



# NASA Planetary Protection Handbook



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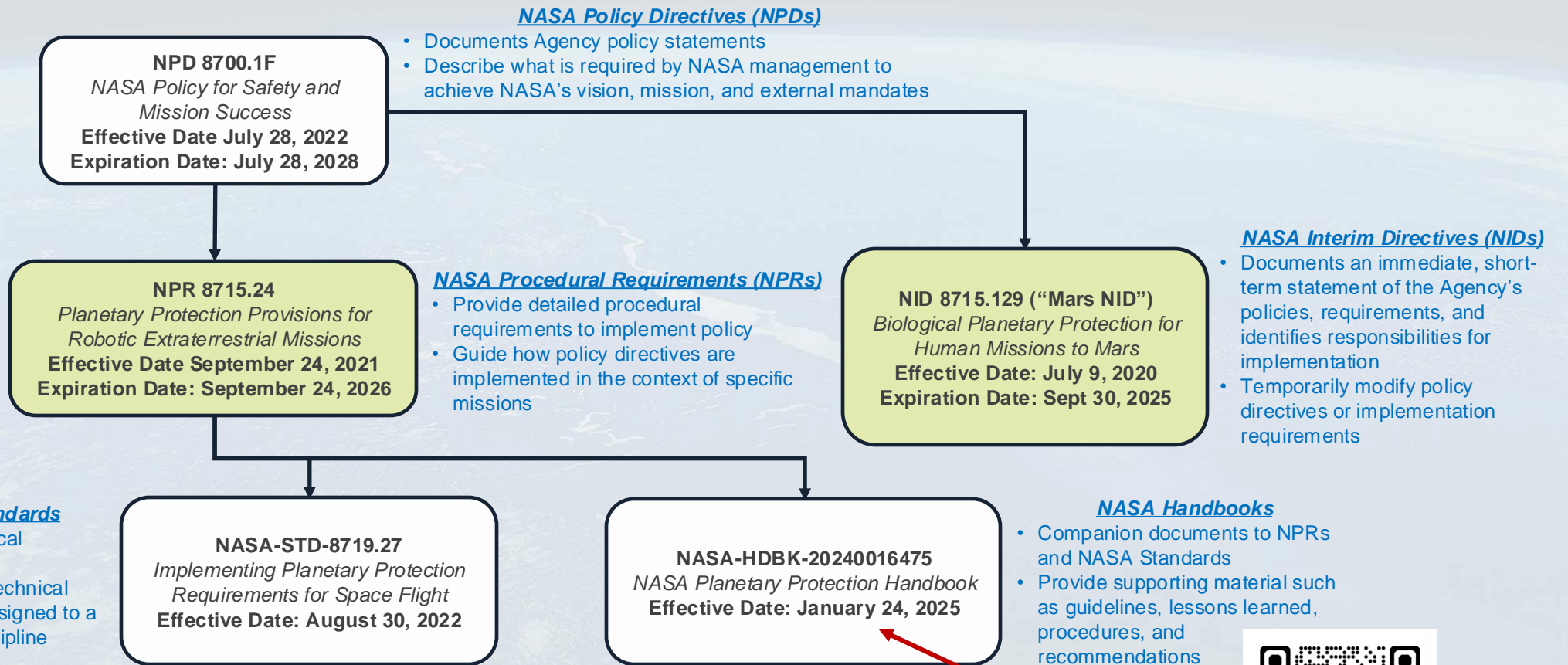
NASEM CoPP

Washington, D.C.

