

# Rio Algom Mining LLC

March 13, 2020

**ATTN: Mr. Thomas Lancaster**

United States Nuclear Regulatory Commission  
Mail Stop T5-A10  
Washington, DC 20555-0001

Re: **License SUA-1473, Docket No. 40-8905**  
**Editorial and Administrative Amendment to SUA-1473**  
**Justification for Removal of Gross Alpha from SUA-1473 Monitoring Requirements**

Dear Mr. Lancaster,

Rio Algom Mining LLC (RAML) respectfully submits the attached Technical Memorandum providing justification to remove Gross Alpha from SUA-1473 monitoring requirements. This is in support of our request that the Nuclear Regulatory Commission (NRC) staff review and amend our present materials license, SUA-1473, Amendment 61, to make editorial and administrative changes to accurately reflect current site conditions and operations.

If you have any questions or need additional information, please do not hesitate to call me at (916) 947-7637.

Sincerely,



Sandra L. Ross, P.G.  
Site Manager  
Rio Algom Mining, LLC

cc: Document Control

## TECHNICAL MEMORANDUM

To: RAML

From: INTERA Incorporated

Date: March 13, 2020

Re: Justification for Removal of Gross Alpha from SUA-1473 Monitoring Requirements

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This memorandum was prepared at the request of the United States Nuclear Regulatory Commission (NRC) to provide justification for removal of the Gross Alpha (GA) standard for upper bedrock units from SUA-1473 (the "License") for the Ambrosia Lake Mill West (Site).

Rio Algom Mining, LLC (RAML), has proposed to remove the GA standard in the License because (1) the License includes a monitoring and compliance requirement for alpha emitters recommended by the Regulatory Guide for Radiological Effluent and Environmental Monitoring at Uranium Mills (NRC, 1980b), (2) there are no analytical methods suitable for measuring GA in high-total dissolved solids (TDS) waters, and (3) alpha activity screening is not necessary for the Site, as alpha-emitting constituents of potential concern listed by regulation (10 CFR Part 40) and NRC guidance (NRC, 1980b) are currently being monitored, with the exception of polonium-210. RAML proposes addition of polonium-210 to the monitoring program as recommended by the NRC (1980b).

### 1.0 PROPOSED LICENSE CHANGES FOR GROSS ALPHA GROUNDWATER PROTECTION STANDARDS

RAML/INTERA Incorporated (INTERA) recommends removal of the groundwater protection standards (GPSs) for GA for the Dakota Sandstone (Dakota), Tres Hermanos A Sandstone (TRA), and Tres Hermanos B sandstones (TRB), and the alternative concentration limit (ACL) for GA. RAML/INTERA propose the addition of polonium-210 monitoring for monitoring wells listed in the License in order to provide the most information possible about alpha-emitting radionuclides in groundwater.

The License standards for GA are not appropriate for compliance monitoring or detection monitoring for the following reasons:

- A monitoring program already exists for certain alpha emitters recommended by the NRC: uranium, thorium-230, radium-226, lead-210, and the proposed addition of polonium-210 to the monitoring program (NRC, 1980a, 1980b). As these parameters are alpha emitters, monitoring of these parameters effectively monitors changes in alpha activity.
- EPA method 900.0 is a rapid screening measurement to indicate whether specific (individual alpha emitters) analyses are required (EPA, 1980). GA screening is unnecessary, as the specific alpha-emitting hazards associated with uranium milling have been identified and are being monitored.
- EPA method 900.0 is not suitable for analysis and compliance monitoring of high-TDS waters (EPA, 1980). Available analytical methods for GA are designed for drinking water matrices.

RAML/INTERA are not aware of any analytical methods suitable for monitoring GA compliance in high-TDS, high-calcium groundwater. The available analytical methods do not have the necessary precision or detection limits to monitor compliance with GA standards for the upper bedrock units.

## 2.0 EXISTING GROSS ALPHA STANDARDS

### 2.1 GPS Calculation

On June 1, 1986, the State of New Mexico relinquished its licensing authority over uranium milling activities, and the NRC reasserted its regulatory jurisdiction over New Mexico uranium processing facilities. As a result of the new regulatory jurisdiction, the Quivira Mining Corporation (QMC, then owner of the Site) submitted a Detection Monitoring Plan to the NRC on January 29, 1988, for the hydrogeologic units that could potentially be impacted by processing of uranium ore and disposal of by-product material at the Facility. The hydrogeologic units addressed by the groundwater protection program were the TRA, the TRB, the Dakota, and the alluvium of Arroyo del Puerto (Alluvium). The Detection Monitoring Plan was submitted pursuant to the Commission's newly adopted 10 CFR 40, Appendix A, Criteria 7 regulations that had become effective on December 14, 1987. Upon plan approval, the Commission established its groundwater protection program for the Facility (AVM & AHA, 2000).

Following the review of data from the groundwater detection monitoring program sampling events, the NRC established GPSs for hazardous constituents in groundwater at the point of compliance (POC) wells. GPSs were set as the highest background concentration or the value listed in Table 5(C) of 10 CFR Part 40, Appendix A. The GPSs for hazardous constituents, except combined radium (radium-226 and radium-228), were set using background concentrations determined from sampling events in October 1988 from one background well in each of the aquifers.

### 2.2 ACL Application

At the time of the Bedrock ACL application, GA, among other constituents, was in exceedance of the GPS in the Dakota aquifer. Since ACLs were being proposed for alpha emitters thorium-230 and radium-226, an ACL for GA was deemed unnecessary and duplicative. The Bedrock ACL Application (AVM and AHA, 2000) proposed that the GPS for GA be removed from the License as a hazardous constituent in bedrock aquifers. Also noted in this application was the fact that a GPS for GA was unnecessary since the alpha activity hazard was addressed by ACLs for uranium, thorium-230, radium-226, and lead-210 (which decays to polonium-210).

Additionally, the Proposed Groundwater Stability Monitoring Plan (included in the December 7, 2005, Response to RAIs Accession number ML053480214 [RAML, 2005]) does not list GA as a monitoring constituent for any of the bedrock units. In the Environmental Assessment for Amendment to Source Materials License SUA-1473 for Ground Water Alternate Concentration Limits, which was prepared by the NRC (NRC, 2006) to document its review of the various submittals during the six-year ACL application process, NRC acknowledges that GA was evaluated as a constituent of concern and that the proposed ACLs (including ACLs for radiologic constituents) are appropriate and protective of human health and the environment. An ACL for GA was never proposed by RAML because (1) the ACLs for the major alpha-emitting constituents were proposed instead and (2) the GPS for GA was requested to be removed from

the License. **Table 1** contains the alpha-emitting constituents included in Condition 34 of the License and the respective ACLs.

Table 1. Current Standards for Alpha-Emitting Parameters from the License

		Alluvium		Tres Hermanos B (TRB)		Tres Hermanos A (TRA)		Dakota (KD)	
		ACL	GPS	ACL	GPS	ACL	GPS	ACL	GPS
Uranium	mg/L	23	-	1.6	-	-	0.01	1.6	-
Ra-226 + Ra-228*	pCi/L	3,167	-	218	-	218	-	218	-
Th-230	pCi/L	13,627	-	945	-	945	-	945	-
Pb-210	pCi/L	1,274	-	88	-	88	-	88	-
Gross Alpha**	pCi/L	8,402	-	-	21	-	18	-	56

**Notes**

\* Radium ACLs are for Ra-226 and Ra-228 activity combined, however Ra-228 is not discussed further because it is not an alpha-emitting radionuclide.

\*\* The Gross Alpha standards are for GA minus the alpha activity contributed by uranium and radon.

### 3.0 EVALUATION OF APPROVED ANALYTICAL METHODS FOR MEASUREMENT OF GROSS ALPHA ACTIVITY

Several EPA-approved methods have been published for screening of GA activity for drinking water matrices (40 CFR §141.25). These methods were designed to screen drinking water supplies for alpha activity and determine the necessity for further analysis (EPA, 1980).

EPA-approved analytical methods fall into two basic categories: evaporation methods and precipitation methods. Both methods suffer from matrix interference that makes it impossible to produce a meaningful GA activity measurement from the high-TDS groundwater collected from wells at Ambrosia Lake. The challenges associated with gross alpha analysis in high-TDS waters are presented in INTERA/RAML (2018) and RAML (2017) and detailed in **Attachment A**.

#### 3.1 Method Evaluation

The Groundwater Monitoring Program uses EPA Method 900.0 (an evaporation technique) for measurement of GA. RAML evaluated the use coprecipitation methods during the first half 2016 groundwater monitoring event. Split samples were collected on May 5, 2016, and analyzed by ACZ Laboratories. One split was analyzed using coprecipitation methods (EPA Method 600/00-02), and the second sample was analyzed using the typical evaporation method (EPA Method 900.0). The results of the split sampling are summarized in **Table 2**. The concentration of uranium, TDS, and calcium are presented to provide context for the GA analytical results. TDS and calcium concentrations were not measured during the May 2016 monitoring event, so average concentrations from 2014-2019 are presented for context, as the evaporation method and coprecipitation method have interferences from TDS and calcium, respectively. The corrected GA measurement is calculated from the uncorrected GA activity

minus the estimated alpha activity contribution from uranium (see the definition of corrected and uncorrected GA in **Attachment A**).

The uncertainty (reported at  $2\sigma$ , or 2 standard deviations) associated with both methods is greater than the GPSs. The lower limit of detection (LLD) coupled with the uncertainty for both methods do not provide adequate precision for compliance monitoring (see **Attachment A**).

Table 2. Comparison of EPA-Approved Methods for Gross Alpha Activity

		31-02 TRB-R	36-06 KD
EPA 200.8	Uranium Concentration (mg/L)	0.0045	1.01
SM 2540 C	Average Total Dissolved Solids (mg/L)	7000-8200	5900-8600
EPA 200.7	Average Calcium (mg/L)	628-678	511-545
Evaporation (EPA 900.0)	Uncorrected Gross Alpha (pCi/L)	41	670
	Corrected Gross Alpha (pCi/L)	38	-6.7
	Uncertainty ( $2\sigma$ )	33	100
	LLD	33	28
Coprecipitation (EPA 600/00-02)	Uncorrected Gross Alpha (pCi/L)	50	390
	Corrected Gross Alpha (pCi/L)	47	-287
	Uncertainty ( $2\sigma$ )	40	90
	LLD	58	49
	Gross Alpha GPS (pCi/L)	21	56

### 3.2 Uncertainty Caused by TDS Interference

Monitoring wells 36-06 KD, 31-02 TRB-R, and 32-45 KD-R are currently monitored monthly for GA by EPA method 900.0. Time series graphs for GA concentrations in groundwater from these wells are included in **Attachment B**. These time series graphs include the corrected GA (orange) and the lower limit of detection (LLD; in grey) for each sample. The  $2\sigma$  uncertainties are shown as error bars on the corrected GA data set.

These time series graphs demonstrate the complications inherent to trying to monitor compliance with inappropriate analytical methods.

- Many corrected GA values are negative; some data are not even within  $2\sigma$  of zero, suggesting that the uncertainty resulting from low signal-to-noise ratios may be underestimated.
- The relatively high LLDs can make it difficult to impossible to identify a true exceedance, as observed at 31-02 TRB-R.
- Exceedances are often indistinguishable from the GPS at  $2\sigma$  uncertainty.

## 4.0 POTENTIAL APPROACHES FOR ALPHA ACTIVITY COMPLIANCE

### 4.1 Calculation of Gross Alpha Activity by Summation of Individual Activities

Previous discussions of potential GA GPS exceedances have presented the summation of measured alpha-emitter activities as a tool for evaluation of the measured GA activities (RAML, 2017; INTERA/RAML, 2018). A summation of a complete suite of alpha-emitting daughter products would not produce an accurate estimate of the GA activity of a sample (Arndt and West, 2004). Short-lived daughters have half-lives on the order of seconds to days. Many of those daughters will decay completely once the sample is removed from the aquifer.

At the NRC's request, RAML has updated the Comparison of Gross Alpha Measurements and Combined Alpha Emitter Activities (INTERA/RAML, 2018, Table 3) as **Attachment C**. The updated Table 3 incorporates the alpha contribution from lead-210 into the activity summation. Approximately  $1.9 \times 10^{-6}\%$  of lead-210 decays via alpha emission. In addition, negative activities are rounded up to zero for the purposes of the alpha activity summation. Note that polonium-210 data are not available for comparison.

These data show that the summed activities of alpha emitters are much lower than the measured gross alpha activities. However, direct comparison of measured and summed gross alpha values is misleading for several reasons, including: (1) the large uncertainties and LLDs for gross alpha measurements, and (2) the short-lived daughters cannot be measured and are not accounted for in the summed alpha emitter values. For these reasons, summation of individual alpha emitter activities is not recommended for gross alpha compliance.

