S ALAMOS SCIENTIFIC LABORATORY
UNIVERSITY OF CALIFORNIA
LOS ALAMOS, NEW MEXICO

OFFICE MEMORANDUM

TO : Wright H. Langham

DATE: February 3, 1959

701463

FROM : Marvin A. Van Dilla

SUBJECT: KELLEY ACCIDENT

SYMBOL : H-4

REPOSITORY LanL-RC CRM records Center/Archive
COLLECTION H-4 Radiobiology Group
BOX No. A-92-095, Box 1
FOLDER #1 (1-1, A-92-095

1) Measurement on corpse was made with 3 x 3 inch NaI and a count rate between 2.0 and 3.0 Mev (this region contains the Na-24 peak at 2.76 Mev) was used in the calculations. Na-24 calibration subjects were Don Petersen, Hub Weber, and Glessie Trafton (Fig I). Result (corrected to time of accident) is:

292 μc	(corpse)
0.3 μc	(urinary excretion)
0.1 μc	(fecal excretion)
0.5 μc	(diarrhea fluid)
293 μc	(total)

2) Measurement of whole blood activity leads to serum specific activity of 3.77 mμc per mg Na, based on the following values:

$\text{Serum}^{SA}_{Na} = 5.13 \times \frac{1}{.42} \times \frac{1}{3.33} = 3.66$ mμc/mg.

mμc/ml whole blood = 5.13

mg Na/ml serum = 3.24 (3.33)

hematocrit = 58

Marv 3.66
meat 3.90
2) 7.56
6
75

(3.78 mμc/mg Na ave

3) Soft tissues (Table I) all contain similar Na-24 per gram. Since sodium is extracellular, this means extracellular fluid fractions are similar. Exceptions are hilar lymph nodes (largest fraction of ECF) and psoas muscle (smallest fraction of ECF).

LANL

0007281

TO: Wright H. Langham DATE: February 3, 1959

Table I - Na-24 in Kelley Tissues (corrected to time of accident)

Sample	Weight (grams)	mμc per gm tissue
Heart	372	3.57
Psoas (skeletal) muscle	174	1.54
Lungs	854	3.62
Liver	297	2.48
Kidneys	252	4.36
Spleen	108	3.15
Adrenal	3.5	4.51
Thymus	25	3.28
Stomach	203	3.31
Ileum	91.5	5.21
Jejunum	169	6.30
Colon	161	3.57
Hilar lymph nodes	5.3	7.94
Whole blood		
Weighted average (soft tissue)		3.61
Serum		12.20
Sternal bone		7.30
Sternal cartilage		7.60
Vertebral bodies		6.52
Corpse		3.76

LANL

0007282

4) If sodium space is taken as:

$$\text{Na Space} = \frac{Na^{24}/\text{gm tissue}}{Na^{24}/\text{gm serum}} 100\%$$

then sodium space of the soft tissues = 29.6%, which is close to the value of 25% reported by Hevesy (Radioactive Indicators, page 207).

5) Bone contains more sodium per gram than soft tissues. This is due to the sodium content of bone mineral. According to Edelmann et al (4th Conference on Metabolic Interrelations, Josiah Macy Foundation (1952), page 240), about 30% of body sodium is in bone; about 50% of bone sodium is exchangeable. Hence, bone specific activity S is given by

$$S = 0.50\ S_E + 0.50\ S_{NE}$$

where

S_E = specific activity of exchangeable fraction

S_{NE} = specific activity of nonexchangeable fraction

Since S_E = serum specific activity which we know (3.77 mμc/mg Na), we can calculate S_{NE} for sternum and vertebral bodies when cold sodium is measured. This should give information on depth dose distribution.

LANL

0007283

6) Sternal cartilage and sternal bone have almost the same Na-24 per gram.

7) Godiva activation shows sternal bone and vertebral bodies have same sodium per gram.

8) Fecal sample showed 15-hour Na-24 and 38-minute Cl-38, and a third activity which seems to be 2.6-hour Mn-56 (daily intake of manganese is about 5 mg normally; only stable isotope is Mn-55 with a fairly large -- 13-barn -- thermal cross section; maximum concentration in nuts and cereals).

