Effects of Ambient Alcohol Levels on the Real-time Monitoring of the Atmosphere of the International Space Station

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Monitoring of the spacecraft environment is required to ensure the safety of the crew and the health of the vehicle systems. For the ISS atmosphere, routine monitoring has been performed for many years by the Major Constituent Analyzer (MCA) and two Air Quality Monitors (AQMs), which, together, are used to monitor for trace (ppb) levels of 22 volatile organic compounds (VOCs). The target compounds measured by the AQMs include three types of chemicals: 1) those compounds that would be harmful to crew, 2) those compounds that have been detected regularly in archival samples, and 3) compounds that, while not necessarily harmful to crew health, could present problems for Environmental Control and Life Support Systems (ECLSS).

In March 2019, following the docking of SpaceX-Demo1 (SpX-DM1), the on-board AQMs began to report extremely high levels of isopropyl alcohol (IPA). While elevated IPA is not abnormal following the docking of visiting vehicles (due to cleaning of the cargo prior to flight), the level measured by the AQM, and its continued presence following multiple days of scrubbing, caused concerns regarding the U.S. Water Recovery System. Following the departure of SpX-DM1, the IPA levels decreased to nominal levels, allowing the team to investigate the cause of the elevated measurements. Initially, based on the changes in the shape of the gas chromatograph (GC) traces in the IPA region during docked operations, it appeared that some unknown coeluting species was causing problems with quantification. However, with the docking of Northrup-Grumman-11 (NG-11), the elevated IPA concentrations returned, as well as the changes in GC traces. In contrast to the SpX-DM1 results, though, the AQM IPA results did not return to nominal levels following the departure of NG-11, suggesting that the changes could not be tied directly to the visiting vehicle.

In this paper, we will discuss a number of potential causes for both the genuine (measured in archival samples) increases in IPA as well as the much higher levels measured by the AQM. Additionally, we will discuss methods being explored to decrease the potential for a reoccurrence in the future.