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RESULTS OF THE EXCRETA BIOASSAY QUALITY CONTROL PROGRAM FOR APRIL 1, 2007 THROUGH MARCH 31, 2008

CL Antonio

December 2008

Pacific Northwest
NATIONAL LABORATORY

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December 2008

Peer Reviewed by_____
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SUMMARY

A total of 79 urine samples, 3 blank fecal and 5 spiked artificial fecal samples were submitted during the report period (April 1, 2007 through March 31, 2008) to General Engineering Laboratories, South Carolina by the Hanford Internal Dosimetry Program (IDP) to check the accuracy, precision, and detection levels of their analyses. Urine analyses for tritium, Sr, ^{238}Pu, ^{239}Pu, ^{241}Am, ^{243}Am ^{235}U, ^{238}U, elemental uranium and fecal analyses for ^{241}Am, ^{238}Pu and ^{239}Pu were tested this year. The number of QC urine samples submitted during the report period represented 1.8% of the total samples submitted.

In addition to the samples provided by IDP, GEL was also required to conduct their own QC program, and submit the results of analyses to IDP. About 35% of the analyses processed by GEL during the third year of this contract were quality control samples. GEL tested the performance of 24 radioisotopes, all of which met or exceeded the specifications in the Statement of Work within statistical uncertainty (Table 4).

IDP concluded that GEL was performing well for all analyses tested, and concerns identified earlier were satisfactorily resolved (see section on Follow-up on Concerns During the Third Contract Year)

The isotopic uranium analysis reports on three uranium isotopes: ^{234}U, ^{235}U, and ^{238}U. The isotopes are differentiated only during counting by alpha spectrometry. GEL reported that the calculated minimum detectable activity (MDA) for ^{233,234}U for the year slightly exceeded the contract required detection limit. The MDA reported by GEL was within statistical uncertainty and determined to be acceptable.

Because IDP used a depleted uranium source material for the isotopic uranium urinalyses, ^{233,234}U was not evaluated. However, the performance statistics for ^{235}U and ^{238}U were reviewed and the MDA for ^{235}U and the bias and precision for ^{238}U were acceptable.

No concerns were identified with the elemental uranium urinalysis program and it was considered acceptable. Because IDP uses a 0.2 µg screening level for elemental uranium, samples spiked at 0.06 µg were discontinued. The MDA at the contractual level of 0.06 µg was evaluated through GEL's program and were found to be acceptable. The relative bias was within statistical uncertainty and the relative precision was acceptable. The bias and

precision as tested by IDP met the acceptance criteria. The bias and precision was tested by IDP at 0.2 µg and by GEL at 1 µg and at 0.06 µg.

The total strontium procedure is used to screen samples to determine which will require analysis for ^{90}Sr. Samples with total strontium results less than 15 dpm do not undergo further analysis. Samples with results greater than or equal to 15 dpm may undergo ^{90}Y in growth to specifically determine ^{90}Sr levels. The calculated MDA, as reported by GEL, for the total strontium part of the analysis was about 28% of the CL. The relative bias and precision, tested by IDP and GEL for the ^{90}Sr and total Sr procedures were all within limits. The 20 samples spiked at the contractual level by IDP were all detected. The strontium urinalysis procedure was concluded to be acceptable.

Samples spiked with ^{238}Pu and ^{239}Pu were analyzed using the same procedures and same reagents. The two isotopes are differentiated only at the end of the procedure by alpha spectrometry. Therefore, laboratory performance is expected to be similar for both isotopes using any of the seven procedures that incorporate plutonium analysis (IPU, IPA, IPS, IPSA, IPSR, IUPU, and ITPAC).

The MDAs and performance statistics for ^{239}Pu and ^{238}Pu in urine were acceptable. The 33 samples spiked at the CL for ^{239}Pu were reported with only one result less than the decision level indicating a 3% false negative. There were four blank samples indicating ^{238}Pu activity, one sample indicated activity in excess of the CL. Upon review it appears that the samples may have been cross-contaminated during handling in the audit laboratory. Results of the four samples were not removed from the data set because it could not be verified that the samples were contaminated. Including the four elevated samples, the MDA as analyzed by IDP for ^{238}Pu was only slightly elevated. GEL reported an MDA for ^{238}Pu that was 50% of the CL. Overall the plutonium urinalyses were considered acceptable.

The MDA and performance statistics for ^{239}Pu and ^{238}Pu in feces were acceptable. Approximately 15% of the fecal samples analyzed were duplicated to test the consistency of the aliquoting procedure. A review of the duplicate samples determined that the aliquoting procedure produced results within 3 sigma of the initial results. The fecal aliquoting procedure was acceptable. None of the 7 blank ^{238}Pu or the 2 blank ^{239}Pu fecal analyses were greater than the decision level. There were no fecal samples spiked at the CL with ^{238}Pu. The five fecal samples

spiked with ^{239}Pu were reported with a result greater than the decision level. Overall the plutonium fecal analyses were considered acceptable.

The ^{241}Am fecal and urine analysis met the acceptance criteria for MDA, relative bias and precision. The MDA as reported by GEL was 50% of the contractual level. There were 25 ^{241}Am samples spiked at the contractual detection level (CL) and 14 indicated activity between three to five times the CL. It was later determined that cross contamination of the samples occurred in the audit laboratory during spiking. A more detail discussion of the cross contamination is in the Am241 discussion section. The 14 data points were removed from the data set to evaluate the relative bias and precision, both of which met the acceptance criteria. GEL reported a slightly elevated precision for ^{241}Am, but the results were within statistical uncertainty. The current AM241 urinalysis procedure was considered acceptable.

Both blank ^{241}Am fecal samples were less than the decision level and the five spiked fecal samples were all greater than the decision. The ^{241}Am fecal duplicate samples were evaluated and it was concluded that the aliquoting procedure produced results within the control limits.

The AM243 procedure was identical to the AM241 procedure, except a different tracer is used (^{244}Cm instead of ^{243}Am). The seven blank ^{243}Am QC samples submitted were all reported with results less than the decision level and the calculated MDA was 65% of the contractual detection level. The performance statistics for ^{243}Am, as tested by GEL, met the acceptance criteria. The ^{243}Am procedure was concluded to be acceptable.

IDP did not submit QC samples to test the isotopic curium program, therefore performance statistics were based on the GEL QC results. GEL tested the MDA for ^{242}Cm and ^{244}Cm and the relative bias and precision for ^{244}Cm. The results met the acceptance criteria and the isotopic curium urinalysis program was considered acceptable.

IDP also did not submit QC samples to test the isotopic thorium program, therefore performance statistics were based on the GEL QC results. GEL tested the MDA for ^{228}Th, ^{229}Th, ^{230}Th and ^{232}Th and the relative bias and precision for ^{232}Th. The results met the acceptance criteria and the isotopic thorium urinalysis program was considered acceptable.

A new ^{236}U analysis procedure was initiated in June 2007 and one urinalysis was run. The analysis for ^{236}U uses an inductively coupled plasma mass spectrometry. A review of the ^{236}U analysis determined that more work was needed in reducing uncertainties and improving the

analysis. The procedure was not formally approved until June 2008 and will be discussed in the fourth contract year's report.

CONTENTS

TABLES

INTRODUCTION

This report summarizes the results of the excreta bioassay quality control program's monitoring of the performance of General Engineering Laboratories (GEL) for samples submitted from April 1, 2007 through March 31, 2008. During the reporting period GEL analyzed, under the contract with Battelle, 4621 urine and 98 fecal samples for various radionuclides. This is about the same workload as reported in the 2006 report.

The results of the analyses are part of a system of legal records concerning internal deposition of radionuclides for workers at the Hanford Site. GEL is required to have a rigorous quality control (QC) program to ensure the accuracy of its results. In addition, the Pacific Northwest National Laboratory's (PNNL) Hanford Internal Dosimetry Program (IDP) has a QC program in place to independently check the accuracy of the results from GEL. The objective of the PNNL excreta bioassay QC program is to provide quantitative data to support the assessment of performance criteria for excreta bioassay analyses, as specified in the Statement of Work (Battelle 2007).

The reliability of the excreta bioassay program depends, to a significant extent, on the adoption and implementation of performance criteria for laboratory accuracy, precision, and detection levels. Such performance criteria are established in the Statement of Work (Battelle 2007) and include the following:

- Actual minimum detectable activities (MDAs) determined from QC samples for the year shall be equal to or less than the contractual detection level (CL) in the Statement of Work, as calculated from blank QC samples.
- The mean relative bias, B_r, shall fall within ± 20% when calculated from 15 to 50 samples spiked at greater than three times the CL, and within ± 10% when calculated from greater than 50 samples.

- The relative precision statistic, S_B, shall be less than or equal to 0.4 for samples spiked at greater than three times the CL, and less than or equal to 0.5 for samples spiked between one and three times the CL.

Formulas for MDA, B_r, and S_B, presented in the next section of this report, are based on recommendations in the Health Physics Society (HPS) Standard N13.30 (1996) and are listed in the Statement of Work. In addition to the Statement of Work (SOW) performance criteria, it is expected that the MDA shall also be such that fewer than 10% of the QC samples spiked at the CL shall be reported with values less than the decision level (i.e., twice the total propagated uncertainty of the result)..

METHODS

GENERAL METHODS

Urine collected from PNNL employees who are not occupationally exposed to radioactive material was prepared in the 325 Building as blank and spiked samples by PNNL Radiochemical Processing Group (RPG), according to the directions given by the PNNL Internal Dosimetry Program (IDP), following Procedure PNL-MA-565-800-20, Rev. 2. Most samples were submitted as double-blind samples, with the exception of isotopic uranium urinalyses and the spiked fecal samples. Double blind samples are scheduled with and collected by GEL as if they were personnel samples. The isotopic uranium urinalyses were scheduled as single-blind intercomparisons, which meant that GEL was aware they were intercomparison samples but unaware of the activity. The samples were scheduled as single-blinds because they were spiked with a depleted uranium source. Since depleted uranium exposures at Hanford are rare, the intercomparison samples would stand out and the QC alias names used could become known and compromise the double-blind intercomparison program. The spiked fecal samples were artificial fecal samples consisting of a soil matrix. Blank fecal samples were scheduled as double-blind samples and were actual fecal samples.

GEL analyzed urine samples for tritium, ^{90}Sr, ^{242}Cm, ^{244}Cm, ^{238}Pu, $^{239,240}Pu$, ^{241}Pu ^{241}Am, ^{243}Am, ^{228}Th, ^{229}Th, ^{230}Th, ^{232}Th ^{236}U, ^{234}U, ^{235}U, ^{238}U and elemental uranium and fecal samples for ^{238}Pu, $^{239,240}Pu$, ^{241}Am, ^{234}U, ^{235}U, ^{238}U . To reduce costs in the intercomparison program, plutonium, americium, and strontium analyses were tested using routine sequential procedures when possible (i.e., where one urine sample is analyzed for several radionuclides). The analysis categories specified in the contract with GEL are shown in Table 1. All urinalysis samples contained approximately 1000 ml of urine, except for the samples analyzed for tritium, which contained approximately 100 ml.

GEL's QC sample total is dependent on the number of analytical batches run during the ear, and they were well over the 15% criteria specified in the contract.

TABLE 1. Analytical and Reporting Requirements for Routine Processing of Samples

Battelle Contract 11530 - Feb-06

Analytical and Reporting Requirements for Routine Processing of Samples

Analysis (Code)	Constituents Reported	Contractual Detection Level (a) (dpm/sample) Urine	Fecal	Determination Time (business days following sample receipt)	Reporting Time: Oral[g]	Electronic[a]	Written[a]	Oral Reporting Level; (dpm/sample) Urine	Fecal
Pu(∝) Isotopic (IPU)	Pu-238, Pu-239, 240	0.02	0.2	20	By close of business on day of determination	Within five business days of determination	Within 10 business days of determination	Eq. 1	Eq. 1
Pu(∝) Isotopic (IPUL)	Pu-238, Pu-239, 240	0.005		30				Eq. 1	
Am-241 (AM241)	Am-241	0.02	0.8	20				Eq. 1	Eq. 1
Am-243 (AM243)	Am-243	0.02	0.8	20				Eq. 1	Eq. 1
Cm(∝) Isotopic (ICM)	Cm-242, Cm-244(b)	0.02		20				Eq. 1	
U(∝) Isotopic (IU)	U-233, 234, U-235, U-238	0.02		20				(f)	
Th(∝) Isotopic (ITH)	Th-228, Th-229, Th-230, Th-232	0.1	1	20				Eq. 1	Eq. 1
Tritium (H3)	H-3	20 dpm/ml		5				10dpm/ml	
Sr-total (SR)	Sr (sum Sr-89 + Sr-90)	10		20				5	
Sr-90 (SR90)[c]	Sr-90	10		30				5	
Gamma Spectroscopy (ISPEC)	K-40, Cs-137 + Others(d)	See Table B-5		20				Eq. 1	
Gamma Spectroscopy (LEPD)	Am-241	5		20				Eq. 1	
U-nat (U)	Elemental U	0.06 µg/sample	0.3 µg/sample	20				0.2	0.2
Sequential Analyses:									
Pu(∝) Iso and Sr-total (IPS)	As for individual analyses	As for individual analyses		25	As for individual analyses				
Pu(∝) Iso, Am-241 (IPA)				25					
Pu(∝) Iso, Am-241, Sr-total (IPSA)				25					
Pu(∝) Iso, U-nat (IUPU)				25					
Actinide(∝) Isotopic (ITPAC)[e]				25					
Pu(∝) Iso and U ISO (IPIU)				25					

(a) Time allowed following determination of results to receipt of results by Battelle.

(b) Report measured activity for Cm-246, and Cm-248 upon request of the Battelle Technical Administrator.

(c) If total Strontium is less than 15 dpm, Yingrowth is not required.

(d) Report all isotopes present at levels exceeding Equation 5. If ordered by the Battelle Technical Administrator, report results for radionuclides in Table B-5 specified in the processing instruction, regardless of the activity measured.

(e) Pu (∝) Isotopic, Am-241, and Cm (∝) Isotopic.

(f) 0.16 dpm for U-234, 0.15 dpm for U-238, and the greater of 0.007dpm and Equation 5 for U-235.

(g) Oral report required only when analytical results exceed level specified. **Eq. 1 Lc=2(combined standard uncertainty)**

TABLE 2. Number and Category of Bioassay Samples Analyzed

Procedure Code[a]	SECOND CONTRACT YEAR - GEL 4/1/06 through 3/31/07 Total	IDP QC	%	GEL QC[b]	THIRD CONTRACT YEAR - GEL 4/1/07 through 3/31/08 Total	IDP QC	%	GEL QC[b]
Urine								
H3	892	3	0.3	276	821	0	0.0	282
SR90, SR	231	3	1.3	482	181	0	0.0	447
C14	--	--	--	--	--	--	--	--
AM241	103	--	--	437	99	--	--	463
AM243	85	6	7.1	122	88	7	8.0	84
U235	--	--	--	--	--	--	--	--
ICM	13	--	--	241	7	--	--	
IPU	1243	--	--	1152	1401	9	--	1261
IPUL	1	--	--	N/A	5	--	--	--
IPA	293	4	1.4	N/A	401	4	1.0	N/A
IPS	553	2	0.4	N/A	481	0	0.0	N/A
IPSA	152	15	9.9	N/A	158	20	12.7	N/A
IPSR	--	--	--	--	--	--	--	--
ISPEC	--	--	--	--	--	--	--	--
ITPAC	90	--	--	N/A	116	--	--	N/A
ITH	--	--	--	--	1	--	--	8
IUPU	108	--	--	N/A	114	--	--	N/A
IPIU	4	1	25.0	N/A	10	0	0.0	N/A
IU	500	14	2.8	279	519	16	3.1	243
NP237	--	--	--	--	--	--	--	--
U236	--	--	--	--	1	--	--	3
UNAT	235	18	7.7	339	218	23	10.6	462
LEPD	--	--	--	--	--	--	--	--
PU241	--	--	--	--	--	--	--	--
Total	*4503*	*66*	*1.5*	*3328*	*4621*	*79*	*1.7*	*3253*
Fecal [c]								
U232	--	--	--	--	--	--	--	--
ICM	1	--	--	--	--	--	--	--
IU	--	--	--	--	3	1	--	7
AM241	15	--	--	133	4	--	--	86
IPU	12	--	--	138	36	--	--	116
IPA	83	12	14.5	N/A	55	7	12.7	N/A
Total	*111*	*12*	*10.8*	*271*	*98*	*8*	*8.2*	*209*

[a] Procedures not specifically tested are evaluated with isotopic results from other procedures.

[b] N/A = not available. QC samples are tracked as isotopic analyses not as multiple analyses.

[c] Analyses not analyzed (IPUBA, IRA, ITPAC, IUPU, UNAT, IU, M243)

Table 2 presents a breakdown of the numbers and categories for all bioassay samples analyzed, including personnel and QC samples. From 79 urine and 8 fecal QC samples submitted by IDP to GEL during the reporting period, GEL reported 4621 analytical urine results for 13 different analytes and 98 fecal results for 4 different analytes. The 87 QC samples represent 1.8% of the total analyses performed by GEL. In addition to these samples, GEL analyzed 3,462 internal QC samples. The QC samples analyzed equaled 35% of the samples analyzed by GEL under their contract with Battelle.

GEL's performance was checked by determining detection level, bias, and precision based on the results of blank and spiked samples. Spiked samples fell into two categories: those spiked near the CL and those spiked at equal to or greater than three times the CL. These two categories were necessary to check compliance with the criteria for relative precision (S_R) specified by the Statement of Work. Satisfying these two categories also verified that GEL could detect sample activities near the CL.

DETECTION LEVELS

Various mathematical expressions and terminology can be used to describe a detection level. The statistical approach specified in the Statement of Work basically follows that of Currie (1968) and HPS N13.30 (HPS 1996). However, the HPS N13.30 formulas were modified to account for the difference between a priori estimates of detection levels based on counts (Currie 1968) and a posteriori estimates based on total activity, where chemical yield is determined specifically for each sample.

Two test criteria were used: the decision level (L_c) and the MDA (also called the detection level). The decision level was defined in the Statement of Work as the quantity of radioactivity or mass above which there is at least 95% confidence that the sample is not a blank (Type I error). If the measured value was greater than the L_c, the sample was considered likely to contain the radionuclide of interest. If the measured value was less than L_c, then the result was considered indistinguishable from a blank. The L_c was determined solely by measuring blank samples. Before the L_c was calculated, results that were significant outliers were eliminated from the data set. Outliers were identified by the use of the criteria of ASTM E178-94 (ASTM 1994).

Mathematically, L_c is defined by the following equation:

$$L_c = 2s_A$$

where, s_A equals the combined standard uncertainty of the net analyte reported.

The MDA was based on a 95% confidence in detecting activity when the actual activity was equal to the MDA. Conversely, the 95% confidence level is the point at which only 5% of the results for samples containing activity equal to the MDA fall below the L_c and, thus, were judged to contain no activity (Type II error). The MDA, expressed in units of disintegrations per minute, is calculated from the same set of blanks as the L_c (outliers excluded), using the following equation:

$$MDA = \overline{X_o} + 2(t_{n-1})\ s_o + \frac{(t_{n-1})^2}{ERT}$$

where E is the typical counter detection efficiency in counts per disintegration, R is the average fractional chemical recovery or yield, and T is the typical counting time. In keeping with the philosophy of HPS N13.30, if t^2 is less than 3, then 3 is used instead. For elemental uranium analyses, the analytical method does not produce count data; the unit for the analysis result and MDA is micrograms. Thus, the "3" term is not an appropriate part of the equation for the elemental uranium analysis.

