TABLE 2

Effect of Water Boration on Gamma Centerline Measurements

		N. SLABS; MODIFI D: SLAB FROM SOU	33% Pb, 11 SLABS, MODIFIED B REMOVAL OF 8TH AND 10TH SLAB		
<b>. Z</b>	100 lb B <sub>2</sub> O <sub>3</sub> 0.1% B	200 lb B <sub>2</sub> 0 <sub>3</sub> 0 2% B	400 1b B <sub>2</sub> O <sub>3</sub> 0.4% B	400 16 B <sub>2</sub> O <sub>3</sub> 0 4% B	600 lb B <sub>2</sub> O <sub>3</sub>
80	4952	3710	2915		
90	2739	2063	1664		
100	1523	1133	906		861
110	879	631	511		463
120	525	384	307	342	301
130	313	236	183		

2

TABLE 3
Gamma Measurements

 $R^{\,2}\,l$  and l for Pb,  ${
m H_2O}$  and B Composite Shields of 1-in. Pb Slabs

UNEFO	RM 33% P	Pb 67% H <sub>2</sub> O RON	UNIFOR	M 17% Pb: -	M 17% Pb: - 83% H <sub>2</sub> O UNIFORM 33% Pb: - 67% H <sub>2</sub> O NON-UNIFORM - 6% BORON - 6% BORON - 6% BORON						
RADIUS	(cm)	$R^2 l \times 10^{-4}$ (cm <sup>3</sup> )	RADIUS (in.)	(cm)	R <sup>2</sup> l x 10 <sup>r4</sup> (cm <sup>3</sup> )	RADIUS (in.)	l (cm)	$R^2 l \times 10^{-4}$ (cm <sup>8</sup> )	RADIUS	l (cm)	$R^2 l \times 10^{-4}$ (cm <sup>3</sup> )
25	neg.	:	25	3 61	1.46	25	40.35	16.27	25.31	13.8	5.73
28			30.88	2.47	1.52	28	18.39	9.30	26.6**		
31			36.76	2.66	2.32	31	17.04	10.57	27.9	10.10	5.05
34	6.09	4.54	42.64	-		34	12.62	9 . 41	29.3**		
37			48.52	2.59	3.94	37			30.8	8.77	5.23
40	6.37	6.58	54.40	2.49	4.75	40	11.0	11.34	32.3**		
43			60.78	2.33	5.46	43			33.9	6.32	4.56
46	5.18	7.07	66.16	2.35	.6 . 63	46	6.71	9.15	35.3**		
49						49		· •	37:4	4.72	4.15
52	3.66	6.38				52	4.42	7 . 7	41.8	3.70	4.08
									47 - 1	3.56	:497
					,				<b>54</b> .0	2.73	5.15
Weigh	t Shie	ld 59.5 Tons	Weight S	hield 66	Tons	Weig	ht Shield	1 59.1 Tons	Weigh	t Shield	54 Tons

Note: Shield weights were calculated for a 118-cm shield, 24-in.-radius spherical reactor, 400 mw power.

<sup>\*</sup> Second slab removed when these l's were measured.

<sup>\*\* 3/16-</sup>in. Pb slabs.

Table 4 shows in more detail the method of computation of  $R^2 l$ , using as an example a non-uniform shield with 0.4% B in the water.

Table 5 shows the effect of moving a single slab with all others in near-optimum positions. It has been found that it is most expeditious to adjust the outermost slab first, since the  $R^2l$  for this slab is less sensitive to the position of the other slabs. This slab is also the most important from the point of view of both weight and attenuation. Other slabs are then adjusted to give the same value. Table 6 shows essentially the same data as Table 5 for a different distribution of intermediate slabs, demonstrating the relative insensitivity of the optimum position for the outermost slab.

The minimum in  $R^2l$  for an intermediate slab is shown in Table 7.

Further experiments and calculations to check the shield weights quoted here are still underway.

Fast Neutron Dosimeter. This instrument, described in previous reports, was developed by the ORNL Health Physics and Instrument Divisions. It has been made water-proof and used in the lid tank for a few representative readings. Comparison with fast neutron estimates from thermal flux measurements shows the latter to have been somewhat low, so that the shield thickness estimates have been increased. The reasons for the discrepancy are discussed below separately.

