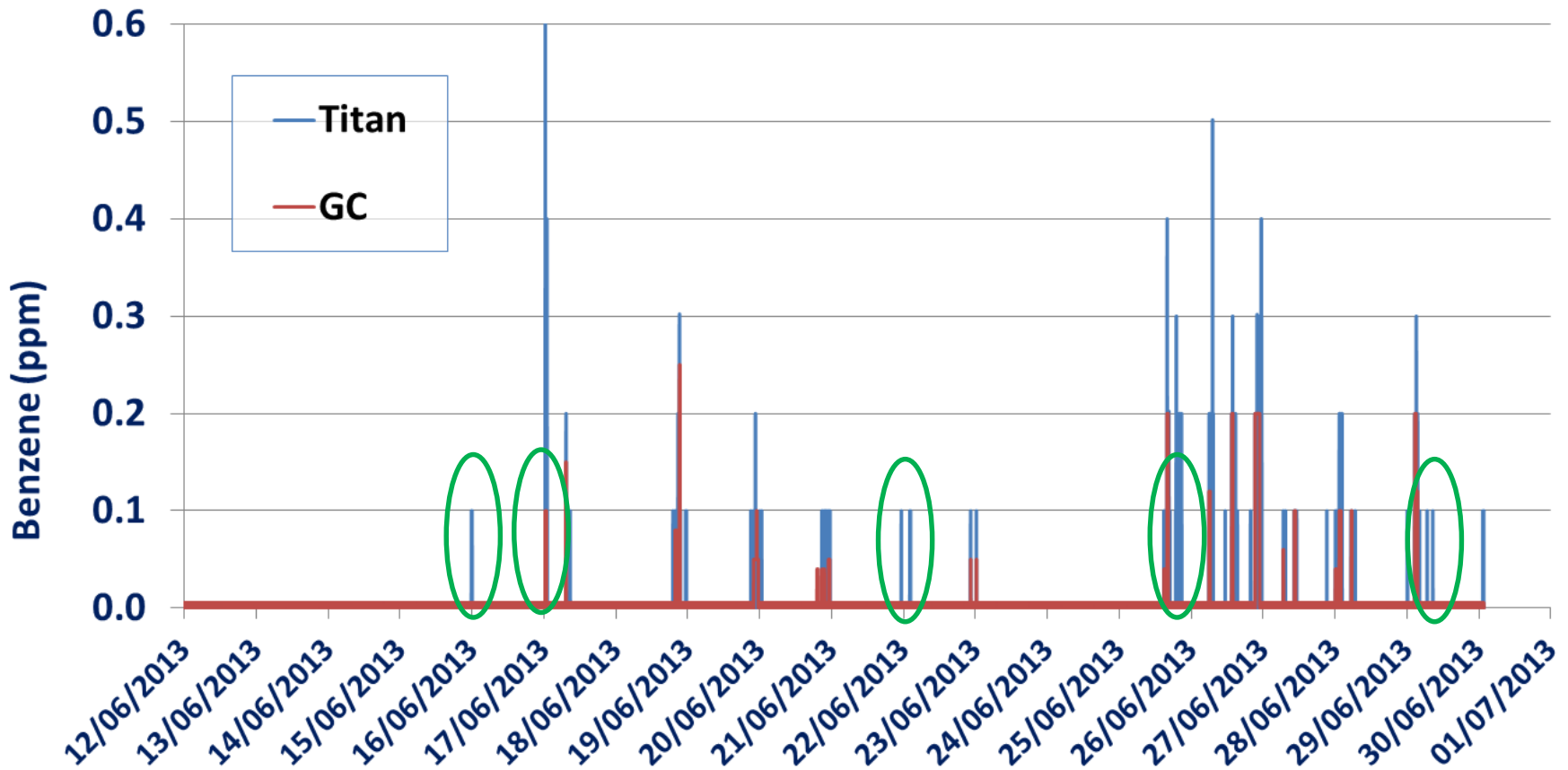
# Methods

- Criteria:
  - Selective
  - Sensitive
  - Costs
  - Resources to operate
  - Continuous

