3.2 MEDICAL REQUIREMENTS OVERVIEW

TABLE 3.2: MEDICAL REQUIREMENTS OVERVIEW

MRID# and Title:	MR051L Microbial Analysis of ISS Water Using the EHS Water Kit
Sponsor:	Medical Operations
Discipline:	Environmental Health System (EHS)
Category:	Medical Requirements (MR)
References:	SSP 50260 ISS Medical Operations Requirements Document (MORD)
Purpose/Objectives:	To evaluate crew provided water for the presence of microbial contaminants in the potable water supply on the U.S. On-Orbit Segment (USOS) of ISS based on results from preflight analysis, in-flight analysis, and postflight analysis of archive samples.
Measurement Parameters:	The detection of coliforms and enumeration of microorganisms in ISS potable water
Deliverables:	• Preflight assessment of the microbiological content of potable water delivered to the ISS. • In-flight assessment of microbiological content of potable water in the US On-Orbit Segment (USOS) of ISS. • Postflight report assessing the microbiological content of the potable water supply in the USOS of ISS based on analysis of archive samples.
Flight Duration:	≥ 30 days
Number of Flights:	Every ISS Increment
Number and Type of Crewmembers Required:	One to two crewmembers (CM) are trained in all EHS activities (US Specialist) One EHS CM will perform the in-flight activities
Other Flight Characteristics:	N/A

3.3 Preflight Training

TABLE 3.3: PREFLIGHT TRAINING

Preflight Training Description:	One CM will be trained in all EHS activities (US Specialist)				
Schedule:	**Duration:**		**Schedule (L-months):**	**Flexibility:**	**Personnel Required:**
	Inexperienced Crew:				
	EHS Water Collection:	45 minutes	L-18/15	N/A	Crewmembers/Instructors
	EHS Water Processing	75 minutes	L-12/9	N/A	
	EHS Water Sim:	120 minutes	L-9/6	N/A	
	Experienced Crew:				
	EHS Water Experienced:	75 minutes	L-15/12	N/A	Crewmembers/Instructors
	EHS Water Sim:	120 minutes	L-9/6	N/A	
Ground Support Requirements Hardware/Software:	**Preflight Hardware:**		**Preflight Software:**	**Test Location:**	
	EHS Water Kit containing: Water Sample Collection Packet Microbial Analysis Packet Nonconsumables Items Kit		N/A	U.S.	
Training Facilities:	**Minimum Room Dimensions:**	**Number of Electrical Outlets:**	**Temperature Requirements:**	**Special Lighting:**	
	EHS Water Collection & EHS Water Processing: 8' x 10' EHS Water Sim: Bldg. 9 SSTF	One (110 volt AC)	Ambient	N/A	
	Hot or Cold Running Water:	**Privacy Requirements:**	**Other:**		
	N/A	Private room free from any distractions	Table & 4-6 chairs 28V Power supply Absorbent towels to collect spillage, if necessary		
Constraints/Special Requirements:	EHS Water Sim takes place in the Space Station Training Facility (SSTF) in Building 9.				
Launch Delay Requirements:	Refresher training will be conducted if currency (18 months) expires or at crewmember request.				
Notes:	Experienced CM – Crewmembers who have had previous training on EHS activities. Inexperienced CM – Crewmembers who have not had previous training on EHS activities.				

3.4 Preflight Activities – No crew time

TABLE 3.4: PREFLIGHT ACTIVITIES

Preflight Activity Description:	Preflight samples will be collected from all vehicles and/or hardware used to resupply potable water to the USOS of ISS. These samples will be analyzed to verify that the water transferred to ISS meets applicable requirements and is safe for crew consumption.				
Schedule:	**Activity:**	**Duration:**	**Schedule:**	**Flexibility:**	**Personnel Required:**
	Preflight Water Sampling	Vehicle Dependent	Vehicle Dependent	N/A	Vehicle Dependent
Ground Support Requirements Hardware/Software:	**Preflight Hardware:**		**Preflight Software:**		**Test Location:**
	Ground Servicing Equipment, Approved Sample Containers		None		Vehicle Dependent
Testing Facilities:	**Minimum Room Dimensions:**	**Number of Electrical Outlets:**	**Temperature Requirements:**		**Special Lighting:**
	N/A	N/A	Ambient		N/A
	Hot or Cold Running Water:	**Privacy Requirements:**	**Vibration/Acoustic Isolation:**		**Other:**
	Water for hand-washing	N/A	N/A		N/A
Constraints/Special Requirements:	Detailed logistics (volume and quantity samples) will be determined by personnel from the JSC Microbiology Laboratory in coordination with visiting vehicle representatives, hardware providers, and the Multilateral Medical Operations Panel (MMOP) Microbiology Subgroup.				
Launch Delay Requirements:	Preflight sampling will need to be repeated if the potable water system or water resupply hardware is reprocessed due to a launch delay.				
Notes:	N/A				
Data Delivery:	Reports from preflight microbial analysis of water samples will be provided to JSC Microbiology Laboratory personnel and the MMOP Microbiology Subgroup prior to vehicle launch.				

