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RADIATION LABORATORY
BERKELEY 4, CALIFORNIA

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June 30, 1951

Russell H. Ball, Chief
Research Service Branch
U. S. Atomic Energy Commission
Berkeley Area Office
P. O. Box 559
Berkeley, California

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Dear Mr. Ball:

Summary and data are submitted concerning results obtained and methods and equipment employed in the recently terminated atmospheric air sampling program for filterable beta-gamma variations. This program was initiated at the request of the AEC, as transmitted verbally to this office by B. Moyer via W. Nolan April 16, 1951.

SUMMARY

A. Scope

Commencing April 17, 1951, filterable material from a total of 182 outdoor air samplings were collected in duplicate on high efficiency sampling paper. With few exceptions all collection papers were "read" promptly upon termination of the sampling period and "reread" 36 hours later.

Readings were counts per minute determinations for (1) beta-gamma and (2) alpha content, method as described in appendix.

B. Findings

1. All collected alpha and beta-gamma activity decayed to background levels (within the limits of error of the methods) in 36 hours or less, with the exception of four samples as noted in paragraph B.2 below.

2. Four samples (actually two, replicated, Nos. 73 and 74) did not suffer beta-gamma decay promptly to background. In view of the possible interest in these, the beta-gamma decay data are included in this summary. (It is noted that alpha determinations were not made until 151 and 139 hours after collection for the two groups of replicas, respectively,

* Classification designated by Dr. D. Cooksey via B. Moyer 5/3/51.

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due to equipment failure. In each case the alpha activity did not then significantly differ from background). The beta-gamma activity above background however had a decay pattern extending over many days with an estimated average reduction to half value of 480 hours. (21.2 and 18.7 days for the two groups of replicas respectively). See attached curves in Appendix, Graph A.

Beta-gamma Determinations on Samplings and on Background

Samples 73(1) and 73(2) were collected between 1600 on 5/25/51 and 0800 5/26/51, 16 hours total.

| <u>Hours Decay Time</u> | <u>Beta-gamma counts/minute</u> | | <u>Background</u> |
|---------------------------------|---------------------------------|--------------|-------------------|
| | <u>73(1)</u> | <u>73(2)</u> | |
| 0 | 282 | 248 | 22 |
| 55 | 75 | 85 | 22 |
| 73 | 74 | 81 | 22 |
| 97 | 61 | 64 | 21 |
| 121 | 74 | 83 | 21 |
| 144 | 63 | 64 | 23 |
| 217 | 59 | 60 | 21 |
| 240 | 58 | 60 | 23 |
| 288 | 58 | 58 | 21 |
| 385 | 50 | 51 | 22 |
| 432 | 50 | 51 | 25 |
| 481 | 50 | 50 | 20 |
| 576 | 45 | 43 | 23 |

Samples 74(1) and 74(2) were collected between 0800 on 5/26/51 and 2000 on 5/26/51, 12 hours total.

| <u>Hours Decay Time</u> | <u>Beta-gamma counts/minute</u> | | <u>Background</u> |
|---------------------------------|---------------------------------|--------------|-------------------|
| | <u>74(1)</u> | <u>74(2)</u> | |
| 0 | 106 | 96 | 18 |
| 43 | 36 | 35 | 22 |
| 61 | 31 | 35 | 22 |
| 85 | 36 | 35 | 21 |
| 109 | 29 | 33 | 22 |
| 133 | 28 | 34 | 18 |
| 205 | 29 | 29 | 21 |
| 229 | 29 | 29 | 23 |
| 277 | 28 | 27 | 21 |
| 374 | 30 | 29 | 22 |
| 421 | 29 | 28 | 25 |
| 469 | 29 | 26 | 20 |
| 565 | 27 | 23 | 23 |

3. Total initial activity (averages of replicas) and background levels ranged between the following limits, in counts per minute:

| | <u>Samples</u> <u>Initial c/m</u> | <u>Background c/m</u> |
|------------|--------------------------------------|-----------------------|
| beta-gamma | 25-265 | 14-25 |
| alpha | 11-510 | 3-30 |

4. No correlation was found with either alpha or beta-gamma activity and wind direction, velocity or precipitation.

C. Method

With some exceptions, sampling period was 12 hours (14 periods per week) at rate of 4 CFM; each such sample thus represented collection of material from 2,880 cubic feet of air.

