Field Gas Chromatography
Its still about Separation!

MEASUREMENT TECHNOLOGY WORKSHOP 2015

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Ray Merrill

merrill.raymond@epa.gov

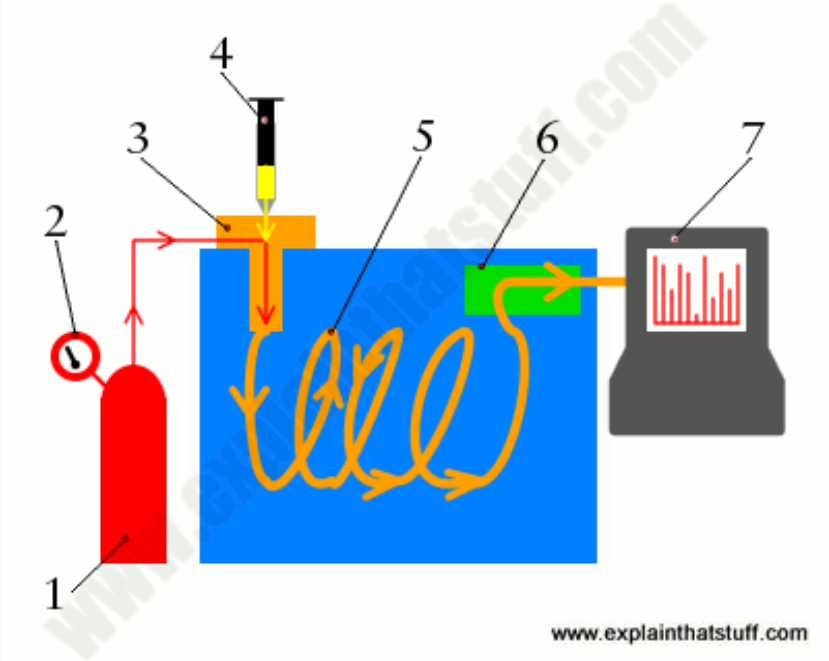
919-541-5225

U.S. Environmental Protection Agency

Fundamentals

- Gas Separation followed by a detector
  - Instrument Parts
    - Inlets
    - Separation
    - Detectors
  - Typical Output
    - Time
    - Quantity

How does gas chromatography work?



1. The carrier gas (red) transports the sample to the separation column.
2. The rate of flow of the carrier gas is controlled to give the separation of the components in the sample.
3. The carrier gas enters the GC through an inlet.
4. The sample is injected into the carrier gas and vaporizes.
5. The gaseous sample separates out as it moves along the column (orange). The temperature of the oven is be carefully controlled.
6. The sample components enter a detector that senses the time and quantity of material
7. The detector signal is recorded

What are the major hardware for GC

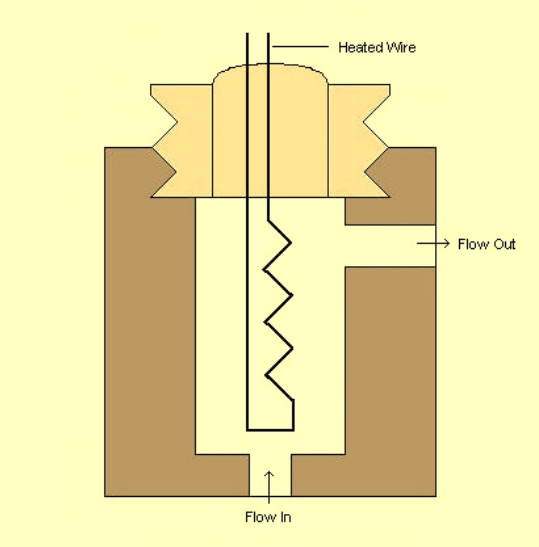
- Instrument Parts
  - Inlets – sample gas quantity is important
    - ✓ Gas syringe injection
    - ✓ Gas loop injection – Bag
    - ✓ Direct gas loop injection
  - Columns
    - ✓ Separation depends
      - The column packing/coating
      - The matrix
      - The target compounds