9) Tooth with amalgam filling shows 47-day Hg-203 and 110-day Ag-110. Godiva activation did not change activity. I am taking a spectrum today (February 2, 1959). If observed decrease in activity is consistent with above half-lives, I will turn it over to Moe Milligan for cold mercury and cold silver analysis (Payne agrees). Done 3 Feb 59

10) Rod Day's spectra taken at 4 hours and 70 hours after the accident show a 15% loss of Na-24 in this time interval (66 hours). This is very close to the value of 13% expected from Chet Richmond's data on Na-22 retention in people (LA-2207).

At the time of the accident, Rod Day's body content of Na-24 was ~~0.9~~ 1.1 μc (Fig II shows calibration).

MAV:ES

Marvin A. Van Dilla

LANL

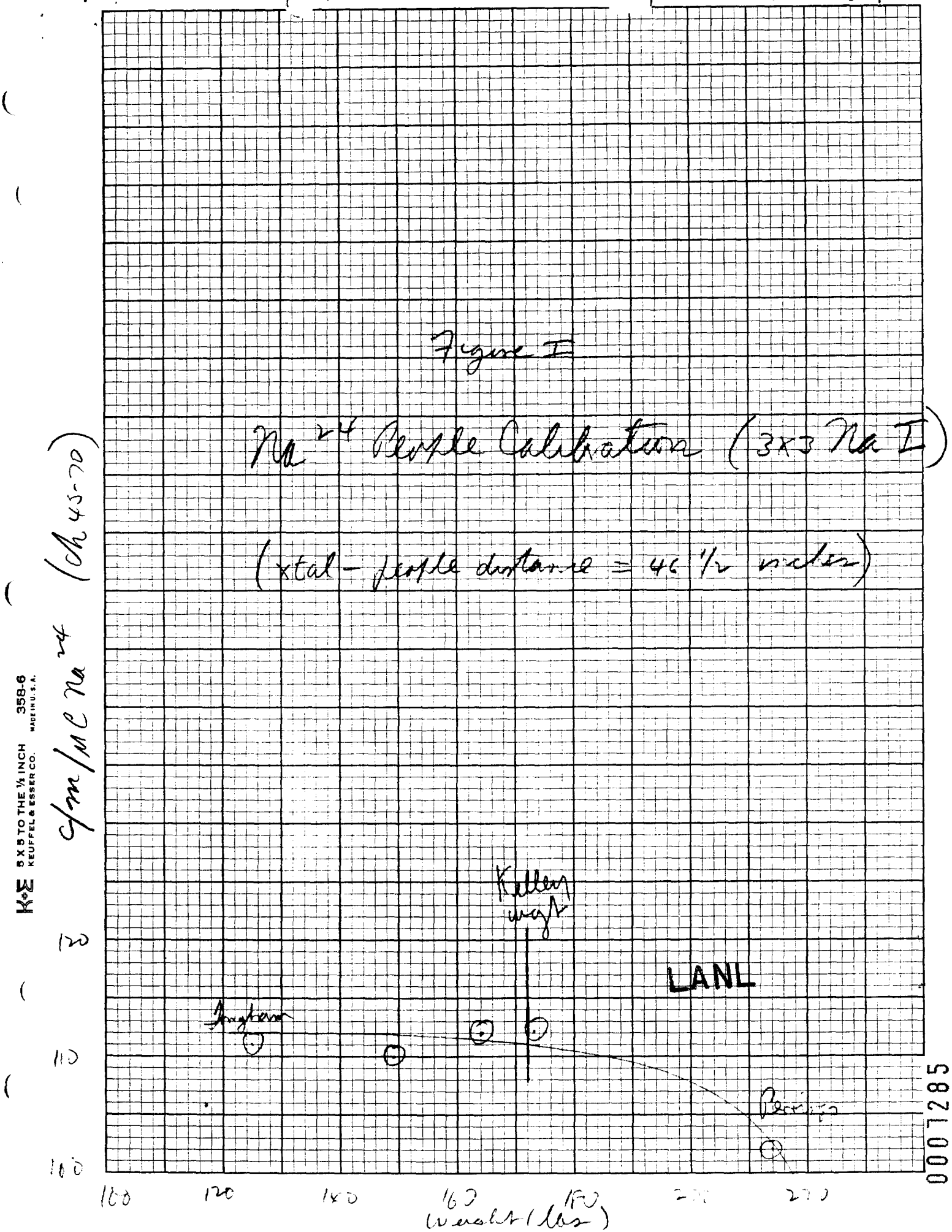
0001284

47 Feb 59

Figure I

Na^{24} Peaple Calibration (3x3 Na I)