### 4.2 Measurement of Long-Lived Constituent Isotopes in Place of GA Analysis

The NRC's Regulatory Guide 4.14 (1980b) states that groundwater from sources not expected to be used as drinking water should be analyzed for dissolved natural uranium, thorium-230, radium-226, polonium-210, and lead-210. For this reason, RAML proposes adding polonium-210 to groundwater monitoring program for wells listed in the License. Monitoring for uranium, thorium-230, radium-226, and lead-210 are already required by the License and already have GPSs or ACLs (NRC, 2006).

With the addition of polonium-210 to the monitoring program, RAML will be monitoring for the longest-lived alpha emitters in the uranium decay series. Though the combination of these measured activities will not sum to a complete GA activity, these measurements do serve to screen groundwater samples for alpha activity just as the EPA-approved GA methods are designed to screen drinking water for alpha activity. Changes in uranium, thorium-230, radium-226, polonium-210, and lead-210 activities would be indicative of changing groundwater quality, providing information that is needed for understanding ongoing impacts to groundwater from the tailings impoundments.

#### 4.2.1 Impacts to Accelerated Monitoring Program

Monthly monitoring of GA activity is currently required for wells 31-02 TRB-R, 32-45 KD-R, and 36-06 KD. If a License amendment is approved to remove GA, monthly monitoring for GA will be discontinued. The listed alpha emitters will remain as part of the semiannual monitoring program per the terms of the License. Removal of monthly GA monitoring will not influence whether monthly monitoring for other parameters (e.g. beryllium, cadmium, and molybdenum) continues.

## 5.0 PROPOSED APPROACH FOR ALPHA ACTIVITY COMPLIANCE

Continued GA monitoring does not serve its purpose for compliance and detection monitoring at the Site, as measuring gross alpha in high-TDS and high-calcium waters results in high detection limits and analytical uncertainties. Instead, continued monitoring of alpha-emitting uranium daughter products including radium-226, thorium-230, polonium-210, and lead-210 will continue to provide the data necessary for compliance with License standards and detection monitoring for alpha activity.

RAML proposes the following actions to address the need for monitoring alpha activity in groundwater in lieu of gross alpha analysis:

- Removal of the existing GA GPS for the upper bedrock units and the GA ACL for alluvial monitoring wells.
- Addition of polonium-210 to the License as part of the regular semiannual monitoring program as recommended by NRC Regulatory Guide 4.14 (NRC, 1980b).
- Continued monitoring for uranium and alpha emitting radionuclides already required by the License.

## 6.0 REFERENCES

- American Public Health Administration (APHA), 2012. Standard Methods for the Examination of Water and Wastewater. 22<sup>nd</sup> Ed.
- Arndt M.F., and West, L. 2004. A Study of the factors Affecting the Gross Alpha Measurement, and a Radiochemical Analysis of some Groundwater Samples from the State of Wisconsin Exhibiting an Elevated Gross Alpha Activity.
- AVM Environmental Services and Applied Hydrology Associates (AVM and AHA), Inc. 2000. Corrective Action Program and Alternate Concentration Limits Petition For Upper Most Bedrock Units, Ambrosia Lake Uranium Mill Facility Near Grants, New Mexico. February 15, 2000.
- Department of Energy (DOE), United States. 1997. RP710 Laboratory Method for Gross Alpha and Beta Activity Determination.
- Environmental Protection Agency (EPA), United States, EMSL. 1980. Method 900.0: Gross Alpha and Gross Beta Radioactivity in Drinking Water. Prescribed Procedures for Measurement of Radioactivity in Drinking Water, EPA/600/4/80/032.
- \_\_\_\_\_. 2000. *Radionuclides Notice of Data Availability Technical Support Document*. March 2000.
- INTERA Incorporated and Rio Algom Mining LLC (INTERA/RAML). 2018. INTERA/RAML Responses to Comments, Ambrosia Lake Work Plans 2017 and 2018, ML18193A982, April 16, 2018.
- Nuclear Regulatory Commission (NRC) United States. 1980a. Final Generic Environmental Impact Statement on Uranium Milling. ML032751663.
- \_\_\_\_\_. 1980b. Regulatory Guide 4.14 Radiological Effluent and Environmental Monitoring at Uranium Mills
- \_\_\_\_\_. 2006. Environmental Assessment for Amendment to Source Materials License SUA-1473 for Ground Water Alternate Concentration Limits, Rio Algom Mining LLC, Ambrosia Lake Uranium Mill Tailings Site, Ambrosia Lake, McKinley County, New Mexico. January 2006, Source Materials License SUA-1473, Docket No. 40-8905, ML060130091.
- Rio Algom Mining LLC (RAML). 2005. Response to RAIs, Accession number ML053480214. December 7, 2005.
- \_\_\_\_\_. 2017. Groundwater Stability Monitoring Report, Second half 2016, Rio Algom LLC, Ambrosia Lake Facility. January 23, 2017.



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# ATTACHMENT A

## Comparison of Gross Alpha Measurements and Combined Alpha Emitter Activities

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## A.1 Gross Alpha Correction

The GA measurement is meant to be a measurement of the gross alpha particle activity of a sample. The Safe Drinking Water Act (40 CFR § 141.66(c)) regulates the gross alpha particle activity, less the alpha activity from radon and uranium. When this document refers to gross alpha, it is in reference to the “corrected” gross alpha value unless otherwise stated.

The sample preparation methods for both evaporation and precipitation-based GA analytical methods volatilize radon in water samples, but the GA measurement must be corrected for the activity from uranium based on measurement of uranium concentrations by other methods. EPA (2000) states, “If uranium (U) is determined by mass-type methods, a 0.67 pCi/μg uranium conversion factor must be used. This conversion factor is conservative and is based on the 1:1 activity ratio of U-234 to U-238 that is characteristic of naturally-occurring uranium in rock.” The application of this correction is the difference between “uncorrected” and “corrected” gross alpha activities.

## A.2 Evaporation Methods

Published and approved evaporation methods are very similar and usually differ in the selection of calibration standards or scintillation counters. These methods include EPA Method 900.0 (1980), Standard Method SM 7110 B (APHA, 2012), and DOE Method RP710 (DOE, 1997). The evaporation methods require the evaporation of a liquid sample into an evaporite residue. The residue is then ground and placed into a planchet and activity is counted using a gas proportional counter or Geiger counter.

The maximum volume that can be evaporated is limited by the TDS concentration of a sample. Precipitated solids will act to self-attenuate radiation within the planchet by absorbing alpha particles emitted during scintillation counting. This self-attenuation interference will bias results towards lower values. To minimize self-attenuation, the evaporation methods require that no more than 100 milligrams (mg) of evaporite residue is contained within the sample planchet, which necessitates smaller sample volumes for water samples with higher TDS concentrations. The smaller evaporated sample volumes contain fewer radionuclides, leading to fewer scintillations during counting, fewer counts, and low signal-to-noise ratios. The low concentration of alpha-emitting radionuclides in the sample planchet results in poor counting statistics and high uncertainties.

These methods were explicitly designed as screening-level evaluations of drinking water matrices. Due to the potential for interference by high TDS concentrations, Method 900.0 (EPA, 1980) states it is only appropriate for samples with < 500 milligrams per liter (mg/L) TDS. Method RP710 (DOE, 1997) states, “Gross alpha screening analyses are not expected to be as accurate nor as precise as more detailed radiochemical separations. Rather, they are intended to provide rapid information associated with a particular action level with minimal chemical preparation. Additionally, these types of analyses are not intended to give “absolute” activity measurements, but rather ‘order-of-magnitude’ estimates.”

TDS concentrations of each monitoring well listed in Condition 34 of the License exceed the 500 mg/L upper limit of applicability for the evaporation methods.

## A.3 Coprecipitation Methods

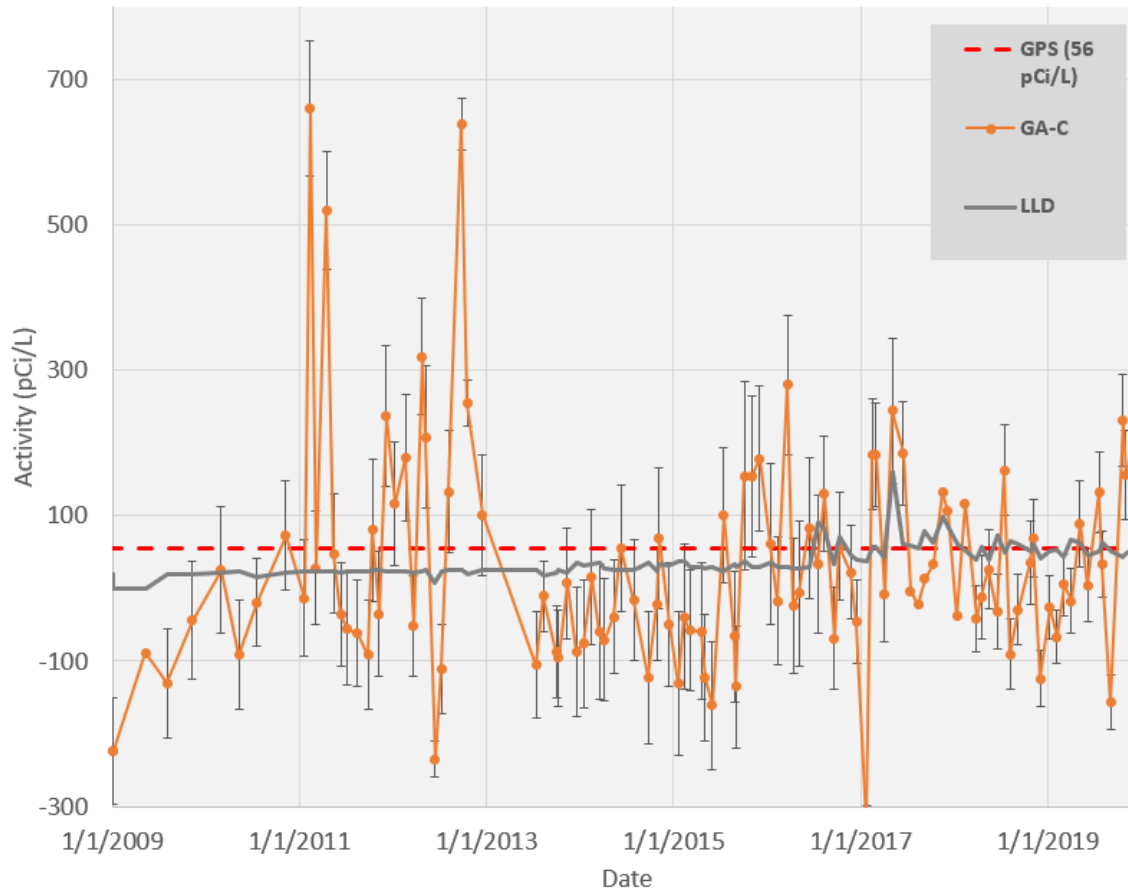
The coprecipitation methods (EPA 600/00-02 or SM 7110 C) are based on coprecipitation of barium sulfate and iron oxyhydroxides (APHA, 2012). Radium precipitates with the barium sulfate as a barium/radium sulfate solid solution phase, whereas other alpha emitters sorb to the precipitated iron oxyhydroxides. The precipitates are filtered from the sample and the filtrate is counted for alpha activity. However, relatively high concentrations of calcium and barium in solution can cause increased precipitation of non-radioactive sulfate phases and result in the same self-attenuation issue described regarding evaporation methods.