Shield for Reactor with Fe Reflector. Two and five-eights inches of Fe were inserted at the inside of a Pb-H<sub>2</sub>O-B mock-up in order more closely to approximate an engineered installation. The attenuation was not changed appreciably, indicating that Fe is approximately as efficient for neutrons and gammas as the Pb-H<sub>2</sub>O it replaced. The data, including an ideal shield weight calculation for 4-ft diameter outside the iron, are shown in Table 8.

Interpretation of Dosimeter Data (E. P. Blizard). Discussions with H. A. Bethe, F. Friedman, and M. Deutsch served to clarify an apparent discrepancy between the dosimeter determination of fast current and that inferred from thermal neutron flux measurements (see ORNL 768). The dosimeter indicated fast flux to be about three times higher than is indicated from a simple interpretation of thermal flux data. The difference is attributed primarily

TABLE 4  $R^{2}l \text{ for Non-Uniform} \quad \text{Pb-H}_{2}0$ 

0.4% Boron - 9 in. Pb

SLAB NUMBER REMOVED	RADIUS (in.)	R <sup>2</sup>	$R^2/R_0^2$	Cts/min at 120 cms	Γ <u>•</u> /Γ	$\ln \Gamma_0 / \Gamma$	t(cm)	l (cms)	$R^2 l/R_0^2$	$R^2 l = 10^{-4}$ (cm <sup>3</sup> )
none				390						
1	25	625	1.00	471.9	1.21	.1908	2.75	14.41	14.41	5.81
2	27.94	780.6	1.25	458.4	1.1753	.1615	2.73	16.9	21.10	8.51
3	30.88	953.6	1.53	541.9	1.389	.3282	2.57	7.8305	11.98	4.83
· <b>4</b>	33.82	1143.8	1.83	590.3	1.513	.4121	2.73	6.625	12.12	4.89
5	36.76	1351.2	2.16	593	1.520	.4125	2.53	6.133	13.25	5.34
6	39.70	1576.1	2.52	647.4	1.659	.506	2.72	5.375	13.545	5.46
7	42.64	1818.1	2.91	675.1	1.731	.5481	2.51	4.579	13.32	5.37
8	48.52	2354.2	3.77	785.8	2.015	.700	2.53	3.614	13.63	5.49
9	54.40	2959.4	4.73	875	2.243	.806	2.54	3.151	14.90	6.01
	$\sum R = 338$	$\Sigma R^2 = 13,562$								

Shield Weight Calculation:

Weight Pb = (13,562-338) × 2.346 × 10<sup>-3</sup> = 31.02 tons of Pb 25.45 tons of H<sub>2</sub>O 56.47 tons - Total

ACTUAL DATA				DATA FROM: SMOOTH CURVE OF COUNTS VS. RADIUS		
R (in.)	(cm)	$R^2 l \times 10^{-4}$ (cm <sup>3</sup> )	(cm)	R <sup>2</sup> l x 10 <sup>-4</sup> (cm <sup>3</sup> )	POSITION OF SLABS	
50.03	3.49	5.63	3.61	5 . 82	25	
51.40	3.36	5.73	3.30	5.63	27.9	
52.40	3.07	5.44	3.12	5.52	30.9	
53.40	2.97	5.46	2.94	5.41	33.8	
54.40	2.95	5.63	2.79	5.32	36.8	
55.40	2.77	5.48	2.68	5.31	39.7	
56.40	2.59	5.32	2.60	5.34	42.6	
57.40	2.46	5.23	2.51	5.34	48.5	
58.40	2.49	5.48	2.45	5.40	54.4*	
59.40	2.44	5.56	2.42	5.51		
60.40	2.37	5.58	2.38	5.61		
64.40	2.08	5.59	·			

<sup>\*</sup> Slab moved in this experiment.

