

Simple Mathematical Models for Estimating the Bio-Contamination Transported from a Lander or a Rover to the Martian Soil

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ABSTRACT

To enable reliable life detection science, it is critical that Mars Sample Return missions be free of any earth-sent biological materials. Therefore, it is important that likely cross-contamination mechanisms be thoroughly studied.

Three simple models have been developed to estimate the ~~worst-case~~ ^{Maximum} contamination to be expected from such cross-contamination. All three models estimate the ground contamination levels at given distances from the lander. The first models the ground concentration from isotropic transport over 360°. The second model uses a steady state Gaussian plume transported from the Lander. The third model determines the ground contamination level from an instantaneous Gaussian puff generated at the time of landing

Input to the models includes the total spacecraft contamination level, the height of the lander, the size distribution of the particles, and their microbial burden, the fraction of the total contamination that is removed, the wind speed, and the diffusivities of the plumes. The results are given for data available from old studies performed at the Kennedy Space Center.