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ISPO Task A-126: Application of Mixed Internal Standards to the Mass Spectrometric Analysis of Plutonium and Uranium in Spent Fuel Dissolver Solutions: ORNL Results

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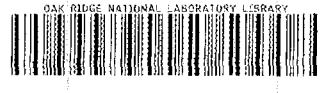

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D. H. Smith, R. L. Walker, and J. A. Carter

Abstract

An experiment conducted jointly by the International Atomic Energy Agency, the COGEMA reprocessing facility at LaHague, France, the French Center for Nuclear Studies at Saclay, and ORNL is nearing completion. The aim of this experiment is to evaluate the use of internal standards when applied under field conditions to spent fuel dissolver solutions. Samples were taken at LaHague and shipped to Saclay, the IAEA in Vienna, and ORNL. Both resin beads and dried residues were shipped.

ORNL has analyzed plutonium and uranium from these samples with good results: external precisions for uranium concentrations were $\pm$0.06% and for plutonium $\pm$0.2%.

Copies of our report sheets are given in the appendices.

INTRODUCTION: Internal Standards

Use of internal standards (also called double spikes) significantly improves the precision and accuracy of isotope ratio measurements. This technique has long been used in geological applications, and the use of synthetic standards for uranium was first suggested by Dietz et al. in 1962.[1] In our experience, improvements in external precision by factors of five or more can be realized when such standards are applied to uranium and plutonium analyses.

Internal standards address one of the thorniest problems in thermal ionization: irreproducibility of ionization behavior from filament to filament. Mass spectrometrists in the field have long known that a different bias correction is needed for each filament, but, without internal standards, are unable to measure it. The universally applied technique is to calibrate the instrument using a certified isotopic standard (such as NBS-U500) and determine what we shall call an average bias correction. This average is derived from a number (5-10) of replicate analyses of different sample loadings on different filaments. The value thus determined is monitored by periodic analysis of certified isotopic standards whose compositions approximate that of typical samples. NBS-U010, NBS-U020, and NBS-U030, with about 1, 2, and 3 atom percent ^{235}U, respectively, are the most often used standards for heavy elements; NBS-Pu947 is also used.

There are many identifiable causes of bias in thermal ionization analysis. All elements will fractionate during the evaporation process, the lighter isotopes being slightly more volatile than the heavy ones. This is a well-known phenomenon, and volatility varies with the inverse square root of the mass. To obtain the best results using an average bias correction, one must take data for all samples at that point on the fractionation curve where this correction applies. This is not easy to do in practice, however. The exact shape of the fractionation curve is unknown for any given sample, being a function of the amount of sample loaded, the chemical form of the sample, what contaminants and how much of them are present, filament temperature, the work function of the

ionizing surface, and many more. The analyst tries to standardize his procedure so that sample size and chemical form are as nearly the same as possible and by following the same thermal conditioning schedule—in general, treating all samples as nearly identically as is possible.

Other factors that affect bias are variable extraction efficiency of the ion source, transmission through the spectrometer, and conversion of ions to electrons at the detector. These factors are not nearly as significant as vagaries in the ionization process and are addressed by internal standards only insofar as they are mass-dependent, as opposed to random, in origin.

To apply an internal standard, one must have a spike that has an isotope ratio that is known to a high degree of accuracy. By comparing the measured value of this ratio to the known, a bias correction applicable to the filament in question can be calculated. The most felicitous case of an internal standard is exemplified by strontium, where the $^{86}Sr/^{88}Sr$ ratio is invariant in nature and can be used as an internal standard to determine ^{87}Sr, a fission product used in geochronology. Mother Nature is not usually so cooperative, however, and it then becomes necessary to synthesize one's own internal standard.

For the cases of uranium and plutonium, available spike materials will have isobaric overlaps from sample isotopes, making it essential to have accurate knowledge of the complete isotopic composition of each to allow the necessary corrections to be made. For uranium, the obvious choices for isotopes are ^{233}U and ^{236}U because they are of low abundance in most samples. For plutonium, the choices are ^{242}Pu and ^{244}Pu. Both these isotopes have relatively long half-lives, making them safer to work with than the shorter-lived isotopes and yielding a ratio that is stable on a human time scale.

As an example of applying an internal standard, let us consider uranium. The two isotopes, ^{233}U and ^{236}U, are mixed to give a

ratio of about one. The isotopic composition of this mixture is measured, and an accurate value of the $^{233}U/^{236}U$ ratio determined using NBS-U500 ($^{235}U/^{238}U$ = 1.0) as an internal standard. The concentration of the 233-236 mixture is determined using a gravimetric solution for a reference. Appropriate amounts of spike (also called tracer) are added to the target samples, and an isotopic analysis performed. Computer programs perform the necessary calculation of the bias, and a report sheet of the isotopic composition of the mixture of spike and sample and of the concentration of the sample is generated.

Thus, from the analyst's point of view, use of an internal standard is no different from that of a conventional, single-isotope spike for isotope dilution analysis. The additional work necessary has all been done beforehand by calibrating the internal standard and modifying computer programs.

The theory of internal standards has been discussed by Dodson.[2,3] Among the elements to have been analyzed by this technique are U[4,5], Pb, Ca, Ba, and Mo.[6] Previous work in this laboratory on uranium and plutonium has been reported.[7]

INTRODUCTION: Task A-126

There have been numerous laboratory experiments verifying the efficacy of internal standards as applied to uranium. Callis has been able to measure isotopic ratios to precisions and accuracies of better than ±0.01%,[8] and precisions of ±0.15% or better were obtained in our laboratory for $^{235}U/^{238}U$ ratios during a comprehensive survey of uranium isotopic standards.[7] We also obtained ±0.1% or better for uranium and plutonium concentration measurements. This is the first reported application of a plutonium internal standard. The consensus is that improvements in precision and accuracy of about a factor of five can be realized by use of internal standards. This means that, for pulse-counting mass spectrometers that analyze nanogram-sized samples, precision improves from about ±0.5% to ±0.1%—a dramatic improvement. For instruments with Faraday cup detectors that analyze microgram-sized samples, precisions much better than ±0.1% should be routinely achievable; we have obtained ±0.005% for replicate analyses of a single sample using our multi-collector commercial instrument.

One area where such analytical improvement would be of great value is in nuclear safeguards. To evaluate the effect of internal standards in a safeguards application, an experiment was set up to be carried out under the administrative leadership of the International Atomic Energy Agency in Vienna. French participation and cooperation were the key to the experiment. Arrangements were made through P. Patigny to sample the French reprocessing plant operated by COGEMA near Cap LaHague. The mass spectrometry section under J. Cesario at the French nuclear center at Saclay synthesized and characterized the internal standards, creating mixtures of the spikes of the two elements in appropriate Pu/U ratios. ORNL participation was funded through ISPO as Task A-126.

The goals of the experiment may be summarized:

1. To compare results obtained using internal standards to those obtained without.

2. To compare results obtained from samples loaded on resin beads[9] to those obtained from samples loaded conventionally as dried solutions.

Inter- and intra-laboratory comparisons would be made in both cases. The IAEA and Saclay were to analyze all samples by both loading techniques; COGEMA was to analyze only solution loadings, and ORNL was to analyze only resin beads.

To facilitate comparisons, each laboratory was to report its results as calculated in three different ways: 1) using the bias corrections derived from use of the internal standards; 2) applying the conventional average bias corrections; 3) with no bias correction applied.

This report thus contains only a relatively small fraction of the results generated in the experiment. Detailed evaluation of the entire experiment will require the services of a professional statistician.

EXPERIMENTAL OVERVIEW

Two samples were processed in parallel at the COGEMA facility: one taken from a spent-fuel dissolver solution and one provided by Saclay to serve as a reference to calibrate the tracer and in case questions should arise. Each of these two samples was in turn processed in parallel: each was divided into three samples, and all chemical and spiking operations were carried out individually on each subsample. Each of these samples was to be analyzed in duplicate at each laboratory using the loading techniques described above. Table 1 summarizes the samples analyzed at ORNL.

Table 1. Sample Summary

Sample Name	Description
T015	Pure tracers; isotopic analysis only
R015	Pure reference; isotopic analysis only
E015	Pure sample; isotopic analysis only
P215	Mixture of tracer and reference in triplicate;
P315	isotopic and isotope dilution analyses.
P415	
M115	Mixture of tracer and spent fuel sample in
M215	triplicate; isotopic and isotope dilution
M315	analyses.

Thus, since each of the nine samples was analyzed in duplicate for both plutonium and uranium, 36 mass spectrometric analyses were required. In addition, since it had been decided to report results three different ways to facilitate comparisons, 108 different passes through the data reduction computer programs were necessary.

The reference sample, whose characteristics were well-defined and which are summarized in Table 2, was to be used to determine the concentration of the internal standard for use in isotope dilution calculations of the spent fuel sample. The uranium was the natural element.

Table 2. Reference Sample

	238	239	240	241	242	244	
Pu	0.01	95.26	4.52	0.203	0.007	0.000	Saclay (5/15/75)
	0.009	95.32	4.54	0.130	0.007	0.000	Saclay (10/22/84)
	0.2	95.19	4.48	0.131	0.008	0.000	ORNL (10/22/84)

	233	234	235	236	238	
U	0.000	0.0054	0.7205	0.000	99.2741	Saclay
	0.0021	0.0053	0.7186	0.0009	99.2731	ORNL

SAMPLE ACQUISITION

D. H. Smith of ORNL visited the reprocessing facility at LaHague on October 24-26, 1984, to participate in collection of the samples and organize analytical details with staff members of the other laboratories involved. Sample collection proceeded fairly smoothly; the actual hot cell and glove box operations were performed by COGEMA technicians under the direction of S. Deron of IAEA. H. Swietly of IAEA participated in preparation of the resin-bead-loaded samples. Details of this technique for collecting and subsequently mass analyzing uranium and plutonium have been previously described.[9]

EXPERIMENTAL

The samples were received at ORNL via mail from the IAEA in undamaged condition. Samples were analyzed using ORNL's three-stage, high abundance sensitivity mass spectrometer.[10] This instrument is equipped with a pulse-counting detection system to allow analysis of nanogram-sized samples. Data acquisition is effected through a locally designed control panel;[11] the software governing data acquisition and processing has been described.[12,13] These programs automatically apply the bias correction called for, whether calculated from internal standard ratios or by use of an average value.

All samples ran quite well during mass spectrometric analysis, indicating that reasonable loading of the resin beads had been achieved. It was noted, however, that some samples required that two beads be loaded simultaneously on a mass spectrometer filament to obtain a sufficiently intense and stable Pu^+ signal, while others required fairly long times to burn off excess plutonium before starting acquisition of uranium data. This suggests that variable amounts of sample were loaded on the resin beads.

RESULTS AND DISCUSSION

Reference Sample

Our first task was to verify the isotopic composition of the reference sample provided by Saclay. Our results are included in Table 2. Agreement is generally good. The ORNL ^{238}Pu result is not valid because the low abundance of this isotope combined with the high abundance of ^{238}U united to make a good measurement impracticable; this is the cause of the occasional negative values in the appendices. We had only the Pu-U mixture and did not have samples of the pure elements. Because of this, we used Saclay's abundance values for our calculations. They were corrected to October 22, 1984 (the date of sampling) to adjust for radioactive decay. This is particularly significant for ^{241}Pu. On the other hand, we felt constrained to use our abundance values for uranium because we found small amounts of ^{233}U and ^{236}U indicating contamination of the sample. Since these are the internal standard isotopes, the value of the bias corrections calculated from their ratio will be very sensitive to any discrepancy in its value.

Tracer

The internal standard (or tracer) alone was analyzed two different ways. We first measured its isotopic composition from samples loaded on beads at LaHague; results are given in Table 3. We also analyzed some of the starting material obtained directly from Saclay using NBS-U500 and NBS-Pu947, both certified isotopic standards, as internal standards. Table 4 contains our results for uranium. Agreement with Saclay values is quite good, and no problems are anticipated from the slight disagreement between the two laboratories.

Table 3. Analysis of Internal Standard Tracer from LaHague

	238	239	240	241	242	244	244/242	Conc. µg/g	Lab
Pu	0.3537	0.4801	1.7389	0.7582	66.6821	29.9870	0.44970	6.189	Saclay
	0.3499	0.4854	1.7354	0.7562	66.6853	29.9879	0.44969		ORNL

	233	234	235	236	238	236/233	Conc. µg/g	Lab
U	67.6520	0.3329	3.0226	28.5470	0.4456	2.36946	981.0	Saclay
	67.6531	0.3308	3.0176	28.5522	0.4464	2.36946		ORNL

Table 4: Uranium Results for Tracer from Saclay

	233/236 (as received)	233/236 (after $HClO_4$)
	2.37279	2.37088
	2.37306	2.37059
	2.37074	2.36793
	2.37090	2.37544
	2.37139	2.37374
	2.37056	2.37252
Avg.	2.37157	2.37185
SD	0.00109	0.00264
RSD, %	0.05	0.12
ORNL/Sac	1.0007	1.0008

The two columns in Table 4 refer to two different sample preparations that were dictated by our experiences with plutonium described below. Each preparation gave an average within ±0.1% of Saclay's values, which is within expected experimental uncertainties.

It was found difficult to obtain comparable precision and agreement with Saclay's values for plutonium. Analysis of our results revealed that the problem was probably due to the fact that we did not have an appropriate reference for use as an internal standard. We used the $^{239}Pu/^{240}Pu$ ratio of the NBS-947 certified isotopic reference standard as the calibration ratio for our internal standard calculations. This standard has a 239/240 ratio of 0.2414, with an isotopic abundance of ^{240}Pu of 18.8%. The abundance of ^{240}Pu in the Saclay internal standard was about 1.7%. Our mixture of the Saclay internal standard and NBS-947 was in an approximate 60/40 ratio with an abundance of ^{240}Pu of about 8.4%. The relatively high contribution of the internal standard

to this mass position resulted in a less-than-perfect situation with regard to correction of it prior to performing calibration calculations: about 12% of the total counts had to be subtracted before the bias correction per mass could be calculated. Although our precision and agreement with the Saclay value for the $^{244}Pu/^{242}Pu$ ratio were within the targeted range of $\pm$0.2%, previous experience had led us to hope for better results.[7] To investigate the possibility of failure to attain isotopic equilibrium during mixing of the two components, we prepared a second set of samples that had been evaporated with $HClO_4$ to break up any polymers that might have formed. Results from the two preparations were comparable, thus eliminating this possibility. Another possible limitation to our precision was due to counting statistics. We therefore analyzed the samples from the original preparation a second time using a peak monitoring scheme devised to give approximately the same numbers of counts for each critical mass position (239, 240, 242, 244): the time spent on each isotope was in a 1:4:1:2 ratio. Results are given in Table 5a.

With a mixture of this sort, one can use either component as the internal standard; our goal was, of course, to verify the abundance values measured at Saclay for the material later used as the internal standard for the LaHague spent fuel sample, but using Saclay's reference value for the $^{244}Pu/^{242}Pu$ ratio as the internal standard calibration ratio provided a check on the results obtained using the NBS-947 as the internal standard. Results are presented in table 5. Table 5a lists values obtained for the $^{244}Pu/^{242}Pu$ using the $^{240}Pu/^{239}Pu$ ratio as the internal standard for both sets of analyses; those in the first column were obtained for the first set of measurements which had relative factors of 1:2:1:1 for the times spent on mass positions 239, 240, 242, and 244, respectively; in the second column, the results for the second analyses, with relative times of 1:4:1:2 for the critical isotopes, are listed. Table 5b presents different results obtained from the same data; in this case, $^{240}Pu/^{239}Pu$ was calculated using the $^{244}Pu/^{242}Pu$ from the Saclay spike as the internal standard. This ratio should be the

Table. 5a. Calibration of Saclay Tracer using NBS-947 as Internal Standard

	244/242 (1)	SD		244/242 (2)	SD
1	0.45082	0.00217	7	0.44904	0.00213
2	0.44956	0.00274	8	0.44946	0.00273
3	0.44882	0.00266	9	0.44804	0.00184
4	0.44983	0.00261	10	0.45014	0.00215
5	0.44861	0.00156	11	0.44927	0.00160
6	0.44860	0.00190	12	0.44985	0.00216
X =	0.44937	0.00227		0.44930	0.00210
SD =	0.00087			0.00073	
RSD =	0.20%			0.16%	

Table. 5b. Calibration of NBS-947 using Saclay Tracer as Internal Standard

	240/239 (1)	SD		240/239 (2)	SD
1	0.24087	0.00045	7	0.24131	0.00044
2	0.24113	0.00058	8	0.24121	0.00056
3	0.24130	0.00056	9	0.24152	0.00039
4	0.24107	0.00054	10	0.24108	0.00045
5	0.24133	0.00033	11	0.24127	0.00034
6	0.24134	0.00061	12	0.24115	0.00046
X =	0.24117	0.00051		0.24126	0.00044
SD =	0.00019			0.00015	
RSD =	0.08%			0.06%	

(1) 1:2:1:1 Scanning scheme

(2) 1:4:1:2 Scanning scheme

certified value for NBS-947 at the date in question: 0.24136. Thus, our accuracy in Table 5b is better than 0.1%. The results show about a 25% improvement in precision when the optimized scanning scheme was used (i.e., comparing between the two columns); however, for the $^{244}Pu/^{242}Pu$ ratios listed in Table 5a, precision is still about $\pm$0.2%, which meets our goal but is not as good as we had hoped. On the other hand, when $^{244}Pu/^{242}Pu$ ratio is used for calibration purposes, internal precisions for the $^{240}Pu/^{239}Pu$ ratio are improved by more than a factor of four. External precisions were improved by a factor of 2.5, to better than $\pm$0.1%, which is consistent with our previous experience. During an earlier calibration of a $^{244}Pu/^{242}Pu$ internal standard synthesized in our laboratory for ORNL use, we used enriched isotopes that yielded a much lower (0.07%) abundance of ^{240}Pu and thus required application of a much lower correction during data processing. Results of this calibration are summarized in Table 6.

Precision for the $^{244}Pu/^{242}Pu$ ratio for these measurements is $\pm$0.06%; thus, from Tables 5b and 6, it seems clear that our inability to duplicate this level of precision for the results in Table 5a is due to the combination of a relatively high concentration of ^{240}Pu in the proposed internal standard and a relatively low abundance of that isotope in the certified reference material used to calibrate it. What is needed is a reference material that has a $^{240}Pu/^{239}Pu$ reasonably close to 1.0 to reduce the statistical effects of the correction. Since enriched plutonium isotopes of sufficient purity for use in internal standard applications are in extremely short supply, it may be necessary to synthesize such a calibration sample solely to certify internal standards.

To keep results from the various laboratories consistent, we used the Saclay values for the critical isotopic ratios ($^{244}Pu/^{242}Pu$ and $^{233}U/^{238}U$). In neither case did our values differ significantly from theirs.

