American Glovebox Society
ENCLOSURE
SUMMER 2021

AGS VIRTUAL CONFERENCE
JULY 26, AUGUST 2, AUGUST 9

Conference Info and Registration – Pages 24, 25

Some Technology Challenges for a Facility Handling Samples from Mars

Article by: Merrick & Company - Valerie Walker, Frank Granadino, Sandy Ellis, Dave Luke, Dave Munge – Page 8

CHANGE SERVICE REQUESTED
American Glovebox Society
526 So E. Street, Santa Rosa, CA 95404

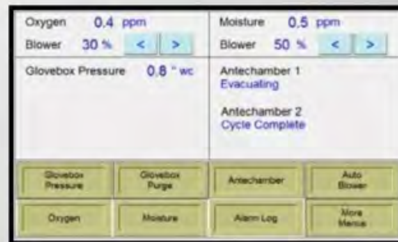
Vacuum Atmospheres Company

SETTING THE STANDARD FOR OVER 50 YEARS

Vacuum Atmospheres Company is committed to supplying the nuclear, industrial and academic communities with the highest quality, most technologically advanced inert atmosphere products available anywhere.

NexGen Platform

Revolutionary cartridge based technology that requires NO REGENERATION.
Independent oxygen and moisture purification to less than 1 ppm for large and small volumes.
Touchscreen operator interface for monitoring and control of all glovebox functions.



Purifier depicted with and without a Faraday Cage

Nexus Platform

Modular gas purification to less than 1 ppm oxygen and moisture in argon or nitrogen atmospheres.

Custom glovebox design and fabrication

WWW.VAC-ATM.COM
INFO@VAC-ATM.COM

NQA-1 Compliant
ISO 9001:2015 Certified
US Patents 9,878,283; 10,549,004
MADE IN THE USA

Main Offices and Manufacturing Facilities
4652 W. Rosecrans Ave,
Hawthorne, CA 90250
(310) 644-0255
East Coast Office (978) 561-1763

ENCLOSURE
American Glovebox Society

Inside This Issue:

In This Issue...

Departments:

Advertisers:

Cover Photo: Courtesy of NASA - www.nasa.com

President's Message

By: Gary Partington

I am honored to continue serving as your AGS President. As you know, officers' terms generally end at the Annual Conference and new officers take over. Due to the pandemic we needed to cancel our 2020 Conference and reschedule for 2021 and my term as President continued for another year. The pandemic, however, did not keep us from moving forward with our agenda.

The Guideline for Gloveboxes is being edited and it is anticipated that the Fourth Edition will be available in the Spring of 2022. A Leak Test Errata & Second Printing, which will incorporate the Errata, will be available by July of this year. The Glovebox Fire Protection document is in the process of being updated and will be released later this year. The Board continues to investigate secure ways to purchase guidelines via a cloud-based service, allowing us to go green. The AGS website has lots of useful information. Access the website at GloveboxSociety.org, type in your username (last name) and password (Member ID number - which can be found on your AGS membership card). Once signed in, you will have access to Guidelines for Gloveboxes Gap Analysis, Membership Directory and Technical Library. There is also a Product and Service Directory, searchable by Product/Service and Vendor.

Finally, we were able to present a virtual webinar series which was held in November and December 2020. Both sessions ran 2 hours in length. Over the course of these 2 dates, 6 presentations were given covering ergonomics, welding 300 series stainless steel, low moisture applications, unleaded shielding gloves, lessons learned, and society update. Thanks again to our presenters Martha Chan, Stan Gingrich, Craig Dees, Denis Johnston, Wendy Conley and Stanley Trujillo for sharing their knowledge experience in these areas. Thanks also to the over 70 participants in attendance.

Sadly, the pandemic is still with us and we have had to make that difficult choice again. However, I am excited to announce that we will be holding a virtual conference on three consecutive Mondays beginning July 26th." The conference will be complete with focused training, many informational presentations given by Society members and a virtual exhibit hall. If you have a topic you would like to present, please contact the AGS office. More information on our virtual conference will be released soon.

I would like to thank the entire Board of Directors, and to Dorothy and Crissy for their commitment to the Society and the membership especially during these challenging times. They have done a great job in coordinating our webinar and are the driving force behind what will be an informative virtual conference.While things continue to change, the AGS mission remains the same. AGS promotes safety and quality of glovebox systems; promotes communication; and disseminates knowledge in the field of glovebox technology. We will continue to meet these goals and support our membership. Soon, we will be together again, and in the meantime, get your vaccination and stay healthy and safe. ❖

The Enclosure

Editor
Justin Dexter
j.dexter@mbraunusa.com

Advertising Manager
Crissy Willson

Design and Production
Tony Monaco

Publisher
American Glovebox Society

The Enclosure is published for the benefit of the glovebox engineering profession serving nuclear, biomed, pharmaceutical, semi-conductor, aerospace technology, and other industries.

Circulation: Our continually increasing circulation is now at 3,100 copies. We have subscribers throughout the United States, Canada and around the world.

Readership: Glovebox designers, users, engineers, fabricators, manufacturers, suppliers, contractors, libraries, and universities.

Advertising: Deadlines for display ads are: March 1st & September 1st. All rights reserved: Material may be reproduced or republished with credit to source and author (when indicated).

Submittals: All letters, articles and photographs are welcome and should be directed to the AGS office, editor's attention. Material will not be returned unless accompanied by a self-addressed, stamped envelope.

Disclaimer: The information contained herein is correct to the best of our knowledge. Recommendations and suggestions are made without guarantee or representation as to the result since conditions of use are beyond our control. The contents are intended as a source of information.

Opinions, beliefs and viewpoints expressed by the various authors do not necessarily reflect the opinions, beliefs, and viewpoints of the American Glovebox Society.

The Enclosure is published by:
American Glovebox Society
526 So. E Street
Santa Rosa, CA 95404

Tel.: (800) 530-1022 or (707) 527-0444
Fax: (707) 578-4406
E-mail: ags@gloveboxsociety.org
Website: www.gloveboxsociety.org

Postmaster: Send address changes to:
American Glovebox Society
526 So. E Street
Santa Rosa, CA 95404

2020/21 Board of Directors

Officers

PRESIDENT
Gary Partington
ProSys Containment & Sampling Technology
T. (262) 325-8971
gary.partington@prosysgroup.com

PRESIDENT-ELECT
Justin Dexter
MBraun, Inc.
T. (603) 773-9333
j.dexter@mbraunusa.com

SECRETARY/TREASURER
Paul Contreras
Los Alamos National Lab.
T. (505) 665-3617
pcontreras@lanl.gov

IMMEDIATE PAST PRESIDENT
Tony Heinz
Leak Testing Specialists
T. (407) 737-6415
tony.heinz@leaktestingspec.com

EXECUTIVE DIRECTOR
Dorothy Calegari
T. (800) 530-1022
dcalegari@gloveboxsociety.org

Directors

Mark Borland
Idaho National Lab.
T. (208) 533-7812
mark.borland@inl.gov

Craig Dees
Idaho National Lab.
T. (208) 533-8030
craig.dees@inl.gov

Directors (Continued)

Tim Gabriel
Savannah River National Lab.
T. (803) 725-2226
timothy.gabriel@srnl.doe.gov

Kevin Kotter
Premier Technology, Inc.
T. (208) 782-9126
kkotter@ptius.net

Nate Levene
Merrick & Company
T. (303) 353-3880
nate.levene@merrick.com

Joe McVeigh
ORNL
T. (865)576-6631
mcveighjh@ornl.gov

John T. Newman, PE
MBraun, Inc.
T. (603) 773-9333
j.newman@mbraunusa.com

Dan Payne
Wagstaff Applied Technologies
T. (208) 241-3319
dan.payne@wagstaff.com

Jose Rodriguez
Los Alamos National Lab.
T. (505) 655-9953
rodriguez_j@lanl.gov

Greg Wunderlich
AECOM
T. (303) 843-2000
greg.wunderlich@aecom.com

2020/21 Liaisons

Martyn Page, UK Liaison
AWE, plc
Bus: 44 1189850633
martyn.page@awe.co.uk

Kristin Leeder, Canadian Liaison
Canadian Nuclear Lab.
T. (613) 584-3311
kristin.leeder@cnl.ca

Moving ?

Please let the AGS Central Office know of any changes in address. Send your name, address, city, state and zip code information to:

American Glovebox Society
526 So. E Street
Santa Rosa, CA 95404
Bus: (800) 530-1022 or (707) 527-0444
Fax: (707) 578-4406

Some Technology Challenges for a Facility Handling **Samples** from **Mars**

By: Merrick & Company - Valerie Walker, Frank Granadino, Sandy Ellis, Dave Luke, Dave Munger

Note from Editor:

Witnessing the recent success on Mars, AGS decided to open the vault and reprint an older article that highlights the role the glovebox industry plays in space exploration. We hope you enjoy this flashback from 2004.

1. Introduction

The NASA Mars Exploration Program is currently pursuing a science-driven agenda of robotic exploration of Mars. NASA has orbited two major scientific observatories, the Mars Global Surveyor, orbiting Mars since 1997, and Mars Odyssey, orbiting since 2002. Each has made major discoveries. The landings and discoveries of the Mars Exploration Rovers named Spirit and Opportunity are well known to a significant portion of the world's citizens. In 2005 another science orbiter, named Mars Reconnaissance Orbiter will begin its journey to Mars. A lander mission named Phoenix will, in 2008, land near the northern Mars pole to study that environment. A rover, currently named the Mars Science Laboratory, more scientifically sophisticated and capable than the Spirit and Opportunity rovers, will launch to Mars in 2009, arriving in 2010, and be capable of surviving for many months, making scientific observations of an ever more detailed nature.