TABLE 6 Effect of Moving Pb Slab on  $\mathbb{R}^2 l$  - All Other Slabs Remaining Constant

Total 9 in. Pb - 0.6% Boron

	ACTUAL DATA			MOOTE: CURVE: OF VS.RADIUS	POSITION OF SLABS		
:R :(in.)	(cm)	R <sup>2</sup> l x 10 <sup>-4</sup> (cm <sup>3</sup> )	(cm)	R <sup>2</sup> l x 10 <sup>-4</sup> (cm <sup>3</sup> )	(din.)	SLAB NUMBER	
46.15	5.63	7.74	5.93	8.16	25.00	1	
48.15	4.41	6.60	4.11	6.15	27.94	2	
50.15	3.38	5.48	3.36	5.44	30.88	3	
52.15	3.20	5.61	2.95	5.17	33.82	-4	
54.15	2.64	4.99	2.73	5.16	36.76	5	
56.15	2.58	5.24	2.59	5.27	39.70	6	
58.15	2.54	5.54	2.54	5.54	43.75	7	
	·				45.25	8	
					54.40*	9	

<sup>•</sup> Slab moved.

TABLE 7  ${\tt Effect\ of\ Moving\ Pb\ Slab\ on\ } R^2\,l\ {\tt -\ All\ Other\ Slabs\ Remaining\ Constant}$ 

Total 8 in. Pb - 0.6% Boron

ACTUAL DATA			DATA FROM: SMC COUNTS 1	OOTH CURVE OF	POSITION OF Ph SLABS		
R (in.)	l (c=)	R <sup>2</sup> l x 10 <sup>-4</sup> (cm <sup>3</sup> )	(cm)	R <sup>2</sup> l x 10 <sup>-4</sup> (cm <sup>3</sup> )	RADIUS (in.)	SLAB NUMBER	
34.87	4.93	3.88	5.01	3.94	25.00	1	
36.00	4.82	4.02	4.85	4.05	27.94	2	
37.25	4.66	,4.17	4.46	4.00	30.88	3	
38.25	3.98	3.75	4.06	3.83	33.82	4	
39.25	3.88	3.86	3.87	3.86	36.76*	5	
40.25	3.85	4.02	3.85	4.02	43.75	6	
41.25	3.99	4.37.	3.94	4.31	45.25	7	
42.00	4.03	4.59	4.05	4.61	54.40	8	
			1				

<sup>·</sup> Slab moved.

Gamma Centerline Neasurements

# 2-5/8 in. Fe Thermal Shield and 7-3/16 in. Pb - Total

TABLE 8

Thickness Neutron Shield 142 cm

Total Weight Shield Including Fe Reflector = 61.0 Tons\*

Z	MATERIAL	R (in.)	GAMMA CENTERLINE MEASUREMENTS: - GM TUBE			
(In. from Source to to Back of \$lab)		(48 in. Sphere Re-) flector Inside)	(cms)	(c/m)	R/hr x 10 <sup>5</sup>	
1	7/8 in. Fe	22	135	502.1	5.52	
2	7/8 in. Fe	23	120	971	10.68	
3	7/8 in. Fe	24	110	1551	17.06	
5.06	1 in. Pb	26.06				
7.00	l in. Pb	28.00				
9.31	1 in. Pb	30.31				
11.75	1 in. Pb	32.75				
15.13	l in. Pb	36.13				
14.13	l in. Pb	40.13				
21.25	3/16 in. Pb	42.25				
24.4	l in. Pb	45.4 .				

(1) Wt. 
$$H_2O$$
 inches  $H_2O = \frac{142}{2.54} = 55.9$  in.  $+ 24 = 80$  in.

wt. 
$$H_2O = \frac{4\pi}{3} \frac{(80^3 - 24^3)}{2000} \cdot 0361 = (80^3 - 24^3) \cdot 7.559 \times 10^{-5} =$$

$$(5.12 \times 10^5 - .1382 \times 10^5) \ 7.56 \times 10^{-5} = 38.6 \ \text{Tons} \ \text{H}_2\text{O}$$

(2) Wt. 1 in. Pb - wt. 
$$H_2O$$
 displaced =  $8142 \times 2.346 \times 10^{-3}$  = 19.22 Tons Pb

(3) Wt. 
$$3/16$$
 in. Pb= $(41.24)^2 \times 3/16 \times 2.346 \times 10^{-3}$   
=  $1701 \times 3/16 \times 2.346 \times 10^{-3}$  = .75 Tons Pb

(4) Wt. Fe = 
$$\frac{7}{8} \times \frac{4.188 (24^3 - 21^3)}{2000} \frac{7.86 \times 62.4}{1728}$$
  