The site of collection was the southwest corner of Bldg. 50 roof. Two-inch diameter pick-up tubes leading to the collection filters were presented to prevailing southwest winds beyond the roof parapet. Wind velocity and direction data were procured from the U. S. Weather Bureau Station at South Hall on lower campus.

APPENDIX

A. Method of Sampling

1. Air mover - modified commercial domestic vacuum cleaner.
2. Collection medium - 4" x 9" of 9 mil Hollingsworth and Vose filter paper #H-70 (reportedly better than 99.9% efficient in removing airborne particulates of 0.3 micron mean diameter).
3. Rate of sampling - 4 CFM through 36 sq. inches collection medium at 16 FPM face velocity.
4. Limitations of sampling - The procedure involves sucking air through a pick-up tube thence through the collection medium. Since the tube is but 2" in diameter the velocity at 4 CFM is 200 FPM or about 2½ MPH which is substantially lower than the prevailing wind velocity of about 7-18 MPH at the sampling site. Hence the air samples represent whatever the wind brings to the sampler rather than upon any ability of the sampler to "reach out" across flow lines. Because of perhaps complicated local aerodynamics no conclusive statement can be made about authenticity of the sample with respect to winds in the area. The attempt was made however to select a sampling site not subjected to local stack discharges or to possibly contaminated eddies near the building.

B. Method of Alpha Determinations

Sample collection and background papers are each rolled into tubes, "contaminated" side innermost, and successively inserted into an ionization chamber. Chamber is flushed with argon for one minute. Ionization events are detected on a central electrode, amplified, viewed in an oscilloscope, scaled and registered. Readings are triplicated and averaged. Rereadings are similarly performed after 36 hours decay. (The method is basically the well known "Filter Queen" technique of Pfanstiehl developed in 1944 at Argonne, with minor local modifications).

C. Method of Beta-Gamma Determinations

Sample collection and background papers are folded into 3" x 4" three-layered packets, inserted within a 3.8 cm I.D. bakelite tube which is concentric with an axially positioned G-M tube. A 5.5 cm wall lead chamber surrounds all. Ionization events are amplified and counted on a scaler and register. Readings are triplicated and averaged. Rereadings were similarly performed after 36 hours decay.