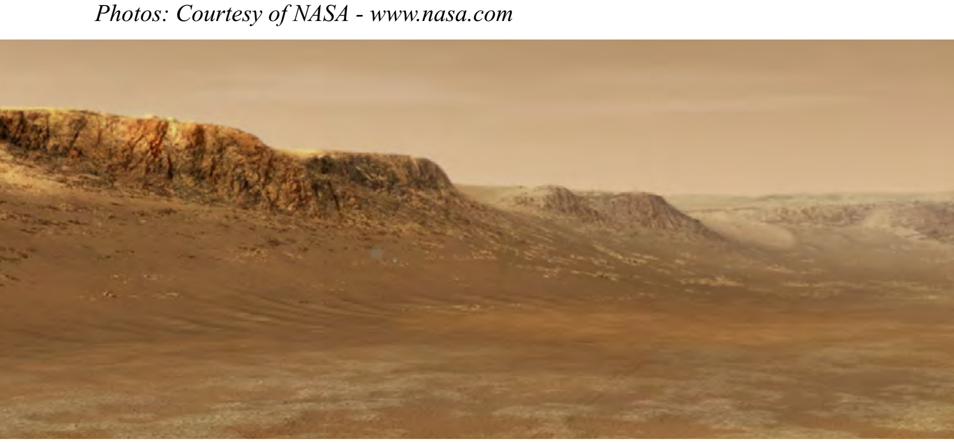
However, there are limitations on what can be learned about Mars from surface measurements. Some of the most critical measurements needed to more fully understand Mars ultimately depend on those measurements being made on samples returned to Earth laboratories. In this paper, we discuss technology challenges for a Mars sample receiving facility, to which the containerized and highly insulated Mars samples will be delivered.

By international treaty agreements, NASA and the other space agencies have agreed not to bring terrestrial organisms to Mars. Likewise, a spacecraft returning to Earth must not be allowed to carry martian material on the outside of its container, so as to potentially contaminate Earth with unknown organisms. The practical implementations of these agreements imply very detailed considerations for handling, sealing, opening, and analyzing martian samples. Such considerations won't be discussed in this paper, but are taken very seriously by NASA, and discussed in great detail in what is referred to as planetary protection (for an extensive source of planetary protection information and documentation, readers are invited to peruse the NASA web site http://planetaryprotection.nasa.gov/pp/.

This paper does discuss briefly the careful considerations and the resulting test protocols that are to be followed within the SRF and some of the technical challenges in implementing those protocols.

continued on next page

Photos: Courtesy of NASA - www.nasa.com



continued from previous page

2. Test Protocols for Samples

Between March 2000 and June 2001, NASA convened a series of Mars Sample Handling Protocol workshops attended by both U.S. and international participants expert in fields relevant to planetary protection, the overall objective of which was to "produce a draft protocol by which returned Martian sample materials could be assessed for biological hazards and examined for evidence of life (extant or extinct), while safeguarding the samples from possible terrestrial contamination" [1]. The term "Draft" is intended to really signify that much new knowledge, resulting from the continuing exploration of Mars, and analyses of data collected from these exploration activities, including the sample return mission itself, will be utilized in producing the final version of the protocol. In the interim, the Draft Protocol is intended to "provide a proof-of-concept model of the final protocol, demonstrating a sufficient approach to testing returned samples for possible biohazards or biological activity of Martian origin" [1].

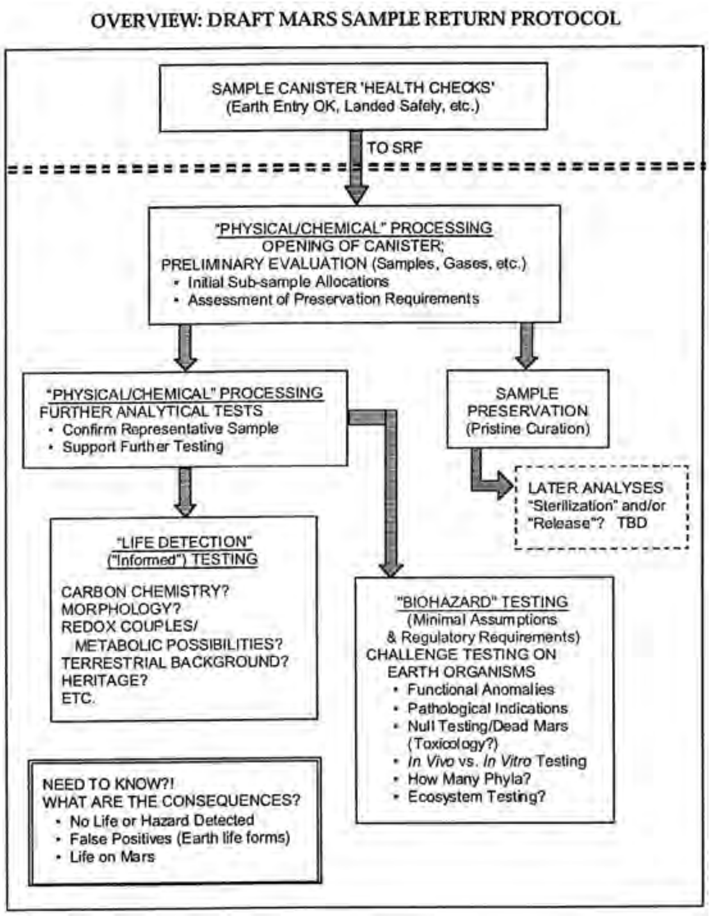


Fig. 1. Testing Process

Figure 1 is an overview taken from the Draft Protocol noting the principal steps in the returned sample testing process. After the initial 'health checks' at the landing site, the sample canister is transported to the SRF, where it is opened for the first time since leaving the Martian surface, and initial assessments are made of its contents, which include Martian surface gases as well as fines and small rock cores and fragments. The principal elements of the protocol are a) physical and chemical processing, to characterize in detail exactly what has been brought back to the SRF; b) life detection testing, which is analytical and descriptive, and seeks signs of life in either morphology, chemistry, or cultivation; c) bio-hazard testing, which will test to see if the sample contains any hazardous properties that can be shown to be the result of a self-replicating entity contained within the sample.

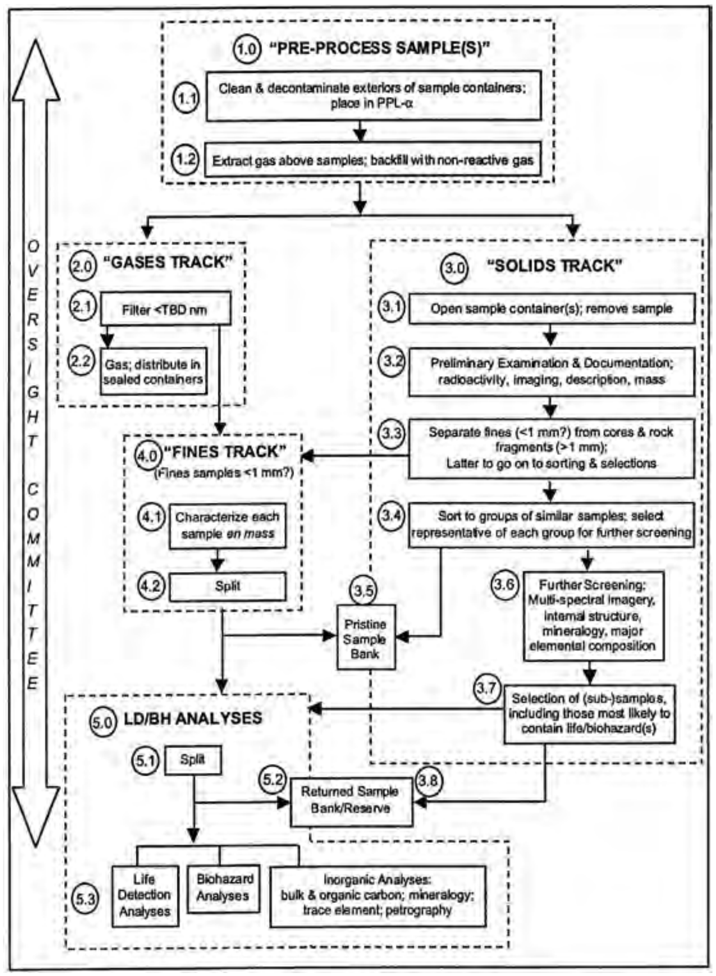
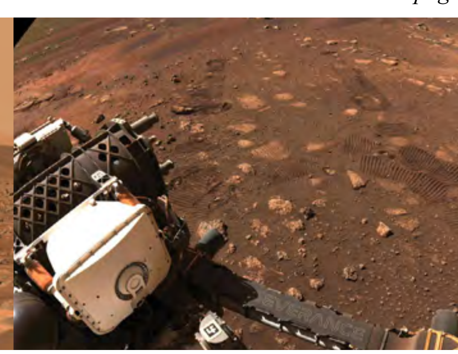


Fig. 2. Analytical Testing

continued on next page



continued from previous page

Figures 2, 3, and 4 are taken from the Draft Protocol, and show the steps to be taken to satisfy the test protocols for physical and chemical characterization, life detection, and biohazard detection. Each of the steps in the entire set of test protocols will be carried out in maximum biocontainment. The Draft Protocol describes the overall process thusly: the sample(s) will be removed from the sample return canister (SRC) under maximum biocontainment in modules containing an inert gas atmosphere and housed within a combination cleanroom/biosafety lab. After initial documentation, samples will undergo preliminary characterization, splitting, and detailed examination using a variety of different methodologies. Ultimately, data from life detection and biohazard testing will be used to determine whether to release materials from biocontainment. All sample materials not selected for further testing will be archived in sealed containers in an inert atmosphere module within the lab for future scientific purposes.

A series of concept studies for a Sample Receiving Facility has been carried out by three teams of experts in biocontainment, cleanroom design, and related fields. The study results have indicated that the containment demanded by the Draft Protocol can be effectively achieved through the use of a series of double-walled containment vessels housed within a cleanroom. The vessels must have the capability to allow access of scientific instrumentation for sample analyses. Additionally, during the process of opening the containers and analyzing the material, it will be crucial that potential Martian biological/hazards material be contained while at the same time the Mars sample material must remain free of terrestrial contaminants. In the remaining discussion, details are provided on the nature of double-walled containment vessels being consider for the facility, the need for special glove materials and glove ports.

