#12

NAVAL MEDICAL RESEARCH INSTITUTE
NATIONAL NAVAL MEDICAL CENTER
BETHESDA 14, MARYLAND

NP-27-mve
M3-4
Ser: 00111
7 May 1954

[redacted]

SECRET
RESTRICTED DATA

407577

From: Commanding Officer, Naval Medical Research Institute
To: Project Officer 4.1, Task Unit 13, JTF-7

Subj: Assay of radioactive samples; report on

Encl: (1) Six (6) graphs

1. Earth, water, and food samples received in this Institute 1 April 1954 from your project have been assayed. A report of the procedure and results as prepared by G. W. Imirie follows. Although the receipt of these samples was anticipated, delay in reporting has been incurred by the required repair of four of six nucleometers and the burn-out of two high voltage transformers after the assay was begun.

a. The decay of the radioactive constituents of the samples was determined by the use of separate nucleometers for each sample. Aliquots of each sample were so selected as to yield optimum counting rates. These rates were continuously recorded by Esterline-Angus recorders.

b. The specific activities of each of the three samples was determined at 1400, 13 April 1954, or H + 1040 hours. This assay was made with a proportional counter, Nuclear Measurements Corporation PC-1, which has a counting efficiency of 100% for beta particles at a 50% geometry. The results are as follows:

(1) Soil sample - Approx. 28,000 disintegrations per minute per gram.

(2) Cistern water - Approx. 20,000 disintegrations per minute per cc.

(3) "Jugaroo" - Approx. 10,000 disintegrations per minute per cc.

The cistern water and jugaroo were filtered upon arrival; the solids were found to be non-radioactive. The assay of the filtered cistern water and the jugaroo was made on dried samples. However, only a gross assay was done on a sample of 1.716 grams of soil, so that there resulted an undetermined self-absorption of the radiation.

c. The results of the decay determination on each of the three samples are as follows:

[redacted]

SECRET
[redacted]

DECLASSIFIED

STATUS VERIFIED UNCLASSIFIED
AUTHORIZED DERIVATIVE CLASSIFIER
5/7/97
DATE

RESTRICTED DATA
This document contains restricted data as defined in the Atomic Energy Act of 1946. Its transmittal or the disclosure of its contents in any manner to an unauthorized person is prohibited.

CLASSIFICATION CANCELLED
Date..... By .....
Per Authority of .....

(1) Soil $I = I_M \left(\frac{T}{T_M}\right)^{-1.20}$

(2) "Jugaroo" $I = I_M \left(\frac{T}{T_M}\right)^{-1.60}$

(3) Cistern water $I = I_M \left(\frac{T}{T_M}\right)^{-1.90}$

d. The data taken on each of these three samples are reliable and apparently without error. No incontestable accounting can be given for the three different slopes of -1.20, -1.60, and -1.90. However, the following possible explanation is offerred:

Since the "fallout" was of visible weighable size as opposed to micron diameter, quantities of chemicals foreign to the cistern water or jugaroo would be present as components of the "fallout". It appears possible that this material acted as a carrier for the radioactive constituents and selectively adsorbed on the liquids' container walls or precipitated out of solution. This effect would disturb the normal balance of fission product distribution and account for the decay law's exponent being a value other than -1.20. It is inferred by Way and Wigner[1] that the decay law exponent cannot possibly be greater than unity at sufficiently short times because this would result in an infinite total dose. The present data contain no information as to the time at which the exponent became larger than one, but on the assumption that it was before H + 5 hours, the total doses between H + 5 and H + 50 hours are as follows:

(1) Soil 137 r

(2) "Jugaroo" 610 r

(3) Cistern water 1275 r

The soil sample should be representative of the "fallout" unless it had been leached by rain. The fact that the decay of this sample follows a $T^{-1.20}$ law confirms other workers' results. Initial data from Operation Castle[2] indicates that the fission product decay follows the curve:

