Radiochemistry Expert Committee (REC)
Meeting Summary

January 23, 2016

1. Roll Call and Minutes:

Bob Shannon, Chair, called the meeting to order at 1:30 pm Central on January 23, 2017 in Houston, TX. Attendance is recorded in Attachment A – there were 5 members present. Associates on Webex: Carolyn Wong, Jennifer Western and Matt Sowards.

The November 23, 2016 and December 28, 2016 minutes were distributed by email. There were no comments and they have been posted on the TNI website.

There were 11 conference attendees at the meeting.

2. Houston Meeting

Bob gave an overview of what the committee has been working on since Orange County. He also provided information about training available on the TNI website. The document used to prepare the webcast/training in Tulsa, OK is also being used to help with the work on the Small Laboratory Handbook.

3. Charter Update

There is a new format for the Charter that was distributed last Friday by the Policy Committee. Carolyn Wong, Richard Sheibley and Nile Ludtke have rotated off the committee. We have some applications, but unfortunately they are from laboratories and we need some AB or Other members to keep up with balance. Bob asked the audience to apply or recommend to people with interest to complete an application on the TNI website.

4. Small Laboratory Handbook

Dave reviewed the draft Small Laboratory Handbook (SLHB) on screen. Committee members were asked to provide examples and these examples have been added to the document.

Bob noted that the committee needs to be careful that it doesn't add to the Standard. The Handbook is meant to provide guidance in implementing the standard, but not provide new requirements.

David noted that "Notes" were used to highlight important changes and things relevant to the lab.

Radiation Measurement Batch is a new term introduced. The audience was aware of this. Appendix C gives examples to labs to make it easier to implement.

Appendix B: Vas sent Dave some comments that he tried to address in this section. Dave asked that everyone look closely at the new text and provide comment.

Bob added some language to the document – Note: The DL equation should be modified to reflect factors used in the calculation of activity for the method in question.

The detection for DW has limits that are different than other radiochemistry work. Vas said there are examples including DW in the Appendix.

The example above should move down to 1.3.2 – Exclusions and Exceptions. Currently it is in Section 1.1 – 1.3.

Discussion under 1.5.1
Change last words to read – … outside of the scope of the method. Also look at page 2 of checklist and add language to the example.

1.5.2 – Add "As long as the method is being run throughout the year and ongoing QC data does not indicate a change in method performance, there is no annual requirement for determination of the detection capability."

1.5.3 – Dave thinks there will be issues for labs. He is not sure

It was agreed to delete the last two bullets under Keypoints in 1.5.3

The paragraph seems like more of an example of how to implement instead of a Keypoint. It will be moved.

1.5.4 Larry asked if there is an example of calculating Uncertainty. There is not, so some examples should be added. Dave will talk to Keith to see if he can provide a simple example. Focus on tritium? Prefer not to mention co-variance.

Add discussion of difference between counting and total uncertainty. Bob suggested looking at MARLAP for some examples too although some MARLAP examples are more complicated than we might need here.

1.5.5 Vas thinks this a little hazy. Can examples be added? Vas will try to send Dave something.

5. Checklist

Larry reviewed the work done on the checklist. Changes worked on during the meeting made can be found in Attachment D.

Bob asked about #96 – add monitoring background and cross contamination.

#104 – 1.7.3.3.a.ii Is the question valid.? Are data that are not related to the matrix spike affected by a matrix spike failure? Is there any impact on batch related samples?

6. New Business

None.

7. Action Items

A summary of action items can be found in Attachment B.

8. Next Meeting and Close

A next meeting was tentatively scheduled for Thursday, February 22, 2017. The date will be confirmed by email.
(Addition: THE MEETING WAS ULTIMATELY SCHEDULED FOR MARCH 1 DUE TO INABILITY OF KEY COMMITTEE MEMBERS TO PARTICIPATE.)

A summary of action items and backburner/reminder items can be found in Attachment B and C.

The meeting was adjourned at 4 pm Central.

Attachment A
Participants
Radiochemistry Expert Committee

Members	Affiliation		Contact Information	
			Phone	Email
Bob Shannon (Chair) (2019) **Present**	QRS, LLC Grand Marais, MN	Other	218-387-1100	BobShannon@boreal.org
Tom Semkow (Vice Chair) (2019) **Absent**	Wadsworth Center, NY State DOH Albany, NY	AB	518-474-6071	thomas.semkow@health.ny.gov
Sreenivas (Vas) Komanduri (2019) **Present – Webex**	State of NJ Department of Environmental Protection Trenton, NJ	AB	609-984-0855	Sreenivas.Komanduri@dep.state.nj.us
Marty Johnson (2019) **Absent**	US Army Aviation and Missile Command Nuclear Counting Redstone Arsenal, AL	Lab	865-712-0275	Mjohnson@tSC-tn.com
Dave Fauth (2018) **Present – Webex**	Consultant Aiken, SC	Other	803-649-5268	dj1fauth@bellsouth.net
Keith McCroan (2018) **Present**	US EPA ORIA NAREL, Montgomery AL	Lab	334-270-3418	mccroan.keith@epa.gov
Larry Penfold (2018) **Present**	Test America Laboratories, Inc; Arvada, CO	Lab	303-736-0119	larry.penfold@testamericainc.com
Ron Houck (2018*) **Absent**	PA DEP/Bureau of Laboratories	AB	717-346-8210	rhouck@pa.gov
Ilona Taunton (Program Administrator) **Present**	The NELAC Institute	n/a	828-712-9242	Ilona.taunton@nelac-institute.org

Attachment B

Action Items – REC

	Action Item	Who	Target Completion	Completed
75	Prepare copy of Standard annotated with summary document language.	Carolyn	On hold	
80	Combine recent work on Checklist to produce an updated copy of the Checklist and distribute update so that members can look it over prior to the Houston meeting	Larry	1/15/16	
81	Update Charter to prepare for new format and prepare DRAFT presentation for Houston. Send to committee members for comment.	All	3/1/17	
82	Provide examples to Dave to incorporate into the small lab handbook prior to the Houston Meeting	As assigned	3/1/17	

