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Date 9/20/51 Initials D.H.T.

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To: Mr. E. C. McCarthy

Date: September 19, 1951

Subject: Calorimetric Determinations of 57
Hot Slugs numbered 4416 to 4472
Inclusive

The Operations Division of Mound Laboratory on June 26, 1951 sent the first of 57 hot bismuth slugs to the Research Calorimetry Laboratory, Group 8. These slugs constituted a single channel load from the Hanford pile. The polonium content of these slugs was determined at the rate of two slugs per day. Calorimeter 54, though originally designed for very high activity samples, proved very useful in making these determinations.

Table I gives the activity values, decayed to noon September 1, 1951, of the bismuth slugs that were run in the Calorimeter Research Laboratory between June 26 and August 7. Since bismuth-210 is partially present in the slugs and decays to polonium-210, the usual polonium-210 decay table could not be used.

Each run was decayed by calculations using equations that involve the relative amounts of bismuth-210 and polonium-210 in the slugs at the time they were discharged from the pile. The shut-down schedule of the pile during irradiation of these slugs was not known so that a precise determination of the ratio of curies of bismuth-210 to polonium-210 at the time of discharge from the pile could not be made. However, a maximum probable error could be calculated for this ratio. This error and the errors of the decay constants of bismuth-210 and of polonium-210 were used to calculate the error incurred in decaying the measured values to September 1, 1951. The accuracy of Calorimeter 54 was checked with a dummy heater wound on a cylinder of aluminum of about the same size as a bismuth slug and found to give results of 0.1 per cent low. Each slug value was adjusted using the factor 1.001. Six runs were made on one slug to determine the probable error of a single measurement. With the results of these runs and of the calculations we feel the probable error that can be attached to each of these values and to the total is 0.05 per cent.

The values given in Table I can be decayed forward by use of the polonium-210 decay tables but not backward because of the error that would be introduced by not accounting for the bismuth-210 that is present at times shortly after the discharge of the slugs from the pile. A report on the method for backward decay of polonium-210 in hot slugs of bismuth is being prepared by the Calorimetry Research Group.

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Table I

SLUG ACTIVITY IN CURIES

<u>Slug No.</u>	<u>Value (9-1-51)</u> <u>(12:00 Noon)</u>	<u>Slug No.</u>	<u>Value (9-1-51)</u> <u>(12:00 Noon)</u>
4416	3.9108	4445	10.1111
4417	4.4307	4446	10.1699
4418	4.9053	4447	10.1106
4419	5.3505	4448	10.0754
4420	5.6804	4449	9.9273
4421	6.1228	4450	9.8298
4422	6.4640	4451	9.7374
4423	6.8440	4452	9.5760
4424	7.2099	4453	9.4006
4425	7.5294	4454	9.1545
4426	7.8109	4455	8.9644
4427	8.0477	4456	8.6892
4428	8.1684	4457	8.3516
4429	8.3087	4458	7.9831
4430	8.6711	4459	7.8502
4431	8.9703	4460	7.6922
4432	9.1506	4461	7.4596
4433	9.3827	4462	7.1641
4434	9.5830	4463	6.8556
4435	9.7080	4464	6.4795
4436	9.8609	4465	6.1343
4437	9.9607	4466	5.7822
4438	10.0594	4467	5.4317
4439	10.1464	4468	5.0174
4440	10.1755	4469	4.6262
4441	10.2010	4470	4.1912
4442	10.1248	4471	3.7370
4443	9.9049	4472	3.2628
4444	9.8865		

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The measured values of the slugs were decayed back to the time at which Hanford specified the quantity of polonium in these 57 slugs. This date was June 11, 1951. Mound Laboratory's value is 675.94 curies of polonium-210 and Hanford's value is 694 curies. This shows that Hanford's value is 2.6 per cent high.

S. R. Orr

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J. R. Parks

J. R. Parks

SRO/JRP:pm

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