

Title:

Microbial Challenge Testing of Single Liquid Cathode Feed Water Electrolysis Cells for the International Space Station (ISS) Oxygen Generator Assembly (OGA)

Authors

Greg S. Diderich / Jacobs Engineering / Johnson Space Center

Robert J. Roy / Hamilton Sundstrand Corporation

John W. Steele / Hamilton Sundstrand Space Systems International, Inc.

Steven P. Van Keuren / Anadarko Industries

Mark E. Wilson / The Boeing Company

Abstract:

The International Space Station (ISS) Oxygen Generator Assembly (OGA) operational performance may be adversely impacted by microbiological growth and biofilm formation over the electrolysis cell membranes. Biofilms could hinder the transport of water from the bulk fluid stream to the membranes and increase the cell resistance resulting in higher cell voltages and a shorter cell life. A microbial challenge test was performed on duplicate single liquid cathode feed electrolyzer cells to evaluate operational performance with increasing levels of a mixture of five bacteria isolated from ISS and Space Shuttle potable water systems. Baseline performance of the single water electrolysis cells was determined for approximately one month with deionized water. Monthly performance was also determined following each inoculation of the feed tank with 100, 1000, 10,000 and 100,000 cells/ml of the mixed suspension of test bacteria. Water samples from the feed tank and recirculating water loops for each cell were periodically analyzed for enumeration and speciation of bacteria and total organic carbon. While initially a concern, this test program has demonstrated that the performance of the electrolysis cell is not adversely impacted by feed water containing the five species of bacteria tested at a concentration measured as high as 1,000,000 colony forming units (CFU)/ml. This paper presents the methodologies used in the conduct of this test program along with the performance test results at each level of bacteria concentration.