Choosing the Right Detector

- Detectors
  - Inert gases – Thermal Conductivity (TCD)
  - Combustable VOC – Flame ionization (FID)
  - Reduced Sulfur – Flame Photometric (FPD)
  - Mass Selective Detectors (GC/MS)

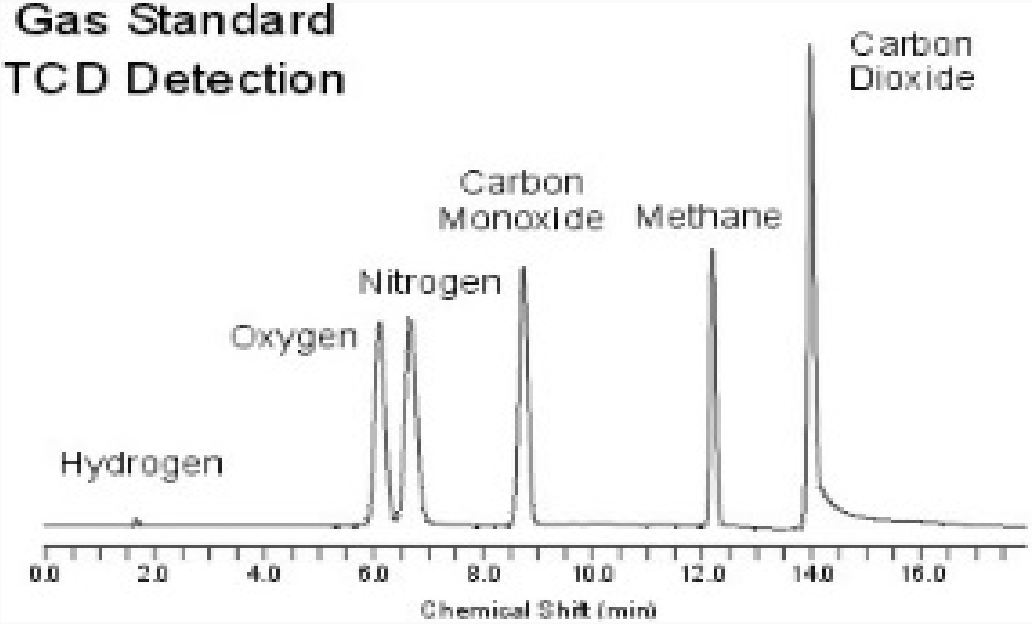
Thermal Conductivity Detector

Difference in thermal conductivity between the carrier gas and sample gas causes a voltage output

