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memorandum

TO: Distribution

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FROM: T. E. Sampson, Q-1

MAIL STOP/TELEPHONE: E540/7-6968

SYMBOL: Q-1-83-232/0612D

SUBJECT: SUMMARY OF ANALYSIS RESULTS FOR LA0225BS

Introduction

When the breeder oxide program at TA-55 began processing 16% ^{240}Pu material, it was felt desirable to have a well-characterized sample of this material to use for checking the performance of the Multiple Detector Plutonium Isotopic System. A 1-kg can of PuO_2, LA0225BS, was dedicated to this task. At the present time, this material remains part of the breeder program. If it were to be dedicated as a standard, consent of appropriate breeder oxide program personnel would be needed.

In addition to the regular analysis done on the LA0225 batch, we submitted additional samples from a separate archive sample for more analysis. The results are reported below.

Sample Mass

The sample LA0225BS was weighed on May 19, 1982. Its net weight of 1000.0 g probably has an uncertainty of ±0.1 g.

Pu Concentration

Two different plutonium concentration analyses have been done, one from the breeder oxide QA program and the second from a sample from the separate archive sample. The results are shown in Table I.

TABLE I

PLUTONIUM CONCENTRATION (G PU/G SAMPLE) FROM BATCH LA0225

Analysis Date	As Received (% Pu)	Ignited (% Pu)	Wt. Loss (%)	As Received Adjusted to Ignited Basis (% Pu)
6/2/82	87.52	88.01	0.31	87.79
1/19/83	87.37 ± .04	88.00 ± .04	0.7	87.99

We see the same trend as with STD40 (Q-1-82-985, Dec. 1, 1982) in that the later analyzed sample picked up more moisture than the one analyzed shortly after the batch was processed. This makes it likely that the "As Received" value for the original QA analysis of 6/2/82 most probably represents the contents of LA0225BS. An uncertainty of ±0.1% is probably appropriate for LA0225BS.

Isotopic Composition

Three different mass spectrometry analyses were done on this batch, two by CHM-1 and one by INC-7. All data decayed to a common date of 1/1/83 are shown in Table II. The following half-lives were used for the decay corrections: ^{238}Pu--87.74 y, ^{239}Pu--24119 y, ^{240}Pu--6562 y, ^{241}Pu--14.348 y, ^{242}Pu--376300 y, and ^{241}Am--433.6 y.

TABLE II

MASS SPECTROMETRY ANALYSES OF SAMPLES FROM BATCH LA0225 DECAYED TO JANUARY 1, 1983 (01/01/83)

No.	Analysis Date	Group	Cut	^{238}Pu	^{239}Pu	Wt.% ^{240}Pu	^{241}Pu	^{242}Pu
1.	6/2/82	CHM-1	A	.07569	81.7067	16.4366	1.4298	.3512
2.			B	.07070	81.7012	16.4355	1.4395	.3531
3.	1/13/83	CHM-1	Avg 3 Cuts	.06301(1)	81.7241	16.4327	1.4292	.3510
4.	3/8/83	INC-7	A	.06223	81.6967	16.4578	1.4305	.3526
5.			B	.06240	81.7077	16.4475	1.4316	.3507
6.			C	.06291	81.6936	16.4568	1.4325	.3541

(1) Radiochemistry for ^{238}Pu

Measurements 1 and 2 for ^{238}Pu were discarded. The remaining four values were averaged with value no. 3 weighted times 3. This average ^{238}Pu value was used to renormalize measurements 1 and 2, and the resulting six values for 239-242 were averaged with no. 3 again, getting a times 3 weight. The final results are given in Table III. Absolute accuracy is likely not to be as good as the precision, $S_{\bar{X}}$, indicates because of uncertainties in the mass spectrometer calibration standards.

TABLE III

AVERAGED VALUES FOR ISOTOPIC COMPOSITION OF LA0225BS
JANUARY 1, 1983 (01/01/83)

	Weight %				
	^{238}Pu	^{239}Pu	^{240}Pu	^{241}Pu	^{242}Pu
$\bar{X}$	0.06276	81.7120	16.4419	1.4315	0.3518
S_i	0.00035 (0.56%)	0.0124 (0.015%)	0.0107 (0.065%)	0.0035 (0.24%)	0.0013 (0.36%)
$S_{\bar{X}}$	0.00014 (0.23%)	0.0044 (0.005%)	0.0038 (0.023%)	0.0012 (0.086%)	0.0004 (0.13%)

Am-241 Concentration

Four measurements of ^{241}Am concentrations were done by CHM-1. All measurements were consistent. The final value was a weighted average of the four measurements with the weighting factor being the quadrature sum of the precision and estimated systematic errors. The measurements are tabulated in Table IV. The weighted average is listed also.

TABLE IV

^{241}Am ANALYSES OF SAMPLES FROM BATCH LA0225
RESULTS IN μg/g Pu

Measurement	Date	Result	Est. Precision (1σ)	Est. Systematic	Decayed Value Jan. 1, 1983
Gamma Count	5/26/82	1176.9	3.8	6	1598.8
Gamma Count	1/14/83	1633.3	3.1	8	1608.8
Extraction	1/14/83	1628.4	2.4	8	1603.9
IDMS	1/14/83	1625.8	0.8	8	1601.3

Weighted average 1/1/83 1603.3 ± 4.3 (0.27%) μg/g Pu

Summary

In Table V the results for this sample are summarized. Note that the summary date is not the current one and that all values are time dependent and must be updated before use.

TABLE V

SUMMARY OF CHARACTERISTICS OF LA0225BS
AS OF JANUARY 1, 1983

Plutonium Mass (grams)	874.79 ± .87 (0.1%)	
Plutonium Isotopic Composition	^{238}Pu	0.06276 ± 0.00014 (0.23%)
	^{239}Pu	81.7120 ± 0.0044 (0.005%)
	^{240}Pu	16.4419 ± 0.0038 (0.023%)
	^{241}Pu	1.4315 ± 0.0012 (0.086%)
	^{242}Pu	0.3518 ± 0.0004 (0.13%)
	^{241}Am	0.16033 ± 0.00043 (0.27%)
		(1603.3 ± 4.3 µg/g Pu)
Total Power (watts)	2.9123	

Because the isotopic distribution and ^{241}Am content of this sample have been so well characterized, it would be very desirable to preserve this as a permanent standard for the plutonium isotopic system. Its ^{240}Pu value of 16% is in a range where similar standards do not currently exist.

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