

MR054L ISS Potable Water Quality Monitoring

3.2 Medical Requirements Overview

TABLE 3.2: MEDICAL REQUIREMENTS OVERVIEW

MRID# and Title:	MR054L ISS Potable Water Quality Monitoring
Sponsor:	Medical Operations
Discipline:	Environmental Health
Category:	Medical Requirements (MR)
References:	SSP 50260, ISS Medical Operations Requirements Document; SSP 41000, System Specification for the International Space Station
Purpose/Objectives:	To check for the presence of chemical contaminants in the potable water provided for crew use on ISS and verify compliance with established water quality requirements
Measurement Parameters:	<p>Preflight:</p> <ul style="list-style-type: none"> • See Section 7.2.2.1 Preflight Water Quality Monitoring, SSP 50260 <p>In-flight:</p> <ul style="list-style-type: none"> • See Section 7.2.2.2, In-flight Water Quality Monitoring in SSP 50260 <p>Postflight:</p> <ul style="list-style-type: none"> • For samples from the Russian segment, see Table D-1 Water Quality Requirements for the ISS Russian Segment in SSP 50260 • For samples from the U.S. segment, see Table LXX Water Quality Requirements for the U.S. On-Orbit Segment in SSP 41000.
Deliverables:	<ul style="list-style-type: none"> • Preflight assessment of water chemistry for potable water delivered to the ISS. • In-flight assessment of water chemistry on ISS • Postflight water chemistry report on archive water samples collected from the Russian and U.S On-Orbit Segments
Flight Duration:	≥ 30 days
Number of Flights:	All flights
Number and Type of Crew Members Required:	One crewmember as operator
Other Flight Characteristics:	N/A

MR054L ISS Potable Water Quality Monitoring

3.3 Preflight Training

TABLE 3.3: PREFLIGHT TRAINING

Preflight Training Activity	Description:	Training includes the procedures for the collection and chemical analysis of water. Water collection will be reviewed; sample processing will be performed by crewmembers, with instructor guidance and supervision. The Water Collection class covers Iodine analysis (CWQMK); EHS Microbiology Operations introduces TOCA analysis; and the EHS Water Sim incorporates both Iodine and TOCA analysis activities into the longer water day timeline.			
	Schedule:	Nominally one to two crewmembers will be trained.			
		Duration:	Schedule:	Flexibility:	Personnel Required:
		Water Collection (Water Coll) – 90/60 min -Inexperienced crewmember – 90 min training -Experienced crewmember – 60 min training	Trip 2A5	N/A	Crewmembers/Instructors
	EHS Microbiology Operations (Micro Ops) – 90/75 -Inexperienced crewmember – 90 min training -Experienced crewmember – 75 min training	Trip 2A7	N/A	Crewmembers/Instructors	
	EHS Water Sim – 180 min	Trip 2A9	N/A	Crewmembers/Instructors	
Ground Support Requirements Hardware/Software	Preflight Hardware:		Preflight Software:		Test Location:
	Total Organic Carbon Analyzer (TOCA) Water Sample Collection Packet (WSCP) Colorimetric Water Quality Monitor Kit (CWQMK) T61p USB to serial adapter T61p Laptop (SSC)		TOCA software CWQMK data transfer spreadsheet		U.S.
Training Facilities	Minimum Room Dimensions:	Number of Electrical Outlets:	Temperature Requirements:	Special Lighting:	
	Water Coll & Micro Ops: 8' x 10' EHS Water Sim: Bldg 9 SSTF	2 110V	Ambient	None	
	Hot or Cold Running Water:	Privacy Requirements:	Other:		
	None	N/A	Table & 4-6 chairs 28V Power supply		
Constraints/Special Requirements:	EHS Water Sim takes place in the Space Station Training Facility in Bldg 9.				
Launch Delay Requirements:	Refresher training will be conducted if currency (18 mos) expires or at crewmember request.				
Notes:	Experienced crewmembers – Assigned expedition crewmembers who have worked onboard ISS.				