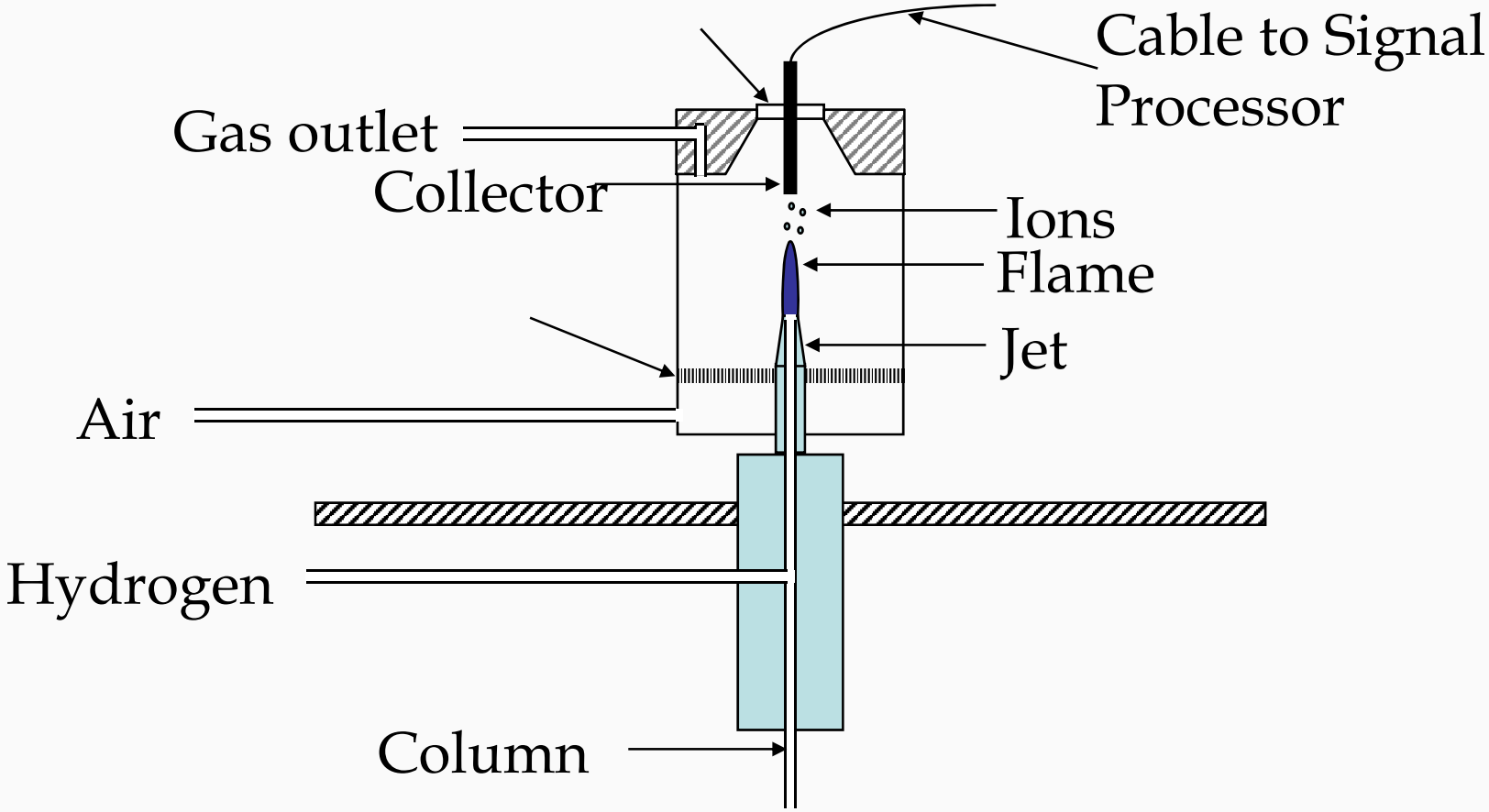


What Do I Measure with TCD?

- ✓Detects most everything in the gas phase
- ✓Retention time = identify
- ✓Peak area = quantity
- ✓Lacks of sensitivity

