

# Rapid, Comprehensive Landfill Gas Analysis Using SIFT-MS

## Key Benefits

Comprehensive analysis of organics, organosulfur and organosilicon compounds

Direct gas analysis

Wide dynamic and linear ranges

Simple operation

Automated sample analysis option

Industry-proven technology ready for the process line



SIFT-MS provides rapid and comprehensive analysis of landfill gas, making it ideally suited to the complete range of environmental and industrial applications.

High per capita production of waste is a hallmark of modern consumer societies. Despite minimization and re-use initiatives, landfills continue to play a key role in managing this waste. These landfills have a number of detrimental impacts on climate and air quality through gaseous emissions of (i) greenhouse gases (methane and carbon dioxide), (ii) non-methane organic compounds (which contribute to the formation of ozone in photochemical smog, and can also be hazardous), and (iii) odorous compounds. Increasingly landfill gas is burned to reduce its environmental impact and generate electricity. However, the presence of hydrogen sulfide, and organosulfur and organosilicon compounds can cause reductions in efficiency and greatly increased maintenance requirements if not properly scrubbed.

Comprehensive and selective analysis of all environmentally and commercially critical compounds in a single analysis is impossible using traditional laboratory based technologies, and analysis times are long. Selected Ion Flow Tube Mass Spectrometry (SIFT-MS) is a unique analytical technique because it is able to provide comprehensive analysis for all compounds, whether in the laboratory, at the site boundary, or integrated on-line.

Figures 1 to 4 summarize concentration data (the mean of three replicates) obtained for gas sampled from an active landfill near Auckland, New Zealand. All compounds shown were analyzed in a single method with 10-second time resolution, demonstrating both the selectivity and the comprehensive nature of the rapid SIFT-MS analysis. Also determined, but not shown in the figures, were additional hydrocarbons and chlorinated hydrocarbons from the United States EPA's AP-42 suite, methane (48%), and the total non-methane organic compound (NMOC) content (2400 mg m<sup>-3</sup> as hexane at 25°C).

The ease with which SIFT-MS analyzes very diverse chemical species with high selectivity and high time resolution means that it is ideally suited to rapid analysis of landfill gas emissions for environmental and public health protection, and for ensuring optimal performance of turbines. The Syft Voice200ultra SIFT-MS instrument provides unprecedented opportunities for regulators, landfill operators, gas turbine manufacturers, and testing agencies to better monitor emissions and efficiencies both in-line and off-line in the laboratory.



### Experimental Method

Triplicate samples (in 10-liter Tedlar® bags) from an active landfill were obtained using standard methods by a third-party consulting environmental engineer. They were airfreighted to our laboratory for next-day analysis. Prior to analysis, samples were diluted 100-fold using static dilution.

### SIFT-MS Analysis

Instrument	Voice200
Inlet type	High performance
Sample flow	25 sccm
Software	Voice200
Analysis type	Selected Ion Mode
Reagent ions	H <sub>3</sub> O <sup>+</sup> , NO <sup>+</sup> , O <sub>2</sub> <sup>+</sup>
Compounds	See the graphed data for examples of diverse hydrocarbons, inorganics, and chlorine-, oxygen-, nitrogen-, sulfur-, and silicon-containing compounds
Analysis time	180 seconds
Typical LOD	50 ppbv (due to dilution)
Methane LOD	5 ppmv (due to dilution)

### Further Reading

Syft Brochure *SIFT-MS Technology Overview*

Syft Brochure *Environmental Solutions*

B.J. Prince, et al. (2010), "Application of [SIFT-MS] to real-time atmospheric monitoring", *Rapid Commun. Mass Spectrom.* **24**, 1763.

V.S. Langford et al. (2013), "Detection of Siloxanes in Landfill Gas and Biogas Using SIFT-MS", *Curr. Analytical Chem.*, **9**, 558.

Figure 1. SIFT-MS concentrations of selected hydrocarbons and chlorinated hydrocarbons in a gas sample from a landfill near Auckland, New Zealand.

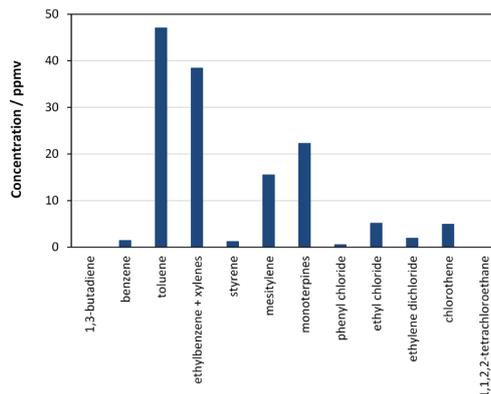


Figure 2. SIFT-MS concentrations of oxygen- and nitrogen-containing compounds in a gas sample from a landfill near Auckland, New Zealand.

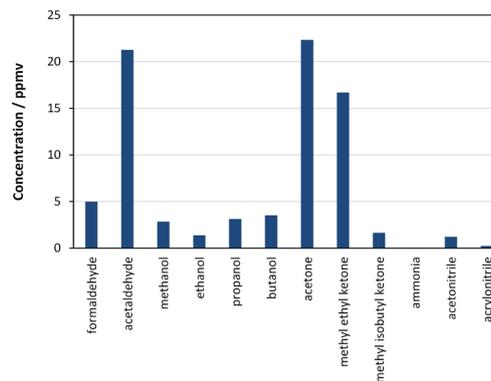


Figure 3. SIFT-MS concentrations of sulfur-containing compounds in a gas sample from a landfill near Auckland, New Zealand.

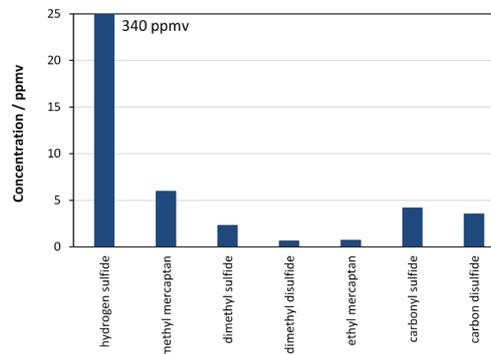


Figure 4. SIFT-MS concentrations of organosilicon compounds in a gas sample from a landfill near Auckland, New Zealand.