Attachment C – Back Burner / Reminders

	Item	Meeting Reference	Comments
1	Update charter in October 2016	n/a	Delayed due to new Charter format.
5	Form subcommittee of experts in MS and other atom counting techniques to see that these techniques are adequately addressed in the radiochemistry module.	9/24/14	

Guidance to Users

- Use of this checklist is not mandatory. This is an optional tool auxiliary to the TNI Standard. It is comprised of questions used to assess compliance with the 2015 TNI Standard, Volume 1, Module 6. The language in the checklist sometimes paraphrases the language in the Standard. If there are any apparent conflicts between the checklist and the Standard, the original language in the Standard is primary.

- Where a "Clarification" is added to the checklist, this is provided to help explain the item of inquiry, but it is not intended to change the meaning of the Standard.

- Where a "Note" is added to the checklist, it is a note taken directly from the Standard, and in accordance with TNI convention does not change the meaning or intent of the Standard.

- Where a declarative statement is added to the checklist without being identified as a "Clarification" or as a "Note," the language is taken verbatim from the Standard.

Assessment Checklist for Radiochemistry 1/22/2017 Draft – Post 1/23/17 Meeting

Methods Reviewed – *complete as appropriate*

Gross Alpha/Gross Beta	***Strontium-89-90***	***Americium***
☐ 900.0, ☐ water	☐ 905.0, ☐ water	☐ Am-01-RC, ☐ solid
☐ 7110B, ☐ water	☐ Sr-03, ☐ water, ☐ solid, ☐ air	☐ Am-04-RC, ☐ water, ☐ air
☐ 9310, ☐ water, ☐ solid*, ☐ air*	☐ Sr-04, ☐ water	
		Plutonium Isotopes
Total Radium	**Tritium**	☐ Pu-01-RC, ☐ air
☐ 903.0, ☐ water	☐ 906.0, ☐ water	☐ Pu-02-RC, ☐ solid
☐ 903.1, ☐ water	☐ H-02, ☐ water	☐ Pu-03-RC, ☐ solid
☐ 9315, ☐ water, ☐ solid*, ☐ air*	☐ 7500-3H B, ☐ water	
	☐ Sr-02, ☐ water	**Uranium**
Radium-226	☐ 300 3H-04, ☐ water	☐ 908.0, ☐ water
☐ 903.2, ☐ water		☐ 908.1, ☐ water
☐ Ra-04, ☐ water	**Carbon-14**	☐ 7500-U B ☐ water
☐ 7500-Ra B, ☐ water	☐ C-01, ☐ water	☐ 7500-U C ☐ water
☐ 7500-Ra C, ☐ water		☐ U-02, ☐ water, ☐ solid, ☐ air
☐ EMSL-19, ☐ water, ☐ solid, ☐ air	**Cesium-134/137**	☐ U-04, ☐ water, ☐ solid, ☐ air
	☐ 901.0, ☐ water	
Radium-228		**Gamma Emitters**
☐ 904.0, ☐ water	**Iodine-131**	☐ 901.1, ☐ water
☐ Ra-05, ☐ water	☐ 7500-I B, ☐ water	☐ 902.0, ☐ water
☐ 7500-Ra D, ☐ water	☐ 7500-I C, ☐ water	☐ Ga-01-R, ☐ water, ☐ solid, ☐ air
☐ 9315 , ☐ water, ☐ solid, ☐ air		
☐ 9320, ☐ water, ☐ solid		
Analytes: _____Lab SOP # _____	**Analytes: _____Lab SOP # _____**	**Analytes: _____Lab SOP # _____**

Notes: Solids can include soils, sediments, sludges, vegetation, and other bulk materials

* EPA 9310 and/or 9315 modified to include solids and/or air

[The methods and matrices above are examples, and should be customized to the needs of each assessment or program.]

Assessment Checklist for Radiochemistry 1/22/2017 Draft – Post 1/23/17 Meeting

Audit ID: _____ **Laboratory:** _____ **Assessor:** _____ **Date:** _____

Item No.	Line of Inquiry		Status			Observations/Comments
			Y	N	n/a	
Method Validation						
1	V1M6, 1.5.1 a)	Does the laboratory, - Validate all methods, prior to their acceptance and institution, for which data will be reported? - Validate all methods across the range of physical and chemical parameters (e.g., density, Test Source composition, and analytical configurations) and activities that will be encountered in samples? - Where applicable, activity range includes zero activity (e.g., a method blank) in the validation?				
2	V1M6, 1.5.1 b), 1.5.2 through 1.5.5	Does the laboratory, - Validate method(s) in each quality system matrix? - Demonstrate method detection capability (DL for drinking water, MDA of other applications)? - Does the validation include evaluation of the following: - Precision - Bias - Measurement Uncertainty, and - Selectivity				
3	V1M6, 1.5.1 c)	For each method for which documented data are not otherwise available, does the laboratory perform validation to demonstrate that the above requirements are met?				
4	V1M6, 1.5.1 d)	Has the laboratory recorded the quality system matrix used in initial method validation studies?				
5	V1M6, 1.5.1 e)	Do the laboratory's method validations comply with the requirements at V1M2 5.4.5.1 through V1M2 5.4.5.3?				
6	V1M6, 1.5.1 f)	Has the laboratory documented the method validation procedure used and the results obtained? Does the documentation include a statement on the suitability of the method for the intended use?				
7	V1M6, 1.5.1 g)	Does the laboratory analyze, wherever available, externally-produced quality control samples from a nationally or internationally recognized source provider to determine its ability to produce acceptable data?				

