



Jet Propulsion Laboratory
California Institute of Technology

Marshall Space Flight Center



Organic Inventory Reporting

Organic Inventory Workshop

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Sonya Dillard, Planetary Protection Discipline Lead, NASA/MSFC

Sonya.Dillard@nasa.gov

Ryan Hendrickson, Planetary Protection Engineer, Jet Propulsion Laboratory, California Institute of Technology

ryan.c.hendrickson@jpl.nasa.gov

Agenda

- Organic Inventory Process Overview
- Important Questions to Consider
 - What Materials are Organic vs Non-Organic?
 - How to Compile Organic Materials Lists
 - What is the Expected Timeline?
 - Who are the Stakeholders?
- Mission Examples (Cat II, III, IV)
- Lessons Learned
- Group Discussion on Current Reporting Practices

Organic Inventory Process Overview

Obtain Mission PP
Categorization
Letter

Incorporate Applicable
Requirements into
Project Documentation

Develop
Timeline and
Compile
Data

Submit Organic
Materials
Deliverables to
OPP

- Requirements derived from NPR 8715.24
- Organic Inventory List (All PP Missions)
- Organic Material Archive (Cat IV and V Missions)
- Essential to incorporate Organic Material requirement(s) directly into Project Requirement Documents (i.e. PSRDs, PRDs, etc.)
- Start conversations early with mission partners (both internal and external)
- Deliverables likely to overlap with hardware delivery schedule (which may extend long term)
- Compile the list as you go along the timeline (don't wait until the end to compile).
- Verification and Validation of requirements are delivered in the Pre-Launch Report
- If organic samples are collected, they must be well documented.

Important Questions to Consider

- What Materials are “Organic”?
 - All carbon-containing compounds excluding carbides, carbonates, cyanides and simple oxides of carbon (i.e., CO and CO₂). (NPR 8715.24)
 - Includes Commercial of the Shelf (COTS) materials if they meet the above criteria
- What is the Expected Timeline?
 - The process takes a significant amount of time and effort, start early
 - May be difficult to decipher between organic and non-organic materials.
 - Building a custom list that doesn’t currently exist.
 - For internally built projects, recommend compiling list when hardware is delivered instead of bulk effort later in the mission
 - For externally built projects (but managed internally), ensure this list is a required deliverable/DRD
- Who are the Stakeholders?
 - Internal and External hardware providers
 - Office of Planetary Protection
 - Payloads, Flight Operations, etc.

Example of a Category IIb Mission (HLS)

- **Organic Inventory for Category II Missions to the Earth's Moon**
 - Category IIa – Limited to propulsion inventory only
 - Volatile Materials reporting is required for both Category IIa and IIb missions.
 - Documents required for IIa missions and Programs must obtain concurrence from the PPO.
 - Category IIb – Requires a regular inventory
 - Non-Biological Organic Materials, and Biological Materials listing is required for IIb missions only.
 - The Human Landing System (HLS) has been categorized as a Category IIb Mission and the HLS-PLAN-013 Rev D., HLS Program Planetary Protection Plan is currently approved for this mission.
 - For Category IIb missions only; All payloads will provide an inventory of materials subject to the Appendix C – Organic Materials Inventory Worksheet. (See Backup chart).
- **Moon to Mars (M2M-30120) Planetary Protection Plan is being worked for future Missions beyond the moon.**
- **NASA-STD-8719.27, Implementing Planetary Protection Requirements for Space Flight**
 - Follows COSPAR guidelines and requires organic inventory reporting for Category II, III and IV missions in the PP Pre-Launch Report.
- **The Importance of Knowing Your Stakeholders**
 - Stakeholders may include: Industry Providers, Utilization Payloads, Science Community, Flight Projects Office, GFE/GFP
 - Building Strong Relationships can help tremendously in the future, when trying to meet deadlines for the PPO.

