



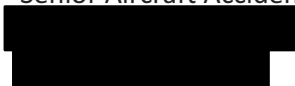
Test Report

August 25, 2021

Project 20.082001

National Transportation Safety Board
Portland, OR 97209

Attn: Zoë Keliher
Senior Aircraft Accident Investigator



Fuel/Residue Analysis – From Fatal Helicopter Accident

Four vials containing aircraft fuel and dried residue were received on August 20th, 2020. The samples were analyzed by various methods to determine whether there were any contaminants present.

Summary

- 1) The fuel and the dried residues showed the presence of similar amounts of Pb (TEL), Fe and Cu-Zn (brass) and Br. The Fe and brass likely result from corrosion.
- 2) Removed from the vial and collected on filters, the dark colored fuel showed the presence of low concentrations of glass fibers, Titania particles and a calcium compound. These likely were fillers in a polymeric material. A zinc compound is also present separate from the brass.
- 3) The debris in the fuel line may have accumulated in the aircraft fuel filter and affected fuel flow.
- 4) The debris may have corroded the plugs.
- 5) GC-FID analysis produced a normal distillation curve and carbon numbers for AvGas.
- 6) FTIR analysis revealed the presence of a toluene-based solvent – about 2 percent.

Comments

The fuel from the fuel line appears to contain debris that could interfere with normal gas flow by collecting in the filter.

Table 1: Test Results.

TABLE 27. TEST RESULTS:		
20.082001-01	Residue in vials 2,3,4 from Dried Fuel in Gascolator	Visual– through glass: Tan-colored residue.
20.082001-02		XRF –through glass: Pb (TEL), Fe, Cu-Zn (brass), Br.
20.082001-03	Vial 1 containing dark gray fuel	Visual - through glass: Dark gray fuel.
20.082001-04		XRF –through glass: Pb (TEL), Fe, Cu-Zn (brass), Br.
		XRF: Filtered on MCM and Silver filter. Variety of small 1-5µm particles [Si (glass fibers}, Ti particles, Ca particles, Fe Brass, Zn compound, Pb (TeL), Br.
		Gc-FID: Normal AVGAS

FTIR: AVGAS plus a toluene -based solvent

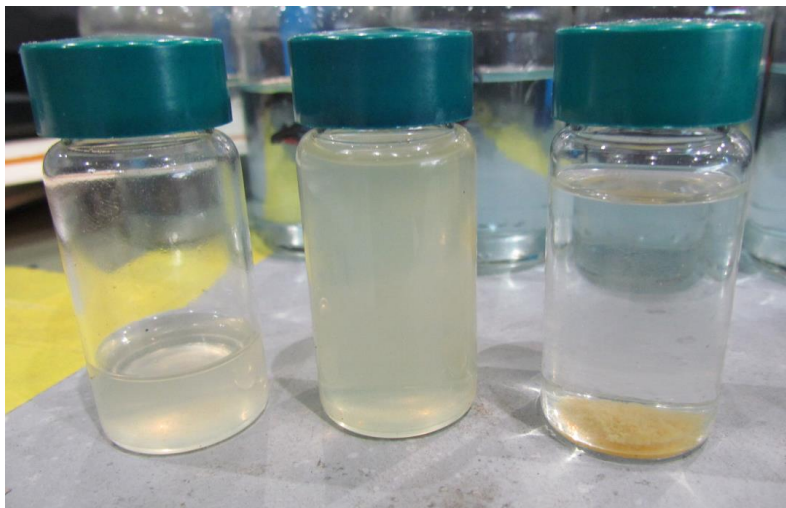
FTIR: Thermo Nicolet 380 SN: AGL0500626 with Smart Orbit Diamond ATR

XRF: Amptek X-Ray Spectrometer – SN: X10606



Aircraft Fuel at Accident Site

AvGas samples from the gascolator – on-site. Blue dye more faint than usual.



Aircraft Fuel 2

AvGas samples from the gascolator – after overnight on-site. Blue color gone, turned cloudy and precipitate started to settle out in the vials. This was likely the result of a cold night and some moisture in the fuel.

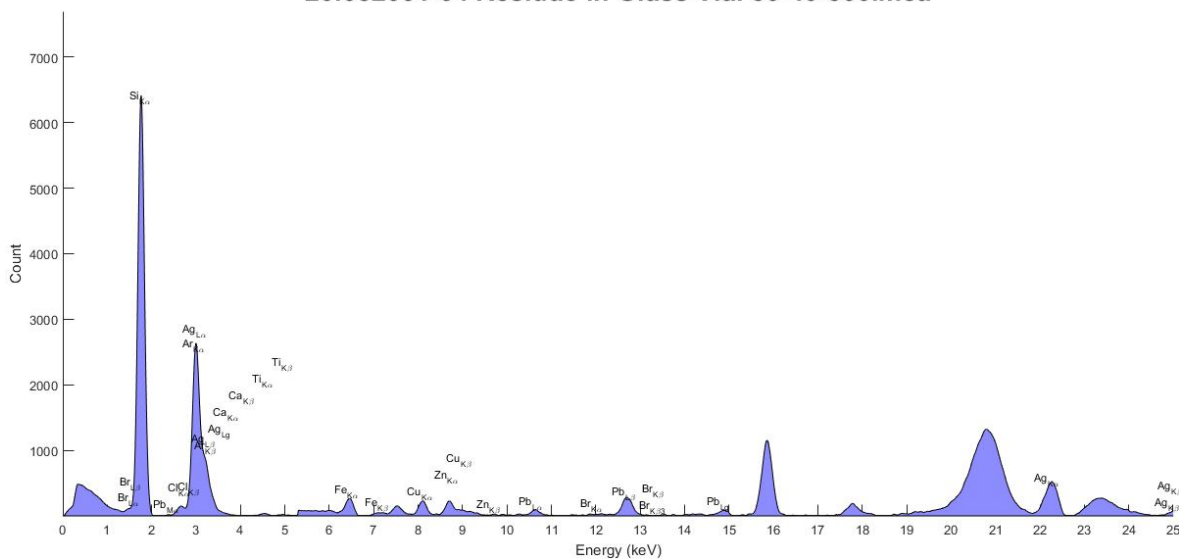


Vials arrived with solid residue but no fuel.

