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Transformation of Air Quality Monitor Data from the International Space Station into Toxicological Effect Groups

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The primary reason for monitoring air quality aboard the International Space Station (ISS) is to determine whether air pollutants have collectively reached a concentration where the crew could experience adverse health effects. These effects could be near-real-time (e.g. headache, respiratory irritation) or occur late in the mission or even years later (e.g. cancer, liver toxicity). Secondary purposes for monitoring include discovery that a potentially harmful compound has leaked into the atmosphere or that air revitalization system performance has diminished. Typical ISS atmospheric trace pollutants consist of alcohols, aldehydes, aromatic compounds, halo-carbons, siloxanes, and silanols. Rarely, sulfur-containing compounds and alkanes are found at trace levels. Spacecraft Maximum Allowable Concentrations (SMACs) have been set in cooperation with a subcommittee of the National Research Council Committee on Toxicology. For each compound and time of exposure, the limiting adverse effect(s) has been identified. By factoring the analytical data from the Air Quality Monitor (AQM), which is in use as a prototype instrument aboard the ISS, through the array of compounds and SMACs, the risk of 16 specific adverse effects can be estimated. Within each adverse-effect group, we have used an additive model proportioned to each applicable 180-day SMAC to estimate risk. In the recent past this conversion has been performed using archival data, which can be delayed for months after an air sample is taken because it must be returned to earth for analysis. But with the AQM gathering *in situ* data each week, NASA is in a position to follow toxic-effect groups and correlate these with any reported crew symptoms. The AQM data are supplemented with data from real-time CO_2 instruments aboard the ISS and from archival measurements of formaldehyde, which the AQM cannot detect.