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CALIBRATION OF A SLOW NEUTRON POCKET DOSEMETER

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HEALTH PHYSICS DIVISION

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Ben Kalmon

On loan from

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Calibration of a Slow Neutron Pocket Dosemeter

A boron lined, thermal neutron sensitive, pocket dosemeter has been tested for response to radium gamma, Po-Be fast neutrons, and thermal neutrons from the Clinton Pile. The dosemeter is manufactured by Kelley-Koett Manufacturing Company, catalog number K-300, serial number N-125.

The meter responds to the $B(n, \alpha)$ Li reaction in which the alpha particle produces the ionization within the chamber. A capacitor is inserted in parallel with the chamber in order to decrease the gamma response. The total chamber capacitance, with the parallel condenser, is 197 $\mu\mu f$ as measured on a Boonton Radio Corporation model number 160-A, "Q" meter.

Radium gamma exposure to approximately 500 mr indicated less than 10 mr. On exposure to 7.35×10^6 fast neutrons per square centimeter, from a Po-Be fast neutron source, there was no significant response.

7.35×10^6 fast neutrons per square centimeter is 127.5% of the maximum daily permissible dose. The maximum daily permissible dosage rate is considered to be 200 fast neutrons per square centimeter per second for an eight hour working day.

The meter was exposed in a thermal neutron field at Clinton Pile up to a total exposure of 65.24×10^6 neutrons/cm^2. 1600 thermal neutrons per square centimeter per second is considered to be the maximum daily permissible dosage based on an eight hour working day. The flux was determined by a boron lined Lauritsen electroscope previously calibrated by the indium foil method. The data and calibration curve is attached to this memorandum. The insulation leakage of the dosemeter was 5 mr in 18 hours.

All measurements were made with a Victoreen model number 287 minometer, serial number 287-1001. The range used was the 0-200 mr. The minometer was also used as the charging device.

There are two minor faults that could be easily remedied. First, the anodized coating on the meter case made poor electrical contact with the minometer case. The dosemeter should have a bare metal tip of sufficient length to make firm electrical contact. As an expedient, a coating of aquadag was painted on the case. The aquadag coating improved

The maximum permissible exposure flux to thermal neutrons in use at Oak Ridge National Laboratory during the past few years has been 4525 neutrons/cm^2 sec for an 8 hr day corresponding to 50 mrep/day. The value of 1600 neutrons/cm^2 sec for an 8 hr day was used at Oak Ridge National Laboratory until 1945.

the electrical contact. Secondly, the dosemeter fit too loosely into the minometer. By improper insertion, the capacity of the system was changed sufficiently to cause a reading error of as much as 30 mr. This could be improved by fabricating a tighter fitting connector into the minometer. However, it must be remembered that the pocket meter and the charge-reader were made by two different companies.

With the elimination of the two minor faults, the pocket meter is satisfactory as a personnel monitoring instrument for thermal neutrons. Its sensitivity is such that the maximum daily permissible dose, for thermal neutrons, indicates approximately 120 mr.

Table I

Neutron Flux $n/cm^2/sec.$	Total Neutron Exposure $(n/cm^2) \times 10^{-6}$	Indicated mr
2610	7.52	15
3070	5.89	18
7200	7.79	20
4380	9.74	27
6720	16.12	41
5140	24.65	55
2352	25.42	60
5680	27.90	65
5140	37.00	92
5670	46.30	117
9150	50.0	120
5670	51.04	130
4470	55.6	158
4470	60.42	165
4470	65.24	170

