BIOCONTAINMENT CHALLENGES FOR HANDLING AND LIFE DETECTION OF EXTRATERRESTRIAL SAMPLES. M. A. Grimaldo L., M. Eng.[1], R. L. Beets, FAIA[2], and J. S. Sandlin, AIA[3]; [1]Director of Institutional Biocontainment Resources, University of Texas Medical Branch, 301 University Boulevard, Galveston, TX 77555-0609, magrimal@utmb.edu, [2]Perkins+Will, 1001 McKinney St., Suite 1300, Houston, TX 77002, Raymond.Beets@perkinswill.com, [3]Perkins+Will, 1001 McKinney St., Suite 1300, Houston, TX 77002, Scott.Sandlin@perkinswill.com.

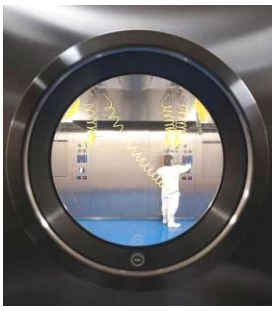
Introduction: The intent of our presentation will be to initiate a multidiscipline discussion on how samples would be collected, transported, preserved and analyzed where the environment and the scientist can be protected and the life detection work could be carried out in a safe manner that protects the researcher and the general public. We propose to present and discuss issues of sample integrity and containment, and lessons learned from our experience in the design, construction, commissioning and operation of high-containment biological research facilities. We will focus on our experience with Biosafety Level 4 (BSL-4) laboratories as well as the challenges that maximum containment has on sample handling, specialized equipment operation and maintenance, sample storage, environmental conditions, disinfection methodologies, air filtration, effluent decontamination, validation of systems and preparation for unknowns.

History: "The prospect of eventually returning samples from diverse bodies throughout the solar system underscores the need for a specialized sample return facility dedicated to the study and detection of life in extreme environments. …In anticipation of the variety of proposed sample return missions…, it will be important to be prepared with a suitably stringent containment and quarantine facility…"[1]

To date, the most relevant extraterrestrial samples returned to Earth have been the samples collected by the Apollo and Luna missions, and more recently, the Genesis and Stardust missions. These have shown to be devoid of life and to contain only extremely low amounts of organic materials. In contrast, it is expected that future missions will involve return of samples from bodies that cannot with the same degree of confidence be assumed not to contain life. Studies by the Space Studies Board of the National Research Council[1,2] have recommended that such samples be handled under strict biological containment, even though the possibility that they contain life is very small. In addition, the science to be done on returned samples requires that they be handled under extremely clean conditions to maximize their scientific value, especially to avoid "false positives" for the detection of life, i.e., mistaking terrestrial contaminants for evidence of life on these extraterrestrial bodies.

A planetary sample collection will be an invaluable, international scientific resource. It is well-established that planetary samples must be stored and scientifically manipulated in a manner so that their state of preservation will not be compromised or degraded.

Summary: The design, construction, and operation of a Sample Receiving Facility will require the coordination and work of multiple teams of experts, spanning a decade or more. It is important for various layers of scientific and technical oversight to be in place early in the planning process to ensure continuity throughout the lengthy and complex Mars sample return mission planning process.[3] To meet the recommendations of the 2009 report to be "fully operational at least 2 years prior to the return of samples to Earth", we hope this dialogue will contribute to the process of planning and constructing a safe and secure sample receiving facility, built according to applicable containment level standards, with the ability to maintain strict cleanliness conditions, equipment integrity, and operational protocols necessary to optimize the unique opportunities presented by a Mars sample return.



References: [1] *Evaluating the Biological Potential in Samples Returned from Planetary Satellites and Small Solar System Bodies: Framework for Decision Making;* National Academy Press, (1998). [2] *Mars Sample Return: Issues and Recommendations;* National Academy Press, (1997). [3] *Assessment of Planetary Protection Requirements for Mars Sample Return Missions;* Committee on the Review of Planetary Protection Requirements for Mars Sample Return Missions, National Academies Press, (2009).