MR054L ISS Potable Water Quality Monitoring

3.4 Preflight Activities – No Crew time

TABLE 3.4: PREFLIGHT ACTIVITIES

Preflight Activity	Description:	<u>Ground Supplied Water (Russian, JAXA, and Commercial Spaceflight Vehicles):</u> Prior to launch water samples are collected and analyzed to determine if the ground-supplied potable water meets applicable requirements. These data are used to verify that system-servicing procedures were properly performed and that the water transferred to ISS is safe for crew consumption. RSA			
	Schedule:	Duration:	Schedule:	Flexibility:	Personnel Required:
		Vehicle dependent	Vehicle specific	N/A	Vehicle specific
Ground Support Requirements Hardware/Software	Preflight Hardware:	Preflight Software:		Test Location:	
	Ground Servicing Equipment	None		Vehicle specific	
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:	
	N/A	None	N/A	N/A	
Constraints/Special Requirements:	None				
Launch Delay Requirements:	N/A				
Notes:	None				
Data Delivery	Reports from preflight chemical analyses will be provided by the appropriate agency to JSC Toxicology and Environmental Chemistry Laboratory personnel as soon as results are available.				

MR054L ISS Potable Water Quality Monitoring

3.5 In-Flight Activities

TABLE 3.5.1: IN-FLIGHT ACTIVITIES

In-Flight Activity	Description:				
	Activity	Duration	Schedule	Flexibility	Personnel Required
Schedule:	In-flight water quality monitoring activities include the collection of water samples from the US and Russian water systems on the ISS. Samples will be collected for in-flight analysis using the Total Organic Carbon Analyzer (TOCA) and Colorimetric Water Quality Monitor Kit (CWQMK) and detailed post-flight.				
	Water sample collection	For PWD: Unstow 15 min Clean Port/Sample Collect 10 min/sample Stow 15 min For Russian Segment: Unstow 15 min SRV-K heating cycle 20 min/525mL Sample collection 10 min/sample Stow 15 min	See SSP 50260, Table D-3, ISS U.S. On Orbit Segment Water Sampling and Analysis Schedule See SSP 50260, Table D-2, ISS Russian Segment Water Sampling and Analysis Schedule Number of samples to be collected is specified in the procedures.	Contact Lab	1 Crewmember
	TOCA Installation	155 min crew time Includes Unstow TOCA 20 min Installation 135 min	One time Immediately following a TOCA hard failure	N/A	1 Crewmember
	TOCA Chemical Analysis from Hose or Bag	15 mins + 3 hrs unattended Includes Initiate Hose or Bag Analysis 10 min Unattended 180 min Data Calldown/TOCA Shutdown 5 min	See SSP 50260, Appendix D-3, ISS U.S. On Orbit Segment Water Sampling and Analysis Schedule	Contact Lab	1 Crewmember
	TOCA Waste Water Bag Changeout	10 min crew time Includes: Replacement 10 min	After every 6 analyses	N/A	1 Crewmember
	TOCA Software Update	10 min crew time	As Needed	N/A	1 Crewmember

MR054L ISS Potable Water Quality Monitoring

MR054L ISS Potable Water Quality Monitoring

TABLE 3.5.1: IN-FLIGHT ACTIVITIES (Cont'd)