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## **ATTACHMENT B**

### **Gross Alpha Time Series for Monthly Monitoring Locations**

**Figure B1. Gross Alpha Activities in  
Dakota Monitor Well 36-06 KD**

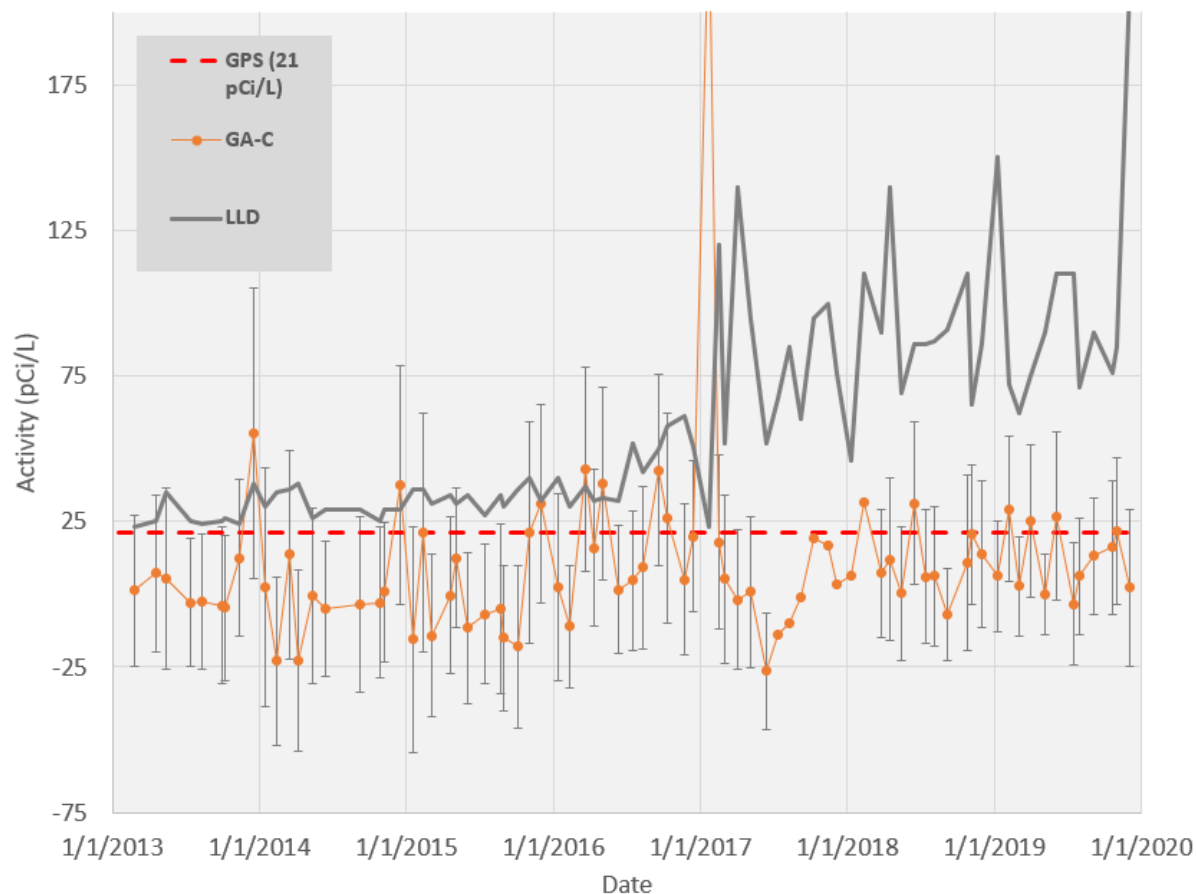


**Figure B.1.** Uncertainties for GA measurements are significant. The Lower LLD is less than or equal to the Dakota GPS of 56 picoCuries per liter (pCi/L). Most corrected GA results are below both the GPS and LLD. Exceedances are often within  $2\sigma$  of the GPS. Uncertainties are typically between 70-100 pCi/L. Note that 36-06 KD has been monitored since 1988, but LLDs and uncertainty are generally not available for data collected prior to 2009.

Note that many corrected GA values are negative; some of these are not even within  $2\sigma$  of zero.

These time series include the corrected GA activity (orange) and the LLD (grey) for each sample. The  $2\sigma$  uncertainties are shown as error bars on the corrected GA data set. Note that corrected GA is a calculated value. The LLD and uncertainties are derived from the initial, uncorrected GA measurement.

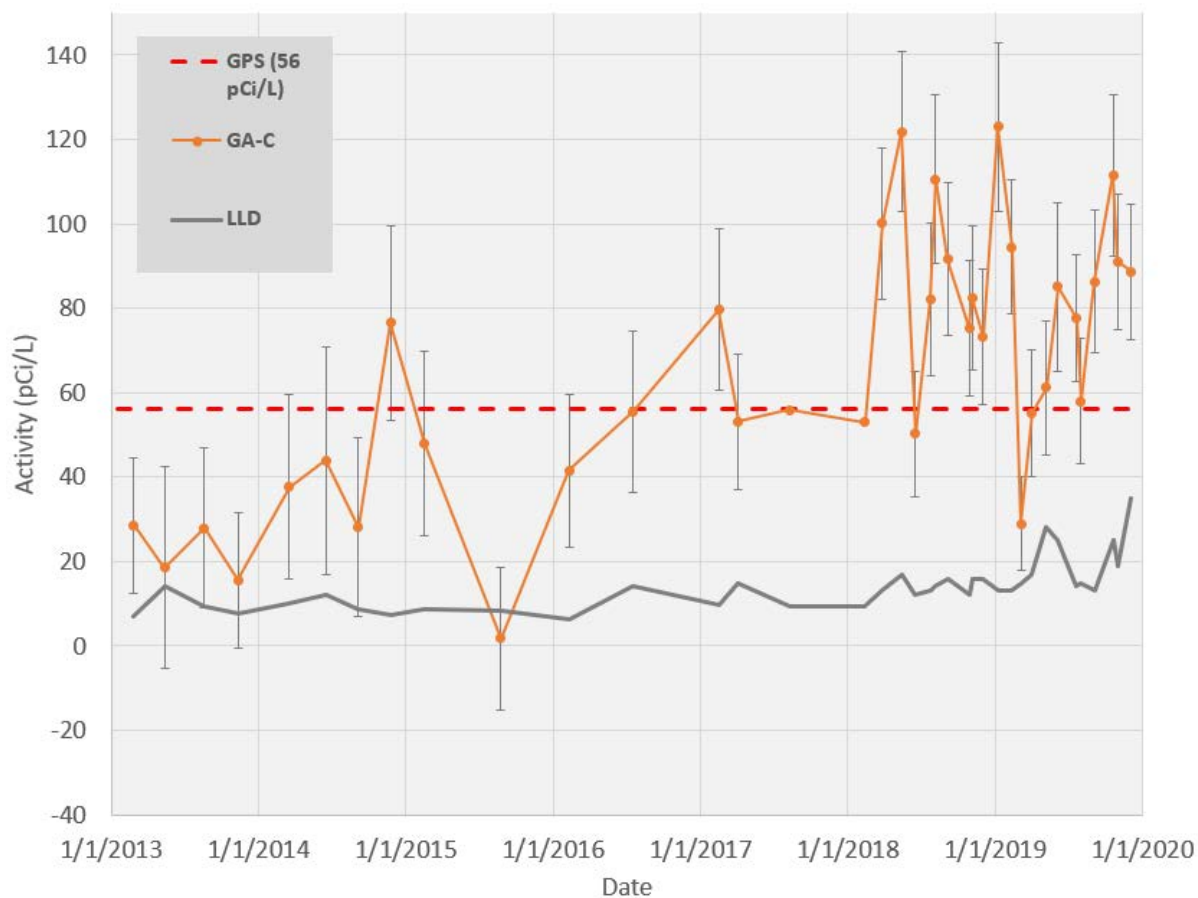
**Figure B.2. Gross Alpha Activities in  
Tres Hermanos B Monitor Well 31-02 TRB-R**



**Figure B.2.** Uncertainties for GA measurements are significant relative to the TRB GPS of 21 pCi/L. The LLD (grey) exceeds the TRB GPS for all but 4 results. Combined with the relatively larger reported uncertainties, there has never been a statistically significant detection of GA at 31-02 TRB-R. At 31-02 TRB-R, uncertainties are typically between 30-40 pCi/L. Note that the off-scale value is 237 pCi/L (January 2017).

These time series include the corrected GA activity (orange) and the LLD (grey) for each sample. The  $2\sigma$  uncertainties are shown as error bars on the corrected GA data set. Note that corrected GA is a calculated value. The LLD and uncertainties are derived from the initial, uncorrected GA measurement.

**Figure B.3. Gross Alpha Activities in  
Dakota Monitor Well 32-45 KD-R**



**Figure B.3.** Groundwater from 32-45 KD-R contains less TDS than 36-06 KD or 31-02 TRB-R. The LLD for all measurements is below the KD GPS of 56 pCi/L. Uncertainties are typically between 20-30 pCi/L.

These time series include the corrected GA activity (orange) and the LLD (grey) for each sample. The  $2\sigma$  uncertainties are shown as error bars on the corrected GA data set. Note that corrected GA is a calculated value. The LLD and uncertainties are derived from the initial, uncorrected GA measurement.

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## ATTACHMENT C

### Comparison of Gross Alpha Measurements and Combined Alpha Emitter Activities

**ATTACHMENT C**  
**Comparison of Gross Alpha Measurements and Combined Alpha Emitter Activities**

#	Station	Date Sampled	Total Dissolved Solids	Uranium (mg/L)	Gross Alpha (pCi/L)	Gross Alpha Uncertainty (2σ)	Gross Alpha LLD	Gross Alpha - Corrected (pCi/L)	Ra-226 Activity (pCi/L)	Th-230 Activity (pCi/L)	Pb-210 Activity (pCi/L)	Pb-210 Activity (alpha fraction) (pCi/L)	Combined Alpha Activity (pCi/L)	Combined V. Adjusted RPD
3	31-61 ALL	8/31/2009	11300	0.439	130	45	28	-164.13	0.76	-0.06	0.02	3.80E-10	7.60E-01	-202%
4	31-61 ALL	11/2/2009	13000	0.523	210	68	34	-140.41	1.2	-0.1	0	0.00E+00	1.20E+00	-203%
5	31-61 ALL	3/9/2010	13000	0.464	180	64	38	-130.88	0.46	0.08	0	0.00E+00	5.40E-01	-202%
6	31-61 ALL	5/4/2010	13400	0.459	150	59	38	-157.53	0.34	0	6.5	1.24E-07	3.40E-01	-201%
7	31-61 ALL	7/12/2010	13800	0.511	160	64	38	-182.37	0.66	0.04	0	0.00E+00	7.00E-01	-202%
8	31-61 ALL	11/15/2010	13800	0.507	220	70	39	-119.69	0.3	-0.06	0.49	9.31E-09	3.00E-01	-201%
9	31-61 ALL	3/1/2011	13700	0.515	190	77	41	-155.05	0.7	0.18	1.7	3.23E-08	8.80E-01	-202%
23	31-61 ALL	9/3/2014	11900	0.586	160	98	63	-232.62	0.15	0.05	-190	-3.61E-06	2.00E-01	-200%
24	31-61 ALL	11/7/2014	13300	0.606	190	92	62	-216.02	0.42	0	-3.3	-6.27E-08	4.20E-01	-201%
25	31-61 ALL	2/13/2015	14100	0.588	240	100	59	-153.96	0.19	0.05	0.32	6.08E-09	2.40E-01	-201%
26	31-61 ALL	8/7/2015	13100	0.694	110	44	25	-354.98	18	1.3	-1.2	-2.28E-08	1.93E+01	-223%
27	31-61 ALL	2/9/2016	13500	0.703	260	88	50	-211.01	0.32	0.16	-6.3	-1.20E-07	4.80E-01	-201%
28	31-61 ALL	7/28/2016	13800	0.642	210	93	87	-220.14	0.38	0.28	52	9.88E-07	6.60E-01	-201%
29	31-61 ALL	2/17/2017	13600	0.692	320	100	160	-143.64	0.2	-0.17	-4	-7.60E-08	2.00E-01	-201%
32	31-61 ALL	8/8/2018	14100	0.646	190	89	180	-242.82	0.39	-0.19	0.51	9.69E-09	3.90E-01	-201%
33	31-61 ALL	2/27/2019	13900	0.735	340	88	150	-152.45	0.37	-0.06	4.1	7.79E-08	3.70E-01	-201%
34	31-61 ALL	7/29/2019	13900	0.668	390	110	180	-57.56	0.55	0.09	5.5	1.05E-07	6.40E-01	-204%
37	31-65 ALL	8/31/2009	10100	0.112	53	36	30	-22.04	0.43	-0.02	0.46	8.74E-09	4.30E-01	-208%
38	31-65 ALL	11/2/2009	10400	0.126	-14	30	30	-98.42	0.52	0.12	0	0.00E+00	6.40E-01	-203%
39	31-65 ALL	3/9/2010	10800	0.114	56	35	32	-20.38	0.33	-0.01	0	0.00E+00	3.30E-01	-207%
40	31-65 ALL	5/4/2010	11400	0.111	67	42	33	-7.37	0.44	-0.29	5.5	1.05E-07	4.40E-01	-225%
41	31-65 ALL	7/12/2010	11900	0.129	44	36	33	-42.43	0.77	0.31	0	0.00E+00	1.08E+00	-210%
42	31-65 ALL	11/15/2010	12100	0.119	69	45	37	-10.73	0.46	0.06	1.2	2.28E-08	5.20E-01	-220%
43	31-65 ALL	3/1/2011	12600	0.102	35	49	40	-33.34	0.56	0.9	4.5	8.55E-08	1.46E+00	-218%
57	31-65 ALL	9/3/2014	13300	0.101	39	73	70	-28.67	0.27	-15	-13	-2.47E-07	2.70E-01	-204%
58	31-65 ALL	11/7/2014	14100	0.102	100	73	58	31.66	1.4	0.13	-2.1	-3.99E-08	1.53E+00	-182%
59	31-65 ALL	2/11/2015	14000	0.094	17	79	75	-45.98	0.33	0.24	-1.1	-2.09E-08	5.70E-01	-205%
60	31-65 ALL	8/24/2015	14200	0.101	-28	64	74	-95.67	0.67	2.2	-1.4	-2.66E-08	2.87E+00	-212%