Table 6. Calibration of Local ORNL Pu Internal Standard

	238/242	239/242	240/242	241/242	244/242
	0.00000	0.00042	0.00133	0.00015	0.99682
	0.00001	0.00046	0.00137	0.00020	0.99587
	0.00001	0.00046	0.00136	0.00018	0.99681
	0.00002	0.00045	0.00136	0.00018	0.99720
	0.00001	0.00046	0.00138	0.00018	0.99586
Avg	0.0001	0.00045	0.00136	0.00018	0.99663
SD	0.0005	0.00001	0.00002	0.00002	0.00062

Unspiked Sample

Analyses of the unspiked sample are summarized in Table 7. It is unfortunate that insufficient high purity ^{236}U is available for isotope dilution work. This isotope, enriched to 99% or better, could be mixed with high purity ^{233}U (which is available) to yield an internal standard capable of refining $^{235}U/^{238}U$ values to give external precisions comparable to those for isotope dilution ratios. The ^{236}U used in this experiment was obtained from the U. S. and had an enrichment of about 89%. It also had about 10% ^{235}U and, when mixed 1:2 with ^{233}U, led to a tracer of about 3% ^{235}U (see Table 3). Since the sample was less than 1% ^{235}U, the adjustment necessary to apply to that mass position to correct for the contribution of the tracer in the mixture was too large to yield reliable results. There was no way of checking the results in Table 7 since the composition of the sample was unknown.

Table 7. Isotopic Analysis of Spent Fuel Sample

	238	239	240	241	242	244
Pu	1.312	60.484	23.719	9.872	4.613	0.000

	233	234	235	236	238
U	0.000	0.0144	0.8856	0.3072	98.793

Reference Plus Tracer

To obtain a concentration for the tracer, it was necessary to use the reference sample as a calibration standard. Since, in the mixture of tracer and reference sample, the calibration ratio was to be found in the sample rather than the spike, our computer programs[13] were revised to accommodate this combination. Results for the same analyses calculated both with an average bias correction applied and with the specific bias corrections calculated through use of the internal standards are listed in Table 8. As can be seen, use of the internal standard substantially improved the precision for the six analyses of each element by factors of about 2 and 4 for plutonium and uranium, respectively.

Table 8. Tracer Calibration

	Concentration, μg/g			
Sample	Avg.	Int. Std.	Avg.	Int. Std.
P215	10.228	10.160	1420.20	1424.10
	10.227	10.134	1421.95	1423.38
P315	10.160	10.166	1426.23	1421.59
	10.195	10.151	1425.40	1423.45
P415	10.147	10.184	1428.52	1422.83
	10.175	10.139	1428.38	1422.85
Avg.	10.189	10.156	1425.11	1423.03
S.D.	0.034	0.018	3.4	0.84
RSD, %	0.33	0.18	0.24	0.06

Sample Plus Tracer

The concentrations of the tracer determined by application of average bias corrections were used to determine the concentration of the sample when average bias corrections were applied. For calculations using internal standards, the tracer concentrations supplied by Saclay were used. The results are summarized in Table 9. Precision for uranium concentration measurements was again improved by about a factor of four, but plutonium results yielded the same precision calculated either way.

Table 9. Sample Concentration Results

	Concentrations, µg/g			
	Pu		U	
Sample	Avg.	Int. Std.	Avg.	Int. Std.
M115	6.382	6.352	890.90	894.91
	6.370	6.365	894.69	894.11
M215	6.373	6.367	891.23	894.41
	6.357	6.364	890.27	895.45
M315	6.391	6.347	889.48	895.09
	6.370	6.337	888.38	895.24
Avg.	6.373	6.355	890.83	894.87
S.D.	0.012	0.012	2.15	0.51
RSD, %	0.19	0.19	0.24	0.06

Comments

The results presented in Tables 8 and 9 deserve some comment. First, the results obtained using our average bias correction are better than we usually obtain. A typical precision is in the range of 0.2-0.5%; except for plutonium in the reference-tracer mixture, we are in the lower portion of this range in Tables 8 and 9. Thus, the improvement in results obtained through use of an internal standard is not as dramatic as usual. Nonetheless, the consistent improvement of a factor of four in uranium concentration measurements is noteworthy.

To make comparisons as meaningful as possible, concentrations for uranium with average bias were calculated using 238/233 as the isotope dilution ratio. Any errors in the bias correction per mass is thus magnified by a factor of five by the difference in mass between the two isotopes. If 238/236 ratios had been used, more precise results could have been obtained, although it is possible that the relatively large contribution of the sample at the mass 236 positron might cause some loss in accuracy. In any case, since the goal of the experiment was to compare results obtained using internal standards to those obtained in a conventional manner, use of 238/233 for the isotope dilution ratio was indicated.

Another observation requiring comment is the inferior precision of plutonium concentration measurements in comparison to those for uranium. Because of the element's relatively benign behavior under thermal ionization conditions, plutonium analyses usually give better precision than uranium with application of an average bias correction; and we have always obtained $\pm$0.1% or better on previous analyses using a plutonium internal standard.[7] It appears that something is keeping our precision for plutonium concentrations using an internal standard at $\pm$0.2%. We collected about 4×10^6 counts of ^{244}Pu during a typical analysis, which imposes a lower limit of $\pm$0.05% precision due to counting statistics; thus this approach does not explain our (relatively) poor results.

Any time one encounters erratic results in isotope dilution analyses of plutonium, the question of isotopic equilibration arises. For a valid isotope dilution analysis, sample and tracer must be brought to the same oxidation state at some point in the process. Uranium usually presents no problem, but plutonium can be very difficult. Plutonium assumes a multiplicity of oxidation states, and its various molecular anions tend to polymerize. Both these facts must be addressed in a successful equilibration procedure. Marsh et al. made a comparative study of ten reduction-oxidation equilibration procedures and found only one that reliably achieved its goal.[14] This procedure involves reduction to Pu (III) with heated ferrous sulfamate followed by oxidation to Pu (IV) with heated sodium nitrite. This is the procedure followed by COGEMA at LaHague.

It is still possible that equilibrium was not attained. There are two points at which such an operation would be necessary: in synthesizing the internal standard from its enriched ^{242}Pu and ^{244}Pu components, and in mixing the tracer with the sample at LaHague. The fact that our analysis of the tracer supplied directly by Saclay (see Table 5b) gave results both accurate and precise indicates that equilibration was achieved in the former step. Use of an internal standard provides the potential of much higher precision than has previously been accessible, which in turn can lead to exposure of heretofore unsuspected problems. We would consider the precision of our plutonium results using an average bias correction as excellent ($\pm$0.2 - 0.35%), while those using the internal standard as mediocre.

The stated goal of the experiment, however, is to obtain a precision and accuracy of $\pm$0.2% for isotope dilution analyses,[15] and that goal has been met at ORNL.

An important point to keep in mind is that the results in Tables 8 and 9 are for three separate and independent sample preparations. This means that all chemical operations, including plutonium sample-tracer equilibration, were carried out individually for each of the three samples. Uranium concentration measurements of the precision we observed ($\pm$0.06%) are utterly impossible in our laboratory without using an internal standard.

It is instructive to investigate in more detail the operation of internal standards. Our average bias correction for uranium is 0.368% per mass and that for plutonium is 0.628% per mass. To apply it one selects a base mass (usually 238 for uranium and 242 for plutonium) that has a defined bias of 1.0. Multiplying the bias correction per mass by the difference in mass units between the isotope in question and the base mass and subtracting this from 1.0 yields the bias correction to apply to the intensity of the isotope in question. For example, for ^{235}U, the calculation would be 1.0-3(0.00368) = 0.9890; for ^{244}Pu: 1.0 + 2(0.00628) = 1.0126. Table 10 presents mean values of bias corrections

Table 10. Bias Corrections Calculated from Internal Standards

Sample	Pu		U	
	Bias Corr., %/Mass	Calc. Bias/ Avg. Bias*	Bias Corr., %/Mass	Calc. Bias/ Avg. Bias*
T015	0.601	0.957	0.575	1.563
	0.476	0.758	0.466	1.266
P215	0.408	0.650	0.320	0.870
	0.319	0.508	0.355	0.965
P315	0.647	1.030	0.433	1.177
	0.487	0.775	0.410	1.114
P415	0.723	1.151	0.465	1.234
	0.502	0.799	0.454	1.234
M115	0.681	1.084	0.423	1.149
	0.559	0.890	0.329	0.894
M215	0.564	0.898	0.418	1.136
	0.490	0.780	0.446	1.212
M315	0.690	1.099	0.465	1.264
	0.797	1.269	0.492	1.337
Avg.	0.567	0.903	0.432	1.175
S.D.	0.131	0.209	0.067	0.181
RSD%	23.2	23.2	15.4	15.4

*Avg. bias correction = 0.628%/mass (Pu); 0.368%/mass (U).

applied to the various mixtures of tracer with reference or sample. Each mean is taken from the individual values, one for each run, that comprised the analysis. Ten to twelve runs were taken for each sample. Also included in the table are the values of the ratios obtained when the bias corrections calculated from the internal standards were divided by the average bias correction of the element in question. These ratios should, when averaged over all samples, give a value of 1.0. Neither of our values is 1.0, but the limits of error overlap that figure. The evidence indicates that our average bias correction for uranium may be a bit low, but this may be due to similar chemical interaction of the samples with the filaments. We have noted before that samples of similar origin tend to require similar bias corrections.

It should be pointed out that, if the internal standards are properly calibrated, the bias corrections calculated from them will be the correct ones. We have had occasions where, for less well-behaved samples than those of this experiment, the bias correction per mass has been negative. Bias correction values during a single analysis often vary $\pm$20% from the average for that analysis.

CONCLUSIONS

It is clear from our results that use of internal standards more tha justifies the additional cost and effort involved in synthesizing and calibrating them. Material balance calculations for safeguards require the highest possible precision, and it is only through use of internal standards that levels of ±0.1% or better can be approached using pulse-counting instruments, or ±0.01% using instruments with current-integrating detectors. An additional advantage that we hope will be made clear when results from all participants are correlated is that, with the internal standard, all laboratories will have calibrated to an identical ratio. Round robin experiments, such as IDA-80[16] and that of the resin bead overseen by NBS and funded by the Office of Safeguards and Security,[17] have usually shown more scatter in interlaboratory than in intralaboratory results; in other words, laboratories disagreed with each other more than they did with themselves. One reason for this variance lies in the vagaries of instrumental calibration, which vary between laboratories. It is hoped and expected that internal standards will largely eliminate this effect.

To have a viable internal standard program on an international (or even national) scale, enriched isotopes of sufficient purity must be available in sufficient quantity. Earlier in this report we described the benefits that would accrue if ^{236}U were available in 99+% purity as opposed to the 89% now available. The problem is even worse for plutonium. With uranium, we can at least perform isotope dilution measurements with the present stock, although we cannot provide precise $^{235}U/^{238}U$ ratios; with plutonium, there is not enough ^{244}Pu of any purity to allow more than the most valuable of samples to be treated with internal standards. It is hoped that the results of this experiment will provide a cogent argument for production of the two isotopes in short supply.

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Appendix 1: Results with No Bias Correction

Laboratoire ORNL Echantillon T015 Methode GR

Signature _____ Date 11- 9-85 Correction WITHOUT Element PU

	Bloc	Intensite Principal	238/239	240/239	241/239	242/239	244/239	Element ug/g
	1	1.1E-14	0.714308	3.434202*	1.492377	131.493958*	58.059345*	
	2	7.8E-15	0.713412	3.525182	1.518791	133.508087	58.993561	
	3	1.8E-14	0.724632	3.552632	1.543004	135.285751	59.915516	
Filament	4	1.3E-14	0.748725	3.528723	1.524148	134.679291	59.662117	
1	5	1.4E-14	0.714468	3.553329	1.507677	134.092041	59.625427	
	6	9.9E-15	0.745147	3.565145	1.558755	136.434875	60.467758	
Date de	7	1.3E-14	0.734094	3.578531	1.512461	136.182938	60.603062	
Mesure	8	6.8E-15	0.766694	3.636258	1.596965*	138.897644	62.017551	
22-10-84	9	8.3E-15	0.682277	3.580582	1.541377	135.930908*	61.146942*	
	10	1.9E-15	0.720659	3.583698	1.519635*	137.874359	61.384941	
Valeurs moyennes			0.726442	3.567120	1.524824	135.869370	60.333744	
SD			0.023506	0.033547	0.021687	1.855494	0.996746	
	1	1.6E-14	0.705296	3.585104	1.535227	135.255371	60.180645	
	2	1.4E-14	0.710626	3.523373	1.497292	134.075592	59.634232	
	3	1.2E-14	0.738586	3.570821	1.496855	135.193985	60.202801	
Filament	4	1.7E-14	0.708473	3.524422	1.515220	133.158249	59.219975	
2	5	1.5E-14	0.720999	3.555377	1.527461	135.019547	60.181847	
	6	1.4E-14	0.717644	3.567517	1.530155	135.759445	60.487198	
Date de	7	1.3E-14	0.709327	3.531121	1.492240	133.318237	59.442024	
Mesure	8	1.7E-14	0.722026	3.559982	1.484580	134.488892	60.047192	
22-10-84	9	1.6E-14	0.730677	3.549258	1.511640	135.179184	60.244045	
	10	1.5E-14	0.721091	3.527783	1.526637	134.359055	59.866085	
Valeurs moyennes			0.718475	3.549476	1.511731	134.580765	59.950603	
SD			0.010535	0.021889	0.018013	0.862901	0.401812	

Laboratoire ORNL Echantillon R015 Methode GR

Signature _____ Date 11- 9-85 Correction WITHOUT Element PU

	Bloc	Intensite Principal	238/239	240/239	241/239	242/239	244/239	Element ug/g
	1	1.6E-14	0.001583	0.046956	0.001338	0.000069	0.000002	
	2	1.4E-14	-0.001333	0.047110	0.001294	0.000064	0.000000	
	3	1.1E-14	-0.002450	0.046587	0.001292	0.000093	0.000004	
Filament	4	1.9E-14	-0.001314	0.046745	0.001441*	0.000070	0.000000	
1	5	1.8E-14	-0.001180	0.046797	0.001355	0.000078	0.000002	
	6	1.6E-14	-0.000035	0.046772	0.001352	0.000075	0.000000	
Date de	7	1.5E-14	-0.001791	0.046922	0.001337	0.000088	0.000004	
Mesure	8	1.6E-14	0.000604	0.047029	0.001385	0.000075	0.000000	
22-10-84	9	1.3E-14	-0.001415	0.047015	0.001349	0.000078	0.000000	
	10	1.5E-14	-0.000753	0.047215	0.001344	0.000080	0.000004	
Valeurs moyennes			-0.000808	0.046915	0.001339	0.000077	0.000002	
SD			0.001203	0.000190	0.000029	0.000009	0.000002	
	1	2.5E-16	-0.015793	0.046845	0.001585*	0.000158*	0.000067*	
	2	3.0E-16	-0.010190	0.047035	0.001520	0.000128	0.000050*	
	3	6.6E-16	-0.002037	0.047072	0.001312	0.000106	0.000026	
Filament	4	6.8E-16	-0.006572	0.046635	0.001384	0.000082	0.000011	
2	5	1.7E-15	0.002136	0.046752	0.001357	0.000066	0.000001	
	6	1.6E-15	0.006381	0.047143	0.001318	0.000079	0.000004	
Date de	7	5.5E-15	-0.007401	0.046509	0.001325	0.000078	0.000003	
Mesure	8	4.8E-15	0.010592	0.046860	0.001317	0.000070	0.000000	
22-10-84	9	1.3E-14	-0.008051	0.046193	0.001291	0.000072	0.000001	
	10	1.1E-14	-0.002789	0.046223	0.001343	0.000079	0.000000	
	11	1.7E-14	0.036418	0.046421*	0.001307	0.000064	0.000000	
	12	1.2E-14	0.015059	0.046852	0.001368	0.000064	0.000002	
Valeurs moyennes			0.001479	0.046738	0.001349	0.000081	0.000005	
SD			0.014181	0.000321	0.000063	0.000020	0.000008	
	1	1.6E-14	-0.000176	0.046479	0.001339	0.000065	0.000007	
	2	1.5E-14	-0.000007	0.046785	0.001318	0.000083	0.000006	
	3	1.4E-14	-0.000000	0.046628	0.001350	0.000085	0.000003	
Filament	4	1.3E-14	0.000788	0.046871	0.001331	0.000084	0.000000	
3	5	1.7E-14	0.000026	0.046861	0.001314	0.000078	0.000004	
	6	1.6E-14	-0.000236	0.046263	0.001380	0.000073	0.000002	
Date de	7	1.7E-14	0.000149	0.046368	0.001396	0.000079	0.000000	
Mesure	8	1.7E-14	-0.000433	0.046691	0.001389	0.000097*	0.000003	
22-10-84	9	1.6E-14	-0.000299	0.046424	0.001338	0.000077	0.000000	
	10	1.6E-14	0.000059	0.046417	0.001309	0.000074	0.000001	
Valeurs moyennes			-0.000013	0.046579	0.001347	0.000078	0.000003	
SD			0.000335	0.000218	0.000032	0.000006	0.000003	

Laboratoire ORNL Echantillon E015 Methode GR

Signature _____ Date 11- 9-85 Correction WITHOUT Element PU

	Bloc	Intensite Principal	238/239	240/239	241/239	242/239	244/239	Element ug/g
	1	1.6E-14	0.022042	0.389519	0.161480	0.075027	0.000008	
	2	1.3E-14	0.021772	0.389895	0.161090	0.075679*	0.000004	
	3	1.6E-14	0.022130	0.389242	0.160864	0.074702	0.000003	
Filament	4	1.2E-14	0.021117	0.388432	0.160536	0.074404	0.000001	
1	5	1.5E-14	0.021922	0.388189	0.161083	0.074097	0.000008	
	6	1.1E-14	0.022095	0.389734	0.160368	0.074432	0.000009	
Date de	7	1.6E-14	0.022607	0.388868	0.161232	0.074503	0.000004	
Mesure	8	1.2E-14	0.022464	0.389394	0.161248	0.074632	0.000005	
22-10-84	9	1.5E-14	0.021849	0.390201	0.161076	0.074833	0.000008	
	10	1.1E-14	0.021452	0.390105	0.162243*	0.075406	0.000013	
Valeurs moyennes			0.021945	0.389358	0.160997	0.074671	0.000006	
SD			0.000440	0.000683	0.000354	0.000384	0.000004	
	1	1.6E-14	0.021433	0.389017	0.161392	0.074520	0.000007	
	2	1.4E-14	0.021475	0.390595	0.161842	0.074785	0.000001	
	3	1.2E-14	0.021379	0.388759	0.160898	0.074707	0.000005	
Filament	4	1.1E-14	0.021526	0.390961	0.162286	0.074898	0.000004	
2	5	1.6E-14	0.021749	0.390651	0.161278	0.075167	0.000003	
	6	1.5E-14	0.021647	0.390461	0.161790	0.075204	0.000005	
Date de	7	1.4E-14	0.021819	0.390430	0.161556	0.074246	0.000005	
Mesure	8	1.6E-14	0.021958	0.390496	0.161896	0.074763	0.000004	
22-10-84	9	1.5E-14	0.021466	0.390241	0.161042	0.075268	0.000005	
	10	1.4E-14	0.021968	0.389496	0.161424	0.075251	0.000004	
	11	1.6E-14	0.020957	0.391404	0.161172	0.075410	0.000010	
Valeurs moyennes			0.021580	0.390228	0.161507	0.074929	0.000005	
SD			0.000293	0.000810	0.000415	0.000363	0.000002	
	1	1.6E-14	0.020894	0.388454	0.160272	0.074545	0.000009	
	2	1.5E-14	0.021596	0.389302	0.160408	0.074930	0.000007	
	3	1.3E-14	0.021930	0.389122	0.160710	0.074148	0.000002	
Filament	4	1.8E-14	0.022472	0.388638	0.160812	0.074854	0.000005	
3	5	1.9E-14	0.021442	0.388871	0.161162	0.075023	0.000006	
	6	1.9E-14	0.021466	0.388906	0.160041	0.074180	0.000009	
Date de	7	1.9E-14	0.021740	0.390254	0.162141*	0.074728	0.000008	
Mesure	8	2.1E-14	0.021591	0.390132	0.161150	0.075124	0.000005	
22-10-84	9	2.2E-14	0.022301	0.390402	0.161276	0.074643	0.000005	
	10	1.7E-14	0.022321	0.389709	0.160207	0.075811*	0.000008	
Valeurs moyennes			0.021775	0.389379	0.160671	0.074686	0.000006	
SD			0.000487	0.000703	0.000461	0.000347	0.000002	