Audit ID: _____ **Laboratory:** _____ **Assessor:** _____ **Date:** _____

Item No.	Line of Inquiry		Status			Observations/Comments
			Y	N	n/a	
Demonstration of Capability (DOC)						
8	V1M6, 1.5.2	Has the laboratory established detection capability for each method/matrix combination? Has the laboratory documented the procedure used to determine the detection capability? Does the laboratory documentation of detection capability identify the software used for calculations?				
9	V1M6, 1.5.2.1 a) - c)	Does the laboratory's MDA include all sample processing steps? Is the laboratory's initial detection capability determined in a quality system matrix free of target analytes and interferences at levels that would impact results? Does the laboratory document detection capability each time there is a change in the test method or instrumentation that affects the analytical detection capability?				
10	V1M6, 1.5.2.2	If performing drinking water analysis for SDWA compliance, does the laboratory's detection capability conform to requirements in 40 CFR 141.25 c)?				
11	V1M6, 1.5.2.3 a)	Does the laboratory's method validation documentation include an evaluation of precision and bias for each analyte of interest, characterized across the range of activities that brackets the activities applicable in samples, including zero activity?				
12	V1M6, 1.5.2.3 b) - c)	Does the laboratory's method validation include all sample preparation steps in each relevant quality system matrix? Is the precision and bias of a method determined each time there is a change in the test method that affects the performance of the method or when a change in instrumentation occurs that affects the precision & bias?				
13	V1M6, 1.5.2.3 d)	Where there are no established criteria for precision and bias, has the laboratory documented acceptance criteria based on intended use of the data, applicable regulations, or guidelines in MARLAP or the EPA FEM Document # 2006-01?				
14	V1M6, 1.5.4 a) - c)	Is the laboratory reporting results with a an estimate of Total Uncertainty consistent with the GUM and MARLAP, with exceptions for drinking water compliance testing? Do laboratory reports clearly specify the type of uncertainty reported, including the level of confidence? Are the results of precision obtained from the method validation process compared to the uncertainty estimates as a check on the validity of the uncertainty estimates?				Note: Counting uncertainty for drinking water. Total uncertainty for other applications.

Audit ID: _____ **Laboratory:** _____ **Assessor:** _____ **Date:** _____

Item No.	Line of Inquiry		Status			Observations/Comments
			Y	N	n/a	
Demonstration of Capability (DOC) (continued)						
15	V1M6, 1.5.5	Does method validation documentation include a qualitative statement describing the means of evaluating selectivity during method validation?				
16	V1M6, 1.6.1	Is an initial DOC conducted by individuals prior to performing any method without constant/close supervision, any time there is a significant change in instrument type, or any time that a method has not been performed by the analyst in a twelve (12) month period?				
17	V1M6, 1.6.2.1	Is documentation maintained for each initial DOC consistent with the minimum elements specified in Section 1.6.2.1 a) – g) ?				
18	V1M6, 1.6.3.1	Does the laboratory have a documented procedure describing ongoing DOC demonstrating that the analyst(s) has been able to routinely meet QC requirements in the last twelve (12) month period?				
19	V1M6, 1.6.3.2	Does the on-going demonstration include one of the following: a) Acceptable performance of blank(s) and sample(s) that have known accepted values, single blind to the analyst; another initial DOC; b) at least four (4) consecutive blank samples and four (4) consecutive spiked samples (e.g., batch LCS) with acceptable levels of precision and accuracy; c) a documented process of analyst review using QC samples. d) if a) through d) are not technically feasible, then analysis of real-world samples with results within predefined acceptance criteria (defined by the laboratory or method)?				
Technical Requirements						
20	V1M6 1.7.1	Does the lab's process ensure meeting appropriate regulatory or contractual specifications and support decision making?				
21	V1M6 1.7.1	Does the instrument QC program meet the requirements of method regulation, contract and or the TNI Standard? When regulation/contract and or the method does not address instrument quality control program, does the laboratory incorporate MARLAP or other consensus standard guidelines?				

Audit ID: _____ **Laboratory:** _____ **Assessor:** _____ **Date:** _____

Item No.	Line of Inquiry		Status			Observations/Comments
			Y	N	n/a	
Technical Requirements (continued)						
22	V1M6, 1.7.1.1 a)	Does the laboratory maintain the instrumentation required for each method it performs or seeking accreditation? When multiple instruments (or detectors) are involved for a common method, are the results across the instruments comparable? Does the laboratory establish the configuration and operating parameters for each measurement system (or instrument)?				
23	V1M6 1.7.1.1 b)	Does the laboratory document specific deviations for the system configuration or operational parameters when such modifications are required or necessary for a specific method(s)? Does the laboratory document the rationale for such changes?				
24	V1M6 1.7.1.1. c)	Does the laboratory periodically verify user-maintainable values for operational parameters to ensure their consistency with values recorded at the time of initial calibration and to ensure the continued integrity of the system configuration? If the system parameters have changed, does the laboratory perform corrective actions to determine and ameliorate any potential impact of the changes to the system configuration or operating parameters?				