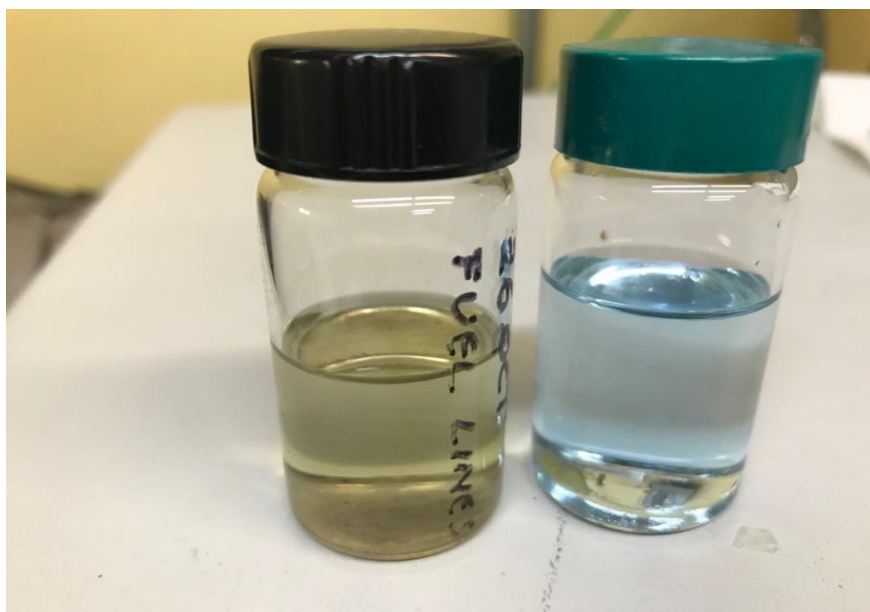
A small amount of residue is present on the bottoms of the vials.

XRF analysis was carried out through the glass. Spectrum shown below. All 3 of the vials gave the same spectra. From the mass of the residue, the original fuel volume from the on-site photo it is found that the residue corresponds to about 2 wt. % solids.

20.082001-04 Residue in Glass Vial 50-40-300.mca

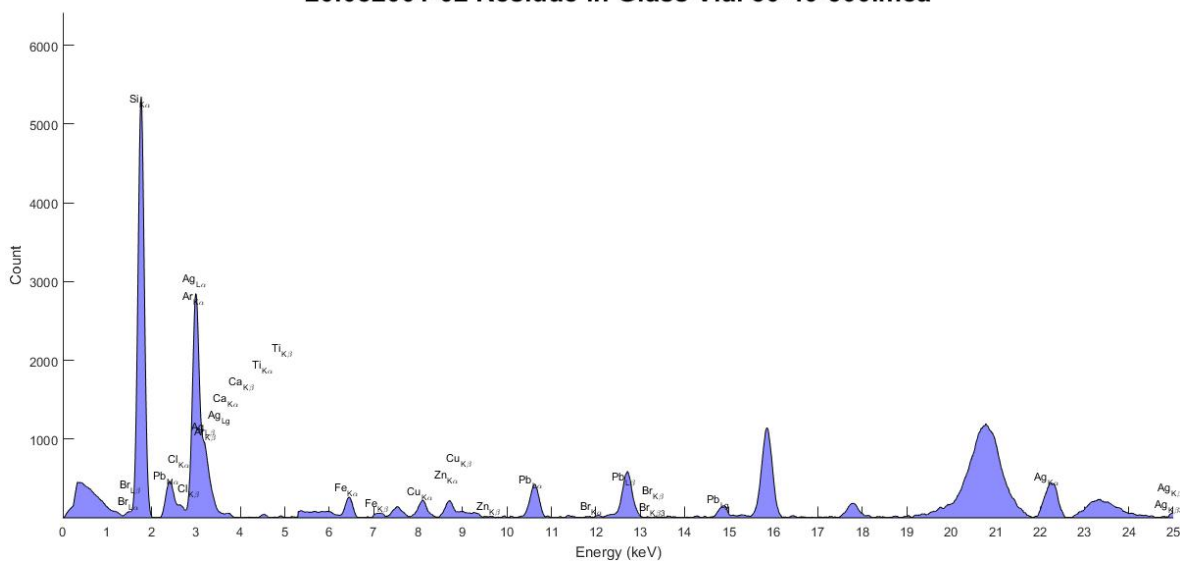


Primary residue components are Fe, Cu-Zn (brass) and TEL (Pb)

