Developing an Air Quality Index for Microgravity Indoor Environments/Space Missions

Meytar Sorek-Hamer[1] Marit Meyer[2]
[1] NASA Ames Research Center [2] NASA Glenn Research Center

Indoor pollution sources (on Earth) that release gases or particles into the air are the primary cause of air quality problems in indoor environments. The development of an adequate tool to understand pollution levels in a certain location is of high importance. This tool must be able to inform about the levels of pollution in a simple and understandable way but also, used to take a series of predetermined measures to protect the health of the exposed population. One of the most useful and up to date approaches for characterizing air pollution is the Air Quality Index (AQI). It is an easily-calculated powerful data-driven tool, that summarizes a complex phenomenon, such as air pollution, in straightforward indicators. The AQI system has been developed in different countries around the world, mainly for outdoor environments, based on the results of risk assessments, epidemiology studies, and current local air pollution regulations and standards.

Air quality in microgravity indoor environments is of fundamental importance to crew health, with concerns encompassing both gaseous contaminants and particulate matter. Although the concentration of gases in the microgravity indoor environment is well studied, aerosols remain one of the major pollutants that affect air quality and has reported adverse health effects and hasn't been reported under these unique conditions. Earth-based AQIs can't be extrapolated to microgravity indoor environments due to different aerosol characteristics and altered lung deposition in low gravity.

Concurrent with the aerosol-focused AQI effort, we assess and document how the process would apply for combining particles & gases into a composite index, with the ability to query each AQI independently. All this information can be combined in a spacecraft-specific AQI for future space missions and habitats. The objective of this work are to determine what areas of expertise will contribute, what research and data will be required, and explore the scope of effort needed to formulate a spacecraft AQI in addition to analyzing ISS aerosol sampling data and incorporate results from both aerosol Sampling experiments (the only relevant data available from space).