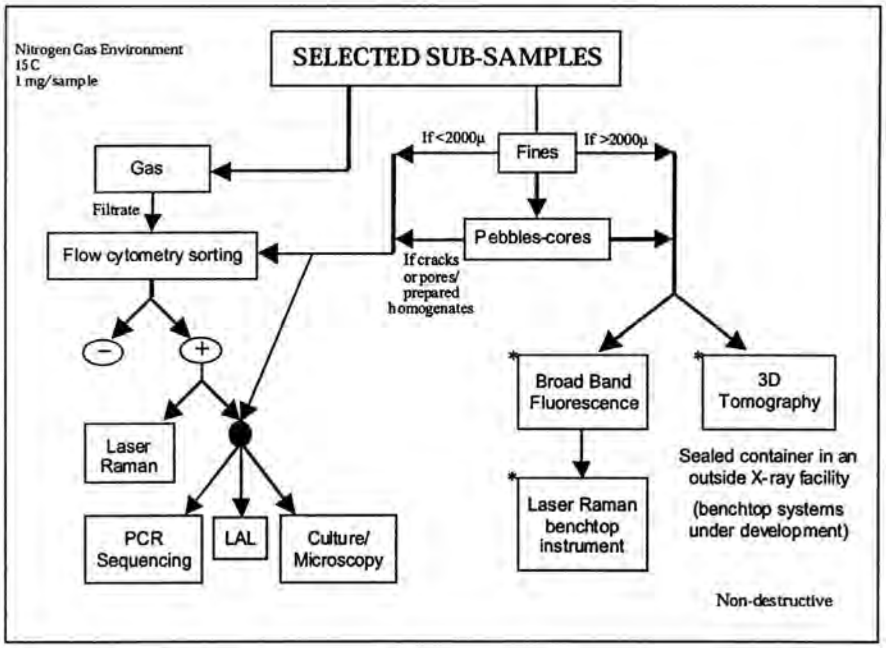
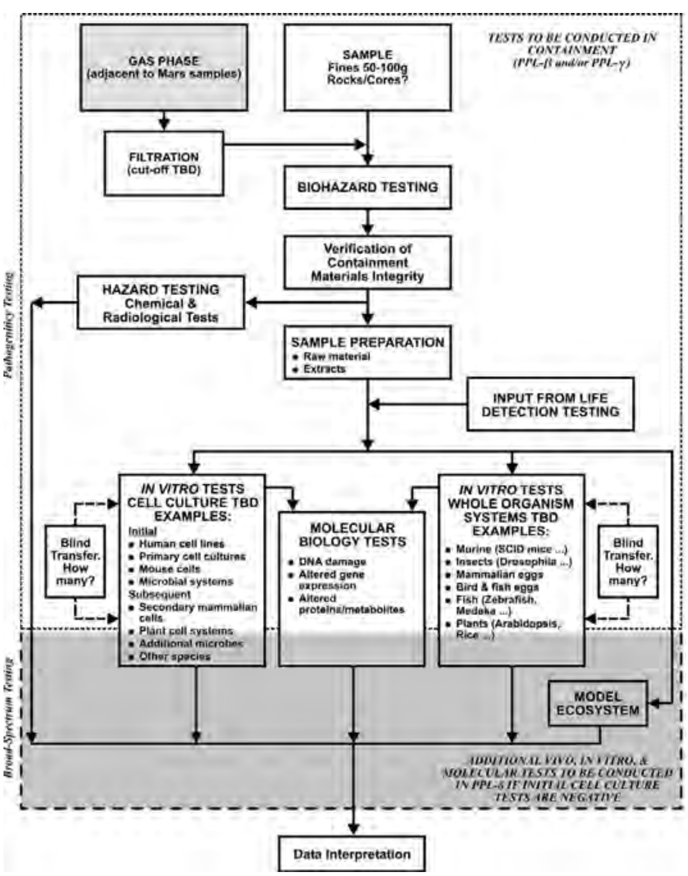


Fig. 3. Life Detection Process Flowchart Fig. 4 (below)



3. Facility Concept

A concept for the SRF developed by the Merrick/Flad team during the studies consists of three laboratories that will be used for initial receiving and removal of the SRC (contained within the OS) from the EEV and subsequent removal of the samples from the SRC for analysis and curation. Additional laboratory support space, office space and engineering space has also been programmed for a facility of approximately 45,000 gross square feet.

In general, Lab 1 will be used to remove the SRC from the EEV and test the integrity of the SRC to ensure containment was not breached during re-entry and landing as well as guarantee the integrity of the sample that it has not been compromised by terrestrial contamination. The work in this laboratory will be primarily in glove boxes, similar to Class III biological safety cabinets. The environment inside the glove box will be ambient earth atmosphere with clean room like conditions. Lab 1 will be constructed to meet the requirements for a CDC/NIH BMBL BSL 3 laboratory with enhancements to include HEPA and carbon filtration of the exhaust air and retention of the liquid waste for effluent decontamination. The lab will also have a cleanliness of ISO 8, class 100k.

Lab 2 is used to open the SRC, sample aliquot, initial Physical Characteristic, Biohazard Analysis and Life Detection testing. The primary containment will be double wall containment modules with an internal environment of pure nitrogen at ambient temperatures and pressures. The work in these boxes is anticipated to be primarily robotic with glove ports to support contingencies. Lab 2 will be constructed to meet the requirements for a CDC/NIH BMBL BSL 4, cabinet lab as well as ISO 7, class 10k cleanliness. Features include double HEPA and single carbon filtration of the exhaust air, single HEPA filtration of the supply air. The laboratory secondary barrier systems will be pressure decay tested for integrity. Lab 2 will primarily be used by personnel wearing

continued on next page

continued from previous page

static personal protective equipment such as one-piece tyvek suits, gloves, although the laboratory workers will be able to don one-piece positive pressure suits and exit through a chemical decontamination shower to meet the capability of a BSL4 suit laboratory.

Lab 3 is used to perform additional biohazard and life detection analysis and provides for testing on live animals and/or plants. Lab 3 will be constructed to meet the requirements for a CDC/NIH BMBL BSL 4, Suit Lab. Features of Lab 3 will be the same as Lab 2.

Major Sub-Systems

To adequately characterize the SRF, major sub-systems are required to ensure containment and maintain the samples in a pristine condition. Following is a list of the major sub-systems:

- *Secondary Containment Barrier (i.e. the integrated building components that form an air-tight interior environment for Labs 1, 2, and 3)*
- *Primary Containment Module (glovebox type enclosures)*
- *Laboratory casework and furnishings*
- *Mechanical Systems including HEPA filtration, systems to ensure pressure decay and system redundancy.*
- *Plumbing Systems including high purity inert gas delivery system, breathing air systems, chemical decontamination, and waste decontamination.*
- *Power Systems including primary commercial power with appropr iate backup and standby power systems; and special systems for communications, fire protection and security.*

4. Technical Challenges

Maintaining containment and the pristine nature of the material will pose a unique challenge, as no system is currently available which meets all the requirements for sample testing and handling. The final solution will likely encompass technology and standard practices from the nuclear, pharmaceutical, biohazard and clean room industries. Handling and analyzing the material will need to be performed in a containment module(s) that incorporate features of standard gloveboxes typically used in the nuclear industry as well as Class III biological safety cabinets used in the biohazard industry. It may also necessitate that unique concepts, such as double wall modules, be developed. Double wall concepts have been produced on a prototypical level, but a production model has not been developed that would be acceptable for use in this unique application.

Other aspects that will need to be considered during design include: sterilization and cleanliness of the modules and equipment, development of specialized robotic handling/test equipment, ultra-high purity gas delivery system, material compatibility of the equipment with Martian sample material, integration of equipment in the modules, and the room environment for the modules. While the technical challenges to accomplish the test protocols are numerous, only a few are addressed in this paper.

continued on next page

continued from previous page

Secondary Confinement Ventilation System: The inert purge gas fed to the module secondary confinement is removed via the induced flow blowers. All flow from the secondary confinement volume is double HEPA filtered before intermingling with other module vent gas. The pressure in the secondary confinement is controlled to 0.50" water column relative to the room and -0.25" water column relative to the primary confinement. Two independent controls maintain these pressure relationships. The main control is via the control system monitoring the pressure in the secondary confinement volume and adjusting the control valve on the module exhaust using standard control algorithms. In case the pressure drifts above ~0.40" water column, a pressure switch opens a solenoid valve to bleed excess gas into the ventilation system. Exhaust is combined in the secondary confinement exhaust header prior to being mixed with the primary confinement exhaust before being routed through the blowers.

Leak Analyzer: A residual gas analyzer is used to determine if leakage is occurring across the confinement boundaries. The analyzer is shared among all the modules using sequencing valves to draw the gas samples from the intended system. A tracer gas such as helium is added to the primary confinement inert gas feed to allow the analyzer to determine if leakage is occurring from the primary to secondary confinement volumes. If leakage is occurring from the room to either confinement volumes the analyzer will see increased oxygen levels. This scheme is not designed to sense leaks from the secondary to the primary confinement volumes since the pressures gradients will force leaks the other direction. If this leak check is required, a second tracer gas such as argon could be added to the secondary confinement gas purge.

Ventilation Blowers: Essential to the success of the ventilation system to meet the requirements is the reliability of the blowers to remain on-line. To enable this, three blowers are envisioned. At any time, two blowers are operating and a third is in stand-by or is being maintained. The blowers are sized so either, but not both can fail, and the module pressures will still be maintained at designed levels. The control system for the blowers will be set up such that the controller can fail and the blowers stay on-line. The blower exhausts to the process stack through HEPA filters.

