B-46

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ISSUED TO: Col. Peterson

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PHYSICS DIVISION

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REPORT FOR MONTH ENDING DECEMBER 31, 1945

L. W. Nordheim

Series B Recieved: 3/25/46
Series B Issued: 3/25/46

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For the new unit the heterogeneous type has been adopted as preferable at this time due to its much greater simplicity compared to the homogeneous unit. Approximately the same performance in flux and isotope production can be achieved with only slightly greater losses. A description of the physical characteristics and constants will be issued in the near future.

Details on the critical experiments have been worked out in conjunction with the technical division. They will be modified also into an heterogeneous arrangement which is more easily manageable and will permit to obtain all pertinent data.

Continued thought has been given to the construction of the pilito and to possible power piles. In the latter field, a simple pressure type, with cooling water at 500-pound pressure, producing saturated steam of four-pound pressure in a boiler type heat exchanger will give an efficiency of order of 23 percent and seems thus to be quite promising.

From the other work of the division the satisfactory operation of the double crystal spectrometer and the observation of the local response in the neighborhood of an oscillator may be noted especially.

The detailed reports of the various sections follow.

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Physics Section I

A. H. Snell, Section Chief

Total technical personnel (including supervision)..... 11 (this period)

Problem Assignment Number	Subject	Status	Percentage of Section Manpower Report Per.	Next Per.
PX1-7	C^{14} Production	Active	30	30
PX6-4	Neutron Temperature in Pile	Active	10	10
PX8-1	Gamma Ray Spectra	Inactive	0	0
PX8-2	Photoneutron Sources	Active	20	20
PX10-4	Be^{10}	Inactive	0	0
PX10-6	Fast Neutron Yields	Inactive	0	0
PX14-1	Criticality of Vessels	Active	30	10
163-X39P	Service Flux Measurements	Active	5	10
PX8-4	Mean Gamma Energy per Beta	Inactive	0	10
PX5-15	Controls	Active	5	10
		Total.....	100	100

[redacted]

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PX1-7 - C^{14} Production - (Norris, Meiners)

We have to retract last month's statement on the gamma rays of carbon 14, because careful measurements with thin sources have led to the conclusion that the observed effects can be accounted for on the basis of bremsstrahlung. The ratio of the counting rates obtained when the betas are stopped in lead and in aluminum was plotted as a function of source thickness. The curve should be flat if gammas are involved, but actually it decreased with decreasing sample thickness toward a value not far from the ratio of the atomic numbers plus a contribution from innere bremsstrahlen. Furthermore, the overall yield of the x-rays is not far from what would be expected on the basis of bremsstrahlen if reasonable counting efficiencies are assumed. Finally, a direct comparison of the counting rates of betas and x-rays was made with a known pure beta emitter (P^{32}). The P^{32} emits betas of higher energy, and it gave about twice as many x-ray counts per beta as did the C^{14}.

Trouble with the circulating pump in the factory has restricted our production during the past month. We have about 34 mc on hand.

An estimate has been made of the C^{14} production which could be expected if the outlying regions of the Clinton pile were loaded with canned nitrogenous material. If 100 channels in Zone 9 of the pile were loaded for a length of 15 feet near the middle of the pile, about 1 curie could be made per year. If calcium nitrate

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were used, about a ton would be involved. The liquid factory in the middle of the pile could be dispensed with, because the new loading would yield 10-15 times as much C^{14}. This production rate may be negligible compared to what can be expected from Hanford, but it would have an advantage in flexibility -- that is, different techniques could be experimented with.

PX6-4 - Neutron Temperature Measurements - (Branch)

Measurements of the neutron temperature in the Clinton pile yield a value of $729^{\circ} \pm 25^{\circ}$ A, which corresponds to an energy of 0.063 ± 0.002 ev for the neutrons with the most probable velocity of 3456 ± 84 m/sec. The range in probable errors given are computed from the scatter in the data; no estimate has been made of the errors inherent in the method and apparatus. These latter errors will be estimated from neutron temperature measurements that are to be undertaken in a thermal column, using the same and improved absorbers and detectors.