=  $.503 \times 10^{-3} (13,824 - 9,261)$   
=  $.520 \times 10^{-3} (4,563)$  =  $\frac{2.37 \text{ Tons Fe}}{61.0 \text{ short tons}}$ 

### to two factors:

- (1) The dosimeter is non-directional, hence weights all fast neutrons equally regardless of direction, whereas the thermal flux indicates fast current, weighting individual neutrons with the cosine of their angle to the outward mormal. This discrepancy is hard to define quantitatively, but Wick's method will be applied to obtain an order of magnitude correction.
- (2) Although there is a dominant high energy which determines the local relaxation length, there is considerable extra lower energy neutron component for which the age to thermal is considerably smaller. This indicates that the "displacement" distance between the fast collision and thermal absorption will be about one-half of that predicted by the simpler treatment.

That this is so is indicated by an exact calculation of the density of second collisions in hydrogen which has recently been carried out by Nelson, Albert, and Mulliken of the ORNL Mathematics Panel. (1) Their results are as follows:

(Ratio	οf	second	tο	first	collision	density	ı in .	hydrogen
( I C C C C C	OI.	Second	CO	11120	COTITION	densit	A T 11	HAGE OKEH!

t	ν = <b>1</b>	ν <b>7 1.222</b>	$\nu = 61.5$
10	2.97	2 . 83	2.67
15	3.35	3.17	2.98
20	3.62	3.41	3.20
25	3.83	3.61	3.37

where t is the distance from source in mean free paths and  $\nu$  describes the variation of mean free path with energy of scattered neutrons as follows:

$$\frac{\lambda_0}{\lambda} = \left(\frac{E}{E'}\right)^{\nu/2}$$

Neutron Energy Spectrometer (F. J. Muckenthaler, \* K. Henry\*). During the past quarter some changes were made on the proton recoil fast neutron spectrometer. The glass sleeve on the Kovar seal was shortened, and the

<sup>(1)</sup> Memo, Nelson to Blizard, August 31, 1950, Second Collision Density in Hydrogen.

• NEPA.

sensitive region of the tungsten anode was then restricted by enlarging the diameter of the anode wire up to this region. This reduced the effect of static charges forming on the glass. Various gas mixtures have been tried but the data remain to be analyzed.

Emphasis has been changed from the single wire counter (ORNL 711) to a two anode coincident arrangement. This has worked very well in preliminary tests. A Po-Be spectrum indicates a better resolution than that obtained with the single anode. Several points of the  $U^{2\,3\,5}$  spectrum were obtained using the thermal column water tank, and these points give a spectrum similar to that found by B. E. Watt (LA-718).

Measurements of Fast Neutrons in the Lid Tank Using Sulphur as a Detector (H. E. Hungerford). Measurements of fast neutrons have been made using sulphur as a detector in conjunction with the 33% Pb- $H_2O$  experiment in the lid tank. The reaction used is a  $S^{3\,2}(n,p)P^{3\,2}$  reaction, which has a threshold of about 1 Mev. The half-life of the beta-active product is 14.3 days.

Sulphur in the form of ammonium sulphate,  $(NH_4)_2SO_4$ , was packed into a thin layer in appropriate containers and exposed between the lead slabs in the lid tank. After exposure the active phosphorus was chemically separated from the inert material using molybdic acid as the reagent. The yellow-green precipitate, ammonium phospho-molybdate,  $(NH_4)_3PO_4 \cdot 12MoO_3$ , was washed, dried, and mounted on suitable cards and counted. The counters were calibrated against the standard pile by using both indium foils and phosphorus in the form of monobasic ammonium phosphate,  $NH_4H_2PO_4$ , suitably mounted.