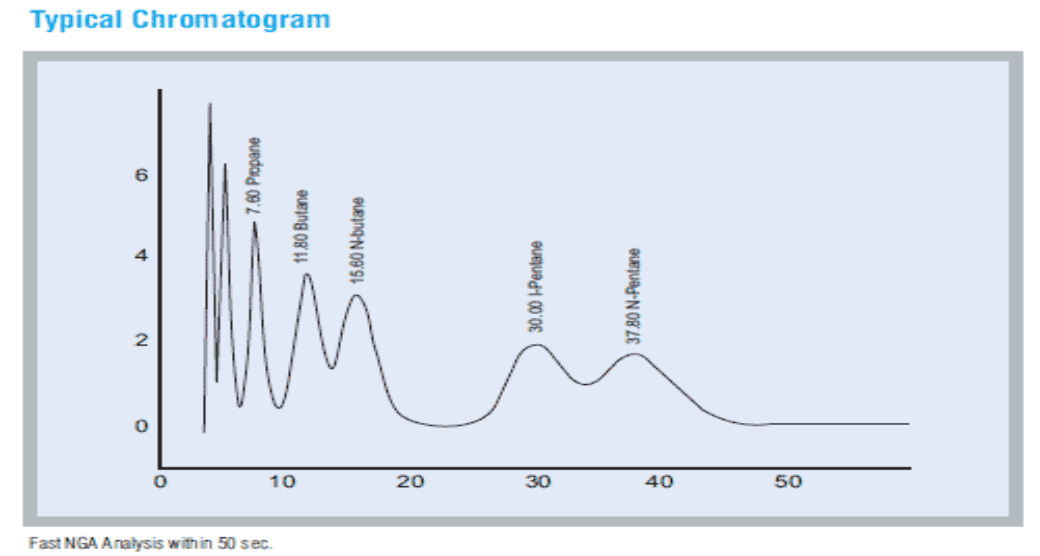


Flame Ionization Detector

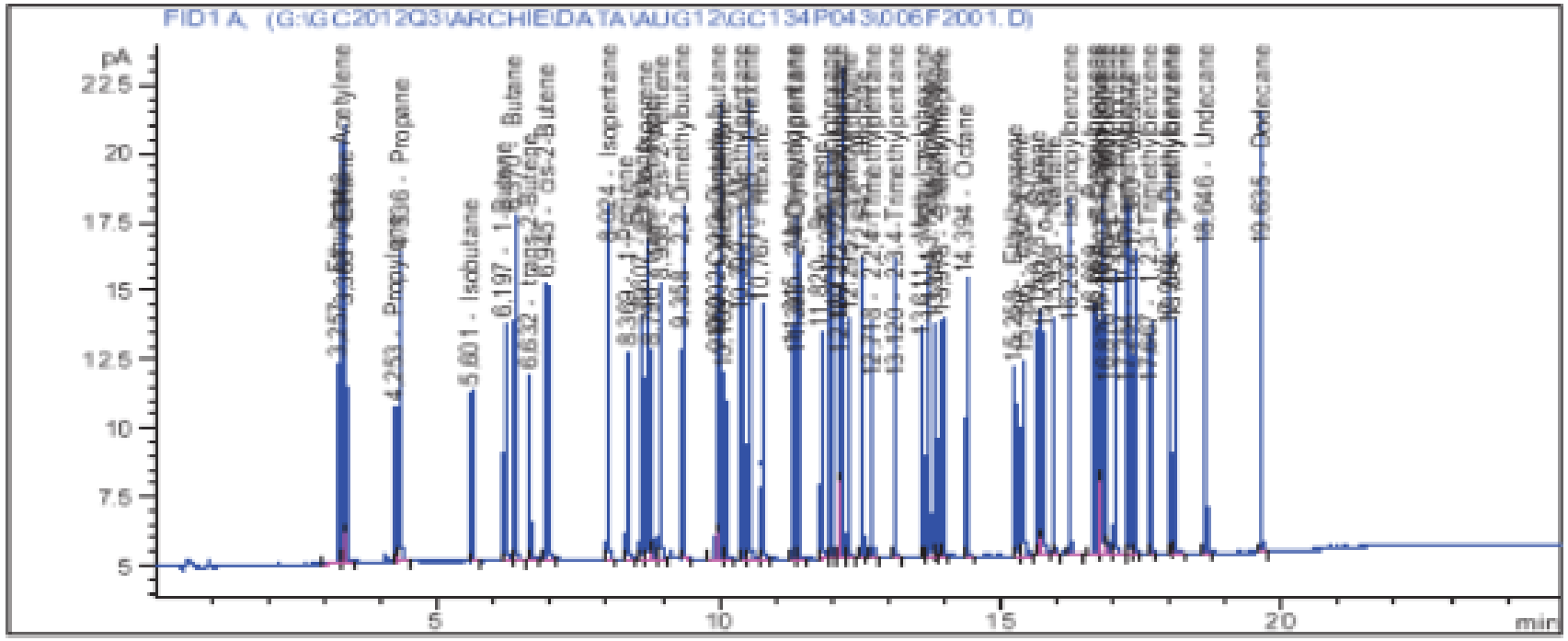


What Do I Measure with TCD?