Schedule:	Activity	Duration	Schedule	Flexibility	Personnel Required
	TOCA Calibration Check	15 min crew time + 180 min unattended Includes: Initiate Bag Analysis 10 min Unattended 180 min Data Calldown/TOCA Shutdown 5 min	Every 90 days	Contact Lab	1 Crewmember
	TOCA Calibration	30 min crew time + 360 min unattended Includes: Initiate Bag Analysis Pt. 1 10 min Unattended 180 min Data Calldown/TOCA Shutdown 5 min Start Bag Analysis Pt. 2 10 min Unattended 180 min Data Calldown/TOCA Shutdown 5 min	As needed	Contact Lab	1 Crewmember
	CWQMK Total Iodine Analysis	65 min crew time Includes: Unstow/Stow 15 min Analysis 50 min	See SSP 50260, Appendix D-3, ISS U.S. On Orbit Segment Water Sampling and Analysis Schedule	Contact Lab	1 Crewmember
	CWQMK Data Transfer	10 min crew time	After each scheduled analysis	Contact Lab	1 Crewmember
	CWQMK Calibration	20 min crew time	Once per resupply	Contact Lab	1 CM
	Photos	5-10 minutes/photo	Water Collection: Photo documentation is required during a contingency situation. TOCA: Photo documentation is required during a contingency situation	N/A	1 CM

MR054L ISS Potable Water Quality Monitoring

TABLE 3.5.1: IN-FLIGHT ACTIVITIES (Cont'd)

<p>Procedures:</p>	<p>Sample collection procedures are based on published procedures, but are customized for each sampling session.</p> <p>Russian Water Sampling: SM water collection procedures are located in the Russian Operation Data File (RODF):</p> <ul style="list-style-type: none"> • 2.1.12.4 Water Sampling from Potable Water Container using U.S. Water Samplers • 2.1.12.6 Water Sampling from EDV using U.S. Water Sampler <p>U.S. Water Sampling: PWD water collection procedure is located in the Systems Operation Data File (SODF) Med Ops book:</p> <ul style="list-style-type: none"> • Potable Water Dispenser – Water Sample Collection <p>TOCA procedures are located in the Systems Operation Data File (SODF) Med Ops book:</p> <ul style="list-style-type: none"> • TOCA Installation • TOCA Analysis Using Water Sample Hose • TOCA Analysis From Sample Bag • TOCA Waste Water Bag Changeout • TOCA Calibration Check • TOCA Calibration • TOCA Software Update <p>CWQMK procedures are located in the Systems Operation Data File (SODF) Med Ops book:</p> <ul style="list-style-type: none"> • Colorimetric Water Quality Monitor Kit: Sample Analysis • Colorimetric Water Quality Monitor Kit: Total Iodine Analysis • Colorimetric Water Quality Monitor Kit: Data Transfer • Colorimetric Water Quality Monitor Kit: Activation and Checkout
<p>Constraints / Special Requirements</p>	<p>Potable Water Collection from SM and PWD</p> <ul style="list-style-type: none"> • When chemical samples are collected in conjunction with micro samples, only 15 min of unstow time & 15 min of stow time is required • Chemical & micro water collection to be done in same session • Water samples from SVO-ZV are collected during SRV-K heating cycles • Archive samples from SRV-K will require additional heating cycles for volumes exceeding 525 mL • Real-time changes to the sampling schedule & frequency may be made depending on priorities and water systems performance <p>TOCA Operational Constraints:</p> <ul style="list-style-type: none"> • Should not be scheduled at the same time as T2 exercise • Should not occur during N2 Leak Checks • Should be deconflicted with WSTA Fills as there is a UOP conflict. • Cannot be performed during CWC-1 Fills or any activity that involves getting into WRS2 (such as UPA, RFTA fills, etc). <p>TOCA Chemical Analysis from Hose or Bag</p> <ul style="list-style-type: none"> • A 10 min Loop Prime may be required before analysis. • TOCA requires 180 min unattended/sample