The present contract with GEL, implemented on April 1, 2005 with GEL, specifies an operational year that ends March 31st, each year. This QC report covers the second operational year of that contract, and includes samples analyzed by GEL during period of April 1, 2006 through March 31, 2007.

The MDA values GEL calculates for their QC reports are based on mean values for parameters of equation 2 of the contract statement of work, and not replicate measurements. GEL also uses synthetic samples, whereas IDP uses real fecal and urine samples.

The IDP QC samples were evaluated by first calculating the L_c from blank samples, excluding outliers. This L_c was compared with the L_c calculated from GEL's own QC samples. Then, the MDA was calculated and compared with the CL and the MDA calculated from GEL's own QC samples. Values used for E, R, and T in the MDA equation were obtained from the

laboratory; they are listed in Table 3. Finally, the percentage of QC samples spiked at the CL that were measured by the laboratory as having less than the decision level (i.e., no activity was detected) was determined; this percentage was then compared with the 5% allowed in the Statement of Work. Outliers were included in this test.

BIAS

Relative bias is defined as the mean fractional deviation of the reported results from the true values of spikes added to the samples. The formulas in the Statement of Work used to measure bias in sample results are the same as those in HPS N13.30 (1996). The mean relative bias, Br, is determined using:

$$B_r = \sum_{i=1}^{m} \sum_{j=1}^{n} \frac{B_{rij}}{N}$$

where n = number of spike samples in each level
m = number of spike levels
N = total number of spiked samples
B_{rij} = bias of a single measurement, defined as:

$$B_{rij} = \frac{(A_{ij} - A_{ai})}{A_{ai}}$$

where A_{ij} = the jth measured value of the ith spike level,
A_{ai} = the true value of the ith spike level

TABLE 3. Typical Chemical Yield (R), Typical Detector Efficiencies (E), and Counting Time (T) Values from GEL Quality Control Report

	Nuclide/	Count	Contract	Counter Efficiency		Chemical Yield	
Matrix	Method	Minutes	Limit[a]	2006-2007	2007-2008	2006-2007	2007-2008
Urine	^{3}H	20	20	0.18	0.24	---	---
	Total Sr	60	10	0.396	0.379	0.774	0.788
	SR90	60	10	---	---	---	---
	^{241}Am	2520	0.02	0.385	0.391	0.725	0.816
	^{243}Am	2520	0.02	0.385	0.391	0.885	0.871
	^{242}Cm/^{244}Cm	2520	0.02	0.385	0.391	0.725	0.816
	^{237}Np	2520	0.02	---	---	---	---
	^{239}Pu/^{238}Pu	2520	0.02	0.385	0.391	0.915	0.890
	IPUL	10000	0.005	---	---	---	---
	^{228}Th/^{230}Th/^{232}Th	2520	0.1	NA	0.386	NA	0.880
	^{234}U/^{235}U/^{238}U	2520	0.02	0.382	0.386	0.709	0.834
	Uranium	--	0.06	N/A	N/A	N/A	N/A
Fecal	^{241}Am	960	0.8	0.385	0.391	0.744	0.757
	^{238}Pu/^{239}Pu	960	0.2	0.385	0.391	0.90	0.85

(a) Units dpm/sample except dpm/mL for ^{3}H, and µg/sample for U.

Outliers were excluded from the test, but not ignored for the procedure evaluation. As stipulated in the Statement of Work, the mean relative bias shall fall within ± 20% when calculated from 15 to 50 spiked samples, and within ± 10% when calculated from over 50 samples.

PRECISION

The precision statistic used for this contract was S_B from HPS N13.30 (1996), but the limits differ from that standard. S_B is given by:

$$S_B = \sqrt{\sum_{i=1}^{m}\sum_{j=1}^{n}\frac{(B_{rij} - B_r)^2}{(N-1)}}$$

where the symbols are the same as for relative bias (B_r).

The above equation is valid for samples spiked at one or more levels, subject to the limits for the relative precision, which depend on the activity of the spikes relative to the CL. Specifically, the relative precision statistics shall be less than or equal to 0.4 for samples spiked greater than three times the CL and less than or equal to 0.5 for samples spiked between one and three times the CL. Outliers were not included in the determination of precision.

FINDINGS

Results from three types of QC samples were available: 1) those prepared by GEL and analyzed as single-blinds (spike amount unknown to the analyst), 2) those submitted by IDP and analyzed as single-blinds (spike amount unknown to the analyst), and 3) those submitted by IDP and analyzed as double-blinds (spike amount and sample origin unknown to the analyst).

Single-blind samples this year included 22 urines and 7 artificial fecal samples prepared by RPG. The results of the statistical tests (see Table 4 and Appendix A) are discussed below. Statistical results from the present and previous years are compared in Table 5.

OUTLIERS

Analytical results that are biased by "blunders" during the analysis should not be included in the data set used for the statistical evaluation of the analytical procedure, but too many outliers would indicate poor laboratory performance (see Table 6). GEL (see Appendix B) did not identify any outliers. However, there were 14 analytical ^{241}Am urinalysis results spiked at the CL that were determined to be outliers. These samples indicated activity between three to five times the CL. An investigation concluded that the samples were contaminated in the RPG laboratory during spiking. All 14 urine samples were spiked with 0.02 dpm ^{239}Pu and 0.02 dpm ^{241}Am, unfortunately the ^{239}Pu source material was contaminated with ^{241}Am. The 14 data points were subsequently removed from the data set.

TABLE 4. Summary of Statistical Values by Nuclide

Isotope[a]	Sample Source	Blank (dpm) n	L_c	MDA	CL	Spike level at CL (dpm) n	B_r	S_B	Spike Level > 2CL (dpm) n	B_r	S_B
^{3}H(dpm/mL)	**IDP**	0	…	…	**20**	0			0.00	…	…
	GEL	141	0.9960	0.009	**20**				141	-0.01	0.07
Total Sr	**IDP**	0	…	…	**10**	20	0.003	0.10	0	…	…
	GEL	20	0.32	2.82	**10**	20	0.05	0.13	20	-0.01	0.06
^{90}Sr	GEL	127	0.62	2.32	**10**	12 3	-0.02	0.15	133	0.015	0.103
^{228}Th	GEL	6	0.030	0.044	**0.1**	…	…	…	…	…	…
^{229}Th	GEL	6	0.021	0.032	**0.1**	…	…	…	…	…	…
^{232}Th	GEL	6	0.021	0.032	**0.1**	1	0.05	…	1	-0.042	…
^{230}Th	GEL	6	0.021	0.036	**0.1**	…	…	…	…	…	…
^{242}Cm	GEL	38	0.004	0.011	**0.02**	…	…	…	…	…	…
^{244}Cm	GEL	155	0.004	0.010	**0.02**	30	0.19	0.28	38	0.065	0.095
^{238}Pu-urine	**IDP**	32	0.011	0.025[c]	**0.02**	0	…	…	0	…	…
	GEL	426	0.004	0.010	**0.02**	…	…	…	…	…	…
feces	**IDP**	7	0.01	0.041	**0.2**	0	…	…	0	…	…
	GEL	34	0.01	0.069	**0.2**	…	…	…	…	…	…
^{239}Pu-urine	**IDP**				**0.02**	33 37	-0.02	0.30	0	…	…
	GEL	426	0.005	0.011	**0.02**	8	0.02	0.27	454	-0.001	0.072
feces	**IDP**	2	0.04	0.197	**0.2**	5	-0.10	0.11	0		
	GEL	34	0.01	0.076	**0.2**	31	0.17	0.00	25	-0.055	0.057
^{241}Am-urine	**IDP**				**0.02**	25 14	0.14	0.50	0	…	…
	GEL	155	0.004	0.011	**0.02**	6	0.012[c]	0.32	157	0.053	0.107
feces	**IDP**	2	0.03	0.205	**0.8**	5	-0.08	0.10	0	…	…
	GEL	24	0.01	0.062	**0.8**	21	0.11	0.20	19	0.005	0.089
^{243}Am-urine	**IDP**	7	0.006	0.016	**0.02**	0	…	…	0	…	…
	GEL	38	0.005	0.013	**0.02**	17	0.20	0.32	37	-0.013	0.097
^{234}U	**IDP**	0	…	…	**0.02**	…	…	…	0	…	…
	GEL	80	0.010	0.021[e]	**0.02**	…	…	…	…	…	…
feces	GEL	2	0.149	0.016	…	…	…	…	…	…	…
^{235}U	**IDP**	8	…	0.020	**0.02**	…	…	…	0	…	…
	GEL	80	0.007	0.016	**0.02**	…	…	…	…	…	…
feces	GEL	2	0.085	0.016	…	…	…	…	…	…	…
^{238}U	**IDP**	0	…	…	**0.02**	16	-0.02	0.30	0		
	GEL	80	0.009	0.020	**0.02**	78	-0.04	0.22	82	-0.05	0.11
feces	GEL	2	0.112	0.016	…	2	0.514[c]	0.536[c]	2.00	0.105	0.005
^{236}U (ICPMS)	GEL	1	0.000	95.5 pg	**140 pg**	1	-0.05	…	…	…	…
U-urine [b]	**IDP**	0	…	…	**0.06**	0			22	-0.064	0.321
	GEL	225	0.006 µg	0.011 µg	**0.06 µg**	74	-0.12	0.20	75	-0.124	0.117

(a) Analyzed in urine matrix unless otherwise noted.

(b) Units for L_c, MDA, and CL are mg per sample.

(c) Failed performance criterion.

(d) Possible environmental contaminant.

(e) Within statistical uncertainty

(f) Stats for Cm same as Am-241

TABLE 5. Comparison of Quality Control Statistics Between the First and Second Contract Year with GEL Using QC Samples Submitted by IDP

		Report	Blanks			Spike Level at CL			Spike Level > 3CL		
Nuclide	CL	Year	n	L_c	MDA	n	B_r	S_R	n	B_r	S_R
^{3}H	20 dpm/mL	2006	1	…	…	2	0.42	0.63	…	…	…
		2007	0	…	…	0	0.00	0.00	…	…	…
Sr	10 dpm	2006	1	…	…	14	0.12	0.23	…	…	…
		2007	0	…	…	20	0.00	0.10	0	…	…
U	0.06 mg	2006	1	…	…	2	-1.6 (c)	2.05 (c)	15	-0.14	0.22
(elemental)		2007	0	…	…	0	0.00	0.00	22	-0.06	0.32
^{235}U	0.02 dpm	2006	12	0.01	0.02	3	-0.24(c)	0.3	…	…	…
		2007	8	…	0.02	…	…	…	0	…	…
^{238}U	0.02 dpm	2006	…	…	…	0	0.00	0.00	15	0.02	0.23
		2007	0	…	…	16	-0.02	0.30	0	0.00	0.00
^{238}Pu	0.02 dpm	2006	21	0.004	0.011	1	-0.18	…	…	…	…
(urine)		2007	32	0.011	0.025(c)	0	…	…	0	…	…
^{239}Pu	0.02 dpm	2006	6	0.002	0.009	16	0.05	0.23	…	…	…
(urine)		2007	0	0.000	0.000	33	-0.02	0.30	0	…	…
^{239}Pu	0.2 dpm	2006	6	0.027	0.07	…	…	…	6	-0.05	0.09
(fecal)		2007	2	0.036	0.20	5	0	0	0	0.00	0.00
^{241}Am	0.02 dpm	2006	2	0.005	0.068(c)	17	0.19	0.35	…	…	…
(urine)		2007	0	0.000	0.000	25	0.14	0.50	0	…	…
^{241}Am	0.02 dpm	2006	8	0.025	0.063	4	-0.17	0.09	…	…	…
(fecal)		2007	2	0.033	0.205	5	-0.08	0.10	0	…	…
^{243}Am	0.02 dpm	2006	2	0.020	0.09	0	…	…	…	…	…
		2007	7	0.006	0.016	0	…	…	0	…	…

Note: L_c and MDA units same as CL. B_r and S_R are unitless (fractional values).

TABLE 6. Other Indicators of Analytical Uncertainty (IDP Samples)

Nuclide	Analyses	Outliers	Spikes at CDL IDP	Spikes at CDL GEL	False Negatives (%) IDP	False Negatives (%) GEL	2007-2008 Yield Flags	2007-2008 Failed Analyses
Urine								
^{3}H	0	0 (0)	0		0 (0)			
^{90}Sr	20	0 (0)	20	20	0 (0)		1.4%	0.2%
^{238}U	16	0 (0)	16	78	0 (0)		13.5%	2.9%
^{238}Pu	32	0 (0)	0		0 (0)		0.4%	0.0%
^{239}Pu	33	0 (0)	33	378	1 (3%)	4 (1%)	0.4%	0.0%
^{241}Am	11	14 (56%)	11	146	0 (0)	1 (0.7%)	0.4%	0.4%
^{243}Am	7	0 (0)	0	17	0 (0)			
Unat	22	0 (0)	22	74	0 (0)		1.3%	1.3%
Total	*149*	0 (0)	*68*		0 (0)			
Feces								
^{241}Am	7	0 (0)	5	21	0 (0)		25.0%	4.2%
^{238}Pu	7	0 (0)	...		0 (0)		6.3%	
^{239}Pu	7	0 (0)	5	31	0 (0)			
Total	*21*	*0 (0)*	*10*		*0 (0)*			

TRITIUM

Effective June 2006, the tritium intercomparison program by IDP was discontinued, performance indicators will be evaluated through GEL's QC program. The control samples run by GEL also met all the acceptance criteria tested as part of the quality control program. The tritium analyses were considered acceptable.

STRONTIUM-90 AND TOTAL STRONTIUM

The total strontium procedure is used to screen samples to determine which will require analysis for ^{90}Sr. Samples with total strontium results less than 15 dpm do not undergo further analysis. Samples with results greater than or equal to 15 dpm may undergo ^{90}Y in growth to specifically determine ^{90}Sr levels. The calculated MDA, as reported by GEL, for the total strontium part of the analysis was about 28% of the CL. The relative bias and precision, tested by IDP and GEL for the ^{90}Sr and total Sr procedures were all within limits. The 20 samples spiked at the contractual level by IDP were all detected. The strontium urinalysis procedure was concluded to be acceptable.

PLUTONIUM-238 AND -239

Samples spiked with ^{238}Pu and ^{239}Pu were analyzed using the same procedures and same reagents. The two isotopes are differentiated only at the end of the procedure by alpha spectrometry. Therefore, laboratory performance is expected to be similar for both isotopes using any of the seven procedures that incorporate plutonium analysis (IPU, IPA, IPS, IPSA, IPSR, IUPU, and ITPAC).

The MDAs and performance statistics for ^{239}Pu and ^{238}Pu in urine were acceptable. The 33 samples spiked at the CL for ^{239}Pu were reported with only one result less than the decision level indicating a 3% false negative. There were four blank samples indicating ^{238}Pu activity, one sample indicated activity in excess of the CL. Upon review it appears that the samples may have been cross-contaminated during handling in the audit laboratory. Results of the four samples were not removed from the data set because it could not be verified that the samples were contaminated. Including the four elevated samples, the MDA as analyzed by IDP for ^{238}Pu was only slightly elevated. GEL reported an MDA for ^{238}Pu that was 50% of the CL. Overall the plutonium urinalyses were considered acceptable.

URANIUM (UNAT)

No concerns were identified with the elemental uranium urinalysis program and it was considered acceptable. Because IDP uses a 0.2 µg screening level for elemental uranium, samples spiked at 0.06 µg were discontinued. The MDA at the contractual level of 0.06 µg was evaluated through GEL's program and were found to be acceptable. The relative bias was within statistical uncertainty and the relative precision was acceptable. The bias and precision as tested by IDP met the acceptance criteria. The bias and precision was tested by IDP at 0.2 µg and by GEL at 1 µg and at 0.06 µg.

ISOTOPIC URANIUM

The isotopic uranium analysis reports on three uranium isotopes: ^{234}U, ^{235}U, and ^{238}U. The isotopes are differentiated only during counting by alpha spectrometry. GEL reported that the calculated minimum detectable activity (MDA) for ^{233,234}U for the year slightly exceeded the contract required detection limit. The MDA reported by GEL was within statistical uncertainty and determined to be acceptable.

Because IDP used a depleted uranium source material for the isotopic uranium urinalyses, ^{233,234}U was not evaluated. However, the performance statistics for ^{235}U and ^{238}U were reviewed and the MDA for ^{235}U and the bias and precision for ^{238}U were acceptable. GEL is still working to improve the

tracer yields on the isotopic uranium urinalysis program and this will continue to be monitored.

AMERICIUM-241

The ^{241}Am fecal and urine analysis met the acceptance criteria for MDA, relative bias and precision. The MDA as reported by GEL was 50% of the contractual level. There were 25 ^{241}Am samples spiked at the contractual detection level (CL) and 14 indicated activity between three to five times the CL. An investigation, which ran from November 2007 through March 2008, concluded that the samples were contaminated in the RPG laboratory during spiking (Attachment 1). All 14 urine samples were spiked with 0.02 dpm ^{239}Pu and 0.02 dpm ^{241}Am, unfortunately the ^{239}Pu source material was contaminated with ^{241}Am. Americium-241 may have been added to the ^{239}Pu source material via a contaminated pipette tip, however, the exact circumstance is unknown. A new ^{239}Pu source material was prepared. Subsequent samples did not show ^{241}Am contamination.

The 14 data points were removed from the data set to evaluate the relative bias and precision, both of which met the acceptance criteria. GEL reported a slightly elevated precision for ^{241}Am, but the results were within statistical uncertainty. The current AM241 urinalysis procedure was considered acceptable.

Both blank ^{241}Am fecal samples were less than the decision level and the five spiked fecal samples were all greater than the decision. The ^{241}Am fecal duplicate samples were evaluated and it was concluded that the aliquoting procedure produced results within the control limits.

AMERICIUM-243

The AM243 procedure was identical to the AM241 procedure, except a different tracer is used (^{244}Cm instead of ^{243}Am). The seven blank ^{243}Am QC samples submitted were all reported with results less than the decision level and the calculated MDA was 65% of the contractual detection level. The performance statistics for ^{243}Am, as tested by GEL, met the acceptance criteria. The ^{243}Am procedure was concluded to be acceptable.

ISOTOPIC CURIUM

IDP did not submit QC samples to test the isotopic curium program, therefore performance statistics were based on the GEL QC results. GEL tested the MDA for ^{242}Cm and ^{244}Cm and the relative bias and precision for ^{244}Cm. The results met the acceptance criteria and the isotopic curium urinalysis program was considered acceptable.

ISOTOPIC THORIUM

IDP also did not submit QC samples to test the isotopic thorium program, therefore performance statistics were based on the GEL QC results. GEL tested the MDA for ^{228}Th, ^{229}Th, ^{230}Th and ^{232}Th and the relative bias and precision for ^{232}Th. The results met the acceptance criteria and the isotopic thorium urinalysis program was considered acceptable.

URANIUM VIA INDUCTIVELY COUPLED PLASMA MASS SPECTROMETRY (ICPMS)

A new ^{236}U analysis procedure was initiated in June 2007 and one urinalysis was run. The analysis for ^{236}U uses an inductively coupled plasma mass spectrometry (ICPMS). A review of the ^{236}U analysis determined that more work was needed in reducing uncertainties and improving the analysis. The procedure was not formally approved until June 2008 and will be discussed in the fourth contract year's report.