3.5 In-Flight Activities

TABLE 3.5.1a: IN-FLIGHT ACTIVITIES – POTABLE WATER COLLECTION

In-Flight Activity Description:	Water samples will be collected from the US Potable Water Dispenser (PWD) for in-flight and ground analysis.				
Schedule:	**Activity:**	**Duration:**	**Schedule:**	**Flexibility:**	**Personnel Required:**
	Water Sample Collection	Unstow: 15 minutes Clean Port/ Collect Sample: 10 minutes/sample Stow: 15 minutes	See Table D-3 in SSP 50260	N/A	1 Crewmember
Procedures:	Procedures are contained within the System Operation Data File (SODF) Med Ops Book				
Constraints / Special Requirements:	Potable Water Sample Collection: • Whenever possible, microbiology sample collections should be coordinated with chemistry sample collections. • When microbiology and chemistry samples are collected during the same session, only 15 minutes of unstow time and 15 minutes of stow time is required. • Real-time changes to the sampling schedule and frequency may be made depending on priorities and water systems performance. • Schedule on same day and prior to TOCA analysis.				
Photo / TV Requirements:	N/A				
Cold Stowage Requirements:	N/A				
Mission Extension Requirements:	N/A				
Notes:	N/A				
Data Delivery:	N/A				

TABLE 3.5.1b: IN-FLIGHT ACTIVITIES – IN-FLIGHT WATER SAMPLE PROCESSING USING MICROBIAL CAPTURE DEVICE AND COLIFORM DETECTION BAG

In-Flight Activity Description:	Microbiology water samples will be processed for the enumeration of bacteria and detection of coliforms.				
	Activity:	**Duration:**	**Schedule:**	**Flexibility:**	**Personnel Required:**
Schedule:	Microbial Capture Device (MCD) Processing (Enumeration) and Coliform Detection	MCD Processing Sample: 10 minutes/MCD sample Coliform Detection Processing Sample: 10 minutes/coliform bag/sample Tear down/Stow: 15 minutes	IDRD Annex 4, Table 3.4-1	Samples collected from hot port must cool for 1 hour before processing and within 6 hours of sample collection.	1 Crewmember
Procedures:	Procedures are located in the System Operations Data File (SODF) Med Ops Book				
Constraints / Special Requirements:	MCD and Coliform Sample Processing: • Unstow time is bookkept in water collection activities. • Samples collected from the USOS hot water port must cool for 1 hour before processing and within 6 hours of sample collection when in-flight samples are collected. • All in-flight samples need to be processed within 6 hours after sample collection for all ports.				
Photo / TV Requirements:	N/A				
Cold Stowage Requirements:	N/A				
Mission Extension Requirements:	N/A				
Notes:	• Late access for hardware: L-2 weeks. • On-Board Computer-Based Training (OBT) is available for crewmembers. • Date and sample source should be recorded on MCD.				
Data Delivery:	N/A				

TABLE 3.5.1c: IN-FLIGHT ACTIVITIES – MICRO VISUAL ANALYSIS (MCDs and COLIFORM DETECTION)

<table>
<tr><td>In-Flight Activity
Description:</td><td colspan="5">Enumeration of MCDs is performed.
Record observations of color change for Coliform Detection Bags.</td></tr>
<tr><td>Schedule:</td><td>Activity:</td><td colspan="2">Duration:</td><td>Schedule:</td><td>Flexibility:</td><td>Personnel Required:</td></tr>
<tr><td></td><td>Data recording from MCD (enumeration) and Coliform Detection</td><td>Unstow

Read MCD & record colony count

Read Coliform Detection Bag

Stow</td><td>5 minutes

5 minutes/MCD

5 minutes/bag

20 minutes</td><td>At T.0+2 days post-sample processing</td><td>Must be read after 44 ± 4 hours of incubation</td><td>1 Crewmember</td></tr>
<tr><td>Procedures:</td><td colspan="5">Procedures are located in the System Operations Data File (SODF) Med Ops Book</td></tr>
<tr><td>Constraints / Special Requirements:</td><td colspan="5">MCD and Coliform Visual Analysis:
Visual analysis of MCDs and data recording should be done after 40-48 hours of incubation.
Visual analysis of Coliform Detection Bags should be done after 40-48 hours of incubation.
If MCD analysis results are unable to be quantified or above limits, digital imaging, repeat sampling, and/or remediation may be required.
If Coliform Detection Bag is positive, digital imaging, repeat sampling, and/or remediation may be required.</td></tr>
<tr><td>Photo / TV Requirements:</td><td colspan="5">A request for contingency digital photography downlink of the sample (MCD or Coliform Detection Bag) may be requested by ground control if sample results are unable to be quantified.
In the event that an acceptability limit is exceeded, contingency digital photography downlink of the sample (MCD) may be requested by ground-control.
In the event that a Coliform Detection Bag is positive, contingency digital photography downlink of the sample may be requested by ground-control.</td></tr>
<tr><td>Cold Stowage Requirements:</td><td colspan="5">Archived samples shall be stowed at coolest temperature location possible.</td></tr>
<tr><td>Mission Extension Requirements:</td><td colspan="5">N/A</td></tr>
<tr><td>Landing Wave-Off Requirements:</td><td colspan="5">N/A</td></tr>
<tr><td>Notes:</td><td colspan="5">Results are called down or recorded in crew notes section of Optimis Viewer, called down to MCC-H, and/or XML downlink.
When analytical results for in-flight water quality samples exceed the acceptability limits, remediation actions may be initiated. Follow-up samples may be taken and analyzed to ensure any remediation actions that were performed were successful.</td></tr>
<tr><td>Data Delivery:</td><td colspan="5">Any data called down during activities will be logged by BME and distributed to Crew Surgeon and to JSC Microbiology personnel.
Downlinked data will be made available to JSC Microbiology personnel upon receipt.
A data summary from the in-flight analyses will be distributed to stakeholders within 1 week of receipt of downlinked data file.</td></tr>
</table>