Laboratoire ORNL Echantillon P215 Methode GR

Signature _____ Date 11- 9-85 Correction WITHOUT Element PU

	Bloc	Intensite Principal	238/239	240/239	241/239	242/239	244/239	Element ug/g
	1	1.7E-14	0.004355	0.069587	0.011087	0.874131	0.388817	
	2	1.7E-14	0.004441	0.069471	0.011132	0.875204	0.389876	
	3	1.7E-14	0.003704	0.069544	0.011266	0.873337	0.388815	
Filament	4	1.6E-14	0.003962	0.069417	0.011043	0.873317	0.389813	
1	5	1.6E-14	0.004422	0.069714	0.011155	0.873708	0.390562	
	6	1.5E-14	0.005133	0.069584	0.011105	0.876362	0.389310	
Date de	7	1.4E-14	0.002834	0.069758	0.011368*	0.875103	0.389321	
Mesure	8	1.7E-14	0.003982	0.070211*	0.011235	0.879693	0.393024	
22-10-84	9	1.6E-14	0.005239	0.069568	0.011154	0.880826	0.393972	
	10	1.4E-14	0.003526	0.069921	0.011176	0.877865	0.393759	
Valeurs moyennes			0.004160	0.069618	0.011150	0.875955	0.390727	10.0343
SD			0.000725	0.000155	0.000070	0.002687	0.002051	
	1	1.5E-14	0.004722	0.069848	0.011044	0.871308	0.388956	
	2	1.4E-14	0.004003	0.069412	0.011163	0.869296	0.387099	
	3	1.3E-14	0.004491	0.069235	0.011066	0.870783	0.387103	
Filament	4	1.7E-14	0.004394	0.069602	0.011124	0.873790	0.390119	
2	5	1.5E-14	0.005126	0.069521	0.011227	0.875233	0.391073	
	6	1.4E-14	0.004806	0.069803	0.011229	0.877303	0.390299	
Date de	7	1.5E-14	0.004555	0.069613	0.011227	0.876495	0.391940	
Mesure	8	1.0E-14	0.004193	0.069924	0.011293	0.879636	0.392840	
22-10-84	9	1.6E-14	0.004147	0.070008	0.011221	0.878642	0.394764	
	10	1.5E-14	0.004230	0.070106	0.011114	0.878477	0.392368	
	11	1.6E-14	0.004142	0.069732	0.011166	0.879764	0.394140	
	12	1.3E-14	0.005334	0.070080	0.011211	0.879456	0.392759	
Valeurs moyennes			0.004512	0.069740	0.011174	0.875849	0.391122	10.0330
SD			0.000417	0.000272	0.000075	0.003739	0.002504	

Laboratoire ORNL Echantillon P315 Methode GR

Signature _____ Date 11- 9-85 Correction WITHOUT Element PU

	Bloc	Intensite Principal	238/239	240/239	241/239	242/239	244/239	Element ug/g
	1	1.7E-14	0.004649	0.069871*	0.011175	0.867130	0.383604	
	2	1.7E-14	0.004747	0.069107	0.010941	0.867182	0.384340	
	3	1.7E-14	0.004733	0.069366	0.011109	0.867847	0.384780	
Filament	4	1.6E-14	0.004554	0.069472	0.011057	0.868713	0.385128	
1	5	1.6E-14	0.004667	0.069550	0.011140	0.869163	0.386565	
	6	1.6E-14	0.004754	0.069036	0.010892	0.867515	0.385676	
Date de	7	1.6E-14	0.004742	0.069409	0.011018	0.870120	0.385436	
Mesure	8	1.5E-14	0.004709	0.069629	0.011181	0.870872	0.387291	
22-10-84	9	1.5E-14	0.004880	0.069045	0.011117	0.870762	0.386924	
	10	1.5E-14	0.004820	0.069774	0.011109	0.872209	0.388904	
Valeurs moyennes			0.004726	0.069376	0.011074	0.869151	0.385865	9.9670
SD			0.000090	0.000265	0.000097	0.001776	0.001573	
	1	1.6E-14	0.004587	0.069762	0.010972	0.871176	0.387234	
	2	1.4E-14	0.005110	0.069508	0.011143	0.874203	0.388213	
	3	1.2E-14	0.004290	0.069723	0.011300*	0.873824	0.387928	
Filament	4	1.7E-14	0.004596	0.069467	0.011048	0.872455	0.387049	
2	5	1.4E-14	0.004898	0.069629	0.011090	0.870884	0.386826	
	6	1.6E-14	0.004744	0.069577	0.011151	0.873120	0.389850	
Date de	7	1.4E-14	0.003912	0.069860	0.011171	0.871139	0.388242	
Mesure	8	1.2E-14	0.004024	0.069551	0.011058	0.872192	0.390298	
22-10-84	9	1.7E-14	0.005361	0.069684	0.010957	0.870661	0.388310	
	10	1.5E-14	0.004897	0.069218*	0.011003	0.871792	0.390297	
Valeurs moyennes			0.004642	0.069640	0.011066	0.872145	0.388425	10.0015
SD			0.000462	0.000128	0.000079	0.001246	0.001302	

Laboratoire ORNL Echantillon P415 Methode GR

Signature _____ Date 11- 9-85 Correction WITHOUT Element PU

	Bloc	Intensite Principal	238/239	240/239	241/239	242/239	244/239	Element us/s
	1	1.5E-14	0.005582	0.073646	0.013636*	1.037244	0.459640	
	2	1.2E-14	0.005791	0.073937	0.012979	1.040786	0.461789	
	3	1.6E-14	0.005572	0.073567	0.013000	1.033171	0.457276	
Filament	4	1.4E-14	0.005602	0.073659	0.013239	1.032960	0.457477	
1	5	1.3E-14	0.005893	0.074157	0.013064	1.038228	0.460815	
	6	1.8E-14	0.005746	0.073397	0.012942	1.035936	0.457716	
Date de	7	1.7E-14	0.005765	0.073710	0.012922	1.038289	0.460177	
Mesure	8	1.6E-14	0.005725	0.073997	0.012980	1.038265	0.459464	
22-10-84	9	1.7E-14	0.005827	0.073917	0.012905	1.034225	0.457039	
	10	1.7E-14	0.005571	0.073577	0.013019	1.036482	0.459398	
	11	1.7E-14	0.005728	0.073805	0.013063	1.036155	0.460695	
	12	1.6E-14	0.005750	0.073721	0.012936	1.039764	0.460767	
Valeurs moyennes			0.005713	0.073758	0.013004	1.036792	0.459354	9.9544
SD			0.000107	0.000213	0.000094	0.002469	0.001610	
	1	2.0E-14	0.005621	0.074062	0.012909	1.039571	0.462461	
	2	2.1E-14	0.005739	0.073873	0.012966	1.038721	0.462516	
	3	2.2E-14	0.005416	0.073757	0.013042	1.038543	0.461481	
Filament	4	1.7E-14	0.005321	0.073797	0.013025	1.038236	0.462690	
2	5	1.7E-14	0.005556	0.074106	0.013033	1.040183	0.462619	
	6	1.7E-14	0.005550	0.073891	0.012846	1.040017	0.463681	
Date de	7	1.7E-14	0.005570	0.073455	0.012949	1.039863	0.463494	
Mesure	8	1.6E-14	0.005497	0.073876	0.013097	1.038404	0.463265	
22-10-84	9	1.6E-14	0.006112	0.073606	0.013021	1.041263	0.463171	
	10	1.6E-14	0.005766	0.074283	0.013185	1.042746*	0.463921	
Valeurs moyennes			0.005617	0.073871	0.013007	1.039422	0.462930	9.9817
SD			0.000221	0.000241	0.000096	0.001015	0.000721	

Laboratoire ORNL Echantillon M115 Methode GR

Signature _____ Date 11- 9-85 Correction WITHOUT Element PU

	Bloc	Intensite Principal	238/239	240/239	241/239	242/239	244/239	Element ug/g
	1	1.7E-14	0.028660	0.421353	0.175973*	1.465722	0.615988	
	2	1.3E-14	0.028962	0.422742	0.175456	1.469781	0.616396	
	3	1.6E-14	0.028096	0.422096	0.174959	1.471388	0.621010	
Filament	4	1.3E-14	0.027817	0.422670	0.175730	1.476381	0.621123	
1	5	1.1E-14	0.028010	0.426324*	0.175946	1.477191	0.623324	
	6	1.8E-14	0.029172	0.423233	0.175106	1.471942	0.620184	
Date de	7	1.5E-14	0.028838	0.422463	0.175443	1.474239	0.621153	
Mesure	8	1.3E-14	0.029334	0.420545	0.175704	1.472770	0.619949	
22-10-84	9	1.7E-14	0.029182	0.425243	0.176436	1.484780	0.627373	
	10	1.4E-14	0.027553	0.422218	0.176159	1.481749	0.628009	
Valeurs moyennes			0.028562	0.422507	0.175660	1.474594	0.621451	6.4918
SD			0.000641	0.001301	0.000478	0.005652	0.003961	
	1	1.6E-14	0.028983	0.423545	0.175851	1.477374	0.624606	
	2	1.5E-14	0.028549	0.423377	0.175966	1.474179	0.621818	
	3	1.3E-14	0.028887	0.423003	0.176092	1.477117	0.621987	
Filament	4	1.7E-14	0.029049	0.422637	0.175619	1.473635	0.624014	
2	5	1.6E-14	0.028908	0.422774	0.175791	1.476534	0.622553	
	6	1.5E-14	0.028848	0.423334	0.175739	1.476777	0.622841	
Date de	7	1.4E-14	0.029247	0.425137*	0.175966	1.480603	0.624191	
Mesure	8	1.7E-14	0.029126	0.423881	0.175808	1.478736	0.626536	
22-10-84	9	1.5E-14	0.028609	0.422826	0.175773	1.481297	0.626308	
	10	1.4E-14	0.029209	0.422663	0.175879	1.474862	0.624511	
Valeurs moyennes			0.028942	0.423116	0.175848	1.477111	0.623937	6.4800
SD			0.000233	0.000438	0.000135	0.002552	0.001654	

Laboratoire ORNL Echantillon M215 Methode GR

Signature _____ Date 11- 9-85 Correction WITHOUT Element PU

	Bloc	Intensite Principal	238/239	240/239	241/239	242/239	244/239	Element ug/g
	1	1.8E-14	0.029233	0.423174	0.175155	1.533962	0.646418*	
	2	1.8E-14	0.029575	0.424587	0.175831	1.540682	0.651733	
	3	1.8E-14	0.029026	0.424478	0.176120	1.538914	0.652197	
Filament	4	1.7E-14	0.029078	0.424420	0.176561	1.538848	0.652647	
1	5	1.6E-14	0.028921	0.424649	0.176336	1.544706	0.652442	
	6	1.7E-14	0.029098	0.424687	0.175983	1.538332	0.652160	
Date de	7	1.5E-14	0.029094	0.424527	0.176109	1.543082	0.652383	
Mesure	8	1.4E-14	0.028946	0.422989*	0.177158	1.540952	0.653721	
22-10-84	9	1.7E-14	0.029657	0.426127	0.178318*	1.547936	0.655262	
	10	1.5E-14	0.029367	0.426110	0.176625	1.544197	0.654816	
Valeurs moyennes			0.029199	0.424751	0.176209	1.541161	0.653040	6.4817
SD			0.000255	0.000901	0.000563	0.003970	0.001260	
	1	1.4E-14	0.029158	0.423745	0.179892*	1.542311	0.651469	
	2	1.4E-14	0.029144	0.424649	0.176903	1.543976	0.651535	
	3	1.1E-14	0.028851	0.425415	0.176716	1.543858	0.652581	
Filament	4	1.2E-14	0.029368	0.423752	0.177366	1.545188	0.656884	
2	5	8.7E-15	0.029201	0.425768	0.176172	1.543617	0.654070	
	6	1.8E-14	0.028955	0.424002	0.176536	1.545889	0.654503	
Date de	7	1.9E-14	0.028852	0.425690	0.176409	1.547000	0.655946	
Mesure	8	1.7E-14	0.029339	0.425174	0.176143	1.544782	0.656413	
22-10-84	9	1.7E-14	0.029224	0.425640	0.175856	1.544344	0.654949	
	10	1.7E-14	0.029069	0.423737	0.176582	1.546348	0.655984	
	11	1.7E-14	0.029410	0.424164	0.175992	1.546462	0.657575	
	12	1.6E-14	0.029191	0.424393	0.176835	1.546664	0.654582	
Valeurs moyennes			0.029147	0.424677	0.176501	1.545036	0.654709	6.4644
SD			0.000187	0.000817	0.000447	0.001462	0.002011	

Laboratoire ORNL Echantillon M315 Methode GR

Signature _____ Date 11- 9-85 Correction WITHOUT Element PU

	Bloc	Intensite Principal	238/239	240/239	241/239	242/239	244/239	Element ug/g
	1	1.8E-14	0.029095	0.423230	0.176470	1.486421	0.626460	
	2	1.6E-14	0.029132	0.422719	0.175637	1.484905	0.626087	
	3	1.4E-14	0.028960	0.423325	0.175552	1.487326	0.627121	
Filament	4	1.7E-14	0.028493	0.423826*	0.174929	1.484414	0.622672	
1	5	1.7E-14	0.028894	0.422682	0.175839	1.485299	0.625061	
	6	1.6E-14	0.029184	0.423545	0.175959	1.485181	0.624337	
Date de	7	1.6E-14	0.028880	0.421933	0.175487	1.480936*	0.624582	
Mesure	8	1.5E-14	0.028571	0.423636	0.175540	1.486980	0.627075	
22-10-84	9	1.7E-14	0.029120	0.423137	0.175488	1.487289	0.627187	
	10	1.6E-14	0.029158	0.423786	0.175620	1.487871	0.629631	
	11	1.6E-14	0.028794	0.422295*	0.175379	1.488796	0.629190	
	12	1.5E-14	0.029288	0.423821	0.174540*	1.489391	0.628626	
Valeurs moyennes			0.028964	0.423181	0.175627	1.486716	0.626503	6.4862
SD			0.000248	0.000593	0.000383	0.001631	0.002089	
	1	1.7E-14	0.029090	0.422887	0.175362	1.480043	0.623045	
	2	1.6E-14	0.028948	0.421873	0.176534	1.478559	0.621130	
	3	1.6E-14	0.028609	0.423483	0.176314	1.482345	0.624784	
Filament	4	1.6E-14	0.029147	0.421699	0.175867	1.484844	0.622622	
2	5	1.6E-14	0.029349	0.423057	0.175407	1.483741	0.624833	
	6	1.6E-14	0.028712	0.423278	0.175323	1.487362	0.626507	
Date de	7	1.6E-14	0.029277	0.423397	0.175672	1.487589	0.625059	
Mesure	8	1.5E-14	0.029028	0.422535	0.176306	1.485882	0.624160	
22-10-84	9	1.6E-14	0.028697	0.421474	0.175062	1.484158	0.623400	
	10	1.6E-14	0.029003	0.421972	0.174985	1.483075	0.626399	
Valeurs moyennes			0.028986	0.422565	0.175683	1.483760	0.624194	6.4999
SD			0.000249	0.000757	0.000550	0.002921	0.001684	

Laboratoire ORNL Echantillon T015 Methode GR

Signature _____ Date 11- 9-85 Correction WITHOUT Element U

	Bloc	Intensite Principal	233/238	234/238	235/238	236/238	Element ug/g
	1	5.8E-14	156.951355	0.754622	6.933789	65.110901	
	2	6.2E-14	154.275833	0.742473	6.811355	64.010445	
	3	5.3E-14	158.233536	0.774981	6.972669	65.586449	
Filament	4	4.6E-14	157.865799	0.758396	6.992923	65.502602	
1	5	3.9E-14	153.988556	0.744380	6.793630	63.868828	
	6	5.1E-14	155.485535	0.758256	6.881771	64.511330	
Date de	7	4.1E-14	155.833282	0.761189	6.882392	64.624786	
Mesure	8	4.8E-14	156.957092	0.760887	6.874032*	65.101379	
24- 1-85	9	3.6E-14	154.551559	0.757937	6.798639	64.161858	
	10	5.4E-14	157.219086*	0.771332	6.911360	64.998177*	
Valeurs moyennes			156.015839	0.758445	6.886503	64.719849	
SD			1.569149	0.010115	0.073854	0.637725	
	1	5.6E-14	155.968414	0.760672	6.874830	64.833321	
	2	5.5E-14	154.693954	0.748375	6.823297	64.512955	
	3	4.9E-14	153.824615	0.746358	6.781999	64.135742	
Filament	4	4.6E-14	156.584137	0.768190	6.898903	65.241936	
2	5	4.4E-14	154.643127	0.757203	6.862900	64.350349	
	6	4.1E-14	153.735504	0.746217	6.774504	64.046860	
Date de	7	5.4E-14	156.148880	0.766590	6.901613	64.845047	
Mesure	8	4.8E-14	153.148956	0.752167	6.773874	63.709492	
28- 1-85	9	4.7E-14	153.531128	0.743461	6.789079	63.832977	
	10	5.4E-14	156.669098	0.754485	6.889040	65.054024	
	11	4.9E-14	156.020035	0.759649	6.930079	64.814957	
Valeurs moyennes			154.997086	0.754851	6.845465	64.488884	
SD			1.318293	0.008390	0.058389	0.511450	

