

# MR004L In-flight Area Radiation Monitoring with Dosimeters

## 3.2 Medical Requirements Overview

**TABLE 3.2: MEDICAL REQUIREMENTS OVERVIEW**

<b>MRID# and Title:</b>	MR004L In-flight Area Radiation Monitoring with Dosimeters
<b>Sponsor:</b>	Medical Operations
<b>Discipline:</b>	Radiation
<b>Category:</b>	Medical Requirements
<b>References:</b>	SSP 50260 ISS Medical Operations Requirement Document SSP 50667 Med Vol B, Preflight, In-flight, Postflight Medical Evaluation Document Requirements for Long Duration Crewmembers
<b>Purpose/Objectives:</b>	<ul style="list-style-type: none"> <li>• To monitor and document crew exposure to radiation and to maintain crew exposures “as low as reasonable achievable”.</li> <li>• To perform risk assessment.</li> </ul>
<b>Measurement Parameters:</b>	Ionizing radiation environment
<b>Deliverables:</b>	<ul style="list-style-type: none"> <li>• Record of radiation doses used to document occupational exposure.</li> <li>• Area dosimeters provide spacecraft location-specific information.</li> <li>• High Rate Dosimeters (HRDs) will provide data during contingencies.</li> <li>• Doses from each mission and accumulated doses shall be used for health risk assessment.</li> </ul>
<b>Flight Duration:</b>	All flights
<b>Number of Flights:</b>	All flights
<b>Number and Type of Crew Members Required:</b>	ISS crewmembers (Primary and backup will be trained) who are scheduled operators for dosimetry activities.
<b>Other Flight Characteristics:</b>	N/A

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## 3.3 Preflight Training

**TABLE 3.3: PREFLIGHT TRAINING**

<b>Preflight Training Activity</b>	<b>Description:</b>			
	Training will be covered in the following lessons and documents: Radiation Operations Dosimeter Deployment –Crewmembers who are scheduled operators for dosimetry activities. These sessions will familiarize the crew with the dosimeters. Use and deployment will be discussed.			
	<b>Duration:</b>	<b>Schedule:</b>	<b>Flexibility:</b>	<b>Personnel Required:</b>
	Radiation Operations 45 min	L-19 months	N/A	Crew/Instructors
<b>Schedule:</b>	Training for Dosimeter Deployment 60 min			
		L-3 months	N/A	Operator
<b>Ground Support Requirements Hardware/Software</b>	<b>Preflight Hardware:</b>		<b>Preflight Software:</b>	<b>Test Location:</b>
	Radiation Area Monitors (RAMs) New RAM Location Subpack High Rate Dosimeters (HRDs)		N/A	U.S.
<b>Training Facilities</b>	<b>Minimum Room Dimensions:</b>	<b>Number of Electrical Outlets:</b>	<b>Temperature Requirements:</b>	<b>Special Lighting:</b>
	Conference Room	N/A	Ambient	N/A
	<b>Hot or Cold Running Water:</b>	<b>Privacy Requirements:</b>	<b>Other:</b>	
	N/A	N/A	Overhead projector, access to ISS mockups	
<b>Constraints/Special Requirements:</b>	Station (Soyuz) crewmembers will be trained to install/deploy and retrieve RAMs on ISS (every crew rotation).			
<b>Launch Delay Requirements:</b>	Training will be repeated if requested by the crewmember. If a launch delay of more than 90 days occurs Space Radiation Analysis Group (SRAG) will decide whether to refurbish, replace, or take no action.			
<b>Notes:</b>	None			