TABLE 3.5.2: IN-FLIGHT HARDWARE

Hardware/Software Name
EHS Water Kit
Coliform Detection Kit
Water Sample Collection Packet (Shared with MR054L)
Microbial Analysis Packet
Nonconsumable Items Kit

3.6 Postflight Activities – No crew time

TABLE 3.6: POSTFLIGHT ACTIVITIES

Postflight Activity **Description:**	Comprehensive microbial analyses will be performed by JSC Microbiology Laboratory on the returned archive water samples, identification of isolates will be performed on returned MCDs. Coliform Detection Bags are not returned.
Constraints/Special Requirements:	Stowage temperatures during transport of the return samples to the Microbiology Laboratory should be maintained between 2ºC - 25ºC temperatures and shall be monitored during storage and transport.
Early Destow/Early Return:	Archive (return) samples are approved for early destow from IP, US, and COTS vehicles per OB-14-023.
Notes:	Microbial isolates from in-flight water samples will be identified by standard laboratory methods. Archived water samples will be analyzed for the quantification and identification of bacteria.
Data Delivery:	If the analysis of archive samples indicates an elevation or trend, then JSC Microbiology Laboratory will notify the Anomaly Resolution Team (ART) and/or Common Environments Team (CET), which includes the ISS Increment Lead Crew Surgeon. Analytical results from the analysis of routine samples will be reported within 30 days of receipt.

3.7 Summary Schedule

TABLE 3.7: SUMMARY SCHEDULE

ACTIVITY:	DURATION:	SCHEDULE:	PERSONNEL REQUIRED:	CONSTRAINTS:
Preflight Training:				
EHS Water Collection EHS Water Processing	Inexperienced CM: 45 minutes Inexperienced CM: 75 minutes Water Sim: 120 minutes	L-18/15 L-12/9 L-9/6	Crewmember/ Instructor	EHS Water Sim takes place in the Space Station Training Facility in Building 9.
EHS Water Experienced	Experienced CM: 75 minutes Water Sim: 120 minutes	L-15/12 L-9/6	Crewmember/ Instructor	
Preflight Activity: - No crew time				
Preflight Water Sampling	Vehicle dependent	Vehicle dependent	Vehicle dependent	N/A
In-flight Activity:				
Potable Water Collection:	Unstow: 15 minutes Sample: 10 minutes/Sample Stow: 15 minutes	See Table D-3 in SSP 50260	1 Crewmember	▪ Whenever possible, microbiology sample collections should be coordinated with chemistry sample collections. ▪ When microbiology and chemistry samples are collected during the same session, only 15 minutes of unstow time and 15 minutes of stow time is required. ▪ Real-time changes to the sampling schedule and frequency may be made depending on priorities and water systems performance. ▪ Schedule on same day and prior to TOCA analysis.

In-Flight Activities: (continued)				
Water Sample Processing using MCD and Coliform Detection Bag:	MCD or Coliform Bag Sample: 10 minutes Stow: 15 minutes	Per IDRD Annex 4, Table 3.4-1	1 Crewmember	• Unstow time is bookkept in water collection activities. • Samples collected from the USOS hot water port must cool for 1 hour before processing and within 6 hours of sample collection when in-flight samples are collected. • All in-flight samples need to be processed within 6 hours after sample collection for all ports.
Micro Visual Analysis for (MCDs and Coliform Detection):	Unstow: 5 minutes Analysis: 5 minutes/MCD or Coliform Bag Stow: 20 minutes	For MCD - At T.0+2 days post-sampling For Coliform Detection Bag – 40-48 hours post-sampling	1 Crewmember	• Visual analysis of MCDs and data recording should be done after 40-48 hours of incubation. • Visual analysis of Coliform Detection Bags should be done after 40-48 hours of incubation. • If MCD analysis results are unable to be quantified or above limits, digital imaging, repeat sampling, and/or remediation may be required.
Postflight: - No crew time				
Destow & return of samples to JSC (No crew time)	Vehicle dependent	Vehicle dependent	JSC Personnel	• Returned water samples should be maintained between 2ºC - 25ºC and temperatures shall be monitored during storage and transport. • Early destow of water samples and return to JSC is requested.
Postflight Debrief:				
Debrief	No extra time	~R+30 days	Crewmember/ Microbiology Team	Included as part of the Med Ops overall debrief.