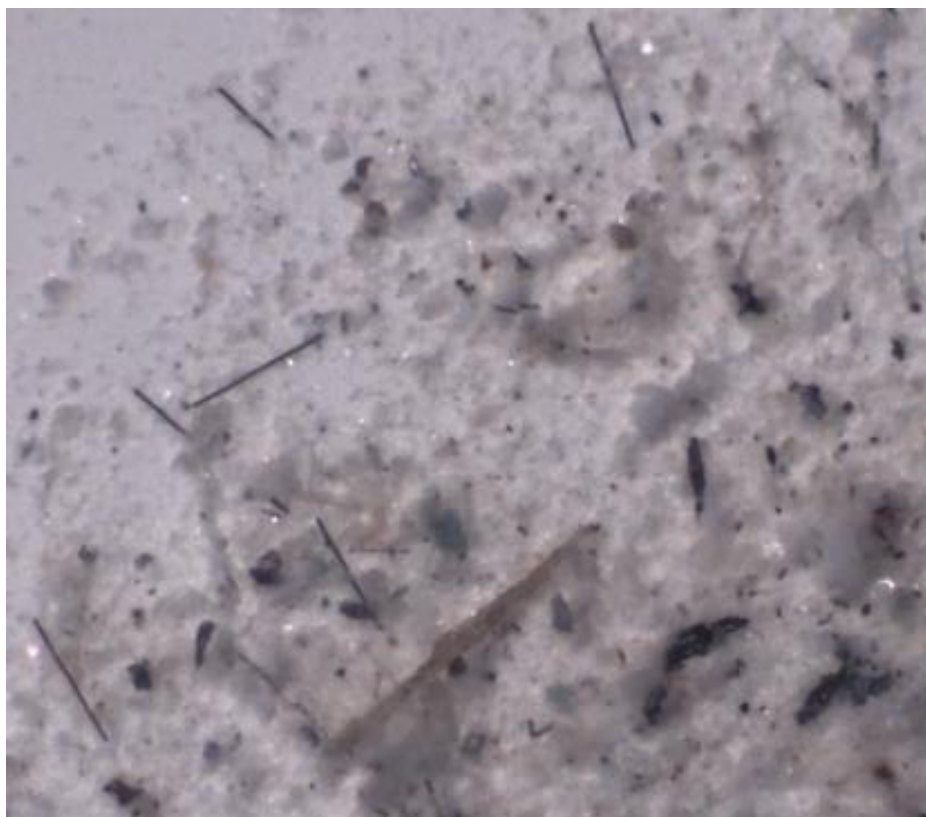


Avgas from the fuel line (left) in comparison with reference Avgas.

20.082001-02 Residue in Glass Vial 50-40-300.mca



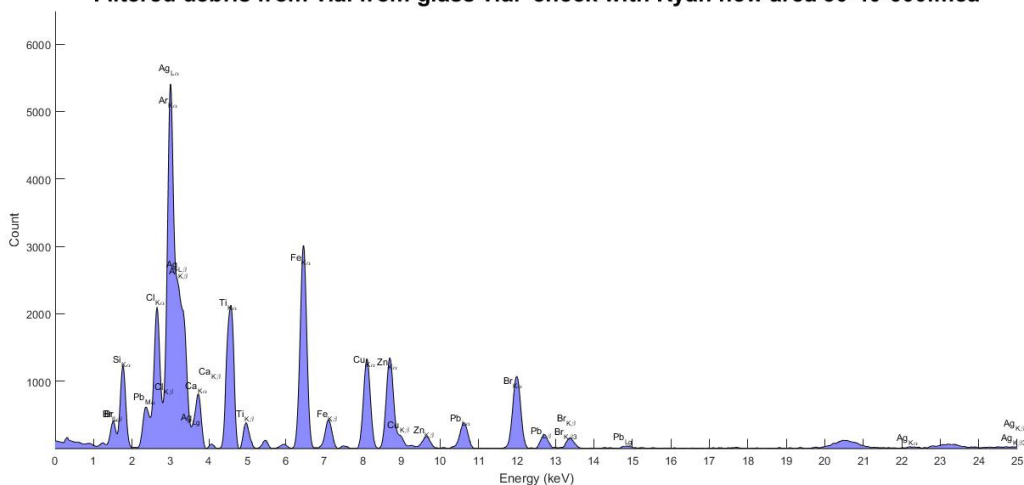
XRF of the dark-colored residual AvGas in the vial exhibits a somewhat higher concentration of Fe and Cu-Zn brass) than in the dried vials.



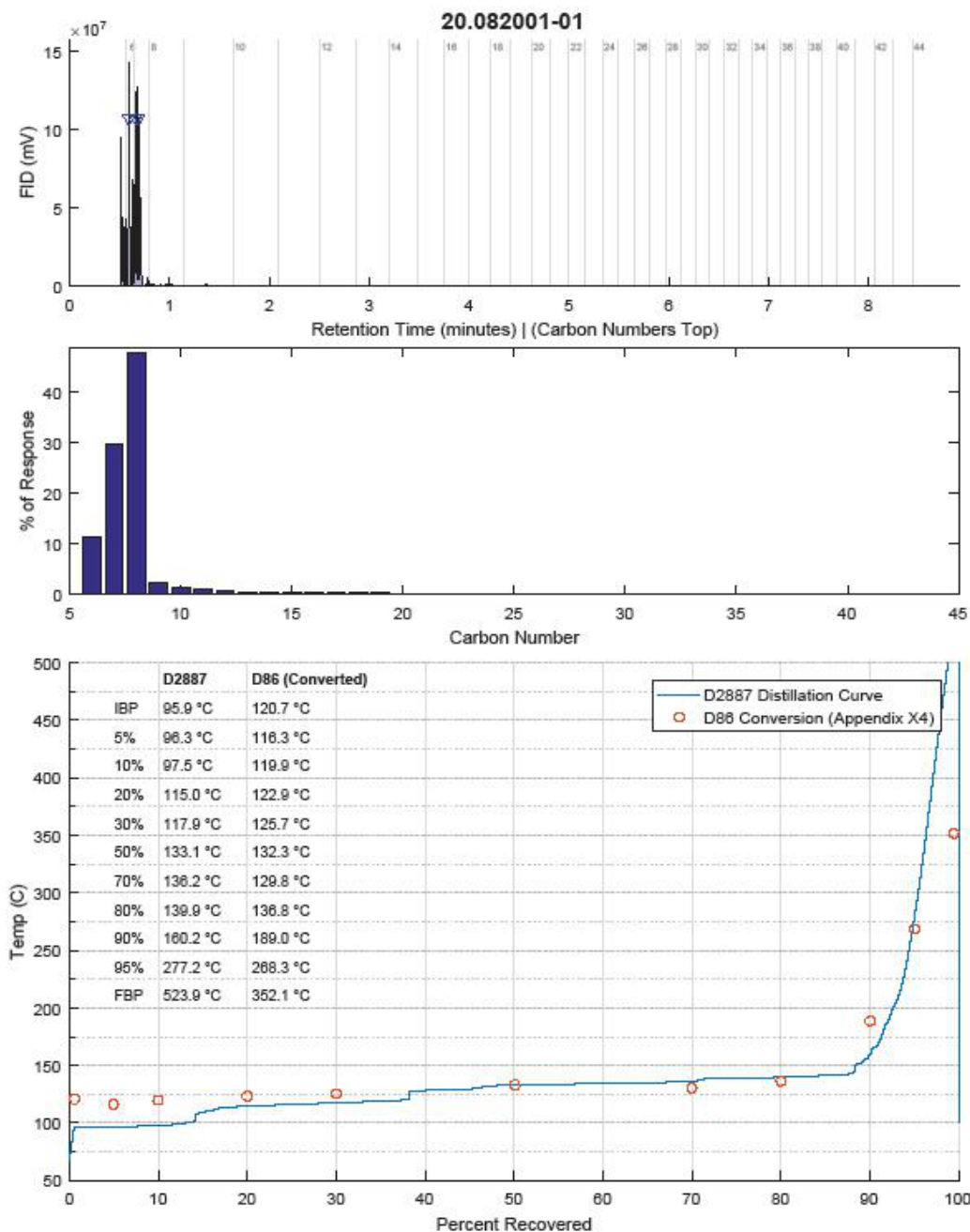
**Suspended residue in fuel line fluid collected on a nylon membrane filter.
The fibers appear to be fiberglass from the composition shown below.**