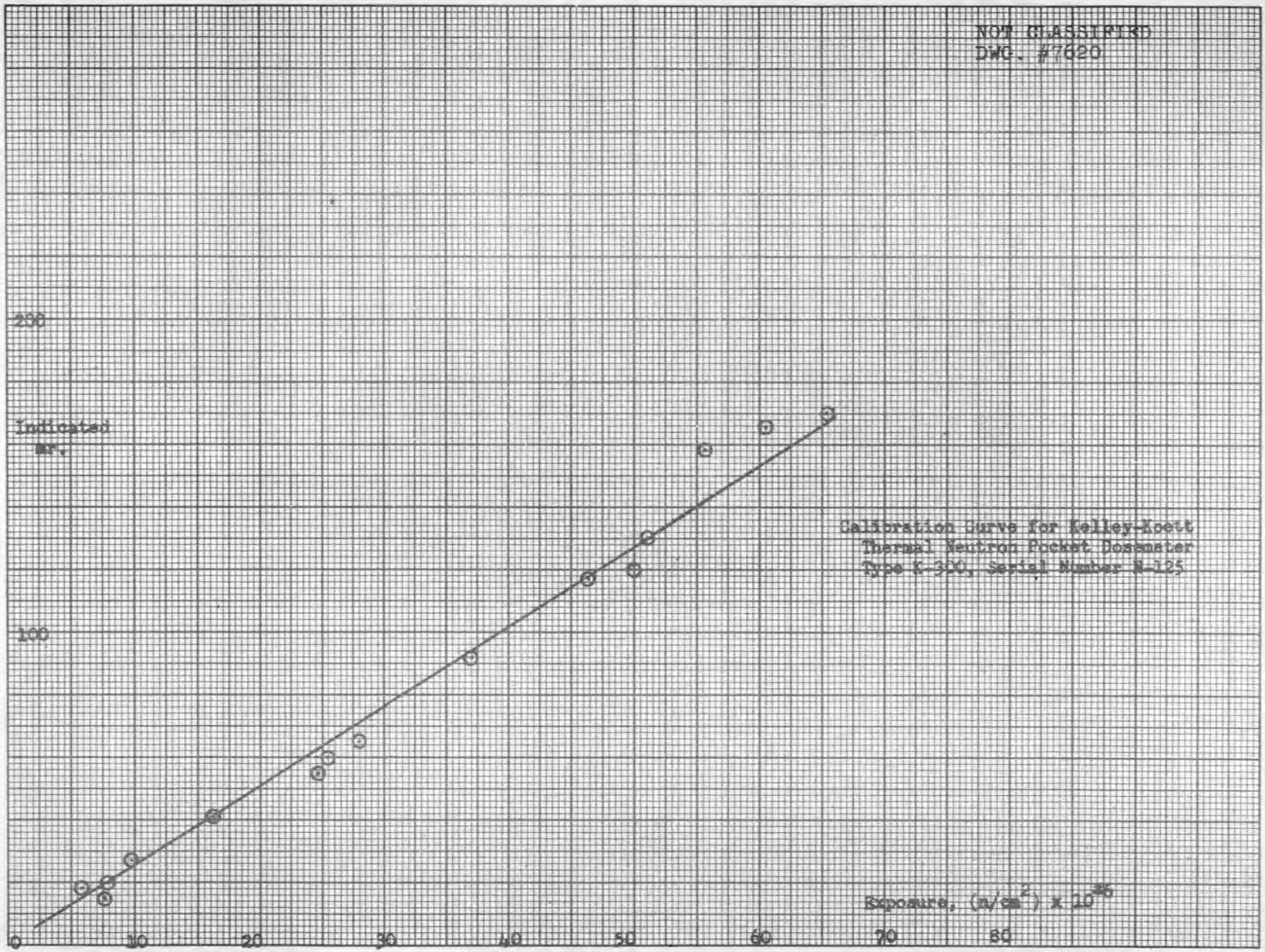
NOT CLASSIFIED
DWG. #7620
200
Indicated
mr.
100
Calibration Curve for Kelley-Koett
Thermal Neutron Pocket Dosimeter
Type K-300, Serial Number N-125
Exposure, (n/cm²) x 10³⁶
0
10
20
30
40
50
60
70
80

Figure 1.