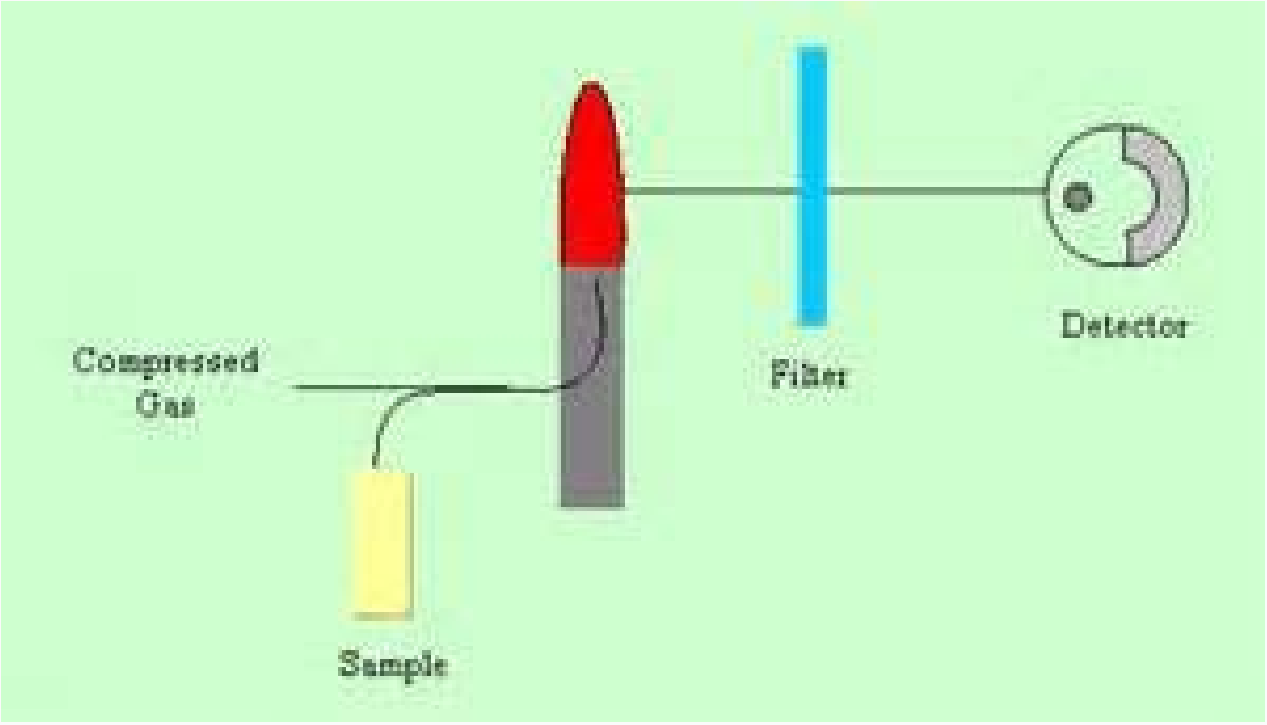
- ✓Selective for combustible VOC
- ✓Wide concentration range
- ✓Reasonably sensitive (0.1 ppm)
- ✓Low response to oxygenated VOC