Audit ID: _____ **Laboratory:** _____ **Assessor:** _____ **Date:** _____

Item No.	Line of Inquiry		Status			Observations/Comments
			Y	N	n/a	
Technical Requirements (continued)						
25	V1M6, 1.7.1.2 a) i) – iii)	Does the laboratory define the procedures and documentation for initial calibration, and do the procedures include requirements for recalibration for any of the following conditions: • following replacement of a key detector element (e.g., a photomultiplier tube, silicon barrier detector, gas proportional detector chamber, germanium crystal, etc.)? • after a repair when subsequent performance checks indicate a change in performance? • after modification of system parameters that affect instrument response? • when instrument performance checks exceed predetermined acceptance criteria (i.e., limit of a statistical or tolerance control chart or other QC parameters) indicating a change in instrument response since the initial calibration? • when indicated by corrective actions? • when calibration is due according to a predetermined frequency?				
26	V1M6 1.7.1.2 b)	Does the laboratory perform multi-point calibrations, required, to correlate parameters (other than activity) such as the following cases? • channel-energy calibration of alpha or gamma spectrometers • energy-efficiency calibration of gamma spectrometers • mass-efficiency (mass-attenuation) calibration of gas-flow proportional • or x-ray detectors • quench-efficiency calibration of liquid scintillation detectors • mass-crosstalk calibration of gas-flow proportional; and • quench-crosstalk calibration of liquid scintillation detectors.				
27	V1M6 1.7.1.2 c)	Do instrument calibrations make use of reference standards based on physical measurements as defined in Section 1.7.2.6.c)? Do calibration standards have the same general physical characteristics (i.e., geometry, density, composition, nuclear decay properties, etc.) that match as closely as possible those of the samples to which the calibration will be applied [except as noted in Section 1.7.1.2 d)].				

Audit ID: _____ **Laboratory:** _____ **Assessor:** _____ **Date:** _____

Item No.	Line of Inquiry		Status			Observations/Comments
			Y	N	n/a	
Technical Requirements (continued)						
28	V1M6 1.7.1.2 d) i) - iii	In cases where the laboratory uses empirical techniques (e.g., gamma transmission) and/or computational techniques (e.g., Monte Carlo or efficiency modeling techniques) to generate corrections for minor differences between the calibration standard and samples: • Does the laboratory performed documented validation of the correction method or model by physical measurement of reference standards as defined in Section 1.7.2.6.c)?) • Does the validation span the entire range of physical characteristics observed in samples to which the correction will be applied (i.e., geometry, density, etc.) ? • Does the applied correction consistently minimize measurement bias across the range of physical characteristics? • Does the laboratory estimate and validate the uncertainty associated with the correction (see Section 1.5.4) and included it in the uncertainty reported with each associated sample result.				
29	V1M6 1.7.1.2 e) i) – iv)	Does the laboratory establish and document in written procedures and in records the following details of initial instrument calibrations: • The type of calibrations to be performed? • The number of calibration points required • A description of the calibration standards required? • The preparation of calibration standards? • The counting of the calibration standards? • The maximum permissible uncertainty for calibration (e.g., maximum combined uncertainty of the calibration parameter or a minimum number of counts collected? • All calculations? Are there established acceptance criteria in the laboratory's procedure that are appropriate to initial calibration techniques? If the initial instrument calibration results are outside established acceptance criteria, does the laboratory perform corrective actions? Are sufficient raw data records available to permit reconstruction of the initial instrument calibration?				

Audit ID: _____ **Laboratory:** _____ **Assessor:** _____ **Date:** _____

Item No.	Line of Inquiry		Status			Observations/Comments
			Y	N	n/a	
Technical Requirements (continued)						
30	V1M6 1.7.1.2 f)	Does the laboratory quantitate sample results only from initial instrument calibrations unless otherwise allowed by regulation, method, or contract?				
31	V1M6, 1.7.1.3 a)	Are initial instrument calibrations verified with a reference standard from a source or lot independent of that used for the initial calibration by: • Performing a second set of calibration measurements compared to the first, or • Quantifying a set of prepared standards using the initial calibration?				
32	V1M6, 1.7.1.3 b) & c)	Does the laboratory have a procedure stating the maximum uncertainty for calibration verification, and was that criterion met? Does the laboratory have a procedure with acceptance criteria for calibration verification, and were those criteria met? Does the laboratory perform corrective action if the criteria for calibration verification are not met?				
33	V1M6, 1.7.1.4 a) ii) & iii)	Is the same check source used for ongoing performance checks as was used in the preparation of the tolerance or control charts? Are performance check sources prepared, handled, sealed and/or encapsulated to prevent damage, loss of activity and contamination?				
34	V1M6, 1.7.1.4 a) iv)	Is the activity of performance check sources and the counting duration sufficient to provide adequate counting statistics over the life of the sources?				
35	V1M6, 1.7.1.4 a) v)	Where significant, is radioactive decay of the check source taken into account when evaluating count-rate sensitive parameters such as efficiency?				

Audit ID: _____ **Laboratory:** _____ **Assessor:** _____ **Date:** _____

Item No.	Line of Inquiry		Status			Observations/Comments
			Y	N	n/a	
Technical Requirements (continued)						
36	V1M6, 1.7.1.4 a) vi) & vii)	Are instrument performance checks monitored using control or tolerance charts to ensure that performance has not changed significantly since initial calibration Do laboratory procedures specify corrective actions to be taken when performance check acceptance criteria are not met, and does the laboratory take corrective actions in accordance with those procedures?				
37	V1M6, 1.7.1.4 b) & c)	Are performance checks conducted consistent with the minimum required frequency: For gamma spectrometry systems, are detector efficiency, energy calibration, and peak resolution checked as follows: - Semiconductor detectors: twice weekly on non-consecutive days, or on day of use if the detector is not used continuously? - Scintillation detector (e.g., sodium iodide) each day of use? For alpha spectrometry systems is - energy calibration checked weekly and - Detector efficiency checked monthly? For gas-proportional and semiconductor alpha/beta detectors is - alpha and beta efficiency checked each day of use? For liquid scintillation detectors is the - calibration at frequency recommended by the manufacturer and - efficiency checked with unquenched ^{3}H and ^{14}C standards each day of use? For solid-state scintillation detectors used for non-spectrometic measurements (e.g. zinc sulfide) is the - efficiency checked each day of use Exceptions to minimum performance check frequencies allowing periods longer than the required interval include the following: i) To allow for completion of the test source count as long as instrument performance checks performed at the beginning and end of the measurement period meet all acceptance criteria, and ii) To allow for completion of a Preparation Batch or Radiation Measurement Batch measured on an instrument with an automated sample changer, as long as the period between checks does not exceed seven (7) calendar days and checks are done at the beginning and end of the measurement in question and meet all acceptance criteria.				