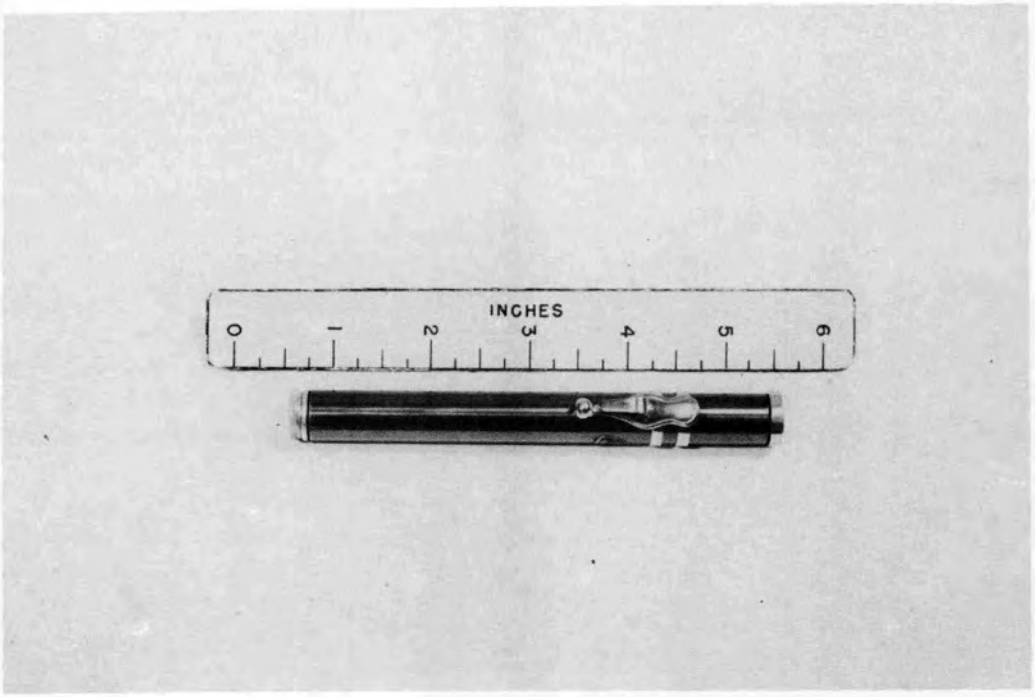

FIG. 2

ASSEMBLED THERMAL NEUTRON POCKET DOSEMETER

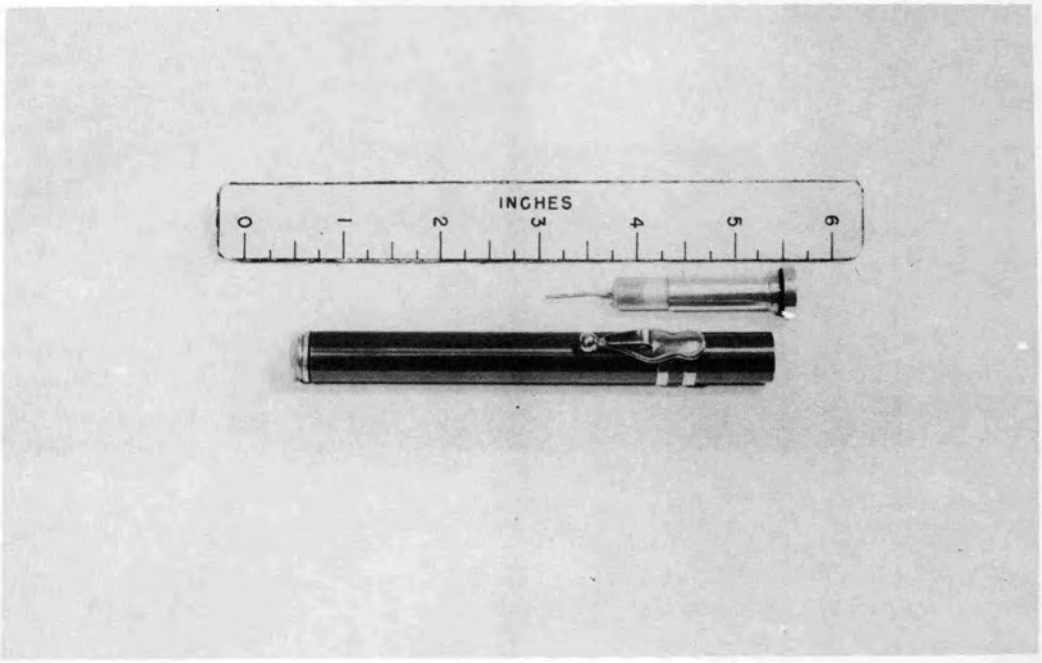

FIG. 2a

DISASSEMBLED DOSEMETER SHOWING CAPACITOR MOLDED IN INSULATOR