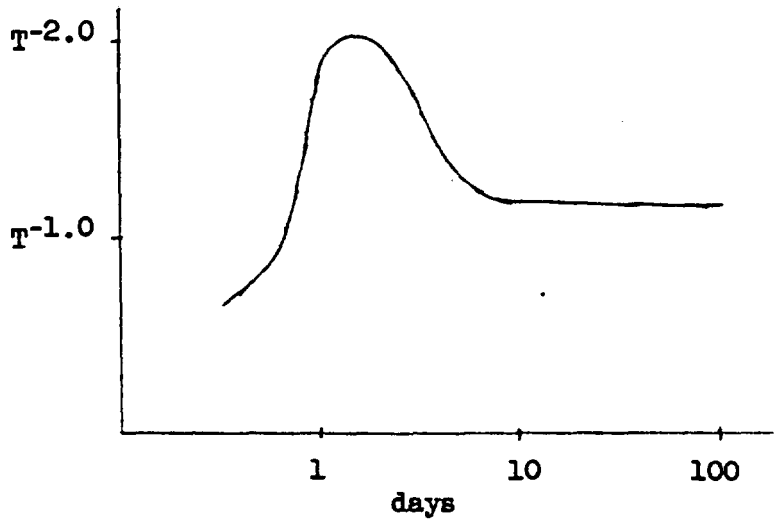
---

[1]K. Way and E. Wigner, Phys. Rev. 73, 1318 (1948).

[2]Private conversation between G.W. Imirie and AFSWP.

DECLASSIFIED

~~SECRET~~
~~RESTRICTED DATA~~



Using the value of $T^{-1.20}$, the calculated dose received by the natives is 137 r, which is in approximate agreement with the exposure estimated from the observed biological effects.

2. A determination was made of the radiation energies of each sample. There was no alpha particle activity present. There is no hard gamma radiation present at this time; this may not be true at a much later date when the long-lived daughter products are the predominate part of the total activity.

Using a thin-window Geiger counter at a 15% counting geometry, approximately 600 mg/cm^2 of Al (2mm.) diminishes the count by a factor of about 60. Five millimeters of Al absorber decreases this count to approximately background irrespective of a zero absorber initial count.

The shape of the absorption curves indicates the likelihood of either (1) K-capture phenomenon with its accompanying X-ray and Auger electron emission, or (2) a very soft beta particle about 0.1 Mev, and a harder one about 1.0 Mev; the first appears more likely.

3. The preponderance of active material in the soil sample appears to be centered in the R_2O_3 chemical group and the heavy metals group. Much of the activity appears soluble in hydrochloric acid, nitric acid, sodium hydroxide, and a potassium bisulfate fusion. These few observations with others made during the chemical treatment are compatible with the presence of rare earths, one of the more abundant groups of fission products.

DECLASSIFIED

~~SECRET~~

~~SECRET~~
~~RESTRICTED DATA~~

4. The preliminary chemical and radiation assay of earth, water, and food samples from Rongelap Island indicates that the "fallout" is quite active, the decay apparently is characteristic, and that rare earths and the heavy metals group of chemicals are possibly present.

5. Recommendations:

a. The decay law requires further study and evaluation as to the variables of time, distance, and assay of elements present in the "fallout".