FOLLOW-UP ON CONCERNS DURING THE THIRD CONTRACT YEAR

There were few concerns during the third year with General Engineering Laboratories (GEL). The main emphasis was developing an ICPMS procedure for ^{236}U analysis. This was accomplished in June 2008.

A review of Incident reports since the contract with GEL was initiated did not identify a trend or a concern. The majority of incident reports were due to human error and corrective actions were deemed acceptable. Incident reports issued during the second contract year and their follow-up are reported in Appendix B.

SUMMARY OF THE BIOASSAY QUALITY CONTROL REPORT FROM GEL INCORPORATED, FOR THE CONTRACT 313500 FOURTH OPERATIONAL YEAR

GEL reported all analytical batches were analyzed with a reagent blank (Unat only), matrix blank or both. GEL considered blanks in control when the calculate MDA was less than the Contract Limit (CL) and the L_c was less than ½ CL (see Appendix B). In addition, the chemical tracer yields were evaluated against the yield requirements stated in the subject contract. Overall, GEL believed that the blank and spike data for each analytical process demonstrated that the analyses were in control.

In the review GEL indentified laboratory control samples that had yields greater than 125%. However, a review of excreta sample results found no analytical sample that had a tracer yield greater than 125%. GEL also indentified laboratory control samples that met the criteria for low yield, but likewise a review of excreta sample results found the low yield rate to be acceptable. GEL is still working to improve the tracer yields on the isotopic uranium urinalysis program and this will continue to be monitored.

RESULTS FROM INTERCOMPARISON PROGRAMS

GEL participated in 3 intercomparison programs (Appendix D – Intercomparison Programs) in the third contract year. On April 1, 2006 they participated in the National Institute of Standards and Technology's program testing the relative bias and precision for ^{238}Pu, ^{239}Pu, ^{241}Am, ^{230Th}, ^{235}U, ^{238}U, ^{234}U and ^{90}Sr in synthetic feces. GEL met the acceptance criteria for relative bias and precision for all isotopes except for ^{90}Sr, which failed the portion on relative bias but passed on relative precision. Because Hanford does not use fecal samples for strontium analyses, this was not deemed a concern. GEL also participated in the National Institute of Standards and Technology's program testing the relative bias and precision for ^{238}Pu, ^{239}Pu, ^{241}Am, ^{230}Th, ^{235}U, ^{238}U, ^{234}U, ^{90}Sr, ^{60}Co, ^{133}Ba, ^{137}Cs and ^{152}Eu in synthetic urine. GEL met the acceptance criteria for relative bias and precision on all isotopes.

On December 1, 2006 GEL participated in the Department of Energy Laboratory Accreditation Program, Session 10. Isotopes tested in a fecal matrix were ^{238}Pu, ^{239}Pu, ^{241}Am, ^{230}Th, ^{232}Th, ^{2228}Th ^{238}U, ^{234}U, ^{90}Sr, ^{60}Co, and ^{137}Cs. Isotopes tested in a urine matrix were ^{238}Pu, ^{239}Pu, ^{241}Am, ^{230}Th, ^{232}Th, ^{2228}Th, ^{238}U, ^{234}U, ^{90}Sr, ^{60}Co, ^{137}Cs, tritium and U-total. GELpassed the acceptance criteria for all isotopes in both the fecal and urine matrix for relative bias and precision.

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RELEVANT PROCEDURES AND CORRESPONDENCE

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APPENDIX A

QUALITY CONTROL SAMPLE RESULTS
(Historical File Only)

QC SUMMARY REPORT Analysis dates from 4/1/2007 to 3/31/2008 Run Date 10/27/2008

ISO CD	YRMO	SEQ	ANAL DATE	TAGWORD	PAYID	REQ ANAL	VOL	SPIKE	UNCERT	TYPE	MR	RESULT	UNCERT	DET	REL BIAS
AM241	0710	10	10/20/2007	07J0402	AU001	IPA	130.	0.0000	0.0000	F	J	-0.0082	0.0081	-	
AM241	0711	14	12/15/2007	07K0479	AU001	IPA	13.0	0.0000	0.0000	F	J	-0.0009	0.0036	-	
				2	F	AM241 Count		0.0000	Average Result		-0.0045	DL	0.0325	Chem Yield 0.76	Time 960
								2	St Dev		0.0051	MDA	0.2053	Det Eff 0.39	
AM241	0711	11	12/15/2007	07K0476	AU001	IPA	11.8	0.9000	0.0450	F	J	0.8470	0.1770	+	-0.0589
AM241	0711	12	12/15/2007	07K0477	AU001	IPA	11.6	0.9000	0.0450	F	J	0.8950	0.1870	+	-0.0056
AM241	0711	13	12/15/2007	07K0478	AU001	IPA	11.7	0.9000	0.0450	F	J	0.6630	0.1430	+	-0.2633
AM241	0711	15	12/15/2007	07K0475	AU001	IPA	10.7	0.9000	0.0450	F	J	0.8680	0.1810	+	-0.0356
AM241	0711	16	12/15/2007	07K0474	AU001	IPA	10.4	0.9000	0.0450	F	J	0.8500	0.1790	+	-0.0556
				5	F	AM241 Count		0.9000	Average Result		0.8246			Mean Rel. Bias	-0.0838
								5	St Dev		0.0923			Mean Rel. Precision	0.1026
	Number of total F AM241 7														
AM241	0704	08	05/07/2007	07D0234	3G544	IPSA	1326	0.0200	0.0008	U	L	0.0469	0.0119	+	1.3450
AM241	0704	09	05/07/2007	07D0229	99153	IPSA	1134	0.0200	0.0008	U	L	0.0323	0.0090	+	0.6150
AM241	0705	08	05/31/2007	07E0061	91382	IPSA	1338	0.0200	0.0006	U	L	0.0153	0.0065	+	-0.2350
AM241	0705	09	05/31/2007	07E0107	50575	IPSA	1179	0.0200	0.0006	U	L	0.0122	0.0058	+	-0.3900
AM241	0705	10	05/31/2007	07E0159	3C135	IPSA	1287	0.0200	0.0006	U	L	0.0185	0.0071	+	-0.0750
AM241	0706	05	07/02/2007	07F0079	31776	IPSA	1129	0.0200	0.0006	U	L	0.0227	0.0071	+	0.1350
AM241	0706	09	07/02/2007	07F0246	59621	IPSA	1350	0.0200	0.0006	U	L	0.0161	0.0060	+	-0.1950
AM241	0706	08	07/02/2007	07F0247	99156	IPSA	1192	0.0200	0.0006	U	L	0.0189	0.0063	+	-0.0550
AM241	0706	06	07/02/2007	07F0119	50807	IPSA	1319	0.0200	0.0006	U	L	0.0241	0.0074	+	0.2050
AM241	0706	07	07/02/2007	07F0120	50809	IPSA	1280	0.0200	0.0006	U	L	0.0163	0.0055	+	-0.1850
AM241	0706	10	08/01/2007	07G0091	99159	IPSA	1136	0.0200	0.0006	U	L	0.0273	0.0080	+	0.3650
				11	U	AM241 Count		0.0200	Average Result		0.0228			Mean Rel. Bias	0.1391
								11	St Dev		0.0099			Mean Rel. Precision	0.4956
	Number of total U AM241 11														

Total Samples 18

Total Results 18

ISO CD	YRMO	SEQ	ANAL DATE	TAGWORD_1	PAYID	REQ ANAL		VOL	SPIKE	UNCERT	TYPE	MR	RESULT	UNCERT	DET		REL BIAS
AM241	0710	10	10/20/2007	07J0402	AU001	IPA		130.	0.0000	0.0000	F	J	-0.0082	0.0081	-		
AM241	0711	14	12/15/2007	07K0479	AU001	IPA		13.0	0.0000	0.0000	F	J	-0.0009	0.0036	-		
				2	**F**		**AM241 Count**		**0.0000**	**Average Result**		**-0.0045**		**0.0325**	**Chem Yield**	**0.76**	**Time 960**
									2	**St Dev**		**0.0051**	**DL**	**0.2053**	**Det Eff**	**0.39**	
													MDA				
AM241	0711	13	12/15/2007	07K0478	AU001	IPA		11.7	0.9000	0.0450	F	J	0.6630	0.1430	+		-0.2633
AM241	0711	11	12/15/2007	07K0476	AU001	IPA		11.8	0.9000	0.0450	F	J	0.8470	0.1770	+		-0.0589
AM241	0711	12	12/15/2007	07K0477	AU001	IPA		11.6	0.9000	0.0450	F	J	0.8950	0.1870	+		-0.0056
AM241	0711	15	12/15/2007	07K0475	AU001	IPA		10.7	0.9000	0.0450	F	J	0.8680	0.1810	+		-0.0356
AM241	0711	16	12/15/2007	07K0474	AU001	IPA		10.4	0.9000	0.0450	F	J	0.8500	0.1790	+		-0.0556
				5	**F**		**AM241 Count**		**0.9000**	**Average Result**		**0.8246**			**Mean Rel. Bias**		**-0.0838**
									5	**St Dev**		**0.0923**			**Mean Rel. Precision**		**0.1026**
	Number of total F AM241 7																
PU238	0710	10	10/19/2007	07J0402	AU001	IPA		130.	0.0000	0.0000	F	J	-0.0013	0.0046	-		
PU238	0711	12	12/13/2007	07K0477	AU001	IPA		11.6	0.0000	0.0000	F	J	0.0070	0.0063	-		
PU238	0711	16	12/13/2007	07K0474	AU001	IPA		10.4	0.0000	0.0000	F	J	0.0224	0.0122	-		
PU238	0711	13	12/13/2007	07K0478	AU001	IPA		11.7	0.0000	0.0000	F	J	0.0105	0.0086	-		
PU238	0711	11	12/13/2007	07K0476	AU001	IPA		11.8	0.0000	0.0000	F	J	0.0078	0.0070	-		
PU238	0711	15	12/13/2007	07K0475	AU001	IPA		10.7	0.0000	0.0000	F	J	0.0122	0.0083	-		
PU238	0711	14	12/13/2007	07K0479	AU001	IPA		13.0	0.0000	0.0000	F	J	0.0038	0.0047	-		
				7	**F**		**PU238 Count**		**0.0000**	**Average Result**		**0.0089**	**DL**	**0.0144**	**Chem Yield**	**0.85**	**Time 960**
									7	**St Dev**		**0.0074**	**MDA**	**0.0407**	**Det Eff**	**0.39**	
	Number of total F PU238 7																
PU239	0710	10	10/19/2007	07J0402	AU001	IPA		130.	0.0000	0.0000	F	J	-0.0127	0.0046	-		
PU239	0711	14	12/13/2007	07K0479	AU001	IPA		13.0	0.0000	0.0000	F	J	-0.0047	0.0038	-		
				2	**F**		**PU239 Count**		**0.0000**	**Average Result**		**-0.0087**	**DL**	**0.0356**	**Chem Yield**	**0.85**	**Time 960**
									2	**St Dev**		**0.0056**	**MDA**	**0.1966**	**Det Eff**	**0.39**	
PU239	0711	11	12/13/2007	07K0476	AU001	IPA		11.8	1.0000	0.0350	F	J	0.7290	0.0887	+		-0.2710
PU239	0711	13	12/13/2007	07K0478	AU001	IPA		11.7	1.0000	0.0350	F	J	0.9400	0.0976	+		-0.0600
PU239	0711	16	12/13/2007	07K0474	AU001	IPA		10.4	1.0000	0.0350	F	J	0.8510	0.0897	+		-0.1490
PU239	0711	15	12/13/2007	07K0475	AU001	IPA		10.7	1.0000	0.0350	F	J	1.0100	0.1000	+		0.0100
PU239	0711	12	12/13/2007	07K0477	AU001	IPA		11.6	1.0000	0.0350	F	J	0.9670	0.1020	+		-0.0330
				5	**F**		**PU239 Count**		**1.0000**	**Average Result**		**0.8994**			**Mean Rel. Bias**		**-0.1006**
									5	**St Dev**		**0.1116**			**Mean Rel. Precision**		**0.1116**
	Number of total F PU239 7																
U 234	0709	10	10/18/2007	07J0401	AU001	IU		130.	0.0000	0.0000	F	U	2.4400	0.2500	+		

ISO CD	YRMO	SEQ	ANAL DATE	TAGWORD	J	PAYID	REQ ANAL	VOL	SPIKE	UNCERT	TYPE	MR	RESULT	UNCERT	DET			REL BIAS
					1	F	U 234 Count		0.0000 1	Average Result St Dev		2.4400 0.0000	DL MDA		Chem Yield Det Eff	0.83 0.39	Time	960
	Number of total F U234 1																	
U 235	0709	10	10/18/2007	07J0401		AU001	IU	130.	0.0000	0.0000	F	U	0.0303	0.0225	-			
					1	F	U 235 Count		0.0000 1	Average Result St Dev		0.0303 0.0000	DL MDA		Chem Yield Det Eff	0.83 0.39	Time	960
	Number of total F U235 1																	
U 238	0709	10	10/18/2007	07J0401		AU001	IU	130.	0.0000	0.0000	F	U	1.7900	0.1960	+			
					1	F	U 238 Count		0.0000 1	Average Result St Dev		1.7900 0.0000	DL MDA		Chem Yield Det Eff	0.83 0.39	Time	960
	Number of total F U238 1																	
AM241	0704	08	05/07/2007	07D0234		3G544	IPSA	1326	0.0200	0.0008	U	L	0.0469	0.0119	+			1.3450
AM241	0704	09	05/07/2007	07D0229		99153	IPSA	1134	0.0200	0.0008	U	L	0.0323	0.0090	+			0.6150
AM241	0705	10	05/31/2007	07E0159		3C135	IPSA	1287	0.0200	0.0006	U	L	0.0185	0.0071	+			-0.0750
AM241	0705	08	05/31/2007	07E0061		91382	IPSA	1338	0.0200	0.0006	U	L	0.0153	0.0065	+			-0.2350
AM241	0705	09	05/31/2007	07E0107		50575	IPSA	1179	0.0200	0.0006	U	L	0.0122	0.0058	+			-0.3900
AM241	0706	05	07/02/2007	07F0079		31776	IPSA	1129	0.0200	0.0006	U	L	0.0227	0.0071	+			0.1350
AM241	0706	07	07/02/2007	07F0120		50809	IPSA	1280	0.0200	0.0006	U	L	0.0163	0.0055	+			-0.1850
AM241	0706	06	07/02/2007	07F0119		50807	IPSA	1319	0.0200	0.0006	U	L	0.0241	0.0074	+			0.2050
AM241	0706	09	07/02/2007	07F0246		59621	IPSA	1350	0.0200	0.0006	U	L	0.0161	0.0060	+			-0.1950
AM241	0706	08	07/02/2007	07F0247		99156	IPSA	1192	0.0200	0.0006	U	L	0.0189	0.0063	+			-0.0550
AM241	0706	10	08/01/2007	07G0091		99159	IPSA	1136	0.0200	0.0006	U	L	0.0273	0.0080	+			0.3650
AM241	0708	10	09/03/2007	07H0312		99151	IPSA	1283	0.0200	0.0006	U	L	0.1100	0.0246	+			4.5000
AM241	0708	09	09/03/2007	07H0272		99162	IPSA	1183	0.0200	0.0006	U	L	0.1010	0.0225	+			4.0500
AM241	0708	08	09/03/2007	07H0227		51077	IPSA	1312	0.0200	0.0006	U	L	0.0622	0.0152	+			2.1100
AM241	0710	09	11/03/2007	07J0188		99161	IPSA	1300	0.0200	0.0008	U	L	0.0674	0.0159	+			2.3700
AM241	0711	10	12/05/2007	07K0153		59600	IPSA	1342	0.0200	0.0010	U	L	0.0858	0.0196	+			3.2900
AM241	0801	09	02/06/2008	08A0222		3C134	IPSA	1165	0.0200	0.0003	U	L	0.0705	0.0167	+			2.5250
AM241	0801	11	02/06/2008	08A0276		99158	IPSA	1162	0.0200	0.0003	U	L	0.0807	0.0186	+			3.0350
AM241	0801	10	02/06/2008	08A0223		3C142	IPSA	1379	0.0200	0.0003	U	L	0.0924	0.0208	+			3.6200
AM241	0802	10	03/07/2008	08B0353		99157	IPA	1277	0.0200	0.0007	U	J	0.0911	0.0207	+			3.5550
AM241	0802	09	03/07/2008	08B0345		99150	IPA	1409	0.0200	0.0007	U	J	0.0934	0.0212	+			3.6700
AM241	0802	08	03/10/2008	08B0348		99154	IPA	1165	0.0200	0.0007	U	J	0.0908	0.0206	+			3.5400
AM241	0802	07	03/10/2008	08B0208		59600	IPA	1158	0.0200	0.0007	U	J	0.0958	0.0213	+			3.7900
AM241	0802	11	03/10/2008	08B0357		59001	IPSA	1178	0.0200	0.0007	U	L	0.0815	0.0186	+			3.0750
AM241	0802	12	03/10/2008	08B0207		99156	IPSA	1398	0.0200	0.0007	U	L	0.0874	0.0199	+			3.3700

