

Microbial Anomalies Encountered on the International Space Station

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Microorganisms in our living environments are unavoidable. A community of microbes arrived in space with the delivery of the first element of the International Space Station (ISS), attached to hardware and on the bodies of the humans tasked with the initial assembly missions. The risk that microorganisms could cause adverse effects in the health of both the human occupants of the ISS as well as the physical integrity of the station environment and life support systems has been both a driver and a function of engineering and operational controls. Scientists and engineers at NASA have gone to extensive measures to control microbial growth at levels safe for the crewmembers and the spacecraft environment. Many of these measures were initiated with the design of the spacecraft and its systems. Materials used in the ISS were tested for resistance to fungi, such as mold and a paint with a fungus-killing chemical was also used. Controlling the humidity of the air in the Station is also an effective way of discouraging microbe growth. The breathing air is reconditioned by the Environmental Control Life Support System (ECLSS) prior to distribution, utilizing High Efficiency Particulate Air (HEPA) filtration. Requirements restricting the accumulation of water condensate in the air handlers and habitable volume of the ISS were other safeguards added. Water for drinking and food rehydration is disinfected or filtered. A robust in-flight housekeeping regimen for the ISS significantly reduces inappropriate growth of microorganisms and includes a regular cleaning of accessible surfaces with disinfectant wipes. Most of these requirements were suggested by microbiologists to mitigate and possibly prevent many microbiological risks. In addition to these controls, before flight monitoring and analyses of the cabin air, exposed surfaces, water and food, consumables, and crew members are conducted to mitigate microbial risk to the crew and spacecraft. Many microbial risks are much easier to identify and resolve before launch than during space flight. Although the focus has been on prevention of microbiologically related, not all problems can be anticipated. A number of microbial anomalies have occurred on ISS. This paper will discuss the occurrences, root-cause investigations, and mitigation steps taken to remediate the contamination.