Laboratoire ORNL Echantillon R015 Methode GR

Signature _____ Date 11- 9-85 Correction WITHOUT Element U

	Bloc	Intensite Principal	233/238	234/238	235/238	236/238	Element ug/g
	1	4.9E-14	0.000020	0.000056	0.007324	0.000005	
	2	4.7E-14	0.000019	0.000052	0.007240	0.000009	
	3	4.4E-14	0.000020	0.000051	0.007278	0.000010	
Filament	4	5.3E-14	0.000021	0.000051	0.007389	0.000010	
1	5	4.8E-14	0.000018	0.000058	0.007273	0.000011	
	6	4.1E-14	0.000015	0.000055	0.007329	0.000010	
Date de	7	3.4E-14	0.000020	0.000058	0.007223	0.000014	
Mesure	8	4.7E-14	0.000016	0.000050	0.007229	0.000010	
24- 1-85	9	3.1E-14	0.000024	0.000060	0.007197	0.000007	
	10	4.1E-14	0.000027*	0.000058	0.007300	0.000008	
Valeurs moyennes			0.000019	0.000055	0.007278	0.000009	
SD			0.000003	0.000004	0.000059	0.000002	
	1	5.8E-14	0.000026	0.000048*	0.007234	0.000010	
	2	6.1E-14	0.000019	0.000056	0.007277	0.000011	
	3	6.6E-14	0.000023	0.000051	0.007339	0.000011	
Filament	4	5.4E-14	0.000022	0.000052	0.007312	0.000013	
2	5	5.4E-14	0.000016	0.000054	0.007432	0.000007	
	6	5.4E-14	0.000016	0.000055	0.007414	0.000011	
Date de	7	5.4E-14	0.000023	0.000056	0.007313	0.000007	
Mesure	8	5.3E-14	0.000019	0.000055	0.007309	0.000010	
24- 1-85	9	5.2E-14	0.000021	0.000056	0.007317	0.000010	
	10	5.3E-14	0.000023	0.000056	0.007378	0.000008	
Valeurs moyennes			0.000021	0.000055	0.007332	0.000010	
SD			0.000003	0.000002	0.000060	0.000002	
	1	5.0E-14	0.000022	0.000051	0.007332	0.000009	
	2	4.7E-14	0.000019	0.000052	0.007420	0.000008	
	3	4.5E-14	0.000021	0.000058	0.007409	0.000013	
Filament	4	5.2E-14	0.000022	0.000055	0.007345	0.000009	
3	5	5.0E-14	0.000023	0.000063*	0.007349	0.000007	
	6	4.7E-14	0.000020	0.000055	0.007304	0.000008	
Date de	7	4.5E-14	0.000016*	0.000052	0.007315	0.000011	
Mesure	8	5.6E-14	0.000023	0.000048	0.007359	0.000012	
4- 2-85	9	5.6E-14	0.000022	0.000051	0.007310	0.000008	
	10	5.3E-14	0.000026	0.000053	0.007312	0.000009	
Valeurs moyennes			0.000022	0.000053	0.007346	0.000009	
SD			0.000002	0.000003	0.000041	0.000002	

Laboratoire ORNL Echantillon E015 Methode GR

Signature _____ Date 11- 9-85 Correction WITHOUT Element U

	Bloc	Intensite Principal	233/238	234/238	235/238	236/238
	1	5.2E-14	0.000000	0.000138	0.009061	0.003076
	2	4.8E-14	0.000000	0.000144	0.008952	0.003068
	3	4.4E-14	0.000000	0.000157	0.008995	0.003115
Filament	4	5.0E-14	0.000000	0.000142	0.008935	0.003104
1	5	4.3E-14	0.000000	0.000139	0.008998	0.003129
	6	3.8E-14	0.000000	0.000152	0.009049	0.003129
Date de	7	5.0E-14	0.000000	0.000159	0.008973	0.003116
Mesure	8	4.2E-14	0.000001	0.000145	0.009008	0.003085
25- 1-85	9	4.5E-14	0.000000	0.000149	0.008976	0.003089
	10	3.7E-14	0.000000	0.000140	0.008983	0.003176*
Valeurs moyennes			0.000000	0.000146	0.008993	0.003101
SD			0.000000	0.000008	0.000039	0.000023
	1	5.2E-14	0.000000	0.000162*	0.009071	0.003170
	2	4.9E-14	0.000000	0.000145	0.009192*	0.003172
	3	4.6E-14	0.000000	0.000150	0.009068	0.003111
Filament	4	5.2E-14	0.000001	0.000143	0.009046	0.003087
2	5	4.9E-14	0.000000	0.000148	0.009024	0.003138
	6	4.7E-14	0.000000	0.000140	0.009010	0.003127
Date de	7	4.5E-14	0.000000	0.000142	0.009119	0.003165
Mesure	8	4.2E-14	0.000000	0.000150	0.009069	0.003164
28- 1-85	9	5.6E-14	0.000000	0.000143	0.009004	0.003067
	10	5.3E-14	0.000000	0.000132	0.009048	0.003133
Valeurs moyennes			0.000000	0.000144	0.009051	0.003133
SD			0.000000	0.000006	0.000036	0.000036
	1	5.2E-14	0.000001	0.000147	0.009174	0.003160
	2	4.8E-14	0.000001	0.000158	0.009199	0.003107
	3	3.8E-14	0.000001	0.000151	0.009109	0.003212*
Filament	4	5.3E-14	0.000000	0.000152	0.009102	0.003134
3	5	5.3E-14	0.000000	0.000154	0.009191	0.003145
	6	5.2E-14	0.000003	0.000153	0.009177	0.003161
Date de	7	5.2E-14	0.000000	0.000149	0.009155	0.003142
Mesure	8	5.2E-14	0.000000	0.000156	0.009117	0.003143
4- 2-85	9	4.8E-14	0.000000	0.000160	0.009056	0.003184
	10	5.3E-14	0.000000	0.000145	0.009072	0.003167
Valeurs moyennes			0.000001	0.000152	0.009135	0.003149
SD			0.000001	0.000005	0.000051	0.000022

Laboratoire ORNL Echantillon P215 Methode GR

Signature _____ Date 11- 9-85 Correction WITHOUT Element U

	Bloc	Intensite Principal	233/238	234/238	235/238	236/238	Element ug/g
	1	5.4E-14	0.803123	0.003973	0.042956	0.334950	
	2	5.5E-14	0.802319	0.003980	0.043063	0.335062	
	3	5.2E-14	0.803930	0.004028	0.042785	0.336047	
Filament	4	5.5E-14	0.802540	0.003977	0.042988	0.335530	
1	5	6.1E-14	0.802682	0.003969	0.042896	0.335931	
	6	6.0E-14	0.802068	0.003996	0.042696	0.334825	
Date de	7	5.2E-14	0.801976	0.004029	0.042867	0.334696	
Mesure	8	6.0E-14	0.800531	0.003946	0.042752	0.335547	
28- 1-85	9	7.1E-14	0.801190	0.003913	0.042850	0.334730	
	10	7.2E-14	0.799614	0.003959	0.042769	0.334929	
Valeurs moyennes			0.801997	0.003977	0.042862	0.335225	1446.7576
SD			0.001263	0.000035	0.000116	0.000500	
	1	5.3E-14	0.803991	0.003955	0.042688	0.335749	
	2	5.4E-14	0.804383	0.003989	0.042637	0.335840	
	3	5.8E-14	0.802779	0.003970	0.042534	0.334833	
Filament	4	5.8E-14	0.803989	0.004030*	0.043134*	0.334940	
2	5	5.4E-14	0.803420	0.003970	0.042953	0.335811	
	6	5.7E-14	0.802842	0.003951	0.042813	0.334505	
Date de	7	5.5E-14	0.803237	0.003944	0.042850	0.335583	
Mesure	8	5.5E-14	0.802610	0.003996	0.042702	0.335575	
5- 2-85	9	5.3E-14	0.802797	0.003925	0.042715	0.335251	
	10	5.5E-14	0.801876	0.003918	0.042788	0.335061	
	11	5.4E-14	0.802224	0.003976	0.042925	0.335156	
	12	4.9E-14	0.801731	0.003960	0.042778	0.335151	
Valeurs moyennes			0.802990	0.003959	0.042762	0.335288	1448.5574
SD			0.000845	0.000024	0.000124	0.000425	

Laboratoire ORNL Echantillon P315 Methode GR

Signature _____ Date 11- 9-85 Correction WITHOUT Element U

	Bloc	Intensite Principal	233/238	234/238	235/238	236/238	Element ug/g
	1	5.4E-14	0.809720	0.003962	0.043023	0.336031	
	2	5.3E-14	0.808893	0.004006	0.042861	0.335475	
	3	5.2E-14	0.808848	0.003968	0.042790	0.335456	
Filament	4	5.1E-14	0.807438	0.003955	0.042678	0.335606	
1	5	4.9E-14	0.805325	0.003967	0.042818	0.336028	
	6	4.7E-14	0.804622	0.003917	0.042899	0.334836	
Date de	7	4.5E-14	0.804440	0.003933	0.042861	0.334929	
Mesure	8	5.3E-14	0.800191	0.003927	0.042740	0.334643	
29- 1-85	9	4.9E-14	0.798830	0.003932	0.042749	0.334341	
	10	4.4E-14	0.797372	0.003991	0.042597	0.334086	
Valeurs moyennes			0.804568	0.003956	0.042802	0.335143	1453.0905
SD			0.004425	0.000029	0.000120	0.000679	
	1	5.3E-14	0.806412	0.003943	0.042826	0.335339	
	2	4.6E-14	0.805431	0.003975	0.042866	0.335589	
	3	4.6E-14	0.804297	0.003963	0.043049*	0.335340	
Filament	4	4.9E-14	0.805742	0.003930	0.042839	0.335365	
2	5	5.6E-14	0.803911	0.003918	0.042658	0.335272	
	6	5.0E-14	0.803663	0.004016*	0.042878	0.334900	
Date de	7	4.8E-14	0.803137	0.003877	0.042634	0.335456	
Mesure	8	4.6E-14	0.802745	0.003943	0.042834	0.334916	
29- 1-85	9	4.2E-14	0.801326	0.003932	0.042833	0.334144*	
	10	5.1E-14	0.804392	0.003950	0.042776	0.335528	
Valeurs moyennes			0.804106	0.003937	0.042794	0.335301	1452.2510
SD			0.001514	0.000028	0.000089	0.000244	

Laboratoire ORNL Echantillon P415 Methode GR

Signature _____ Date 11- 9-85 Correction WITHOUT Element U

	Bloc	Intensite Principal	233/238	234/238	235/238	236/238	Element ug/g
	1	5.5E-14	0.963223	0.004703	0.049901	0.400314	
	2	4.8E-14	0.964094	0.004718	0.049907	0.400603	
	3	4.3E-14	0.962753	0.004706	0.049749	0.399571*	
Filament	4	5.7E-14	0.960875	0.004770	0.049978	0.400158	
1	5	5.4E-14	0.961265	0.004739	0.049618	0.400987	
	6	5.0E-14	0.961906	0.004741	0.049841	0.400432	
Date de	7	5.0E-14	0.962868	0.004701	0.049740	0.400627	
Mesure	8	6.0E-14	0.962981	0.004757	0.049866	0.401199	
4- 2-85	9	5.5E-14	0.962870	0.004719	0.049682	0.400782	
	10	4.8E-14	0.962791	0.004684	0.049952	0.401006	
Valeurs moyennes			0.962563	0.004724	0.049823	0.400679	1455.4614
SD			0.000954	0.000027	0.000120	0.000346	
	1	5.2E-14	0.965109	0.004750	0.049830	0.400797	
	2	5.1E-14	0.963393	0.004811	0.049659	0.400632	
	3	4.9E-14	0.963891	0.004794	0.049695	0.400600	
Filament	4	4.7E-14	0.964031	0.004747	0.049888	0.401567*	
2	5	4.6E-14	0.961773	0.004711	0.049736	0.400323	
	6	5.5E-14	0.960619	0.004749	0.049798	0.400371	
Date de	7	5.2E-14	0.962065	0.004724	0.049625	0.401030	
Mesure	8	5.1E-14	0.961747	0.004701	0.049609	0.400195	
4- 2-85	9	5.0E-14	0.962426	0.004774	0.049683	0.400934	
	10	4.9E-14	0.959574	0.004755	0.049848	0.400248	
Valeurs moyennes			0.962463	0.004752	0.049737	0.400570	1455.3094
SD			0.001675	0.000035	0.000098	0.000305	

Laboratoire ORNL Echantillon M115 Methode GR

Signature _____ Date 11- 9-85 Correction WITHOUT Element U

	Bloc	Intensite Principal	233/238	234/238	235/238	236/238	Element ug/g
	1	5.3E-14	0.937457	0.004638*	0.050490	0.393050	
	2	4.8E-14	0.935584	0.004671	0.050237	0.392974	
	3	4.6E-14	0.934259	0.004728	0.050317	0.392434	
Filament	4	4.3E-14	0.933596	0.004738	0.050176	0.392370	
1	5	3.7E-14	0.932942	0.004722	0.050138	0.392448	
	6	5.5E-14	0.939476	0.004739	0.050672	0.394335*	
Date de	7	4.8E-14	0.939840	0.004725	0.050478	0.393686	
Mesure	8	5.7E-14	0.935043	0.004732	0.050215	0.392461	
30- 1-85	9	5.0E-14	0.936168	0.004705	0.050445	0.393257	
	10	4.3E-14	0.935183	0.004732	0.050587	0.392991	
Valeurs moyennes			0.935955	0.004721	0.050376	0.392852	873.2128
SD			0.002330	0.000022	0.000184	0.000455	
	1	4.9E-14	0.931373	0.004712	0.050305	0.392494	
	2	4.4E-14	0.930427	0.004699	0.050214	0.392018	
	3	4.2E-14	0.930123	0.004707	0.050245	0.391809	
Filament	4	5.3E-14	0.931046	0.004728	0.050439	0.391924	
2	5	4.6E-14	0.931315	0.004647	0.050408	0.391690	
	6	4.4E-14	0.933163	0.004719	0.050449	0.392775	
Date de	7	4.1E-14	0.933437	0.004598*	0.050191	0.393004	
Mesure	8	5.4E-14	0.933019	0.004684	0.050381	0.392653	
31- 1-85	9	5.0E-14	0.932817	0.004642	0.050164	0.393400*	
	10	4.4E-14	0.933375	0.004683	0.050471	0.392934	
Valeurs moyennes			0.932009	0.004691	0.050327	0.392367	876.9290
SD			0.001282	0.000030	0.000117	0.000510	

Laboratoire ORNL Echantillon M215 Methode GR

Signature _____ Date 11- 9-85 Correction WITHOUT Element U

	Bloc	Intensite Principal	233/238	234/238	235/238	236/238	Element ug/g
	1	5.4E-14	0.980395	0.004957	0.052418	0.410461*	
	2	4.6E-14	0.977894	0.004987	0.052489	0.411011	
	3	3.8E-14	0.978393	0.004960	0.052560	0.411175	
Filament	4	5.3E-14	0.979931	0.004929	0.052285	0.411041	
1	5	4.9E-14	0.979975	0.004914	0.052418	0.411032	
	6	4.5E-14	0.979933	0.004913	0.052378	0.410880	
Date de	7	4.2E-14	0.980879	0.004887	0.052646	0.411227	
Mesure	8	5.4E-14	0.978147	0.004850	0.052469	0.411415	
31- 1-85	9	5.2E-14	0.977302	0.004921	0.052168	0.410808	
	10	5.0E-14	0.976646	0.004962	0.052124	0.410633	
Valeurs moyennes			0.978949	0.004928	0.052395	0.411025	873.5443
SD			0.001449	0.000041	0.000165	0.000234	
	1	5.5E-14	0.978954	0.004966	0.052580	0.410845	
	2	5.1E-14	0.980872	0.005004	0.052282	0.412293*	
	3	4.5E-14	0.980701	0.004834	0.052419	0.410678	
Filament	4	4.2E-14	0.981578	0.004906	0.052256	0.410738	
2	5	5.1E-14	0.980429	0.004960	0.052439	0.411347	
	6	4.6E-14	0.982914	0.004841	0.052546	0.411561	
Date de	7	4.0E-14	0.982740	0.004975	0.052667	0.410851	
Mesure	8	5.5E-14	0.977356	0.004929	0.052251	0.410429	
5- 2-85	9	5.2E-14	0.977301	0.004874	0.052166	0.411106	
	10	5.5E-14	0.977263	0.004879	0.052433	0.410797	
Valeurs moyennes			0.980011	0.004917	0.052404	0.410928	872.5942
SD			0.002180	0.000059	0.000163	0.000351	

Laboratoire ORNL Echantillon M315 Methode GR

Signature _____ Date 11- 9-85 Correction WITHOUT Element U

	Bloc	Intensite Principal	233/238	234/238	235/238	236/238	Element ug/g
	1	5.8E-14	0.946204	0.004706	0.050894	0.396477	
	2	6.0E-14	0.945935	0.004735	0.050626%	0.396516	
	3	6.2E-14	0.946612	0.004795	0.050759	0.396452	
Filament	4	6.2E-14	0.943483	0.004717	0.050917	0.395736	
1	5	6.3E-14	0.944591	0.004718	0.050848	0.395922	
	6	6.4E-14	0.945605	0.004684	0.050949	0.396159	
Date de	7	5.4E-14	0.944219	0.004817	0.050817	0.395907	
Mesure	8	5.3E-14	0.943678	0.004743	0.050715	0.395621	
1- 2-85	9	5.3E-14	0.945390	0.004742	0.050784	0.396759	
	10	5.3E-14	0.944424	0.004748	0.050965	0.396393	
	11	5.3E-14	0.943975	0.004758	0.050817	0.396542	
Valeurs moyennes			0.944920	0.004742	0.050847	0.396226	871.8127
SD			0.001076	0.000038	0.000083	0.000376	
	1	6.6E-14	0.948152	0.004783	0.051186	0.397209	
	2	7.0E-14	0.949815	0.004813	0.050814	0.397294	
	3	7.4E-14	0.949322	0.004772	0.051091	0.396842	
Filament	4	6.0E-14	0.946608	0.004745	0.050907	0.396174	
2	5	5.4E-14	0.944353	0.004711	0.050746	0.396308	
	6	5.5E-14	0.947941	0.004760	0.051026	0.396397	
Date de	7	5.2E-14	0.946475	0.004743	0.050975	0.396227	
Mesure	8	6.7E-14	0.944803	0.004824	0.050804	0.395907	
1- 2-85	9	6.0E-14	0.945308	0.004775	0.051024	0.396142	
	10	5.8E-14	0.945096	0.004680	0.050966	0.396518	
	11	5.8E-14	0.944548	0.004727	0.050863	0.395409	
	12	5.3E-14	0.943712	0.004752	0.050844	0.396486	
Valeurs moyennes			0.946344	0.004757	0.050937	0.396409	870.4949
SD			0.002044	0.000041	0.000131	0.000527	

Appendix 2: Results using Average Bias Correction

Laboratoire ORNL Echantillon T015 Methode GR

Signature _____ Date 11- 9-85 Correction DISCRI Element PU

	Bloc	Intensite Principal	238/239	240/239	241/239	242/239	244/239	Element ug/g
	1	1.1E-14	0.709714	3.456280*	1.511519	134.023087*	59.919079*	
	2	7.8E-15	0.708818	3.547873	1.538284	136.077209	60.883797	
	3	1.8E-14	0.719988	3.575430	1.562778	137.885803	61.833790	
Filament	4	1.3E-14	0.743929	3.551374	1.543683	137.267975	61.572422	
1	5	1.4E-14	0.709887	3.576166	1.527012	136.670731	61.535141	
	6	9.9E-15	0.740368	3.588090	1.578759	139.060165	62.405155	
Date de	7	1.3E-14	0.729418	3.601479	1.531837	138.799454	62.543003	
Mesure	8	6.8E-15	0.761837	3.659660	1.617459*	141.570251	64.004562	
22-10-84	9	8.3E-15	0.678505	3.603519	1.561113	138.541443*	63.103764*	
	10	1.9E-15	0.719650	3.606803	1.539154*	140.529312	63.352608	
Valeurs moyennes			0.722211	3.590044	1.544373	138.482620	62.266312	
SD			0.023173	0.033770	0.021964	1.891970	1.029001	
	1	1.6E-14	0.700773	3.608091	1.554893	137.853897	62.106987	
	2	1.4E-14	0.706078	3.545925	1.516456	136.649597	61.542244	
	3	1.2E-14	0.733861	3.593687	1.516018	137.789948	62.129230	
Filament	4	1.7E-14	0.703927	3.547030	1.534634	135.716995	61.115799	
2	5	1.5E-14	0.716383	3.578154	1.547019	137.612656	62.107815	
	6	1.4E-14	0.713048	3.590382	1.549752	138.367218	62.423153	
Date de	7	1.3E-14	0.704784	3.553754	1.511353	135.879227	61.344578	
Mesure	8	1.7E-14	0.717402	3.582799	1.503594	137.072296	61.969078	
22-10-84	9	1.6E-14	0.725998	3.572003	1.530999	137.775665	62.172146	
	10	1.5E-14	0.716475	3.550385	1.546185	136.939560	61.781986	
Valeurs moyennes			0.713873	3.572221	1.531090	137.165710	61.869301	
SD			0.010470	0.022031	0.018245	0.879315	0.414603	

