Technical Readiness Evaluation (TRE) 10-1
for
Joint Chemical Biological Radiological Agent Water Monitor-Radiological (JCBRAWM-R)

Test Participant Report (Technical Associates)
5 October 2010

Prepared for:

Technical Associates, Inc.
7051 Eton Ave.
Canoga Park, CA 91303

Technical Readiness Evaluation (TRE) 10-1
for
Joint Chemical Biological Radiological Agent Water Monitor-Radiological (JCBRAWM-R)

Test Participant Report (Technical Associates)
5 October 2010

Prepared for:

Technical Associates, Inc.
7051 Eton Ave.
Canoga Park, CA 91303

Prepared By:

US Army, RDECOM, ECBC, R&T Directorate, Detection Division
Chemical Biological Radiological Technology Evaluation Branch

Test Director:
Daniel Nowak (410) 436-5631

Test Manager:
Michael DeSha (410) 436-6629, Joseph Traino (410) 436-6471

Test Officer:
Francisco Giner (575) 678-6253

Background

In the first quarter of FY2010 the Edgewood Chemical Biological Center (ECBC) Point Detection Branch Chief requested the ECBC Chemical Biological Radiological Technology Evaluation Branch (CBR TEB) execute a Technical Readiness Evaluation (TRE) of Commercial Off-The-Shelf (COTS) water monitoring technologies to detect gross α and β contamination in drinking water. The objectives of the program were to characterize the performance and suitability of technologies to detect alpha and beta radioisotope contaminants in drinking water. Performance testing of the Technical Associates SSS-22P/LAM-10-DSC was conducted at the Survivability, Vulnerability and Surveillance Directorate, White Sands Test Center, White Sands Missile Range, NM. The event examined the system's performance when challenged with two radioisotopes mixed in formulated tap water:

- Americium-241 at an activity of 3.0 µCi/L
- Americium-241 at an activity of 0.05 µCi/L
- Strontium-90 at an activity of 3.0 µCi/L
- Strontium-90 at an activity of 0.05 µCi/L

Methodology

Each system was challenged with 171 samples broken down as follows:

Sample	Number
Am-241at 3.0 µCi/L	35
Sr-90 at 3.0 µCi/L	33
Am-241at 0.05 µCi/L	45
Sr-90 at 0.05 µCi/L	45
Blank	13

Each participant was also given 4 background samples of formulated tap water each day.

The SSS-22P/LAM-10-DSC system was operated in accordance with the operation manual provided to the CBR TEB prior to testing. Technical Associates trained Government personnel during the ORI and first day of trails to operate the SSS-22P/LAM-10-DSC. Technical Associates personnel operated the SSS-22P/LAM-10-DSC from the ORI day (12 July 2010) to last day (23 July 2010) of testing. The SSS-22P/LAM-10-DSC was operated in a cumulative count mode, where counts were recorded for 10 minutes in 2-minute intervals.

The performance metric for detection of ^{241}Am and ^{90}Sr at both the 3.0-µCi/L and 0.05-µCi/L activities is based on the mean SNR determined for each of the instruments under test. We calculate the SNR by first subtracting the average daily background, in counts per minute (CPM), from the average 10-minute instrument response, also in CPM, for each experiment for that day. We then correlate to system sample volume to the M329 Kit (used as a baseline). The sample correlation ratio is calculated by dividing the sample volume for the M329 Kit, 2.4 milliliter, by the sample volume for each instrument. For example the correlation ratio for the SSS-22P/LAM-10-DSC would be:

$$Sample\ Correlation\ Ratio = \frac{M329\ Sample\ Volume}{SSS\text{-}22P\ Sample\ Volume} = \frac{2.4\ \text{ml}}{5\ \text{ml}} = 0.48$$

The sample volume corrected response, $Sample_{vc}$, is simply the product of the background subtracted instrument response and the sample correlation ratio for each experiment. The SNR for each experiment is then calculated from the simple expression:

$$SNR = \frac{Sample_{vc} + Background}{Background}$$

The mean *SNR*, statistically determined for each combination of contaminant and activity, is used to evaluate the performance of each technology.