Audit ID: _____ **Laboratory:** _____ **Assessor:** _____ **Date:** _____

Item No.	Line of Inquiry		Status			Observations/Comments
			Y	N	n/a	
Technical Requirements (continued)						
38	V1M6, 1.7.1.4 d)	When detector systems are powered off between performance checks, are performance checks counted prior to the next Test Source measurement?				
39	V1M6, 1.7.1.5 a)	Are subtraction background measurements performed and evaluated separately for each detector and appropriate to the method?				
40	V1M6, 1.7.1.5 b)	Is the subtraction background counting time at least as long as the longest associated sample counting time?				
41	V1M6, 1.7.1.5 c)	Are subtraction background measurements conducted consistent with the minimum required frequency, as specified for any of the three following alternatives: i) Paired measurements performed before and after each batch of Test Source measurements (a batch could be as small as a single sample); ii) Measurements performed at a fixed minimum frequency depending on the detector technology: • Gamma spectrometry: M**onthly** • Alpha spectrometry: M**onthly** • Gas-proportional and semiconductor alpha/beta detectors: **Quarterly** • Liquid scintillation detectors. o Individual quenched background: **Once per Preparation Batch**. o Quenched background curve: **Per laboratory procedures** • Solid-state scintillation detectors (e.g., zinc sulfide) for non-spectrometric measurements: **Each day of use** iii) Composite measurements using combined background measurements collected in a manner resulting in a representative determination with a combined counting time at least as long as the longest associated Test Source count time.				
42	V1M6, 1.7.1.5 d) & e)	Does the laboratory have procedures for performing and evaluating subtraction background measurements that include the following: • Frequency and length of measurements? • Use of control or tolerance charts and acceptance criteria? • Counts or count rate are monitored for significant changes • Corrective action taken when acceptance criteria are not met?				

Audit ID: _____ **Laboratory:** _____ **Assessor:** _____ **Date:** _____

Item No.	Line of Inquiry		Status			Observations/Comments
			Y	N	n/a	
Technical Requirements (continued)						
43	V1M6, 1.7.1.6 a) – e)	Does the laboratory have a written procedure for performing and evaluating short-term background checks that includes the following: • Indication of the frequency and length of checks? • Establishes control or tolerance charts and acceptance criteria to monitor for significant changes? • Requires monitoring of counts or count rate of a detector or an analytical region of interest for significant changes? Note that exceptions to the minimum short-term background frequency can include: • Uninterrupted counting of an individual Test Source for a time longer than the required time between short-term background checks; • Allowing completion of a Preparation Batch or a RMB measured on an instrument with an automated sample changer, as long as the period between checks does not exceed seven (7) calendar days and that checks done at the beginning and end of the measurement period meet all applicable criteria Does the laboratory take corrective action when short-term background has changed since the previous determination? Note that subtraction background measurements may be substituted for short-term background checks if performed with sufficient frequency For liquid scintillation detectors, does the laboratory check unquenched short-term backgrounds each day of use?				
44	V1M6, 1.7.1.7	Does the laboratory have written procedures for corrective actions when radiation detectors have been contaminated, as determined by the subtraction background measurements, short-term background checks, or method blanks? Are detectors used before corrective actions have been completed?				

Audit ID: _____ **Laboratory:** _____ **Assessor:** _____ **Date:** _____

Item No.	Line of Inquiry		Status			Observations/Comments
			Y	N	n/a	
Quality Control for Radiochemistry – General Requirements						
45	V1M6, 1.7.2.1 a)	Does the laboratory follow a documented QC program that monitors and assesses the performance of the laboratory's analytical systems? Does the laboratory, at a minimum, incorporate the QA program imposed by regulation, method(s) and this Standard? Does the laboratory follow the imposed regulations when the regulations are more stringent than this Standard? (see Module 2, Section 5.9.3.c). If it is not apparent which requirement is more stringent, does the laboratory follow the requirements of the regulation or the mandated method? Does the laboratory establish requirements in its quality system based on the guidelines of MARLAP Manual or other similar consensus standard organizations when there are no established guidelines?				
46	V1M6 1.7.2.1 b)	Does the laboratory process batch and sample-specific quality controls to provide empirical evidence that demonstrates that the analytical system is in control? Does the laboratory use the results for these controls to assess the data quality of sample results produced by the analytical system?				
47	V1M6 1.7.2.1 c)	Does the laboratory employ either a sample Preparation Batch or a RMB to determine the grouping of samples and assignment of batch QC?				
48	V1M6 1.7.2.1 c) i)	Does the laboratory initiate a Preparation Batch for samples that involves physical or chemical processing which affects the outcome of the test? Does the laboratory prepare the QC samples together with the associated preparation batch using the same process, personnel, and lot(s) of reagents?				