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## 3.4 Preflight Activities

<b>Preflight Activity</b>	<b>Description:</b>	No crew activities			
	<b>Schedule:</b>	<b>Duration:</b> N/A	<b>Schedule:</b> N/A	<b>Flexibility:</b> N/A	<b>Personnel Required:</b> N/A
<b>Ground Support Requirements Hardware/Software</b>	<b>Preflight Hardware:</b>	<b>Preflight Software:</b>		<b>Test Location:</b>	
		N/A	N/A	N/A	N/A
<b>Constraints/Special Requirements:</b>	When transporting hardware to launch location, hardware should not be x-rayed or stowed/shipped with radioactive material. Dosimeters should be transported inside lead-lined bags. If X-ray is necessary for security, the dosimeters must be kept inside the lead-lined bags and the number of X-rays should be recorded.				
<b>Notes:</b>	N/A				
<b>Data Delivery</b>	None				

## 3.5 In-Flight Activities

**TABLE 3.5.1: IN-FLIGHT ACTIVITIES**

<b>In-Flight Activity</b>	<b>Description:</b>	Radiation Area Monitors (RAMs) are deployed at designated locations on ISS during the docked phase. The deployment location is identified and the dosimeter placed in that location. After the initial flight, the RAMs will be exchanged 1 for 1. The dosimeters are color-coded and carry a mission identifier. After all of the dosimeters have been collected that are to be returned, they will be transferred to the Soyuz for stowage. A set of 2 High Rate Dosimeters (HRDs) will be exchanged every 3 years after initial flight or longer than 3 years as recommended by SRAG. The exchange is one for one. Radiation monitoring will be performed in a contingency situation using the HRDs. The HRDs will be read in the event of a contingency and called down when communication is available.				
	<b>Schedule:</b>	<b>Activity:</b>	<b>Duration:</b>	<b>Schedule:</b>	<b>Flexibility:</b>	<b>Personnel Required:</b>
		RAMs– deploy/exchange on ISS	If performing a RAM swap, 00:04 per RAM/location If only deploying new RAMs or only removing old RAMs, 00:02 per RAM/location If deploying a single RAM with imagery req'd, 00:10. If imagery activity scheduled in parallel, add 00:30 to activity	Once/ 6 months or as part of any crew rotation	N/A	ISS Crew
		HRD	As needed	Contingency	N/A	1 Crewmember
		Photo of RAM deployment	If imagery activity scheduled in parallel, add 00:30 to activity	Once every crew rotation	N/A	1 Crewmember

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<b>Procedures:</b>	Procedure for HRD: -2.6.260 High Rate Dosimeter – Dose Measurement Procedures for RAM deployment can be found in Joint Execute Package Development and Integration (JEDI).
<b>Constraints / Special Requirements:</b>	Scrub turnaround = If a launch delay of more than 90 days occurs, Space Radiation Analysis Group (SRAG) will decide whether to refurbish, replace, or take no action  RAM dosimeters will be deployed to designated locations. For new deployment sites, the crew will deploy the New RAM Location Subpack including ISS location label decal and tether  HRDs are also contained within the Passive Dosimeter Kit (PDK) and are stored on ISS as a set. The HRDs will remain in their stowage location and will be read during radiation contingencies. No crew time will be scheduled for HRDs.
<b>Photo / TV Requirements:</b>	Photos are required for each RAM deployment (once every crew rotation) to document: <ul style="list-style-type: none"> <li>a.) The surroundings of each deploy location</li> <li>b.) Any changes that may have occurred since the last deployment (e.g. stowage configuration changes resulting in more or less shielding)</li> </ul>
<b>Cold Stowage Requirements:</b>	N/A
<b>Mission Extension Requirements:</b>	N/A
<b>Notes:</b>	Resupply Requirements: Radiation Area Monitors (RAMs) and High Rate Dosimeters (HRDs) will be exchanged 1 for 1. Nominally, this will occur approximately every 6 months on a flight dependent schedule determined by the Space Radiation Analysis Group.
<b>Landing Wave-Off Requirements:</b>	N/A
<b>Data Delivery</b>	HRDs will be read in the event of a contingency situation and called down when communication is available. A final report containing analytical results of RAMs will be delivered to the Radiation Health Officer (RHO) 45 days after receiving the RAMs at the Space Radiation Dosimetry Laboratory.