Hydrocarbon Cal Gas from Ethane to C12

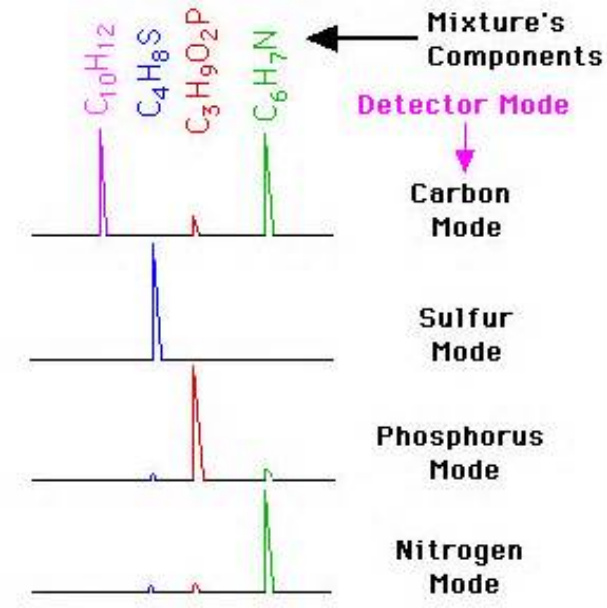


Flame Photometric Detector



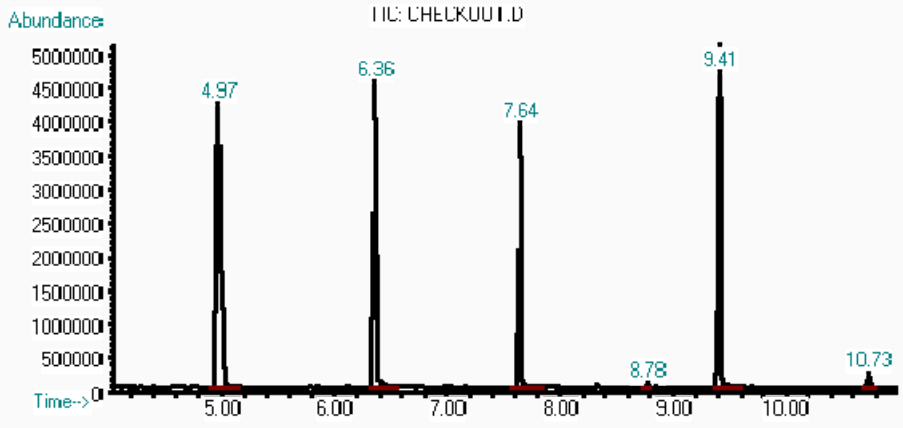
What do I measure with Flame Photometric Detectors?

✓Selective for specific compound classes

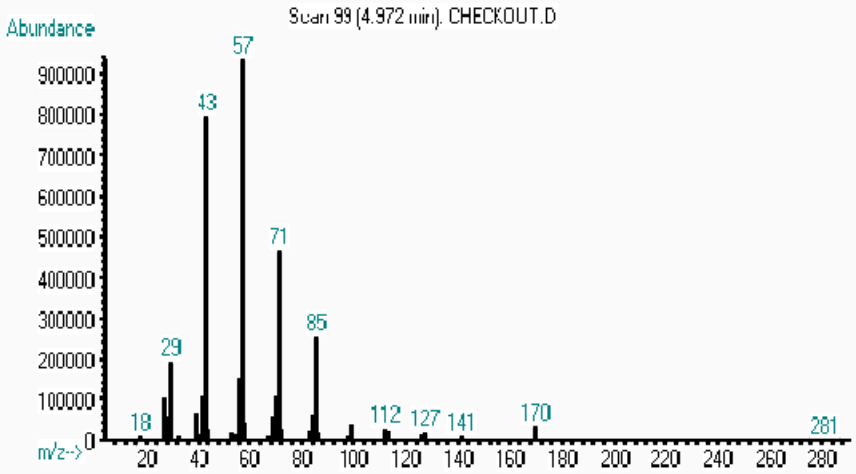


Mass Spectrometer

- ✓Low Resolution
- ✓High Resolution
- ✓Time of Flight



Chromatogram generated by a GC. (www.gmu.edu).



C-12 Mass-spectrum generated by an MS (www.gmu.edu).

Choosing the Right Column

- Its Mostly About Separation
  - Packed columns
    - ✓ Coated packing – boiling point separations
    - ✓ Solid packing – shape separators
  - Open Tubular columns
    - ✓ PLOT
    - ✓ Megabore
    - ✓ Capillary

Method Basics

- Setup and Calibration
  - Blanks
  - Separation
  - Interference
- Calibration and Quantitation
  - Analysis
  - Analysis QC

What to look for in a report.

- Post Analysis QC
  - Spike recovery
- Setup and Calibration
  - Blanks
  - Interference
  - Linearity
- Analysis
  - Retention time match
  - Separation

Questions.