Outliers

ISO CD	YRMO	SEQ	ANAL DATE	TAGWORD	J	PAYID	REQ ANAL	VOL	SPIKE	UNCERT	TYPE	MR	RESULT	UNCERT	DET	REL BIAS
				25	U		AM241 Count		0.0200 25	Average Result St Dev		0.0584 0.0343			Mean Rel. Bias Mean Rel. Precision	1.9212 1.7133
	Number of total U AM241 25															
AM243	0704	03	04/24/2007	07D0189		99120	AM243	1302	0.0000	0.0000	U		-0.0043	0.0032	-	
AM243	0704	01	04/24/2007	07D0107		91386	AM243	1333	0.0000	0.0000	U		-0.0056	0.0013	-	
AM243	0704	02	04/29/2007	07D0129		32533	AM243	1223	0.0000	0.0000	U		-0.0060	0.0019	-	
AM243	0706	01	07/18/2007	07G0097		80098	AM243	1255	0.0000	0.0000	U		0.0014	0.0013	-	
AM243	0707	01	09/02/2007	07H0276		3C136	AM243	1253	0.0000	0.0000	U		0.0005	0.0055	-	
AM243	0709	01	10/01/2007	07I0062		32514	AM243	1259	0.0000	0.0000	U		-0.0014	0.0020	-	
AM243	0709	02	10/01/2007	07I0176		99152	AM243	1087	0.0000	0.0000	U		-0.0013	0.0027	-	
				7	U		AM243 Count		0.0000 7	Average Result St Dev		-0.0024 0.0029	DL MDA	0.0057 0.0161	Chem Yield 0.82 Det Eff 0.39	Time 2520
	Number of total U AM243 7															
PU238	0704	09	05/07/2007	07D0229		99153	IPSA	1134	0.0000	0.0000	U	L	-0.0011	0.0019	-	
PU238	0704	08	05/07/2007	07D0234		3G544	IPSA	1326	0.0000	0.0000	U	L	-0.0020	0.0010	-	
PU238	0705	08	05/27/2007	07E0061		91382	IPSA	1338	0.0000	0.0000	U	L	-0.0001	0.0025	-	
PU238	0705	10	05/27/2007	07E0159		3C135	IPSA	1287	0.0000	0.0000	U	L	-0.0001	0.0019	-	
PU238	0705	09	05/27/2007	07E0107		50575	IPSA	1179	0.0000	0.0000	U	L	-0.0001	0.0026	-	
PU238	0706	05	07/02/2007	07F0079		31776	IPSA	1129	0.0000	0.0000	U	L	0.0056	0.0030	-	
PU238	0706	08	07/02/2007	07F0247		99156	IPSA	1192	0.0000	0.0000	U	L	0.0038	0.0028	-	
PU238	0706	07	07/02/2007	07F0120		50809	IPSA	1280	0.0000	0.0000	U	L	0.0035	0.0035	-	
PU238	0706	06	07/02/2007	07F0119		50807	IPSA	1319	0.0000	0.0000	U	L	0.0090	0.0036	+	
PU238	0706	09	07/02/2007	07F0246		59621	IPSA	1350	0.0000	0.0000	U	L	0.0081	0.0039	+	
PU238	0706	10	08/01/2007	07G0091		99159	IPSA	1136	0.0000	0.0000	U	L	0.0343	0.0069	+	
PU238	0707	05	08/13/2007	07G0098		80098	IPU	1302	0.0000	0.0000	U	Q	0.0000	0.0020	-	
PU238	0708	11	08/24/2007	07H0417		99159	IPU	1413	0.0000	0.0000	U	Q	-0.0015	0.0033	-	
PU238	0707	06	08/24/2007	07H0418		99159	IPU	1432	0.0000	0.0000	U	Q	-0.0003	0.0022	-	
PU238	0708	09	09/05/2007	07H0272		99162	IPSA	1183	0.0000	0.0000	U	L	0.0022	0.0032	-	
PU238	0708	08	09/05/2007	07H0227		51077	IPSA	1312	0.0000	0.0000	U	L	0.0069	0.0033	+	
PU238	0708	10	09/05/2007	07H0312		99151	IPSA	1283	0.0000	0.0000	U	L	-0.0014	0.0028	-	
PU238	0708	14	09/12/2007	07H0451		AU001	IPU	1202	0.0000	0.0000	U	Q	0.0025	0.0030	-	
PU238	0708	13	09/12/2007	07H0452		AU001	IPU	1193	0.0000	0.0000	U	Q	0.0012	0.0026	-	
PU238	0708	15	09/12/2007	07H0453		AU001	IPU	1197	0.0000	0.0000	U	Q	0.0000	0.0016	-	
PU238	0708	16	09/12/2007	07H0454		AU001	IPU	1191	0.0000	0.0000	U	Q	0.0012	0.0036	-	
PU238	0708	12	09/12/2007	07H0450		AU001	IPU	1183	0.0000	0.0000	U	Q	0.0012	0.0026	-	
PU238	0708	17	09/12/2007	07H0455		AU001	IPU	1102	0.0000	0.0000	U	Q	0.0048	0.0029	-	
PU238	0801	09	02/05/2008	08A0222		3C134	IPSA	1165	0.0000	0.0000	U	L	0.0044	0.0027	-	
PU238	0801	11	02/05/2008	08A0276		99158	IPSA	1162	0.0000	0.0000	U	L	-0.0012	0.0019	-	

ISO CD	YRMO	SEQ	ANAL DATE	TAGWORD I	PAYID	REQ ANAL	VOL	SPIKE	UNCERT	TYPE	MR	RESULT	UNCERT	DET	REL BIAS
PU238	0801	10	02/05/2008	08A0223	3C142	IPSA	1379	0.0000	0.0000	U	L	0.0023	0.0023	-	
PU238	0802	08	03/08/2008	08B0348	99154	IPA	1165	0.0000	0.0000	U	J	0.0043	0.0031	-	
PU238	0802	09	03/08/2008	08B0345	99150	IPA	1409	0.0000	0.0000	U	J	0.0023	0.0023	-	
PU238	0802	11	03/08/2008	08B0357	59001	IPSA	1178	0.0000	0.0000	U	L	0.0000	0.0028	-	
PU238	0802	07	03/08/2008	08B0208	59600	IPA	1158	0.0000	0.0000	U	J	0.0000	0.0016	-	
PU238	0802	12	03/08/2008	08B0207	99156	IPSA	1398	0.0000	0.0000	U	L	0.0055	0.0029	-	
PU238	0802	10	03/13/2008	08B0353	99157	IPA	1277	0.0000	0.0000	U	J	0.0011	0.0024	-	
				32	U	PU238 Count		0.0000 32	Average Result St Dev			0.0030 0.0064	DL MDA	0.0108 0.0250	Chem Yield 0.89 Det Eff 0.39	Time 2520
	Number of total U PU238 32														
PU239	0704	09	05/07/2007	07D0229	99153	IPSA	1134	0.0200	0.0004	U	L	0.0217	0.0052	+	0.0850
PU239	0704	08	05/07/2007	07D0234	3G544	IPSA	1326	0.0200	0.0014	U	L	0.0154	0.0042	+	-0.2300
PU239	0705	08	05/27/2007	07E0061	91382	IPSA	1338	0.0200	0.0003	U	L	0.0236	0.0059	+	0.1800
PU239	0705	09	05/27/2007	07E0107	50575	IPSA	1179	0.0200	0.0000	U	L	0.0158	0.0056	+	-0.2100
PU239	0705	10	05/27/2007	07E0159	3C135	IPSA	1287	0.0200	0.0003	U	L	0.0163	0.0056	+	-0.1850
PU239	0706	05	07/02/2007	07F0079	31776	IPSA	1129	0.0200	0.0003	U	L	0.0225	0.0055	+	0.1250
PU239	0706	08	07/02/2007	07F0247	99156	IPSA	1192	0.0200	0.0003	U	L	0.0241	0.0061	+	0.2050
PU239	0706	09	07/02/2007	07F0246	59621	IPSA	1350	0.0200	0.0003	U	L	0.0142	0.0043	+	-0.2900
PU239	0706	07	07/02/2007	07F0120	50809	IPSA	1280	0.0200	0.0003	U	L	0.0119	0.0048	+	-0.4050
PU239	0706	06	07/02/2007	07F0119	50807	IPSA	1319	0.0200	0.0003	U	L	0.0315	0.0065	+	0.5750
PU239	0706	10	08/01/2007	07G0091	99159	IPSA	1136	0.0200	0.0003	U	L	0.0256	0.0059	+	0.2800
PU239	0707	05	08/13/2007	07G0098	80098	IPU	1302	0.0200	0.0003	U	Q	0.0141	0.0050	+	-0.2950
PU239	0708	11	08/24/2007	07H0417	99159	IPU	1413	0.0200	0.0003	U	Q	0.0256	0.0065	+	0.2800
PU239	0707	06	08/24/2007	07H0418	99159	IPU	1432	0.0200	0.0003	U	Q	0.0140	0.0050	+	-0.3000
PU239	0708	09	09/05/2007	07H0272	99162	IPSA	1183	0.0200	0.0003	U	L	0.0233	0.0056	+	0.1650
PU239	0708	08	09/05/2007	07H0227	51077	IPSA	1312	0.0200	0.0003	U	L	0.0175	0.0052	+	-0.1250
PU239	0708	10	09/05/2007	07H0312	99151	IPSA	1283	0.0200	0.0003	U	L	0.0290	0.0065	+	0.4500
PU239	0708	13	09/12/2007	07H0452	AU001	IPU	1193	0.0200	0.0003	U	Q	0.0233	0.0056	+	0.1650
PU239	0708	14	09/12/2007	07H0451	AU001	IPU	1202	0.0200	0.0003	U	Q	0.0196	0.0056	+	-0.0200
PU239	0708	12	09/12/2007	07H0450	AU001	IPU	1183	0.0200	0.0003	U	Q	0.0218	0.0056	+	0.0900
PU239	0708	15	09/12/2007	07H0453	AU001	IPU	1197	0.0200	0.0003	U	Q	0.0092	0.0044	+	-0.5380
PU239	0708	16	09/12/2007	07H0454	AU001	IPU	1191	0.0200	0.0003	U	Q	0.0262	0.0065	+	0.3100
PU239	0708	17	09/12/2007	07H0455	AU001	IPU	1102	0.0200	0.0003	U	Q	0.0262	0.0060	+	0.3100
PU239	0710	09	11/05/2007	07J0188	99161	IPSA	1300	0.0200	0.0003	U	L	0.0143	0.0087	-	-0.2850
PU239	0801	09	02/05/2008	08A0222	3C134	IPSA	1165	0.0200	0.0003	U	L	0.0122	0.0044	+	-0.3900
PU239	0801	10	02/05/2008	08A0223	3C142	IPSA	1379	0.0200	0.0003	U	L	0.0145	0.0046	+	-0.2750
PU239	0801	11	02/05/2008	08A0276	99158	IPSA	1162	0.0200	0.0003	U	L	0.0189	0.0057	+	-0.0550
PU239	0802	08	03/08/2008	08B0348	99154	IPA	1165	0.0200	0.0004	U	J	0.0160	0.0050	+	-0.2000
PU239	0802	09	03/08/2008	08B0345	99150	IPA	1409	0.0200	0.0004	U	J	0.0155	0.0048	+	-0.2250

ISO CD	YRMO	SEQ	ANAL DATE	TAGWORD_1	PAYID	REQ ANAL	VOL	SPIKE	UNCERT	TYPE	MR	RESULT	UNCERT	DET	REL BIAS
PU239	0802	11	03/08/2008	08B0357	59001	IPSA	1178	0.0200	0.0004	U	L	0.0089	0.0039	+	-0.5545
PU239	0802	12	03/08/2008	08B0207	99156	IPSA	1398	0.0200	0.0004	U	L	0.0250	0.0058	+	0.2500
PU239	0802	07	03/08/2008	08B0208	59600	IPA	1158	0.0200	0.0004	U	J	0.0196	0.0052	+	-0.0200
PU239	0802	10	03/13/2008	08B0353	99157	IPA	1277	0.0200	0.0004	U	J	0.0286	0.0070	+	0.4300
				33	**U**	**PU239 Count**		**0.0200**	**Average Result**		**0.0196**			**Mean Rel. Bias**	**-0.0213**
								33	**St Dev**		**0.0060**			**Mean Rel. Precision**	**0.2983**
	Number of total U PU239 **33**														
SR	0704	09	05/03/2007	07D0229	99153	IPSA	1134	10.0000	0.1900	U	L	10.3000	0.7820	+	0.0300
SR	0704	08	05/03/2007	07D0234	3G544	IPSA	1326	10.0000	0.1900	U	L	9.8300	0.7600	+	-0.0170
SR	0705	08	05/29/2007	07E0061	91382	IPSA	1338	10.0000	0.1300	U	L	9.8900	1.2800	+	-0.0110
SR	0705	09	05/29/2007	07E0107	50575	IPSA	1179	10.0000	0.1300	U	L	10.7000	1.6100	+	0.0700
SR	0705	10	05/29/2007	07E0159	3C135	IPSA	1287	10.0000	0.1300	U	L	10.3000	1.3300	+	0.0300
SR	0706	05	06/30/2007	07F0079	31776	IPSA	1129	10.0000	0.0900	U	L	9.5600	1.2200	+	-0.0440
SR	0706	06	06/30/2007	07F0119	50807	IPSA	1319	10.0000	0.0900	U	L	8.5100	1.1800	+	-0.1490
SR	0706	08	06/30/2007	07F0247	99156	IPSA	1192	10.0000	0.0900	U	L	9.9500	1.2500	+	-0.0050
SR	0706	09	06/30/2007	07F0246	59621	IPSA	1350	10.0000	0.0900	U	L	10.2000	1.3800	+	0.0200
SR	0706	07	06/30/2007	07F0120	50809	IPSA	1280	10.0000	0.0900	U	L	11.1000	1.3100	+	0.1100
SR	0706	10	07/30/2007	07G0091	99159	IPSA	1136	10.0000	0.0900	U	L	8.0600	1.1300	+	-0.1940
SR	0708	08	08/30/2007	07H0227	51077	IPSA	1312	10.0000	0.0900	U	L	9.3000	1.0900	+	-0.0700
SR	0708	09	08/30/2007	07H0272	99162	IPSA	1183	10.0000	0.0900	U	L	10.8000	1.2100	+	0.0800
SR	0708	10	08/30/2007	07H0312	99151	IPSA	1283	10.0000	0.0900	U	L	12.7000	1.3700	+	0.2700
SR	0710	09	11/05/2007	07J0188	99161	IPSA	1300	10.0000	0.1700	U	L	9.8600	0.5890	+	-0.0140
SR	0801	10	02/04/2008	08A0223	3C142	IPSA	1379	10.0000	0.0001	U	L	10.3000	0.7600	+	0.0300
SR	0801	11	02/04/2008	08A0276	99158	IPSA	1162	10.0000	0.0001	U	L	9.2900	0.6770	+	-0.0710
SR	0801	09	02/04/2008	08A0222	3C134	IPSA	1165	10.0000	0.1360	U	L	9.8200	0.6840	+	-0.0180
SR	0802	12	03/09/2008	08B0207	99156	IPSA	1398	10.0000	0.2100	U	L	10.0000	0.5910	+	
SR	0802	11	03/09/2008	08B0357	59001	IPSA	1178	10.0000	0.2100	U	L	10.2000	0.5590	+	0.0200
				20	**U**	**SR Count**		**10.0000**	**Average Result**		**#######**			**Mean Rel. Bias**	**0.0034**
								20	**St Dev**		**0.9521**			**Mean Rel. Precision**	**0.0952**
	Number of total U SR **20**														
U	0704	05	04/23/2007	07D0044	3G522	U	1417	0.2000	0.0014	U		0.2750	0.0499	+	0.3750
U	0704	06	04/23/2007	07D0186	80076	U	1200	0.2000	0.0014	U		0.2940	0.0517	+	0.4700
U	0705	02	05/14/2007	07E0198	99152	U	1265	0.2000	0.0016	U		0.2960	0.0631	+	0.4800
U	0706	02	06/29/2007	07F0195	80109	U	1582	0.2000	0.0021	U		0.3240	0.1960	-	0.6200
U	0706	03	07/26/2007	07G0133	99158	U	1213	0.2000	0.0021	U		0.2550	0.0347	+	0.2750
U	0706	04	07/26/2007	07G0132	99157	U	1142	0.2000	0.0021	U		0.1670	0.0229	+	-0.1650
U	0708	02	08/31/2007	07H0278	3C142	U	1107	0.2000	0.0013	U		0.1650	0.0222	+	-0.1750
U	0708	06	08/31/2007	07H0226	32472	U	1195	0.2000	0.0013	U		0.1010	0.0153	+	-0.4950

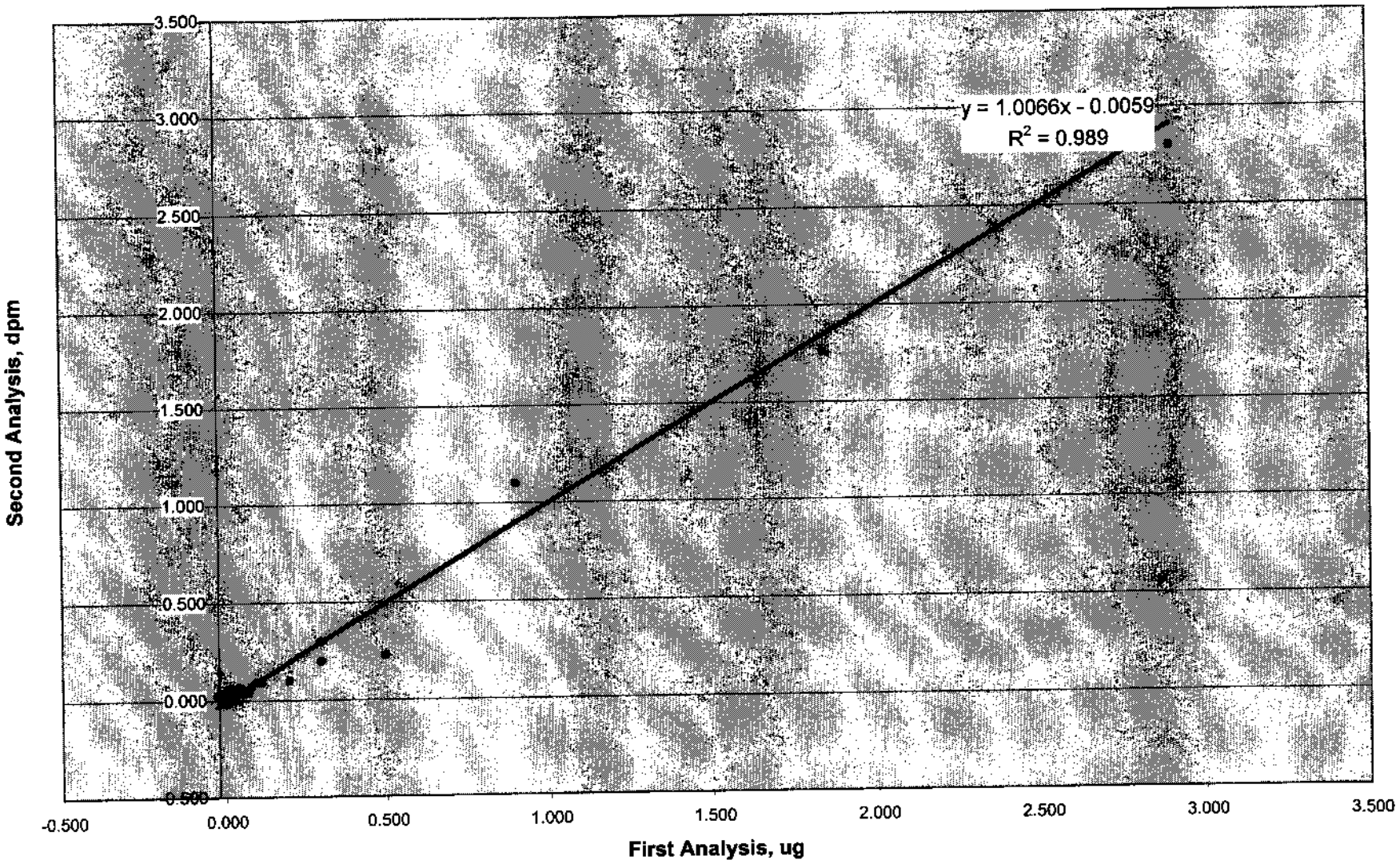
ISO CD	YRMO	SEQ	ANAL DATE	TAGWORD 1	PAYID	REQ ANAL	VOL	SPIKE	UNCERT	TYPE	MR	RESULT	UNCERT	DET	REL BIAS
U	0708	07	08/31/2007	07H0224	32533	U	1123	0.2000	0.0013	U		0.1500	0.0320	+	-0.2500
U	0708	03	08/31/2007	07H0290	59600	U	1324	0.2000	0.0013	U		0.1190	0.0172	+	-0.4050
U	0708	05	08/31/2007	07H0271	99161	U	1456	0.2000	0.0013	U		0.1380	0.0196	+	-0.3100
U	0709	03	09/27/2007	07I0066	91386	U	1345	0.2000	0.0021	U		0.1740	0.0112	+	-0.1300
U	0709	05	09/27/2007	07I0143	3C137	U	1436	0.2000	0.0021	U		0.1840	0.0114	+	-0.0800
U	0709	04	09/27/2007	07I0177	99156	U	1105	0.2000	0.0021	U		0.1770	0.0105	+	-0.1150
U	0709	06	10/02/2007	07I0153	3C135	U	1215	0.2000	0.0021	U		0.1860	0.0302	+	-0.0700
U	0710	02	10/29/2007	07J0237	3G522	U	1322	0.2000	0.0029	U		0.1740	0.0101	+	-0.1300
U	0710	03	10/29/2007	07J0122	50784	U	1187	0.2000	0.0029	U		0.1910	0.0179	+	-0.0450
U	0710	04	10/29/2007	07J0197	80076	U	1223	0.2000	0.0029	U		0.1600	0.0111	+	-0.2000
U	0711	02	11/27/2007	07K0080	3C136	U	1236	0.2000	0.0021	U		0.1780	0.0482	+	-0.1100
U	0711	04	11/27/2007	07K0272	59783	U	1085	0.2000	0.0021	U		0.1690	0.0458	+	-0.1550
U	0711	03	12/12/2007	07K0271	SG563	U	1414	0.2000	0.0021	U		0.1710	0.0378	+	-0.1450
U	0801	02	02/08/2008	08A0142	91384	U	0982	0.2000	0.0298	U		0.0704	0.0057	+	-0.6480
				22	**U**	**U Count**		**0.2000 22**	**Average Result St Dev**		**0.1872 0.0642**			**Mean Rel. Bias Mean Rel. Precision**	**-0.0640 0.3211**
U	0710	08	11/01/2007	07J0390	SG561	U	1375			U		0.0375	0.0082	+	
				1	**U**	**U Count**		**1**	**Average Result St Dev**		**0.0375 0.0000**				
	Number of total U U **23**														
U 234	0705	05	07/16/2007	07E0553	AU001	IU	1431	0.1480	0.0012	U	U	0.1570	0.0185	+	0.0608
U 234	0705	07	07/16/2007	07E0555	AU001	IU	1113	0.1480	0.0012	U	U	0.0749	0.0110	+	-0.4939
U 234	0705	04	07/16/2007	07E0556	AU001	IU	1103	0.1480	0.0012	U	U	0.0790	0.0109	+	-0.4662
U 234	0705	06	07/16/2007	07E0554	AU001	IU	1183	0.1480	0.0012	U	U	0.0943	0.0127	+	-0.3628
U 234	0711	07	12/10/2007	07K0481	AU002	IU	0974	0.1480	0.0016	U	U	0.1400	0.0160	+	-0.0541
U 234	0711	06	12/10/2007	07K0480	AU002	IU	0975	0.1480	0.0016	U	U	0.1810	0.0192	+	0.2230
U 234	0711	09	12/10/2007	07K0483	AU002	IU	0975	0.1480	0.0016	U	U	0.1420	0.0162	+	-0.0405
U 234	0711	08	12/10/2007	07K0482	AU002	IU	0976	0.1480	0.0016	U	U	0.1290	0.0154	+	-0.1284
				8	**U**	**U 234 Count**		**0.1480 8**	**Average Result St Dev**		**0.1246 0.0383**			**Mean Rel. Bias Mean Rel. Precision**	**-0.1578 0.2586**
	Number of total U U 234 **8**														
U 235	0705	04	07/16/2007	07E0556	AU001	IU	1103	0.0070	0.0001	U	U	0.0128	0.0048	+	0.8286
U 235	0705	07	07/16/2007	07E0555	AU001	IU	1113	0.0070	0.0001	U	U	0.0009	0.0044	-	-0.8737
U 235	0705	05	07/16/2007	07E0553	AU001	IU	1431	0.0070	0.0001	U	U	0.0109	0.0047	+	0.5571
U 235	0705	06	07/16/2007	07E0554	AU001	IU	1183	0.0070	0.0001	U	U	0.0056	0.0040	-	-0.2000
U 235	0711	06	12/10/2007	07K0480	AU002	IU	0975	0.0070	0.0001	U	U	0.0034	0.0030	-	-0.5100
U 235	0711	09	12/10/2007	07K0483	AU002	IU	0975	0.0070	0.0001	U	U	0.0107	0.0043	+	0.5286
U 235	0711	07	12/10/2007	07K0481	AU002	IU	0974	0.0070	0.0001	U	U	0.0076	0.0036	+	0.0843