Audit ID: _____ **Laboratory:** _____ **Assessor:** _____ **Date:** _____

Item No.	Line of Inquiry		Status			Observations/Comments
			Y	N	n/a	
Quality Control for Radiochemistry – General Requirements (continued)						
49	V1M6 1.7.2.1 c) ii)	Does the laboratory initiate an RMB in lieu of preparation batch where sample processing does not involve physical or chemical processing of the samples? (e.g., non-destructive gamma spectrometry, alpha/beta counting of air filters, or swipes on gas proportional detectors). Are the samples and associated QC in the RMB similar in physical and chemical parameters, and analytical configurations? (e.g., analytes, geometry, calibration, and background correction).				
50	V1M6 1.7.2.1 c) iii)	Does the laboratory keep open the RMB for adding samples for a period not exceeding 14 calendar days from the start of the first sample counting or until twenty (20) environmental samples have been counted, whichever occurs first?				
51	V1M6 1.7.2.1 c) iv)	Does the laboratory combine only such samples and associated QC within an RMB that share a range of physical and chemical parameters, and analytical configurations (e.g., analytes, geometry, calibration, density) that conform to the ranges of physical and chemical parameters, and analytical configurations demonstrated by method validation studies (see Section 1.5)? Do laboratory procedures for RMB document how method validation is performed, and how corrections are applied to physical calibration? (e.g., for efficiency, density, cascade summing, and background)				
52	V1M6 1.7.2.1 d)	Does the laboratory's QC program document the frequency required for quality controls?				
53	V1M6 1.7.2.1 e)	Does the laboratory process all batch QC samples together with and under the same conditions as the associated samples, and use the same processes and procedures for preparation, analysis, data reduction and reporting of results? *Note:* Although samples in a Preparation Batch must be prepared together, they need not be analyzed concurrently on a single detection system, rather they may be analyzed on different detection systems as long as the detection systems are calibrated for the technique in question and instrument quality controls indicate that the systems are in control.				

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Item No.	Line of Inquiry		Status			Observations/Comments
			Y	N	n/a	
Quality Control for Radiochemistry – General Requirements (continued)						
54	V1M6 1.7.2.1 f)	Does the laboratory systematically or preferentially use specific detectors, equipment or glassware for the analysis of QC samples? This not preclude laboratories from segregating detectors, equipment, or glassware to minimize the risk of cross-contamination of samples or equipment as long as the criteria for segregation applies equally to batch QC samples and samples.				
55	V1M6 1.7.2.1 g)	Does the laboratory's QC program document acceptance criteria for batch QC samples, sample-specific QCs, and for the evaluation of long-term trends and the methods used to establish these criteria?				
56	V1M6 1.7.2.1 h)	Does the laboratory assess the results of the QC samples against acceptance criteria documented in the QC program? Does the laboratory develop acceptance criteria consistent with guidelines in MARLAP or other consensus standards, or other criteria such as statistical control charts developed by the laboratory where there are no established criteria in regulations, the method, or contract?				
57	V1M6 1.7.2.1 i)	Does the laboratory track and trend the results of batch QC samples using statistical or tolerance control charts?				
58	V1M6 1.7.2.1 j)	Does the laboratory investigate the cause when results do not meet acceptance criteria and take corrective actions to eliminate the source or minimize the magnitude of the problem? Does the laboratory consider samples associated with a failed QC parameter as suspect and, wherever possible, reprocess such samples? Does the laboratory report results with appropriate data qualifiers when reprocessing is not possible? Does the laboratory note the occurrence of a failed QC sample and any associated actions in the laboratory report?				

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Item No.	Line of Inquiry		Status			Observations/Comments
			Y	N	n/a	
Quality Control – Negative Control						
59	V1M6 1.7.2.2 a)	Does the laboratory employ a minimum of one Method Blank (MB) per Preparation Batch or Radiation Measurement Batch?				
60	V1M6 1.7.2.2 b)	Are MBs prepared using a quality system matrix that is sufficiently analyte-free (to the extent possible), and using an aliquot of the matrix similar to that of routine samples? If sample aliquot sizes vary, do method blank acceptance criteria compensate for those differences?				
61	V1M6 1.7.2.2 c)	Does the laboratory have procedures in place to determine if MB results are significantly different than zero or impacts sample analytical results (e.g., MB > sample-specific MDA)?				
62	V1M6 1.7.2.2 d)	Is corrective action taken when a method blank (MB) result is significantly different than zero and associated sample results are < 5 * MB?				
63	V1M6 1.7.2.2 e)	Are method blank results monitored for long term trends, absolute bias, possible contamination or interferences that may affect sample results?				
64	V1M6 1.7.2.2 f)	Are sample results being calculated without batch-specific MB subtraction? Does the laboratory account for the uncertainty of the subtracted value in its estimate of uncertainty for the final result? Note: Average historical activity of MBs may be subtracted when systematic bias has been demonstrated.				
Item No.	**Line of Inquiry**		**Status**			**Observations/Comments**
			Y	**N**	**n/a**	
Quality Control – Positive Control						
65	V1M6 1.7.2.3 a)	Does the laboratory employ a minimum of one Laboratory Control Sample (LCS) per Preparation Batch or Radiation Measurement Batch (RMB)? For RMBs, a calibration verification standard may be used in place of an LCS.				

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Item No.	Line of Inquiry		Status			Observations/Comments
			Y	N	n/a	
Quality Control – Positive Control (continued)						
66	V1M6 1.7.2.3 b)	Are LCSs prepared using a quality system matrix that is sufficiently analyte-free (to the extent possible), and using an aliquot of the matrix similar to that of routine samples? If sample aliquot sizes vary, do LCS acceptance criteria compensate for those differences?				
67	V1M6 1.7.2.3 d)	Are LCSs spiked at a level such that the uncertainty of the LCS result is < 1/3 * acceptance criteria?				
68	V1M6 1.7.2.3 e)	Do the standards used to prepare LCSs conform to the requirements for reference standard provided in Section 1.7.2.6 c?				
69	V1M6 1.7.2.3 e) i-iii	Do LCSs include all of the radionuclide(s) being determined with the following allowed exceptions: • Gross alpha or beta: A surrogate such as the radionuclide(s) used to calibrate the detector • Alpha spectrometry: only one radionuclide when the others have similar chemical characteristics and are determined simultaneously in a single measurement • Gamma-ray spectrometric radionuclides with similar gamma energies or radionuclides that represent at least the low and high energy ranges used for analysis.				
70	V1M6 1.7.2.3 f)	Are LCSs in each batch evaluated using a statistical technique that allows comparison to the lab's established acceptance criteria?				
71	V1M6 1.7.2.3 g)	Where more than one analyte is spiked in the LCS, is each analyte evaluated against acceptance criteria?				