Off-normal operation (during operation mode) such as nitrogen supply system failure, pressure level in the primary confinement volume is too high, pressure level in the secondary confinement volume is too high and loss of blower suction, etc., will need to be considered in the design of the ventilation control system.

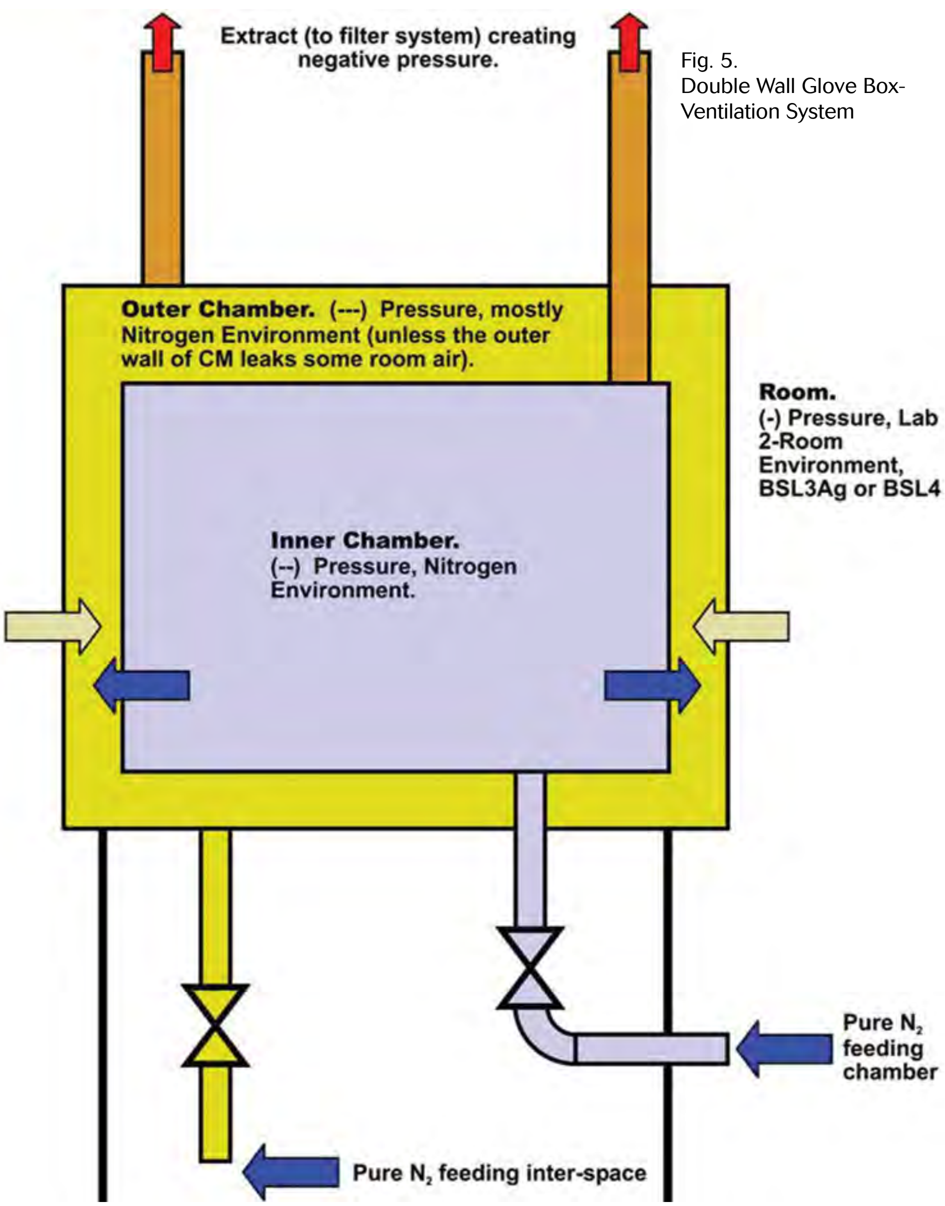


Fig. 5. Double Wall Glove Box-Ventilation System

Containment Module

The construction of the module itself would employ industry standard techniques used for gloveboxes. Material selection for windows, gaskets, seals, etc. would need to be compatible not only with Martian samples, but also with any clean or sterilization techniques.

The following concept shows a cross section, at the windows, of a double shell module.

Containment module utility penetrations and filters/housings consistent with AGS standards will need to be developed for bulk head connections, electrical pass-throughs and connections. Bulges/blisters may be required to fully accommodate these penetrations.

Airlock/gaslock doors associated with the double shell containment modules will require added sealing features to ensure the negative pressure interspace is maintained. A standard door would need to be redesigned to add a second o-ring along the sealing surface. The interspace between the o-rings would be purged with the same double shell flow to maintain the negative pressure barrier. Opening the door will require that the environment on both sides of the door be the same. Decontamination/sterilization of the containment module, followed by a nitrogen purge may be necessary in the initial transfer from an air to the nitrogen environment. The door plate is contained within a sealed shroud such that ambient air does not touch the door plate. The following sketches depict a door concept.

continued on page 14

continued from page 12

Double Wall Containment Module

The double wall containment module will essentially be a 'box in a box' philosophy. The double wall containment module (CM) concept incorporates an inter-space (or annulus) surrounding a standard single wall containment module which is at a negative pressure, relative to the room and to the interior of the module where the sample is located. In this approach the pristine nature of the Martian sample is preserved and personnel protected from any potential biological hazards. The room is maintained at a positive pressure relative to both the inter-space and to the module interior (although negative relative to the balance of the facility). The module interior is positive to the inter-space. The module interior and the inter-space will have separate inlet and exhaust systems. In this manner, any leakage or permeation from the room will exhaust through the inter-space ventilation and any leakage from the module interior will also exhaust through the inter-space. The double shell construction for containment modules would likely only require a double shell in areas where there is a potential leak path (seals/gaskets/o-rings) or where permeation could be a factor (windows, gloves, seals/gaskets).

Figure 5 (page 12) provides a schematic of the concept of the ventilation system.

Module Ventilation

The ventilation control system would be designed based on the following assumptions:

1. *Humans are protected from potential extra terrestrial hazards is the first priority,*
2. *Martian samples are protected from terrestrial contamination is of second priority,*
3. *Containment module ventilation system must be highly reliable, and*
4. *Gloves are used only for maintenance activities and all gloveports are plugged during normal operations.*

The basic concept for normal atmospheric independent of control of ancillary systems such as airlocks, internal analyzers and equipment, and other transfer systems are discussed below.

Containment Modules: The module is divided into two volumes. The inner volume is the primary confinement designed to be maintained at approximately -0.25" water column relative to the room environment. The outer volume is the secondary confinement designed to be maintained at approximately -0.50" water column relative to room environment. The theory of operation is that any leaks through either the primary confinement boundary outward or the secondary confinement boundary with the room will be captured into the secondary confinement ventilation system. In case a leak forms in one of the limited primary to room boundaries, the leak will be captured in the primary confinement ventilation system. The module will be operated in an operational mode and a maintenance mode. In the operational mode, vulnerable boundary materials such as gloves will be removed and replaced or reinforced with less vulnerable systems.

Inert Purge Gas Feeds: An inert gas, such as nitrogen, is fed to the module primary confinement volume and the module secondary volume. Each system has a bottled nitrogen backup system in case of primary gas system failure. The module primary confinement volume also has a tracer gas, such as helium, added to the nitrogen for leak detection purposes describe in a later section. Both feeds are metered using rotameters and pass through check valves and in-line HEPA filters to prevent back migration of particulate. Bottled nitrogen is also available to purge the module primary volume incase of low module pressure. This system is controlled by a rotameter and solenoid valve opened by a low pressure switch from the module primary confinement.

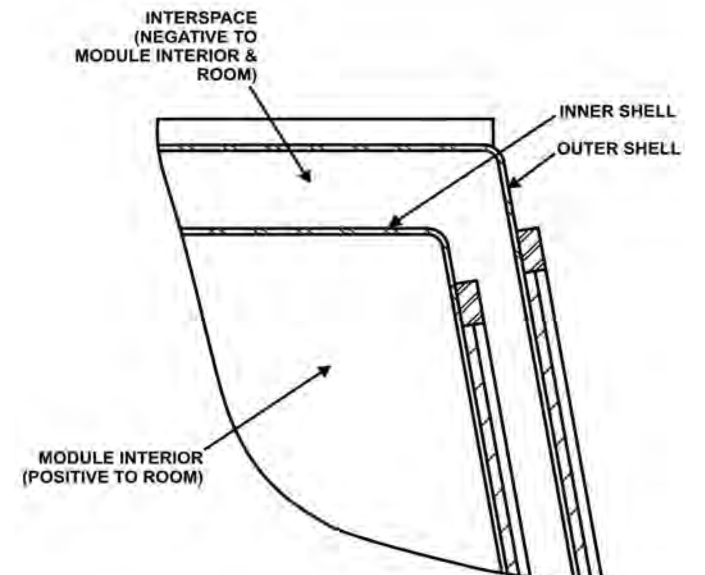


Fig. 6. Double Wall-Window Detail

Primary Confinement Ventilation System: The inert purge gas fed to the module primary confinement is removed via induced flow blowers described below. The blowers maintain ventilation duct pressure at approximately -2.0" water column relative to the room. All flow from the primary confinement volume is double HEPA filtered before intermingling with other module vent gas. The pressure in the primary confinement is controlled to -0.25" water column relative to the room and +0.25" water column relative to the secondary confinement. Two independent controls maintain these pressure relationships. The main control is via the control system monitoring the pressure in the primary confinement volume and adjusting the control valve on the module exhaust using standard control algorithms. In case the pressure drifts above ~0.15" water column, a pressure switch opens a solenoid valve to bleed excess gas into the ventilation system. Exhaust is combined in the primary confinement exhaust header prior to being mixed with the secondary confinement exhaust before being routed through the blowers.