The temperature of a neutron flux, if a Maxwellian velocity distribution is assumed, is computed from the ratio A/A_0, where A is the saturated activity induced by the neutrons in a thin 1/v detector shielded by a 1/v absorber of known thickness and cross-section and A_0 is the activity induced by an unshielded flake, by the relation

$$A/A_0 = 4/\sqrt{\pi} \int_0^{\infty} x^2 e^{-x^2} E_2(K\delta/vx)dx, \qquad (1)$$

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where v is the most probable velocity, $K\delta$ is a constant determined by the thickness and cross-section of the absorber and is measured independently in a monochromatic neutron beam and E_2 is a tabulated E function.

For the thin 1/v detectors required by this procedure, Mn flakes, 1 cm x 1 cm x 0.1 cm were used. In order to eliminate the activity induced by the Mn resonance neutrons, activations were made with and without Cd with detectors shielded and unshielded with the 1/v absorber, Pyrex plates ground to 0.050" thickness. (The method of Cd differences in effect eliminates not only the resonance neutrons but also all the neutrons in the spectrum above the Cd "cut-off". This introduces no difficulty in interpreting the results because practically all the energies of the thermal neutrons that make up the Maxwellian distribution lie below the cut-off.)

Prior to the absorption measurements in the pile, the total cross-section constant for the Pyrex, $K\delta$, was measured in a collimated monoenergetic neutron beam obtained with Mr. Borst's spectrometer to have the value

$$K\delta = 1060 \pm 20 .$$

[redacted]

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At least 6 determinations of each type of activity listed below were made, yielding the following results, normalized to $A_{tot} = 1000$:

Activity	Symbol	Shielding	Observed Value
Total	A_{tot}	none	1000
Resonance	$A_{r'}$	0.019" Cd	69.9 ± 1.2
Resonance	$A_{r''}$	0.038" Cd	62.7 ± 0.3
Total	A_B	Pyrex	503 ± 2
Resonance	$(A_{r'})_B$	Pyrex + 0.019" Cd	62.7 ± 0.5

The thermal activity in the detector is determined by subtracting the resonance activity from the total activity. Since the Cd absorbs a fraction of the resonance neutrons as well as all the thermals, the resonance activity was measured as a function of Cd thickness so the activity could be extrapolated back to zero thickness of Cd. This extrapolation was made according to the following relation which takes into account the oblique incidence of the randomly directed neutrons:

$$(A_r)_x = A_r E_2(\sigma x) \qquad (2)$$

where σ is the macroscopic cross-section of Cd for Mn-resonance neutrons and x is the Cd thickness. Actually σ was not known, but

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cut-and-try methods gave a curve that fitted the two observed points ($x = 0.019'' = 0.048$ cm, $x = 0.038'' = 0.096$ cm) for which σx was 0.0370. The resulting total microscopic cross-section of Cd for Mn-resonance neutrons is

$$\sigma = 16.4 \text{ barns.}$$

Extrapolation by Equation (2) gives

$$A_r = 81 \pm 3.$$

The activity in the detector shielded with Pyrex plates and 0.019" Cd is corrected for the absorption of Mn-resonance neutrons in the Cd as follows:

$$(A_r)_B = A_r/A_{r'} \cdot (A_{r'})_B = (1.16 \pm 0.03) \cdot (62.7 \pm 0.5) = 73 \pm 2.$$

Letting A and A_o be the thermal activities in the detector shielded and unshielded with boron, respectively:

$$A = A_B - (A_r)_B = 430 \pm 3$$
$$A_o = A_{tot} - A_r = 919 \pm 3.$$

from which the transmission ratio is:

$$A/A_o = 0.468 \pm 0.004.$$

[redacted]

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From a numerical integration of Equation (1), the most probable velocity corresponding to a transmission of 0.468 ± 0.004 is

$$v = 3456 \pm 84 \text{ meters/sec.}$$

from which is computed the neutron temperature of $729^\circ \pm 25^\circ$ A.