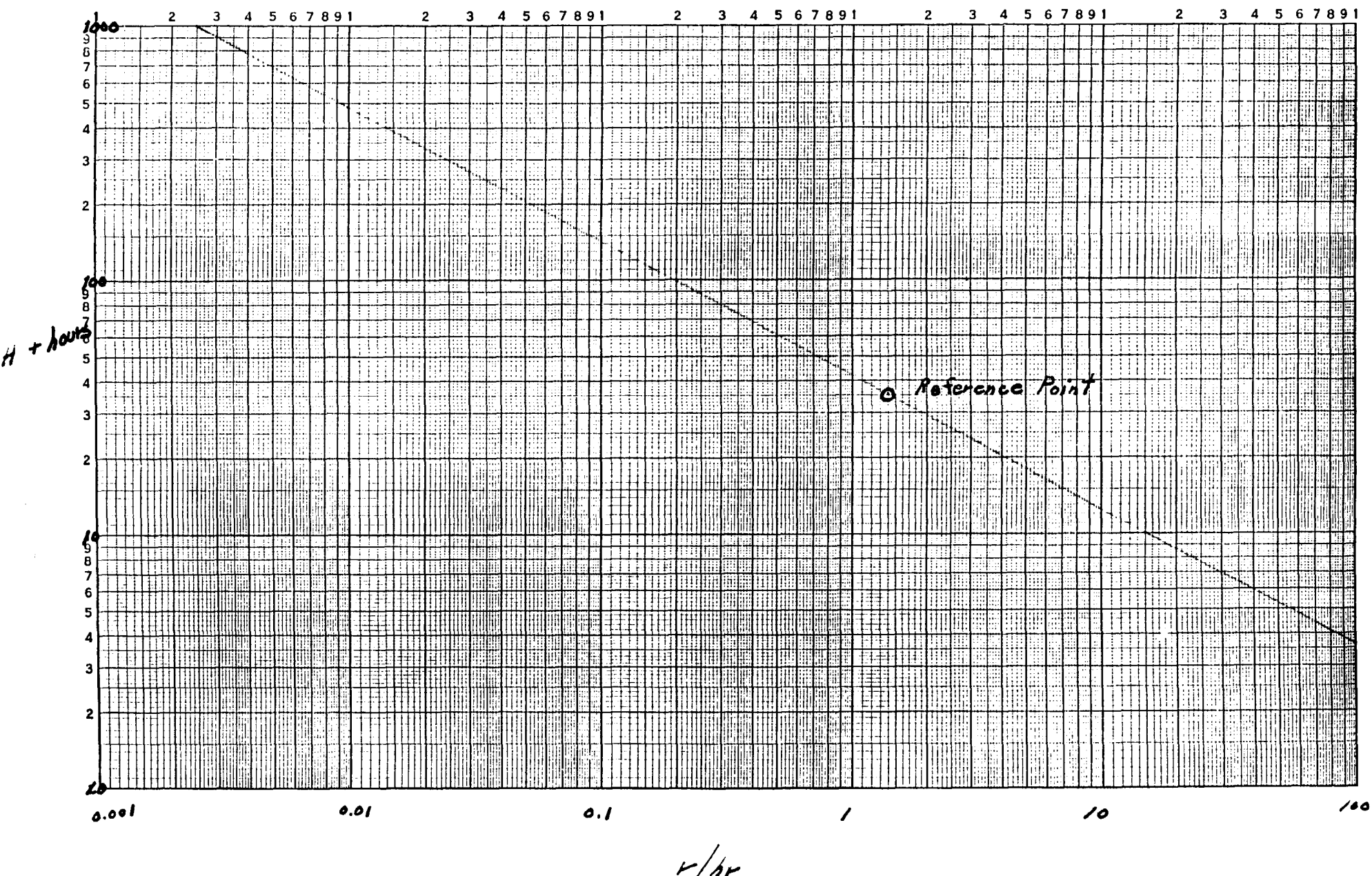
b. In view of the softness of the radiation, methods of measurement of radiation dosage from "fallout" require careful evaluation.