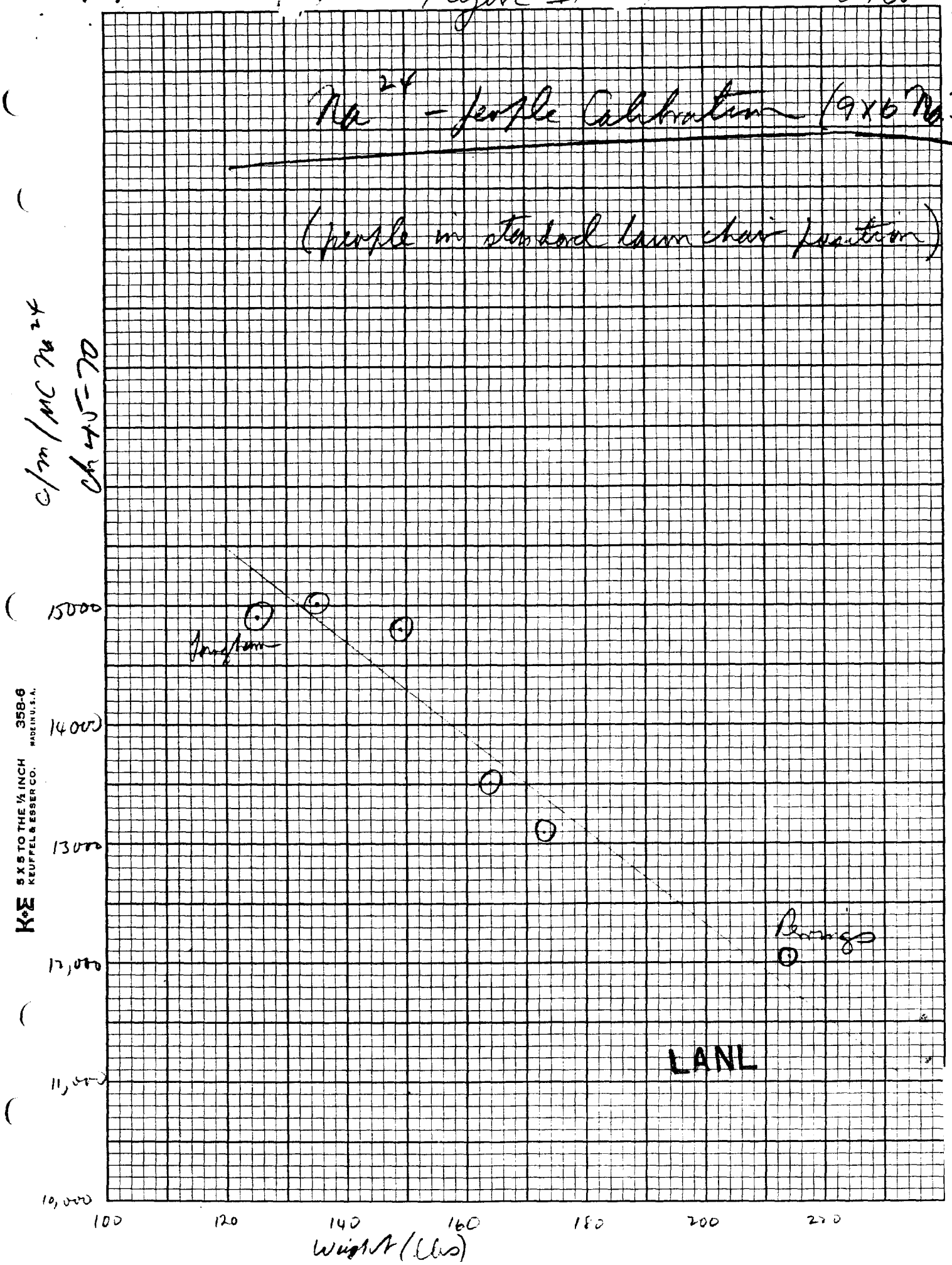
(xtal - peaple distance = 46 1/2 inches)



K+E 5 X 5 TO THE 1/2 INCH 358-6 KEUFFEL & ESSER CO. MADE IN U.S.A.

0007285

Figure II 3 Feb 59



0007286