

Marshall Space Flight Center

# Chemistry and Contamination Control

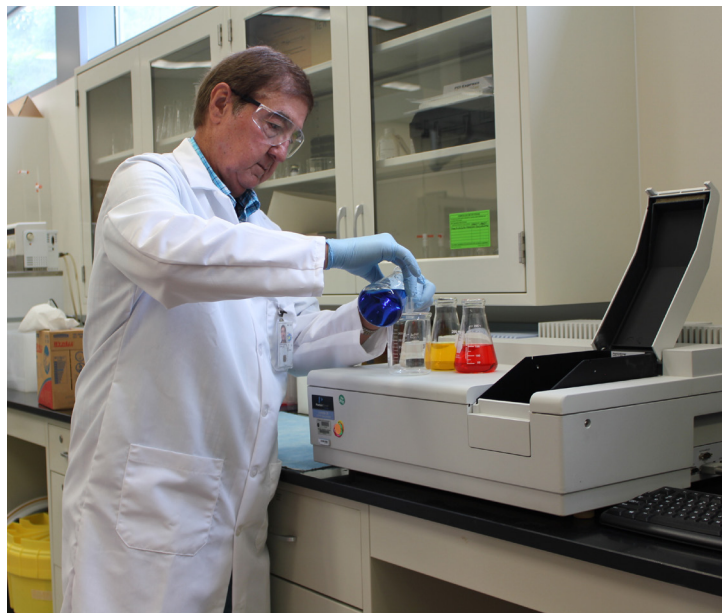
Engineering Solutions for Space Science and Exploration

## Analytical Chemistry

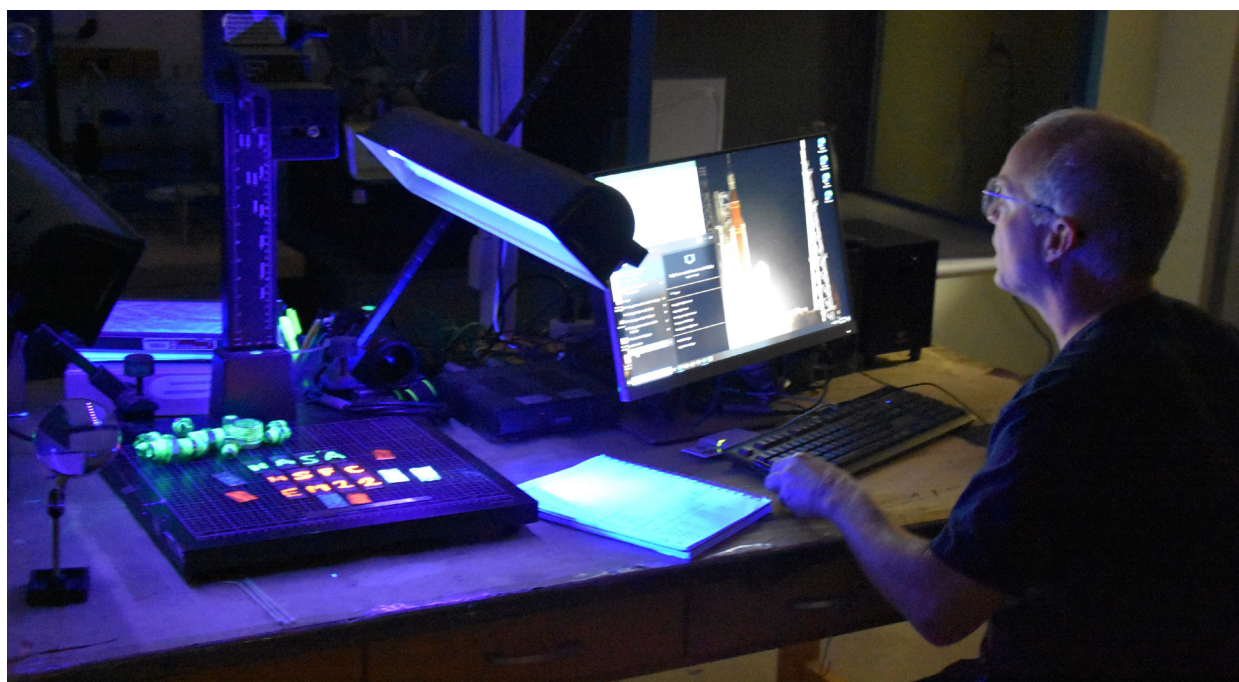
The chemistry lab is a fully equipped analytical chemistry laboratory that stands ready to perform any chemical analysis needed for NASA's exploration missions. Testing can range from verifying materials meet NASA specifications to identifying unknown materials or chemicals. Standard ASTM methods can be used, or custom testing methods can be developed to meet a customer's needs.

## Contamination Control

The contamination control team provides contamination control support from project inception up to launch. Support ranges from the development and implementation of contamination control plans to the identification and remediation of contaminants on space flight hardware. The team actively evaluates novel, greener cleaning technologies to ensure NASA's ability to meet cleaning specifications despite the phase out of previously used, environmentally harmful solvents.



Ultraviolet-visual light spectroscopy to identify unknown chemical species



Blacklight inspection of parts to verify complete removal of contaminants

## Capabilities

### Chemistry Laboratory

- Elemental analysis for hydrogen, nitrogen, oxygen, carbon, and sulfur content
- Inductively coupled plasma (ICP) with mass or optical emission spectroscopy to determine metal content
- Thermal analysis including differential scanning calorimetry, thermogravimetric analysis with optional infrared (FTIR) analysis, and dynamic mechanical analysis, to characterize thermal stability, phase behavior, and coefficient of thermal expansion
- Ultraviolet-visual light spectroscopy for chemical identification
- Density and viscosity measurements
- Karl Fischer water content analysis

### Environmental Gas Laboratory

- Testing of facility gases and cryogenic liquids for purity, particulates, and moisture content
- Automated microscopy for characterizing particle size and distribution
- Testing of clean rooms and flow benches to verify they are functioning within specified parameters

### Ionic Liquids Laboratory

- Performs research in the use of ionic liquids epoxies for the fabrication of carbon fiber composite cryotanks, the extraction of oxygen and metals from lunar or martian soil, and the development of other novel technologies to meet NASA's space exploration needs
- Fully equipped laboratory for synthesis and characterization of novel chemicals and materials
- Nuclear magnetic resonance (NMR) spectroscopy for characterization of chemical structures
- Dynamic vapor sorption (DVS) system for characterization of sorption and desorption of gases, such as CO<sub>2</sub>, from liquid and solid sorbents

### Contamination Control

- Drafting, implementation, and monitoring of contamination control and foreign object debris (FOD) plans
- Identification of unknown contaminants and development of cleaning methodologies to remediate contaminated hardware
- Vapor degreasing and vacuum degreasing for precision cleaning hardware
- Testing and qualification of novel green cleaning technologies such as environmentally friendly solvents, vacuum cyclic nucleation, and supercritical CO<sub>2</sub>
- Full powder analysis suite including particle size distribution, morphology, density, tap density, flowability, and angle of repose to support additive manufacturing powder acceptance and receiving

National Aeronautics and Space Administration

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