Wilbur E. Kellum
WILBUR E. KELLUM
Captain, MC, USN

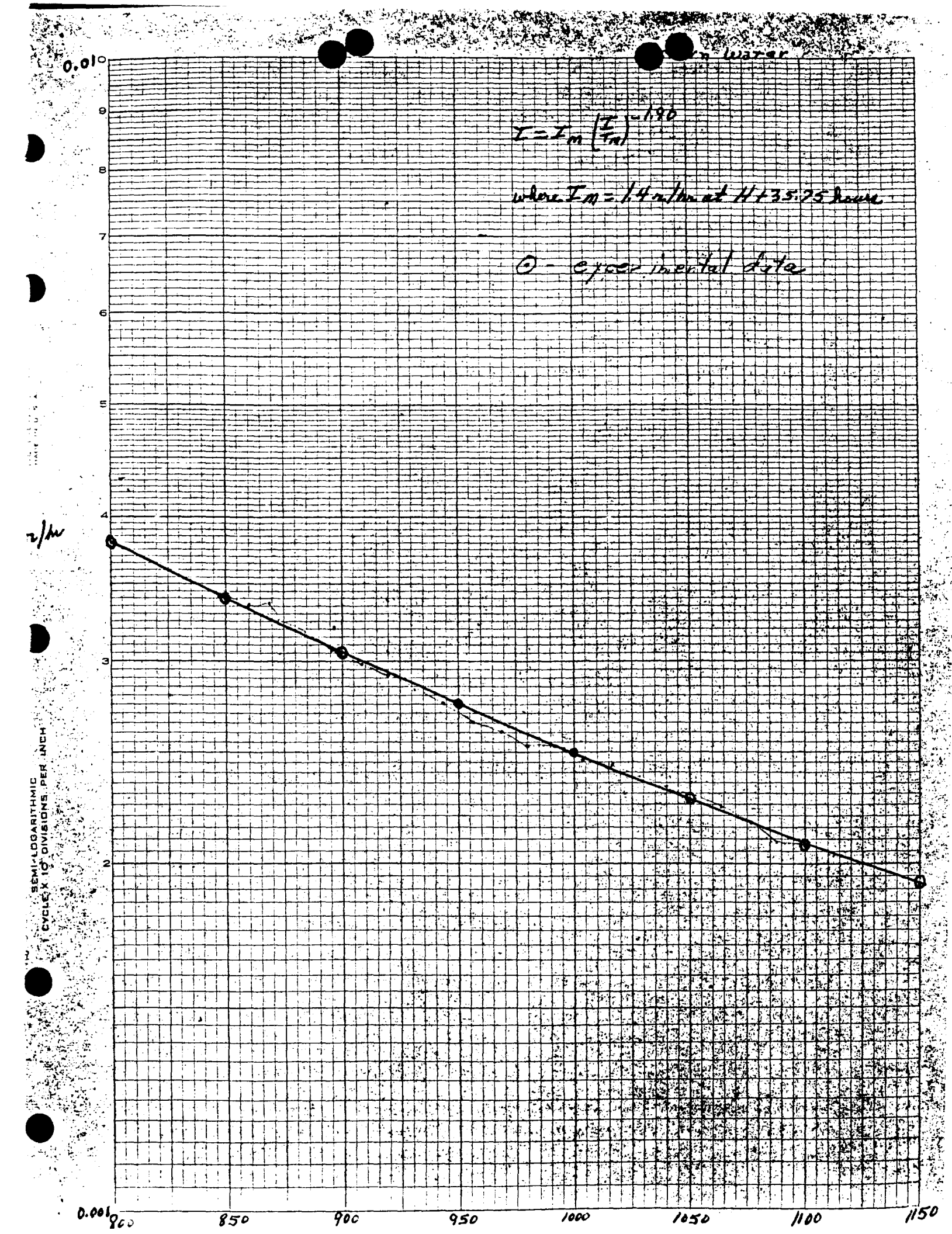
Copy to:
USNRDL

KEUFFEL & ESSER CO., N. Y. NO. 358-125
Logarithmic, 3 × 5 Cycle
F. C. C. Sheet
MADE IN U.S.A.