Results

Below is a tabulation of the SSS-22P/LAM-10-DSC detection ratios based on the number of true positives versus the total number of samples for each of the contaminants at the high and low activities. The results are given as:

$$Detection\ Ratio = \frac{True\ Positive}{Total\ Samples}$$

The ratio is followed by the detection rate, in parenthesis, given as a percentage. The data in table 1 was calculated from the data tabulated in table 5 at the end of this report.

Table 1. Detection ratio and rates for each experimental condition

System	^{241}Am		^{90}Sr		False Positive
	3.0 µCi/L	0.05 µCi/L	3.0 µCi/L	0.05 µCi/L	
SSS-22P	35/35 (100%)	44/44 (100%)	30/30 (100%)	44/44 (100%)	0/13

Below in table 2 are a tabulation of the mean counts per minute (CPM) and mean signal-to-noise ratios (SNR) for the SSS-22P/LAM-10-DSC for each contaminant at high and low activities. The CPM has been corrected for background (i.e. background subtracted) and sample volume as discussed above.

Table 2. System CPM and SNR for each experimental condition

System	^{241}Am				^{90}Sr				Blanks	
	3.0 µCi/L		0.05 µCi/L		3.0 µCi/L		0.05 µCi/L			
	CPM	SNR	CPM	SNR	CPM	SNR	CPM	SNR	CPM	SNR
SSS-22P	15005	113	204	2.5	16767	126	305	3.3	-1.6	1.0

Below in table 3 are a tabulation of suitability values for the SSS-22P/LAM-10-DSC.

Table 3. Suitability values for the SSS-22P/LAM-10-DSC

System	Size (cu.ft.)	Weight (lbs)	Power		Setup (min)	Startup (sec)
			Line	Batt		
SSS-22P	1.5	20.9	Yes	Yes	2.224	15

Ranking

The SSS-22P/LAM-10-DSC performance and suitability ranking is presented below in figures 1 through 3 below. These plots display relative rank of the SSS-22P/LAM-10-DSC as compared to the other test participants and the M329 Kit.