April 2, 2025

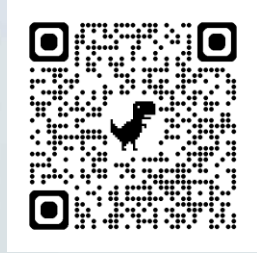


Link to NASA Planetary Protection policy and guidance documents at [www.sma.nasa.gov](http://www.sma.nasa.gov)



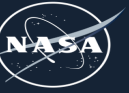
**NEW!!**

= Document being updated



All published documents found in NODIS: <https://nodis3.gsfc.nasa.gov/> or the OPP website: <https://sma.nasa.gov/sma-disciplines/planetary-protection#PolicyGuidance>

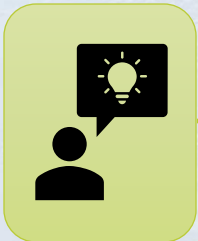
# Overview of Planetary Protection for Space Flight Handbook



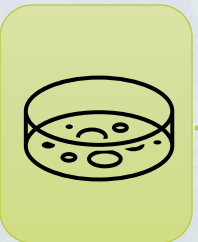
Replaces NASA-HDBK-6022, *Handbook for the Microbial Examination of Space Hardware*.



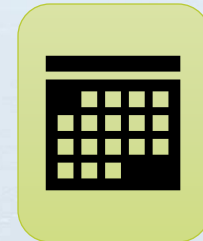
Aligns to NASA's PP policy and technical standards.



Provides significant updates in PP approaches and implementation.



Expands beyond the NASA Spore Assay.



First major update since 2010.

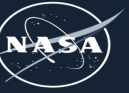


129 pages of content.  
8 Chapters, 6 Appendixes



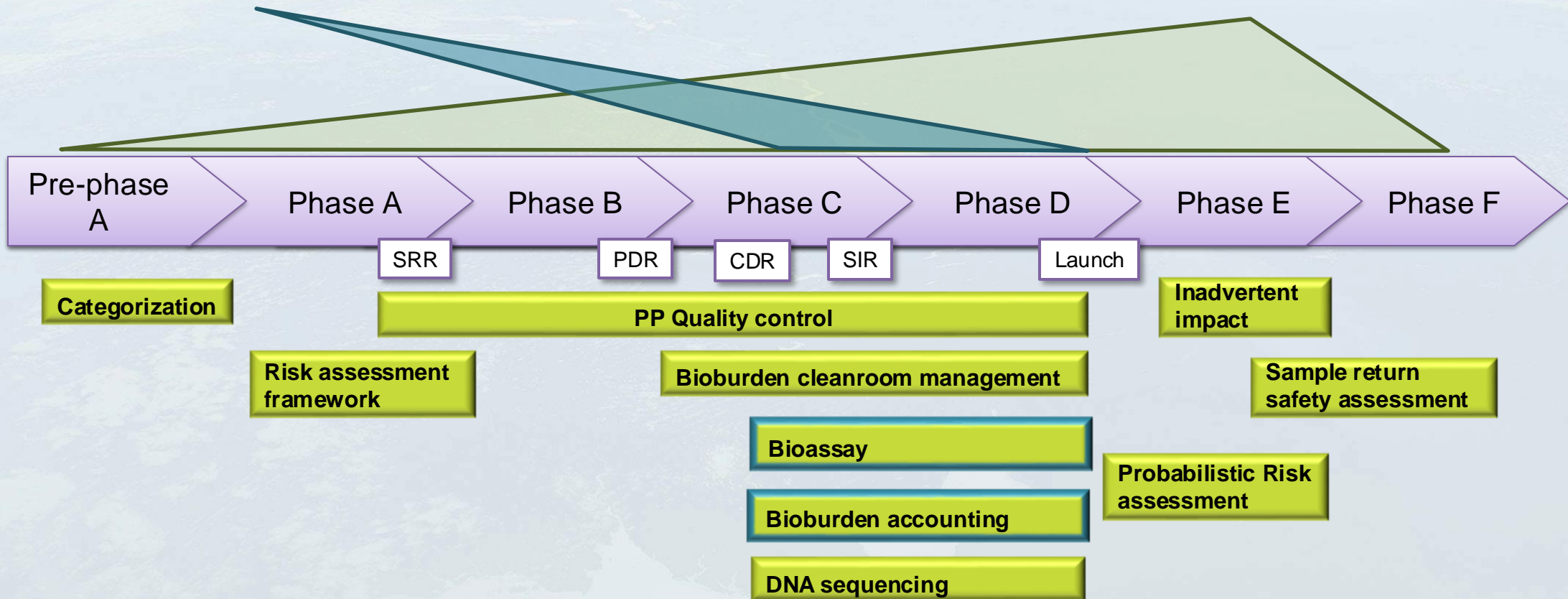
Reviewed by 20 NASA SMEs.