The debris composition is a mixture of several elements. This area includes several fibers and some titanium filler.

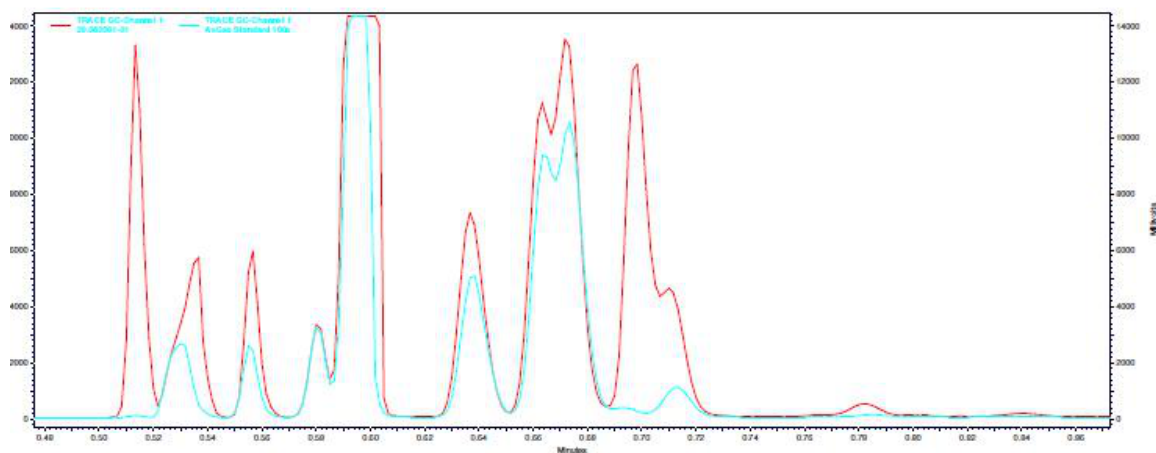
Filtered debris from vial from glass vial check with Ryan new area 30-40-600.mca



GC-FID Analysis



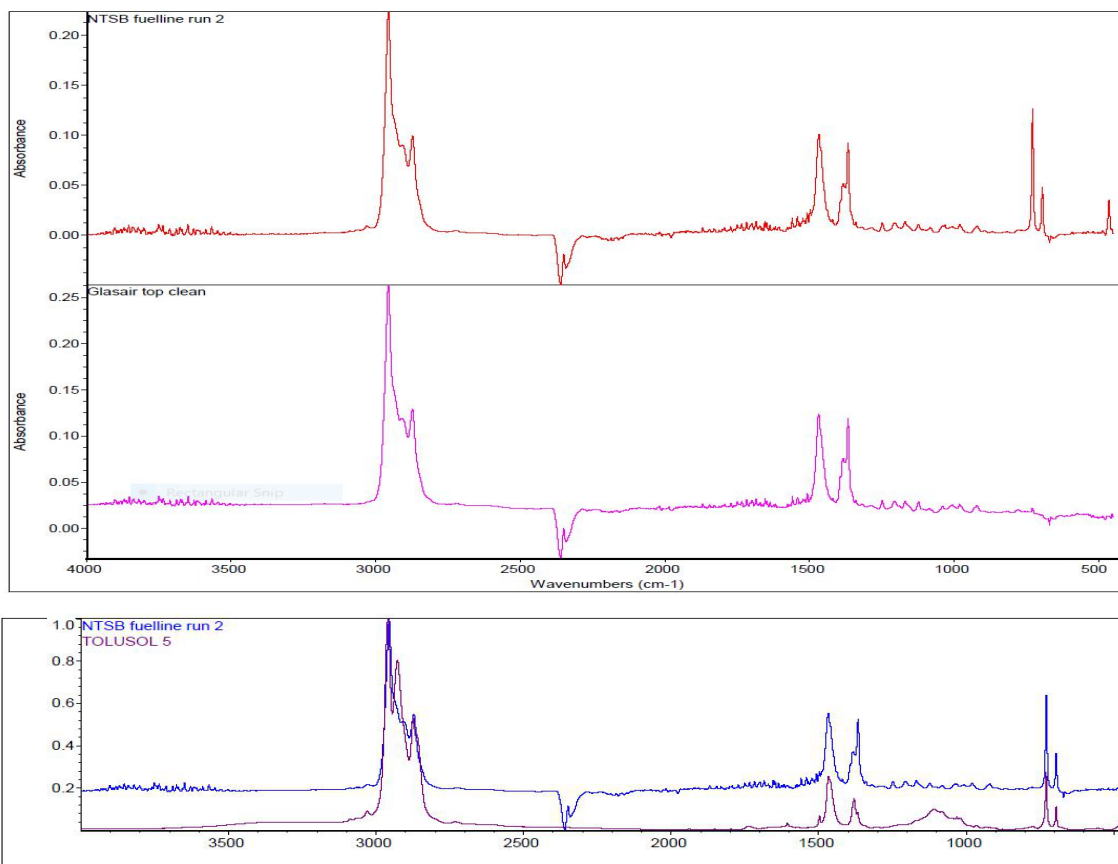
Comparative CG-FID analysis of sample AvGas: Top GC spectrum – derived carbon numbers. Peak at 8 typical of gasoline. Bottom simulated distillation curve derived using ASTM D2887 within specifications.