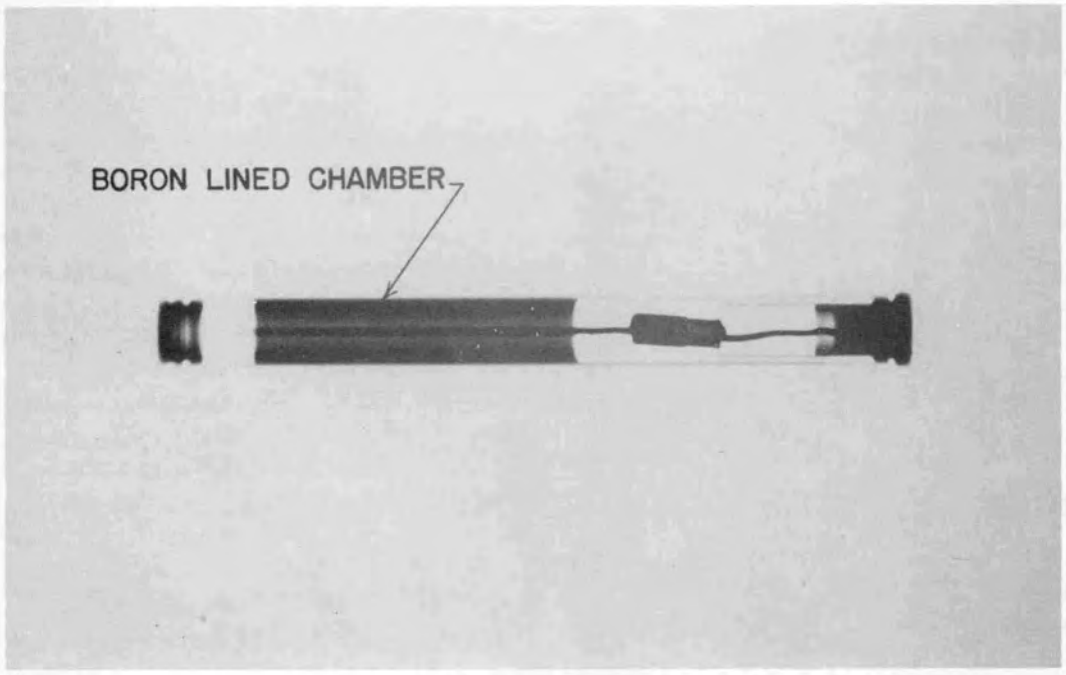

FIG. 3

X-RAY RADIOGRAPH OF ASSEMBLED DOSEMETER
—FULL SCALE

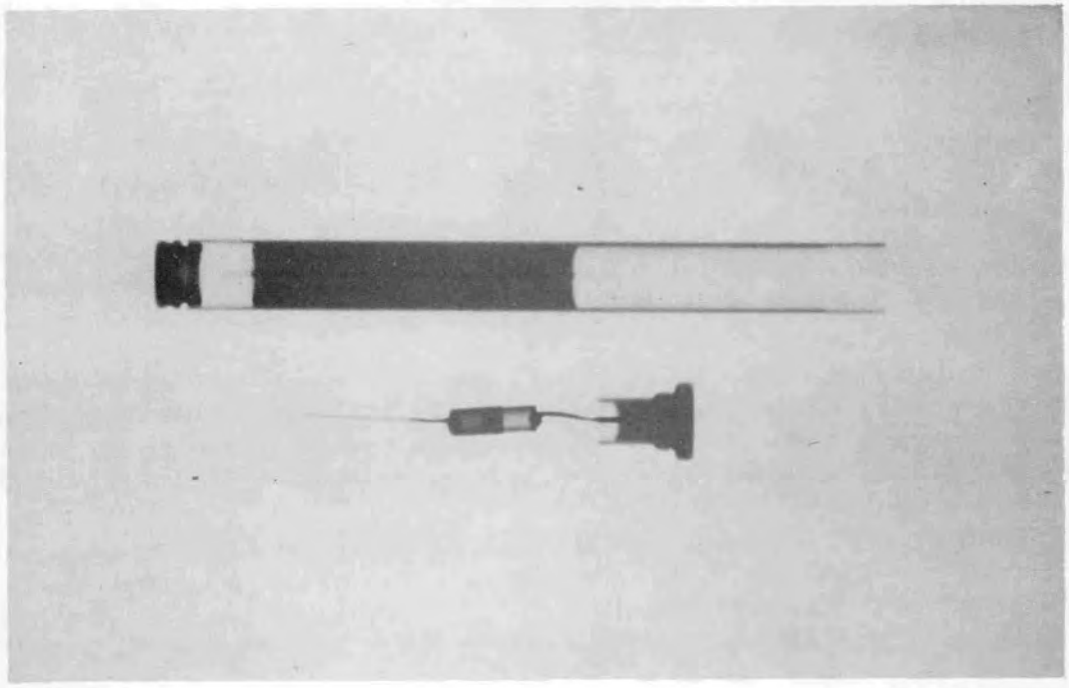

FIG. 3a

X-RAY RADIOGRAPH OF DISASSEMBLED DOSEMETER
— FULL SCALE