# Modernizing a more useful Planetary Protection Handbook



**Old Planetary Protection Handbook**

**New Planetary Protection Handbook**



# Handbook Philosophy and Approach

- Provides guidance to Mission providers and Planetary Protection (PP) practitioners on implementing PP measures for both robotic and crewed space Missions.
  - Companion document to NPR 8715.24 and NASA-STD-8719.27.
  - Provides guidance but is not the only approach that can be taken.
- Shifts emphasis from strictly prescriptive requirements to allow performance-based requirements and approaches.
  - Documents guidelines on how to approach a topic as opposed to step-by-step protocols.
  - Leverages and encourages use of peer-reviewed publications and industrial standards.
  - Captures lessons learned and helpful user tips.
- Intended to be a living document and will be frequently updated over time with the latest information.
  - Feedback from the PP practitioner community will support future handbook updates.
  - Initial updates already being incorporated internally for next release



*Planetary protection laboratory practices.*



# A Living Document: Feedback from Planetary Protection Practitioner Community

## 1.3.2 A Living Document

Approaches and implementation practices to satisfy PP requirements, and the requirements themselves, will continue to change as NASA explores new areas of the solar system with robotic and crewed missions. This handbook is a living document and will continue to be updated over time with the latest information. Comments on information to be updated or included in future handbook revisions may be submitted to the OPP through an online Web form at <https://sma.nasa.gov/sma-disciplines/planetary-protection>.



### Planetary Protection Handbook

This handbook provides guidance to mission providers and Planetary Protection (PP) practitioners on implementing PP measures for both robotic and crewed space missions. This handbook represents major updates to PP practices since a previously drafted handbook from 2010.

In 2017, NASA reorganized the Office of Planetary Protection (OPP) from the Science Mission Directorate (SMD) to a Technical Authority (TA) within the Office of Safety and Mission Assurance (OSMA). With this organizational change came a complete overhaul of NASA's PP policy and technical standards.

This handbook reflects the latest NASA PP policy updates in NPR 8715.24, Planetary Protection Provisions for Robotic Extraterrestrial Missions and technical requirements of NASA-STD-8719.27, Implementing Planetary Protection Requirements for Space Flight. This handbook is a companion document to the NPR and technical standard and provides guidance, best practices, background information, and advice for practitioners to consider when implementing PP on NASA missions and NASA-partnered missions.

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## Planetary Protection Handbook Feedback Form

Please submit feedback for the Planetary Protection Handbook by completing and submitting this form.

Name

Email Address

Center or Organization

Planetary Protection Handbook Feedback. Please include chapter and section numbers in your feedback as applicable.

Submit

### New form submission

[PP Handbook Feedback](#)

Submitted on 26 March 2025, 02:18 PM, via IP 128.154.170.108 by Anonymous

Name	Erin
Email Address	[REDACTED]
Center or Organization	GSFC/OPP
Planetary Protection Handbook Feedback. Please include chapter and section numbers in your feedback as applicable.	I have fantastic ideas about what you should add to the handbook, detailed below