— F:\GC\2020 Projects\NTSB\2\20.082001-01.dat, TRACE GC-Channel 1

— F:\GC\2020 Projects\NTSB\2\AvGas Standard 100x.dat, TRACE GC-Channel 1

Peaks present in fuel line sample not present in reference AVGAS



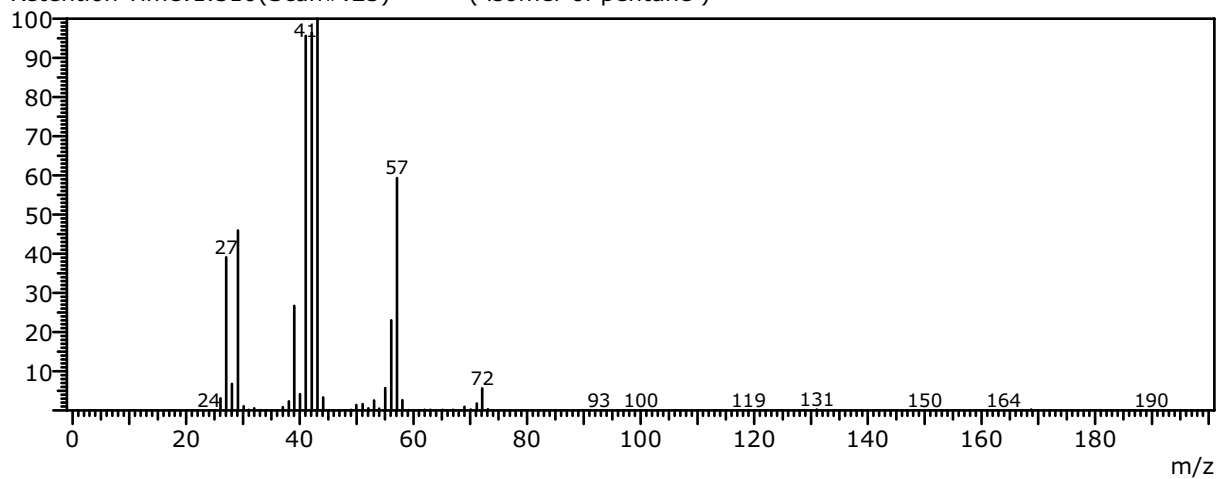
Peaks at ~ 800 wave numbers not present in reference AVGAS. They match a toluene- base solvent.

**The results presented in this report relate only to the samples tested.
This report shall not be duplicated, except in full, without written approval from
Lab/Cor Materials, LLC.**

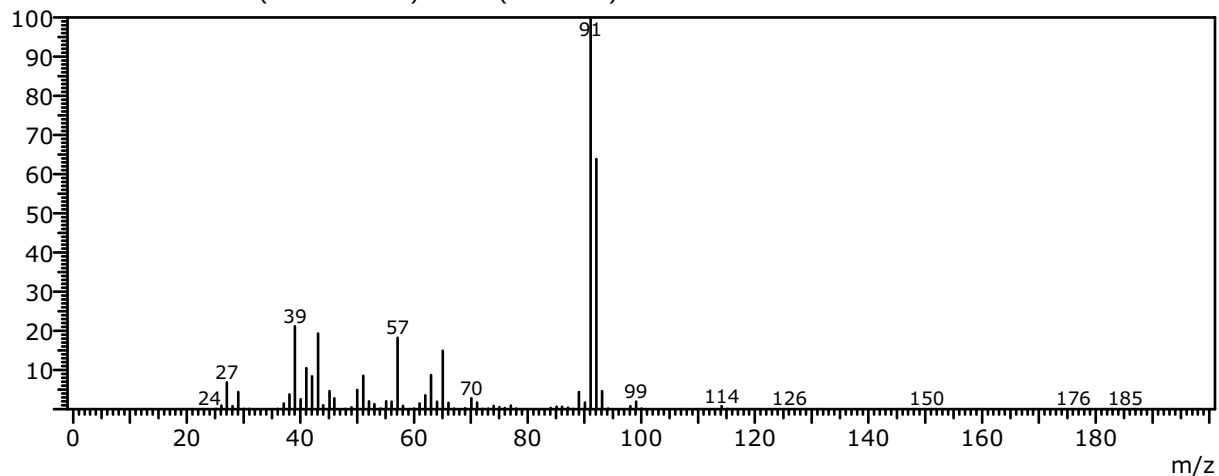
Certifying Manager
Robert M. Fisher, PhD
Chief Scientist