RESULTS

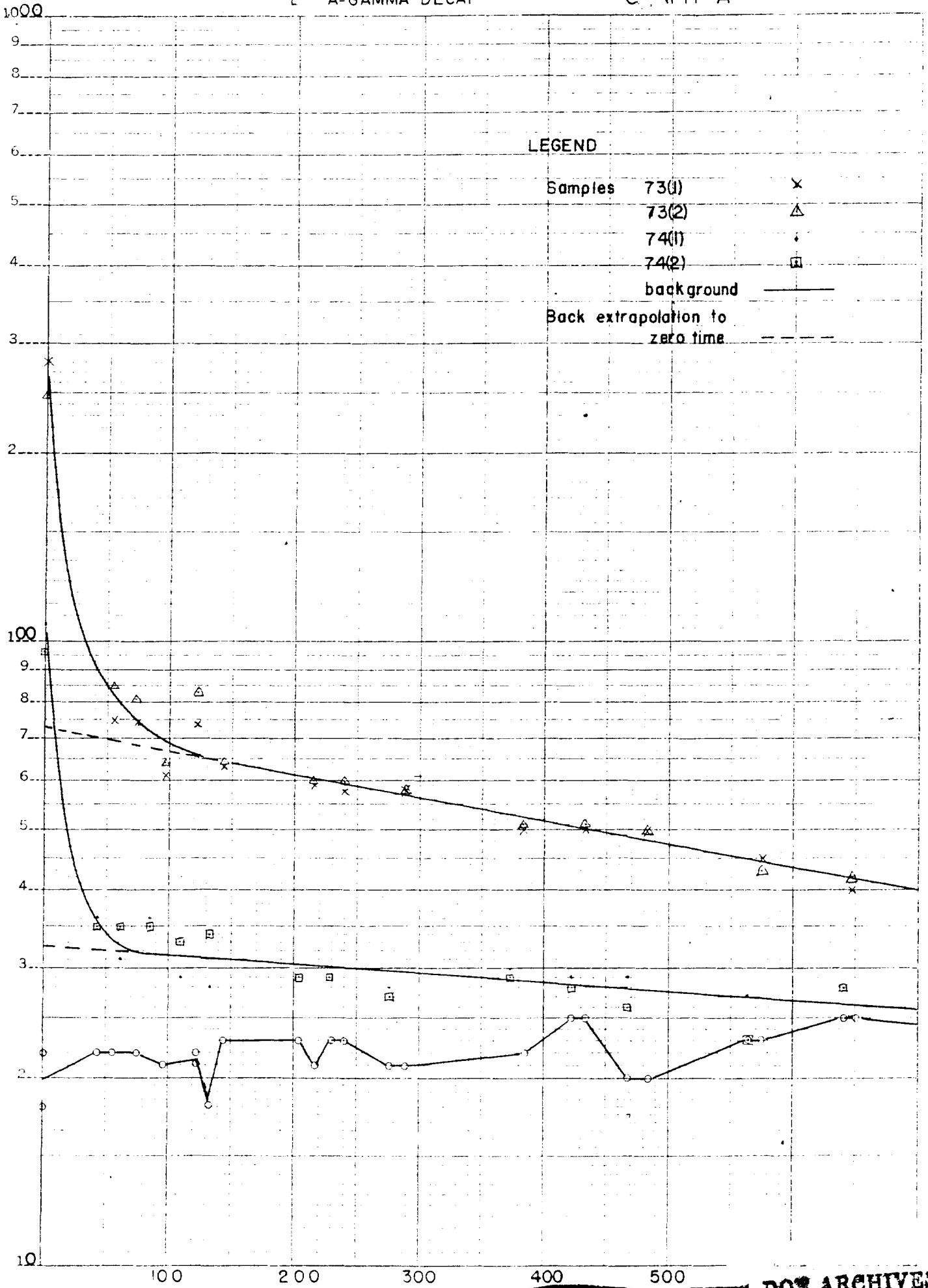
- A. Attached alpha and beta-gamma c/m curves (Graphs B and C) plotted on semilogarithmic paper vs time illustrate the determinations for the two-week periods 5/2/51 to 5/16/51 and 5/20/51 to 6/1/51 respectively. Note that curves labelled "decayed samples" represent data computed as follows: at 36 hours the sample reading may or may not differ from background at that time. Any such difference is added, algebraically, to the background at the time of original reading and plotted as "decayed sample". This procedure tends to eliminate random variation in background from the curve.
- B. Computation of half value for the long lived beta-gamma material as summarized in paragraph B.2 above is set forth in Graph A and computation sheet following.
- C. Complete data are on file in this office, including weather information.