**ATTACHMENT C**  
**Comparison of Gross Alpha Measurements and Combined Alpha Emitter Activities**

#	Station	Date Sampled	Total Dissolved Solids	Uranium (mg/L)	Gross Alpha (pCi/L)	Gross Alpha Uncertainty (2σ)	Gross Alpha LLD	Gross Alpha - Corrected (pCi/L)	Ra-226 Activity (pCi/L)	Th-230 Activity (pCi/L)	Pb-210 Activity (pCi/L)	Pb-210 Activity (alpha fraction) (pCi/L)	Combined Alpha Activity (pCi/L)	Combined V. Adjusted RPD
61	31-65 ALL	2/10/2016	14600	0.098	23	55	60	-42.66	0.34	-0.06	-5.3	-1.01E-07	3.40E-01	-203%
62	31-65 ALL	7/28/2016	15700	0.086	5.5	59	170	-52.12	0.11	0.14	-17	-3.23E-07	2.50E-01	-202%
64	31-65 ALL	3/2/2017	-	-	47	59	280	47	1.5	1.3	-6.6	-1.25E-07	2.80E+00	-178%
67	31-65 ALL	8/10/2018	15500	0.077	33	60	220	-18.59	0.27	-0.02	8.3	1.58E-07	2.70E-01	-206%
68	31-65 ALL	2/12/2019	15100	0.095	33	35	110	-30.65	0.39	0.36	3.5	6.65E-08	7.50E-01	-210%
69	31-65 ALL	7/24/2019	15100	0.083	69	52	140	13.39	0.38	0.33	16	3.04E-07	7.10E-01	-180%
72	32-59 ALL	8/18/2009	4140	0.147	63	20	11	-35.49	0.09	-0.15	2.8	5.32E-08	9.00E-02	-201%
73	32-59 ALL	11/2/2009	4220	0.16	59	20	9.9	-48.2	0.19	-0.01	0	0.00E+00	1.90E-01	-202%
74	32-59 ALL	3/9/2010	4080	0.148	53	20	12	-46.16	0.08	-0.36	1.3	2.47E-08	8.00E-02	-201%
75	32-59 ALL	5/4/2010	4200	0.15	75	23	12	-25.5	0.13	-0.05	4.3	8.17E-08	1.30E-01	-202%
76	32-59 ALL	7/12/2010	4290	0.172	84	25	11	-31.24	0.2	-0.12	1.2	2.28E-08	2.00E-01	-203%
77	32-59 ALL	11/15/2010	4830	0.174	110	31	15	-6.58	0.09	-0.36	4.6	8.74E-08	9.00E-02	-206%
78	32-59 ALL	3/1/2011	4610	0.157	94	33	17	-11.19	0.24	0.07	5	9.50E-08	3.10E-01	-211%
79	32-59 ALL	6/6/2011	4670	0.1435	110	31	15	13.855	-0.02	-0.45	0.74	1.41E-08	1.41E-08	-200%
92	32-59 ALL	9/3/2014	4240	0.1959	89	34	18	-42.253	0.17	0.19	-3.8	-7.22E-08	3.60E-01	-203%
93	32-59 ALL	12/10/2014	4650	0.1502	93	31	15	-7.634	0.09	2.1	-0.64	-1.22E-08	2.19E+00	-361%
94	32-59 ALL	2/10/2015	4660	0.1437	61	30	19	-35.279	0.22	0.1	-0.96	-1.82E-08	3.20E-01	-204%
95	32-59 ALL	9/1/2015	4440	0.175	79	37	23	-38.25	0.23	-0.19	-1.4	-2.66E-08	2.30E-01	-202%
96	32-59 ALL	2/9/2016	4800	0.1998	85	33	20	-48.866	0.14	-0.11	-1.9	-3.61E-08	1.40E-01	-201%
97	32-59 ALL	7/28/2016	4910	0.1706	84	29	47	-30.302	0.1	-0.24	2.8	5.32E-08	1.00E-01	-201%
98	32-59 ALL	2/21/2017	4690	0.152	54	23	45	-47.84	0.39	-0.43	-2	-3.80E-08	3.90E-01	-203%
101	32-59 ALL	8/8/2018	4530	0.21	84	26	50	-56.7	0.13	-0.22	0.48	9.12E-09	1.30E-01	-201%
108	5-03 ALL-R	9/3/2014	4110	0.0911	40	26	18	-21.037	0.18	0.42	2.4	4.56E-08	6.00E-01	-212%
109	5-03 ALL-R	11/6/2014	4390	0.0935	64	27	18	1.355	0.43	0.07	-0.36	-6.84E-09	5.00E-01	-92%
110	5-03 ALL-R	2/10/2015	4200	0.0874	51	24	16	-7.558	0.33	-0.35	-0.69	-1.31E-08	3.30E-01	-218%
111	5-03 ALL-R	8/21/2015	4270	0.0949	37	21	15	-26.583	0.22	0.31	-2.5	-4.75E-08	5.30E-01	-208%
112	5-03 ALL-R	2/8/2016	4340	0.101	66	33	24	-1.67	0.35	-0.13	1.4	2.66E-08	3.50E-01	-306%
113	5-03 ALL-R	7/28/2016	4490	0.1019	47	22	29	-21.273	0.31	-0.14	53	1.01E-06	3.10E-01	-206%

**ATTACHMENT C**

**Comparison of Gross Alpha Measurements and Combined Alpha Emitter Activities**

#	Station	Date Sampled	Total Dissolved Solids	Uranium (mg/L)	Gross Alpha (pCi/L)	Gross Alpha Uncertainty (2σ)	Gross Alpha LLD	Gross Alpha - Corrected (pCi/L)	Ra-226 Activity (pCi/L)	Th-230 Activity (pCi/L)	Pb-210 Activity (pCi/L)	Pb-210 Activity (alpha fraction) (pCi/L)	Combined Alpha Activity (pCi/L)	Combined V. Adjusted RPD
114	5-03 ALL-R	2/21/2017	4340	0.103	43	21	32	-26.01	0.23	-0.23	-4.9	-9.31E-08	2.30E-01	-204%
117	5-03 ALL-R	8/7/2018	4430	0.0926	42	22	42	-20.042	0.36	-0.35	1	1.90E-08	3.60E-01	-207%
118	5-03 ALL-R	2/28/2019	4400	0.0784	17	4.9	8.8	-35.528	0.15	0.14	2.4	4.56E-08	2.90E-01	-203%
119	5-03 ALL-R	7/26/2019	4540	0.107	66	22	44	-5.69	0.31	0.21	6.6	1.25E-07	5.20E-01	-240%
122	5-04 ALL	8/17/2009	4590	0.0011	39	21	14	38.263	0.33	0.28	2.9	5.51E-08	6.10E-01	-194%
123	5-04 ALL	11/2/2009	4530	0.0012	3.2	13	15	2.396	0.55	0.06	1.5	2.85E-08	6.10E-01	-119%
124	5-04 ALL	3/9/2010	4550	0.0012	-2.1	11	15	-2.904	0.44	-0.07	0	0.00E+00	4.40E-01	-271%
125	5-04 ALL	5/4/2010	4530	0.11	11	16	15	-62.7	0.58	0.01	5.9	1.12E-07	5.90E-01	-204%
126	5-04 ALL	7/12/2010	5520	0.0083	-1.4	11	16	-6.961	0.52	-0.17	0	0.00E+00	5.20E-01	-232%
127	5-04 ALL	11/15/2010	5140	0.003	19	15	15	16.99	0.5	0.05	1.4	2.66E-08	5.50E-01	-187%
128	5-04 ALL	2/28/2011	5110	0.0142	46	30	22	36.486	5.6	-0.26	2.4	4.56E-08	5.60E+00	-147%
129	5-04 ALL	6/6/2011	5130	0.0059	28	19	16	24.047	1	0.34	4.8	9.12E-08	1.34E+00	-179%
142	5-04 ALL	9/2/2014	5100	0.0005	-8.2	19	24	-8.535	0.52	0.14	-19	-3.61E-07	6.60E-01	-234%
143	5-04 ALL	11/25/2014	5240	0.0005	83	35	21	82.665	0.48	0.14	-1.5	-2.85E-08	6.20E-01	-197%
144	5-04 ALL	2/10/2015	5180	0.0009	-5	22	25	-5.603	0.71	0.17	-3.5	-6.65E-08	8.80E-01	-275%
145	5-04 ALL	8/21/2015	4990	0.0005	-19	12	21	-19.335	0.37	-1.8	-0.15	-2.85E-09	3.70E-01	-208%
146	5-04 ALL	2/8/2016	5420	0.0005	-9.2	11	25	-9.535	0.52	0	-4	-7.60E-08	5.20E-01	-223%
147	5-04 ALL	7/27/2016	5120	0.0005	-16	14	43	-16.335	0.35	-0.02	-1.7	-3.23E-08	3.50E-01	-209%
148	5-04 ALL	2/23/2017	4960	0.0005	-10	11	71	-10.335	0.71	-0.12	-7.2	-1.37E-07	7.10E-01	-230%
150	5-04 ALL	2/26/2018	4690	0.0005	-1.6	12	51	-1.935	0.46	0.13	4.5	8.55E-08	5.90E-01	-375%
151	5-04 ALL	8/7/2018	5440	0.0005	1.9	13	63	1.565	0.53	-0.08	2.2	4.18E-08	5.30E-01	-99%
152	5-04 ALL	3/5/2019	5340	0.0005	5.3	10	55	4.965	0.67	0.21	-1.7	-3.23E-08	8.80E-01	-140%
153	5-04 ALL	7/29/2019	5360	0.0005	-7.2	7.7	45	-7.535	0.55	0.13	3.2	6.08E-08	6.80E-01	-240%
160	5-08 ALL-R	9/2/2014	3760	0.0233	10	15	12	-5.611	0.1	0.01	-7.4	-1.41E-07	1.10E-01	-208%
161	5-08 ALL-R	11/5/2014	3830	0.0226	17	14	12	1.858	0.45	-0.07	0.2	3.80E-09	4.50E-01	-122%
162	5-08 ALL-R	2/10/2015	3770	0.0203	7.6	17	14	-6.001	0.24	0.22	-1	-1.90E-08	4.60E-01	-233%
163	5-08 ALL-R	8/21/2015	3880	0.0233	4.9	14	15	-10.711	0.33	-0.4	-0.95	-1.81E-08	3.30E-01	-213%
164	5-08 ALL-R	2/8/2016	3920	0.0244	32	20	18	15.652	0.14	-0.06	-8.2	-1.56E-07	1.40E-01	-196%

