

**APPENDIX M**  
Two-Tiered Approach

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-----Original Message-----

[REDACTED]

Sent: Monday, September 30, 2019 3:23 PM

[REDACTED]

Subject: Ra-226 and Confirmation Samples (UNCLASSIFIED)

CLASSIFICATION: UNCLASSIFIED

[REDACTED]

Your approach outlined below has been reviewed by USACE technical PDT staff and appears to accurately summarize the discussion between Plexus and USACE regarding use of a two-tier approach for determining Ra-226 concentrations. For specific confirmation samples where it appears that interference from U-235's 185.7 keV gamma peak has occurred and resulted in an overestimate of the Ra-226 concentration, we concur the Bi-214 value is more reliable and should be used and corrected for ingrowth using the factor of 0.165 provided by the lab. We concur with your plan to use Bi-214 values with the appropriate ingrowth correction factors for samples that exceed the DCGL based on the 186.2 keV Ra-226 peak and/or if the SOR is greater than 1. Additionally, we concur with your intent to use other appropriate ingrowth correction factors for longer ingrowth times at the lab (e.g., 0.304 for a 2-day ingrowth). Thank you for providing USACE with your proposed methodology described below [REDACTED]

[REDACTED]

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-----Original Message-----

[REDACTED]

Sent: Thursday, September 26, 2019 3:38 PM

[REDACTED]

Subject: [Non-DoD Source] Ra-226 and Confirmation Samples

[REDACTED]

The following summarizes our discussion during this week's call regarding Ra-226 and confirmation samples: Plexus currently uses a 3-day turnaround time (TAT) for confirmation samples. Plexus proposes to use a two-tiered approach for determining Ra-226 concentrations. Samples analyzed on a 3-day TAT, are usually counted on the same day or within one day following prep and sealing performed by the lab. The primary means for determining the Ra-226 concentration, as described in the UFP-QAPP, relies upon Ra-226's 186.2 keV peak using the gamma spectroscopy method. For most samples collected to date, this approach has worked successfully in confirming the excavation sidewall meets the cleanup criteria. For a handful of samples, interference from U-235's 185.7 keV gamma peak has occurred which can result in an overestimate of the Ra-226 concentration (along with larger uncertainty values when U-235 concentrations are high enough) indicating Ra-226 concentrations above the cleanup criteria. In these cases, the Bi-214 value is more reliable and will be used and corrected for ingrowth using a factor of 0.165 provided by the lab. As an example, DU1/L4 with a 1-day ingrowth:  $Ra-226 = Bi-214 / 0.165 \rightarrow 2.12 / 0.165 = 12.8$  pCi/g which yields a sum-of-ratios (SOR) less than 1. In summary, Bi-214 values with the appropriate ingrowth correction factors will be used for samples that exceed the DCGL based on the 186.2 keV Ra-226 peak and/or if the SOR is greater than 1. Plexus will use other appropriate ingrowth correction factors for longer ingrowth times at the lab (e.g., 0.304 for a 2-day ingrowth).

We request that USACE concur with the two-tiered approach as described above.

[REDACTED]

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**Table 17.3. Ingrowth Factors for Short –lived Radium-226 Progeny**

% Ingrowth		% Ingrowth		% Ingrowth	
Day1	0.165	Day2	0.304	Day3	0.419
Day4	0.515	Day5	0.595	Day6	0.662
Day7	0.718	Day8	0.765	Day9	0.804
Day10	0.836	Day11	0.863	Day12	0.886
Day13	0.905	Day14	0.920	Day15	0.933
Day16	0.944	Day17	0.954	Day18	0.961
Day19	0.968	Day20	0.973	Day21	0.977
Day22	0.981	Day23	0.984	Day24	0.987
Day25	0.989	Day26	0.991	Day27	0.992

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