ISO CD	YRMO	SEQ	ANAL DATE	TAGWORD 1	PAYID	REQ ANAL		VOL	SPIKE	UNCERT	TYPE	MR	RESULT	UNCERT	DET		REL BIAS
U 235	0711	08	12/10/2007	07K0482	AU002	IU		0976	0.0070	0.0001	U	U	0.0080	0.0046	-		0.1400
				8	U		U 235 Count		0.0070 8	Average Result St Dev			0.0075 0.0040	MDA	0.0197	Mean Rel. Bias Mean Rel. Precision	0.0694 0.5767
	Number of total U U 235 8																
U 238	0705	05	07/16/2007	07E0553	AU001	IU		1431	0.1460	0.0012	U	U	0.2740	0.0275	+		0.8767
U 238	0705	07	07/16/2007	07E0555	AU001	IU		1113	0.1460	0.1150	U	U	0.1480	0.0174	+		0.0137
U 238	0705	04	07/16/2007	07E0556	AU001	IU		1103	0.1460	0.0012	U	U	0.1890	0.0198	+		0.2945
U 238	0705	06	07/16/2007	07E0554	AU001	IU		1183	0.1460	0.0012	U	U	0.1760	0.0192	+		0.2055
U 238	0711	06	12/10/2007	07K0480	AU002	IU		0975	0.1460	0.0015	U	U	0.1590	0.0176	+		0.0890
U 238	0711	07	12/10/2007	07K0481	AU002	IU		0974	0.1460	0.0015	U	U	0.1320	0.0154	+		-0.0959
U 238	0711	09	12/10/2007	07K0483	AU002	IU		0975	0.1460	0.0015	U	U	0.1290	0.0154	+		-0.1164
U 238	0711	08	12/10/2007	07K0482	AU002	IU		0976	0.1460	0.0015	U	U	0.1610	0.0179	+		0.1027
U 238	0801	04	03/12/2008	08A0625	AU001	IU		0974	0.1460	0.0022	U	U	0.1120	0.0169	+		-0.2329
U 238	0801	06	03/12/2008	08A0627	AU001	IU		0980	0.1460	0.0022	U	U	0.1250	0.0143	+		-0.1438
U 238	0801	05	03/12/2008	08A0626	AU001	IU		0979	0.1460	0.0022	U	U	0.1260	0.0144	+		-0.1370
U 238	0801	07	03/12/2008	08A0628	AU001	IU		0984	0.1460	0.0022	U	U	0.1250	0.0144	+		-0.1438
U 238	0802	02	03/24/2008	08B0625	AU001	IU		0980	0.1460	0.0020	U	U	0.0897	0.0107	+		-0.3856
U 238	0802	03	03/24/2008	08B0626	AU001	IU		0976	0.1460	0.0020	U	U	0.1060	0.0123	+		-0.2740
U 238	0802	04	03/24/2008	08B0627	AU001	IU		0979	0.1460	0.0020	U	U	0.1210	0.0136	+		-0.1712
U 238	0802	05	03/24/2008	08B0628	AU001	IU		0976	0.1460	0.0020	U	U	0.1070	0.0134	+		-0.2671
				16	U		U 238 Count		0.1460 16	Average Result St Dev			0.1425 0.0441			Mean Rel. Bias Mean Rel. Precision	-0.0241 0.3021
	Number of total U U 238 16																

Total Samples 88

Total Results 196

GEL Fecal Duplicates, April 2007 - March 2008



APPENDIX B

GEL QUALITY CONTROL SAMPLE REPORT SUMMARY
(Historical File Only)

PNNL
ANNUAL
QC PACKAGE

Contract Year 2007/2008
April 1, 2007 – Ma[illegible]31, 2008

Appendix B

Data was reviewed and found acceptable.

Reviewed By: Sdb 5-14-08 Date:

Table of Contents

U-233/234 – Blank Activity
U-235/236 – Blank Activity
U-238 – Blank Activity
U-238 – LCS Bias High
U-238 – LCS Bias Low
U-236 – Blank Activity
U-236 – LCS Bias Low
U-236 – Tracer Yield

Fecal Data
Am-241 – Blank Activity
Am-241 – Duplicate RER
Am-241 – LCS Bias High
Am-241 – LCS Bias Low
Am-243 – Tracer Yield
Pu-238 – Blank Activity
Pu-238 – Duplicate RER
Pu-239/240 – Blank Activity
Pu-239/240 – Duplicate RER
Pu-239/240 – LCS Bias High
Pu-239/240 – LCS Bias Low
Pu-242 – Tracer Yield
U-232 – Tracer Yield
U-233/234 – Blank Activity
U-233/234 – Duplicate RER
U-235/236 – Blank Activity
U-235/236 – Duplicate RER
U-238 – Blank Activity
U-238 – Duplicate RER
U-238 – LCS Bias High
U-238 – LCS Bias Low

Legend

#	= the N-value (number of the samples in the data set)
Samp ID	= GEL laboratory sample identification number
Inst	= the analytical instrument identification number/name
Run Date	= the sample analysis date
LCL	= Lower Control Level (minus 3 sigma)
LWL	= Lower Warning Level (minus 2 sigma)
Mean	= the average value of the data set

Numvalue	= Number Value for parameter being monitored
Exclude	= a checked box indicates the data was not used in the calculation of the mean and control limits
Stdev	= Standard Deviation
UWL	= Upper Warning Level (plus 2 sigma)
UCL	= Upper Contol Level (plus 3 sigma)
Dispersion	= the difference of the individual relative bias from the mean
Parent Sample	= the sample that was duplicated
TPU	= Total Proportion Uncertainty (1 sigma combined standard uncertainty)
RER	= Relative Error Ratio (the difference of the individual duplicate pairs based on the combined standard uncertainties of the individual analyses)
Nominal	= the calculated concentration of the spike in the sample geometry
Result	= the actual measured analyte concentration in the sample
Bias	= the deviation of a measured value from the expected value

Statistical Parameters Utilized by The GEL Group, Inc

Zone Definitions

Zone A – Area defined as being between 2 and 3 times sigma above the center line
Zone B – Area defined as being between 1 and 2 times sigma above the center line
Zone C – Area defined as being between the center line and 1 times sigma

Data Flag Definitions

1. Nine (9) points on Zone C and beyond on one side of the central line - Indicates that the process average may have changed
2. Six (6) points in a row steadily increasing or decreasing on one side of the central line – Indicates that a drift may be occurring in the process average
3. Fourteen (14) points in a row alternating up or down on either side of the center line – If this test is positive it indicates that two systematically alternating causes may be producing different results
4. Two (2) out of three (3) points in a row are in Zone A or beyond – Indicates an early warning of a process shift
5. Four (4) out of five (5) points are in Zone B or beyond – If positive, this, like flag 4, indicates and early warning of a potential process shift
6. Fifteen (15) points are in Zone C above or below the center line – Indicates a smaller variability than expected
7. Eight (8) points in a row are in Zone B, A or beyond on either side of the center line with no points occurring in Zone C – Indicates that different samples are affected by different factors resulting in bimodal distribution of averages

References

Statistica Software – Data Mining, Statistical Analysis and Quality Control
Quality Control Charts – www.statsoft.com/textbook/stquacon.html

SECTION 1

CASE NARRATIVE

4th Quarter QC Report - Operational Year 2007

This report summarizes Quality Control Samples (QC) analyzed with bioassay samples under Contract 11530 during the Contract Year 2007, beginning April 1, 2007 and ending March 31, 2008. Included in the report are listings for the blank, duplicate and spike results. A description of the attached data is provided below. 6303 reported samples were analyzed under this contract with a run date during the annual quarter including failed analyses, recounts, and reanalyses. The QC samples include blanks, spikes, and duplicates.

PNNL Sample/QC Summary

Test Description	Matrix	Reported Samples	QC Samples	Total Samples	% QC
Americium	Fecal	58	86	144	60
Uranium	Fecal	3	7	10	70
Plutonium	Fecal	91	116	207	56
Americium-243	Urine	89	84	173	49
Thorium	Urine	1	8	9	89
Uranium by ICPMS	Urine	1	3	4	75
Americium	Urine	796	463	1259	37
Plutonium	Urine	2750	1261	4011	31
Strontium 90	Urine	798	384	1182	32
Total Strontium	Urine	36	63	99	64
Total Uranium	Urine	334	462	796	58
Tritium	Urine	816	282	1098	26
Uranium	Urine	529	243	772	31
Totals		6303	3465	9768	35

Blanks

The following table contains the analyses, isotope, matrix, and the calculated MDAs. The alpha spectrometry MDAs are based on the average blank counts and average tracer yields for the quarter. The Strontium MDAs are adjusted according to the average tracer yield for the quarter. The total uranium MDAs are based on the standard deviation of the 0.05 ug/L standard analyzed each day throughout the quarter.

Isotope	Matrix	N#	MDA	Lc	Avg. Volume	Sample units	Detector Yield	Count Efficiency	Time (min)
Am-241	Urine	155	0.011	0.00447	1	dpm/s	0.816	0.391	2520
Am-243	Urine	38	0.013	0.00506	1	dpm/s	0.8709	0.391	2520
Cm-242	Urine	38	0.011	0.00413	1	dpm/s	0.816	0.391	2520
Cm-243/244	Urine	155	0.010	0.00410	1	dpm/s	0.816	0.391	2520
Pu-238	Urine	426	0.010	0.00403	1	dpm/s	0.89	0.391	2520
Pu-239/240	Urine	426	0.011	0.00450	1	dpm/s	0.89	0.391	2520
Th-228	Urine	6	0.044	0.02953	1	dpm/s	0.8804	0.386	2520
Th-229	Urine	6	0.032	0.02137	1	dpm/s	0.8804	0.386	2520
Th-230	Urine	6	0.036	0.02137	1	dpm/s	0.8804	0.386	2520
Th-232	Urine	6	0.012	0.00630	1	dpm/s	0.880	0.386	2520
U-233/234	Urine	80	0.021	0.00962	1	dpm/s	0.834	0.386	2520
U-235/236	Urine	80	0.016	0.00669	1	dpm/s	0.834	0.386	2520
U-238	Urine	80	0.020	0.00898	1	dpm/s	0.834	0.386	2520
U-236	Urine	1	9.55E-05	0.00000	1 L	ug/L	n/a	n/a	n/a
Sr-90	Urine	127	2.32	0.61810	1	dpm/s	0.789	0.379	60
Total Sr	Urine	20	2.82	0.31600	1	dpm/s	0.788	0.379	60
Tritium	Urine	141	996	8.55251	0.01 L	dpm/L	n/a	0.243	20
Total U	Urine	225	0.011	0.00632	0.05 L	ug/s	n/a	n/a	n/a
Am-241	Fecal	24	0.062	0.00514	0.3333	dpm/s	0.757	0.391	960
Pu-238	Fecal	34	0.069	0.00774	0.3333	dpm/s	0.847	0.391	960
Pu-239/240	Fecal	34	0.076	0.00801	0.3333	dpm/s	0.847	0.391	960
U-233/234	Fecal	2	0.149	0.01465	0.3333	dpm/s	0.808	0.386	960
U-235	Fecal	2	0.085	0.00546	0.3333	dpm/s	0.808	0.386	960
U-238	Fecal	2	0.112	0.00799	0.3333	dpm/s	0.808	0.386	960

All analytical batches were analyzed with either a reagent blank, matrix blank or both. Blanks are in control when the calculated MDA and blank activity are both less than CRDL (contract required detection limit). In addition, the chemical tracer yields are evaluated against the yield requirements stated in the subject contract. Overall, the blank data for each analytical process demonstrate the analyses were in control. Processing categories and samples which did not meet contractual requirements are discussed in the **Observations** section of this report.

Laboratory Control Samples (LCS)

The enclosed listing contains the analysis isotope, matrix, average relative bias and the relative precision statistic. One or more LCS sample was analyzed with each batch of samples.

Test	Matrix	Number In Set (N#)	Range High(1)(2)	Average Nominal (dpm/sample)*	Average Relative Bias	Relative Precision
Americium-241	Fecal	19	High(1)	3.87	.00537	.0892
Plutonium-239/240	Fecal	25	High(1)	9.05	-.0545	.0568
Uranium-238	Fecal	2	High(2)	5.7	.105	.005
Americium-241	Urine	157	High(1)	.335	.0534	.107
Americium-243	Urine	37	High(1)	.513	-.0132	.0971
Curium-243/244	Urine	38	High(1)	.331	.0651	.0947
Plutonium-239/240	Urine	454	High(1)	.444	-.0014	.0723
Strontium-90	Urine	133	High(1)	36.6	.0149	.103
Thorium-232	Urine	1	High(1)	2.15	-.042	0
Total Strontium	Urine	20	High (1)	16.46	-0.0098	0.057
Total Uranium	Urine	75	High(1)	1 ug/L	-.124	.117
Tritium	Urine	141	High(1)	17000 dpm/L	-.0147	.0675
Uranium-238	Urine	82	High(2)	.422	-.049	.108

(1) High range: nominal > 2x the Contractual Detection Level (CL)
(2) High range for U-238: nominal > 0.34 dpm/sample
*Unless otherwise noted.

Test	Matrix	Number In Set (N#)	Range Low(1)(2)(3)	Average Nominal (dpm/sample)*	Number Below Lc	Average Relative Bias	Relative Precision
Americium-241	Fecal	21	Low(1)	.554	1	.106	.195
Plutonium-239/240	Fecal	31	Low(1)	.214	0	.17	0
Uranium-238	Fecal	2	Low(3)	.339	0	.514	.536
Americium-241	Urine	146	Low(1)	.0209	0	.122	.316
Americium-243	Urine	17	Low(1)	.0203	0	.196	.321
Curium-243/244	Urine	30	Low(1)	.025	0	.187	.281
Plutonium-239/240	Urine	378	Low(1)	.0223	4	.0164	.267

Strontium-90	Urine	123	Low(1)	10.4	0	-.0189	.1474
Thorium-232	Urine	1	Low(1)	.108	0	.05	0
Total Strontium	Urine	20	Low(1)	4.68	0	.0451	.1344
Total Uranium	Urine	74	Low(1)	.0839	0	-.122	.2
Uranium-236	Urine	1	Low(1)	.05 ug/L	0	-.0498	0
Uranium-238	Urine	78	Low(3)	.127	1	-.0405	.219

(1) Low range: nominal ≈ the Contractual Detection Level (CL)
(3) Low range for U-238: nominal < 0.34 dpm/sample
*Unless otherwise noted.

Overall, the LCS data demonstrates the analytical processes were in control. Any LCS outside the limits is discussed in the **Observations** section of this report.

Duplicate Samples (DUP)

The duplicate samples were evaluated to determine that the aliquot procedure produces results within the RER limits of 0 to 3.