**ATTACHMENT C**

**Comparison of Gross Alpha Measurements and Combined Alpha Emitter Activities**

#	Station	Date Sampled	Total Dissolved Solids	Uranium (mg/L)	Gross Alpha (pCi/L)	Gross Alpha Uncertainty (2σ)	Gross Alpha LLD	Gross Alpha - Corrected (pCi/L)	Ra-226 Activity (pCi/L)	Th-230 Activity (pCi/L)	Pb-210 Activity (pCi/L)	Pb-210 Activity (alpha fraction) (pCi/L)	Combined Alpha Activity (pCi/L)	Combined V. Adjusted RPD
165	5-08 ALL-R	7/27/2016	3880	0.0249	5.9	13	18	-10.783	0.15	0.32	1.7	3.23E-08	4.70E-01	-218%
166	5-08 ALL-R	2/22/2017	3800	0.0216	5.5	12	35	-8.972	0.35	-0.2	-6.5	-1.24E-07	3.50E-01	-216%
168	5-08 ALL-R	2/26/2018	3760	0.0242	25	13	32	8.786	0.3	0.24	3.5	6.65E-08	5.40E-01	-177%
169	5-08 ALL-R	8/7/2018	3810	0.0235	2.5	8.2	34	-13.245	0.27	0.17	2.2	4.18E-08	4.40E-01	-214%
170	5-08 ALL-R	3/5/2019	3810	0.0238	12	9.4	33	-3.946	0.35	-0.24	0.06	1.14E-09	3.50E-01	-239%
171	5-08 ALL-R	7/25/2019	3730	0.0258	27	13	33	9.714	0.53	-0.02	5.7	1.08E-07	5.30E-01	-179%
178	5-73 ALL-R	9/4/2014	5340	1.04	330	76	29	-366.8	0.16	-0.92	-0.12	-2.28E-09	1.60E-01	-200%
179	5-73 ALL-R	11/5/2014	5800	1.12	420	82	28	-330.4	1.4	0.2	-0.71	-1.35E-08	1.60E+00	-202%
180	5-73 ALL-R	2/10/2015	6100	1.28	210	62	29	-647.6	1	-0.24	-1.6	-3.04E-08	1.00E+00	-201%
181	5-73 ALL-R	8/21/2015	6070	1.24	300	72	29	-530.8	0.31	0.2	1.4	2.66E-08	5.10E-01	-200%
182	5-73 ALL-R	8/21/2015	5780	1.25	160	54	28	-677.5	0.1	-0.26	-1.7	-3.23E-08	1.00E-01	-200%
183	5-73 ALL-R	2/8/2016	5710	1.3	770	120	33	-101	0.07	0.12	-1.6	-3.04E-08	1.90E-01	-201%
184	5-73 ALL-R	7/28/2016	5720	1.23	510	77	40	-314.1	0.16	0.29	56	1.06E-06	4.50E-01	-201%
185	5-73 ALL-R	2/22/2017	5570	1.17	360	60	34	-423.9	0.34	-0.04	-9.8	-1.86E-07	3.40E-01	-200%
187	5-73 ALL-R	2/26/2018	5820	1.33	680	83	36	-211.1	0.2	-0.5	4.3	8.17E-08	2.00E-01	-200%
188	5-73 ALL-R	8/7/2018	6510	1.64	710	100	170	-388.8	0.26	-0.76	3	5.70E-08	2.60E-01	-200%
189	5-73 ALL-R	3/7/2019	6500	1.76	730	94	82	-449.2	0.23	-0.02	3.4	6.46E-08	2.30E-01	-200%
190	5-73 ALL-R	7/29/2019	6650	1.92	630	90	87	-656.4	0.28	0.03	1	1.90E-08	3.10E-01	-200%
193	17-01 KD	9/28/2009	1160	0.0001	1.7	2.9	3.2	1.633	0.23	0.15	0.83	1.58E-08	3.80E-01	-124%
194	17-01 KD	11/10/2009	1130	0.0003	1.3	2.8	2.4	1.099	0.05	0.21	0	0.00E+00	2.60E-01	-123%
195	17-01 KD	3/16/2010	1120	0.0011	0.83	2.4	2.9	0.093	0.13	-0.04	0	0.00E+00	1.30E-01	33%
196	17-01 KD	9/28/2010	1100	0.0007	0	2.7	2.9	-0.469	0.69	-0.3	0	0.00E+00	6.90E-01	1049%
197	17-01 KD	11/8/2010	1080	0.0001	6.6	10	9.4	6.533	0.46	0.03	2.2	4.18E-08	4.90E-01	-172%
198	17-01 KD	3/1/2011	1100	0.0003	0.61	3.5	3	0.409	0.49	-0.45	0	0.00E+00	4.90E-01	18%
199	17-01 KD	6/20/2011	1090	0.003	0	3.1	3.5	-2.01	0.76	-0.24	1.2	2.28E-08	7.60E-01	-443%
200	17-01 KD	9/27/2011	1080	0.0003	0	3.2	3.1	-0.201	0.61	0.05	1.6	3.04E-08	6.60E-01	375%
201	17-01 KD	11/7/2011	1070	0.003	2	3.3	2.7	-0.01	1	-0.05	0.74	1.41E-08	1.00E+00	204%
202	17-01 KD	2/27/2012	1060	0.0002	3.9	3.9	3	3.766	0.4	0.06	3.5	6.65E-08	4.60E-01	-156%

**ATTACHMENT C**

**Comparison of Gross Alpha Measurements and Combined Alpha Emitter Activities**

#	Station	Date Sampled	Total Dissolved Solids	Uranium (mg/L)	Gross Alpha (pCi/L)	Gross Alpha Uncertainty (2σ)	Gross Alpha LLD	Gross Alpha - Corrected (pCi/L)	Ra-226 Activity (pCi/L)	Th-230 Activity (pCi/L)	Pb-210 Activity (pCi/L)	Pb-210 Activity (alpha fraction) (pCi/L)	Combined Alpha Activity (pCi/L)	Combined V. Adjusted RPD
203	17-01 KD	5/7/2012	1100	0.0003	5.5	3.4	3.3	5.299	0.56	0.3	2.6	4.94E-08	8.60E-01	-144%
204	17-01 KD	8/13/2012	1090	0.003	9.4	4.2	3	7.39	0.48	0.28	3	5.70E-08	7.60E-01	-163%
205	17-01 KD	11/6/2012	1050	0.003	9.7	4.3	2.9	7.69	0.93	0.07	6.6	1.25E-07	1.00E+00	-154%
206	17-01 KD	8/6/2013	1100	0.003	0	3.4	3.5	-2.01	0.53	-2.1	-3.5	-6.65E-08	5.30E-01	-343%
207	17-01 KD	11/12/2013	1040	0.001	2.8	3.5	2.8	2.13	0.94	0.03	-5.8	-1.10E-07	9.70E-01	-75%
208	17-01 KD	3/18/2014	1070	0.0018	0.64	4.3	3.9	-0.566	1.6	0.11	1.2	2.28E-08	1.71E+00	398%
209	17-01 KD	6/10/2014	1070	0.0012	1.7	4	3.3	0.896	1	0.13	1.5	2.85E-08	1.13E+00	23%
210	17-01 KD	9/23/2014	820	0.0001	-2	2.5	3.4	-2.067	0.22	0.04	0	0.00E+00	2.60E-01	-258%
211	17-01 KD	12/16/2014	1040	0.0001	0	3.1	3.1	-0.067	0.43	0.12	0.91	1.73E-08	5.50E-01	255%
212	17-01 KD	2/17/2015	1110	0.0001	0.2	4	3.8	0.133	1.4	0.16	-0.75	-1.43E-08	1.56E+00	169%
213	17-01 KD	8/12/2015	900	0.0001	4.3	3.8	3	4.233	0.57	0.08	-0.12	-2.28E-09	6.50E-01	-147%
214	17-01 KD	2/16/2016	1010	0.0001	9.6	4.9	3.9	9.533	0.8	0.07	-1.4	-2.66E-08	8.70E-01	-167%
215	17-01 KD	7/26/2016	1080	0.0001	0	3	7.9	-0.067	0.59	-0.09	2.6	4.94E-08	5.90E-01	251%
216	17-01 KD	2/23/2017	1130	0.0001	3.8	3.7	13	3.733	0.8	-0.08	4.8	9.12E-08	8.00E-01	-129%
218	17-01 KD	2/28/2018	1060	0.0001	4.2	3.5	8.7	4.133	0.57	-1.3	4.9	9.31E-08	5.70E-01	-152%
219	17-01 KD	8/21/2018	1110	0.0001	-0.15	2.3	9.4	-0.217	0.88	0.05	1.2	2.28E-08	9.30E-01	322%
220	17-01 KD	3/1/2019	1050	0.0001	4.2	2.6	8.7	4.133	1.3	-0.06	3.6	6.84E-08	1.30E+00	-104%
221	17-01 KD	7/24/2019	1130	0.0001	0.58	1.6	9.1	0.513	0.86	-0.03	4.8	9.12E-08	8.60E-01	51%
224	30-02 KD	8/18/2009	6030	0.0019	0	18	21	-1.273	1.2	0.11	2.5	4.75E-08	1.31E+00	13962%
225	30-02 KD	11/3/2009	6050	0.004	0	21	22	-2.68	1.3	-0.29	0	0.00E+00	1.30E+00	-577%
226	30-02 KD	3/8/2010	5580	0.0029	3.1	20	23	1.157	1	0.2	2.2	4.18E-08	1.20E+00	4%
227	30-02 KD	7/20/2010	5640	0.0005	-12	21	22	-12.335	0.86	-0.11	2.2	4.18E-08	8.60E-01	-230%
228	30-02 KD	11/16/2010	6160	0.0005	19	23	23	18.665	1.3	0.03	0	0.00E+00	1.33E+00	-173%
229	30-02 KD	3/8/2011	6220	0.0018	-0.98	19	22	-2.186	0.94	-0.41	2.1	3.99E-08	9.40E-01	-502%
230	30-02 KD	6/20/2011	5920	0.0015	25	28	24	23.995	1.6	2.1	0	0.00E+00	3.70E+00	-147%
231	30-02 KD	9/26/2011	6070	0.0013	0	26	26	-0.871	1.1	0.02	0	0.00E+00	1.12E+00	1599%
232	30-02 KD	2/21/2012	6060	0.0007	28	25	24	27.531	0.94	0.18	0	0.00E+00	1.12E+00	-184%
233	30-02 KD	5/29/2012	6210	0.0109	30	27	26	22.697	2.1	-0.34	0.15	2.85E-09	2.10E+00	-166%

**ATTACHMENT C**  
**Comparison of Gross Alpha Measurements and Combined Alpha Emitter Activities**

#	Station	Date Sampled	Total Dissolved Solids	Uranium (mg/L)	Gross Alpha (pCi/L)	Gross Alpha Uncertainty (2σ)	Gross Alpha LLD	Gross Alpha - Corrected (pCi/L)	Ra-226 Activity (pCi/L)	Th-230 Activity (pCi/L)	Pb-210 Activity (pCi/L)	Pb-210 Activity (alpha fraction) (pCi/L)	Combined Alpha Activity (pCi/L)	Combined V. Adjusted RPD
234	30-02 KD	12/11/2014	3980	0.0017	0	17	17	-1.139	0.69	-0.14	2.7	5.13E-08	6.90E-01	-815%
235	30-48 KD-R	3/5/2013	4420	0.0048	5.1	14	12	1.884	3.2	0.45	-5.5	-1.05E-07	3.65E+00	64%
236	30-48 KD-R	5/20/2013	4370	0.0013	8.2	13	13	7.329	3.4	-0.22	-110	-2.09E-06	3.40E+00	-73%
237	30-48 KD-R	8/20/2013	4110	0.0009	6.8	16	15	6.197	2.8	0.42	-6.5	-1.24E-07	3.22E+00	-63%
238	30-48 KD-R	11/12/2013	4510	0.0018	0	13	12	-1.206	2.8	19	-5.9	-1.12E-07	2.18E+01	223%
239	30-48 KD-R	3/18/2014	4320	0.0042	-4.8	17	20	-7.614	2.3	-0.43	0.8	1.52E-08	2.30E+00	-373%
240	30-48 KD-R	6/17/2014	4420	0.0011	-16	18	24	-16.737	2.4	-0.05	-10	-1.90E-07	2.40E+00	-267%
241	30-48 KD-R	9/25/2014	4250	0.0005	7.4	18	19	7.065	2.7	0.24	-47	-8.93E-07	2.94E+00	-82%
242	30-48 KD-R	11/5/2014	4250	0.0005	29	23	19	28.665	3.3	0.03	0.76	1.44E-08	3.33E+00	-158%
243	30-48 KD-R	2/17/2015	4350	0.0005	3	19	19	2.665	3.1	0.12	0.05	9.50E-10	3.22E+00	19%
244	30-48 KD-R	8/24/2015	4330	0.0005	-0.85	21	22	-1.185	1.9	1.2	-0.35	-6.65E-09	3.10E+00	448%
245	30-48 KD-R	2/18/2016	4170	0.0005	24	19	18	23.665	2.5	-0.25	15	2.85E-07	2.50E+00	-162%
246	30-48 KD-R	7/26/2016	4350	0.0005	6.8	16	34	6.465	2.3	-0.04	2.1	3.99E-08	2.30E+00	-95%
247	30-48 KD-R	2/22/2017	4260	0.0005	2.3	12	40	1.965	2.7	0.22	-2.1	-3.99E-08	2.92E+00	39%
250	30-48 KD-R	8/17/2018	4250	0.0005	-5	7	41	-5.335	2.7	0	3.4	6.46E-08	2.70E+00	-610%
251	30-48 KD-R	2/26/2019	4180	0.0002	19	12	30	18.866	2.1	0.04	0.78	1.48E-08	2.14E+00	-159%
252	30-48 KD-R	7/25/2019	4200	0.0005	4.3	8.2	41	3.965	3	0.35	3.3	6.27E-08	3.35E+00	-17%
253	32-45 KD-R	2/26/2013	2450	0.0395	55	16	7.1	28.535	2.7	1.2	-0.11	-2.09E-09	3.90E+00	-152%
254	32-45 KD-R	5/14/2013	2920	0.0439	48	24	14	18.587	3.1	6.8	-63	-1.20E-06	9.90E+00	-61%
255	32-45 KD-R	8/19/2013	3100	0.0494	61	19	9.5	27.902	110	-0.08	-8.8	-1.67E-07	1.10E+02	119%
256	32-45 KD-R	11/12/2013	2890	0.0498	49	16	7.7	15.634	1.9	0.35	-0.6	-1.14E-08	2.25E+00	-150%
257	32-45 KD-R	3/18/2014	2630	0.0452	68	22	10	37.716	1.4	0.12	0.32	6.08E-09	1.52E+00	-185%
258	32-45 KD-R	6/17/2014	2350	0.0836	100	27	12	43.988	1.2	0.19	-9.8	-1.86E-07	1.39E+00	-188%
259	32-45 KD-R	9/5/2014	2440	0.0699	75	21	8.6	28.167	2.3	0.35	-0.2	-3.80E-09	2.65E+00	-166%
260	32-45 KD-R	11/24/2014	2330	0.0649	120	23	7.4	76.517	2.6	-0.05	2.7	5.13E-08	2.60E+00	-187%
261	32-45 KD-R	2/17/2015	2260	0.0687	94	22	8.8	47.971	2.4	-0.06	-1.4	-2.66E-08	2.40E+00	-181%
262	32-45 KD-R	8/24/2015	2090	0.0795	55	17	8.3	1.735	1	0.08	-0.94	-1.79E-08	1.08E+00	-47%
263	32-45 KD-R	2/11/2016	1900	0.0783	94	18	6.3	41.539	1	0.16	-5.8	-1.10E-07	1.16E+00	-189%

