The National Academies of
SCIENCES • ENGINEERING • MEDICINE

COMMITTEE ON PLANETARY PROTECTION

Planetary Protection for the Study of Lunar Volatiles

Committee on Planetary Protection
Space Studies Board
in collaboration with
Board on Life Sciences
and
Aeronautics and Space Engineering Board

National Academies of Sciences, Engineering, and Medicine

Lunar Planetary Protection Statement of Task from NASA

CoPP should prepare a short report on:

1. **Current scientific understanding, value, and potential threat of organic and biological contamination to:**
   a) **permanently shadowed regions for study of the history of the solar system and its associated organic compounds,**
   b) **understanding the process of prebiotic chemical evolution and the origin of life,**
   c) **likelihood that spacecraft reaching the lunar surface will transfer volatiles to polar cold traps.**
2. **An assessment, to the degree possible, of how much and which regions of the Moon's surface and subsurface are of sufficient scientific value to warrant protection from organic and biological contamination.**

Current Scientific Understanding and Value of Permanently Shadowed Regions

- **Important for understanding transport of organics and other volatiles throughout the solar system. May provide a unique record of ancient volatiles brought to the Earth-Moon system. (Finding 1)**

- **However, little understanding exists regarding the full suite of volatiles present, their quantities, ages, sources and time of introduction, and the processes affecting delivery, retention, and distribution. (Finding 2)**

- **The numerous landed missions to the lunar polar regions planned for the next 5 to 10 years suggests that answering these key questions is needed sooner rather than later. Such information to guide realistic planetary protection approaches needs to be available in advance of large-scale missions for human exploration and lunar resource extraction. (Finding 3)**

Planetary Protection Guidelines for Lunar Missions

COSPAR	NASA Lunar Interim Directive	SSB Committee on Planetary Protection
Category II (with organic inventory): requires an organic inventory, i.e., list of materials on the spacecraft, including volatiles released by a propulsion or life support system.	Category II-L: applies to PSRs at high latitudes and to Apollo landing and other historic sites. Only requires inventory of biological materials. Category I-L: all other lunar missions. No planetary protection requirements.	Inventories of biological materials for spacecraft and other lunar equipment are unimportant for planetary protection purposes. Contamination by volatiles from the breakdown of solid organics on spacecraft or lunar structures will happen slowly and be distributed only locally in the region of the landed source. For buried samples, contamination by organic volatile and condensable gasses from propulsive landings and venting from human landers is likely to be minimal. Contaminants are not expected to penetrate below the surface on the timescale of planned human lunar exploration. Spacecraft emissions modeling--in combination with laboratory, remote sensing, and in-situ data--can help tailor individual mission planetary protection approaches.