MR054L ISS Potable Water Quality Monitoring

	<p>TOCA Waste Water Bag Changeout</p> <ul style="list-style-type: none"> • After every 6 analyses <p>TOCA Calibration</p> <ul style="list-style-type: none"> • Requires two 180 min unattended periods (for 2 sample bag analyses) <p>CWQMK Sample Analysis</p> <ul style="list-style-type: none"> • Must be performed within 10 days of water collection
Photo / TV Requirements:	Photos required during TOCA deployment – photo to be taken at a medium distance Photo documentation is required during contingency situations.
Cold Stowage Requirements:	None
Mission Extension Requirements:	None
Landing Wave-Off Requirements:	N/A
Notes:	None
Data Delivery	<ul style="list-style-type: none"> • Call-down data is logged by the BME then sent to the Crew Surgeon and to the JSC Toxicology and Environmental Chemistry Laboratory personnel. • Downlinked data file from SSC is made available to JSC Toxicology and Environmental Chemistry Laboratory and Flight Hardware personnel upon receipt. A report is sent to the stakeholders by e-mail within 1 week of receipt of downlinked data file.

TABLE 3.5.2: IN-FLIGHT HARDWARE

Hardware/Software Name
Total Organic Carbon Analyzer (TOCA)
Colorimetric Water Quality Monitor Kit
Water Sample Collection Packet (WSCP) (Shared with MR051L)
T61p Laptop (SSC)
TOCA USB
USB to serial adapter

MR054L ISS Potable Water Quality Monitoring

3.5 Postflight Activities – No Crew time

TABLE 3.6: POSTFLIGHT ACTIVITIES

Postflight Activity	Description:	<u>Destow and return of samples to JSC:</u> Comprehensive chemical analyses are performed on returned archive water samples at JSC Toxicology and Environmental Chemistry Laboratory.			
	Schedule:	Duration	Schedule	Flexibility	Personnel Required
		Vehicle dependent	Vehicle dependent	N/A	JSC Personnel
Ground Support Requirements Hardware/Software	Postflight Hardware	Postflight Software		Test Location	
	N/A	N/A		U.S./Russia	
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	
	N/A	None	N/A	N/A	
Constraints/Special Requirements:	Returned water samples should be maintained between 2°C - 10°C and temperatures shall be monitored during storage and transport.				
Early Destow / Early Return:	Early destow of water samples and return JSC is requested.				
Notes:	N/A				
Data Delivery	Data/Report to Designated Recipients (Nominal/Contingency):		Mission Summary Report:	Data Archives:	
	<p>Nominal: The final post-flight water chemistry assessment will be delivered with 60 days of sample receipt in the laboratory.</p> <p>Contingency: If the analysis of ISS water indicates presence of contaminant(s) or a suspicious trend, a preliminary report will be distributed to crew surgeon and other stakeholders.</p> <ul style="list-style-type: none"> A preliminary report will be provided within 1 week of the receipt of water samples collected in a part of the response to a contingency/off-nominal event (including, but not limited to, crew symptoms). 		A final report including assessment of water quality on ISS will be distributed to the MMOP Environmental Health Working Group, which includes the Flight Surgeons and BMEs no later than 2 months after the return of the samples.	All reports will be archived electronically on the WAFL server located on JSC server \\jsc-sislp-fs02 with regularly scheduled data back-ups.	

MR054L ISS Potable Water Quality Monitoring

3.6 Summary Schedule

TABLE 3.7: SUMMARY SCHEDULE

ACTIVITY	DURATION	SCHEDULE	PERSONNEL REQUIRED	CONSTRAINTS
Preflight Training				
Water Collection (Water Coll) – 90/60 min -Inexperienced crewmember -Experienced crewmember	90/60 min 90 min 60 min	Trip 2A5	Crewmembers/Instructors	EHS Water Sim takes place in the Space Station Training Facility in Bldg 9.
EHS Microbiology Operations (Micro Ops) -Inexperienced crewmember -Experienced crewmember	90/75 min 90 min 75 min	Trip 2A7		
EHS Water Sim	180 min	Trip 2A9		
Preflight Activity – no crew time				
Collection of Water Samples	Vehicle dependent	Vehicle dependent	Vehicle dependent	None
In-Flight Activity				
Potable Water Collection for: Chemical In-flight Analysis Chemical Archive Sample	For PWD: Unstow 15 min Clean Port/Sample Collect 10 min/sample Stow 15 min For Russian Segment: Unstow 15 min SRV-K heating cycle 20 min/525mL Sample collection 10 min/sample Stow 15 min	Follow schedule according to Appendix D Environmental Health Detailed System Requirements, ISS MORD Number of samples to be collected is specified in the Water Flight Note to be submitted one week prior to the schedules activity.	1 Crewmember	-When chemical samples are collected in conjunction with micro samples, only 15 min of unstow time & 15 min of stow time is required. -Chemical & micro water collection to be done in same session. -Collected from PWD, SRV-K & SVO-ZV with SVO-ZV collected during SRV-K heating cycle. -Archive samples from SRV-K will require multiple heating cycles for volumes exceeding 525 mL -Schedule so there is no interference with meals