Some of the greatest challenges in the development of a double walled module will be in the use of gloves and material pass-throughs

Double Glove Gloveport System Description

The Double Glove Gloveport System (patent pending) provides a way that allow two layers of gloves to be used to do off normal and maintenance activities within a Double Containment Module. The

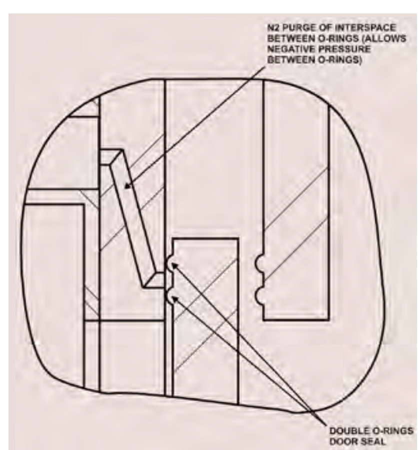


Fig. 7. Double Wall-Door Concept

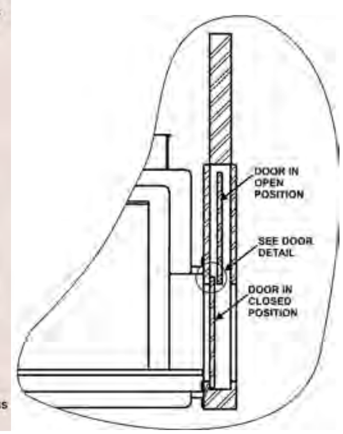


Fig. 8. Double Wall-Door Concept detail

continued on next page

continued from previous page

Double Glove Gloveport consists of a gloveport housing mounted to two containment window panes with channel gaskets and a spacer to ensued proper leak tight seal. The gloveport housing is designed to accept two gloves and glove rings back to back while allowing the purge air of the inter-space of the containment module to flow between the two sets of gloves and glove rings. The glove ring design is based on a proven industry standard push through style gloveport and glove ring. The glove will have dimples on the outer surface of the gloves that will provide air space between the gloves and promote good purge flow between gloves. A drawing of the Double Glove Gloveport System is shown on Figures 9 and 10. The materials of construction of the Double Gloveport System will be similar to those of the containment module. The gloveport housing, gloveport housing spacer, and gloveport housing cap will be fabricated from Type 316L stainless steel. The inner and outer window channel gasket will be made from an elastomer. The inner and outer glove rings, which are identical in design, may be fabricated from Teflon. The o-rings used on the glove rings and on the gloveport housing cap will be constructed of an elastomer.

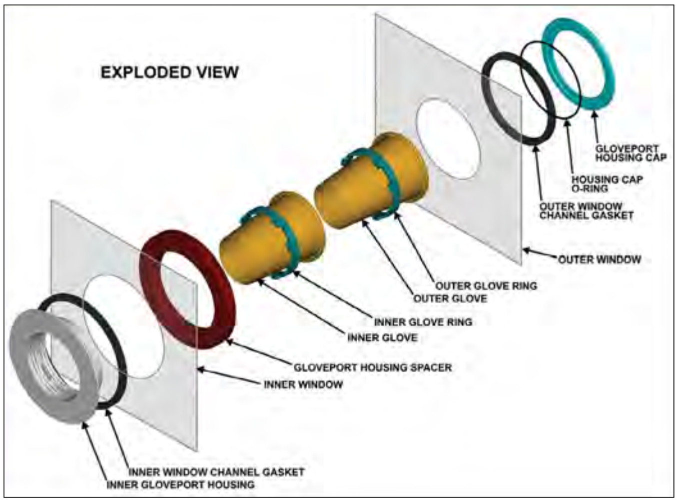
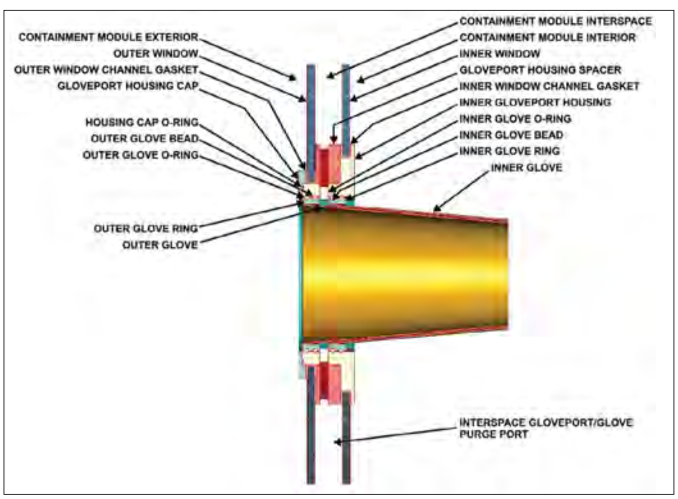


Fig. 9. Double Glove - Glove Port Concept (Pat. Pending)

Fig. 10 Double Gloveport Concept - Exploded View (Pat. Pending)



Under normal containment module operating conditions the Double Glove Gloveport System will be plugged by utilizing two Teflon gloveport plugs with o-ring in place of the gloves and glove rings shown on Figures 9 and 10. The plugged arrangement will provide double containment and eliminates the danger of torn or ruptured gloves that could cause a loss of containment. As mentioned above the gloves within the Double Glove.

continued on next page

AGS STANDARDS DEVELOPMENT COMMITTEE UPDATE

By: Craig Johnson, SDC Chair

The AGS Standards Development Committee (SDC) is currently working on the following three projects.

Guidelines for Gloveboxes (G001), Fourth Edition

The Guidelines for Gloveboxes Committee, led by Patrick Westover and a Sub-Committee, led by Mark Borland, is in the final phase of editing. It is anticipated that the fourth edition will be released in 2022.

Standard of Practice for Leak Test Methodologies for Gloveboxes and Other Enclosures (G004)

An errata has been issued for the Leak Test standard. The errata corrects formulas in the appendix. Anyone who has purchased the document will receive the errata. A reprint of the Leak Test standard which incorporates the errata is also available for purchase. If you have questions regarding the errata, please contact

Standard of Practice for Glovebox Fire Protection (G010)

The second edition of the Standard of Practice for Glovebox Fire Protection, originally published in 2011, is nearly complete. The Fire Protection Sub-Committee, led by Rick Hinkley, are in the final phase of editing. It is anticipated that the second edition will be released in 2022.

Join the SDC

If you are interested in participating in the development of AGS standards and guidelines, and would like more information on joining the AGS Standards Development Committee, please contact the AGS Executive Office at AGS@GloveboxSociety.org or (800) 530-1022

continued from previous page

Gloves, glove rings and gloveport plugs must all be properly sterilized prior to pushing them into the containment module. Sterilization could be accomplished by fabricating a small containment chamber that fits around the glove loading tool.

Gloves and Glove Material

The gloves themselves will require research and development to design gloves with a proper standoff to maintain a slight negative interspace. Additionally, new glove technology is being considered for the glove material. Researchers in Polymers and Coatings (MST-7) at Los Alamos National Laboratory and North Hand Protection from Charleston, SC, have developed a material technology that provides instant detection of punctures or other breaches of personal protective equipment, including gloves, bodysuits, biohazard suits and boots, or containment vessels such as hazardous waste drums, chemical drums and radiation sources. The flexible product consists of five layers of material with conducting layer separated by insulting layers. A weak electrical current flows through the conducting layers that are connected to a signal alarm device. Any puncture to the material completes an electrical circuit and sounds and alarm to immediately notify the user. In addition, one of the conducting layers is a modified form of carbon-filled butyl rubber which flows into the small cracks and pinhole puncture to simultaneously protect the user. This technology appears to be very promising and according to North Hand Protection, production models have been produced. While this technology does not solve the problem of a massive glove failure, it does greatly reduce the risk of small pinhole type punctures from contaminating either the Martian samples or extraterrestrial material contaminating the room. Additionally, with the inherent alarm system test validity is increased as potential contamination paths could be proven to be eliminated.

Fig. 11. (North/LANL) Instant Detection Glove Material

Material Transfers in and out of the containment modules would need to maintain confinement and the pristine nature of the sample. Two methods are being considered equipment/material transfers. The equipment item may be bagged, moved to an appropriate airlock, exterior of the bag cleaned and sterilized, and then removed from containment. Alternately, it may need to be accomplished via Rapid Transfer Ports (RTP). Traditional RTPs have what is called 'ring of contamination' around on the exterior of the transfer port, where the double lids meet (see below). There are currently available methods which could sterilize the ring by heating the sealing area (Central Research Laboratory), but the issue of cleanliness still remains. Other methods are available to purge the area with a cover gas to eliminate the ring (NIS/BNFL). Consideration may be given to the possibly combining these to methods into one RTP.

Cleaning and Sterilization of Containment Modules will be of great importance in the module and for equipment transferred into the module. Several methods are available on the market today, and future technology may provide additional methods. At this point, a three stage process is considered for the interior of the modules: an initial spray an isopropyl alcohol and water mixture followed by the introduction of vaporized hydrogen peroxide and completed with a final ultra pure water rinse. Modules would be designed with the capability of decontamination, possibly equipped with an overhead spray manifold to achieve a complete saturation of the module interior. Manifold could be fixed or move (up/down or side/side) if needed, to achieve saturation. This manifold will be

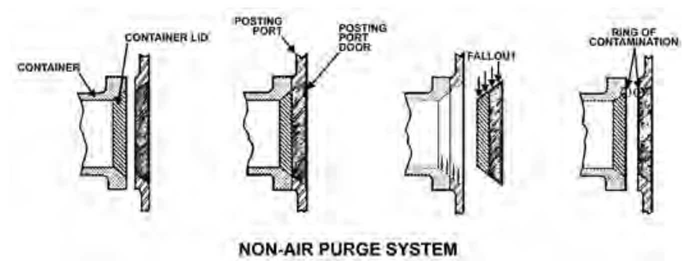


Fig. 12. (NIS/BNFL) Purged Port

utilized for both the isopropyl alcohol/water spray and the final ultra pure water rinse. Hand held cleaning tools (spray nozzles) may also be utilized. VHP will be introduced through the filtration system in order to sterilize the filters. Both the spray system and VHP piping could be used for other liquid/gaseous decontamination techniques should other treatment(s) be deemed more effective.