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Item No.	Line of Inquiry		Status			Observations/Comments
			Y	N	n/a	
Quality Control – Sample Specific QC Measures						
72	1.7.2.4	Does the laboratory document procedures for determining the effect of sample matrix on analytical results? Do the documented procedures relate to the analyses of specific QC samples? Are the QC samples designed as data quality indicators for a specific sample using the designated method? Examples of sample-specific QC include: Matrix Spike (MS); Matrix Spike Duplicate (MSD), Matrix Duplicate (MD), Tracers, and Carriers.				
73	1.7.2.4	Does the laboratory have procedures for, • tracking, managing, and handling sample-specific QC criteria, • spiking radionuclides at appropriate activities, • calculating recoveries, • determining variability (e.g., relative percent difference and/or z-score), • evaluating results and • reporting results based on the performance of the QC samples?				
74	1.7.2.4 a) i	Are matrix spikes (MSs) analyzed as required? Note that MSs are not typically employed (or required) for non-destructive methods (e.g., gamma spectrometry or direct counting of samples for alpha or beta radioactivity), or for methods that employ a chemical yield tracer or carrier for each sample. Are the MS results reported to data users (customers) so that the customers evaluate the impact on their batch(s) samples?				
75	1.7.2.4 a) ii	Is the frequency for MS analysis specified by the method, or a regulation? Or, is it determined as part of the contract review process?				

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Item No.	Line of Inquiry		Status			Observations/Comments
			Y	N	n/a	
Quality Control – Sample Specific QC Measures (continued)						
76	1.7.2.4 a) iii	Are the radionuclides to be spiked for the MS specified in the mandated method, or a regulation? or Are they determined as part of the contract review process? At minimum, are they consistent with those specified for the LCS in Sections 1.7.2.3.e and 1.7.2.3.f of this Standard? (Module 6)				
77	1.7.2.4 a) iv	Is the aliquot used for MS similar to that of routine samples analyzed in the Preparation Batch? If the sample size in the Preparation Batch varies (e.g., due to restriction on the activity or mass residue that may be processed), does the laboratory apply appropriate corrections to compensate for differing aliquots when applying the acceptance criteria for MS?				
78	1.7.2.4 a) v	Is the lack of sufficient volume to perform an MS noted in the laboratory report, when appropriate?				
79	1.7.2.4 a) vi	Is the activity of the MS analyte(s) greater than five (5) times the MDA?				
80	1.7.2.4 a) vii	Are the acceptance criteria for MS recoveries as established or specified in the method, regulation or contract? Where there are no mandatory acceptance criteria established in the method, regulation or contract, does the laboratory develop acceptance criteria based on industry practices and guidelines, or consistent with the guidelines of MARLAP[3] or other consensus standards? Are the criteria documented or referenced in the laboratory's quality manual?				
81	1.7.2.4 a) viii	Does the standard used to prepare the MS meet the requirements for reference standards provided in Section 1.7.2.6.c., when possible?				

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Item No.	Line of Inquiry		Status			Observations/Comments
			Y	N	n/a	
Quality Control – Sample Specific QC Measures (continued)						
82	1.7.2.4 a) ix	Is the MS prepared by adding a known activity of target analyte prior to performing any processes that affect the analyte of interest? (e.g., chemical digestion, dissolution, ashing, separation, etc.).				
83	1.7.2.4 b) i & v	Where applicable, is a matrix duplicate (MD) or matrix spike duplicate (MSD) prepared using a second aliquot of the same sample take through the entire analytical procedure. Based on specific project or program requirements or when there is insufficient sample available, the laboratory may choose to analyze a LCS in duplicate in place of a MD or MSD.				
84	1.7.2.4 b) ii	Are the acceptance criteria for duplicates as established or specified by the method, regulation or contract? Where there are no mandatory acceptance criteria established in the method, regulation or contract, does the laboratory develop the acceptance criteria based on industry practices and guidelines, such as - control charting developed by the laboratory, or - consistent with the guidelines of MARLAP or other consensus standards? Are the criteria documented or referenced in the laboratory's quality manual?				
85	1.7.2.4 b) iii & iv	At a minimum, does the laboratory analyze one MD per Preparation Batch or RMB (radiation measurement batch)? For RMBs, does the MD consist of a second measurement of the sample -on the same detector if only one detector is available, or -on a different detector if more than one detector available? Note that for samples with low-levels of activity (less than approximately three (3) times the MDA) the laboratory, at its discretion, may substitute an MS/MSD pair to determine reproducibility within a Preparation Batch in place of a MD?.				

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Item No.	Line of Inquiry		Status			Observations/Comments
			Y	N	n/a	
Quality Control – Sample Specific QC Measures (continued)						
86	1.7.2.4 c) i	For methods that employ a radioactive Tracer or a stable Carrier as a chemical yield monitor in the analysis, does the laboratory calculate and report the chemical yield for each sample? Is the chemical yield one of the quality control measures to be used to assess the associated sample result acceptance?				
87	1.7.2.4 c) ii	Is a Tracer or Carrier used that does not significantly interfere with the analyte(s) of interest or cause bias in its measurement? When a Tracer or Carrier is not available that is free of interference or bias with the analyte(s) of interest, is the interference or bias caused quantified and appropriate correction applied to the sample results?				
88	1.7.2.4 c) iii	Is the Tracer or Carrier used to monitor chemical yield added to the sample prior to performing any processes that affect the analyte of interest (e.g., chemical digestion, dissolution, ashing, separation, etc.) unless otherwise specified by the method?				
89	1.7.2.4 c) iv	Is the chemical yield assessed against acceptance criteria specified in the method, regulation, contract or laboratory SOP? Where there are no criteria, does the laboratory develop its criteria for data acceptance based on -guidelines established in the MARLAP[3] or -other criteria such control charting developed by the laboratory? Does the chemical yield assessment meet the required project or program MQOs (Section 1.3.1).				

