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Richland, Washington
September 24, 1953

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From: E. D. Falk

RADIATION STUDIES 234-5 BUILDING (VII)

SENSITIVITY OF NUCLEAR TRACK FILM TO Pu-F NEUTRONS

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1956

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SPECIAL RE-REVIEW
FINAL DETERMINATION
DECLASSIFICATION CONFIRMED
BY J. P. Dersman DATE 6-8-81
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INTRODUCTION

The results of theoretical calculations regarding the sensitivity of the NTA emulsion to both Po-B and Pu-F neutrons were described in HW-22020. The purpose of this report is to describe the results of an experiment which was performed to verify these values. Data relating to both the sensitivity and the amount of fading which takes place prior to developing were obtained.

SUMMARY

The NTA emulsion exhibits a sensitivity for Pu-F neutrons of 2.9 ± 0.5 tracks per 10^4 neutrons. The extent of the fading amounts to 40% in one week and 60% in two weeks. This value for the sensitivity of the NTA emulsion is in good agreement with the value of 2.7 tracks per 10^4 neutrons as given in HW-22020. The data relating to the sensitivity for Po-B are somewhat inconclusive due to one apparently high result. The fading, however, amounts to about 10-15% in two weeks. Data taken previously indicate that both the sensitivity and the extent of the fading are affected by the age of the film.

MEASUREMENTS OF SENSITIVITY AND FADING

The film, for the portion of the experiment dealing with Po-B neutrons, was handled in the routine manner by Calibrations. The film, for the portion dealing with Pu-F neutrons, was exposed for 6 1/4 hours to 836.7 grams of plutonium fluoride in a cylindrical container of inner diameter 10.16 cm filled to a depth of 5.71 cm. The number of neutrons per unit of time impinging on the film was determined with a BF_3 long counter in a Hanson Moderator. This counter has a uniform sensitivity to neutrons in this energy range¹⁾.

The results are shown in the following table and also in Fig. 1.

FILM SENSITIVITY
TRACKS PER 10^4 NEUTRONS

Time Between Exposure and Development	Pu-F	Po-B (Exposure 1)	Po-B (Exposure 2)
7 Min.	-	-	5.7 ± 0.4
12 Hours	2.9 ± 0.5	6.2 ± 0.4	-
168 Hours	-	-	5.2 ± 0.4
180 Hours	1.7 ± 0.3	4.9 ± 0.5	-
348 Hours	1.1 ± 0.6	4.8 ± 0.4	-

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The comparison between calculated and experimental values for small delay in development is:

	<u>Tracks per 10⁴ Neutrons</u>	
	<u>Calculated</u>	<u>Experimental</u>
Po-B (Exposure 1)	6.4	6.2 ± 0.4
Po-B (Exposure 2)	6.4	5.7 ± 0.4
Pu-F	2.7	2.9 ± 0.5

In considering these data for Po-B neutrons it is helpful to compare them with data presented in HW 3033-T. These data represent the results of measurements made by E. C. Watson. In these measurements, a number of films were exposed to the Po-B source. About half of the films were one year old and the rest were one month old. The results are shown in Figures 2 and 3. Figure 4 shows the data of this experiment plotted with the data for the year old film from Figure 3. This comparison would seem to indicate that the film used in this investigation was about a year old; in general, the extent of the fading is about the same. Exposure 2 was made in order to check upon the 12 hour value of Exposure 1, since this value with the 180 and 348 hour values would give a high result for the amount of fading. Apparently the film of Exposure 1 was an exceptionally sensitive piece such as are occasionally found in nuclear track film. As may be seen by comparing Figures 2 and 3, old film seems to exhibit more fading than new film for Po-B neutrons and, since the fading is much more pronounced for Pu-F neutrons than for Po-B neutrons, the complication of film age would tend to be more serious.

E. D. Falk
Physics
RADIOLOGICAL SCIENCES DEPARTMENT

ED FALK

REFERENCES:

- 1.) Hanson, A. O., and J. L. McKibbin, Phys. Rev. 72, 673 (1947)

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