$$I = I_M \left(\frac{T}{T_M}\right)^{-1.90}$$

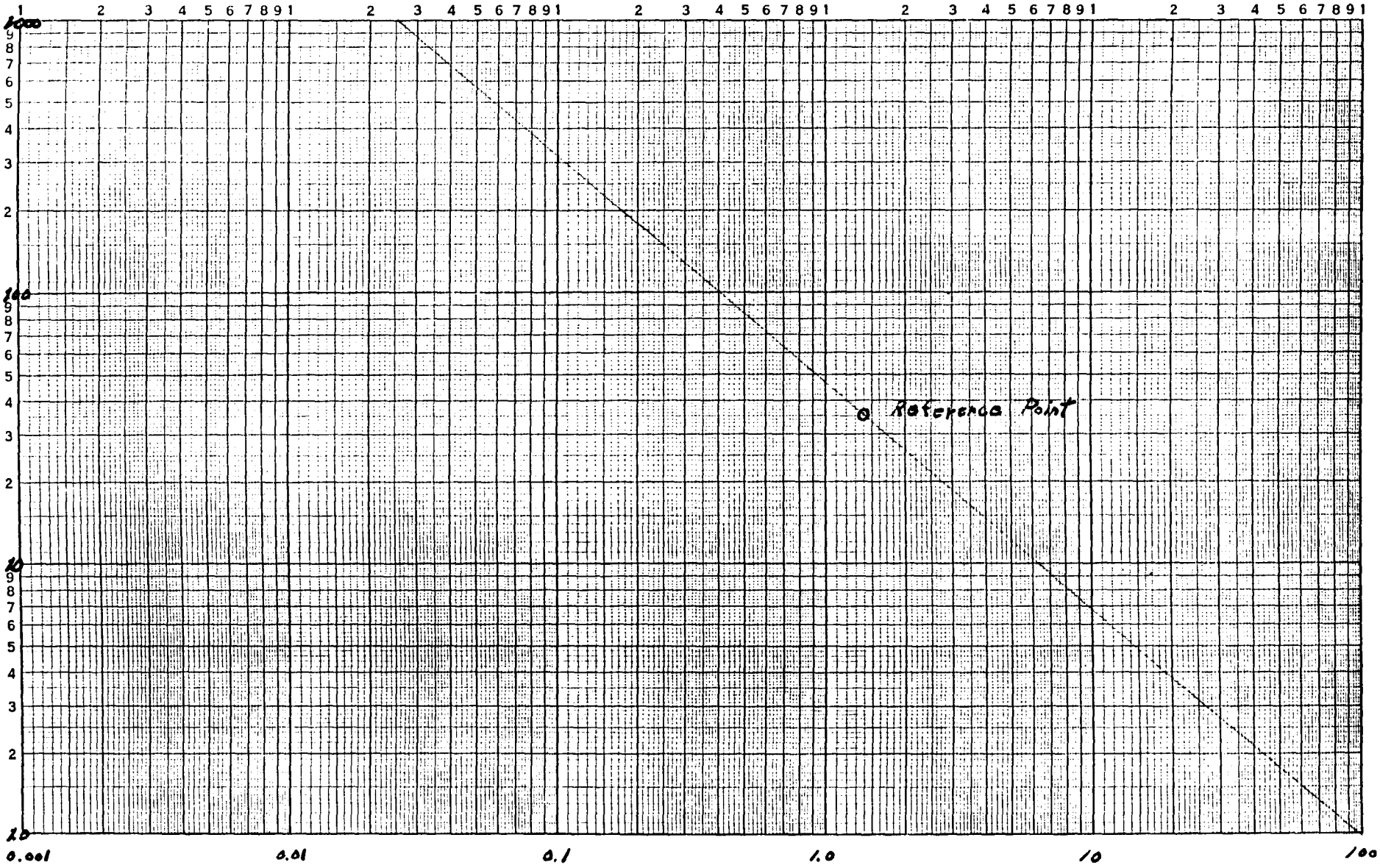


E. # 1


0.01
9
8
7
6
5
4
3
2
0.001
r/hr
in water
$I = I_m \left(\frac{T}{T_m}\right)^{-1.96}$
where I_m = 1.4 r/hr at H+35.75 hours
⊙ - experimental data
800
850
900
950
1000
1050
1100
1150
SEMI-LOGARITHMIC
1 CYCLE X 10 DIVISIONS PER INCH

KEUFFEL & ESSER CO., N. Y. NO. 358-125
Logarithmic, 3 × 5 Cycles
F. C. C. Sheet
MADE IN U.S.A.

$$I = I_M \left(\frac{T}{T_M}\right)^{-1.20}$$



Samples

$$I = I_m \left(\frac{T}{T_m}\right)^{-1.2}$$

where $I_m = 1.4$ r/hr at $H + 35.75$ hrs.