810 NW 45th Street, Suite #3 • Seattle, Washington 98107
Phone: (206) 508-1470 • E-mail: mail@labcormaterials.com

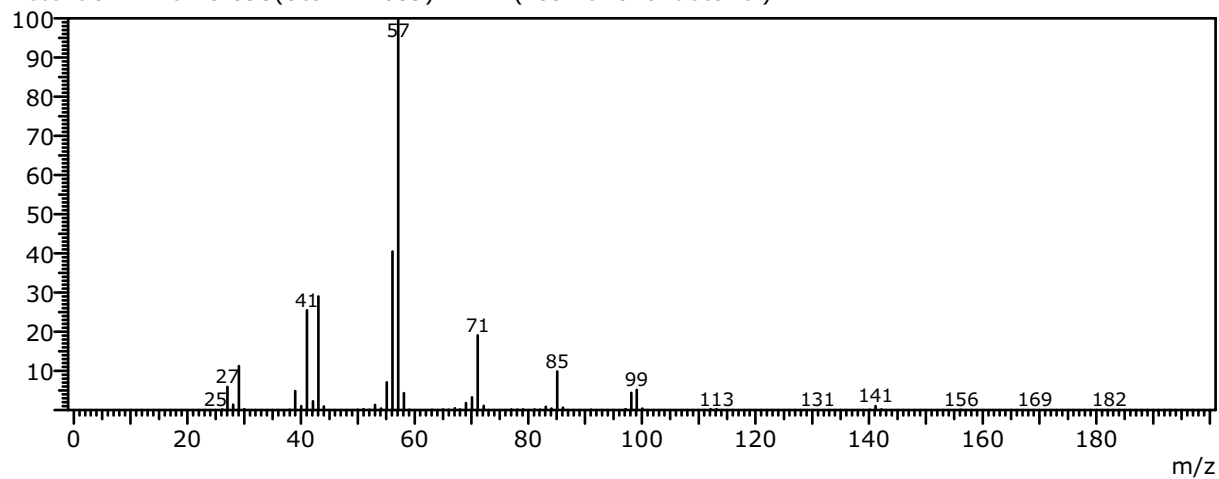
Retention Time:1.510(Scan#:25) - - - (isomer of pentane)



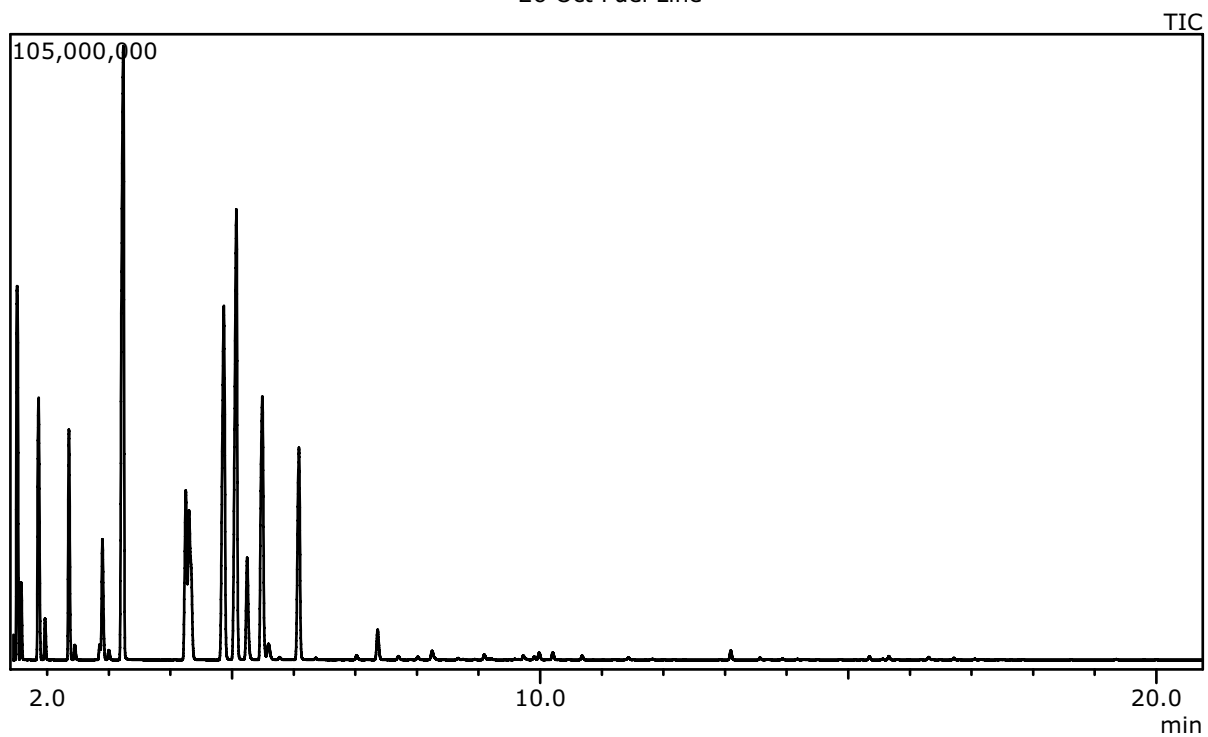
Retention Time:5.487(Scan#:1616) - - - (toluene)