**ATTACHMENT C**

**Comparison of Gross Alpha Measurements and Combined Alpha Emitter Activities**

#	Station	Date Sampled	Total Dissolved Solids	Uranium (mg/L)	Gross Alpha (pCi/L)	Gross Alpha Uncertainty (2σ)	Gross Alpha LLD	Gross Alpha - Corrected (pCi/L)	Ra-226 Activity (pCi/L)	Th-230 Activity (pCi/L)	Pb-210 Activity (pCi/L)	Pb-210 Activity (alpha fraction) (pCi/L)	Combined Alpha Activity (pCi/L)	Combined V. Adjusted RPD
264	32-45 KD-R	7/18/2016	1810	0.0813	110	19	14	55.529	1.1	2.4	-2	-3.80E-08	3.50E+00	-176%
265	32-45 KD-R	2/15/2017	1700	0.0751	130	19	9.6	79.683	1.2	0.04	-5.3	-1.01E-07	1.24E+00	-194%
273	32-45 KD-R	8/6/2018	1490	0.0588	150	20	14	110.604	1.1	-0.05	2.1	3.99E-08	1.10E+00	-196%
279	32-45 KD-R	2/11/2019	1480	0.0529	130	16	13	94.557	2.2	0.17	0.98	1.86E-08	2.37E+00	-190%
284	32-45 KD-R	7/22/2019	1460	0.0484	110	15	14	77.572	1.4	0.02	6.4	1.22E-07	1.42E+00	-193%
290	36-06 KD	1/5/2009	8850	1.05	480	73	20	-223.5	12	37	0.67	1.27E-08	4.90E+01	-312%
293	36-06 KD	8/4/2009	8750	0.971	520	75	20	-130.57	12	37	0	0.00E+00	4.90E+01	-440%
294	36-06 KD	11/9/2009	8870	0.976	610	81	20	-43.92	9.8	34	0.04	7.60E-10	4.38E+01	-146200%
295	36-06 KD	3/1/2010	8390	0.918	640	87	22	24.94	12	37	0	0.00E+00	4.90E+01	65%
296	36-06 KD	5/11/2010	7770	0.808	450	75	23	-91.36	13	28	1.6	3.04E-08	4.10E+01	-526%
297	36-06 KD	7/19/2010	7580	0.671	430	60	15	-19.57	18	63	0	0.00E+00	8.10E+01	327%
298	36-06 KD	11/8/2010	7600	0.608	480	75	22	72.64	10	39	4.5	8.55E-08	4.90E+01	-39%
301	36-06 KD	3/7/2011	7440	0.6745	480	78	23	28.085	10	28	3.5	6.65E-08	3.80E+01	30%
304	36-06 KD	6/13/2011	7900	0.6955	430	71	22	-35.985	14	29	0	0.00E+00	4.30E+01	2252%
307	36-06 KD	9/26/2011	7400	0.7635	420	75	24	-91.545	13	45	0	0.00E+00	5.80E+01	-892%
309	36-06 KD	11/8/2011	7850	0.8135	510	86	26	-35.045	18	170	3.7	7.03E-08	1.88E+02	292%
312	36-06 KD	2/20/2012	7700	0.6135	590	87	23	178.955	10	23	0	0.00E+00	3.30E+01	-138%
315	36-06 KD	5/8/2012	8070	0.735	700	98	26	207.55	12	48	0	0.00E+00	6.00E+01	-110%
318	36-06 KD	8/7/2012	7640	0.6085	540	84	25	132.305	8.3	23	2.8	5.32E-08	3.13E+01	-123%
323	36-06 KD	8/12/2013	6170	0.3746	240	48	17	-10.982	8.4	9.3	-6.7	-1.27E-07	1.77E+01	854%
326	36-06 KD	11/11/2013	7800	0.691	470	76	22	7.03	10	15	27	5.13E-07	2.50E+01	112%
330	36-06 KD	3/17/2014	8210	0.687	400	93	36	-60.29	9.3	25	0.19	3.61E-09	3.43E+01	-728%
333	36-06 KD	6/10/2014	7270	0.738	550	87	25	55.54	9.2	29	-5.6	-1.06E-07	3.82E+01	-37%
335	36-06 KD	9/24/2014	8540	0.7945	410	91	36	-122.315	10	25	-170	-3.23E-06	3.50E+01	-360%
337	36-06 KD	11/6/2014	8480	0.6584	510	96	33	68.872	15	13	0.02	3.80E-10	2.80E+01	-84%
340	36-06 KD	2/11/2015	8770	0.7454	460	100	37	-39.418	12	30	0.57	1.08E-08	4.20E+01	6307%
346	36-06 KD	8/26/2015	8240	0.7405	430	90	33	-66.135	11	13	-4.1	-7.79E-08	2.40E+01	-428%
352	36-06 KD	2/11/2016	8340	0.773	500	88	29	-17.91	16	11	2.2	4.18E-08	2.70E+01	988%

**ATTACHMENT C**  
**Comparison of Gross Alpha Measurements and Combined Alpha Emitter Activities**

#	Station	Date Sampled	Total Dissolved Solids	Uranium (mg/L)	Gross Alpha (pCi/L)	Gross Alpha Uncertainty (2σ)	Gross Alpha LLD	Gross Alpha - Corrected (pCi/L)	Ra-226 Activity (pCi/L)	Th-230 Activity (pCi/L)	Pb-210 Activity (pCi/L)	Pb-210 Activity (alpha fraction) (pCi/L)	Combined Alpha Activity (pCi/L)	Combined V. Adjusted RPD
357	36-06 KD	7/18/2016	7710	0.9195	650	95	91	33.935	19	84	48	9.12E-07	1.03E+02	101%
364	36-06 KD	2/15/2017	6560	0.62	600	76	57	184.6	17	21	2.8	5.32E-08	3.80E+01	-132%
382	36-06 KD	8/6/2018	6050	0.463	220	48	65	-90.21	11	21	6.2	1.18E-07	3.20E+01	-420%
388	36-06 KD	2/7/2019	5460	0.353	170	37	53	-66.51	7.6	10	2.8	5.32E-08	1.76E+01	-344%
393	36-06 KD	7/22/2019	5980	0.415	410	55	51	131.95	14	10	8.7	1.65E-07	2.40E+01	-138%
400	5-02 KD	8/17/2009	390	0.0009	14	4.3	2.1	13.397	2	0.07	1.4	2.66E-08	2.07E+00	-146%
401	5-02 KD	11/9/2009	440	0.0012	9	3.9	2.2	8.196	2.2	0.04	0	0.00E+00	2.24E+00	-114%
402	5-02 KD	3/8/2010	430	0.0007	0.83	2	2.2	0.361	1	-0.18	1.7	3.23E-08	1.00E+00	94%
403	5-02 KD	7/20/2010	480	0.0002	1.3	2.1	2.1	1.166	1.3	0.09	0	0.00E+00	1.39E+00	18%
404	5-02 KD	8/14/2012	660	0.0018	6.4	3.3	2.4	5.194	0	-0.31	2.4	4.56E-08	4.56E-08	-200%
405	5-02 KD	12/10/2014	618	0.003	3.1	3.7	3.1	1.09	0.74	0.02	0.67	1.27E-08	7.60E-01	-36%
406	5-02 KD	2/18/2015	716	0.0019	0.26	5	4.6	-1.013	0.86	0.15	-3	-5.70E-08	1.01E+00	-134867%
407	5-02 KD	8/26/2015	756	0.001	-4.3	4.1	6	-4.97	0.46	0.58	-0.86	-1.63E-08	1.04E+00	-306%
408	5-02 KD	2/15/2016	792	0.0022	2.2	3.9	4.1	0.726	1.1	0.24	1.7	3.23E-08	1.34E+00	59%
411	5-02 KD	9/6/2018	836	0.0013	0.3	2.5	8.3	-0.571	0.64	-0.51	1.5	2.85E-08	6.40E-01	3510%
412	5-02 KD	3/4/2019	898	0.001	2.2	2.4	16	1.53	0.99	0.1	0.28	5.32E-09	1.09E+00	-34%
413	5-02 KD	7/30/2019	806	0.0009	0.9	2	10	0.297	0.64	0.28	-2	-3.80E-08	9.20E-01	102%
414	30-01 TRA	12/10/2014	716	0.0005	0	2.6	2.7	-0.335	0.33	0	2.8	5.32E-08	3.30E-01	-26600%
415	31-01 TRA-R	2/25/2013	2850	0.0113	21	12	7.9	13.429	0.18	0.37	-2.9	-5.51E-08	5.50E-01	-184%
416	31-01 TRA-R	5/13/2013	2620	0.0105	10	9.6	9.1	2.965	0.38	2.1	63	1.20E-06	2.48E+00	-18%
417	31-01 TRA-R	8/13/2013	2410	0.006	4.2	6.6	6.1	0.18	0.23	0.36	-2.4	-4.56E-08	5.90E-01	106%
418	31-01 TRA-R	11/11/2013	2170	0.0055	0	6.5	5.6	-3.685	0.13	0.69	-3	-5.70E-08	8.20E-01	-314%
419	31-01 TRA-R	3/17/2014	2060	0.0033	6.7	8.7	8.1	4.489	0.21	-0.04	-0.42	-7.98E-09	2.10E-01	-182%
421	31-01 TRA-R	9/24/2014	1770	0.0028	6.8	6.9	6	4.924	0.25	0.15	-120	-2.28E-06	4.00E-01	-170%
422	31-01 TRA-R	12/10/2014	1810	0.0031	12	6.8	5	9.923	0.22	0.01	0.28	5.32E-09	2.30E-01	-191%
423	31-01 TRA-R	2/18/2015	1790	0.0019	3	8	7.4	1.727	0.22	-0.21	-0.44	-8.36E-09	2.20E-01	-155%
424	31-01 TRA-R	8/26/2015	1800	0.0016	-1.5	5.2	6.1	-2.572	0.14	0.46	-1.8	-3.42E-08	6.00E-01	-322%
425	31-01 TRA-R	2/12/2016	1760	0.0012	2.3	5.2	5.7	1.496	0.28	-0.05	-5.5	-1.05E-07	2.80E-01	-137%