Figure 1. Performance Ranking

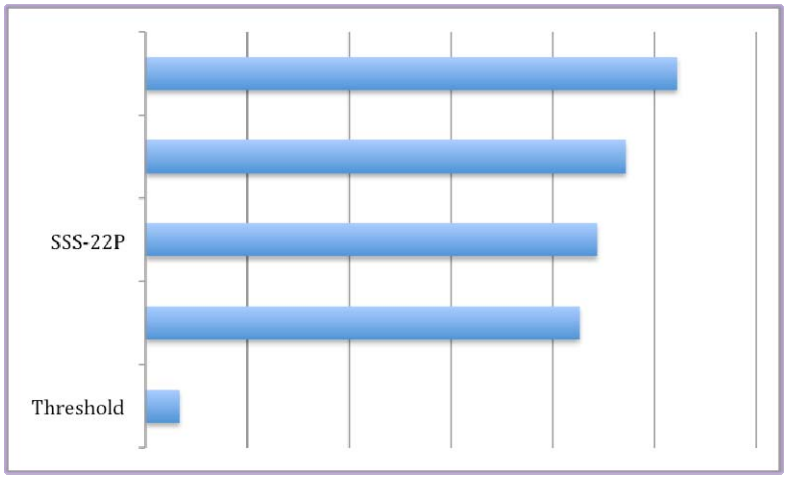


Figure 2. Suitability Ranking

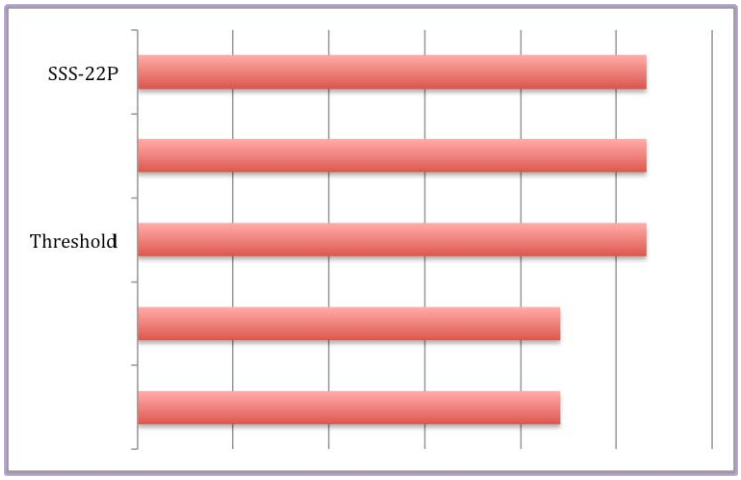
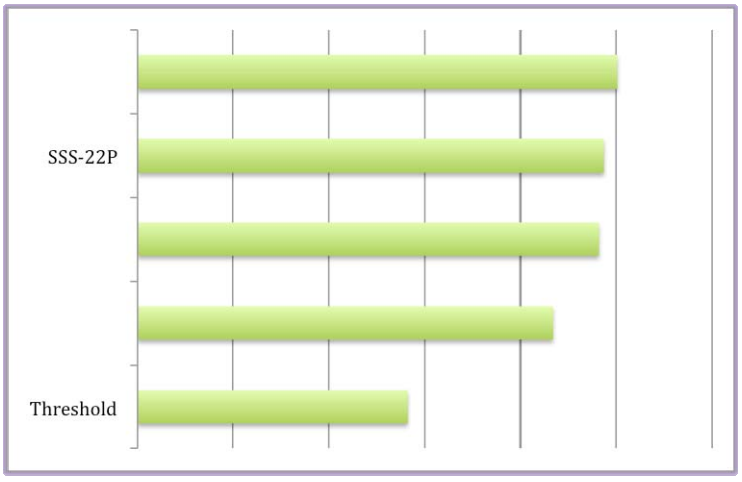


Figure 3. Overall Ranking



Technical Readiness Assessment (TRA)

The result from the TRA, performed after the TRE10-1, is presented below in table 4. The Technology Readiness Assessment (TRA) was conducted on 14 September 2010 for the radionuclide detection capability of the JCBRAWM. The scope of the assessment was to assign a Technology Readiness Level (TRL) and determine the maturity of the technologies that were tested.

The assessment was completed by a panel of subject matter experts from U.S. Army Edgewood CB Center, U.S. Army Public Health Command, and the Joint Project Manager for Contamination Avoidance. The Panel assigned Technology Readiness Levels for Hardware Technology Category only and for the four Readiness variables of Level of Knowledge, Form Fit & Function, Testing and Environment.

The lowest score in any one readiness variable drives the overall score. The score of four (4), for "Environment" reflects the panels' assessment that there is insufficient data to determine the SSS-22P/LAM-10-DSC system performance when challenged with an expanded range of potential interferents/inhibitors.

Table 4. SSS-22P/LAM-10-DSC TRL assignments

System	Level of Knowledge	Form, Fit, Function	Testing	Environment	Overall TRL (Consensus)
Tech Associates (SSS-22P)	8	8	5	4	4