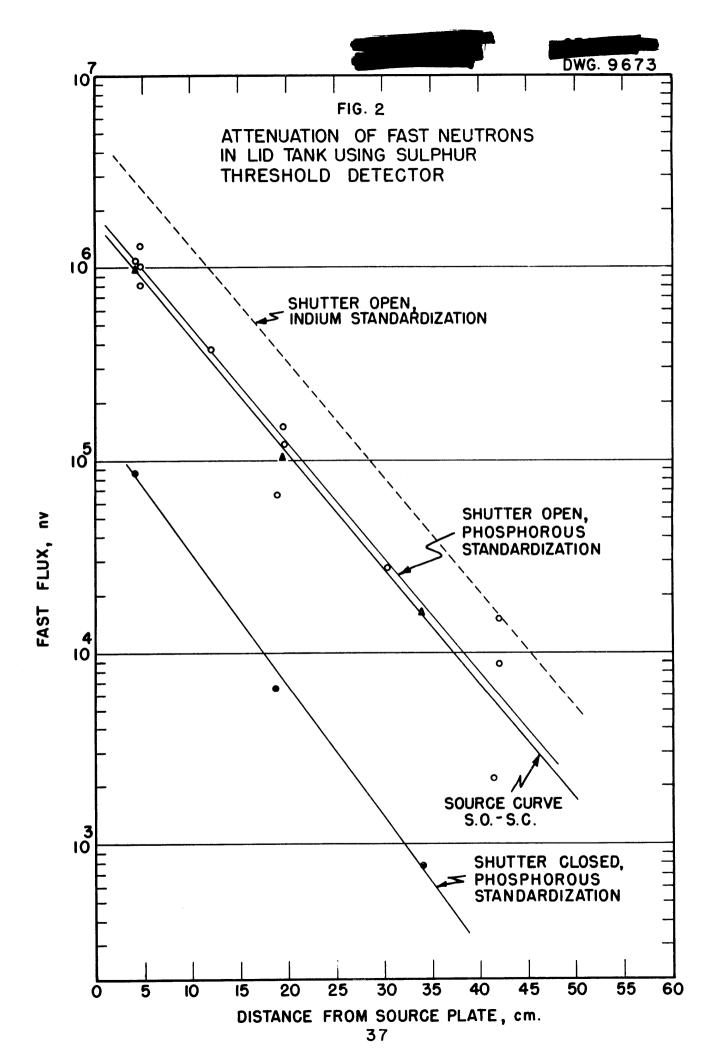
The results of the measurements appear in Table 9 and Fig. 2. Results are reported on measurements taken out to 42 cm from the source plate. This distance was found to be the practical limit for reliable measurements. In these calculations the cross section for the S(n,p)P reaction used was 285 millibarns (AEC Report NP-1254) and thermal activation cross sections for P of .23 barns and for indium of 138 barns as reported in *Phys. Rev.* 72, 888 (1947).

The measurements are fairly reproducible, but lack of identical conditions in the lid tank, uncertainty of the standardization of the counters, self-absorption in the samples, and losses during chemical separation have all contributed to errors in the reported results. Work on the standardizing of the counters is still in progress. Because the indium betas are of lower energy

TABLE 9

Fast Flux Measurements in the Lid Tank

SHUTTER POSITION	DISTANCE OF SAMPLE FROM. SOURCE PLATE (cm)	FAST FLUX (Indium Stand) (nv)	FAST FLUX (P. Stand) (nv)
Open	4.1	2.75 × 10 <sup>6</sup>	1.08 × 10 <sup>6</sup>
Open	4.7	3.31 × 10 <sup>6</sup>	$1.30 \times 10^6$
Open	4.7	2.55 × 10 <sup>6</sup>	$1.00 \times 10^6$
Open	4.7	2.05 × 10 <sup>6</sup>	$8.07 \times 10^5$
Open	12.0	9.48 × 10 <sup>5</sup>	$3.73 \times 10^{5}$
Open	18.8	1.66 × 10 <sup>5</sup>	$6.53 \times 10^4$
Open	19.6	$3.78 \times 10^5$	$1.49\times10^{5}$
Open	19.6	$3.09 \times 10^{5}$	$1.22 \times 10^5$
Open	30.3	$7.00 \times 10^4$	2.76 × 10 <sup>4</sup>
Open	41.5	$5.64 \times 10^3$	$2.22 \times 10^3$
Open	42.0	$3.78\times10^4$	1.49 × 10 <sup>4</sup>
Open	42.0	2.23 × 10 <sup>4</sup>	$8.78 \times 10^3$
Closed	4.1	2.18 × 10 <sup>5</sup>	8.58 × 10 <sup>4</sup>
Closed	18.8	$1.65\times10^4$	$6.50 \times 10^{3}$
Closed	34.2	$1.93 \times 10^3$	$7.60 \times 10^2$



than those of phosphorous, the results reported using the indium standardization are probably too high. At present a known quantity of  $P^{3\,2}$  obtained from the Isotopes Division is being processed for counting on the same apparatus to obtain an independent calibration.