O = experimental data

r/hr

10
9
8
7
6
5
4
3
2
0.01

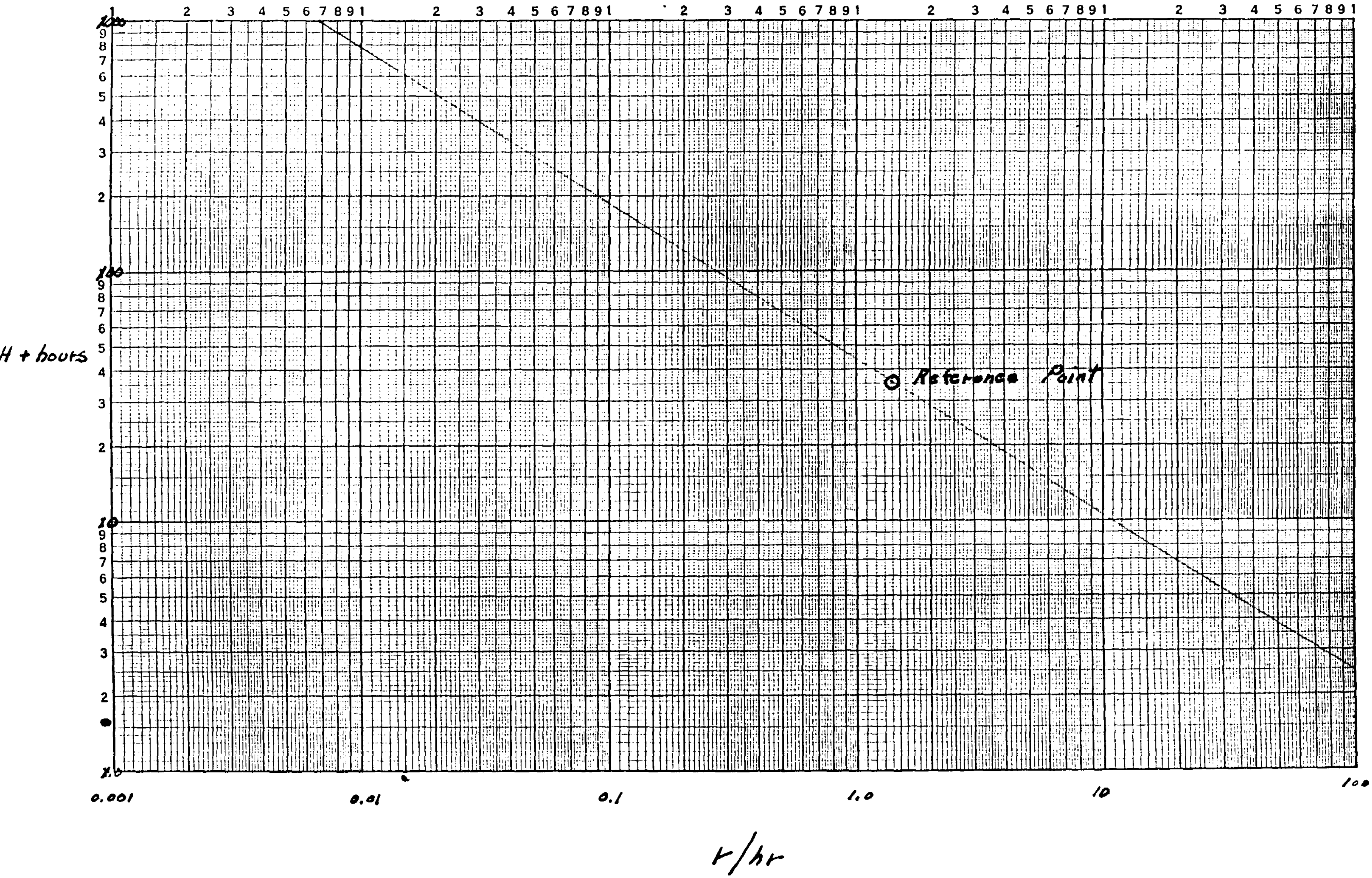
950 900 950 1000 1050 1100 1150 1200

H + hours

KEUFFEL & ESSER CO.
MADE IN U.S.A.
SEMI-LOGARITHMIC
CYCLE X 10 DIVISIONS PER INCH

KEUFFEL & ESSER CO., N. Y. NO. 358-125
Logarithmic, 3 × 5 Cycles
F. C. C. Sheet
MADE IN U.S.A.

