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ORNL SUMMER SHIELDING SESSION

Gale Young, Leader

TOTAL CROSS-SECTIONS OF LIGHT ELEMENTS, AS OBTAINED FROM

G. H. WILLIAMS, E. LAMPI, G. D. FREIER
UNIVERSITY OF MINNESOTA

W. K. ERGEN

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This report is one of a series on shielding and represents part of the work of a summer group working principally at Oak Ridge National Laboratory. Participants are drawn from Nuclear Development Associates (Navy contract), NEPA, Bureau of Ships and Bureau of Aeronautics (Navy Department), AEC, RAND, General Electric, Argonne and Oak Ridge National Laboratory.

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TOTAL CROSS-SECTIONS OF LIGHT ELEMENTS,
AS OBTAINED FROM
G. H. WILLIAMS, E. LAMPI, G. D. FREIER,
UNIVERSITY OF MINNESOTA

G. H. Williams, E. Lampi and G. D. Freier of the Physics Department of the University of Minnesota are taking measurements of the total cross section of some light nuclei in the region up to 5 Mev. They have kindly communicated these data to us as they became available, and these data were used in compilations by Feshbach, which in turn were the basis for stochastic computations by M. L. Nelson and H. Kahn of the attenuation through water.

Later, during a visit at the University of Minnesota the writer obtained a refined, but still preliminary set of data from the above authors, and these data were given limited distribution in Oak Ridge.

Finally, we received a letter from Mr. Lampi giving the latest version of the data up to about 2 Mev. This letter is copied in the following pages, with the kind permission of Mr. Lampi.

The data are being expanded up to 5 Mev and will be published in the Physical Review by the Minnesota authors.

W. K. Ergen

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Table I

Total cross sections of light nuclei containing an integral number of alpha particles as a function of incident neutron energy. The tabulated cross sections have a probable error of ± 5%. The neutron energies are accurate to within ± 20 Kev The following table contains averages of cross sections measured at any given neutron energy.

TABLE I

TOTAL CROSS SECTIONS IN BARNS

E_m Mev	S	Mg	Si	C	O
.532		4.53	3.46	3.26	5.66
.567	2.03	4.69			
.578		4.65	5.53		3.42
.590	2.46	4.75			
.609		4.30	4.38		3.12
.615	2.22	4.36			
.638	1.91	3.76			
.650		3.34	2.95		2.91
.662	1.91	3.29			
.677	1.57	4.00	2.65		2.86
.708	1.72	4.63			
.723			2.53		2.87
.733	2.88	4.26			
.760	3.29	3.98			
.764			2.41		2.63
.782	2.82	3.63			
.798			2.54	2.85	2.87
.803	2.79	3.47			
.822	2.76	3.67			
.833			5.25		2.93
.845	2.55	4.16			
.868	2.04	4.71	4.01	2.74	2.99
.890		3.54			
.905			3.08		2.81
.912	2.09	3.17			
.937	2.62				
.943			3.90		3.78

TABLE I (cont'd)

E_m	S	Mg	Si	C	O
.960	2.80	2.84			
.981	2.28		4.74		4.97
1.003	2.60	2.72			
1.013			4.55		7.08
1.026	2.64				
1.051	2.21	2.48	3.64	2.52	6.36
1.073	2.49	2.50			
1.078			2.93	2.57	4.55
1.098	2.51	2.44			
1.119	2.22	2.90			
1.125			2.68		3.45
1.140	2.20	3.17	2.57		
1.158			2.26		3.02
1.161	2.32	3.07			
1.185	2.16	2.98			
1.196			2.01		2.76
1.206	2.17	2.80			
1.212			2.25		
1.230	2.32	2.80	3.20	2.29	2.90
1.250			2.87		
1.255	3.07				
1.268			1.90		2.84
1.276	2.32	2.78			
1.283			2.48		
1.298	2.19	2.98			
1.300			2.93		3.94
1.319	2.59	4.22	2.96		
1.340	2.48	3.84	2.69	2.24	5.34
1.364	2.71	3.25			

TABLE I (cont'd)

E_m	S	Mg	Si	C	O
1.372			2.52		3.54
1.387	2.32	2.98			
1.390	2.34				
1.409	2.66	2.68	2.62	2.08	2.61
1.430	2.36				
1.433	2.17	2.60			
1.450	2.61		3.09		2.40
1.456	2.60	2.66			
1.467	2.55		2.98		
1.481	2.38	2.56			
1.483			2.81		2.25
1.506	2.21	2.48			
1.521			2.71		2.43
1.523	2.22				
1.543	2.60	2.31			
1.562			2.75		2.06
1.566	2.66				
1.578	2.20	1.93	2.40	2.04	2.13
1.612	2.58	2.05	3.16		
1.637	2.72	2.84	3.78		
1.648		2.84			
1.658	2.93	3.39	4.44		
1.679	2.20	3.55	5.02		
1.698		3.36	3.36		2.23
1.701	1.90	3.25			
1.720	1.75		2.46		
1.731		3.59			
1.743	1.95		2.08		
1.766	3.77	3.25	1.98	1.88	1.86

TABLE I (cont'd)

E_m	S	Mg	Si	C	O
1.787	4.01		2.09		
1.799		2.56			
1.810	2.65		1.83		
1.830	2.26		2.02		
1.836		2.55			
1.853	2.42		3.79	1.84	
1.868		3.00			
1.874	2.01		5.49		
1.896	1.83		4.86		
1.938	1.82		3.40	1.75	

TABLE II

Total cross section of Mg as a function of neutron energy in the neighborhood of .86 Mev. These values were taken with a thin Li target (12.5 Kev for 1.88 Mev protons) which made the measured energy accurate to ± 13 Kev.

E_n(Mev)	σ_T(Barns)
.791	3.31
.807	3.39
.840	3.39
.850	4.26
.858	5.34
.862	6.34
.868	5.81
.872	3.96
.891	3.43
.912	3.23