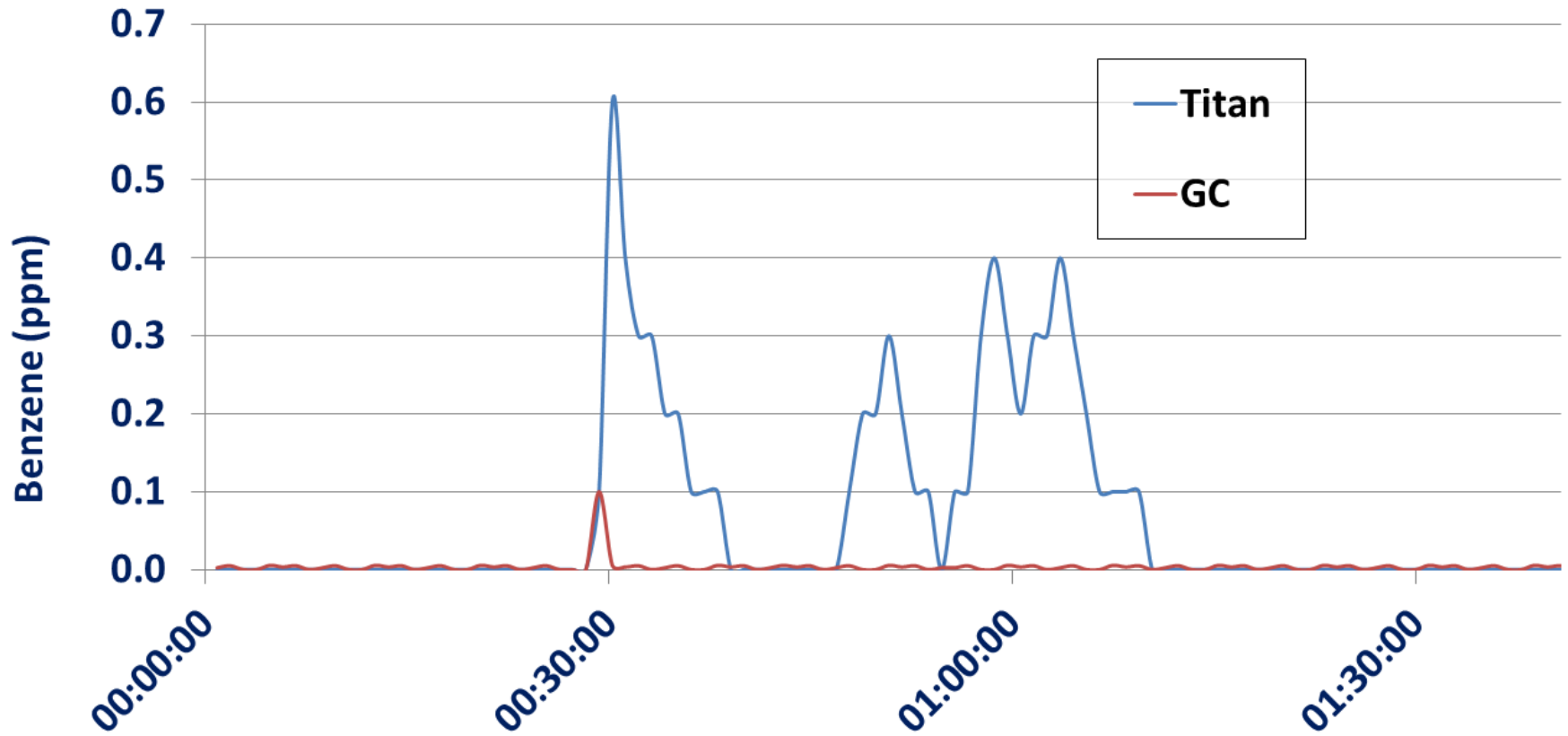
# Methods

	Fixed PID	Tubes	PID + Tubes	GC	TITAN
Selectivity	✗	✓	✓	✓	✓
Sensitivity	✓	✗	✓	✓	✓
Continuous monitoring	✓	✗	✗	✓	✓
Cost	✓	✓	✓	✗	✓
Resource to operate	✓	✗	✗	✓	✓

# The Importance of Continual Monitoring



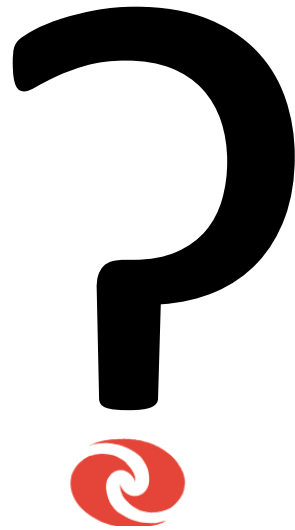
# The Importance of Continual Monitoring



# Conclusion

- Benzene can cause serious health effects;
- It's likely the benzene threshold will be lowered, monitoring will have to be intensified and inspections will increase;
- Doing spot measurements or measuring via sample systems can lead to missing benzene spikes and/or values;

# Any questions?







# Many thanks for your attention!

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