**TABLE 3.5.2: IN-FLIGHT HARDWARE**

Hardware/Software Name
Radiation Area Monitors (RAM)
New RAM Location Subpack
Passive Dosimeter Kit (PDK)
High Rate Dosimeter (HRD)

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## 3.6 Postflight Activities

**TABLE 3.6: POSTFLIGHT ACTIVITIES -**

<b>Postflight Activity</b>	<b>Description:</b>	RAMs are retrieved from vehicle on R+0 and forwarded to JSC SRAG for processing via Bond 421.		
	<b>Schedule:</b>	<b>Duration:</b>	<b>Schedule:</b>	<b>Flexibility:</b>
		N/A	R+0	N/A
<b>Ground Support Requirements Hardware/Software</b>	<b>Postflight Hardware:</b>	<b>Postflight Software:</b>		<b>Test Location:</b>
		N/A	N/A	N/A
<b>Constraints/Special Requirements:</b>	Upon the return of hardware, hardware should not be x-rayed or stowed/shipped with radioactive material. Dosimeters should be transported inside lead-lined bags. If X-ray is necessary for security, the dosimeters must be kept inside the lead-lined bags and the number of X-rays should be recorded.			
<b>Early Destow / Early Return:</b>	N/A			
<b>Notes:</b>	N/A			
<b>Data Delivery</b>	<b>Data/Report to Designated Recipients (Nominal/Contingency):</b>	<b>Mission Summary Report:</b>	<b>Data Archives:</b>	
	A final report containing analytical results of RAMs will be delivered to the Radiation Health Officer (RHO) 45 days after the RAMs are received at the Space Radiation Dosimetry Laboratory (SRDL).	The RHO will submit a preliminary or final mission dosimetry and risk report to the Flight Surgeon and Medical Operations at R+ 60 days. A final report will be issued within 14 days after all necessary physical dosimetry data are received from the SRDL.	Astronaut Radiation Exposure Assessment System (AREAS ) and SRAG Internal	

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## 3.7 Summary Schedule

**TABLE 3.7: SUMMARY SCHEDULE**

ACTIVITY	DURATION	SCHEDULE	FLEXIBILITY	PERSONNEL REQUIRED	CONSTRAINTS
<b>Preflight Training</b>					
Radiation Operations	45 min	L-19 months	N/A	Crew/ Instructors	None
Training for Dosimeter Deployment	60 min	L-3 months		Operator	
<b>Preflight – N/A</b>					
<b>In-Flight</b>					
RAMS– deploy/exchange on ISS	<p>If performing a RAM swap, 00:04 per RAM/location</p> <p>If only deploying new RAMs or only removing old RAMs, 00:02 per RAM/location</p> <p>If deploying a single RAM with imagery req'd, 00:10.</p> <p>If imagery activity scheduled in parallel, add 00:30 to activity</p>	Once/6 months or as part of any Crew Rotation	N/A	ISS Crew	<p>For single crew-rotation RAMs (up and down on same Soyuz), new RAMs should be deployed within X days of their arrival on ISS and old RAMs should be packed for return within Y days prior to Soyuz undocking, such that: <math>X + Y \leq 14</math> days.</p> <p>For multiple crew-rotation RAMs(up and down on different Soyuz vehicles), T1 represents time from vehicle docking to deployment on ISS and T2 represents time from retrieval on ISS to vehicle undocking: <math>T1 + T2 \leq 60</math> days.</p>
HRD	As needed	Contingency	N/A	1 Crewmember	None
Photo of RAM deployment	If imagery activity scheduled in parallel, add 00:30 to activity	Once every crew rotation	N/A	1 Crewmember	Photo should include surroundings of deployed location
<b>Postflight – N/A</b>					
<b>Postflight Debrief – N/A</b>					