# Handbook Chapters

1 - Introduction

2 – PP Mission Categorization

3 – Guidelines for Forward Contamination Mitigation

4 – PP Quality Management System

5 – Biologically Controlled Cleanrooms

6 – NASA Standard Assay Laboratory Considerations

7 – Biological Estimation Techniques

8 – Backward PP

Appendices

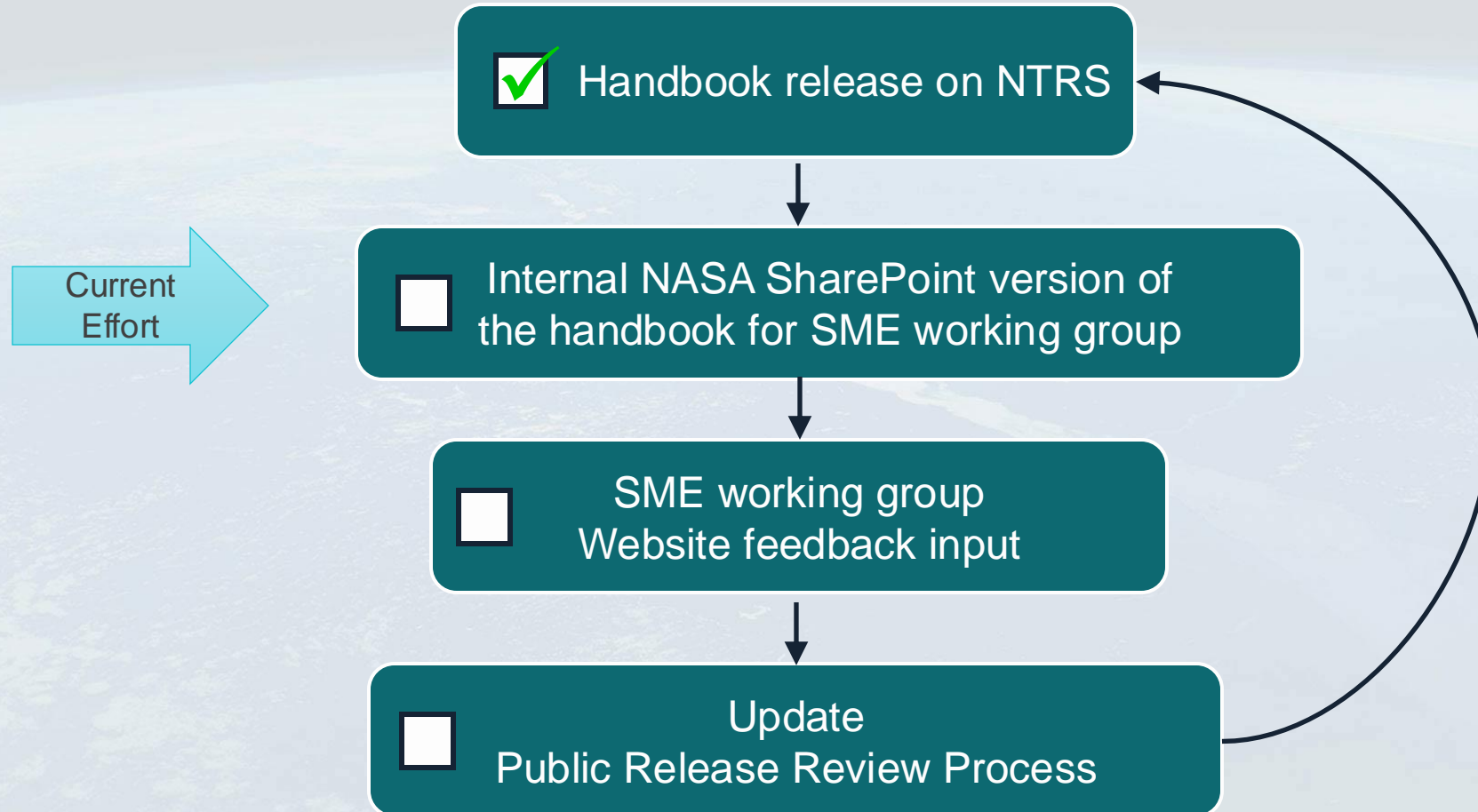
**Table 1:** Handbook Navigation by Mission Class