Laboratoire ORNL Echantillon R015 Methode GR

Signature _____ Date 11- 9-85 Correction DISCRI Element PU

	Bloc	Intensite Principal	238/239	240/239	241/239	242/239	244/239	Element ug/g
	1	1.6E-14	0.001610	0.047257	0.001355	0.000070	0.000002	
	2	1.4E-14	-0.001233	0.047412	0.001311	0.000065	0.000000	
	3	1.1E-14	-0.002334	0.046885	0.001309	0.000095	0.000004	
Filament	4	1.8E-14	-0.001158	0.047044	0.001459*	0.000071	0.000000	
1	5	1.8E-14	-0.001022	0.047097	0.001373	0.000079	0.000002	
	6	1.6E-14	0.000122	0.047072	0.001369	0.000076	0.000000	
Date de	7	1.4E-14	-0.001593	0.047222	0.001355	0.000089	0.000004	
Mesure	8	1.6E-14	0.000795	0.047330	0.001402	0.000077	0.000000	
22-10-84	9	1.3E-14	-0.001144	0.047316	0.001366	0.000080	0.000000	
	10	1.5E-14	-0.000424	0.047517	0.001361	0.000082	0.000004	
Valeurs moyennes			-0.000638	0.047215	0.001356	0.000078	0.000002	
SD			0.001181	0.000191	0.000030	0.000009	0.000002	
	1	2.4E-16	-0.015219	0.047144	0.001605*	0.000161*	0.000069*	
	2	2.9E-16	-0.009553	0.047336	0.001539	0.000131	0.000052*	
	3	6.5E-16	-0.001452	0.047373	0.001329	0.000108	0.000027	
Filament	4	6.7E-16	-0.005547	0.046934	0.001402	0.000083	0.000011	
2	5	1.7E-15	0.003303	0.047051	0.001374	0.000067	0.000001	
	6	1.5E-15	0.007986	0.047445	0.001335	0.000080	0.000004	
Date de	7	5.4E-15	-0.003373	0.046807	0.001342	0.000080	0.000003	
Mesure	8	4.7E-15	0.015510	0.047160	0.001333	0.000071	0.000000	
22-10-84	9	1.3E-14	0.001705	0.046489	0.001308	0.000074	0.000001	
	10	1.1E-14	0.009745	0.046518	0.001360	0.000080	0.000000	
	11	1.7E-14	0.048042	0.046718*	0.001324	0.000066	0.000000	
	12	1.2E-14	0.026232	0.047152	0.001385	0.000065	0.000002	
Valeurs moyennes			0.006448	0.047037	0.001367	0.000082	0.000005	
SD			0.017261	0.000323	0.000064	0.000020	0.000008	
	1	1.6E-14	-0.000149	0.046776	0.001357	0.000067	0.000007	
	2	1.4E-14	0.000013	0.047084	0.001335	0.000084	0.000006	
	3	1.3E-14	0.000018	0.046926	0.001367	0.000086	0.000003	
Filament	4	1.3E-14	0.000816	0.047171	0.001348	0.000086	0.000000	
3	5	1.7E-14	0.000027	0.047161	0.001331	0.000080	0.000005	
	6	1.6E-14	-0.000230	0.046559	0.001397	0.000075	0.000002	
Date de	7	1.7E-14	0.000148	0.046665	0.001414	0.000081	0.000000	
Mesure	8	1.7E-14	-0.000424	0.046990	0.001407	0.000099*	0.000003	
22-10-84	9	1.6E-14	-0.000292	0.046721	0.001356	0.000078	0.000000	
	10	1.6E-14	0.000065	0.046714	0.001326	0.000076	0.000001	
Valeurs moyennes			-0.000001	0.046877	0.001364	0.000079	0.000003	
SD			0.000339	0.000219	0.000032	0.000006	0.000003	

Laboratoire ORNL Echantillon E015 Methode GR

Signature _____ Date 11- 9-85 Correction DISCRI Element PU

	Bloc	Intensite Principal	238/239	240/239	241/239	242/239	244/239	Element ug/g
	1	1.6E-14	0.021901	0.392012	0.163546	0.076467	0.000008	
	2	1.2E-14	0.021643	0.392390	0.163152	0.077132*	0.000005	
	3	1.6E-14	0.021989	0.391732	0.162923	0.076136	0.000003	
Filament	4	1.2E-14	0.021005	0.390917	0.162590	0.075833	0.000001	
1	5	1.5E-14	0.021822	0.390673	0.163145	0.075519	0.000009	
	6	1.1E-14	0.022005	0.392228	0.162420	0.075861	0.000009	
Date de	7	1.6E-14	0.022514	0.391356	0.163295	0.075933	0.000005	
Mesure	8	1.1E-14	0.022402	0.391885	0.163311	0.076065	0.000005	
22-10-84	9	1.4E-14	0.022151	0.392698	0.163137	0.076270	0.000008	
	10	1.1E-14	0.021964	0.392601	0.164320*	0.076854	0.000014	
Valeurs moyennes			0.021940	0.391849	0.163058	0.076104	0.000007	
SD			0.000418	0.000688	0.000358	0.000392	0.000004	
	1	1.6E-14	0.021302	0.391506	0.163457	0.075950	0.000007	
	2	1.4E-14	0.021353	0.393094	0.163913	0.076221	0.000001	
	3	1.2E-14	0.021251	0.391246	0.162957	0.076141	0.000005	
Filament	4	1.1E-14	0.021406	0.393462	0.164362	0.076336	0.000004	
2	5	1.6E-14	0.021616	0.393151	0.163342	0.076610	0.000003	
	6	1.4E-14	0.021527	0.392959	0.163860	0.076648	0.000005	
Date de	7	1.3E-14	0.021692	0.392928	0.163623	0.075671	0.000005	
Mesure	8	1.6E-14	0.021832	0.392995	0.163968	0.076198	0.000004	
22-10-84	9	1.5E-14	0.021345	0.392738	0.163103	0.076713	0.000005	
	10	1.4E-14	0.021841	0.391988	0.163490	0.076695	0.000004	
	11	1.6E-14	0.020850	0.393908	0.163234	0.076857	0.000010	
Valeurs moyennes			0.021456	0.392725	0.163574	0.076367	0.000005	
SD			0.000289	0.000815	0.000421	0.000369	0.000002	
	1	1.6E-14	0.020791	0.390940	0.162323	0.075976	0.000009	
	2	1.4E-14	0.021480	0.391793	0.162461	0.076368	0.000007	
	3	1.3E-14	0.021810	0.391611	0.162766	0.075572	0.000002	
Filament	4	1.8E-14	0.022350	0.391125	0.162869	0.076291	0.000005	
3	5	1.8E-14	0.021343	0.391359	0.163225	0.076463	0.000006	
	6	1.9E-14	0.021359	0.391394	0.162089	0.075603	0.000009	
Date de	7	1.8E-14	0.021626	0.392751	0.164215*	0.076162	0.000008	
Mesure	8	2.0E-14	0.021474	0.392629	0.163212	0.076566	0.000005	
22-10-84	9	2.1E-14	0.022186	0.392900	0.163340	0.076076	0.000005	
	10	1.7E-14	0.022198	0.392202	0.162257	0.077266*	0.000009	
Valeurs moyennes			0.021662	0.391870	0.162727	0.076120	0.000007	
SD			0.000481	0.000707	0.000467	0.000353	0.000002	

Laboratoire ORNL Echantillon P215 Methode GR

Signature _____ Date 11- 9-85 Correction DISCRI Element PU

	Bloc	Intensite Principal	238/239	240/239	241/239	242/239	244/239	Element ug/g
	1	1.7E-14	0.004420	0.070032	0.011229	0.890911	0.401257	
	2	1.7E-14	0.004502	0.069915	0.011274	0.892004	0.402349	
	3	1.6E-14	0.003785	0.069989	0.011410	0.890101	0.401254	
Filament	4	1.6E-14	0.004041	0.069861	0.011184	0.890081	0.402284	
1	5	1.5E-14	0.004493	0.070160	0.011298	0.890479	0.403057	
	6	1.4E-14	0.005189	0.070029	0.011247	0.893184	0.401766	
Date de	7	1.4E-14	0.002927	0.070204	0.011513*	0.891901	0.401777	
Mesure	8	1.7E-14	0.004125	0.070661*	0.011379	0.896580	0.405598	
22-10-84	9	1.5E-14	0.005365	0.070013	0.011296	0.897734	0.406576	
	10	1.4E-14	0.003689	0.070369	0.011319	0.894716	0.406357	
Valeurs moyennes			0.004254	0.070064	0.011293	0.892769	0.403228	10.2281
SD			0.000716	0.000156	0.000071	0.002739	0.002117	
	1	1.5E-14	0.004724	0.070295	0.011185	0.888034	0.401400	
	2	1.4E-14	0.004018	0.069857	0.011306	0.885983	0.399483	
	3	1.3E-14	0.004500	0.069678	0.011208	0.887499	0.399488	
Filament	4	1.7E-14	0.004417	0.070047	0.011266	0.890563	0.402600	
2	5	1.5E-14	0.005146	0.069966	0.011370	0.892034	0.403584	
	6	1.4E-14	0.004833	0.070250	0.011373	0.894144	0.402786	
Date de	7	1.5E-14	0.004604	0.070058	0.011371	0.893320	0.404479	
Mesure	8	9.9E-15	0.004252	0.070372	0.011437	0.896521	0.405409	
22-10-84	9	1.6E-14	0.004220	0.070456	0.011365	0.895508	0.407394	
	10	1.4E-14	0.004312	0.070555	0.011256	0.895340	0.404921	
	11	1.6E-14	0.004247	0.070178	0.011309	0.896651	0.406749	
	12	1.3E-14	0.005432	0.070528	0.011355	0.896338	0.405324	
Valeurs moyennes			0.004559	0.070187	0.011317	0.892661	0.403635	10.2269
SD			0.000415	0.000274	0.000075	0.003810	0.002584	

Laboratoire ORNL Echantillon P315 Methode GR

Signature _____ Date 11- 9-85 Correction DISCRI Element PU

	Bloc	Intensite Principal	238/239	240/239	241/239	242/239	244/239	Element ug/g
	1	1.7E-14	0.004623	0.070318*	0.011318	0.883775	0.395876	
	2	1.7E-14	0.004717	0.069549	0.011081	0.883828	0.396636	
	3	1.6E-14	0.004702	0.069810	0.011251	0.884506	0.397090	
Filament	4	1.6E-14	0.004528	0.069916	0.011199	0.885388	0.397449	
1	5	1.6E-14	0.004640	0.069995	0.011283	0.885848	0.398932	
	6	1.6E-14	0.004723	0.069477	0.011031	0.884168	0.398015	
Date de	7	1.5E-14	0.004712	0.069853	0.011159	0.886823	0.397767	
Mesure	8	1.5E-14	0.004683	0.070074	0.011325	0.887589	0.399682	
22-10-84	9	1.5E-14	0.004854	0.069486	0.011259	0.887477	0.399303	
	10	1.4E-14	0.004789	0.070221	0.011251	0.888952	0.401346	
Valeurs moyennes			0.004697	0.069820	0.011216	0.885835	0.398210	10.1596
SD			0.000089	0.000267	0.000098	0.001810	0.001623	
	1	1.6E-14	0.004598	0.070209	0.011113	0.887899	0.399623	
	2	1.4E-14	0.005123	0.069953	0.011286	0.890984	0.400633	
	3	1.2E-14	0.004319	0.070169	0.011445*	0.890598	0.400338	
Filament	4	1.6E-14	0.004633	0.069911	0.011190	0.889202	0.399432	
2	5	1.4E-14	0.004940	0.070074	0.011232	0.887601	0.399202	
	6	1.6E-14	0.004859	0.070022	0.011293	0.889880	0.402322	
Date de	7	1.4E-14	0.004069	0.070307	0.011313	0.887861	0.400663	
Mesure	8	1.2E-14	0.004199	0.069996	0.011199	0.888934	0.402785	
22-10-84	9	1.7E-14	0.005431	0.070130	0.011097	0.887374	0.400733	
	10	1.4E-14	0.004983	0.069661*	0.011144	0.888526	0.402784	
Valeurs moyennes			0.004715	0.070086	0.011207	0.888886	0.400851	10.1948
SD			0.000432	0.000129	0.000080	0.001270	0.001343	

Laboratoire ORNL Echantillon P415 Methode GR

Signature _____ Date 11- 9-85 Correction DISCRI Element PU

	Bloc	Intensite Principal	238/239	240/239	241/239	242/239	244/239	Element ug/g
	1	1.5E-14	0.005550	0.074118	0.013810*	1.057155	0.474346	
	2	1.2E-14	0.005757	0.074411	0.013145	1.060764	0.476563	
	3	1.6E-14	0.005541	0.074038	0.013167	1.053004	0.471905	
Filament	4	1.4E-14	0.005570	0.074130	0.013408	1.052789	0.472113	
1	5	1.3E-14	0.005858	0.074631	0.013231	1.058158	0.475557	
	6	1.8E-14	0.005713	0.073867	0.013108	1.055821	0.472360	
Date de	7	1.7E-14	0.005730	0.074181	0.013087	1.058220	0.474900	
Mesure	8	1.6E-14	0.005695	0.074470	0.013146	1.058195	0.474164	
22-10-84	9	1.7E-14	0.005796	0.074390	0.013070	1.054078	0.471660	
	10	1.7E-14	0.005543	0.074048	0.013186	1.056378	0.474096	
	11	1.7E-14	0.005701	0.074277	0.013230	1.056045	0.475434	
	12	1.6E-14	0.005720	0.074192	0.013102	1.059723	0.475508	
Valeurs moyennes			0.005681	0.074229	0.013171	1.056694	0.474050	10.1470
SD			0.000106	0.000215	0.000095	0.002517	0.001662	
	1	2.0E-14	0.005607	0.074536	0.013074	1.059526	0.477257	
	2	2.1E-14	0.005743	0.074345	0.013132	1.058660	0.477313	
	3	2.2E-14	0.005409	0.074229	0.013209	1.058479	0.476245	
Filament	4	1.7E-14	0.005316	0.074269	0.013191	1.058165	0.477493	
2	5	1.7E-14	0.005545	0.074580	0.013200	1.060150	0.477420	
	6	1.7E-14	0.005540	0.074364	0.013010	1.059980	0.478515	
Date de	7	1.7E-14	0.005564	0.073925	0.013114	1.059824	0.478322	
Mesure	8	1.6E-14	0.005490	0.074349	0.013264	1.058337	0.478086	
22-10-84	9	1.6E-14	0.006100	0.074077	0.013188	1.061250	0.477989	
	10	1.6E-14	0.005761	0.074758	0.013354	1.062762*	0.478763	
Valeurs moyennes			0.005608	0.074343	0.013174	1.059375	0.477740	10.1748
SD			0.000219	0.000243	0.000097	0.001035	0.000744	

Laboratoire ORNL Echantillon M115 Methode GR

Signature _____ Date 11- 9-85 Correction DISCRI Element PU

	Bloc	Intensite Principal	238/239	240/239	241/239	242/239	244/239	Element us/s
	1	1.7E-14	0.028493	0.424049	0.178225*	1.493858	0.635695	
	2	1.3E-14	0.028784	0.425447	0.177702	1.497995	0.636116	
	3	1.6E-14	0.027944	0.424797	0.177198	1.499632	0.640878	
Filament	4	1.3E-14	0.027677	0.425374	0.177979	1.504722	0.640995	
1	5	1.1E-14	0.027864	0.429052*	0.178198	1.505547	0.643265	
	6	1.8E-14	0.029015	0.425941	0.177347	1.500197	0.640026	
Date de	7	1.5E-14	0.028688	0.425166	0.177689	1.502539	0.641025	
Mesure	8	1.3E-14	0.029184	0.423236	0.177953	1.501041	0.639783	
30- 1-85	9	1.7E-14	0.029053	0.427964	0.178694	1.513282	0.647444	
	10	1.4E-14	0.027471	0.424919	0.178414	1.510192	0.648101	
Valeurs moyennes			0.028417	0.425210	0.177908	1.502900	0.641333	6.3818
SD			0.000627	0.001309	0.000484	0.005761	0.004088	
	1	1.6E-14	0.028803	0.426255	0.178101	1.505733	0.644588	
	2	1.5E-14	0.028371	0.426086	0.178218	1.502477	0.641712	
	3	1.3E-14	0.028709	0.425709	0.178345	1.505471	0.641886	
Filament	4	1.7E-14	0.028872	0.425341	0.177867	1.501923	0.643978	
2	5	1.6E-14	0.028729	0.425479	0.178041	1.504877	0.642470	
	6	1.5E-14	0.028669	0.426043	0.177988	1.505124	0.642767	
Date de	7	1.4E-14	0.029070	0.427857*	0.178218	1.509024	0.644161	
Mesure	8	1.7E-14	0.028950	0.426593	0.178058	1.507122	0.646580	
31- 1-85	9	1.5E-14	0.028439	0.425532	0.178022	1.509731	0.646345	
	10	1.4E-14	0.029037	0.425368	0.178130	1.503174	0.644491	
Valeurs moyennes			0.028765	0.425823	0.178099	1.505466	0.643898	6.3702
SD			0.000233	0.000441	0.000136	0.002601	0.001707	