Filtration for the inner containment module could either be located inside the module or outside the module. If located outside the module a push through type filter would be used. A special sealed cartridge approach would be employed to maintain the pristine nature of the sample. The anticipated number of filters needed for the lifetime of the facility (anticipated to be low) would be cleaned/sterilized and preloaded into the cartridge. A method to mount the sealed cartridge onto the module would be developed. Exhaust would flow through the bottom filter and spacer to the ventilation system. Spent filters (and spacers) would be pushed through to the interior of the module, collected and removed.

If filters were located inside the module, filter change out (either with gloves or robotics) would be required and could increase the complexity of operations. Removal of a spent filter would be accomplished in the same method as with a push through filter. The actual filter type and redundancy requirements will need to be determined during detailed design of the facility. Filtration may be a combination of HEPA, sterile (Teflon), and ***carbon materials. Further development to finalize an appropriate filter technology and optimize filter media will be required.***

Material Compatibility of containment module components will be critical in the design of the system. Selection of gloves, gaskets, sealing materials, filters, windows, shell material, etc. must be compatible with the Martian samples, containment module environment, sterilization/cleanliness techniques. Significant off-gassing, high particle counts, permeation rates, etc. could affect the sample or analyses. Even small amounts of trace elements, such as gold, could have negative impact on the analyses or create false positives. Teflon, aluminum and stainless are materials currently recommended for direct contact with Martian samples. Extensive materials testing or research of existing test data will need to be performed on all materials to be utilized in the containment modules.

continued on page 18

continued from page 16

Methods for Static Dissipation would be employed, especially in the module where the container filled with samples is initially opened and sorted, to minimize particles id the air. Specialty materials or coatings may be required the use of specialized coatings for window, anti static gloves, grounding of the module and the use of static elimination systems within the containment module. Additionally, certain operational tasks, such as sorting the samples may require special considerations. A bulk, very dense transfer of extremely small particles may be impossible to neutralize with today's technology. If the material transfer could be made to be very gradual, and in an environment where ionization can exist, then it may be possible to neutralize the static buildup.

Operations in Double Wall Containment

Operations within the double wall containment modules will likely be primarily accomplished using an automated process: robots, micro-manipulators, automated mechanisms. Gloves will be utilized for certain maintenance tasks, initial placement of equipment and in off normal situations.

Robots/manipulators will perform all primary tasks within the modules including: opening the sample container, sorting/repackaging the samples and in sample handling/transfer during analysis. For sample handling and manipulations, robotic technology exists from clean room, pharmaceutical and semi-conductor industries that can readily applied to the tasks within the double containment modules.

While there are many tasks that must be accomplished during the sample retrieval and testing, one crucial task to be accomplished will be to develop a ***Head Gas Extraction System*** to extract the Mars atmosphere from the SRC without altering its characteristics.

The SRC will contain 500 to 1000 grams of rock and soil samples collected on Mars and some ambient Martian atmosphere that was present in the container at the time it was sealed. The Martian atmosphere is composed of 95.32% carbon dioxide, 2.7% nitrogen, 1.6% Argon, 0.13% Oxygen, 0.08% carbon monoxide and trace amounts of water, nitrogen oxide, neon, hydrogen-deuterium-oxygen, krypton and xenon. The atmospheric pressure on mars is approximately 6 millibars or 600 Pascals. Extraction of the head gas for analysis is a high priority for the sample return mission.

Extracting the low-pressure head gas from the SRC proposes many challenges. First, of all the head gas must be filtered to a sub-micron level to ensure that no viable organisms are included in the gas samples. Filters down to 0.003 microns or 3 nanometers are readily available in ceramic and Fluoropolymer materials. Second, the gas must be transferred and distributed for testing at low pressures. Making some assumptions from the size of the proposed SRC, if 1,075 ml of Martian atmosphere is in the SRC at 6 millibars, this is equivalent to 6.4 ml of head gas at 1 earth atmosphere. This is a small amount of gas and great care must be taken when handling and distributing the gas.

The most efficient method to extract the head gas would be to draw the gas from the SRC through a puncture point, then through a sub-micron filter into a series of vacuum bottles. In this application, even though the pressure drop available is small, the gas is at a very low density and will be transferred at a very low flow rate; therefore it is feasible to draw the gas through the sub-micron filter. The remainder of the gas that is impractical to extract through vacuum bottles can be extracted through a dry vacuum pump. Current technology utilizes scroll-pumping technology for clean and dry duty applications to an ultimate total vacuum as low as 0.01 mbar (or 1 Pa). Alternately, the gas could be extracted via a vacuum pump and delivered through a sub-micron filter at higher pressures to one or more sample containers. The drawback to this technique is the possibility of introducing contaminants to the head gas in the part per million range.

The sample cylinders could be fabricated with an internal piston that ultimately can be used to increase the gas pressure by reducing the volume or simply used as the "syringe" to inject the gas into the gas chromatograph. Since the sample cylinders cannot be drawn to a perfect vacuum, the cylinders would be purged with high purity nitrogen, and then drawn down to approximately a 1 Pa vacuum.

It is proposed to extract the head gas through the center of the (arched) lid of the sample container. A mechanism will be designed to hold the SRC while a curved boot assembly is pressed firmly against the domed section of the SRC. The boot assembly contains a multiple Teflon or PFA O-ring design for sealing around the domed surface; a spring-loaded needle for puncturing the SRC; a vacuum port for evacuating the gas inside the boot prior to puncturing the SRC and head gas extraction tubing. The extraction tubing delivers the head gas through a sub-micron filter to a manifold of vacuum sample cylinders.

Head gas extraction would include the following steps:

- *While the SRC is firmly secured, press boot assembly against top of SRC.*
- *Activate vacuum pump to evacuate the space inside the sealed boot containing the spring-loaded puncture needle. (Note: Tubing and manifold are purged with high purity nitrogen and drawn down to approximately 1 Pa prior to beginning the procedure.)*
- *When vacuum is confirmed release needle to puncture the SRC.*
- *Open valve to extraction tubing, filter and vacuum sample cylinder manifold.*
- *Sequentially open and close the valves to the sample cylinders until most of the gas has been extracted from the SRC.*
- *Vacuum pump the residual head gas from the extraction tubing and SRC into the final sample cylinder, which contains the least amount of head gas.*

6. Conclusion:

The final requirements for test protocols will need to be developed based on new knowledge resulting from the continuing exploration of Mars, and analyses of data collected from these exploration activities. Successful implementation of the requirements set forth in the final protocol will require detailed considerations for handling, sealing, opening, and analyzing Martian samples.

There will be numerous technical challenges requiring development work, not only in the area of containment modules, but in areas such as: specialized robotics for sample access, preparation and handling, integration scientific equipment with in modules, scientific equipment, material compatibilities, filtration, sterilization and cleanliness.

Reference:

1. NASA/CP-2002-211842, a draft test protocol for detecting possible biohazards in Martian samples returned to earth , October 2002.

Some Technology Challenges For a Facility Handling Samples From Mars – Merrick & Company - Valerie Walker, Frank Granadino, Sandy Ellis, Dave Luke, Dave Munger
Bio-Containment Design Services - Paul Langevin ❖

Detectable Hole Size for Validation of Glove Integrity Test System: How Should it be Determined?

There are many factors that go into what hole size is detectable by a glove pressure decay leak test, time being one of the most critical. Glove material, glove thickness, allowable leak test time, pressure used for the measurement, and other variables all come into play. Since there is no regulatory guidance on what hole size your system must be validated to detect, the first thing you should determine is what is the longest time you can spend leak testing gloves on your containment without adversely affecting your production. A good rule of thumb is to determine the smallest hole size your glove testing system can confidently detect within your allowable time frame. The smaller the hole you want to be able to detect, the longer the time it will take to detect it with good confidence in the results. The Glove Integrity Testing System (GITS) experts at MK can help to scientifically determine your smallest detectable hole size within your time requirements. In some cases, you may have to change the material or thickness of the glove you use in order to confidently detect the hole size you choose within your acceptable time frame. There are different options you can choose to meet the needs, just be sure you understand why your choices make sense, in case you have to explain them to a regulator. Be confident in your GITS system choices by working with the experts at MK MetalFree Corp.

Photo: MK Versuchsanlagen

By: John T. Newman, P.E.

Size Matters

I've spent the majority of my professional life in the business of containment/isolation. Being in the custom glovebox fabrication industry, over the last 40 years, I have had the opportunity to design containment or isolation systems for just about every type of hazard known to mankind. I've designed systems for the containment of many different types of nuclear/radioactive materials, military chemical agents, toxic pharmaceuticals, radiopharmaceuticals, aseptic pharmaceuticals, toxic and environmental sensitive chemicals, bio-hazards, animal diseases, human diseases, microelectronics, vacuum, inert gas, acids, explosive materials…I think I've been involved, in some way or another, in containing just about everything. Well, I guess I can't say everything, but there has been a lot of different stuff.

The first question you have to ask when you start a containment project is "How big is the hazard that needs to be contained?" and I'm not talking about the size of the oil spill, I'm talking about the physical size of the substance that you want to contain. Hazardous materials come in many forms and configurations. They can be solid, liquid, or gaseous. Solids can range from a large rock to very fine particulate that can float around in the air. Liquids can be in containers or a mist floating in the air. Gasses can be trace amounts in the air or be concentrated and be at low or high pressure. The actual size of the hazardous material can vary on the size scale from infinitely big to infinitely small down to the size of atoms. In order to safely contain a particular hazard, the physical size of the hazard is quite an important factor in the design of the containment.

It is very important to thoroughly understand the configuration and the actual size of the hazard you are trying to contain.