#### LIQUID METAL DUCT TESTS IN THE THERMAL COLUMN

R. H. Lewis\* C. E. Clifford H. K. Marks M. K. Hullings

Transmission of radiation through a liquid metal filled duct will be measured in a water tank above the thermal column on top of the X-10 pile. This experiment is designed primarily to determine the activation of sodium in a secondary coolant cycle for the case in which the liquid metal duct constitutes the primary neutron path from reactor to heat exchanger. Since this is of immediate interest to the KAPL submarine reactor project, that organization will supply the duct mock-up. Measurements may be made with the liquid metal duct empty as well as full, to check simple duct theory. In addition, the effect of varying the wall material from boron carbide to water will be investigated. Figures 3 and 4 show the duct and foil holders.

The source box and source box locator have been received from KAPL and are being installed in the tank. There are 24 X-10 slugs in the box. This secondary source is estimated to give approximately 10<sup>7</sup> fast flux. Background measurements of the thermal and epi-cadmium flux are being taken at various positions in the tank. A pile monitor for the thermal flux entering the source box has been installed and is being calibrated. The tube in the monitor is a boron lined ion chamber. Plans for a platform to be built around the water tank have been completed and construction will begin September 18. The first leg of the duct is expected to arrive from KAPL by September 30.

#### SHIELD CALCULATIONS

Calculations of Neutron Attenuation (F. H. Murray). Calculations for neutron attenuation in a shield composed of lead and water were made by the method outlined in ORNL 748. This method is based entirely on cross-section information, without the use of lid tank results. The calculated curves for

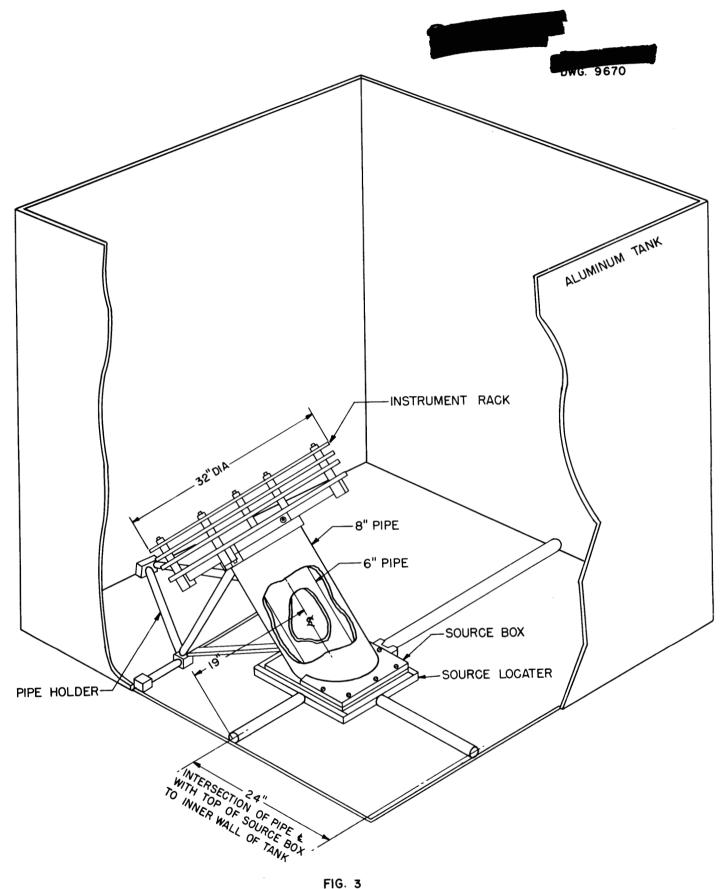
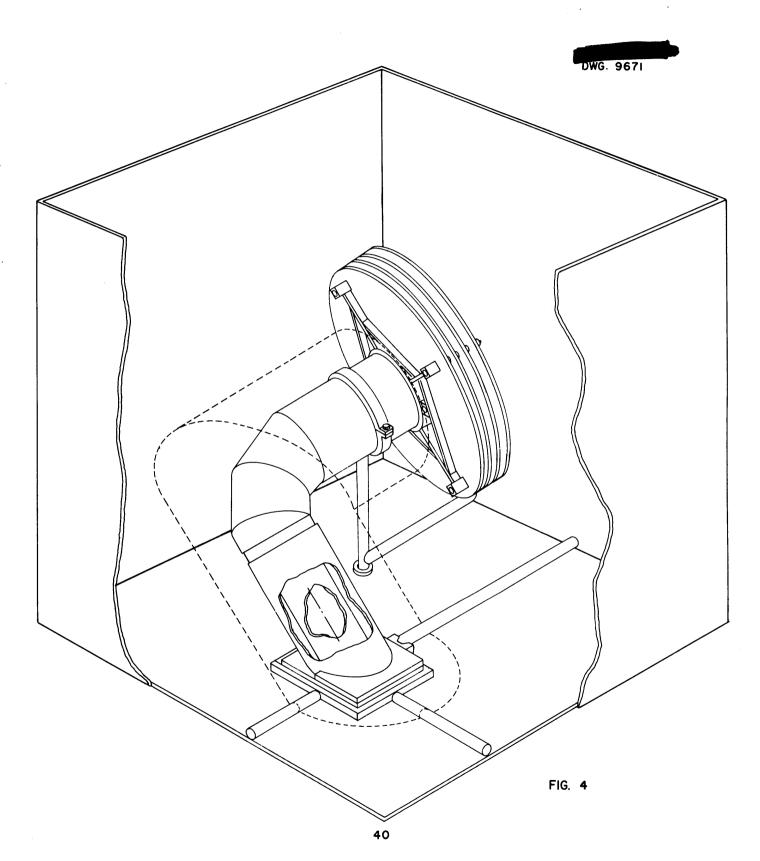