Very truly yours,

M. D. Thaxter (for N. B. Garden)
Health Chemistry

MDT:djt

cc: Dr. D. Cooksey

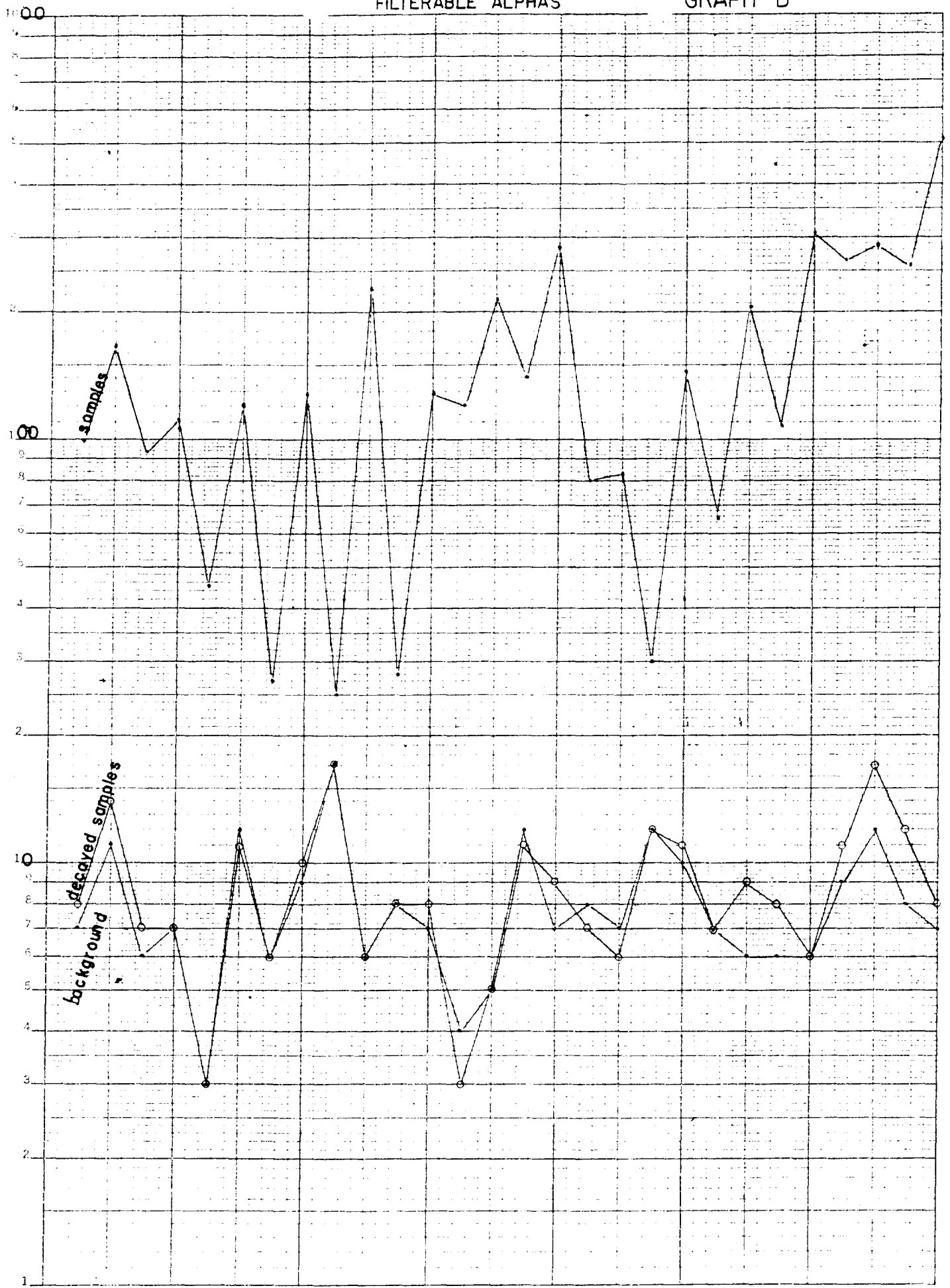


COUNT RATE (COUNTS PER MINUTE)

HOURS

GRAPH A

| | <u>Samples</u> | |
|----------------------------------|----------------|------------|
| | <u>#73</u> | <u>#74</u> |
| Back extrapolation to 0 time c/m | 73 | 33 |
| Less average background | -21 | -21 |
| Net long lived beta-gamma c/m | 52 | 12 |
| "1/2 value" | 26 | 6 |
| Plus average background | +21 | +21 |
| Ordinate for 1/2 value c/m | 47 | 27 |
| 1/2 value time indicated - hours | 510 | 450 |
| 1/2 value time indicated - days | 21.2 | 18.7 |



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