Improving MDC in the Radionuclide Particulate RASA System

OVERVIEW

The monitoring community has expressed some desire to improve the RASA Minimum Detectable Concentration (MDC) to increase network sensitivity. In this project, General Dynamics Mission Systems (GDMS) investigated minor configuration changes to improve the MDC. The following experiments were performed at GDMS's facility to quantify any improvement to the RASA MDC: shielding improvements, alternate detector chamber materials, reducing dead space in the detector chamber and reduction of mechanical and electrical noise.

THE FOLLOWING EXPERIMENTS WERE CONDUCTED AT THE GDMS TEST BED: **A. Lead Cave Configuration Experimentation**



B. Internal Lead Cave Experiments



C. Nitrogen Gas Filled in between the Detector and Lead Cave with CP5 Plug Summary





RESULT AND RECOMMENDATION:

is simple to manufacture, install and maintain. GDMS recommends implementing the CP5 Plug into the IMS to improve the RASA MDC.



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\bullet Normal Lead Configurations \rightarrow with CP5 Plug \rightarrow with CP5 Plug and Extra Lead \rightarrow Different Lead Configurations Summary

Standard Lead with Drum Removed -> Standard Lead with Drum and Guide Rollers Removed -> Internal Lead Cave Summary



Additional lead shielding provides a simple and cost effective method to reduce the MDC. The CP5 Plug

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CP5 LEAD PLUG INSTALLATIONS

- CCR 122974 Approved Nov 8, 2016
- Research showed ~12% MDC improvement for Ba-140
- Approved for installation at IMS stations RN72 and RN75





CP5 LEAD PLUG – RESULTS TO DATE

Summary of Effectiveness of CP5 Lead Plug

_	**	USP75 – Installed Date 2017/01/31 Detector – USP75_005 (CI 9767)	**	
	•••	Pre-Plug 3-Day Blank	•••	F
	•	Pro-Plua Rocult	•••	F
		• Live Time = $258\ 971\text{sec}$	·•	•
_		• Dead Time = 0.08%		•
		 582 keV FWHM = 1.68 keV Channel = 1767.78 		•
 rs		 537 keV Ba-140 is at Channel 1629 		•
-		 Continuum from Channel 1619 to 1639 inclusive is 6212 		٠
		 Gross in total spectrum 1,939,592 		•
	***	Post Plug 3-Day Blank	•	F
		 2017/01/31 Filter #7500013298 		•
	* * *	Post Plug Result	***	F
		• Live Time = 257,517sec		٠
		 Dead Time = 0.65% 		٠
		 582 keV FWHM = 1.66 keV Channel = 1767.33 		٠
		 537 keV Ba-140 is at Channel 1629 		•
_		 Continuum from Channel 1619 to 1639 inclusive is 5225 		٠
_		 Gross in total spectrum 1,667,712 		٠
	***	Background Comparison	•••	E
		 Plug reduced full spectrum background count by 14% 		٠
	***	MDC Comparison	•••	Ν
9		Plug reduced continuum under Ba-140 peak by 15% which		•
		GENERAL DYN Mission Systems	Α	



USP72 – Installed Date 2017/03/16 Detector – USP72 002 (CI 10930) Pre-Plug 3-Day Blank 2016/10/19 Filter #7200015022 Pre-Plug Result Live Time = 259,200sec Dead Time = 1.25%582 keV FWHM = 1.47 keV Channel = 1768.16 537 keV Ba-140 is at Channel 1633 Continuum from Channel 1623 to 1643 inclusive is 6309 Gross in total spectrum 2,098,817 Post Plug 3-Day Blank 2017/03/16 Filter #7200015172 Post Plug Result Live Time = 258,814secDead Time = 0.15%582 keV FWHM = 1.21 keV Channel = 1766.71 537 keV Ba-140 is at Channel 1631 Continuum from Channel 1621 to 1641 inclusive is 5284 Gross in total spectrum 1,711,972 Background Comparison Plug reduced full spectrum background count by 18% MDC Comparison Plug reduced continuum under Ba-140 peak by 16% which reduces Ba-140 MDC by 8.4%