	Cat I	Cat II	Cat III	Cat IV	Cat V	Laboratory	Analysis
Chapter 1	X	X	X	X	X		
Chapter 2	X	X	X	X	X		
Chapter 3		X	X	X			X
Chapter 4			X	X	X	X	
Chapter 5			X	X	X	X	
Chapter 6			X	X	X	X	
Chapter 7			X	X	X	X	
Chapter 8					X		
Appendix 1	X	X	X	X	X		
Appendix 2	X	X	X	X	X		
Appendix 3	X	X	X	X	X		
Appendix 4		X					
Appendix 5			X	X			X
Appendix 6			X	X			X
Appendix 7						X	

## 3.0.0 Forward Planetary Protection

**Navigation Summary:** Chapter 3 discusses approaches for determining the risk of forward contamination at a target body. This chapter is most applicable to Category II, III, and IV missions.

# Release and next steps



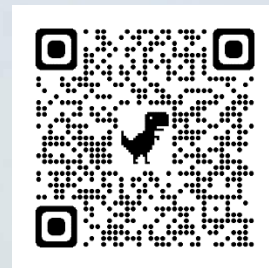


## Questions?

Feel free to reach out as well!

J. Nick Benardini – NASA Planetary Protection Officer – [James.N.Benardini@nasa.gov](mailto:James.N.Benardini@nasa.gov)

Erin Lalime – NASA Deputy Planetary Protection Officer (Acting) - [Erin.Lalime@nasa.gov](mailto:Erin.Lalime@nasa.gov)



<https://sma.nasa.gov/sma-disciplines/planetary-protection>



## Backup



1 - Introduction

2 – PP Mission Categorization

3 – Guidelines for Forward Contamination Mitigation

4 – PP Quality Management System

5 – Biologically Controlled Cleanrooms

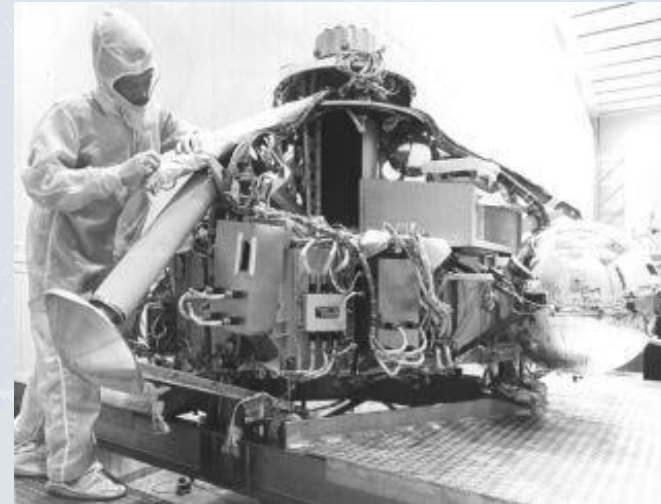
6 – NASA Standard Assay Laboratory Considerations

7 – Biological Estimation Techniques

8 – Backward PP

Appendices

- Background
- Spores and Planetary Protection
- Major Handbook Principles
- History of Bioburden Accounting
- Adoption of New Standards and Approaches
- Communication Mechanisms
- A Living Document



*Planetary protection samples were collected from the Mars Viking landers to verify biological cleanliness levels.*