Laboratoire ORNL Echantillon M215 Methode GR

Signature _____ Date 11- 9-85 Correction DISCRI Element PU

	Bloc	Intensite Principal	238/239	240/239	241/239	242/239	244/239	Element ug/g
	1	1.8E-14	0.029050	0.425882	0.177397	1.563408	0.667099*	
	2	1.8E-14	0.029385	0.427303	0.178081	1.570256	0.672584	
	3	1.8E-14	0.028843	0.427194	0.178374	1.568455	0.673062	
Filament	4	1.7E-14	0.028895	0.427136	0.178820	1.568387	0.673527	
1	5	1.6E-14	0.028742	0.427366	0.178593	1.574358	0.673316	
	6	1.7E-14	0.028917	0.427404	0.178235	1.567862	0.673024	
Date de	7	1.5E-14	0.028912	0.427243	0.178363	1.572702	0.673254	
Mesure	8	1.4E-14	0.028765	0.425696*	0.179425	1.570532	0.674635	
31- 1-85	9	1.7E-14	0.029473	0.428854	0.180600*	1.577649	0.676226	
	10	1.5E-14	0.029190	0.428836	0.178885	1.573839	0.675765	
Valeurs moyennes			0.029017	0.427469	0.178464	1.570745	0.673933	6.3731
SD			0.000254	0.000907	0.000570	0.004046	0.001300	
	1	1.4E-14	0.028981	0.426456	0.182194*	1.571917	0.672311	
	2	1.4E-14	0.028965	0.427366	0.179167	1.573614	0.672400	
	3	1.1E-14	0.028673	0.428137	0.178978	1.573493	0.673459	
Filament	4	1.2E-14	0.029187	0.426463	0.179636	1.574849	0.677900	
2	5	8.7E-15	0.029024	0.428493	0.178426	1.573248	0.674996	
	6	1.8E-14	0.028776	0.426715	0.178795	1.575564	0.675442	
Date de	7	1.9E-14	0.028672	0.428414	0.178667	1.576696	0.676932	
Mesure	8	1.7E-14	0.029155	0.427894	0.178397	1.574435	0.677414	
5- 2-85	9	1.7E-14	0.029046	0.428363	0.178106	1.573989	0.675903	
	10	1.7E-14	0.028888	0.426448	0.178842	1.576032	0.676970	
	11	1.7E-14	0.029227	0.426878	0.178244	1.576147	0.678613	
	12	1.6E-14	0.029008	0.427109	0.179098	1.576353	0.675524	
Valeurs moyennes			0.028967	0.427395	0.178760	1.574695	0.675655	6.3568
SD			0.000186	0.000822	0.000452	0.001490	0.002076	

Laboratoire ORNL Echantillon M315 Methode GR

Signature _____ Date 11- 9-85 Correction DISCRI Element PU

	Bloc	Intensite Principal	238/239	240/239	241/239	242/239	244/239	Element us/s
	1	1.7E-14	0.028912	0.425593	0.177606	1.508453	0.642977	
	2	1.6E-14	0.028768	0.424572	0.178794	1.506941	0.641002	
	3	1.6E-14	0.028435	0.426193	0.178570	1.510800	0.644772	
Filament	4	1.6E-14	0.028967	0.424397	0.178118	1.513346	0.642542	
1	5	1.6E-14	0.029161	0.425764	0.177652	1.512223	0.644823	
	6	1.6E-14	0.028536	0.425986	0.177567	1.515913	0.646551	
Date de	7	1.6E-14	0.029100	0.426106	0.177920	1.516145	0.645057	
Mesure	8	1.5E-14	0.028850	0.425238	0.178562	1.514405	0.644129	
1- 2-85	9	1.6E-14	0.028521	0.424171	0.177302	1.512647	0.643344	
	10	1.6E-14	0.028827	0.424672	0.177224	1.511544	0.646440	
Valeurs moyennes			0.028808	0.425269	0.177931	1.512242	0.644164	6.3908
SD			0.000246	0.000762	0.000558	0.002978	0.001738	
	1	1.7E-14	0.028912	0.425593	0.177606	1.508453	0.642977	
	2	1.6E-14	0.028768	0.424572	0.178794	1.506941	0.641002	
	3	1.6E-14	0.028435	0.426193	0.178570	1.510800	0.644772	
Filament	4	1.6E-14	0.028967	0.424397	0.178118	1.513346	0.642542	
2	5	1.6E-14	0.029161	0.425764	0.177652	1.512223	0.644823	
	6	1.6E-14	0.028536	0.425986	0.177567	1.515913	0.646551	
Date de	7	1.6E-14	0.029100	0.426106	0.177920	1.516145	0.645057	
Mesure	8	1.5E-14	0.028850	0.425238	0.178562	1.514405	0.644129	
22-10-84	9	1.6E-14	0.028521	0.424171	0.177302	1.512647	0.643344	
	10	1.6E-14	0.028827	0.424672	0.177224	1.511544	0.646440	
Valeurs moyennes			0.028808	0.425269	0.177931	1.512242	0.644164	6.3697
SD			0.000246	0.000762	0.000558	0.002978	0.001738	

Laboratoire ORNL Echantillon T015 Methode GR

Signature _____ Date 11- 9-85 Correction DISCRI Element U

	Bloc	Intensite Principal	233/238	234/238	235/238	236/238	Element ug/g
	1	5.7E-14	154.045334	0.743420	6.856415	64.623901	
	2	6.1E-14	151.427597	0.731495	6.735717	63.535130	
	3	5.2E-14	155.320541	0.763559	6.895607	65.102913	
Filament	4	4.5E-14	154.959442	0.747223	6.915634	65.019615	
1	5	3.8E-14	151.153900	0.733412	6.718556	63.398037	
	6	5.0E-14	152.622650	0.747079	6.805693	64.035522	
Date de	7	4.0E-14	152.963821	0.749966	6.806298	64.148064	
Mesure	8	4.7E-14	154.063766	0.749653	6.797889*	64.619820	
24- 1-85	9	3.5E-14	151.701355	0.746743	6.723279	63.686726	
	10	5.3E-14	154.324493*	0.759965	6.834965	64.518860*	
Valeurs moyennes			153.139832	0.747252	6.810240	64.241081	
SD			1.540431	0.009975	0.073056	0.633065	
	1	5.5E-14	153.075562	0.749356	6.797892	64.346275	
	2	5.4E-14	151.839081	0.737312	6.747573	64.034355	
	3	4.8E-14	150.992416	0.735355	6.707026	63.662750	
Filament	4	4.5E-14	153.702057	0.756872	6.822681	64.761169	
2	5	4.3E-14	151.797272	0.746051	6.787099	63.876373	
	6	4.0E-14	150.906860	0.735229	6.699701	63.575325	
Date de	7	5.3E-14	153.274979	0.755298	6.825369	64.367287	
Mesure	8	4.7E-14	150.330505	0.741089	6.699052	63.240192	
28- 1-85	9	4.6E-14	150.706070	0.732516	6.714110	63.362946	
	10	5.3E-14	153.783691	0.743360	6.812848	64.573906	
	11	4.8E-14	153.146820	0.748450	6.853445	64.336693	
Valeurs moyennes			152.141403	0.743717	6.769710	64.012482	
SD			1.292087	0.008260	0.057686	0.506843	

Laboratoire ORNL Echantillon R015 Methode GR

Signature _____ Date 11- 9-85 Correction DISCRI Element U

	Bloc	Intensite Principal	233/238	234/238	235/238	236/238	Element ug/g
	1	4.9E-14	0.000020	0.000055	0.007244	0.000005	
	2	4.7E-14	0.000019	0.000051	0.007160	0.000009	
	3	4.4E-14	0.000019	0.000050	0.007198	0.000010	
Filament	4	5.3E-14	0.000020	0.000050	0.007308	0.000010	
1	5	4.8E-14	0.000018	0.000057	0.007193	0.000011	
	6	4.1E-14	0.000015	0.000054	0.007248	0.000010	
Date de	7	3.4E-14	0.000020	0.000057	0.007143	0.000013	
Mesure	8	4.7E-14	0.000015	0.000049	0.007149	0.000010	
24- 1-85	9	3.1E-14	0.000024	0.000059	0.007117	0.000007	
	10	4.1E-14	0.000027*	0.000057	0.007219	0.000008	
Valeurs moyennes			0.000019	0.000054	0.007198	0.000009	
SD			0.000003	0.000004	0.000058	0.000002	
	1	5.8E-14	0.000025	0.000047*	0.007157	0.000010	
	2	6.1E-14	0.000018	0.000055	0.007199	0.000011	
	3	6.6E-14	0.000023	0.000050	0.007260	0.000011	
Filament	4	5.4E-14	0.000021	0.000052	0.007234	0.000013	
2	5	5.4E-14	0.000016	0.000053	0.007353	0.000007	
	6	5.4E-14	0.000016	0.000054	0.007335	0.000011	
Date de	7	5.4E-14	0.000023	0.000056	0.007236	0.000007	
Mesure	8	5.3E-14	0.000019	0.000054	0.007232	0.000010	
24- 1-85	9	5.2E-14	0.000021	0.000055	0.007240	0.000010	
	10	5.3E-14	0.000023	0.000055	0.007301	0.000008	
Valeurs moyennes			0.000021	0.000054	0.007255	0.000010	
SD			0.000003	0.000002	0.000060	0.000002	
	1	5.0E-14	0.000021	0.000051	0.007251	0.000009	
	2	4.7E-14	0.000018	0.000051	0.007338	0.000008	
	3	4.5E-14	0.000021	0.000057	0.007327	0.000013	
Filament	4	5.2E-14	0.000022	0.000054	0.007264	0.000009	
3	5	5.0E-14	0.000022	0.000062*	0.007268	0.000007	
	6	4.7E-14	0.000020	0.000055	0.007223	0.000008	
Date de	7	4.5E-14	0.000015*	0.000051	0.007234	0.000011	
Mesure	8	5.6E-14	0.000023	0.000047	0.007278	0.000012	
4- 2-85	9	5.6E-14	0.000022	0.000050	0.007230	0.000008	
	10	5.3E-14	0.000025	0.000052	0.007232	0.000009	
Valeurs moyennes			0.000022	0.000052	0.007265	0.000009	
SD			0.000002	0.000003	0.000040	0.000002	

Laboratoire ORNL Echantillon E015 Methode GR

Signature _____ Date 11- 9-85 Correction DISCRI Element U

	Bloc	Intensite Principal	233/238	234/238	235/238	236/238	Element ug/g
	1	5.2E-14	0.000000	0.000136	0.008961	0.003053	
	2	4.8E-14	0.000000	0.000142	0.008853	0.003046	
	3	4.4E-14	0.000000	0.000154	0.008895	0.003092	
Filament	4	5.0E-14	0.000000	0.000140	0.008836	0.003081	
1	5	4.3E-14	0.000000	0.000137	0.008898	0.003106	
	6	3.8E-14	0.000000	0.000150	0.008949	0.003106	
Date de	7	5.0E-14	0.000000	0.000157	0.008874	0.003093	
Mesure	8	4.2E-14	0.000001	0.000143	0.008909	0.003062	
25- 1-85	9	4.5E-14	0.000000	0.000147	0.008877	0.003066	
	10	3.7E-14	0.000000	0.000138	0.008884	0.003153*	
Valeurs moyennes			0.000000	0.000144	0.008894	0.003078	
SD			0.000000	0.000007	0.000039	0.000023	
	1	5.2E-14	0.000000	0.000160*	0.008971	0.003146	
	2	4.9E-14	0.000000	0.000143	0.009091*	0.003149	
	3	4.6E-14	0.000000	0.000148	0.008968	0.003088	
Filament	4	5.2E-14	0.000001	0.000141	0.008946	0.003064	
2	5	4.9E-14	0.000000	0.000146	0.008925	0.003115	
	6	4.7E-14	0.000000	0.000137	0.008911	0.003104	
Date de	7	4.5E-14	0.000000	0.000140	0.009019	0.003141	
Mesure	8	4.2E-14	0.000000	0.000148	0.008969	0.003141	
28- 1-85	9	3.6E-14	0.000000	0.000141	0.008904	0.003044	
	10	5.3E-14	0.000000	0.000130	0.008948	0.003110	
Valeurs moyennes			0.000000	0.000142	0.008951	0.003110	
SD			0.000000	0.000006	0.000036	0.000036	
	1	5.2E-14	0.000001	0.000145	0.009073	0.003136	
	2	4.8E-14	0.000001	0.000155	0.009098	0.003084	
	3	3.8E-14	0.000001	0.000149	0.009008	0.003189*	
Filament	4	5.3E-14	0.000000	0.000150	0.009002	0.003111	
3	5	5.3E-14	0.000000	0.000152	0.009089	0.003122	
	6	5.2E-14	0.000003	0.000150	0.009075	0.003138	
Date de	7	5.2E-14	0.000000	0.000147	0.009054	0.003119	
Mesure	8	5.2E-14	0.000000	0.000153	0.009017	0.003119	
4- 2-85	9	4.8E-14	0.000000	0.000157	0.008956	0.003161	
	10	5.3E-14	0.000000	0.000143	0.008972	0.003143	
Valeurs moyennes			0.000001	0.000150	0.009034	0.003126	
SD			0.000001	0.000005	0.000050	0.000022	

Laboratoire ORNL Echantillon P215 Methode GR

Signature _____ Date 11- 9-85 Correction DISCRI Element U

	Bloc	Intensite Principal	233/238	234/238	235/238	236/238	Element ug/g
	1	5.4E-14	0.788458	0.003915	0.042485	0.332504	
	2	5.5E-14	0.787668	0.003922	0.042591	0.332614	
	3	5.2E-14	0.789249	0.003969	0.042316	0.333593	
Filament	4	5.6E-14	0.787886	0.003919	0.042517	0.333079	
1	5	6.1E-14	0.788025	0.003911	0.042426	0.333477	
	6	6.1E-14	0.787422	0.003938	0.042228	0.332379	
Date de	7	5.3E-14	0.787331	0.003970	0.042397	0.332251	
Mesure	8	6.1E-14	0.785913	0.003888	0.042284	0.333096	
28- 1-85	9	7.1E-14	0.786560	0.003856	0.042381	0.332285	
	10	7.3E-14	0.785013	0.003901	0.042300	0.332483	
Valeurs moyennes			0.787352	0.003919	0.042393	0.332776	1420.2003
SD			0.001240	0.000035	0.000115	0.000496	
	1	5.3E-14	0.789310	0.003897	0.042220	0.333297	
	2	5.4E-14	0.789694	0.003931	0.042170	0.333387	
	3	5.9E-14	0.788120	0.003912	0.042068	0.332387	
Filament	4	5.8E-14	0.789307	0.003971*	0.042661*	0.332494	
2	5	5.5E-14	0.788749	0.003911	0.042482	0.333359	
	6	5.7E-14	0.788181	0.003893	0.042344	0.332061	
Date de	7	5.5E-14	0.788569	0.003886	0.042381	0.333131	
Mesure	8	5.6E-14	0.787954	0.003938	0.042234	0.333123	
5- 2-85	9	5.4E-14	0.788137	0.003868	0.042247	0.332802	
	10	5.6E-14	0.787233	0.003861	0.042320	0.332613	
	11	5.5E-14	0.787575	0.003917	0.042454	0.332708	
	12	4.9E-14	0.787091	0.003902	0.042310	0.332703	
Valeurs moyennes			0.788327	0.003902	0.042294	0.332839	1421.9669
SD			0.000829	0.000024	0.000122	0.000422	

Laboratoire ORNL Echantillon P315 Methode GR

Signature _____ Date 11- 9-85 Correction DISCRI Element U

	Bloc	Intensite Principal	233/238	234/238	235/238	236/238	Element ug/g
	1	5.4E-14	0.794825	0.003904	0.042548	0.333558	
	2	5.3E-14	0.794013	0.003947	0.042388	0.333007	
	3	5.2E-14	0.793969	0.003910	0.042318	0.332988	
Filament	4	5.1E-14	0.792585	0.003897	0.042207	0.333136	
1	5	4.9E-14	0.790511	0.003909	0.042345	0.333556	
	6	4.7E-14	0.789821	0.003859	0.042426	0.332372	
Date de	7	4.5E-14	0.789642	0.003875	0.042388	0.332465	
Mesure	8	5.3E-14	0.785472	0.003869	0.042268	0.332181	
29- 1-85	9	4.9E-14	0.784135	0.003874	0.042277	0.331881	
	10	4.4E-14	0.782704	0.003933	0.042127	0.331628	
Valeurs moyennes			0.789768	0.003898	0.042329	0.332677	1426.2263
SD			0.004344	0.000028	0.000119	0.000674	
	1	5.3E-14	0.791578	0.003885	0.042353	0.332872	
	2	4.6E-14	0.790615	0.003916	0.042393	0.333120	
	3	4.6E-14	0.789502	0.003904	0.042574*	0.332873	
Filament	4	4.9E-14	0.790920	0.003872	0.042366	0.332897	
2	5	5.6E-14	0.789123	0.003861	0.042187	0.332805	
	6	5.0E-14	0.788880	0.003956*	0.042404	0.332436	
Date de	7	4.8E-14	0.788363	0.003820	0.042164	0.332988	
Mesure	8	4.6E-14	0.787978	0.003885	0.042362	0.332452	
29- 1-85	9	4.2E-14	0.786585	0.003874	0.042360	0.331686*	
	10	5.1E-14	0.789595	0.003892	0.042303	0.333059	
Valeurs moyennes			0.789314	0.003879	0.042321	0.332834	1425.4028
SD			0.001486	0.000028	0.000088	0.000242	

Laboratoire ORNL Echantillon P415 Methode GR

Signature _____ Date 11- 9-85 Correction DISCRI Element U

	Bloc	Intensite Principal	233/238	234/238	235/238	236/238	Element ug/g
	1	5.5E-14	0.945505	0.004634	0.049350	0.397369	
	2	4.8E-14	0.946360	0.004649	0.049356	0.397655	
	3	4.3E-14	0.945043	0.004637	0.049200	0.396631*	
Filament	4	5.7E-14	0.943200	0.004699	0.049426	0.397214	
1	5	5.4E-14	0.943583	0.004669	0.049070	0.398037	
	6	5.0E-14	0.944212	0.004671	0.049291	0.397486	
Date de	7	5.0E-14	0.945157	0.004632	0.049191	0.397679	
Mesure	8	6.0E-14	0.945267	0.004687	0.049316	0.398247	
4- 2-85	9	5.5E-14	0.945158	0.004649	0.049134	0.397833	
	10	4.8E-14	0.945080	0.004615	0.049400	0.398055	
Valeurs moyennes			0.944856	0.004654	0.049274	0.397731	1428.5201
SD			0.000937	0.000027	0.000119	0.000343	
	1	5.2E-14	0.947356	0.004680	0.049280	0.397848	
	2	5.1E-14	0.945671	0.004740	0.049111	0.397685	
	3	4.9E-14	0.946160	0.004724	0.049146	0.397652	
Filament	4	4.7E-14	0.946297	0.004677	0.049338	0.398612*	
2	5	4.6E-14	0.944081	0.004642	0.049187	0.397377	
	6	5.5E-14	0.942948	0.004679	0.049249	0.397425	
Date de	7	5.2E-14	0.944368	0.004655	0.049077	0.398079	
Mesure	8	5.1E-14	0.944055	0.004631	0.049061	0.397251	
4- 2-85	9	5.0E-14	0.944722	0.004704	0.049137	0.397983	
	10	4.9E-14	0.941923	0.004685	0.049298	0.397303	
Valeurs moyennes			0.944758	0.004682	0.049188	0.397623	1428.3795
SD			0.001644	0.000034	0.000097	0.000303	