Americium-241

#	Sample ID	Inst	Run Date	Tracer Yield	Mean	RER	TPU	Parent Sample	Result	TPU
1	1201449893	1700	08-NOV-07	.73	.831	1.41	.0295	196602001	.0701 and .0234	.0295 and .0148
2	1201403069	1703	05-SEP-07	.765	.831	.63	.24	192329001	1.11 and .912	.24 and .203
3	1201464614	1680	15-DEC-07	.817	.831	.117	.172	197975001	.821 and .85	.172 and .179
4	1201495192	1673	21-JAN-08	.77	.831	.0405	.071	200812001	.257 and .253	.071 and .0686
5	1201478005	1659	18-	.563	.831	1.55	.00834	199166001	-.00964	.00834

			DEC-07						and .00556	and .00514
6	1201347902	1667	13-JUN-07	.739	.831	.559	.0261	187075001	.0621 and .0414	.0261 and .0263
7	1201349152	1679	15-JUN-07	.842	.831	.591	.0151	187164001	-.0136 and -.00442	.0151 and .00364
8	1201350782	1646	16-JUN-07	.766	.831	1.35	.00597	187371001	-.00992 and -.00104	.00597 and .00271
9	1201354251	1697	19-JUN-07	.683	.831	1.23	.0342	187443001	.0821 and .162	.0342 and .0555
10	1201360628	1635	28-JUN-07	.883	.831	1.88	.00263	188127001	.00224 and -.00471	.00263 and .0026
11	1201387026	1678	11-AUG-07	.298	.831	.364	.011	190622002	.00117 and -.00306	.011 and .00379
12	1201403899	1636	06-SEP-07	.744	.831	1.56	.0123	192440001	-.0145 and .00638	.0123 and .00532
13	1201407277	1624	10-SEP-07	.685	.831	.444	.00553	192741001	.00663 and .0108	.00553 and .00758
14	1201437503	1687	07-NOV-07	.681	.831	.498	.00491	195471001	-.00387 and -.0203	.00491 and .0326
15	1201440105	1697	20-OCT-07	.732	.831	.674	.00473	195489001	-.00186 and -.00816	.00473 and .00807
16	1201518599	1653	27-FEB-08	.844	.831	.389	.0387	203019001	.112 and .092	.0387 and .0339

Plutonium-238

#	Sample ID	Inst	Run Date	Tracer Yield	Mean	RER	TPU	Parent Sample	Result	TPU
1	1201366796	1677	09-JUL-07	.974	.718	.531	.235	188743001	2.76 and 2.59	.235 and .217
2	1201449897	1680	07-NOV-07	.933	.718	.952	.00518	196602001	.00206 and .0139	.00518 and .0113
3	1201403073	1643	04-SEP-07	.685	.718	1.59	.00717	192329001	.0011 and .0329	.00717 and .0187
4	1201464618	1699	13-DEC-07	1.01	.718	1.48	.00411	197975001	.00336 and .0224	.00411 and .0122
5	1201495196	1663	21-JAN-08	.888	.718	.269	.0178	200812001	.036 and .0434	.0178 and .021
6	1201478009	1645	18-DEC-07	.886	.718	.28	.00539	199166001	0 and .00214	.00539 and .00542
7	1201343728	1655	02-JUN-07	.531	.718	.934	.00871	186716001	-.000575 and .0135	.00871 and .0123
8	1201349155	1678	14-JUN-07	.906	.718	.287	.00501	187164001	-.000413 and .00169	.00501 and .00534
9	1201347905	1659	13-JUN-07	1.04	.718	.843	.0123	187075001	-.00296 and .00985	.0123 and .00893
10	1201350786	1675	15-JUN-07	.816	.718	0	.00574	187371001	0 and 0	.00574 and .0049
11	1201358645	1660	26-JUN-07	.93	.718	.117	.241	188066001	2.81 and 2.85	.241 and .244
12	1201360637	1689	27-JUN-07	.984	.718	.513	.00493	188127001	.00195 and .0104	.00493 and .0104
13	1201354257	1710	21-JUN-07	.775	.718	.628	.0206	187443001	.0377 and .0601	.0206 and .0291

14	1201374195	1697	20-JUL-07	1.01	.718	1.68	.00472	189413001	0 and .0251	.00472 and .0142
15	1201375657	1714	24-JUL-07	.903	.718	1.77	.0175	189593001	.032 and -.000298	.0175 and .00503
16	1201378049	1659	25-JUL-07	.396	.718	.225	.242	189776001	1.76 and 1.84	.242 and .261
17	1201379979	1647	30-JUL-07	.939	.718	.598	.0544	190038001	.296 and .344	.0544 and .059
18	1201387031	1673	11-AUG-07	.913	.718	.226	.00509	190622002	-.00212 and -.0053	.00509 and .0131
19	1201403903	1647	06-SEP-07	.955	.718	1.48	.00488	192440001	-.0016 and .017	.00488 and .0116
20	1201407285	1702	08-SEP-07	.705	.718	.271	.00665	192741001	-.0016 and -.012	.00665 and .0378
21	1201437507	1694	07-NOV-07	.542	.718	1.01	.0137	195471001	.015 and 0	.0137 and .0059
22	1201440106	1698	19-OCT-07	.83	.718	.316	.00604	195489001	.00113 and -.00127	.00604 and .00459
23	1201518608	1641	27-FEB-08	.241	.718	.519	.0949	203019001	-.0261 and .0261	.0949 and .0336

Plutonium-239/240

#	Sample ID	Inst	Run Date	Tracer Yield	Mean	RER	TPU	Parent Sample	Result	TPU
1	1201366796	1677	09-JUL-07	.974	.703	.228	.0157	188743001	.031 and .0359	.0157 and .0147
2	1201449897	1680	07-NOV-07	.933	.703	.063	.0293	196602001	.0934 and .096	.0293 and .0291

3	1201403073	1643	04-SEP-07	.685	.703	.0551	.0318	192329001	.0938 and .0963	.0318 and .0324
4	1201464618	1699	13-DEC-07	1.01	.703	1.63	.0997	197975001	1.07 and .851	.0997 and .0897
5	1201495196	1663	21-JAN-08	.888	.703	1.03	.0616	200812001	.356 and .272	.0616 and .0537
6	1201478009	1645	18-DEC-07	.886	.703	1.1	.0261	199166001	-.0148 and .0159	.0261 and .0102
7	1201343728	1655	02-JUN-07	.531	.703	.545	.00809	186716001	.00891 and .018	.00809 and .0146
8	1201349155	1678	14-JUN-07	.906	.703	2.14	.0222	187164001	.0583 and .00791	.0222 and .00791
9	1201347905	1659	13-JUN-07	1.04	.703	.245	.0231	187075001	.0719 and .0809	.0231 and .0286
10	1201350786	1675	15-JUN-07	.816	.703	1.22	.00797	187371001	-.0141 and -.00266	.00797 and .0049
11	1201358645	1660	26-JUN-07	.93	.703	.935	.019	188066001	.0434 and .0723	.019 and .0244
12	1201360637	1689	27-JUN-07	.984	.703	.802	.0129	188127001	.0189 and .00906	.0129 and .00737
13	1201354257	1710	21-JUN-07	.775	.703	.815	.0534	187443001	.248 and .319	.0534 and .0688
14	1201374195	1697	20-JUL-07	1.01	.703	.228	.013	189413001	-.0104 and -.00724	.013 and .00477
15	1201375657	1714	24-JUL-07	.903	.703	0	.00509	189593001	-.00893 and -.00893	.00509 and .00503
16	1201378049	1659	25-JUL-07	.396	.703	.317	.0345	189776001	.0628 and .0481	.0345 and .031

17	1201379979	1647	30-JUL-07	.939	.703	.0109	.00258	190038001	-.00534 and -.0053	.00258 and .00259
18	1201387031	1673	11-AUG-07	.913	.703	.00735	.00994	190622002	-.016 and -.0159	.00994 and .00928
19	1201403903	1647	06-SEP-07	.955	.703	.578	.00514	192440001	-.0129 and -.00922	.00514 and .00375
20	1201407285	1702	08-SEP-07	.705	.703	2.31	.0106	192741001	.0165 and -.0139	.0106 and .00779
21	1201437507	1694	07-NOV-07	.542	.703	.0626	.0237	195471001	-.0153 and -.0135	.0237 and .0163
22	1201440106	1698	19-OCT-07	.83	.703	.231	.0158	195489001	-.0165 and -.0127	.0158 and .00459
23	1201518608	1641	27-FEB-08	.241	.703	1.62	.141	203019001	.496 and .228	.141 and .0871

Uranium-233/234

#	Sample ID	Inst	Run Date	Tracer Yield	Mean	RER	TPU	Parent Sample	Result	TPU
1	1201440104	1587	18-OCT-07	.865	1.82	1.82	.19	195490001	1.87 and 2.44	.19 and .25

Uranium-235/236

#	Sample ID	Inst	Run Date	Tracer Yield	Mean	RER	TPU	Parent Sample	Result	TPU
1	1201440104	1587	18-OCT-07	.865	1.47	1.47	.0365	195490001	.0935 and .0303	.0365 and .0225

Uranium-238

#	Sample ID	Inst	Run Date	Tracer Yield	Mean	RER	TPU	Parent Sample	Result	TPU
1	1201440104	1587	18-OCT-07	.865	.0374	.0374	.182	195490001	1.8 and 1.79	.182 and .196

Sample Summary

Overall, the chemical yields for the analytical processes were greater than the minimum yields required in the SOW. Those not meeting the yield requirements are further discussed in the **Observation** section of this report.

OBSERVATIONS

Am Isotopic in Urine

Out of thirty-nine high range Americium-243 LCSs, two (5.13%) are less than 75%, and one is greater than 125%.

Out of seventeen low range Americium-243 LCSs, two (11.76%) are less than 75%, and six (35.29%) are greater than 125%.

Out of one hundred and fifty-seven high range Americium-241 LCSs, seven (4.46%) are greater than 125%.

Out of one hundred and forty-six low range Americium-241 LCSs, twelve (8.22%) are less than 75%. Forty-five (30.82%) are greater than 125%.

Out of one thousand two hundred and fifty-nine Americium-243 yields, five (0.40%) are less than the low yield of 40%.

Cm Isotopic in Urine

Out of thirty low range Curium-243/244 LCSs, thirteen (43.33%) are greater than 125%. Two (6.67%) are less than 75%.

Out of one hundred and seventy-three Curium-243/244 yields, one (0.58%) is less than the low yield of 40%.

Pu Isotopic in Urine

Out of four hundred and thirty-two Pu-239/240 blanks, one (0.23%) result is greater than the CL. This anomaly is documented by NCR 470608.

Out of four hundred and fifty-four high range Plutonium 239/240 LCSs, three (0.66%) are less than 75%.

Out of three hundred and seventy-eight low range Plutonium 239/240 LCSs, fifty-nine (15.6%) are less than 75%. Sixty-three (16.67%) are greater than 125%.

Out of the four thousand and eleven Pu-242 tracers, eighty-three (2.07%) were less than the low yield of 50%.

Sr-90/Total Sr in Urine

Out of one hundred twenty-three low range Strontium-90 LCSs, five (4.07%) are less than 75%, and three (2.44%) are greater than 125%.

Out of one hundred and thirty-three high range Strontium-90 LCSs, one (0.75%) is less than 75%, and one (0.75%) is greater than 125%.

Out of one thousand one hundred and eight-two Strontium carriers, seventeen (1.44%) are less than the low yield of 50%.

Out of ninety-nine Total Strontium yields, three (3.03%) are less than the low yield of 50%.

Out of twenty low range Total Strontium LCSs, two (10%) are less than 125%.

Th Isotopic in Urine

The Th-232 high and low LCS graphs showed no variation due to there being only one data point.

Total Uranium in Urine

Out of the ninety low range Total U LCSs, thirteen (14.44%) were less than 75% and five (5.56%) were greater than 125%.

Out of ninety-seven high range Total Strontium LCSs, four (4.12%) are less than 75%, and one (1.03%) is greater than 125%.

Tritium

There are no observations for Tritium.

Uranium Isotopic in Urine
Out of seven hundred and seventy-two Uranium-232 yields, fourteen (1.81%) are less than 40%, and one (0.13%) is greater than 125%.

Out of eighty-two Uranium-238 high range LCSs, one (1.22%) is less than 75%, and one (1.22%) is greater than 125%.

Out of seventy-eight low range Uranium-238 LCSs, six (7.69%) are less than 75%, and five (6.41%) are greater than 125%.

The Uranium-236 MB and LCS graphs show no variation due to there being only 1 data point.

Out of three Uranium-236 tracer yields, one (33.3%) is greater than 125%.

Isotopic Am in Feces

Out of twenty-one low range Americium-241 LCSs, six (28.6%) are greater than 125%.

Out of one hundred forty-four Americium-243 tracers, two (1.39%) are less than the low yield of 50%.

Isotopic Pu in Feces

Out of the thirty-one low range Plutonium-239/240 LCSs, one (3.23%) was greater than 125%.

Out of two hundred and seven Plutonium-242 tracer yields, ten (4.83%) are below the low yield of 50%. One (0.48%) is below the minimum yield of 25%. However the sample is a duplicate where the RER requirement was met, so the low recovery yield does not seem to have affected the analysis. Also, the requirement of one duplicate for every seven samples has been exceeded. Therefore, the results were reported.

Isotopic U in Feces

The MDAs for Uranium-233/234 is greater than the CL of 0.02 dpm/sample due to elevated background levels; however, the U-235 MDA is below the CL.

Out of ten Uranium-232 tracer yields, one (10%) is below the low yield requirement of 50%.

The Uranium-233/234, Uranium-235/236, and Uranium-238 RER graph showed no variation due to there being only one data point.

Out of the two Uranium-238 low LCSs, one (50%) is greater than 125%.

Incident Reports

Incident Report for the inability to report Americium results for Tagwords 07B0518, 07B0522, 07B0526, 07B0528, 07B0557, 07B0558, 07B0561, 07B0565, 07B0567, and 07B0569 was submitted on April 6, 2007. The incident involved the inability to produce acceptable Americium tracer yields and was isolated to the technician. The analyses of the back-up samples were ordered and results were reported. Since the incident, the technician has been replaced with a newly trained analyst.

Incident Report for the inability to report Americium and Plutonium results for Tagword 07E0520 was submitted on June 11, 2007. This incident involved the cracking of a beaker and sample loss. The analysis of the back-up sample was ordered and results were reported.

Incident Report for the Americium error associated with work order 190378, August 27, 2007. The incident had no identifiable cause, so corrective action prevent the recurrence was not taken.

Incident Report for the Plutonium tracing error associated with work order 192606, September 18, 2007. The incident involved an experienced analyst along with a witness to the spiking and tracing of the samples. The exact cause is still unknown; however, the fact the samples were not traced with Pu-242 has been established. Since there was a witness and the tracing error was isolated to one batch, no corrective action was taken.

Incident Report for the Strontium error associated with work order 195914, October 23, 2007. The incident had occurred when the lab technician did not save the eluant while doing the column chemistry. Since this was done inadvertently, an incident report was created and no corrective action was necessary.

Incident Report for Tagword 07J0343 associated with work order 196484, November 5, 2007. The incident involved a laboratory technician forgetting to properly record a samples volume. An incident report was created and no further action was taken.

Incident Report for Tagwords 07K0317 and 07K0334 associated with work order 197610, November 13, 2007. This incident involved the receipt of two leaking samples. The loss was less than 10%, so an incident report was created. To resolve the issue, the RSC discussed how to properly tighten lids and purchased a different brand of tape to seal the container. No further action was taken.

Incident Report for Tagwords 07K0154 and 07K0121 associated with work order 197626, November 15, 2007. This incident involved the combining of two separate samples. An incident report was created, and no further action was taken.

Incident Report for work order 201548, February 12, 2008. The incident involved results that were received by the client that did not match the data sent by EDD. The problem seemed to be a conversion error between the reports. The results in the original EDD were reported in pCi/mL while the report units were in dpm/mL. The reason for this could not be determined. An incident report was created, and no further action was taken.

Incident Report for Tagwords 08B0150 and 08B0337, March 5, 2008. The incident involved the analyst accidentally knocking over the QC blank and LCS during the final filtering of the samples. We were able to count the samples and report with a FA qualifier, but the Quality Control samples did not exist. To resolve this incident the Group Leader of the Bioassay laboratory discussed the error with the employee, Technician, Benjamin Finley, and no further action was taken.

Incident Report for Tagwords 08A0058, 08A0121, 08A0149, 08A0168, 08A0186, 08A0202, 08A0238, 08A0245, 08A0286, and 08A0358, March 12, 2008. The incident involved a failed acceptance of a number of records that rejected in the electronic data deliverable (EDD). For each tagword the first line was rejected, and the second line showed in REX. Only the tritium results in the file were wrong. The problem was investigated. The data reported in the EDD sent to the client was in the units of pci/ml. The client required dpm/mL. Review of any possible audit changes to data, required units, client setup specifications, and EDD changes were evaluated, all with negative results. The problem was not reproducible with several re-runs of this work order through the EDD code. An incident report was created and no further action was taken.

Incident Report for Tagwords 08B0221, March 19, 2008. The incident involved a failed analysis for Am-243 due to laboratory error. Technician Tina Schoneman inadvertently poured a rinse from another sample, which had used Am-243 added as a tracer, onto 08B0221. This error was identified by the technician at the time of the prep, and the count room was cautioned to verify the presence of Am-243. Upon completion of the analysis of 08B0221, the result showed Am-243 activity which we suspect is due to the aforementioned analytical error. No sample remained for a reanalysis. To resolve this issue, the Group Leader of the Bioassay laboratory discussed the error with the employee and no further action was taken.

Incident Report for Tagwords 08C0214/08C0215 and 08C0211/08C0212, March 24, 2008. The incident involved the mislabeling of kits that were delivered with bottles labeled for another person. The kit box for multiple analysis Tagwords 08C0214/08C0215 was labeled properly on the outside, but the bottles were labeled for the person who was to receive a kit for Tagwords 08C0211/08C0212. Due to this confusion, both kits were replaced, and any samples collected in the original kits were discarded. The root cause of this error was established as inattention to detail. The incident was resolved when the incorrectly labeled kit for 08C0214/08C0215 was replaced with a correctly labeled kit. The other kit in question was canceled as per PNNL request and PNNL was putting on new tagwords to be delivered in the future. To resolve this incident the Group Leader of the Richland Service Center, Pete Wilber, has discussed the error with Wendy Mitchell, Courier who was responsible for preparing the kits. Attention to detail has been stressed. No further action was taken.

Incident Report for Tagwords 08C0462, April 11, 2008. The incident involved the wet ashing step of the preparatory process. The technician, Ben Finley, accidentally broke the glass vial holding the sample. The entire sample spilled onto the counter top and absorbent and the sample was lost. There is no sample available for re-prep. To resolve the issue the Group Leader of the Bioassay laboratory discussed the error with the employee and no further action was taken.

Corrective Actions

There are no corrective actions at this time.

COMPANY - WIDE NONCONFORMANCE REPORT

Mo.Day Yr.	Division:	Quality Criteria:	Type:
06-SEP-07	Bioassay	Specifications	Process
Instrument Type:	**Test / Method:**	**Matrix Type:**	**Client Code:**
BIOASSAY ALPHA	GL-RAD-B-001	Liquid	PNNL
Batch ID:	**Sample Numbers:**		
657223	See Below		

Potentially affected work order(s)(SDG): 190833,190834

Application Issues:

Method Blank contamination

Specification and Requirements Nonconformance Description:	NRG Disposition:
1. 1201389367 MB contaminated with Pu-239/240.	1. The MB appears to have been spiked with the LCS material. There were no hits in the samples. Results for this client use a blank population. This specific blank was removed from the blank population and the samples processed using the remaining blank population. The batch results are reported as not sample remains for analysis.