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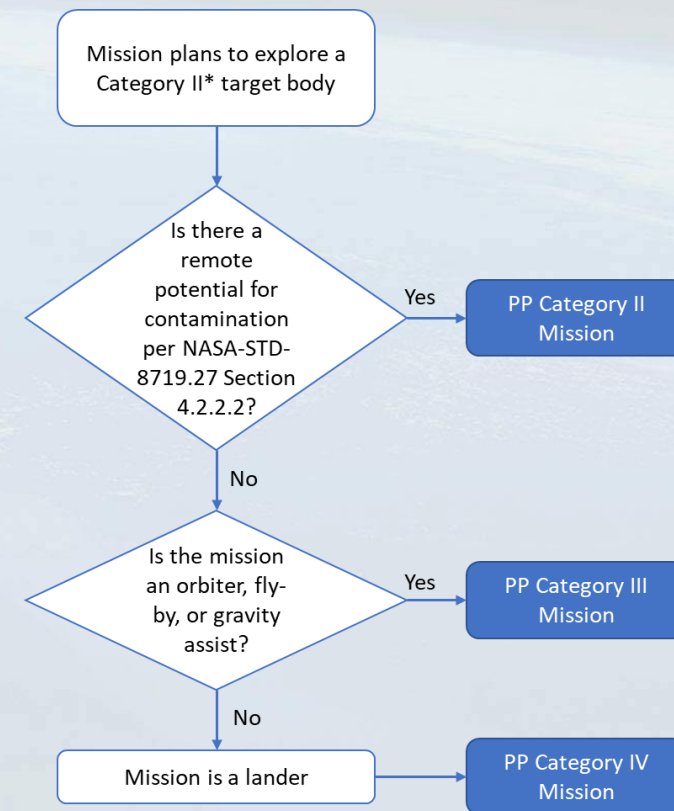
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Appendices

- Overview of the Categories
- Factors to Consider for Categorization
- Key Roles in the Categorization Process
- Updates and Changes to PP Mission Categories
- Sub-Categories
  - Missions to Earth’s Moon
  - Category II\* Target Bodies
  - Landed Missions on Mars
  - Special Regions (Mars)
  - Sample Return Missions
- Horizontal and Vertical Mobility
- Example Categorization Scenarios
- In-Mission Operations for PP on Interplanetary Missions

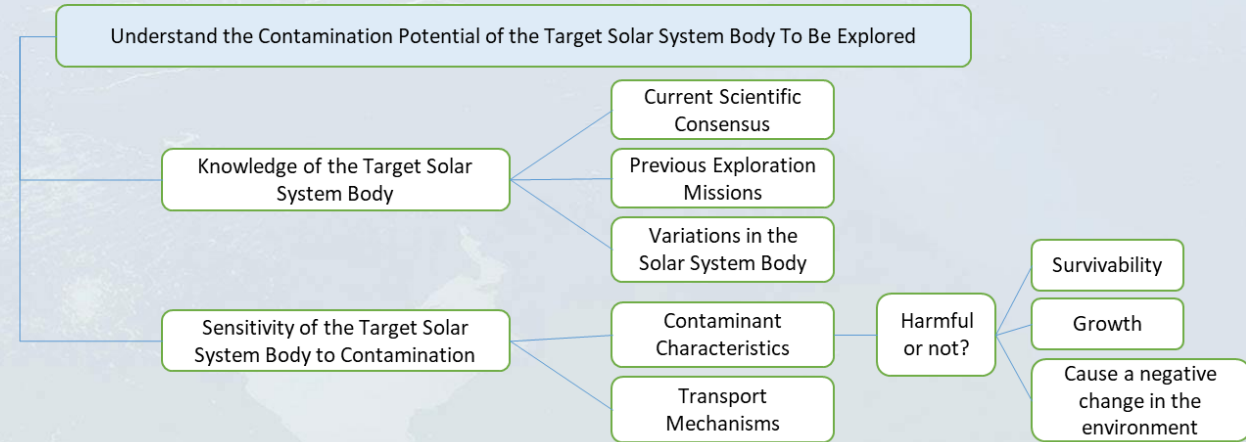


*Decision process for evaluating Category II\* target bodies.*

# Handbook Chapters

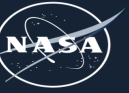
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- Appendices

- Forward Contamination Risk Assessment Framework
- Mission PP Risk analysis
- Development of an Assurance Case
- Inadvertent Impact at Mars for Lunar (Earth-Moon System) Missions
- Generalized Mars Mission 50-Year Probability of Impact Requirement Compliance
- Breakup and Burnup



