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A draft protocol for the safe handling of martian samples returned to Earth

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The exploration of the solar system has gained new force after the success of ambitious missions, like the Mars Exploration Rovers (NASA), Mars Express (ESA) and Cassini-Huygens (ESA/NASA/ASI). At the same time, extraterrestrial material has been, or will be, collected and returned to Earth for in-depth analyses (Genesis [NASA], Stardust [NASA], Hayabusa [JAXA]), demonstrating, along with the lunar sample gathering of the seventies, the feasibility and the high scientific value of the returning samples to Earth. Beyond these missions, the next such target will be the return of samples from Mars. Because of the potential for indigenous life on Mars, as demonstrated by the past presence of surface liquid water, and because of the high value of martian samples in understanding Mars and in the search for evidence of past, present or actual life, it is necessary to prepare for the safe receiving, handling, testing, distributing, and archiving of martian materials on Earth.

Previous groups and committees had studied selected aspects of returned sample procedures, but a specific protocol for handling and testing returned samples from Mars had to be developed. To refine the requirements for Mars sample hazard testing and to develop criteria for the subsequent release of sample materials from precautionary containment, NASA's Planetary Protection Officer convened a series of workshops 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. This Draft Protocol was developed after a series of workshops, and then reviewed by an Oversight and Review Committee composed of senior scientists with appropriate expertise.

To preserve the scientific value of returned martian samples in safe conditions, while avoiding false indications of life within the samples, a dedicated Sample Receiving Facility (SRF) is required. Such a facility will allow handling and processing of the Mars samples, while maintaining strict biological containment. It is also anticipated that samples could be shipped among appropriate containment facilities wherever necessary. The SRF will need to provide different types of laboratory environments for carrying out the various aspects of the protocol, beyond sample description and curation—i.e., Physical/Chemical analysis, Life Detection testing, and Biohazard testing. Because this facility will have to be accepted in its surroundings by the public, and since the technical requirements for the facility will be highly specific, it appears that the process of planning, designing, building, and testing the facility should be initiated well in advance of the actual receipt of the samples. In this paper, the main principle of the proposed testing will be described and the criteria for sample release will be discussed—as well as the high-level requirements for the SRF, the possibility of building a distributed facility to achieve specific kinds of work, and requirements for necessary personnel. The sample analysis process has to be widely understood, and the strategy of the analysis of the samples must to use up-to-date methods. Hence, the proposed process for upgrading the draft protocol will also be presented and discussed.