$$I = I_M \left(\frac{T}{T_M}\right)^{-1.60}$$

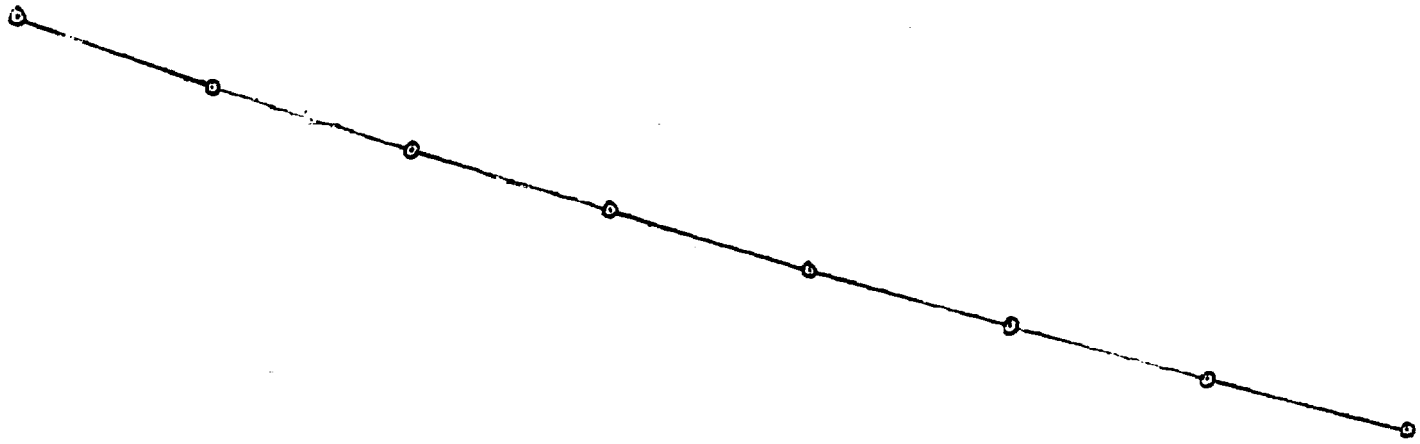


F. #5

0.010

$$I = I_M \left(\frac{T}{T_M}\right)^{-1.60}$$

where I_M = 1.4 c/hr at H + 35.25 hrs.



c/hr.

0.001

1050 1100 1150 1200 1250 1300 1350

H + 0000

TU-13

Forwarding of Blood Counts

Lt Eugene P. Cronkite,USN
Navy No. 824
c/o FPO
San Francisco, Calif.

Commander, Task Unit 13
Task Group 7.1
APO 187-HDw, PO Box 8
c/o PM, San Francisco, Cal.

22 Mar 54
PRICKETT/clg

JF-5312

The blood counts for certain Navy personnel are attached as Incls 1, 2 and 3. Col Maupin advises that their total exposure was between 85 and 95 roentgens.

4 Incls:
1 - SF514b, dtd 11, 12, 13 and 14 Mar, re: Bush, W.M.
2 - SF514b, dtd 11, 12 and 13 Mar re: Hall, G.H.
3 - SF 514b, dtd 11, 12 and 13 Mar re: Peach, R (n)
4 - Cy of ltr dtd 16 Mar fm USS Belle Grove

H. K. GILBERT
Colonel, USAF
Commander, TU-13

Cy furn:
JTF 7 - Estes (w/o Incls)
CTG 7.1 - Estes (w/o Incls)