*Guidelines to understand the contamination potential of the target solar system body to be explored.*

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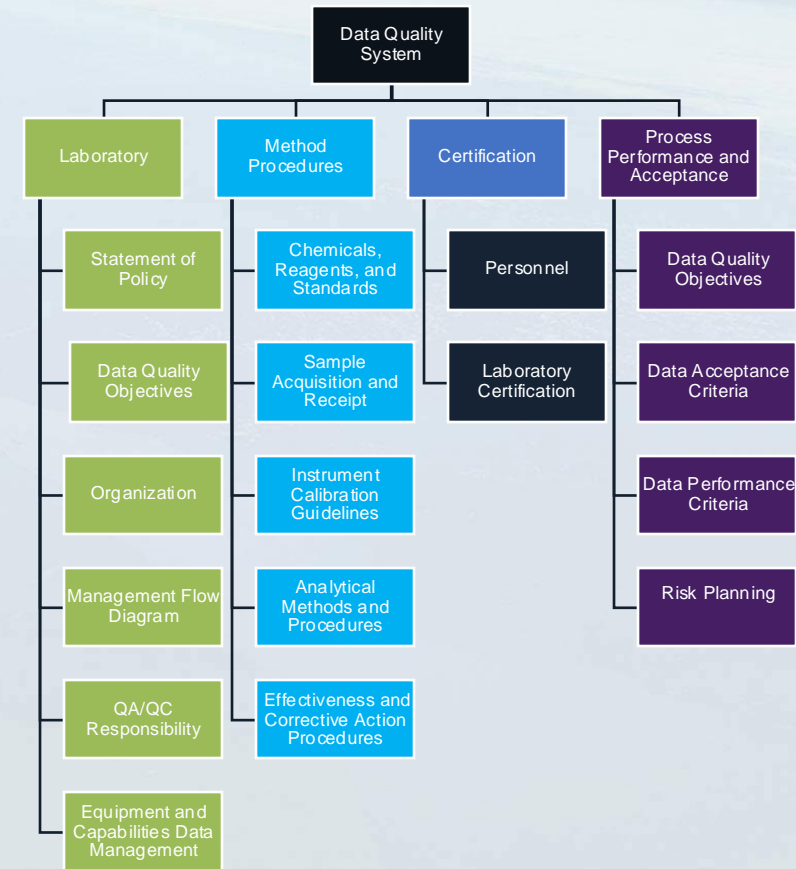
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Appendices

- Process Validation
- Data Quality Objectives
- Data Performance and Acceptance Criteria
- Quality Management System
- Laboratory QA Plan
- Laboratory Methods
- Risk Management
- Proficiency Testing
- Oversight and Concurrence Activities



General topics addressed by a Data Quality System. 14

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Appendices

- Cleanroom Entry
  - Personnel Entry
  - Ground Support Equipment Cleaning & Entry
  - Hardware Entry
- Aseptic Operations in Cleanroom Environments
- Macroorganisms



*The InSight spacecraft has been removed from its shipping container and is being moved for removal of protective wrapping.*



*Mars 2020 lift activities in the Payload Hazardous Servicing Facility (PHSF) cleanroom.*

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Appendices

- Use of Bacterial Endospores
- Laboratory Equipment
- Aseptic Technique in Processing NSA Samples
- Barriers
- Method Implementation and Process Validation
- Environmental Biological Contamination Assessment
- Rapid Biological Contamination Assessments
- PP Sequencing Protocol