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Item No.	Line of Inquiry		Status			Observations/Comments
			Y	N	n/a	
Data Reduction						
90	1.7.2.4 c) v	When the established chemical yield acceptance criteria are not met, does the laboratory follow the specified corrective action and contingencies? Is the occurrence of a failed chemical yield and the actions taken noted in the laboratory report?				
91	1.7.2.5 a-c	Does the laboratory have SOPs documenting data reduction, detection capability (per Section 1.5.2), and measurement uncertainties (per Section 1.5.4)?				
Reagent Quality, Water Quality, and Checks						
92	1.7.2.6 a)	Does the laboratory document the requirements for the reagents used in the laboratory? (At a minimum the reagents must be analytical reagent grade or better)				
93	1.7.2.6 b)	Is the quality of water sources monitored and documented and meet method specific requirements?				
94	1.7.2.6 c)	Does the QC Program establish and maintain provisions for radionuclide standards including the following requirements? • Are reference standards obtained from a national metrology institute (NMI), e.g. NIST in the USA or NPL in Great Britain, or from a supplier of NMI reference standards. • Alternatively, are reference standards obtained from an ISO/IEC Guide 34[6] accredited reference material provider, or an ANSI N42.22[7] reference material manufacturer. • Are reference standards accompanied with a certificate of calibration that meets the requirements of either ISO Guide 31[1], or ANSI N42.22[7], Section 8. • Do certificates include the following information: manufacturer, radionuclides calibrated, identification number, calibration method, activities or emission rates with associated uncertainties and the confidence limits, standard quantity, activity reference time (date or time as appropriate to the half-life of the radionuclide), physical and/or chemical description of the source, and radionuclide impurities.				

[1] ISO Guide 31:2000, *Reference materials - Contents of certificates and labels*; International Organization for Standardization, 2000. Available from: http://www.iso.org/.

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Item No.	Line of Inquiry		Status			Observations/Comments
			Y	N	n/a	
Reagent Quality, Water Quality, and Checks (continued)						
94	1.7.2.6 c) (continued)	QC Program requirements for radionuclide standards (continued): • Are standards prepared or derived from externally-obtained reference materials verified against an independent standard obtained from a second manufacturer prior to use for analysis of samples. (The use of a standard from a second lot obtained from the same manufacturer is acceptable for use as a second source standard.) • Are discrepancies between observed and expected values investigated and appropriate measures taken that document the validity of standards prior to use. • Does the laboratory account for radioactive decay/ingrowth whenever decay/ingrowth has occurred between the Activity Reference Date and use that could impact use of the results. • If there is no known provider of a particular standard (e.g., non-routine radionuclide or non-standard matrix) that is traceable to the International System of Units (SI) and the laboratory must use a standard with less rigorously established traceability, does the laboratory obtain from the provider the minimum information described in Section 1.7.2.6.c.ii? • Does the laboratory independently verify the activity of such standards prior to use and document the verification? • Does the laboratory resolve verification discrepancies? • Does the laboratory disclose in its final report that a non-traceable standard was used to analyze sample unknowns or any other know limitations of the standard?	√			
Constant and Consistent Test Conditions						
95	1.7.2.7 a)	Does the laboratory ensure that test instruments are consistently operated within the specifications required for the application for which the equipment is used?				

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Item No.		Line of Inquiry	Status			Observations/Comments
			Y	N	n/a	
Constant and Consistent Test Conditions (continued)						
96	1.7.2.7 b)	Is labware cleaned to meet the sensitivity requirements of the method? Are cleaning procedures that are not specified in the method documented in the laboratory's quality systems and records?				
97	1.7.2.7 c)	Does the laboratory's radiological control program define segregation of low-level and high-level in order to minimize cross contamination? *[enter something about monitoring background contamination]*				
Data Evaluation and Reporting						
98	1.7.3.1 a)	Are method blank (MB) results evaluated for long-term trends, bias, contamination, or interference that may affect results?				
99	1.7.3.1 b)	If MB acceptance criteria are not met, are corrective actions taken to investigate the source of contamination or other bias? If MB acceptance criteria are not met and sample activity levels are less than or equal to five (5) times the activity found in the MB, are the associated samples reprocessed and reanalyzed?				
100	1.7.3.1 c)	If sample results are reported that are associated with a failed MB, is the failure and associated corrective action or inability to complete corrective action noted in the laboratory report?				
101	1.7.3.2 a)	Are laboratory control sample (LCS) results calculated in percent recovery or other appropriate statistical measure that allows comparison to established acceptance criteria? Are the LCS calculations documented?				
102	1.7.3.2 b)	If LCS acceptance criteria are not met, are corrective actions taken to investigate the source of the failure and are associated samples reprocessed and reanalyzed? If sample results are reported that are associated with a failed LCS, is the failure and associated corrective action or inability to complete corrective action noted in the laboratory report?				

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Item No.	Line of Inquiry		Status			Observations/Comments
			Y	N	n/a	
Data Evaluation and Reporting (continued)						
103	1.7.3.3 a) i	Are matrix spike (MS) and matrix spike duplicate (MSD) results calculated in percent recovery or other appropriate statistical measure that allows comparison to established acceptance criteria? Are precision results for MS/MSD pairs and matrix duplicates (MD) calculated as relative percent difference (e.g., Zrep MARLAP) or other appropriate statistical measure to allow comparison to established acceptance criteria? Are the MS, MSD, and/or MD calculations documented?				
104	1.7.3.3 a) ii	If sample results are reported that are associated with a failed MS, MSD, or MD, is the failure and associated corrective action or inability to complete corrective action noted appropriately in the laboratory report? Note: Appropriate qualification of the associated results depends on the evaluation of whether the failure indicates that associated sample results are impacted.				
105	1.7.3.3 b)					