First, a little about the fundamentals of containment and what it means. If you look up the word containment, the online Merriam-Webster dictionary gives us this definition - "the act, process, or means of keeping something within limits". In our glovebox world, we use containment to either; protect people and/or the environment from a hazardous material/product, or protect the material/product from people and/or the environment.

In simple terms, it takes two things to truly contain something, a container and atmospheric pressure. The container can be many things, but most importantly it must be compatible with or have the ability to contain, what it is you need to contain. If you need to contain water, then obviously you would use a water tight container made from metal or plastic and not a cloth bag. Why? Because the cloth bag is porous and the water molecules would pass right through the pores in the material. Or, you wouldn't put up a chain link fence around your house to keep the mosquitos out. Of course, those little blood suckers would fly right through the holes in the fence and get you. Have you ever noticed that a helium filled balloon will only float for a day or so? That's because the helium atoms are so small, they actually escape containment by passing right through the molecular structure of the rubber balloon wall.

What does atmospheric pressure have to do with containment? Well, we know that everything leaks, it's just a matter of how much. So, when your container leaks, you want it to leak to your advantage. If you have a hazardous material that you want to keep in the container, then you would want the leaks to go into the container, preventing anything from getting out. In this case the contained space would be held to a pressure less than the atmosphere or at a negative internal differential pressure. If you have an environmentally sensitive material in your containment then you would you would want the leaks to go out, thus preventing the outer environment fsrom getting inside the contained space. Then, in this case the contained space would be held to a pressure greater than the atmosphere or at a positive internal differential pressure.

How do we get this positive or negative pressure inside of our contained space? To create a Negative differential pressure in an enclosed space, you need to pull more air out of the space then you let in. To create a Positive differential pressure, you would do just the opposite, and push more air into the space then you let out. We call it differential pressure, being the pressure difference of the internal pressure in respect to the atmospheric pressure outside of the containment. This differential pressure creates a driving force to push the air through all of the leak spots in or out depending on the direction of the pressure.

continued on next page

Continued from previous page

A typical containment system would normally include a glovebox/container, an air blower connected to the glovebox, inlet/exhaust dampers to control the airflow, and inlet/exhaust filters to prevent the contained hazard from escaping in the air stream. The negative system would have the blower placed on the exhaust side of the glovebox so that it sucks the air out of the glovebox. The positive system is the opposite, with the blower placed on the inlet side to push the air into the glovebox. Now, in order to control the amount of pressure differential created from the blower, we use a flow damper on the inlet and the exhaust, so we can adjust/balance the air flow to a level that will cause the desired differential pressure. But then, how is that contained, with a continuous stream of air moving through the contained space? That is where the filters come in. They are placed in the airstream going into and out of the contained space to filter the airstream by catching the hazard in the filter media.

This is where the size really matters. For a majority of the contained hazards, a HEPA filter has ability to catch and hold any contamination that gets into the airstream. HEPA, an acronym, actually stands for High Efficiency Particulate Air, which essentially means the filter is highly efficient at filtering particulate from flowing air. Now I say flowing air, because in order for the filter to catch a particle, that particle has to impact or crash into the filter medium in order to be captured. If you look at the filter medium up close, you would see that it consists of a fibrous material that forms a mesh like barrier with air passageways that allows the air to go through. The passageways or holes, are smaller than the particulate, stopping it from passing through, catching the contamination in the filter medium. Now, one could rationalize at this point, that if the particulate was actually smaller than the air passage ways, then that particulate would pass right through the filter and not be contained.

Filter ratings are normally based on the size of the smallest particle that they can catch. A standard HEPA filter rating is stated as being 99.97 to 99.99 % efficient at catching particulate that is .3 micron or larger. This means that the filter is proven by testing, to catch 99.99 % of all particles that are .3 micron or larger. Also, each filter has an air flow limit which is required for it to operate in its stated efficiency range. If the air flow is not maintained within the rating range, the filter efficiency will drop, allowing more than 0.01 % of the particulate to pass through the filter.

It is very important to thoroughly understand the configuration and the actual size of the hazard you are trying to contain. HEPA filters do well in capturing a hazard that is a particulate with a size larger than .3 micron. Just to be in perspective .3 micron = 0.00001 inch, which is a pretty small number. There are a lot of hazards that we may wish to contain that are quite a bit smaller than .3 micron, meaning a HEPA filter will not work fok everything. All one needs to do is search the internet for a particulate size chart and you can clearly see many things that are quite small. Also, it should be noted that HEPA filters will do absolutely nothing to filter gasses.

One thing of particular importance these days, are virus particles. Any particulate chart that you find will indicate that virus particles range from .005 to .1 micron in size. I've seen some charts that say they can be as large as .3 microns but most say .1 or smaller. So, let us compare the relative difference. If the average marble is 3/8" in diameter and the average BB is 1/8" diameter, it would be the same relative size difference between a .3- and a .1-micron particle. If you had a filter mesh with 3/8" diameter holes in it, do you think it would stop any BB's from getting through? Certainly not. Search the internet for "Bio Level 4 Containment", where extremely dangerous infectious viruses are handled and look at the images. Oddly, you won't see any filters being used. Notice that all the personnel are wearing fully contained positive pressure suits, with supplied breathing air. Hmmm, wonder why? Because a filter, that you can actually breath through, would not be capable of blocking a hazard as small as an extremely dangerous virus particle.

I guess what I'm trying to say is that filter technology and the art of filtering can be rather complicated and is directly tied to the size of the hazard. The filter not only has to be sized for the expected particulate size, but the air flowing through the filter must be tightly controlled to not exceed the filter flow rating to prevent passing any contamination. The seal around the perimeter of the filter is also paramount to its filtering capability. The filter can't filter the air if it flows around the filter. As we can all probably surmise, it is way more complicated than just tying a piece of cloth over the opening.

Size absolutely matters. When your hazard is very small, conventional filters will absolutely do nothing to contain it. Other methods beyond filter technology must be used to stop the hazard from passing, such as carbon absorption filters, chemical and biological scrubbers. And for biological containment, if you can't filter it, you can always kill it, by heat, or chemical treatment. All of which are quite complicated and if not properly done, can produce disastrous results.

Hey, I was watching the news the other day, and a man wearing a suit said that we should use two chain link fences to keep those pesky mosquitos from getting into the house. I'm thinking he may be on to something, and he was on TV, and wearing a "suit," so he has to be right. And my neighbor is doing it, he's a shoe salesman and seems pretty smart, so I'm thinking it's the right thing to do. His outer fence even has a really cool design which even looks good. So, logically, a double, good-looking fence, should work twice as good, right? And besides, I really should do it if everyone else is, I wouldn't want to be different… And as the infamous Foghorn Leghorn would say "That's a joke, I say that's a joke son."

Take care my friends, and remember, always, be aware of your surroundings, be careful who you trust, and question everything! ❖

AGS
American Glovebox Society

MEMBERSHIP APPLICATION

CONTACT INFORMATION			
Name:			
Company:			
Address:			
City:		State:	Zip:
Mail Stop:		Address Type: ❒ Business ❒ Residence	
Bus. Phone:		Cell Phone:	
Email:			

PRODUCTS / SERVICES
Please describe the products and/or services your company offers.

HOW DID YOU HEAR ABOUT AGS?

- ❒ **AGS Website**
- ❒ **AGS Publication Purchase**
- ❒ **AGS Conference**
- ❒ **Internet Search**
- ❒ **Other** ______________________________

PAYMENT INFORMATION

❒ **Regular Member (Individual)**
$75 + $50 Entrance Fee = $125

❒ **Sustaining Member (Company)**
$525 + $50 Entrance Fee = $575

❒ **Check - Payable to AGS and Mailed to:**
American Glovebox Society
526 South E Street, Santa Rosa, CA 95404

❒ **Visa** ❒ **Mastercard** ❒ **American Express**

CC # ______________________________

Exp ______________ Card Verification Code (CVC) __________

Billing Zip Code: ______________________________

Questions:

(800) 530-1022
AGS@GloveboxSociety.org

Join Online At: GloveboxSociety.org

AGS Order Form	AGS Member Price	Non-Member Price	Quantity	Total
GUIDELINE FOR GLOVEBOXES THIRD EDITION (AGS-G001-2007) Contains over 160 pages of established and proven practices compiled by experienced industry professionals. Covers areas of glovebox technology from conception to installation, operations, and maintenance.	$245	$320		
GUIDELINE FOR GLOVEBOX ERGONOMICS (AGS-G013-2011) Recommendations for the application of sound ergonomic principles to the design, operation, and maintenance of gloveboxes, glovebox appurtenances, and glovebox ancillary equipment.	$125	$200		
STANDARD OF PRACTICE FOR LEAK TEST METHODOLOGIES FOR GLOVEBOXES AND OTHER ENCLOSURES AGS-G004-2014 Establishes requirements for leak testing gloveboxes and other enclosures and their appurtenances.	$195	$270		
STANDARD OF PRACTICE FOR GLOVEBOX FIRE PROTECTION (AGS-G010-2011) Establishes fire protection requirements for the design, operation, and maintenance of gloveboxes, isolators, and their appurtenances serving as barriers to protect the worker, the ambient environment, and/or the product.	$125	$200		
STANDARD OF PRACTICE FOR GLOVEBOX INERT GAS RECIRCULATION PURIFICATION SYSTEMS (AGS-G015-2015) Establishes requirements and considerations for the design, procurement, receiving, and installation, test, and operation and maintenance of glovebox inert gas recirculating purification systems and related components.	$125	$200		
STANDARD OF PRACTICE FOR THE DESIGN & FABRICATION OF NUCLEAR APPLICATION GLOVEBOXES, SECOND EDITION (AGS-G006-2017) Establishes requirements for the design and fabrication of nuclear application, negative-pressure gloveboxes used for the operations that involve radioactive materials that emit low-penetrating ionizing radiation.	$125	$200		
STANDARD OF PRACTICE FOR THE SPECIFICATION OF GLOVES FOR GLOVEBOXES SECOND EDITION (AGS-G005-2014) Establishes requirements for procuring gloves to be used on gloveboxes.	$125	$200		
STANDARD OF PRACTICE FOR THE DESIGN AND FABRICATION OF GLOVEBAGS (AGS-G002-1998) A standard of practice establishing standards for the design and fabrication of glovebag components.	$50	$125		
STANDARD OF PRACTICE FOR THE APPLICATION OF LININGS TO GLOVEBOXES (AGS-G003-1998) A standard of practice that establishes the technical requirements for the materials, installation, testing, and quality assurance of corrosion resistant linings for gloveboxes and similar containment enclosures.	$50	$125		
A GUIDE FOR PERSONNEL QUALIFICATION AND CERTIFICATION IN GLOVEBOX/ISOLATOR OPERATIONS (2014) Provides recommendation for the establishment of an employer-based qualification and certification program.	$25	$75		

- Member prices are only available to members of the American Glovebox Society.
- Quantity discounts available. Contact AGS for more information.
- No refunds, returns, or exchanges.