Table 5. SSS-22P/LAM-10-DSC Performance Analysis

Contaminant/ Concentration	Date	Tech Assoc Sample Code	Raw CPM	CPM (background subtracted)	CPM (corrected for sample size)	SNR
Am241 @ 0.05 µCi/L	14/Jul/10	300205	516.0	381.9	183.3	2.4
	14/Jul/10	300207	714.3	580.2	278.5	3.1
	14/Jul/10	300216	618.5	484.4	232.5	2.7
	15/Jul/10	300223	526.1	393.1	188.7	2.4
	15/Jul/10	300224	537.6	404.6	194.2	2.5
	15/Jul/10	300226	615.8	482.8	231.7	2.7
	15/Jul/10	300229	507.3	374.3	179.7	2.4
	15/Jul/10	300236	585.3	452.3	217.1	2.6
	15/Jul/10	300239	516.9	383.9	184.3	2.4
	16/Jul/10	300241	562.7	432.7	207.7	2.6
	16/Jul/10	300243	545.8	415.8	199.6	2.5
	16/Jul/10	300244	522.9	392.9	188.6	2.5
	16/Jul/10	300247	615.0	485.0	232.8	2.8
	16/Jul/10	300248	613.8	483.8	232.2	2.8
	16/Jul/10	300257	531.0	401.0	192.5	2.5
	16/Jul/10	300258	524.0	394.0	189.1	2.5
	19/Jul/10	300266	550.6	413.7	198.6	2.5
	19/Jul/10	300267	488.6	351.7	168.8	2.2
	19/Jul/10	300272	531.3	394.4	189.3	2.4
	19/Jul/10	300277	542.8	405.9	194.8	2.4
	20/Jul/10	300309	598.9	467.9	234.0	2.8
	20/Jul/10	300310	569.8	438.8	219.4	2.7
	21/Jul/10	300312	515.6	383.1	183.9	2.4
	21/Jul/10	300313	507.7	375.2	180.1	2.4
	21/Jul/10	300315	541.3	408.8	196.2	2.5
	21/Jul/10	300318	483.3	350.8	168.4	2.3
	21/Jul/10	300319	619.5	487.0	233.8	2.8
	21/Jul/10	300325	552.4	419.9	201.6	2.5
	21/Jul/10	300328	542.4	409.9	196.8	2.5
	21/Jul/10	300331	560.5	428.0	205.4	2.6
	21/Jul/10	300334	533.3	400.8	192.4	2.5
	22/Jul/10	300341	539.0	401.1	192.5	2.4
	22/Jul/10	300346	556.5	418.6	200.9	2.5
	22/Jul/10	300351	586.8	448.9	215.5	2.6
	22/Jul/10	300352	505.1	367.2	176.3	2.3
	22/Jul/10	300353	563.3	425.4	204.2	2.5
	22/Jul/10	300354	557.4	419.5	201.4	2.5
	22/Jul/10	300358	520.5	382.6	183.6	2.3
	22/Jul/10	300359	572.3	434.4	208.5	2.5
	23/Jul/10	300363	565.1	430.0	206.4	2.5
	23/Jul/10	300368	590.5	455.4	218.6	2.6
	23/Jul/10	300371	631.1	496.0	238.1	2.8
	23/Jul/10	300374	618.2	483.1	231.9	2.7
	23/Jul/10	300382	571.0	435.9	209.2	2.5
Am241 @ 3.0 µCi/L	15/Jul/10	300222	31433.6	31300.6	15024.3	114.0
	15/Jul/10	300230	29837.5	29704.5	14258.2	108.2
	15/Jul/10	300231	31465.3	31332.3	15039.5	114.1
	15/Jul/10	300235	30649.6	30516.6	14648.0	111.1
	16/Jul/10	300259	30434.8	30304.8	14546.3	112.9