MR054L ISS Potable Water Quality Monitoring

TABLE 3.7: SUMMARY SCHEDULE (Cont'd)

ACTIVITY	DURATION	SCHEDULE	PERSONNEL	CONSTRAINTS
TOCA Installation	Crew time 155 min	One time Immediately following a TOCA hard failure	1 Crewmember	
TOCA Chemical Analysis	Crew time 10 min Unattended 3 hrs Data Calldown/TOCA Shutdown 5 min	Following each in-flight chemical water collection session See Appendix D Environmental Health Detailed System Requirements, ISS MORD	1 Crewmember	-Call-down results after each analysis -TOCA requires 180 min unattended/sample if sample introduced from a sample bag. -TOCA Operations should not be scheduled at the same time as T2 exercise. -TOCA Operations should not occur during N2 Leak Checks. -TOCA Operations should be deconflicted with WSTA Fills as there is a UOP Conflict. -TOCA cannot be in a run during CWC-I Fills, or any activity that involves getting into WRS2 like UPA, RFTA Fills, etc.
TOCA Waste Water Bag Changeout	10 min	After every 6 analyses	1 Crewmember	
TOCA Software Update	10 min	As needed	1 Crewmember	
TOCA Calibration Check	Crew time 10 min Unattended 3 hrs Data Calldown/TOCA Shutdown 5 min	Every 90 days	1 Crewmember	-TOCA Operations should not be scheduled at the same time as T2 exercise. -TOCA Operations should not occur during N2 Leak Checks. -TOCA Operations should be deconflicted with WSTA Fills as there is a UOP Conflict.
TOCA Calibration	Crew time 20 min Unattended 360 min Data Calldown/TOCA Shutdown 10 min	As needed	1 Crewmember	Requires two 180 min unattended periods (for 2 bag analyses). -TOCA Operations should not be scheduled at the same time as T2 exercise. -TOCA Operations should not occur during N2 Leak Checks. -TOCA Operations should be deconflicted with WSTA Fills as there is a UOP Conflict.

MR054L ISS Potable Water Quality Monitoring

Colorimetric Water Quality Monitor Kit Iodine and Total Iodine Analysis	65 min	Once per 90 days	1 Crewmember	Within 10 days of water collection
Colorimetric Water Quality Monitor Kit Data Transfer	10 min	After each sample analysis	1 Crewmember	None
Colorimetric Water Quality Monitor Kit Data Calibration	20 min	Once per resupply	1 Crewmember	None
Photos	5 –10 min/photo	<u>Water Collection:</u> Contingency <u>TOCA:</u> Contingency	1 operator	<u>TOCA deployment</u> medium distance shot <u>Chemical archive sampling</u> 3-4 ft from activity to include everything <u>TOCA analyses</u> close-up photo of the sample interface & bag analysis <u>Contingencies</u> close-up photos that document problems
Postflight: No crew time				
<i>Destow & return of samples to JSC</i> (No crew time)	Vehicle dependent	Vehicle dependent	JSC Personnel	Returned water samples should be maintained between 2°C - 10°C 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	Crewmembers/ Water Laboratory	Part of the Med Ops overall debrief.