**ATTACHMENT C**  
**Comparison of Gross Alpha Measurements and Combined Alpha Emitter Activities**

#	Station	Date Sampled	Total Dissolved Solids	Uranium (mg/L)	Gross Alpha (pCi/L)	Gross Alpha Uncertainty (2σ)	Gross Alpha LLD	Gross Alpha - Corrected (pCi/L)	Ra-226 Activity (pCi/L)	Th-230 Activity (pCi/L)	Pb-210 Activity (pCi/L)	Pb-210 Activity (alpha fraction) (pCi/L)	Combined Alpha Activity (pCi/L)	Combined V. Adjusted RPD
426	31-01 TRA-R	7/26/2016	1710	0.0013	3.5	6.4	11	2.629	0.22	-0.4	-6.6	-1.25E-07	2.20E-01	-169%
427	31-01 TRA-R	2/16/2017	1790	0.0019	3.5	4.8	14	2.227	0.48	0.1	-3.3	-6.27E-08	5.80E-01	-117%
430	31-01 TRA-R	8/6/2018	1590	0.0008	0.6	3.4	17	0.064	0.33	0.07	1.2	2.28E-08	4.00E-01	145%
431	31-01 TRA-R	2/8/2019	1700	0.0007	0.89	3.1	17	0.421	0.38	0.1	8.8	1.67E-07	4.80E-01	13%
432	31-01 TRA-R	7/17/2019	1680	0.0007	6.6	4.9	13	6.131	0.33	-0.05	-2.8	-5.32E-08	3.30E-01	-180%
435	33-01 TRA	8/4/2009	2780	0.0035	0	6.2	6.7	-2.345	0.52	-0.21	0	0.00E+00	5.20E-01	-314%
436	33-01 TRA	11/9/2009	2740	0.0031	30	15	8.7	27.923	0.51	0.1	0	0.00E+00	6.10E-01	-191%
437	33-01 TRA	3/1/2010	2760	0.0034	4.7	7.6	6.5	2.422	0.42	-0.28	2.6	4.94E-08	4.20E-01	-141%
438	33-01 TRA	5/10/2010	2760	0.0029	4.1	7.8	7.9	2.157	1.5	0.35	0.72	1.37E-08	1.85E+00	-15%
439	33-01 TRA	7/13/2010	2790	0.0026	7.2	7.6	7.7	5.458	0.7	-0.13	1.4	2.66E-08	7.00E-01	-155%
440	33-01 TRA	11/9/2010	2760	0.0024	-5.1	6.6	7.5	-6.708	0.59	0.26	1.5	2.85E-08	8.50E-01	-258%
441	33-01 TRA	3/7/2011	2720	0.0017	-3.8	4.1	6.8	-4.939	0.78	0.23	0	0.00E+00	1.01E+00	-303%
442	33-01 TRA	6/14/2011	2760	0.0041	41	13	6.7	38.253	0.8	0.05	0	0.00E+00	8.50E-01	-191%
444	33-01 TRA	9/19/2011	2690	0.0046	1.9	9.6	7.9	-1.182	0.46	0.03	0	0.00E+00	4.90E-01	-483%
445	33-01 TRA	11/9/2011	2700	0.0063	6.2	9.3	8	1.979	0.84	0.37	1.3	2.47E-08	1.21E+00	-48%
446	33-01 TRA	2/21/2012	2720	0.0027	11	9	7.7	9.191	0.15	-0.12	0	0.00E+00	1.50E-01	-194%
447	33-01 TRA	5/8/2012	2760	0.0054	4.4	3.8	3.7	0.782	0.63	0.27	0.41	7.79E-09	9.00E-01	14%
448	33-01 TRA	8/13/2012	2740	0.004	3.2	6.2	7.5	0.52	0.44	-0.13	2.7	5.13E-08	4.40E-01	-17%
449	33-01 TRA	8/12/2013	2770	0.0021	0	5.8	7.1	-1.407	0.59	0.64	-7.7	-1.46E-07	1.23E+00	-2980%
450	33-01 TRA	11/12/2013	2740	0.002	2.1	7.2	6.5	0.76	0.82	-0.09	-1.8	-3.42E-08	8.20E-01	8%
451	33-01 TRA	3/17/2014	2730	0.0017	11	13	12	9.861	0.45	-0.18	4	7.60E-08	4.50E-01	-183%
452	33-01 TRA	6/10/2014	2720	0.0016	0	9.3	8	-1.072	0.46	0.15	-4.2	-7.98E-08	6.10E-01	-728%
453	33-01 TRA	9/18/2014	2660	0.0012	-13	11	11	-13.804	0.62	-0.03	-12	-2.28E-07	6.20E-01	-219%
454	33-01 TRA	11/6/2014	2690	0.0011	3.9	8.1	8.5	3.163	0.45	0.21	-1.2	-2.28E-08	6.60E-01	-131%
455	33-01 TRA	2/10/2015	2710	0.0009	2.1	9.4	10	1.497	0.47	0.28	1.3	2.47E-08	7.50E-01	-66%
456	33-01 TRA	8/25/2015	2700	0.0009	-5.1	7.6	9.9	-5.703	0.39	-0.18	-2	-3.80E-08	3.90E-01	-229%
457	33-01 TRA	2/9/2016	2700	0.0009	-2.4	5.5	8.5	-3.003	0.52	-0.29	-2.9	-5.51E-08	5.20E-01	-284%
458	33-01 TRA	7/25/2016	2710	0.0008	4.4	8.5	21	3.864	0.51	0.05	-2.6	-4.94E-08	5.60E-01	-149%



**ATTACHMENT C**  
**Comparison of Gross Alpha Measurements and Combined Alpha Emitter Activities**

#	Station	Date Sampled	Total Dissolved Solids	Uranium (mg/L)	Gross Alpha (pCi/L)	Gross Alpha Uncertainty (2σ)	Gross Alpha LLD	Gross Alpha - Corrected (pCi/L)	Ra-226 Activity (pCi/L)	Th-230 Activity (pCi/L)	Pb-210 Activity (pCi/L)	Pb-210 Activity (alpha fraction) (pCi/L)	Combined Alpha Activity (pCi/L)	Combined V. Adjusted RPD
459	33-01 TRA	2/24/2017	2710	0.0006	2.8	6.3	21	2.398	0.59	0.02	-3.5	-6.65E-08	6.10E-01	-119%
461	33-01 TRA	2/26/2018	2710	0.0006	3.1	7	18	2.698	0.51	-0.25	1.8	3.42E-08	5.10E-01	-136%
462	33-01 TRA	8/9/2018	2690	0.0006	6.8	7.6	22	6.398	0.63	-0.18	2	3.80E-08	6.30E-01	-164%
463	33-01 TRA	2/26/2019	2690	0.0004	3.5	4.9	24	3.232	0.85	-0.13	1.2	2.28E-08	8.50E-01	-117%
464	33-01 TRA	7/30/2019	2700	0.0006	-2.6	3.4	27	-3.002	0.8	0.01	2.2	4.18E-08	8.10E-01	-348%
467	19-77 TRB	8/4/2009	3480	0.0164	2.6	8.5	8.2	-8.388	0.46	0.14	0	0.00E+00	6.00E-01	-231%
468	19-77 TRB	11/3/2009	3510	0.0208	2.7	9.1	8.5	-11.236	0.47	0.13	0	0.00E+00	6.00E-01	-223%
469	19-77 TRB	3/8/2010	3430	0.0163	9.3	10	9.2	-1.621	0.4	-0.11	0.86	1.63E-08	4.00E-01	-331%
470	19-77 TRB	5/11/2010	3460	0.017	16	12	9.2	4.61	0.43	0.18	0	0.00E+00	6.10E-01	-153%
471	19-77 TRB	7/19/2010	3460	0.0099	10	11	9.2	3.367	0.56	-0.13	0	0.00E+00	5.60E-01	-143%
472	19-77 TRB	11/9/2010	3460	0.0113	-0.34	2.6	2.9	-7.911	1.1	-0.23	2.5	4.75E-08	1.10E+00	-265%
473	19-77 TRB	3/8/2011	3440	0.0114	0.8	8.5	9.6	-6.838	1.3	0.08	1.6	3.04E-08	1.38E+00	-301%
474	19-77 TRB	6/14/2011	3500	0.0284	27	14	9.6	7.972	0.49	0.01	0	0.00E+00	5.00E-01	-176%
475	19-77 TRB	9/19/2011	3410	0.0264	6.9	14	10	-10.788	0.33	-0.02	1.8	3.42E-08	3.30E-01	-213%
476	19-77 TRB	11/14/2011	3440	0.0175	15	13	9.7	3.275	1.2	0.2	9.4	1.79E-07	1.40E+00	-80%
477	19-77 TRB	2/21/2012	3460	0.0167	9.5	9.8	9.5	-1.689	0.37	-0.04	0	0.00E+00	3.70E-01	-312%
478	19-77 TRB	5/7/2012	3530	0.0194	36	17	11	23.002	0.91	0.48	0	0.00E+00	1.39E+00	-177%
480	19-77 TRB	8/13/2012	3510	0.0216	14	10	9.2	-0.472	0.3	-0.18	3.8	7.22E-08	3.00E-01	-898%
481	19-77 TRB	8/19/2013	3650	0.0107	16	12	9.9	8.831	2.8	2.1	-2.9	-5.51E-08	4.90E+00	-57%
482	19-77 TRB	11/11/2013	3540	0.014	17	14	11	7.62	0.65	-0.33	2.2	4.18E-08	6.50E-01	-169%
483	19-77 TRB	3/18/2014	3410	0.0099	6.2	18	17	-0.433	0.3	-0.06	3.1	5.89E-08	3.00E-01	-1102%
484	19-77 TRB	6/16/2014	3370	0.012	20	20	18	11.96	0.47	0.75	-14	-2.66E-07	1.22E+00	-163%
485	19-77 TRB	9/23/2014	3390	0.0116	15	14	12	7.228	0.53	0.53	-23	-4.37E-07	1.06E+00	-149%
486	19-77 TRB	11/6/2014	3330	0.0091	8.6	9.8	9.9	2.503	0.49	0.03	-0.24	-4.56E-09	5.20E-01	-131%
487	19-77 TRB	1/12/2015	3350	0.0065	6.7	14	12	2.345	0.37	0.17	-3.3	-6.27E-08	5.40E-01	-125%
488	19-77 TRB	2/13/2015	3290	0.0056	-16	8.4	15	-19.752	0.76	-0.49	-4.6	-8.74E-08	7.60E-01	-216%
489	19-77 TRB	8/25/2015	3330	0.0091	-0.07	13	15	-6.167	0.41	0.2	-2.5	-4.75E-08	6.10E-01	-244%
490	19-77 TRB	2/10/2016	3340	0.0088	9	13	15	3.104	0.33	0.63	-14	-2.66E-07	9.60E-01	-106%