*NASA Standard Assay*

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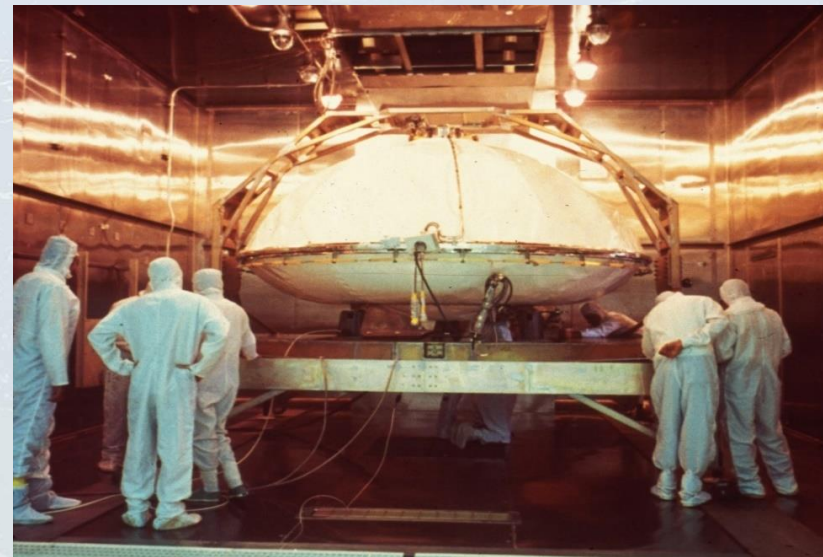
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Appendices

- Organic Inventory, Biological Inventory, and Organic Archiving
  - Historical Background of Requirements
  - Reporting of Inventories and Archives
  - Current Limitations, Challenges, and Opportunities for Improvement
- Bioburden Accounting Parameters



*Mars Viking Landers were part of the historical background of requirements.*

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Appendices

- Backward PP Overview
- Sample Safety Assessment Protocol Concepts
- PP Knowledge Gaps for Crewed Missions to Mars



*Planning for Mars Sample Return and future crewed missions to Mars.*



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Appendices

- 1 – Definitions
- 2 – Abbreviations
- 3 – National Academies Reports
- 4 – Modeling the Probability of Contamination for NASA Missions
- 5 – PP Cat II Mission Organic Inventory Template
- 6 – Generalized Mars Mission 50-Year Probability of Impact Requirement Compliance
- 7 – Example Laboratory Standard Operating Procedures

## Appendix 5: PP Category II Mission Organic Inventory Template

Organic Inventory	Mission Name:
-------------------	---------------

The Mission provides an itemized list of **bulk organic materials** [defined as all carbon-containing compounds, *including* payload biological materials but *excluding* carbides, carbonates, cyanides, and simple oxides of carbon (i.e., CO and CO<sub>2</sub>)] presented at the same level as the materials identification and usage list (MIUL)/materials list, as used on the flight hardware, estimated actual (in kg) for organic materials present in amounts larger than 1kg; "small amounts" for organic materials present in amounts between 1kg and 0.1kg; and "traces" for identifiable organic materials present in amounts less than 0.1kg. (Add more lines as needed for each line entry.)

### 1) Adhesives and Potting Compounds

[e.g., RTV/Silicones (DOW, Nasil, Hysol); polyurethanes such as arathane/solthane, conformal coatings; epoxies such as Scotchweld, CFRP resin]

Material Name and Usage	Actual Amount (kg)	Small Amount	Traces
	0.0	<input type="checkbox"/>	<input type="checkbox"/>
	0.0	<input type="checkbox"/>	<input type="checkbox"/>

### 2) Primers, Paints, and Inks

(e.g., Aeroglaze, Chemglaze, etc.)

Material Name and Usage	Actual Amount (kg)	Small Amount	Traces
	0.0	<input type="checkbox"/>	<input type="checkbox"/>
	0.0	<input type="checkbox"/>	<input type="checkbox"/>

### 3) Thermal Control Films

(e.g., Kapton, FEP Teflon, BetaCloth)

Material Name and Usage	Actual Amount (kg)	Small Amount	Traces
	0.0	<input type="checkbox"/>	<input type="checkbox"/>
	0.0	<input type="checkbox"/>	<input type="checkbox"/>

Example Organic Inventory Template