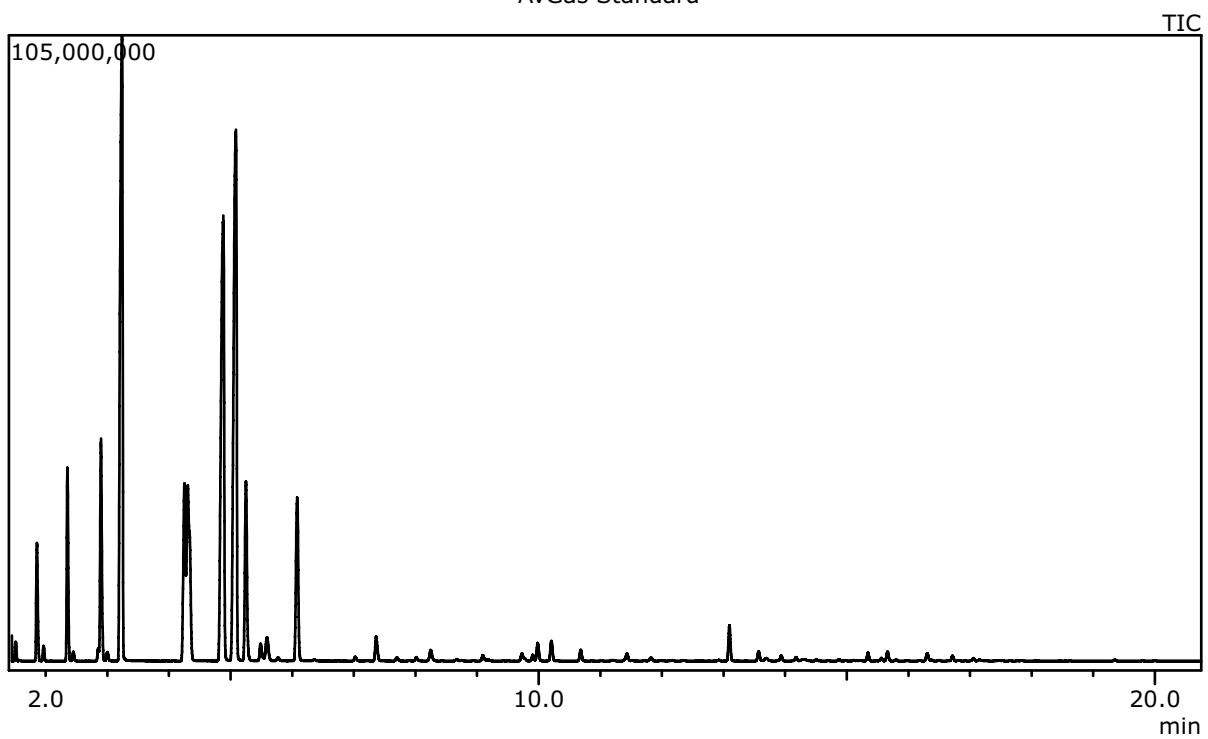
Retention Time:13.095(Scan#:4659) - - - (isomer of undecane)