Originator's Name:

Anson Walsh 06-SEP-07

Data Validator/Group Leader:

Robert Timm 06-SEP-07

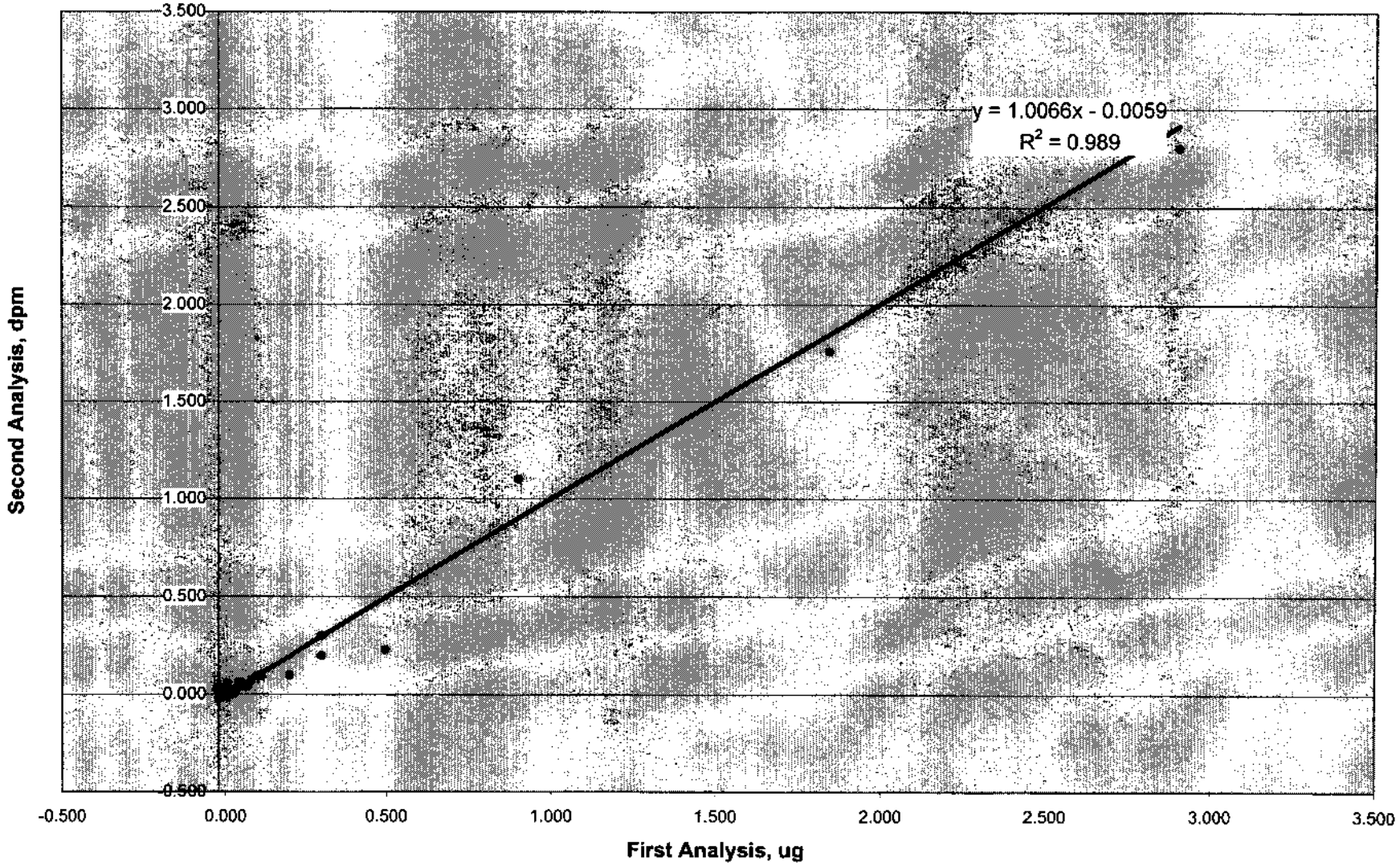
Quality Review:

Director:

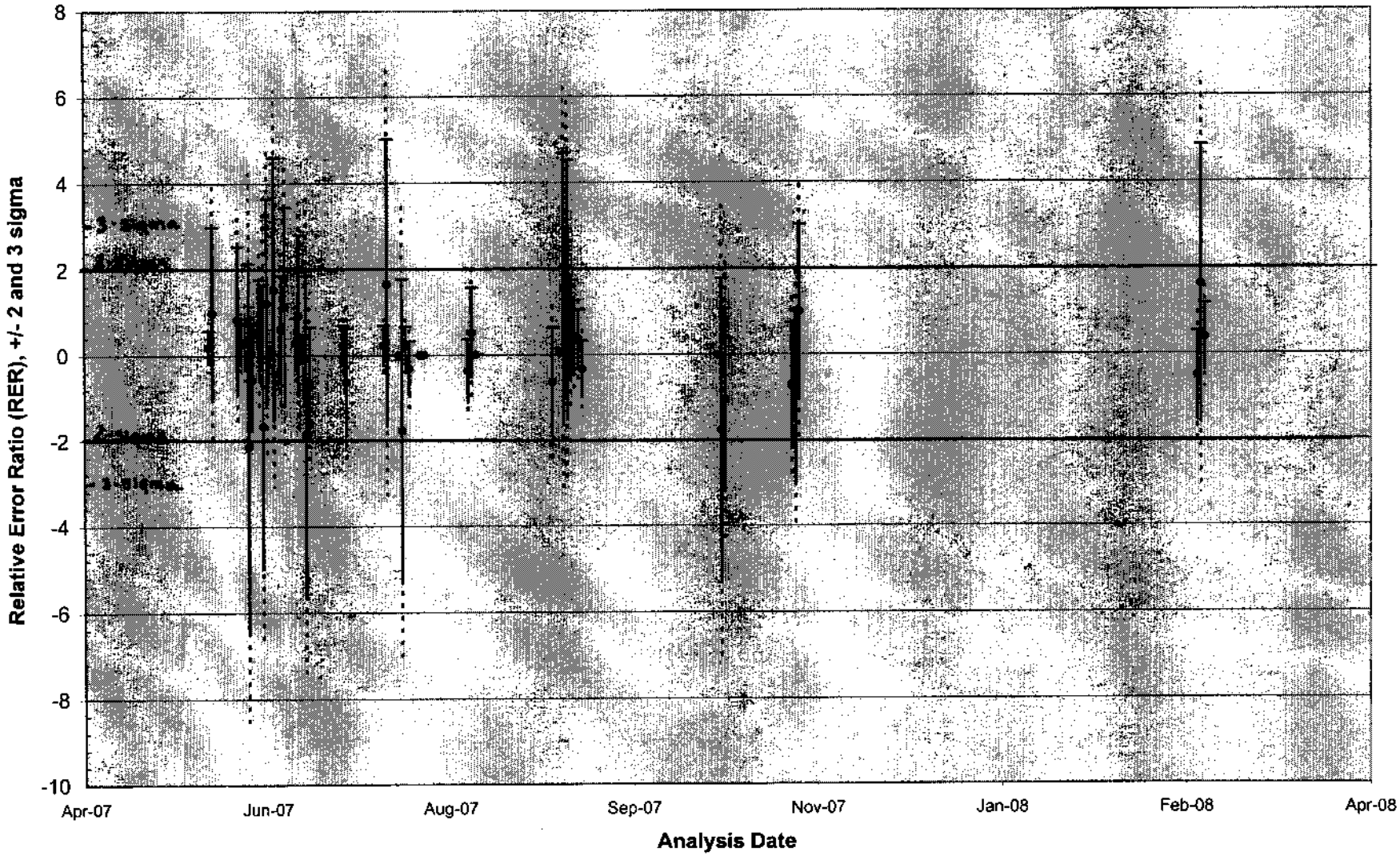
APPENDIX C

GEL Duplicates
(Historical File Only)

GEL Fecal Duplicates, April 2007 - March 2008



GEL Fecal Duplicate Fractional Difference, April 2007 - March 2008



APPENDIX D

QUALITY CONTROL INTERCOMPARISON PARTICIPATION RESULTS

(Historical File Only)

U.S. DEPARTMENT OF COMMERCE

National Institute of Standards and Technology
Gaithersburg, MD

REPORT OF TRACEABILITY

General Engineering Laboratories, LLC
Charleston, South Caroline

Test Identification: NRIP-07-SU
Test Radionuclides: ^{241}Am ^{243}Cm, ^{241}Am, ^{240}Pu, ^{238}Pu,, ^{238}U, ^{235}U, ^{234}U, ^{230}Th, ^{226}Ra, ^{210}Pb, ^{210}Po, ^{137}Cs, ^{90}Sr, ^{60}Co, ^{57}Co
Matrix Description: Synthetic Urine[1]
Test Activity Range: 30mBq•sample^{-1} to 300mBq•sample^{-1}
Reference Time: 12:00 EST, April 1, 2007

Measurement Results

Nuclide	NIST Value[2,3]		Reported Value[4]		Difference[5]
	Massic Activity Bq•g^{-1}	Relative Expanded Uncertainty (%, k=2)	Massic Activity Bq•g^{-1}	Relative Expanded Uncertainty (%, k=2)	(±% Bias)
^{241}Am	2.621	0.80	2.438	10.4	-7.0
^{240}Pu	1.112	0.76	1.050	11.2	-5.6
^{238}Pu	0.901	0.68	0.860	11.6	-4.6
^{238}U	2.954	0.60	2.770	10.7	-6.2
^{234}U	2.846	0.98	2.706	10.7	-4.9
^{235}U	0.136	0.62	0.136	26.2	-0.1
^{230}Th	1.348	0.58	1.276	12.0	-5.4
^{226}Ra	2.277	0.89	1.9	33.7	-16
^{210}Po	11.18	3.2	10.52	10.7	-5.9
^{137}Cs	516.9	0.68	533.2	10.4	3.1
^{90}Sr	25.13	0.74	24.50	11.8	-2.4
^{60}Co	661.0	0.74	672.8	10.2	1.8
^{57}Co	855.1	3.7	839.0	10.3	-1.9

Methods

	NIST[6]	Reporting Laboratory[7]
Activity Measurements	Alpha- and Beta-Spectrometry Mass Spectrometry	Alpha, Beta, and Gamma Spectrometry

Evaluation (per ANSI N42.22 and N13.30)

Nuclide	N42.22[8]		N13.30[9]	
	ANSI N42.22 Traceable	Traceability Limit (±Percent)	Results Acceptable per N13.30 Criteria (Pass/Fail)	
			Bias	Precision
^{241}Am	Yes	15	Pass	Pass
^{240}Pu	Yes	16	Pass	Pass
^{238}Pu	Yes	17	Pass	Pass
^{238}U	Yes	15	Pass	Pass
^{234}U	Yes	15	Pass	Pass
^{235}U	Yes	39	Pass	Pass
^{230}Th	Yes	17	Pass	Pass
^{226}Ra	Yes	42	Pass	Pass
^{210}Po	Yes	16	Pass	Pass
^{137}Cs	Yes	16	Pass	Pass
^{90}Sr	Yes	17	Pass	Pass
^{60}Co	Yes	16	Pass	Pass
^{57}Co	Yes	27	Pass	Pass

Samples Distributed October 1, 2007
Reporting Data Received December 4, 2007

For the Director

Michael Unterweger,
Acting Leader
Radioactivity Group
Physics Laboratory

(Continued)

U.S. DEPARTMENT OF COMMERCE

National Institute of Standards and Technology
Gaithersburg, MD

REPORT OF TRACEABILITY

General Engineering Laboratories, LLC
Charleston, South Caroline

Test Identification: NRIP-07-SU
Test Radionuclides: ^{243}Cm, ^{241}Am, ^{240}Pu, ^{238}Pu,, ^{238}U, ^{235}U, ^{234}U, ^{230}Th, ^{226}Ra, ^{210}Pb, ^{210}Po, ^{137}Cs, ^{90}Sr, ^{60}Co, ^{57}Co
Matrix Description: Synthetic Urine[1]
Test Activity Range: 30mBq•sample^{-1} to 300mBq•sample^{-1}
Reference Time: 12:00 EST, April 1, 2007

Measurement Results

Nuclide	NIST Value[2,3]		Reported Value[4]		Difference[5]
	Massic Activity Bq•g^{-1}	Relative Expanded Uncertainty (%, k=2)	Massic Activity Bq•g^{-1}	Relative Expanded Uncertainty (%, k=2)	(±% Bias)
^{241}Am	2.621	0.80	2.438	10.4	-7.0
^{240}Pu	1.112	0.76	1.046	11.4	-5.9
^{238}Pu	0.901	0.68	0.860	11.6	-4.6
^{238}U	2.954	0.60	2.818	14.3	-4.6
^{234}U	2.846	0.98	2.664	10.8	-6.4
^{235}U	0.136	0.62	0.154	25.2	13
^{230}Th	1.348	0.58	1.200	12.3	-11
^{226}Ra	2.277	0.89	2.2	38.1	-5.5
^{210}Po	11.18	3.2	10.44	11.6	-6.6
^{137}Cs	516.9	0.68	530.6	10.3	2.6
^{90}Sr	25.13	0.74	25.04	13.3	-0.4
^{60}Co	661.0	0.74	654.4	10.1	-1.0
^{57}Co	855.1	3.7	816.4	10.2	-4.5

Methods

	NIST[6]	Reporting Laboratory[7]
Activity Measurements	Alpha- and Beta-Spectrometry Mass Spectrometry	Alpha, Beta, and Gamma Spectrometry

Evaluation (per ANSI N42.22 and N13.30)

Nuclide	N42.22[8]		N13.30[9]	
	ANSI N42.22 Traceable	Traceability Limit (±Percent)	Results Acceptable per N13.30 Criteria (Pass/Fail)	
			Bias	Precision
^{241}Am	Yes	15	Pass	Pass
^{240}Pu	Yes	16	Pass	Pass
^{238}Pu	Yes	17	Pass	Pass
^{238}U	Yes	20	Pass	Pass
^{234}U	Yes	15	Pass	Pass
^{235}U	Yes	43	Pass	Pass
^{230}Th	Yes	16	Pass	Pass
^{226}Ra	Yes	54	Pass	Pass
^{210}Po	Yes	17	Pass	Pass
^{137}Cs	Yes	16	Pass	Pass
^{90}Sr	Yes	20	Pass	Pass
^{60}Co	Yes	15	Pass	Pass
^{57}Co	Yes	24	Pass	Pass

Samples Distributed October 1, 2007
Reporting Data Received December 4, 2007

For the Director

Michael Unterweger,
Acting Leader
Radioactivity Group
Physics Laboratory

(Continued)

U.S. DEPARTMENT OF COMMERCE
National Institute of Standards and Technology
Gaithersburg, MD

REPORT OF TRACEABILITY

General Engineering Laboratories, LLC
Charleston, South Caroline

Test Identification: NRIP-07-SF
Test Radionuclides: ^{241}Am ^{241}Am, ^{238}Pu, ^{240}Pu, ^{230}Th, ^{238}U, ^{235}U, ^{234}U, ^{90}Sr, ^{60}Co, ^{57}Co, ^{137}Cs, ^{210}Pb, ^{210}Po, ^{226}Ra, ^{243}Cm
Matrix Description: Synthetic Feces[1]
Test Activity Range: 30mBq•sample^{-1} to 300mBq•sample^{-1}
Reference Time: 12:00 EST, April 1, 2007

Measurement Results

Nuclide	NIST Value [2,3]		Reported Value[4]		Difference[5]
	Massic Activity Bq•g^{-1}	Relative Expanded Uncertainty (%, k=2)	Massic Activity Bq•g^{-1}	Relative Expanded Uncertainty (%, k=2)	(±% Bias)
^{241}Am	2.479	0.80	2.334	14.1	-5.8
^{238}Pu	0.851	0.68	0.761	11.7	-11
^{240}Pu	1.052	0.76	0.962	11.3	-8.5
^{230}Th	1.275	0.68	1.292	11.7	1.3
^{238}U	2.795	0.76	2.656	10.7	-5.0
^{234}U	2.692	0.80	2.508	10.9	-6.8
^{235}U	0.129	0.74	0.144	25.3	12
^{90}Sr	23.69	0.68	23.14	10.3	-2.3

NR= Not Reported **NA= Not Applicable**

Methods

	NIST[6]	Reporting Laboratory[7]
Activity Measurements	Alpha- and Beta-Spectrometry Mass Spectrometry	Alpha, Beta, and Gamma Spectrometry

Evaluation (per ANSI N42.22 and N13.30)

Nuclide	N42.22[8]		N13.30[9]	
	ANSI N42.22 Traceable	Traceability Limit (±Percent)	Results Acceptable per N13.30 Criteria (Pass/Fail)	
			Bias	Precision
^{241}Am	Yes	20	Pass	Pass
^{238}Pu	Yes	16	Pass	Pass
^{240}Pu	Yes	16	Pass	Pass
^{230}Th	Yes	18	Pass	Pass
^{238}U	Yes	15	Pass	Pass
^{234}U	Yes	15	Pass	Pass
^{235}U	Yes	42	Pass	Pass
^{90}Sr	Yes	15	Pass	Pass

Samples Distributed May 10, 2007
Reporting Data Received July 12, 2007

For the Director

Michael Unterweger,
Acting Leader
Radioactivity Group
Physics Laboratory

(Continued)

U.S. DEPARTMENT OF COMMERCE
National Institute of Standards and Technology
Gaithersburg, MD

REPORT OF TRACEABILITY

General Engineering Laboratories, LLC
Charleston, South Caroline

Test Identification: NRIP-07-SF
Test Radionuclides: ^{241}Am, ^{238}Pu, ^{240}Pu, ^{230}Th, ^{238}U, ^{235}U, ^{234}U, ^{90}Sr, ^{60}Co, ^{57}Co, ^{137}Cs, ^{210}Pb, ^{210}Po, ^{226}Ra, ^{243}Cm
Matrix Description: Synthetic Feces[1]
Test Activity Range: 30mBq•sample^{-1} to 300mBq•sample^{-1}
Reference Time: 12:00 EST, April 1, 2007

Measurement Results

Nuclide	NIST Value[2,3]		Reported Value[4]		Difference[5]
	Massic Activity Bq•g^{-1}	Relative Expanded Uncertainty (%, k=2)	Massic Activity Bq•g^{-1}	Relative Expanded Uncertainty (%, k=2)	(±% Bias)
^{241}Am	2.479	0.80	2.318	15.2	-6.5
^{238}Pu	0.851	0.68	0.796	16.0	-6.5
^{240}Pu	1.052	0.76	0.991	11.7	-5.8
^{230}Th	1.275	0.68	1.232	23.1	-3.4
^{238}U	2.795	0.76	2.666	11.6	-4.6
^{234}U	2.692	0.80	2.514	10.9	-6.6
^{235}U	0.129	0.74	0.137	25.6	6.5
^{90}Sr	23.69	0.68	24.06	10.4	1.5

NR= Not Reported NA= Not Applicable

Methods

	NIST[6]	Reporting Laboratory[7]
Activity Measurements	Alpha- and Beta-Spectrometry Mass Spectrometry	Alpha, Beta, and Gamma Spectrometry

Evaluation (per ANSI N42.22 and N13.30)

Nuclide	N42.22[8]		N13.30[9]	
	ANSI N42.22 Traceable	Traceability Limit (±Percent)	Results Acceptable per N13.30 Criteria (Pass/Fail)	
			Bias	Precision
^{241}Am	Yes	21	Pass	Pass
^{238}Pu	Yes	22	Pass	Pass
^{240}Pu	Yes	17	Pass	Pass
^{230}Th	Yes	34	Pass	Pass
^{238}U	Yes	17	Pass	Pass
^{234}U	Yes	15	Pass	Pass
^{235}U	Yes	41	Pass	Pass
^{90}Sr	Yes	16	Pass	Pass

Samples Distributed May 10, 2007
Reporting Data Received July 12, 2007

For the Director

Michael Unterweger,
Acting Leader
Radioactivity Group
Physics Laboratory
(Continued)

DEPARTMENT OF ENERGY

LABORATORY ACCREDITATION PROGRAM

Summary Report

Laboratory: GEL Session: 1006

Matrix: SF

RESL LogNo	Radionuclide	Mean Bias (Br):	St. Dev Bias (Sb)	Pass / Fail
DL191	Am-241	-0.162	0.045	Pass
DL191	Co-60	0.089	0.034	Pass
DL191	Cs-137	0.032	0.022	Pass
DL191	Pu-238	-0.085	0.019	Pass
DL191	Pu-239	-0.060	0.022	Pass
DL191	Sr-90	0.028	0.051	Pass
DL191	Th-228	-0.065	0.014	Pass
DL191	Th-230	0.076	0.035	Pass
DL191	Th-232	-0.100	0.017	Pass
DL191	U-234	-0.013	0.028	Pass
DL191	U-238	0.020	0.022	Pass

Acceptance Criteria: -0.25 =< Br <= 0.50 Sb =< 0.4

RADIOLOGICAL AND ENVIRONMENTAL SCIENCES LABORATORY

ATTACHMENT 1

AUDIT SAMPLES

(Historical File Only)

Antonio, Cheryl L

From: Swoboda, Robert G
Sent: Monday, July 07, 2008 12:06 PM
To: Antonio, Cheryl L
Cc: MacLellan, Jay; Carbaugh, Eugene H; Gieszler, Debbie L; Greenwood, Larry R
Subject: RE: Audit samples

Attachments: RADREC_438-Pu-dil.XLS

Cheryl,
Preliminary data does indicate that there is some Am-241 contamination in my Pu-239 spike, but I am getting the same count rate (~20cts/1000min) at the moment for Pu and Am which would only account for ~ 0.02 dpm equivalent Am-241. I too am glad that we have found at least a partial root cause. I want to quantify this source problem further, however this Pu-239 spike (W-145-3) is low on remaining volume. And it hails from a Malin Weiler prepared dilution legacy and had very long proven track record. I plan prepare a couple more direct mounts using most of the remaining ~ 1-1.5ml of this spike and quantify the Pu/Am ratio a little better. I am remembering using up a good portion of this spike directly in a previous round of standards checking done a couple years back.