Example of a Category III Mission (Europa Clipper)

- **Office of Planetary Protection located in NASA OSMA**
- **Mission built and managed by JPL/APL**
- **Organic Material requirements derived from *NPR 8020.12D, 2.7.3.6.b***
- **Only Organic Material List Requirement**
 - An inventory of organic materials on the flight system shall be completed no later than 180 days before launch. Organic materials should be identified by Chemical Abstracts Service (CAS) Registry Number and/or manufacturer's part number.
 - Requirement addressed by collating organics from Material Identification Usage Lists (MIULs)
 - Compiled list throughout mission at hardware deliveries (HRCRs)
 - This process has occurred over a 5-year time span (2019 – current)
 - The current Organic Inventory List is over 1,200 line items

Example of a Category IVa Mission (InSight)

- **Office of Planetary Protection was still located in NASA SMD**
- **Mission built externally (Lockheed Martin) and managed by JPL**
- **Organic Material requirements derived from *Categorization Letter and NPR 8020.12D, 2.7.3.6.b***
- **Both an Organic Material List and Organic Material Archiving Requirements**
 - *Material archiving of at least 50 grams of each organic material type for which more than 25 kg is transported to the Martian surface to the InSight Office Jet Propulsion Laboratory (JPL) no later than Launch + 30 days for archiving.*
 - Samples were repackaged according to the guidelines suggested for storage and archiving (Blakkolb, 2007)
 - Materials were wrapped in two layers of ultra-high vacuum (UHV) aluminum foil
 - The foil wrapped parts were placed in Ultra Low Outgassing polyethylene bags
 - Bags purged with Nitrogen gas and sealed
 - Requirements addressed by receivables directly from Lockheed Martin

Lessons Learned

- Start as early as possible on compiling the organic materials list
- Develop a plan based on how and when the organic material information will be available
- If organic materials need to be stored, start asking the questions early
 - What facilities will be used?
 - What procedures need to be followed?
 - Who can manage the archival of materials and what funding source can be used?

Discussion Questions / Topics?

- How are we currently collecting data?
 - Data Collection Types: (i.e. Excel files, PDFs, etc.)
 - What is your preferred data type for receiving data?
- How are we currently reporting data?
- What level of vehicle does reporting inventory and archive apply to?
 - What if there are multiple entities contributing to one vehicle?
 - An example of Sample Retrieval Lander (SRL) including Mars Ascent Vehicle (MAV)
 - Who's responsible for delivering organic archive samples?

Backup

- NPR 8715.24
 - 1.1.2a: "Understand and control harmful contamination of other worlds by terrestrial organisms, organic materials, and volatiles carried or released by spacecraft (referred to as forward contamination) in order to assure integrity in the search for evidence of extraterrestrial life and the study of prebiotic chemistry in the solar system for the appropriate period of biological exploration."

Backup

- HLS-PLAN-013, Rev. D
 - Screenshot of excerpt from Appendix C.
 - Example: Organic Materials Inventory Worksheet
 - Specific Format is not mandatory but is provided as an example only.

APPENDIX C EXAMPLE: ORGANIC MATERIALS INVENTORY WORKSHEET

Organic Materials Inventory

Mission Name:

To be in compliance with planetary protection policy, an itemized list of **bulk organic materials** (defined as; all carbon-containing compounds *including* Biological Organic Materials Waste, payload biological materials but *excluding* carbides, carbonates, cyanides and simple oxides of carbon [i.e., CO and CO₂]) will be provided for each individual source, presented at the same level as the MIUL/materials list, as used on the flight hardware, estimated actual mass (in kg) for organic materials present in amounts larger than 1kg; "small amounts" for organic materials present in amounts between 1kg and 0.0kg.

Note 1 Add more lines as needed for each line entry, if necessary. Include a brief description of when, where and how organic materials will be disposed. (i.e. on the Lunar Surface)

Note 2 This Worksheet format is only an example and is maintained by the PPO.

Note 3 Record the location coordinates of the disposal items to the accuracy known.

1) Adhesives and Potting Compounds

e.g., RTV/Silicones (DOW, Nusil, Hysol); polyurethanes such as arathane/solithane conformal coatings; epoxies such as Scotchweld, CFRP resin

Material Name and Usage	Initial Actual Amount (kg)	Launched Amount	Lunar Disposed Amount
	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	Initial Actual Amount (kg)	Launched Amount	Lunar Disposed Amount
	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, Beta cloth

Material Name and Usage	Initial Actual Amount (kg)	Launched Amount	Lunar Disposed Amount
	0.0	<input type="checkbox"/>	<input type="checkbox"/>
	0.0	<input type="checkbox"/>	<input type="checkbox"/>

4) Lubricants

e.g., Braycote, Molybdenum Disulfide dry film

Material Name and Usage	Initial Actual Amount (kg)	Launched Amount	Lunar Disposed Amount