FIG. 3





17% lead in water were found to agree quite well with the Hurwitz-corrected lid tank data.

The calculations also showed the curves for 17%, 20%, 30%, and 40% lead in water to be nearly coincident.

Analysis of Lid Tank Data (S. Podgor\*). As a first step in the analysis of existing data on lead-water and iron-water systems, effective absorption cross sections for lead and iron are being deduced from the experimental attenuation curves. A preliminary value of 3.8 barns has been obtained for lead, but further geometric corrections will probably reduce this value somewhat.

Heat Generation in Shields (T. Welton). Some simple calculations have been made of the heat sources in the reflector and shield of a typical reactor. The general conclusion reached is that a steel reflector, of three inches thickness and cooled by reactor coolant, can be followed almost directly by thermal insulation and a hydrogeneous layer without dissipating more than one percent of the reactor power in the hydrogeneous layer. Detailed considerations are presented in a memorandum, ANP-5015, entitled Distribution of Heat Sources in Reflector and Shield.

Shield Calculations (K. Keyes). The methods of shield computation devised during the summer by members of the TAB are being checked and extended with the aim of placing at the disposal of design people a flexible and reliable recipe for calculating shield weights. It is hoped that such computations can also give effective guidance in some phases of the lid tank program.

Large Air Ducts in Shields (W. K. Ergen\*). A memorandum (CF 50-8-1) was written while the TAB was in session. It was intended to summarize the presently available information on the shielding for the air cycle. The main difficulty is the decrease in shield efficiency due to the enormous air ducts. Shielding considerations cannot eliminate the air cycle because there are numerous ways (some of which were listed) to circumvent the shielding difficulties, but each of these ways would introduce undesirable features into the air cycle and make it less competitive.

Three theoretical approaches to the duct problem are available: the "distributed density approach," the "line of sight approach," and the following of neutron histories including those which involve scattering. All these approaches yield essentially lower limits for the shield weights, but these

limits are different for these approaches and increase in the order given above. The first two approaches have been used at NEPA and gave widely different results, mainly because of different engineering assumptions, and only secondarily because of the difference in estimation of the influence of the ducts.

No practical way of gamma shielding the air cycle reactor has been proposed and it appears that the shield weights would be prohibitive, even if only partial gamma shielding at the air cycle reactor were attempted.