Laboratoire ORNL Echantillon M115 Methode GR

Signature _____ Date 11- 9-85 Correction DISCRI Element U

	Bloc	Intensite Principal	233/238	234/238	235/238	236/238	Element ug/g
	1	5.3E-14	0.920338	0.004570*	0.049937	0.390178	
	2	4.9E-14	0.918499	0.004602	0.049686	0.390103	
	3	4.7E-14	0.917198	0.004659	0.049766	0.389567	
Filament	4	4.3E-14	0.916548	0.004669	0.049626	0.389504	
1	5	3.8E-14	0.915905	0.004653	0.049588	0.389582	
	6	5.5E-14	0.922320	0.004670	0.050117	0.391454*	
Date de	7	4.8E-14	0.922677	0.004656	0.049925	0.390810	
Mesure	8	5.8E-14	0.917969	0.004662	0.049665	0.389594	
30- 1-85	9	5.0E-14	0.919073	0.004636	0.049892	0.390385	
	10	4.3E-14	0.918106	0.004663	0.050033	0.390121	
Valeurs moyennes			0.918863	0.004652	0.049824	0.389983	890.8980
SD			0.002288	0.000021	0.000182	0.000452	
	1	4.9E-14	0.914366	0.004643	0.049754	0.389627	
	2	4.5E-14	0.913436	0.004630	0.049664	0.389154	
	3	4.2E-14	0.913139	0.004639	0.049695	0.388947	
Filament	4	5.3E-14	0.914044	0.004659	0.049886	0.389061	
2	5	4.6E-14	0.914308	0.004579	0.049856	0.388829	
	6	4.4E-14	0.916122	0.004650	0.049896	0.389906	
Date de	7	4.1E-14	0.916391	0.004530*	0.049641	0.390134	
Mesure	8	5.5E-14	0.915982	0.004615	0.049829	0.389785	
31- 1-85	9	5.0E-14	0.915783	0.004574	0.049615	0.390526*	
	10	4.4E-14	0.916331	0.004614	0.049918	0.390064	
Valeurs moyennes			0.914990	0.004623	0.049775	0.389501	894.6888
SD			0.001258	0.000030	0.000115	0.000506	

Laboratoire ORNL Echantillon M215 Methode GR

Signature _____ Date 11- 9-85 Correction DISCRI Element U

	Bloc	Intensite Principal	233/238	234/238	235/238	236/238	Element ug/g
	1	5.4E-14	0.962492	0.004885	0.051843	0.407463*	
	2	4.6E-14	0.960037	0.004915	0.051914	0.408009	
	3	3.8E-14	0.960526	0.004887	0.051984	0.408172	
Filament	4	5.3E-14	0.962036	0.004857	0.051712	0.408039	
1	5	4.9E-14	0.962080	0.004842	0.051844	0.408030	
	6	4.5E-14	0.962038	0.004841	0.051804	0.407879	
Date de	7	4.2E-14	0.962967	0.004815	0.052069	0.408223	
Mesure	8	5.5E-14	0.960285	0.004779	0.051895	0.408410	
31- 1-85	9	5.2E-14	0.959455	0.004850	0.051596	0.407807	
	10	5.0E-14	0.958812	0.004889	0.051552	0.407633	
Valeurs moyennes			0.961073	0.004856	0.051821	0.408022	891.2349
SD			0.001422	0.000040	0.000163	0.000232	
	1	5.5E-14	0.961077	0.004894	0.052004	0.407844	
	2	5.1E-14	0.962961	0.004931	0.051709	0.409281*	
	3	4.6E-14	0.962792	0.004763	0.051845	0.407678	
Filament	4	4.2E-14	0.963653	0.004834	0.051683	0.407737	
2	5	5.1E-14	0.962526	0.004888	0.051865	0.408342	
	6	4.7E-14	0.964965	0.004770	0.051971	0.408555	
Date de	7	4.1E-14	0.964794	0.004902	0.052090	0.407850	
Mesure	8	5.5E-14	0.959309	0.004857	0.051679	0.407431	
5- 2-85	9	5.3E-14	0.959455	0.004803	0.051594	0.408103	
	10	5.5E-14	0.959418	0.004807	0.051859	0.407796	
Valeurs moyennes			0.962115	0.004845	0.051830	0.407926	890.2655
SD			0.002140	0.000058	0.000161	0.000348	

Laboratoire ORNL Echantillon M315 Methode GR

Signature _____ Date 11- 9-85 Correction DISCRI Element U

Bloc	Intensite Principal	233/238	234/238	235/238	236/238	Element ug/g
1	5.9E-14	0.928923	0.004638	0.050337	0.393580	
2	6.1E-14	0.928659	0.004665	0.050072*	0.393619	
3	6.2E-14	0.929323	0.004725	0.050202	0.393555	
Filament 4	6.2E-14	0.926252	0.004648	0.050359	0.392844	
1 5	6.4E-14	0.927340	0.004649	0.050291	0.393029	
6	6.4E-14	0.928335	0.004616	0.050391	0.393265	
Date de 7	5.4E-14	0.926974	0.004747	0.050260	0.393014	
Mesure 8	5.4E-14	0.926442	0.004673	0.050159	0.392730	
1- 2-85 9	5.3E-14	0.928123	0.004673	0.050228	0.393859	
10	5.4E-14	0.927175	0.004679	0.050407	0.393496	
11	5.4E-14	0.926733	0.004689	0.050260	0.393644	
Valeurs moyennes		0.927662	0.004673	0.050289	0.393331	889.4764
SD		0.001057	0.000038	0.000082	0.000373	
1	6.7E-14	0.930838	0.004714	0.050626	0.394308	
2	7.0E-14	0.932471	0.004743	0.050257	0.394392	
3	7.4E-14	0.931986	0.004703	0.050532	0.393943	
Filament 4	6.1E-14	0.929322	0.004675	0.050349	0.393280	
2 5	5.4E-14	0.927108	0.004642	0.050190	0.393413	
6	5.6E-14	0.930631	0.004691	0.050467	0.393501	
Date de 7	5.2E-14	0.929192	0.004673	0.050416	0.393333	
Mesure 8	6.7E-14	0.927550	0.004754	0.050248	0.393016	
1- 2-85 9	6.0E-14	0.928046	0.004705	0.050465	0.393248	
10	5.9E-14	0.927838	0.004612	0.050407	0.393622	
11	5.8E-14	0.927300	0.004658	0.050306	0.392521	
12	5.4E-14	0.926479	0.004683	0.050287	0.393590	
Valeurs moyennes		0.929063	0.004688	0.050379	0.393514	888.3822
SD		0.002006	0.000040	0.000129	0.000523	

Appendix 3: Results using Internal Standards

Laboratoire ORNL Echantillon T015 Methode GR

Signature _____ Date 11- 9-85 Correction INTERNAL Element PU

	Bloc	Intensite Principal	238/239	240/239	241/239	242/239	244/239	Element ug/g
	1	2.3E-14	0.718763	3.581169	1.560158	137.385590	61.781883	
	2	1.4E-14	0.731182	3.600544	1.527949	138.187469	62.142326	
	3	1.7E-14	0.712481	3.575350	1.511673	136.096634	61.202286	
Filament	4	1.6E-14	0.695608	3.582434	1.510847	138.642090*	62.346935*	
1	5	1.6E-14	0.722812	3.575400	1.509024	136.524826	61.394726	
	6	1.5E-14	0.709383	3.492383	1.497852	135.149216	60.776093	
Date de	7	1.7E-14	0.718936	3.604654	1.550712	137.974319	62.046814	
Mesure	8	1.5E-14	0.708296	3.582249	1.556146	138.551392	62.306492	
22-10-84	9	1.7E-14	0.725163	3.520029	1.516963	136.376541	61.328144	
	10	1.6E-14	0.730029	3.652730	1.592273*	139.752441	62.846424	
Valeurs moyennes			0.717265	3.576694	1.526814	137.333160	61.758354	
SD			0.011001	0.044145	0.023133	1.429503	0.642933	
	1	2.0E-14	0.725595	3.517885	1.525577	136.593140	61.425812	
	2	2.1E-14	0.726923	3.572320	1.490986	136.626038	61.440483	
	3	2.3E-14	0.721396	3.565702	1.532130	138.017776	62.066433	
Filament	4	1.6E-14	0.738764	3.557059	1.506658	136.504074	61.385651	
2	5	1.6E-14	0.719367	3.569364	1.538518	135.923950	61.124844	
	6	1.5E-14	0.711565	3.632668	1.534683	138.447327*	62.259678*	
Date de	7	1.6E-14	0.714591	3.554692	1.512104	136.315353	61.300861	
Mesure	8	1.7E-14	0.725115	3.623860	1.532714	136.642365	61.448002	
22-10-84	9	1.7E-14	0.720102	3.502915	1.512345	136.428070	61.351715	
	10	1.7E-14	0.707891	3.498169	1.506577	135.702637	61.025326	
Valeurs moyennes			0.721131	3.559464	1.519229	136.528152	61.396564	
SD			0.008782	0.045363	0.015682	0.646940	0.290924	

Laboratoire ORNL Echantillon P215 Methode GR

Signature _____ Date 11- 9-85 Correction INTERNAL Element PU

	Bloc	Intensite Principal	238/239	240/239	241/239	242/239	244/239	Element ug/g
	1	1.7E-14	0.004497	0.069976	0.011211	0.888791	0.399685	
	2	1.7E-14	0.004560	0.069805	0.011239	0.887841	0.399258	
	3	1.6E-14	0.003858	0.069900	0.011381	0.886749	0.398767	
Filament	4	1.6E-14	0.004075	0.069680	0.011126	0.883221	0.397180	
1	5	1.5E-14	0.004506	0.069924	0.011223	0.881632	0.396466	
	6	1.4E-14	0.005282	0.070020	0.011244	0.892824	0.401499	
Date de	7	1.4E-14	0.003019	0.070141	0.011493*	0.889527	0.400016	
Mesure	8	1.7E-14	0.004152	0.070443*	0.011309	0.888407	0.399512	
22-10-84	9	1.5E-14	0.005368	0.069757	0.011214	0.888033	0.399344	
	10	1.4E-14	0.003601	0.070011	0.011204	0.881263	0.396300	
Valeurs moyennes			0.004292	0.069913	0.011239	0.886829	0.398803	10.1596
SD			0.000719	0.000145	0.000071	0.003698	0.001663	
	1	1.5E-14	0.004739	0.070108	0.011126	0.881051	0.396205	
	2	1.4E-14	0.004040	0.069760	0.011275	0.882357	0.396792	
	3	1.3E-14	0.004528	0.069643	0.011197	0.886182	0.398512	
Filament	4	1.7E-14	0.004433	0.069856	0.011205	0.883371	0.397248	
2	5	1.5E-14	0.005159	0.069747	0.011300	0.883760	0.397423	
	6	1.4E-14	0.004869	0.070187	0.011352	0.891766	0.401023	
Date de	7	1.5E-14	0.004609	0.069811	0.011291	0.883992	0.397527	
Mesure	8	1.0E-14	0.004266	0.070170	0.011372	0.888894	0.399732	
22-10-84	9	1.6E-14	0.004168	0.070040	0.011231	0.879835	0.395658	
	10	1.4E-14	0.004327	0.070348	0.011191	0.887569	0.399136	
	11	1.6E-14	0.004215	0.069864	0.011208	0.884767	0.397876	
	12	1.3E-14	0.005453	0.070326	0.011290	0.888717	0.399652	
Valeurs moyennes			0.004567	0.069988	0.011253	0.885189	0.398065	10.1338
SD			0.000425	0.000239	0.000072	0.003527	0.001586	

Laboratoire ORNL Echantillon P315 Methode GR

Signature _____ Date 11- 9-85 Correction INTERNAL Element PU

	Bloc	Intensite Principal	238/239	240/239	241/239	242/239	244/239	Element ug/g
	1	1.7E-14	0.004615	0.070463	0.011365	0.889175	0.399858	
	2	1.7E-14	0.004712	0.069624	0.011104	0.886655	0.398725	
	3	1.6E-14	0.004698	0.069871	0.011271	0.886815	0.398797	
Filament	4	1.6E-14	0.004526	0.069981	0.011220	0.887829	0.399253	
1	5	1.6E-14	0.004644	0.069943	0.011266	0.883890	0.397482	
	6	1.6E-14	0.004726	0.069440	0.011019*	0.882765	0.396975	
Date de	7	1.5E-14	0.004705	0.069948	0.011189	0.890403	0.400410	
Mesure	8	1.5E-14	0.004687	0.070025	0.011309	0.885747	0.398316	
22-10-84	9	1.5E-14	0.004856	0.069468	0.011253	0.886761	0.398773	
	10	1.5E-14	0.004799	0.070077	0.011205	0.883540	0.397324	
Valeurs moyennes			0.004697	0.069884	0.011242	0.886358	0.398591	10.1656
SD			0.000092	0.000307	0.000075	0.002455	0.001104	
	1	1.6E-14	0.004618	0.070178	0.011103	0.886737	0.398762	
	2	1.4E-14	0.005147	0.069957	0.011287	0.891116	0.400731	
	3	1.2E-14	0.004352	0.070184	0.011449*	0.891148	0.400745	
Filament	4	1.6E-14	0.004676	0.069951	0.011203	0.890717	0.400551	
2	5	1.4E-14	0.004980	0.070069	0.011230	0.887423	0.399070	
	6	1.6E-14	0.004854	0.069828	0.011231	0.882588	0.396896	
Date de	7	1.4E-14	0.004096	0.070180	0.011273	0.883097	0.397125	
Mesure	8	1.2E-14	0.004136	0.069723	0.011112	0.878683	0.395140	
22-10-84	9	1.7E-14	0.005444	0.069977	0.011049	0.881636	0.396468	
	10	1.5E-14	0.004950	0.069374*	0.011053	0.877674	0.394686	
Valeurs moyennes			0.004725	0.070005	0.011171	0.885082	0.398017	10.1509
SD			0.000438	0.000163	0.000093	0.005067	0.002278	

Laboratoire ORNL Echantillon P415 Methode GR

Signature _____ Date 11- 9-85 Correction INTERNAL Element PU

	Bloc	Intensite Principal	238/239	240/239	241/239	242/239	244/239	Element ug/g
	1	1.5E-14	0.005546	0.074204	0.013842*	1.060797	0.477036	
	2	1.2E-14	0.005756	0.074448	0.013158	1.062344	0.477731	
	3	1.6E-14	0.005536	0.074172	0.013214	1.058650	0.476070	
Filament	4	1.4E-14	0.005564	0.074239	0.013447	1.057369	0.475494	
1	5	1.3E-14	0.005858	0.074655	0.013240	1.059163	0.476301	
	6	1.8E-14	0.005701	0.074067	0.013179	1.064326	0.478623	
Date de	7	1.7E-14	0.005725	0.074261	0.013115	1.061601	0.477397	
Mesure	8	1.6E-14	0.005689	0.074611	0.013195	1.064108	0.478525	
22-10-84	9	1.7E-14	0.005787	0.074586	0.013138	1.062283	0.477704	
	10	1.7E-14	0.005542	0.074126	0.013213	1.059676	0.476532	
	11	1.7E-14	0.005706	0.074233	0.013215	1.054208	0.474072	
	12	1.6E-14	0.005718	0.074278	0.013132	1.063339	0.478179	
Valeurs moyennes			0.005677	0.074323	0.013204	1.060655	0.476972	10.1843
SD			0.000106	0.000200	0.000090	0.002994	0.001346	
	1	2.0E-14	0.005617	0.074471	0.013052	1.056809	0.475242	
	2	2.1E-14	0.005753	0.074245	0.013096	1.054427	0.474171	
	3	2.2E-14	0.005420	0.074208	0.013202	1.057614	0.475604	
Filament	4	1.7E-14	0.005326	0.074136	0.013145	1.052568	0.473335	
2	5	1.7E-14	0.005555	0.074525	0.013181	1.057834	0.475703	
	6	1.7E-14	0.005550	0.074215	0.012958	1.053684	0.473837	
Date de	7	1.7E-14	0.005574	0.073786	0.013066	1.053944	0.473954	
Mesure	8	1.6E-14	0.005500	0.074175	0.013203	1.050998	0.472629	
22-10-84	9	1.6E-14	0.006110	0.074016	0.013166	1.058680	0.476083	
	10	1.6E-14	0.005773	0.074689	0.013330	1.059873	0.476620	
Valeurs moyennes			0.005618	0.074247	0.013140	1.055643	0.474718	10.1387
SD			0.000219	0.000260	0.000102	0.002913	0.001310	

Laboratoire ORNL Echantillon M115 Methode GR

Signature _____ Date 11- 9-85 Correction INTERNAL Element PU

	Bloc	Intensite Principal	238/239	240/239	241/239	242/239	244/239	Element us/g
	1	1.7E-14	0.028449	0.424866	0.178910*	1.502430	0.641731	
	2	1.3E-14	0.028697	0.426818	0.178843	1.512362	0.646200	
	3	1.6E-14	0.027965	0.424636	0.177065	1.497969	0.639724	
Filament	4	1.3E-14	0.027662	0.426031	0.178527	1.511645	0.645878	
1	5	1.1E-14	0.027882	0.428993*	0.178150	1.504958	0.642869	
	6	1.8E-14	0.029014	0.426196	0.177559	1.502887	0.641937	
Date de	7	1.5E-14	0.028690	0.425440	0.177917	1.505440	0.643086	
Mesure	8	1.3E-14	0.029178	0.423723	0.178361	1.506199	0.643427	
22-10-84	9	1.7E-14	0.029092	0.427645	0.178430	1.509961	0.645120	
	10	1.4E-14	0.027531	0.423850	0.177522	1.498947	0.640164	
Valeurs moyennes			0.028416	0.425467	0.178042	1.505280	0.643014	6.3518
SD			0.000614	0.001329	0.000572	0.004955	0.002229	
	1	1.6E-14	0.028839	0.425735	0.177669	1.500302	0.640774	
	2	1.5E-14	0.028373	0.426092	0.178224	1.502564	0.641792	
	3	1.3E-14	0.028682	0.426156	0.178719	1.510189	0.645223	
Filament	4	1.7E-14	0.028936	0.424413	0.177095	1.492218	0.637137	
2	5	1.6E-14	0.028725	0.425605	0.178147	1.506228	0.643441	
	6	1.5E-14	0.028669	0.426100	0.178036	1.505745	0.643223	
Date de	7	1.4E-14	0.029063	0.428050*	0.178379	1.511067	0.645618	
Mesure	8	1.7E-14	0.029021	0.425568	0.177208	1.496407	0.639022	
22-10-84	9	1.5E-14	0.028478	0.425029	0.177605	1.504468	0.642649	
	10	1.4E-14	0.029101	0.424458	0.177373	1.493660	0.637786	
Valeurs moyennes			0.028789	0.425462	0.177846	1.502285	0.641666	6.3653
SD			0.000247	0.000679	0.000537	0.006551	0.002947	