Submit completed form to:
American Glovebox Society
526 South E Street, Santa Rosa, CA 95404
Fax: (707) 578-4406

Online Ordering Available at: GloveboxSociety.org

SHIPPING INFORMATION (PHYSICAL ADDRESS REQUIRED)

Name ______________________________

Company ______________________________

Address ______________________________

City, State, Zip ______________________________

Phone ______________________________

Email ______________________________

Shipping and Handling
Charges included if ordered in the US

Outside US FEDEX account number # Required:
Account Number:

TOTAL:

Payment Method:

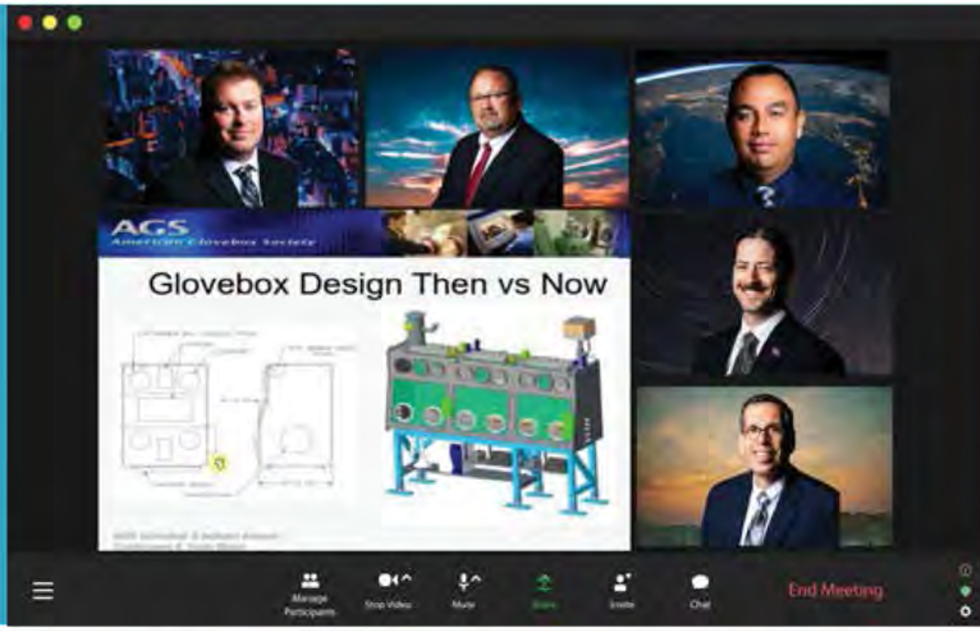
❒ Check (payable to AGS)
❒ Visa ❒ MasterCard ❒ American Express

Account #:

Exp. Date & CID # & Billing Zip:

Authorized Signature:

For Office Use



AGS VIRTUAL CONFERENCE

JULY 26, AUGUST 2, AUGUST 9

FUNDAMENTAL TRAINING JULY 26

Covering the Fundamentals of Gloveboxes geared for the newcomer, or as a refresher including; Containment Theory, Glovebox Design, Fabrication, Operations, and Ergonomics.

FOCUSED TRAINING AUGUST 2

Learn about materials used to fabricate glovebox components including shells, gloves, windows, and other appurtenances and the basis for their selection.

HOT TOPICS LESSONS LEARNED AUGUST 9

Technical sessions and roundtable discussions regarding lessons learned and other hot topics. Information to prevent adverse operating incidents and facilitate the sharing of good work practices.

SPONSORSHIP OPPORTUNITIES

AGS offers vendors an opportunity to provide product/service information to the industry. AGS has developed a sponsor package to provide meaningful marketing opportunties for vendors.

VIRTUAL INFORMATION

After careful deliberation, the AGS Board of Directors made the difficult decision to shift the AGS Conference to a virtual platform. Conference sessions will be held via Zoom webinar platform.

For more info, visit the AGS website at:
GloveboxSociety.org/Conference.html

SCHEDULE & REGISTRATION:

July 26th - Fundamentals Training (Full Day)
August 2nd - Focused Training (8 AM - 12 PM)
August 9th - Lessons Learned/Hot Topics (8 AM - 12 PM)
All times listed are pacific time

Registration Fees:
Full Conference (All 3 Days) $395
Fundamentals Only (July 26) $295
Focused Training Only (Aug. 2) $100
Hot Topics Only (Aug. 9) $100

RECORDINGS
Focused Training & Lessons Learned will be recorded and available thru Dec. 31st

REGISTER ONLINE: GLOVEBOXSOCIETY.ORG   EARLY BIRD DEADLINE: JULY 9TH

AGS VIRTUAL CONFERENCE

JULY 26, AUGUST 2, AUGUST 9

CONTACT INFORMATION

Name ____________________

Company ____________________

Address ____________________

City ____________________ State __________ Zip __________

Phone ____________________ Fax ____________________

Email ____________________

EARLY BIRD REGISTRATION PRICING

- ❑ Full Conference (Jul. 26, Aug. 2, Aug. 9) $395 (includes one year AGS Membership)
- ❑ Fundamental Training Only (Jul. 26) $295 (includes one year AGS Membership)
- ❑ Focused Training Only (Aug. 2) $100 (AGS Membership Not Included)
- ❑ Technical Sessions/Lessons Learned Only (Aug. 9) $100 (AGS Membership Not Included)

Focused Training and Lessons Learned will be recorded.
Recordings will be available to Conference registrants through December 31st.

Early bird deadline is July 9th. After July 9th, add $50 to registration pricing.

ONLINE REGISTRATION AVAILABLE AT: GloveboxSociety.org

Continuing education certificates available upon request

Please contact your licensing board to determine if this program qualifies for continuing education in your state.

PAYMENT INFORMATION

METHOD OF PAYMENT: ☐ Check ☐ VISA ☐ MasterCard ☐ American Express

Card # ____________________ Exp. Date __________ CVV# __________

Name (as it appears on card) ____________________ Billing Zip Code ____________________

Signature ____________________

AGS
American Glovebox Society

AGS EXECUTIVE OFFICE
526 SOUTH E STREET
SANTA ROSA, CA 95404

T: (800) 530-1022
F: (707) 578-4406
E: AGS@GloveboxSociety.org

LESSONS LEARNED *Update*

By: Justin Dexter
Lessons Learned Committee Member

Well, here we are again. Another year has gone by and we are still in a pandemic. We hope that all of you reading this have stayed safe and healthy over the last year. We have all had to get used to working from home with webinars, Teams meetings, WebEx meetings and Zoom meetings. It seems like everything went virtual. The AGS followed suit and also had some webinars in the fall. The Lessons Learned Committee had a chance to participate in the online webinars to update the society with some lessons learned over the course of the pandemic. I hope you had a chance to participate, Stanley and Wendy did a great job. I particularly liked the video that was played from the Los Alamos team. I needed the laugh, and I am sure MC Hammer would have been proud.

The Board of Directors had to make a tough decision this year. As you can imagine, it takes some time to prepare for our conferences, and our preparations start the day after the previous conference. Unfortunately, a decision had to be made as cases were still rising, and variants of the virus were showing up across the United States. This forced the AGS Board of Directors to shift to a virtual conference this summer at the end of July and the first two Mondays of August. The conference will be similar to the webinars that we had in the fall. Lessons Learned will again be a part of these presentations.

As I mentioned in the last Enclosure, if you have been following OPEXShare, you might have heard about the glove breach at Los Alamos National Laboratory. Our Lessons Learned Committee members from Los Alamos were planning on discussing this during the webinars, but they were unable to talk about the event due to lack of information available at the time. Part of our presentation will address the lessons learned from this event and the importance of seasoned glovebox operators transferring the experience to younger operators as they take on new roles and are essentially "learning on the fly." We will also highlight some other lessons learned from Los Alamos. At the end of the conference, if we have time, I will try to talk Stanley into wrapping up the highlights from the presentations as he has done the last several years – one of my favorite additions to the conference.

The Lessons Learned Committee has a UK member who will continue to focus on Knowledge Capture and Knowledge Transfer from our colleagues that might have only a couple years until retirement, to the younger generations that are just beginning their careers in the glovebox industry. Neil will build on the "skills" presentation this spring and talk about the ideas and challenges that our society has in front of us. We will continue to work on this next year in Nashville, when we are face-to-face at the annual conference with breakout sessions to brainstorm knowledge transfer within the AGS and throughout the industry.

Please share any lessoned learned, general knowledge, or best practices with the AGS and OPEXShare. By sharing your experiences, you could help others who might have a similar challenge or are encountering the same concerns. Please note the new link and website – https://doeopexshare.doe.gov/

I look forward to seeing you in July and in August on my computer screen and in Nashville next year face-to-face. Please stay safe, focused, healthy and more importantly, patient during the upcoming months. Take care and see you soon.

If you would like to be a part of the Lessons Learned Committee, please contact the AGS front office.

Justin Dexter
Lessons Learned Committee Member ❖