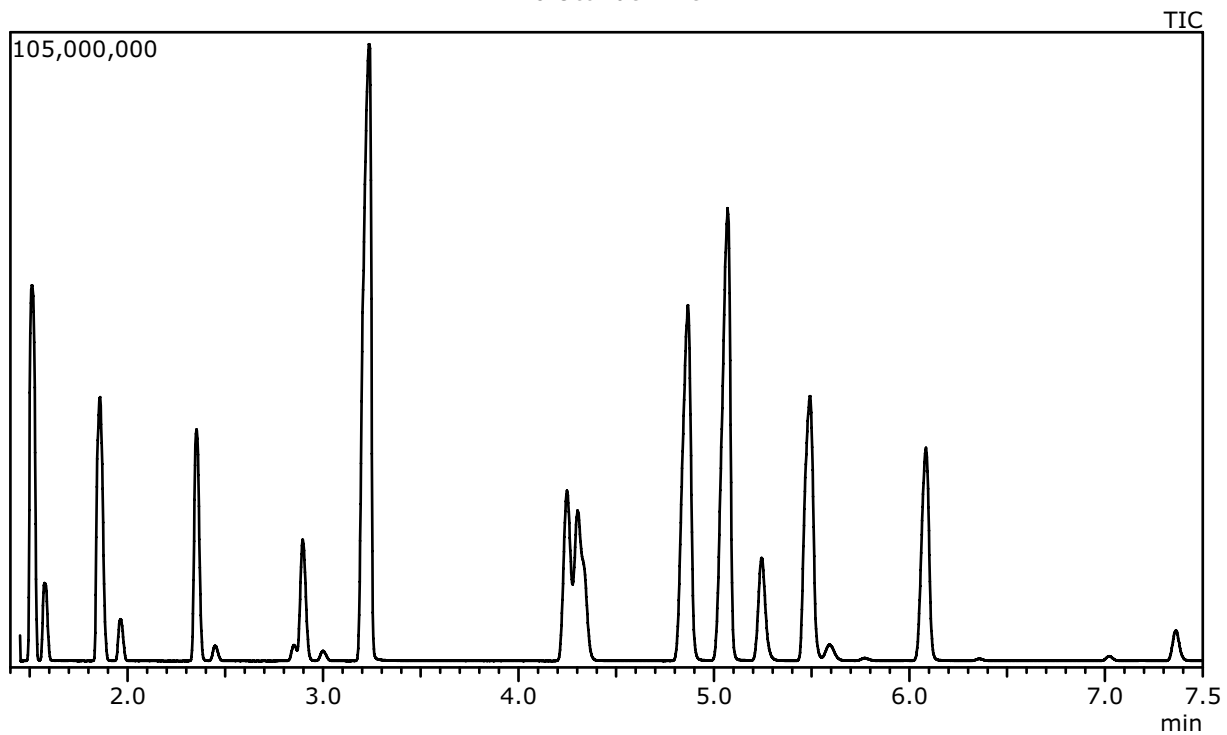
26 Oct Fuel Line



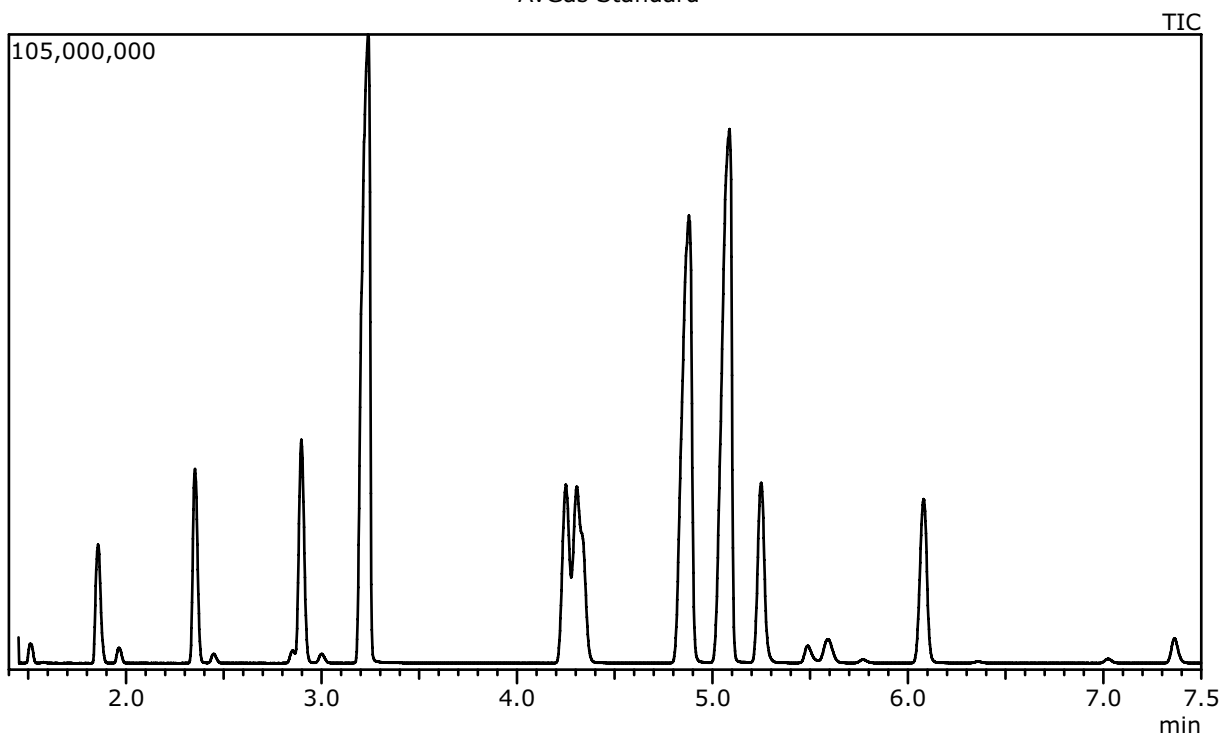
AvGas Standard



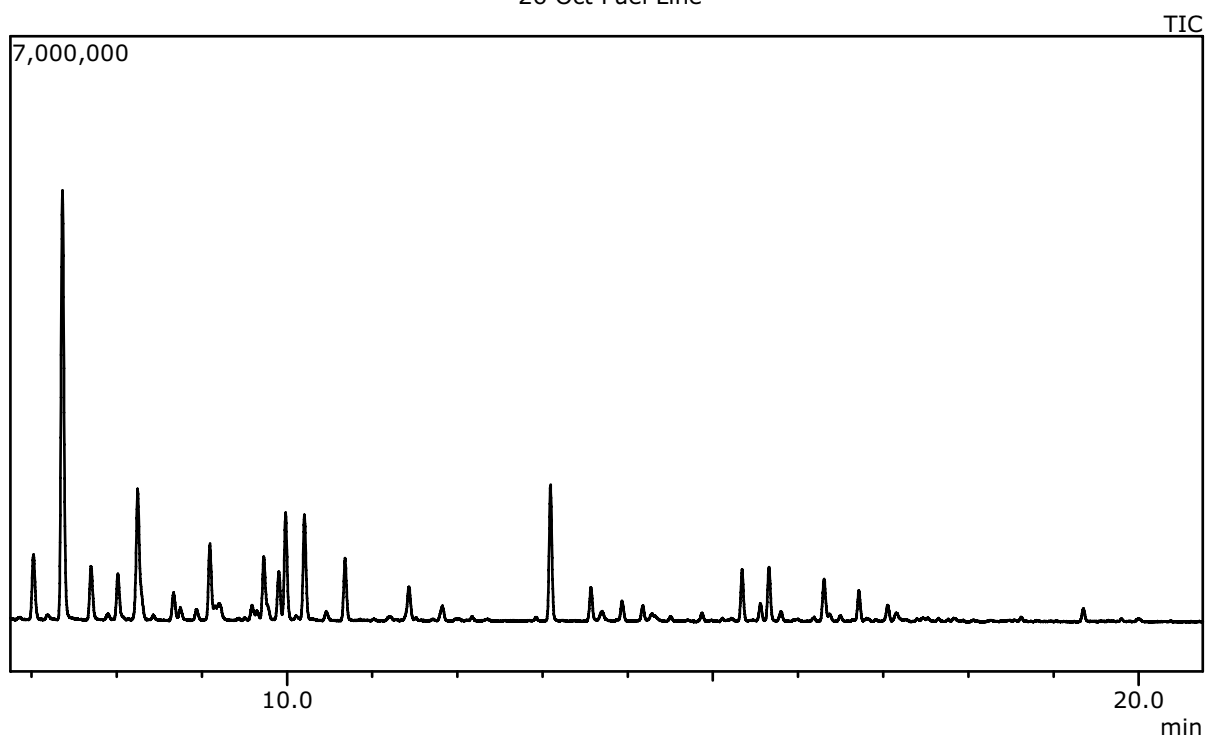
26 Oct Fuel Line



AvGas Standard



26 Oct Fuel Line



AvGas Standard