Laboratoire ORNL Echantillon M215 Methode GR

Signature _____ Date 11- 9-85 Correction INTERNAL Element PU

	Bloc	Intensite Principal	238/239	240/239	241/239	242/239	244/239	Element ug/g
	1	1.8E-14	0.029003	0.426621	0.178010	1.571486	0.672803	
	2	1.8E-14	0.029395	0.427175	0.177975	1.568879	0.671630	
	3	1.8E-14	0.028883	0.426607	0.177887	1.562078	0.668570	
Filament	4	1.7E-14	0.028947	0.426373	0.178186	1.560103	0.667681	
1	5	1.6E-14	0.028726	0.427636	0.178818	1.577337	0.675436	
	6	1.7E-14	0.028963	0.426735	0.177681	1.560605	0.667907	
Date de	7	1.5E-14	0.028913	0.427268	0.178385	1.573003	0.673485	
Mesure	8	1.4E-14	0.028821	0.424887*	0.178748	1.561700	0.668400	
22-10-84	9	1.7E-14	0.029492	0.428613	0.180399*	1.575045	0.674405	
	10	1.5E-14	0.029237	0.428149	0.178316	1.566385	0.670508	
Valeurs moyennes			0.029038	0.427242	0.178223	1.567662	0.671083	6.3670
SD			0.000252	0.000764	0.000384	0.006395	0.002877	
	1	1.4E-14	0.028971	0.426692	0.182395*	1.574528	0.674172	
	2	1.4E-14	0.028942	0.427845	0.179568	1.578877	0.676129	
	3	1.1E-14	0.028679	0.428216	0.179045	1.574385	0.674108	
Filament	4	1.2E-14	0.029264	0.425194	0.178573	1.560969	0.668071	
2	5	8.7E-15	0.029071	0.427984	0.178006	1.567734	0.671115	
	6	1.8E-14	0.028818	0.426420	0.178551	1.572360	0.673196	
Date de	7	1.9E-14	0.028724	0.427771	0.178134	1.569701	0.672000	
Mesure	8	1.7E-14	0.029223	0.426725	0.177428	1.561697	0.668399	
22-10-84	9	1.7E-14	0.029100	0.427652	0.177519	1.566265	0.670454	
	10	1.7E-14	0.028945	0.425690	0.178210	1.567739	0.671117	
	11	1.7E-14	0.029297	0.425564	0.177154	1.561780	0.668436	
	12	1.6E-14	0.029054	0.426911	0.178934	1.574212	0.674029	
Valeurs moyennes			0.029007	0.426889	0.178284	1.569187	0.671769	6.3640
SD			0.000201	0.001026	0.000742	0.005849	0.002632	

Laboratoire ORNL Echantillon M315 Methode GR

Signature _____ Date 11- 9-85 Correction INTERNAL Element PU

	Bloc	Intensite Principal	238/239	240/239	241/239	242/239	244/239	Element ug/g
	1	1.8E-14	0.028919	0.426251	0.178991	1.518285	0.648866	
	2	1.6E-14	0.028977	0.425620	0.178049	1.515514	0.647618	
	3	1.4E-14	0.028801	0.426247	0.177976	1.518150	0.648805	
Filament	4	1.7E-14	0.028278	0.427987*	0.178366	1.528196*	0.653325*	
1	5	1.7E-14	0.028718	0.426048	0.178641	1.520827	0.650009	
	6	1.6E-14	0.028989	0.427181	0.178982	1.523473	0.651200	
Date de	7	1.6E-14	0.028735	0.424730	0.177815	1.510420	0.645327	
Mesure	8	1.5E-14	0.028435	0.426518	0.177930	1.517360	0.648449	
22-10-84	9	1.7E-14	0.028981	0.426026	0.177885	1.517778	0.648638	
	10	1.6E-14	0.029063	0.425844*	0.177326	1.509561	0.644940	
	11	1.6E-14	0.028690	0.424669	0.177351	1.513922	0.646902	
	12	1.5E-14	0.029171	0.426520	0.176764*	1.517870	0.648679	
Valeurs moyennes			0.028813	0.425981	0.178119	1.516651	0.648130	6.3474
SD			0.000261	0.000788	0.000571	0.004123	0.001855	
	1	1.7E-14	0.028879	0.426133	0.178055	1.514164	0.647011	
	2	1.6E-14	0.028702	0.425603	0.179658	1.517828	0.648660	
	3	1.6E-14	0.028422	0.426455	0.178789	1.513583	0.646750	
Filament	4	1.6E-14	0.028867	0.425933	0.179402	1.529641	0.653975	
2	5	1.6E-14	0.029128	0.426247	0.178053	1.517337	0.648439	
	6	1.6E-14	0.028509	0.426443	0.177946	1.520761	0.649980	
Date de	7	1.6E-14	0.029036	0.427166	0.178801	1.527367	0.652952	
Mesure	8	1.5E-14	0.028781	0.426352	0.179494	1.526211	0.652432	
22-10-84	9	1.6E-14	0.028451	0.425281	0.178227	1.524432	0.651631	
	10	1.6E-14	0.028845	0.424437*	0.177030	1.509091	0.644729	
Valeurs moyennes			0.028762	0.426179	0.178546	1.520041	0.649656	6.3366
SD			0.000240	0.000543	0.000832	0.006766	0.003044	

Laboratoire ORNL Echantillon T015 Methode GR

Signature _____ Date 11- 9-85 Correction INTERNAL Element U

Bloc	Intensite Principal	233/238	234/238	235/238	236/238	Element ug/g
1	5.7E-14	152.651596	0.738145	6.821004	64.413673	
2	6.1E-14	150.047302	0.726216	6.699794	63.314896	
3	5.2E-14	153.681946	0.757211	6.853540	64.848442	
Filament 4	4.5E-14	153.532623	0.741751	6.877919	64.785645	
1 5	3.8E-14	149.696182	0.727818	6.680737	63.166687	
6	5.0E-14	151.240784	0.741739	6.769894	63.818424	
Date de 7	4.0E-14	151.485443	0.744268	6.768496	63.921574	
Mesure 8	4.7E-14	152.630768*	0.744189	6.761883*	64.404808*	
24- 1-85 9	3.5E-14	150.475998	0.741988	6.691845	63.495728	
10	5.2E-14	152.015930	0.750940	6.774693	64.145576	
Valeurs moyennes		151.647537	0.741427	6.770880	63.990070	
SD		1.447799	0.009328	0.070931	0.610912	
1	5.5E-14	152.197311	0.746019	6.776237	64.222008	
2	5.4E-14	151.752747	0.737038	6.746340	64.034447	
3	4.9E-14	150.865051	0.734938	6.704988	63.659782	
Filament 4	4.5E-14	153.379791	0.755665	6.815146	64.720993	
2 5	4.4E-14	151.132050	0.743475	6.769897	63.772617	
6	4.0E-14	150.544434	0.733862	6.690825	63.524624	
Date de 7	5.3E-14	152.096008	0.750701	6.794683	64.179359	
Mesure 8	4.7E-14	149.596115	0.738231	6.680040	63.124516	
28- 1-85 9	4.6E-14	149.815994	0.729078	6.690672	63.217354	
10	5.3E-14	152.600113	0.738860	6.782688	64.391991	
11	4.8E-14	152.072403	0.744312	6.825633	64.169365	
Valeurs moyennes		151.459290	0.741107	6.752469	63.910641	
SD		1.177749	0.007805	0.052917	0.496933	

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Signature _____ Date 11- 9-85 Correction INTERNAL Element U

	Bloc	Intensite Principal	233/238	234/238	235/238	236/238	Element ug/g
	1	5.4E-14	0.787678	0.003912	0.042460	0.332375	
	2	5.5E-14	0.788625	0.003926	0.042622	0.332775	
	3	5.2E-14	0.791430	0.003977	0.042386	0.333959	
Filament	4	5.5E-14	0.790310	0.003928	0.042595	0.333486	
1	5	6.1E-14	0.791784	0.003926	0.042547	0.334108	
	6	6.1E-14	0.787865	0.003940	0.042242*	0.332454	
Date de	7	5.3E-14	0.787420	0.003971	0.042400	0.332266	
Mesure	8	6.1E-14	0.791681	0.003911	0.042469	0.334064	
28- 1-85	9	7.1E-14	0.788061	0.003862*	0.042429	0.332537	
	10	7.3E-14	0.789859	0.003920	0.042456	0.333296	
Valeurs moyennes			0.789471	0.003935	0.042485	0.333132	1424.1007
SD			0.001752	0.000024	0.000084	0.000739	
	1	5.3E-14	0.790226	0.003901	0.042250	0.333450	
	2	5.4E-14	0.790327	0.003933	0.042190	0.333493	
	3	5.9E-14	0.787437	0.003909	0.042046	0.332274	
Filament	4	5.9E-14	0.787082	0.003962	0.042590	0.332124	
2	5	5.5E-14	0.790837	0.003920	0.042549	0.333708	
	6	5.7E-14	0.786121	0.003885	0.042278	0.331718	
Date de	7	5.5E-14	0.790063	0.003892	0.042428	0.333381	
Mesure	8	5.5E-14	0.790436	0.003948	0.042313	0.333539	
5- 2-85	9	5.4E-14	0.789054	0.003872	0.042276	0.332956	
	10	5.6E-14	0.788905	0.003868	0.042373	0.332893	
	11	5.5E-14	0.789054	0.003923	0.042502	0.332956	
	12	4.9E-14	0.789353	0.003911	0.042382	0.333082	
Valeurs moyennes			0.789075	0.003910	0.042348	0.332964	1423.3812
SD			0.001487	0.000029	0.000156	0.000627	

Laboratoire ORNL Echantillon P315 Methode OR

Signature _____ Date 11- 9-85 Correction INTERNAL Element U

	Bloc	Intensite Principal	233/238	234/238	235/238	236/238	Element ug/g
	1	5.5E-14	0.787668	0.003876	0.042320	0.332371	
	2	5.4E-14	0.786039	0.003915	0.042134	0.331684	
	3	5.3E-14	0.785996	0.003878	0.042065	0.331666	
Filament	4	5.1E-14	0.787467	0.003877	0.042045	0.332286	
1	5	4.9E-14	0.790454*	0.003908	0.042343	0.333547*	
	6	4.8E-14	0.786274	0.003845	0.042312	0.331783	
Date de	7	4.5E-14	0.786750	0.003863	0.042295	0.331984	
Mesure	8	5.3E-14	0.788367	0.003880	0.042361	0.332666	
29- 1-85	9	4.9E-14	0.788068	0.003890	0.042404	0.332540	
	10	4.5E-14	0.788017	0.003954*	0.042297	0.332518	
Valeurs moyennes			0.787183	0.003882	0.042258	0.332166	1421.5858
SD			0.000930	0.000021	0.000128	0.000393	
	1	5.3E-14	0.787086	0.003868	0.042210	0.332125	
	2	4.7E-14	0.788679	0.003909	0.042331	0.332797	
	3	4.6E-14	0.788439	0.003900	0.042540*	0.332696	
Filament	4	5.0E-14	0.787611	0.003859	0.042260	0.332347	
2	5	5.6E-14	0.788419	0.003858	0.042165	0.332688	
	6	5.0E-14	0.787134	0.003950*	0.042349	0.332146	
Date de	7	4.8E-14	0.789634	0.003825	0.042204	0.333201	
Mesure	8	4.7E-14	0.787783	0.003884	0.042355	0.332420	
29- 1-85	9	4.2E-14	0.785693*	0.003871	0.042332	0.331538*	
	10	5.2E-14	0.789107	0.003890	0.042288	0.332978	
Valeurs moyennes			0.788210	0.003874	0.042277	0.332600	1423.4509
SD			0.000874	0.000026	0.000071	0.000369	

Laboratoire ORNL Echantillon P415 Methode GR

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	Bloc	Intensite Principal	233/238	234/238	235/238	236/238	Element ug/g
	1	5.6E-14	0.939233	0.004609	0.049155	0.396327	
	2	4.8E-14	0.939797	0.004623	0.049152	0.396565	
	3	4.4E-14	0.936655*	0.004604	0.048940	0.395239*	
Filament	4	5.8E-14	0.940122	0.004687	0.049330	0.396702	
1	5	5.4E-14	0.943093	0.004667	0.049055	0.397955	
	6	5.0E-14	0.940525	0.004657	0.049176	0.396872	
Date de	7	5.0E-14	0.940670	0.004614	0.049052	0.396933	
Mesure	8	6.0E-14	0.942819	0.004677	0.049239	0.397840	
4- 2-85	9	5.5E-14	0.941271	0.004634	0.049014	0.397187	
	10	4.8E-14	0.942190	0.004603	0.049310	0.397574	
Valeurs moyennes			0.941080	0.004638	0.049143	0.397106	1422.8274
SD			0.001360	0.000032	0.000128	0.000574	
	1	5.3E-14	0.939909	0.004650	0.049049	0.396612	
	2	5.1E-14	0.940359	0.004719	0.048946	0.396802	
	3	4.9E-14	0.939916	0.004699	0.048953	0.396615	
Filament	4	4.8E-14	0.943576	0.004666	0.049253	0.398159	
2	5	4.6E-14	0.940188	0.004627	0.049067	0.396730	
	6	5.5E-14	0.941111	0.004672	0.049191	0.397119	
Date de	7	5.3E-14	0.942748	0.004648	0.049027	0.397810	
Mesure	8	5.1E-14	0.939713	0.004615	0.048927	0.396529	
4- 2-85	9	5.0E-14	0.942144	0.004693	0.049057	0.397555	
	10	4.9E-14	0.941305	0.004682	0.049279	0.397201	
Valeurs moyennes			0.941097	0.004667	0.049075	0.397113	1422.8533
SD			0.001338	0.000033	0.000126	0.000564	

Laboratoire ORNL Echantillon M115 Methode GR

Signature _____ Date 11- 9-85 Correction INTERNAL Element U

	Bloc	Intensite Principal	233/238	234/238	235/238	236/238	Element ug/g
	1	5.4E-14	0.915387	0.004551*	0.049777	0.389348	
	2	4.9E-14	0.916303	0.004594	0.049616	0.389734	
	3	4.7E-14	0.915054	0.004651	0.049696	0.389207	
Filament	4	4.3E-14	0.915235	0.004663	0.049584	0.389284	
1	5	3.8E-14	0.915966	0.004654	0.049590	0.389592	
	6	5.5E-14	0.919097*	0.004657	0.050013	0.390913*	
Date de	7	4.8E-14	0.916336	0.004631	0.049721	0.389748	
Mesure	8	5.8E-14	0.914652	0.004649	0.049558	0.389038	
30- 1-85	9	5.0E-14	0.917035	0.004628	0.049827	0.390043	
	10	4.3E-14	0.916634	0.004657	0.049985	0.389874	
Valeurs moyennes			0.915845	0.004643	0.049737	0.389541	894.9120
SD			0.000801	0.000022	0.000164	0.000338	
	1	4.9E-14	0.917172	0.004654	0.049845	0.390101	
	2	4.5E-14	0.915924	0.004640	0.049745	0.389574	
	3	4.2E-14	0.915304	0.004647	0.049765	0.389313	
Filament	4	5.3E-14	0.915150	0.004663	0.049922	0.389248	
2	5	4.6E-14	0.914060	0.004578	0.049848	0.388788	
	6	4.4E-14	0.917102	0.004654	0.049928	0.390071	
Date de	7	4.1E-14	0.917822	0.004536*	0.049687	0.390375	
Mesure	8	5.5E-14	0.916717	0.004618	0.049852	0.389909	
31- 1-85	9	5.0E-14	0.919779	0.004590	0.049744	0.391201	
	10	4.4E-14	0.917585	0.004619	0.049959	0.390275	
Valeurs moyennes			0.916661	0.004629	0.049829	0.389885	894.1119
SD			0.001626	0.000030	0.000091	0.000686	

Laboratoire ORNL Echantillon M215 Methode GR

Signature _____ Date 11- 9-85 Correction INTERNAL Element U

	Bloc	Intensite Principal	233/238	234/238	235/238	236/238	Element ug/g
	1	5.4E-14	0.955574*	0.004857	0.051621	0.406305*	
	2	4.6E-14	0.959334	0.004912	0.051892	0.407891	
	3	3.8E-14	0.959652	0.004884	0.051956	0.408025	
Filament	4	5.3E-14	0.958134	0.004841	0.051587	0.407385	
1	5	4.9E-14	0.958067	0.004826	0.051715	0.407356	
	6	4.5E-14	0.957504	0.004823	0.051659	0.407119	
Date de	7	4.2E-14	0.958245	0.004796	0.051917	0.407432	
Mesure	8	5.5E-14	0.960753	0.004781	0.051910	0.408490	
31- 1-85	9	5.2E-14	0.958926	0.004847	0.051579	0.407719	
	10	5.0E-14	0.958666	0.004889	0.051548	0.407609	
Valeurs moyennes			0.958809	0.004845	0.051738	0.407670	894.4104
SD			0.000989	0.000041	0.000162	0.000417	
	1	5.5E-14	0.957997	0.004881	0.051905	0.407328	
	2	5.1E-14	0.962409*	0.004929	0.051692	0.409190*	
	3	4.6E-14	0.956222	0.004737	0.051634	0.406379	
Filament	4	4.3E-14	0.955893	0.004803	0.051435*	0.406439	
2	5	5.1E-14	0.959004	0.004873	0.051752	0.407752	
	6	4.7E-14	0.958238	0.004743	0.051755	0.407429	
Date de	7	4.1E-14	0.955589	0.004865	0.051794	0.406311	
Mesure	8	5.5E-14	0.957410	0.004848	0.051611	0.407079	
5- 2-85	9	5.3E-14	0.960091	0.004805	0.051615	0.408210	
	10	5.5E-14	0.958907	0.004805	0.051842	0.407711	
Valeurs moyennes			0.957706	0.004829	0.051733	0.407204	895.4478
SD			0.001551	0.000061	0.000104	0.000654	

Laboratoire ORNL Echantillon M315 Methode GR

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	Bloc	Intensite Principal	233/238	234/238	235/238	236/238	Element ug/g
	1	5.9E-14	0.923106	0.004614	0.050149	0.392606	
	2	6.1E-14	0.923430	0.004645	0.049904	0.392743	
	3	6.3E-14	0.922745	0.004699	0.049991	0.392454	
Filament	4	6.2E-14	0.921970	0.004631	0.050221	0.392127	
1	5	6.4E-14	0.921979	0.004628	0.050118	0.392131	
	6	6.4E-14	0.922252	0.004592	0.050194	0.392246	
Date de	7	5.4E-14	0.922161	0.004727	0.050105	0.392208	
Mesure	8	5.4E-14	0.921391	0.004653	0.049997	0.391883	
1- 2-85	9	5.3E-14	0.924723	0.004659	0.050118	0.393289	
	10	5.4E-14	0.923922	0.004666	0.050301	0.392951	
	11	5.4E-14	0.924792	0.004681	0.050197	0.393318	
Valeurs moyennes			0.922952	0.004654	0.050118	0.392541	895.0897
SD			0.001150	0.000039	0.000116	0.000485	
	1	6.7E-14	0.924708	0.004689	0.050427	0.393281	
	2	7.1E-14	0.923973	0.004708	0.049984	0.392971	
	3	7.4E-14	0.922530	0.004665	0.050226	0.392362	
Filament	4	6.1E-14	0.921671	0.004645	0.050102	0.391999	
2	5	5.4E-14	0.923645	0.004629	0.050079	0.392832	
	6	5.6E-14	0.921689	0.004655	0.050178	0.392007	
Date de	7	5.2E-14	0.921967	0.004644	0.050183	0.392124	
Mesure	8	6.8E-14	0.921794	0.004730	0.050062	0.392051	
1- 2-85	9	6.0E-14	0.922381	0.004683	0.050282	0.392299	
	10	5.9E-14	0.923984	0.004597	0.050283	0.392975	
	11	5.8E-14	0.920020	0.004629	0.050070	0.391302	
	12	5.4E-14	0.924756	0.004676	0.050232	0.393301	
Valeurs moyennes			0.922760	0.004662	0.050176	0.392459	895.2385
SD			0.001450	0.000037	0.000123	0.000612	

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