I also had prepared a separate BA dilution level of Pu-239 --(R-438-f) material from an IPL source back in 2004 --- but I never implemented a switch based mainly on the consistent good performance of the W-145 ---- 0.5 dpm std.

RADREC_438-Pu-d
I.XLS (720 KB)...

Btw — The Sr-90 spike directly mounted for AEA -- did not have any cts above bkg for 1000 min ct.

Thanks Bob --- 373-6089

From: Antonio, Cheryl L
Sent: Thursday, July 03, 2008 2:29 PM
To: Swoboda, Robert G
Cc: MacLellan, Jay; Carbaugh, Eugene H; Gieszler, Debbie L
Subject: Audit samples
Importance: High

Bob,

I think I might have good news for you, in a bad news way. We had you spike 5 samples in June with 0.02 dpm Pu-239 and 10 dpm Sr-90. We had the lab analyze the samples for Pu-238, Pu-239, Am-241 and Sr-90. We expected results less than the decision level for Pu-238 and Am-241. The Pu-239, Pu-238 and Sr-90 results were within the acceptable range, but the Am-241 results were not blanks. The levels of Am-241 detected were consistent with what we were seeing in August 2007 through February 2008. Looking at the consistency of the results it really looks like either your Pu-239 or Sr-90 tracer is contaminated, my money is on the Pu-239 tracer. The time has come to check your standards for Am-241 contamination. I am optimistic that we almost have this problem solved.

Sample ID	*Sr-90 (dpm)*	*Pu-239 (dpm)*	*Pu-238 (dpm)*	*Am-241 (dpm)*
GEL080602	10.1	0.0204	$<D_L$	0.0727
GEL080603	8.18	0.0206	$<D_L$	0.078
GEL080604	8.84	0.0215	$<D_L$	0.0667
GEL080606	10.2	0.017	$<D_L$	0.0861
GEL080605	6.93	0.0154	$<D_L$	0.0788

Thanks,

Cheryl

Antonio, Cheryl L

From: Swoboda, Robert G
Sent: Monday, August 04, 2008 2:17 PM
To: Antonio, Cheryl L
Cc: MacLellan, Jay
Subject: RE: Audit samples

Attachments: RADREC_544-Pu-0.5dpm.XLS; RADREC_542-Am.XLS

Cheryl,
Here's the Pu and Am prep records. The new preps both check out OK at the intermediate (500dpm) spike level. --- I still owe you a hard copy of these final reports.
Let me know if you'd like a 5ml ampoule of each for archive or for direct validation by GEL.

RADREC_544-Pu-0.5dpm.XLS (450 ... RADREC_542-Am.XLS (2 MB)

Thanks Bob --- 373-6089

From: Antonio, Cheryl L
Sent: Monday, August 04, 2008 10:32 AM
To: Swoboda, Robert G
Cc: Gieszler, Debbie L; MacLellan, Jay
Subject: FW: Audit samples

Bob, I haven't heard back from you yet. Debbie would like to go bring you samples tomorrow, are you ready to spike samples for americium-241, or should we just send you uranium samples and wait a bit on the plutonium and americium?

Thanks,

Cheryl

From: Antonio, Cheryl L
Sent: Tuesday, July 29, 2008 9:22 AM
To: Swoboda, Robert G
Cc: Gieszler, Debbie L; MacLellan, Jay
Subject: Audit samples

Bob,

Next week we plan to send you 5 urine samples to be spiked with plutonium-239 only and another 5 samples to be spiked with plutonium-239 and americium-241. This will be in addition to the uranium samples. Do you think you will be ready for americium-241 sampling?

Debbie, these will be scheduled as AU001 etc..

Antonio, Cheryl L

From: Greenwood, Larry R
Sent: Wednesday, June 04, 2008 4:30 PM
To: MacLellan, Jay
Cc: Swoboda, Robert G; Carbaugh, Eugene H; Antonio, Cheryl L
Subject: RE: Possibility of different lab space

Jay,
I will discuss this with Bob and my management and let you know what we can do. Given the relatively low cost of glassware, pipettes, etc, we should be able to dedicate equipment to this effort and/or use clean equipment for each preparation. Fume hood space should also be dedicated, if possible, or thoroughly cleaned prior to each prep. It is also possible to prepare blanks with each batch as a way of checking on contamination.

Larry Greenwood, Pacific Northwest National Laboratory
Laboratory Fellow
Phone: 509-376-6918, Fax: 509-373-6001

From: MacLellan, Jay
Sent: Wednesday, June 04, 2008 16:03
To: Greenwood, Larry R
Cc: Swoboda, Robert G; Carbaugh, Eugene H; Antonio, Cheryl L
Subject: Possibility of different lab space

Larry,

As you know, Bob Swoboda prepares audit samples for double blind submittal to the Hanford excreta bioassay contractor GEL as a key part of our QC oversight of GEL. In the past few months the Am-241 results from GEL have been consistently higher than the spike level Bob has reported to us. The problem seems to be limited to the samples from Bob's lab, as we are not seeing abnormal false-positive rates in our worker samples, and the GEL-originated lab control samples also don't show a problem. Last month we asked GEL to analyze for Am-241 a U spike Bob had prepared, and that result was a non-detect. We are taking that as a limited indication that the problem is not general contamination in Bob's lab. Bob and you have also checked his standard solutions and those showed the expected levels.

Bob has suggested that the problem may be trace contamination in his lab associated with higher level samples that have been processed there. If that is the case, it would appear to be specific to lab ware or equipment associated with spiking of urine samples with Pu and Am (they have only been done together for the last year). Can you think of any way to check for equipment contamination? The basic problem is we are asking Bob to spike at levels far below what is normally of concern in 325. Bob has also expressed concern that future work planned for his lab may exacerbate the problem. His recommendation was that we inquire of you about the possibility of making alternate lab space available for our low-level audit sample preparation. If you can find new space, we may be able to fund some new lab ware and pipettes for a clean start.

Jay MacLellan, **CHP**
Radiation and Health Technology
Pacific Northwest National Laboratory
Phone: 509-376-7247
Fax: 509-376-8161
jay.maclellan@pnl.gov

Antonio, Cheryl L

From: Swoboda, Robert G
Sent: Thursday, June 05, 2008 2:24 PM
To: MacLellan, Jay
Cc: Carbaugh, Eugene H; Antonio, Cheryl L; Greenwood, Larry R
Subject: RE: Possibility of different lab space

Jay,

I am still perplexed as to how contamination could occur in my lab with the current controls I have in place --- there is little chance other than Chicken Little (falling out of air) that can cause contamination simply considering the very few cross contamination points--- let alone a consistent 3-4 times the 0.02 dpm target activity during the timeframe of these audits. The only logical suspect seemed to be that the spike level was higher than expected target level -- but this was investigated and found not to be the case. --- I again double checked my calculations on spike aliquots on audits in question and they were correct. (i.e. for Aug 2007 -- 2 dpm *0.040 ml/
Pool of 4 = 0.02dpm/s).....

Short of working in a clean plastic tent, I will re-place the following with new and again isolate:
-- Carboy for compositing
-- Pipette (replace end barrel) --- and obtain new box of tips
-- Water storage bottle and transferring container
-- Diaper paper working surface (always new)
--- this is it --- NOTHING else to isolate other that the passage of room air over the open containers.

Also,
-- I cleaned up the Quartz distiller several months ago and am now back on track using this double distilled water, although there is nothing wrong with nanopure system -- both came out comparable to BKG based on ICP-MS measurements.
-- I am archiving the last ampoule of current 2 dpm standard --- this is available for you to send off to GEL if you wish.
--- I will do activity verification check on Am-241 intermediate standard --- then I will prepare a larger set of a new series of ampoulized standards at 0.5 dpm (better level to provide larger spiking aliquot with more precision i.e. 0.02dpm=40µl)--- and will replace with a new ampoule after every couple of uses.

I would also like to recommend that an occasional 10X -- 0.02 dpm be requested (same for Pu) --- this would help getting to potential root cause of problem.

FINAL Word --- I expect this contamination problem will go away but I do find it odd that this Am-241 contamination coincides time wise with a Pu-238 (this has the same AEA energy peak) incident from PNNL (could have extended somehow to my lab here (but I am dubious) or with associated bioassays sent out). Regardless, I am surprised that GEL did not have any problems with cross contamination @ 4.9 MeV ROI.

Thanks Bob --- 373-6089

Antonio, Cheryl L

From: Swoboda, Robert G
Sent: Tuesday, July 01, 2008 10:42 AM
To: MacLellan, Jay
Cc: Carbaugh, Eugene H; Antonio, Cheryl L; Greenwood, Larry R
Subject: RE: TRIM: RE: Possibility of different lab space

Jay, I don't have all the BA samples in which the Am-241 data was high, but it does appear that for Aug, Oct, '07 and Jan '08 that Pu-239 was added @ 0.02dpm level to all samples and also that Sr-90 was added @ 10 dpm level. So the possibility does exist. I will do a little investigating.....of both standards for Alpha @ 5.5 Mev.

-- stay tuned.....

Thanks Bob --- 373-6089

From: MacLellan, Jay
Sent: Friday, June 27, 2008 9:11 AM
To: Swoboda, Robert G
Cc: Carbaugh, Eugene H; Antonio, Cheryl L
Subject: RE: TRIM: RE: Possibility of different lab space

Bob,

Anita Bhatt, the DOELAP administrator, was in town for another reason and Gene took the opportunity to ask her for unofficial thoughts concerning our problem. After some thought she asked if we had checked the Pu standard for Am contamination. Is that a possibility?

Jay MacLellan, **CHP**
Radiation and Health Technology

Pacific Northwest National Laboratory
902 Battelle Boulevard
Richland, WA 99352-USA
P.O. Box 999, MSIN B1-60
Phone: 509-376-7247
Fax: 509-376-8161
jay.maclellan@pnl.gov
www.pnl.gov

From: MacLellan, Jay
Sent: Thursday, June 05, 2008 2:37 PM
To: Swoboda, Robert G
Cc: Carbaugh, Eugene H; Antonio, Cheryl L; Greenwood, Larry R
Subject: TRIM: RE: Possibility of different lab space

Bob,

It is perplexing to us all. There doesn't appear to be gross wide-spread contamination (nothing in the blanks), and the high bias of the results has been rather consistent. I also double checked your calculations and didn't find any errors. We have been leaning toward a contaminated pipette, but I would have guessed the bias from that cause would be more variable. Consistent double or triple spiking of the samples would explain the problem, but that doesn't seem probable. I'll leave it to you and Cheryl to work through the practicality of some high level spikes. Gene will be back on Monday, and may also have additional thoughts.

As with many aspects of our work the shotgun approach may be the only recourse, and an identified cause may continue to elude us.

Jay MacLellan, **CHP**
Radiation and Health Technology
Pacific Northwest National Laboratory
Phone: 509-376-7247
Fax: 509-376-8161
jay.maclellan@pnl.gov

From: Swoboda, Robert G
Sent: Thursday, June 05, 2008 2:24 PM
To: MacLellan, Jay
Cc: Carbaugh, Eugene H; Antonio, Cheryl L; Greenwood, Larry R
Subject: RE: Possibility of different lab space

Jay,

I am still perplexed as to how contamination could occur in my lab with the current controls I have in place --- there is little chance other than Chicken Little (falling out of air) that can cause contamination simply considering the very few cross contamination points--- let alone a consistent 3-4 times the 0.02 dpm target activity during the timeframe of these audits. The only logical suspect seemed to be that the spike level was higher than expected target level -- but this was investigated and found not to be the case. --- I again double checked my calculations on spike aliquots on audits in question and they were correct. (i.e. for Aug 2007 -- 2 dpm *0.040 ml/
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FINAL Word --- I expect this contamination problem will go away but I do find it odd that this Am-241 contamination coincides time wise with a Pu-238 (this has the same AEA energy peak) incident from PNNL (could have extended somehow to my lab here (but I am dubious) or with associated bioassays sent out). Regardless, I am surprised that GEL did not have any problems with cross contamination @ 4.9 MeV ROI.

Thanks Bob --- 373-6089

From: Greenwood, Larry R
Sent: Wednesday, June 04, 2008 4:30 PM
To: MacLellan, Jay
Cc: Swoboda, Robert G; Carbaugh, Eugene H; Antonio, Cheryl L
Subject: RE: Possibility of different lab space

Jay,
I will discuss this with Bob and my management and let you know what we can do. Given the relatively low cost of

glassware, pipettes, etc, we should be able to dedicate equipment to this effort and/or use clean equipment for each preparation. Fume hood space should also be dedicated, if possible, or thoroughly cleaned prior to each prep. It is also possible to prepare blanks with each batch as a way of checking on contamination.

Larry Greenwood, Pacific Northwest National Laboratory
Laboratory Fellow
Phone: 509-376-6918, Fax: 509-373-6001

From: MacLellan, Jay
Sent: Wednesday, June 04, 2008 16:03
To: Greenwood, Larry R
Cc: Swoboda, Robert G; Carbaugh, Eugene H; Antonio, Cheryl L
Subject: Possibility of different lab space

Larry,

As you know, Bob Swoboda prepares audit samples for double blind submittal to the Hanford excreta bioassay contractor GEL as a key part of our QC oversight of GEL. In the past few months the Am-241 results from GEL have been consistently higher than the spike level Bob has reported to us. The problem seems to be limited to the samples from Bob's lab, as we are not seeing abnormal false-positive rates in our worker samples, and the GEL-originated lab control samples also don't show a problem. Last month we asked GEL to analyze for Am-241 a U spike Bob had prepared, and that result was a non-detect. We are taking that as a limited indication that the problem is not general contamination in Bob's lab. Bob and you have also checked his standard solutions and those showed the expected levels.

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Jay MacLellan, **CHP**
Radiation and Health Technology
Pacific Northwest National Laboratory
Phone: 509-376-7247
Fax: 509-376-8161
jay.maclellan@pnl.gov

Antonio, Cheryl L

From: Swoboda, Robert G
Sent: Friday, July 25, 2008 2:14 PM
To: Antonio, Cheryl L
Cc: Soderquist, Chuck Z; Swoboda, Robert G
Subject: RE: Am-241 evaluation

Attachments: RADREC_544-Pu-0.5dpm.XLS; RADREC_542-Am.XLS

Cheryl, I prep'd a new series (10 ampoules @ 5mL each) of Am-241 and Pu-239 @ ~ 0.5 dpm and am re-verifying activity and purity of intermediate parent --- still awaiting data form counting room. The Sr-90 R-444-b standard showed no alpha above bkg upon AEA counting of
. Due to 1yr expiration on opened ampoules usage I will be breaking into a new source material R-484 (series prep) --- I will check an aliquot of this standard upon opening for purity.


RADREC_544-Pu-0.5dpm.XLS (452 ...


RADREC_542-Am.XLS (2 MB)

Here are temporary prep records--- --- I still need to include final verif data.....

Btw--- the W-145-3 Pu-239 material got counted for 7200 min and the Am-241/Pu-238 ROI is about 1.5 - 2 times the Pu-239 ROI --- Chuck and I looked and evaluated the spectral data --- I will send out a formal report. This only accounts for ~ 1/2 the Am-241 you were seeing in the audits, but hopefully with all the new standards and change out again of all associated equip & materials, we will be OK in future.

Thanks Bob --- 373-6089

From: Antonio, Cheryl L
Sent: Thursday, July 24, 2008 1:23 PM
To: Swoboda, Robert G
Cc: MacLellan, Jay
Subject: RE: Am-241 evaluation

Bob, we are getting ready to send another batch of samples to you for spiking. What is the status of Am-241? Also, I may have missed an email but have you checked the strontium source for potential cross contamination? All of the samples since August were spiked with Pu-239 and Sr-90.

Take care,

Cheryl

From: Swoboda, Robert G
Sent: Thursday, July 17, 2008 11:53 AM
To: Soderquist, Chuck Z
Cc: Trang-Le, Truc Ti; Antonio, Cheryl L
Subject: Am-241 evaluation

Chuck,
Can you evaluate the Pu-239 (W-145-3-a,b,c) direct plated looooooow level source checks that are just finishing counting on our new AEA detectors for Am-241/Pu-238 corresponding activity.. All I really need is a good ratio of the 2 energies so I can get a good idea of exactly the maximum contamination was contributed by this source. The Pu-239 activity should be @ 0.2ml * 0.54 dpm/ml = 1.08 dpm. I think the AEA efficiencies are based on co-ppt geometries so I expect nominal total recovery to be greater than 100%.
I am not seeing the same relative levels of Am-241 as BAQC program folks are seeing so I need secondary input on this concern.
Charge your time to K99326 for this effort.----

Thanks Bob --- 373-6089