**ATTACHMENT C**  
**Comparison of Gross Alpha Measurements and Combined Alpha Emitter Activities**

#	Station	Date Sampled	Total Dissolved Solids	Uranium (mg/L)	Gross Alpha (pCi/L)	Gross Alpha Uncertainty (2σ)	Gross Alpha LLD	Gross Alpha - Corrected (pCi/L)	Ra-226 Activity (pCi/L)	Th-230 Activity (pCi/L)	Pb-210 Activity (pCi/L)	Pb-210 Activity (alpha fraction) (pCi/L)	Combined Alpha Activity (pCi/L)	Combined V. Adjusted RPD
491	19-77 TRB	7/25/2016	3330	0.0083	-3	9.8	40	-8.561	0.29	-0.44	-3.1	-5.89E-08	2.90E-01	-214%
492	19-77 TRB	2/16/2017	3340	0.0102	7.9	11	24	1.066	0.39	-0.55	-0.93	-1.77E-08	3.90E-01	-93%
495	19-77 TRB	8/14/2018	3540	0.0117	4.4	8.2	35	-3.439	0.39	-0.14	2.5	4.75E-08	3.90E-01	-251%
496	19-77 TRB	2/26/2019	3500	0.0092	14	10	58	7.836	0.44	0.07	1.7	3.23E-08	5.10E-01	-176%
497	19-77 TRB	7/30/2019	3520	0.0124	7.3	8.5	36	-1.008	0.3	0.02	-2.5	-4.75E-08	3.20E-01	-386%
498	31-02 TRB-R	2/25/2013	6170	0.0034	3.6	26	23	1.322	2.4	0.18	-1.5	-2.85E-08	2.58E+00	64%
500	31-02 TRB-R	5/13/2013	6700	0.0044	8.3	31	35	5.352	1.8	-0.29	47	8.93E-07	1.80E+00	-99%
502	31-02 TRB-R	8/13/2013	8380	0.0038	0	23	24	-2.546	1.6	0.25	-6.7	-1.27E-07	1.85E+00	-1263%
505	31-02 TRB-R	11/11/2013	7390	0.0052	16	27	24	12.516	1.6	0.24	5.4	1.03E-07	1.84E+00	-149%
509	31-02 TRB-R	3/17/2014	7350	0.0036	16	36	36	13.588	1.7	-0.48	1.6	3.04E-08	1.70E+00	-156%
512	31-02 TRB-R	6/16/2014	7060	0.0039	-2.4	23	29	-5.013	2.3	0.3	-8.1	-1.54E-07	2.60E+00	-631%
513	31-02 TRB-R	9/8/2014	7760	0.0035	-1.2	30	29	-3.545	3.3	0.16	-8.6	-1.63E-07	3.46E+00	-16482%
515	31-02 TRB-R	11/7/2014	7500	0.0036	3.1	24	29	0.688	3.8	-0.02	-2.3	-4.37E-08	3.80E+00	139%
518	31-02 TRB-R	2/11/2015	7740	0.0039	24	41	36	21.387	4.1	0.21	-1.6	-3.04E-08	4.31E+00	-133%
524	31-02 TRB-R	8/25/2015	8050	0.0041	-2.3	29	34	-5.047	2.2	0.61	-1.3	-2.47E-08	2.81E+00	-702%
530	31-02 TRB-R	2/10/2016	8160	0.0039	-8.5	21	30	-11.113	2.7	0.07	-2.5	-4.75E-08	2.77E+00	-333%
535	31-02 TRB-R	7/18/2016	7770	0.0045	7.7	24	52	4.685	3.5	0.24	-2.9	-5.51E-08	3.74E+00	-22%
542	31-02 TRB-R	2/16/2017	8250	0.0062	22	30	120	17.846	3.5	-0.08	-4.1	-7.79E-08	3.50E+00	-134%
560	31-02 TRB-R	8/6/2018	7770	0.0037	8.8	24	87	6.321	3.7	0	2.5	4.75E-08	3.70E+00	-52%
566	31-02 TRB-R	2/8/2019	7910	0.004	32	25	72	29.32	2.8	0.08	5	9.50E-08	2.88E+00	-164%
571	31-02 TRB-R	7/17/2019	7740	0.0039	-0.88	21	110	-3.493	4.5	0.03	4.1	7.79E-08	4.53E+00	1547%
579	31-67 TRB	8/18/2009	6850	0.013	0	21	23	-8.71	2.3	0.03	0.34	6.46E-09	2.33E+00	-346%
580	31-67 TRB	11/3/2009	6710	0.0199	4.2	25	22	-9.133	2.2	0.06	0	0.00E+00	2.26E+00	-332%
581	31-67 TRB	3/1/2010	6580	0.0147	29	28	23	19.151	1.9	-0.08	2.7	5.13E-08	1.90E+00	-164%
582	31-67 TRB	5/10/2010	6630	0.0179	47	32	25	35.007	2.8	-0.32	1.5	2.85E-08	2.80E+00	-170%
585	31-67 TRB	7/13/2010	7060	0.0162	26	23	22	15.146	2.5	0.69	2.8	5.32E-08	3.19E+00	-130%
589	31-67 TRB	11/9/2010	6610	0.016	4.5	22	23	-6.22	2.2	0.13	2.2	4.18E-08	2.33E+00	-440%
591	31-67 TRB	3/7/2011	6600	0.0144	14	21	22	4.352	3	0.22	6.5	1.24E-07	3.22E+00	-30%

**ATTACHMENT C**  
**Comparison of Gross Alpha Measurements and Combined Alpha Emitter Activities**

#	Station	Date Sampled	Total Dissolved Solids	Uranium (mg/L)	Gross Alpha (pCi/L)	Gross Alpha Uncertainty (2σ)	Gross Alpha LLD	Gross Alpha - Corrected (pCi/L)	Ra-226 Activity (pCi/L)	Th-230 Activity (pCi/L)	Pb-210 Activity (pCi/L)	Pb-210 Activity (alpha fraction) (pCi/L)	Combined Alpha Activity (pCi/L)	Combined V. Adjusted RPD
592	31-67 TRB	6/13/2011	6680	0.0177	190	50	23	178.141	3.1	0.5	0	0.00E+00	3.60E+00	-192%
594	31-67 TRB	9/19/2011	6390	0.0207	9.4	31	25	-4.469	3.7	-0.03	0	0.00E+00	3.70E+00	-2125%
595	31-67 TRB	11/14/2011	6480	0.0174	24	33	26	12.342	2.9	0.3	7.8	1.48E-07	3.20E+00	-118%
596	31-67 TRB	2/20/2012	6460	0.0223	20	24	23	5.059	2.2	0.06	1.5	2.85E-08	2.26E+00	-76%
597	31-67 TRB	5/22/2012	6550	0.0242	27	26	25	10.786	4.6	0.14	0.82	1.56E-08	4.74E+00	-78%
598	31-67 TRB	8/7/2012	6750	0.0198	36	25	24	22.734	3.3	0.15	2.2	4.18E-08	3.45E+00	-147%
599	31-67 TRB	8/12/2013	6700	0.0131	0	22	24	-8.777	2.3	0.46	-7.7	-1.46E-07	2.76E+00	-383%
600	31-67 TRB	11/5/2013	6420	0.0183	4	22	23	-8.261	2.8	1	8.5	1.62E-07	3.80E+00	-541%
601	31-67 TRB	3/11/2014	7000	0.013	23	34	29	14.29	2.8	-0.54	2.6	4.94E-08	2.80E+00	-134%
602	31-67 TRB	6/3/2014	6340	0.0109	21	29	24	13.697	2.7	0.28	-2.6	-4.94E-08	2.98E+00	-129%
603	31-67 TRB	9/4/2014	6350	0.0121	-9.4	27	29	-17.507	3.1	-0.28	10	1.90E-07	3.10E+00	-286%
604	31-67 TRB	11/7/2014	7000	0.0129	-13	20	29	-21.643	2.6	0.31	-0.14	-2.66E-09	2.91E+00	-262%
605	31-67 TRB	2/17/2015	7120	0.0124	-11	32	36	-19.308	3.4	0.29	-1	-1.90E-08	3.69E+00	-295%
606	31-67 TRB	8/24/2015	7260	0.0117	-4.9	31	37	-12.739	2.4	0.65	0.19	3.61E-09	3.05E+00	-326%
607	31-67 TRB	2/10/2016	7120	0.014	-4.5	20	29	-13.88	3.4	0.37	-3.8	-7.22E-08	3.77E+00	-349%
608	31-67 TRB	7/28/2016	7380	0.0129	-3.4	25	68	-12.043	2.4	-0.21	1.9	3.61E-08	2.40E+00	-300%
609	31-67 TRB	2/20/2017	7160	0.0141	6.3	21	73	-3.147	2.6	0.22	-1.4	-2.66E-08	2.82E+00	-3650%
612	31-67 TRB	8/10/2018	7330	0.0122	43	33	110	34.826	3.2	-0.2	1.9	3.61E-08	3.20E+00	-166%
613	31-67 TRB	2/12/2019	7130	0.0136	17	18	80	7.888	2.7	0.29	0.87	1.65E-08	2.99E+00	-90%
614	31-67 TRB	7/24/2019	7280	0.0126	36	24	56	27.558	3.3	0.21	0.73	1.39E-08	3.51E+00	-155%
618	36-02 TRB	8/4/2009	8220	0.0071	0.93	18	20	-3.827	0.86	-0.01	0	0.00E+00	8.60E-01	-316%
619	36-02 TRB	11/3/2009	9050	0.0132	0	25	26	-8.844	1.2	0.21	0	0.00E+00	1.41E+00	-276%
620	36-02 TRB	3/2/2010	9740	0.0131	-15	17	32	-23.777	0.65	-0.07	0.54	1.03E-08	6.50E-01	-211%
621	36-02 TRB	5/10/2010	10600	0.011	18	34	33	10.63	1.1	0.04	1.1	2.09E-08	1.14E+00	-161%
622	36-02 TRB	7/19/2010	9360	0.0143	7.2	29	29	-2.381	1.2	-0.04	0	0.00E+00	1.20E+00	-606%
623	36-02 TRB	11/9/2010	9790	0.0521	-23	30	33	-57.907	0.85	-0.16	2.8	5.32E-08	8.50E-01	-206%
624	36-02 TRB	3/7/2011	10700	0.009	8.3	26	28	2.27	0.93	0.14	9.9	1.88E-07	1.07E+00	-72%
625	36-02 TRB	6/13/2011	10300	0.006	54	37	33	49.98	1.5	-0.18	7.9	1.50E-07	1.50E+00	-188%

**ATTACHMENT C**

**Comparison of Gross Alpha Measurements and Combined Alpha Emitter Activities**

#	Station	Date Sampled	Total Dissolved Solids	Uranium (mg/L)	Gross Alpha (pCi/L)	Gross Alpha Uncertainty (2σ)	Gross Alpha LLD	Gross Alpha - Corrected (pCi/L)	Ra-226 Activity (pCi/L)	Th-230 Activity (pCi/L)	Pb-210 Activity (pCi/L)	Pb-210 Activity (alpha fraction) (pCi/L)	Combined Alpha Activity (pCi/L)	Combined V. Adjusted RPD
627	36-02 TRB	9/19/2011	8560	0.0176	32	40	30	20.208	1.1	0.19	0	0.00E+00	1.29E+00	-176%
628	36-02 TRB	11/8/2011	8490	0.0106	0	31	31	-7.102	1.5	0.52	1	1.90E-08	2.02E+00	-359%
629	36-02 TRB	2/20/2012	8980	0.0163	42	33	28	31.079	0.66	-0.15	0.37	7.03E-09	6.60E-01	-192%
631	36-02 TRB	5/8/2012	8660	0.0113	1.6	23	32	-5.971	0.65	0.02	0	0.00E+00	6.70E-01	-251%
632	36-02 TRB	8/7/2012	8910	0.0126	72	44	35	63.558	0.86	0.21	2.8	5.32E-08	1.07E+00	-193%
633	36-02 TRB	11/6/2012	8200	0.0143	-2.6	29	31	-12.181	0.76	-0.09	7.7	1.46E-07	7.60E-01	-227%
634	36-02 TRB	2/19/2013	8240	0.0095	12	30	28	5.635	0.67	0.27	-0.72	-1.37E-08	9.40E-01	-143%
635	36-02 TRB	5/7/2013	8870	0.0078	21	29	32	15.774	0.61	4.3	-9.3	-1.77E-07	4.91E+00	-105%
636	36-02 TRB	8/12/2013	9410	0.0092	0	22	27	-6.164	0.79	0.29	-6.1	-1.16E-07	1.08E+00	-285%
637	36-02 TRB	11/5/2013	8880	0.0364	15	31	31	-9.388	0.8	-0.03	50	9.50E-07	8.00E-01	-237%
638	36-02 TRB	3/11/2014	8100	0.0076	3.8	34	35	-1.292	0.84	0	-1.1	-2.09E-08	8.40E-01	-943%
639	36-02 TRB	6/3/2014	8420	0.0056	0	43	36	-3.752	0.62	0.3	0	0.00E+00	9.20E-01	-330%
640	36-02 TRB	9/5/2014	8280	0.0045	-33	30	36	-36.015	0.83	0.2	-0.53	-1.01E-08	1.03E+00	-212%
641	36-02 TRB	11/25/2014	8040	0.0059	2.5	27	26	-1.453	-0.4	0.41	-0.6	-1.14E-08	4.10E-01	-357%
644	36-02 TRB	7/26/2016	8510	0.0031	-28	26	97	-30.077	0.47	0.28	-2.3	-4.37E-08	7.50E-01	-210%
646	36-02 TRB	3/2/2017	-	-	0.15	25	96	0.15	0.49	0.18	-12	-2.28E-07	6.70E-01	127%
649	36-02 TRB	8/8/2018	8500	0.0031	-23	23	170	-25.077	0.72	-0.24	7.1	1.35E-07	7.20E-01	-212%
650	36-02 TRB	2/27/2019	8780	0.0042	6.1	19	75	3.286	0.68	-0.03	3.3	6.27E-08	6.80E-01	-131%
651	36-02 TRB	7/22/2019	7820	0.0035	22	28	88	19.655	0.66	0.09	3	5.70E-08	7.50E-01	-185%

**Notes:**

RPD Relative percent difference.  $(\text{Combined Activity} - \text{Corrected Gross Alpha}) / ((\text{Combined Activity} + \text{Corrected Gross Alpha})/2) * 100$

All gross alpha activities are measured using EPA method 900.0

Combined Activity: Calculated by summing the individual Ra-226, Th-230, and the alpha emitting fraction of Pb-210. All negative activities are rounded up to 0 for the purposes of this calculation.

Pb-210 Activity (alpha fraction only) is calculated from 1.9E-6% of the measured Pb-210 activity to reflect the small fraction of Pb-210 that decays via alpha emission.

Only samples for which uranium concentrations, gross alpha activities, Ra-226 activities, and Th-230 activities are all available are presented in this table.

Note that the corrected gross alpha value is based on the measure gross alpha - 670 \* [U] to remove the alpha activity contribution from uranium. Due to the significant uncertainties in measured gross alpha activities due to the high TDS of these sample, this often produces a negative corrected gross alpha. These are interpreted to be the result of inaccuracies in the gross alpha measurements.