Lunar Dust Toxicity: Pivoting on our Existing Foundation to Inform Artemis. Torin McCoy, Valerie E. Ryder, Chiu-Wing Lam, Robert R. Scully, and Amy A. Romoser. NASA Johnson Space Center, Biomedical Research and Environmental Sciences Division, 2101 NASA Parkway, Houston Texas 77058. Wyle-KBR, Biomedical Research and Environmental Sciences Division, 2101 NASA Parkway, Houston, Texas 77058

Introduction: As lunar exploration comes into greater focus with Artemis mission planning, questions regarding lunar dust management are appropriately garnering attention. Our Apollo experiences and other investigations have demonstrated that lunar dust is an important practical challenge in the context of equipment integrity, spaceflight operations, ECLSS design, and crew health protection. With regard to crew health, it is important to understanding what is known (and what remains uncertain) regarding lunar dust toxicity to the crew, in order to inform lunar dust management practices/design and research plans.

The good news is that, in planning for the Phase 1 Artemis mission to the lunar south pole, there is a significant body of scientific evidence to draw from in regard to crew health protection. Over a decade (2014 Final Report), the Lunar Airborne Dust Toxicity Assessment Group (LADTAG), a highly integrated group of toxicologists, chemists, and geologists, worked to inform toxicological risk assessment regarding lunar dust. This NASA-directed team included internal and external experts, and their work culminated in rat inhalation exposure studies with targeted Apollo 14 lunar dust. Research gaps and areas of uncertainty were identified, along with a recommended 180 day permissible exposure limit (PEL) for crew health protection that was adopted in NASA Standard 3001 Vol 2.

While the LADTAG work represents an excellent starting platform, there are some obvious differences in the Artemis Phase 1 mission that warrant careful consideration. These include the much shorter planned exposure duration (5-7 days), and the potential for crew to encounter somewhat different regolith characteristics (compared to Apollo 14 dust used in LADTAG) at a south polar landing site. However, these sorts of deviances from the known are familiar to the field of risk assessment, and were somewhat anticipated in setting exposure limits during the LADTAG efforts.

This presentation will briefly discuss some foundational LADTAG assumptions and approaches, and where those warrant some adjustment to better reflect anticipated Artemis Phase 1 conditions. Considerations in tailoring PELs to different exposure timeframes and critical concepts inherent to crew health risk assessment will be highlighted. Finally, existing uncertainties, research gaps, and monitoring tools will be discussed, in the context of their relative importance to Artemis mission planning. The goal of the presentation is for the audience to leave with a much better perspective on where NASA stands with respect to crew health protection from lunar dust, and what pivots are planned to address Artemis Phase 1 challenges and opportunities.