Contaminant/ Concentration	Date	Tech Assoc Sample Code	Raw CPM	CPM (background subtracted)	CPM (corrected for sample size)	SNR
	16/Jul/10	300260	30794.7	30664.7	14719.1	114.2
	16/Jul/10	300261	30200.0	30070.0	14433.6	112.0
	19/Jul/10	300273	29866.6	29729.7	14270.3	105.2
	19/Jul/10	300276	29757.1	29620.2	14217.7	104.9
	19/Jul/10	300279	29541.2	29404.3	14114.1	104.1
	19/Jul/10	300282	29342.6	29205.7	14018.7	103.4
	20/Jul/10	300289	29808.3	29677.3	14838.7	114.3
	20/Jul/10	300291	32231.8	32100.8	16050.4	123.5
	20/Jul/10	300298	30921.7	30790.7	15395.4	118.5
	20/Jul/10	300299	31417.5	31286.5	15643.3	120.4
	20/Jul/10	300303	31867.4	31736.4	15868.2	122.1
	20/Jul/10	300311	28346.0	28215.0	14107.5	108.7
	21/Jul/10	300314	30657.7	30525.2	14652.1	111.6
	21/Jul/10	300316	30303.5	30171.0	14482.1	110.3
	21/Jul/10	300317	30755.2	30622.7	14698.9	111.9
	21/Jul/10	300327	30486.4	30353.9	14569.9	111.0
	21/Jul/10	300329	32872.8	32740.3	15715.3	119.6
	21/Jul/10	300330	29593.1	29460.6	14141.1	107.7
	21/Jul/10	300332	29941.5	29809.0	14308.3	109.0
	21/Jul/10	300333	31236.3	31103.8	14929.8	113.7
	21/Jul/10	300336	31748.1	31615.6	15175.5	115.5
	22/Jul/10	300348	32257.3	32119.4	15417.3	112.8
	22/Jul/10	300350	33795.0	33657.1	16155.4	118.2
	22/Jul/10	300356	32205.1	32067.2	15392.3	112.6
	22/Jul/10	300360	31288.7	31150.8	14952.4	109.4
	23/Jul/10	300370	32827.8	32692.7	15692.5	117.2
	23/Jul/10	300375	33071.5	32936.4	15809.5	118.0
	23/Jul/10	300376	33887.6	33752.5	16201.2	120.9
	23/Jul/10	300377	32635.8	32500.7	15600.3	116.5
	23/Jul/10	300380	33667.2	33532.1	16095.4	120.1
Blanks	14/Jul/10	300206	118.6	-15.5	-7.4	0.9
	14/Jul/10	300215	151.0	16.9	8.1	1.1
	14/Jul/10	300220	110.6	-23.5	-11.3	0.9
	15/Jul/10	300221	110.5	-22.5	-10.8	0.9
	15/Jul/10	300237	156.8	23.8	11.4	1.1
	16/Jul/10	300240	111.6	-18.4	-8.8	0.9
	19/Jul/10	300269	109.1	-27.8	-13.3	0.9
	19/Jul/10	300271	164.0	27.1	13.0	1.1
	19/Jul/10	300278	118.6	-18.3	-8.8	0.9
	19/Jul/10	300286	159.9	23.0	11.0	1.1
	20/Jul/10	300295	107.4	-23.6	-11.8	0.9
	20/Jul/10	300297	162.6	31.6	15.8	1.1
	20/Jul/10	300300	114.9	-16.1	-8.1	0.9
Sr90 @ 0.05 µCi/L	14/Jul/10	300209	675.2	541.1	259.7	2.9
	15/Jul/10	300225	824.2	691.2	331.8	3.5
	15/Jul/10	300227	880.3	747.3	358.7	3.7
	15/Jul/10	300232	582.7	449.7	215.9	2.6
	15/Jul/10	300234	637.1	504.1	242.0	2.8
	15/Jul/10	300238	625.0	492.0	236.2	2.8
	16/Jul/10	300242	855.9	725.9	348.4	3.7
	16/Jul/10	300245	625.0	495.0	237.6	2.8