The necessary large air planes of the air cycle allow the use of  $r^2$  attenuation, but this aggravates the problem of neutron-induced activity in the material surrounding the reactor.

#### NEW SHIELD TEST FACILITY

## W. M. Breazeale and J. L. Meem

The work on the building and pool is well underway. The contractor now expects to be out of the building by October 20. Laboratory employees will then move in and install the reactor, measuring equipment, etc. Instrument development for this facility is a joint effort between NEPA and ORNL.

A schedule (CF 50-9-16) has been drawn up covering the installation and initial "shake down" period totaling three and a half months. After this a mock-up of the first shield will be tested. Design and construction of this mock-up will be started when the ANP Shielding Board finishes the preliminary design of an aircraft shield (October 16).

The neutron camera discussed in the last quarterly report has been built and tested with  $U^{235}$  fission spectrum. The results are in accord with the Los Alamos experience. A coincidence circuit has been added to the proton recoil counter<sup>(2)</sup> which substantially reduced the background. The flux required for satisfactory operation is still large, about  $10^4$  nv.

A large NaI-TII crystal has been received by P. R. Bell and is being incorporated in a scintillation spectrometer which he will test. It is hoped that the resolution and sensitivity will be sufficient so that similar equipment

can be used in shielding work. A Compton recoil coincidence spectrometer has been built and bench tested. Inherently its resolution is not as good as the crystal spectrometer.

## CRITICAL EXPERIMENTS

A. D. Callihan, Physics Division J. F. Coneybear, NEPA

Construction of the Oak Ridge Area Critical Mass Laboratory, Building 9213, is now essentially complete. The building was turned over to the operating staff on August 21, 1950, and experimental equipment is now being installed. Operations will commence sometime in October unless the procurement of essential experimental materials, such as graphite, beryllium, and uranium, causes a delay.

Each assembly of fissionable and moderating material will be made in a supporting grid of square aluminum tubing. A sample section of sixteen tubes welded together has been received but preliminary tests showed that excessive warping was introduced in the welding. It appears necessary that the matrix be built with individual tubes held in place by an external frame. The required aluminum tubing has been received. Control and safety rods have been ordered and are scheduled for delivery early in October.

It has been agreed that among the early experiments will be an investigation of heavy metals as reactor reflectors. Specifications have been prepared of Type 310 stainless steel requirements in order to completely enclose the core by approximately eight inches of reflector.

A report, Initial Program of ANP Critical Experiments (NEPA-1522), was issued stating details of the first experiments and some of the techniques to be used.

#### EXPERIMENTAL ENGINEERING

## H. W. Savage, ANP Division

As mentioned in the last ANP Quarterly Report, a new group of the Laboratory has been organized to do experimental engineering work for the ANP program. It is the function of the Experimental Engineering Group to develop the technology of large-scale handling of the coolants of the aircraft reactor, and to make mock-ups and engineering studies of the proposed components. It is intended that the fundamental research and initial development on all such matters as fuel elements, materials for containing corrosive liquids, and heat transfer properties of materials will be done by the other groups of the project whose work is described elsewhere in this report. The Experimental Engineering Group will take the basic information and design suggestions and will reduce them to engineering practice for the ARE.

Present personnel with the Experimental Engineering Group number 19, of whom four are technicians and the balance professional. Several additional technicians are to be added in order to permit 24-hour operations when necessary. During the past three months, attention has been directed principally toward program definition, laboratory installation and personnel acquisition. However, a few liquid metal loops have already been operated.

Because a primary requirement of the ARE is to establish the compatibility of materials, the experimental program is being carefully coordinated with the research programs of the Metallurgy Group, the Heat Transfer Group, the activities of the ANP General Design Group, and the corresponding activities of NEPA. All of the present work is devoted to establishing the compatibility of various metals with sodium and lithium over a range of temperatures reaching somewhat above 1500°F.

The subjects which will be considered in the course of the development of the project are listed below. Many of these tests will be of actual components of the ARE.

- 1. Heat transfer -- specific configurations (not fundamental).
- 2. Hydrodynamics free convection, pressure and velocity distribution, etc., header geometry, dynamic loads, etc.
- 3. Chemistry--corrosion, erosion, solubility.