Contaminant/ Concentration	Date	Tech Assoc Sample Code	Raw CPM	CPM (background subtracted)	CPM (corrected for sample size)	SNR
	16/Jul/10	300249	883.4	753.4	361.6	3.8
	16/Jul/10	300251	840.7	710.7	341.1	3.6
	16/Jul/10	300252	843.4	713.4	342.4	3.6
	16/Jul/10	300255	854.5	724.5	347.8	3.7
	16/Jul/10	300256	636.9	506.9	243.3	2.9
	19/Jul/10	300264	640.6	503.7	241.8	2.8
	19/Jul/10	300270	636.5	499.6	239.8	2.8
	19/Jul/10	300280	670.1	533.2	255.9	2.9
	19/Jul/10	300281	879.7	742.8	356.5	3.6
	19/Jul/10	300283	863.8	726.9	348.9	3.5
	19/Jul/10	300285	860.7	723.8	347.4	3.5
	20/Jul/10	300288	646.7	515.7	257.9	3.0
	20/Jul/10	300292	942.4	811.4	405.7	4.1
	20/Jul/10	300302	883.7	752.7	376.4	3.9
	20/Jul/10	300304	615.0	484.0	242.0	2.8
	20/Jul/10	300305	636.2	505.2	252.6	2.9
	20/Jul/10	300306	664.3	533.3	266.7	3.0
	20/Jul/10	300307	864.1	733.1	366.6	3.8
	20/Jul/10	300308	827.0	696.0	348.0	3.7
	21/Jul/10	300321	885.1	752.6	361.2	3.7
	21/Jul/10	300322	716.4	583.9	280.3	3.1
	21/Jul/10	300323	615.8	483.3	232.0	2.8
	21/Jul/10	300324	676.5	544.0	261.1	3.0
	22/Jul/10	300337	690.2	552.3	265.1	2.9
	22/Jul/10	300340	661.6	523.7	251.4	2.8
	22/Jul/10	300345	958.3	820.4	393.8	3.9
	22/Jul/10	300347	664.8	526.9	252.9	2.8
	22/Jul/10	300355	946.8	808.9	388.3	3.8
	22/Jul/10	300357	644.9	507.0	243.4	2.8
	23/Jul/10	300361	925.7	790.6	379.5	3.8
	23/Jul/10	300364	662.8	527.7	253.3	2.9
	23/Jul/10	300365	960.6	825.5	396.2	3.9
	23/Jul/10	300366	932.5	797.4	382.8	3.8
	23/Jul/10	300367	726.4	591.3	283.8	3.1
	23/Jul/10	300373	675.4	540.3	259.3	2.9
	23/Jul/10	300378	896.6	761.5	365.5	3.7
Sr90 @ 3.0 µCi/L	15/Jul/10	300233	39259.8	39126.8	18780.9	142.2
	16/Jul/10	300246	28378.8	28248.8	13559.4	105.3
	16/Jul/10	300250	19323.4	19193.4	9212.8	71.9
	16/Jul/10	300253	38956.8	38826.8	18636.9	144.4
	16/Jul/10	300254	28684.8	28554.8	13706.3	106.4
	16/Jul/10	300262	41275.7	41145.7	19749.9	152.9
	16/Jul/10	300263	31001.2	30871.2	14818.2	115.0
	19/Jul/10	300265	41599.8	41462.9	19902.2	146.4
	19/Jul/10	300268	29613.5	29476.6	14148.8	104.4
	19/Jul/10	300274	28561.3	28424.4	13643.7	100.7
	19/Jul/10	300275	29184.3	29047.4	13942.8	102.8
	19/Jul/10	300284	39495.0	39358.1	18891.9	139.0
	19/Jul/10	300287	38976.5	38839.6	18643.0	137.2
	20/Jul/10	300290	30142.3	30011.3	15005.7	115.5
	20/Jul/10	300293	39793.9	39662.9	19831.5	152.4

Contaminant/ Concentration	Date	Tech Assoc Sample Code	Raw CPM	CPM (background subtracted)	CPM (corrected for sample size)	SNR
	20/Jul/10	300294	29862.9	29731.9	14866.0	114.5
	20/Jul/10	300296	29338.7	29207.7	14603.9	112.5
	20/Jul/10	300301	43604.8	43473.8	21736.9	166.9
	21/Jul/10	300320	32489.1	32356.6	15531.2	118.2
	21/Jul/10	300326	30906.9	30774.4	14771.7	112.5
	22/Jul/10	300338	32965.9	32828.0	15757.4	115.3
	22/Jul/10	300342	43976.5	43838.6	21042.5	153.6
	22/Jul/10	300343	41311.9	41174.0	19763.5	144.3
	22/Jul/10	300344	30369.3	30231.4	14511.1	106.2
	22/Jul/10	300349	44520.5	44382.6	21303.6	155.5
	23/Jul/10	300362	42796.1	42661.0	20477.3	152.6
	23/Jul/10	300369	32922.7	32787.6	15738.0	117.5
	23/Jul/10	300372	43123.5	42988.4	20634.4	153.7
	23/Jul/10	300379	29282.2	29147.1	13990.6	104.6
	23/Jul/10	300381	33093.9	32958.8	15820.2	118.1