PX8-2 - Photoneutron Sources - (Barker, Sternberg)

Using sodium 24 gamma rays, six complete runs have been made in deuterium and in beryllium spheres in the paraffin pile. Neutron integration measurements by the parabolic-foil method, together with beta-ray measurements on the strengths of the sources, have yielded the following values for the photoneutron cross-sections, assuming one high energy gamma per beta in Na^{24}:

$$\text{Be:} \quad (5.9 \pm 0.1) \times 10^{-28} \text{cm}^2$$

$$\text{D:} \quad (12.8 \pm 0.3) \times 10^{-28} \text{cm}^2 .$$

The probable errors indicated show the spread in the values obtained with the six runs.

The effective gamma ray has an energy of 2.76 mev.

Work is continuing on the gallium 72 gamma ray of 2.25 mev.

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PX14-1 - Criticality of Vessels - (Hoyt, Shrader, Snell, Abelson, Baker, Barker, Kupferberg, Newson)

Two reports are in the final stages of preparation.

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Physics Section II

A. M. Weinberg, Section Chief

Total technical personnel (including supervision).....8 (this period)

Power Extraction from Thermal Piles (Murray and Weinberg)

Perhaps the simplest power producing pile is one which uses water under pressure as a coolant. This hot water can be used to produce steam either by heat transfer to an evaporator or by direct flashing. Some efficiency calculations have been made for systems in which no superheat is used. As an example, a pile run at 500 lb pressure can be used to produce saturated steam at 400 lbs. If this steam is run through a turbine whose condenser pressure is 1" Hg, the Rankin cycle efficiency of the system is 35%. Assuming an engine efficiency of 65% (this probably would require some reheating) an overall theoretical efficiency of about 23% is obtainable. From such a calculation it is evident that power from a thermal breeder is a reasonable proposition, even if superheat and exceedingly high pressures are discarded.

The advantage of running the pile at only 500 lb is that the pile tank could be relatively thin--so thin that all the control elements could probably be placed outside the pressure tank. The advantage of not using the pile water as the working fluid is that by so doing the turbine is kept free of radioactivity. This of course must be balanced against the slight efficiency loss introduced in the irreversible coolant to working fluid heat transfer.

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Capacity of the X-Pile for Isotope Production (Scalettar and Soodak)

Aside from possible increase in operating power the limitation on isotope production in the X-pile is the available excess reactivity, δk over that necessary for keeping the pile critical. At an average position in the pile production in one day at 1000 kw for an absorber taking up 1% in excess reactivity is

5.48×10^{19} atoms/mgwt day/%δk = 9.10×10^{-5} moles/mgwt day/%δk

For tritium (H_2^3 molecule at standard conditions): 1.0 cm^3/mgwt day/%δk

For C^{14} (assumed half life 25,000 years): 1.3 millicuries/mgwt day/%δk.

At the present time approximately 300 i.h. are taken up by absorbers and 50 i.h. by control rods so that about 0.88% in excess reactivity is available; a substantial fraction of this is already taken up in isotope production and the rest by essential experiments so that additional reactivity can only be obtained by increasing the pile size.

If we fill out the pile radially for the next layer of stringers we pick up a reactivity of $\delta k = 0.2\%$

and the added weight of metal is $\delta W = 6.5$ tons

We cannot go much further in this direction because we are already decreasing the reflector size.

By removing the bowing in the pile and making its length uniform we can pick up an additional reactivity of $\delta k = 0.35\%$. If in addition we increase the length of the pile we can pick up reactivity by amounts given in the following table; the zero of reactivity in this table

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is chosen to be the present pile if it were unbowed (52 tons, 830 stringers, 47 $\frac{\text{slugs}}{\text{stringer}}$). The reactivity with respect to this zero and the change in pile metal is given as a function of number of slugs per stringer:

slugs/stringer	δk	W(tons)
40	- 0.65%	- 7.8
45	- 0.15%	- 2.2
(present pile unbowed 47	0	0
50	+ 0.23%	+ 3.3
55	+ 0.53%	+ 8.9
60	+ 0.76%	+14.4
present pile bowed	- .35%	0

One cannot increase the length to much more than 60 slugs per stringer because the reflector thickness then begins to decrease.

Thus the total reactivity that one can pick up by all methods is

$$(\delta k)_{tot} = \underset{\text{(radially)}}{0.2\%} + \underset{\text{(bowing)}}{0.35\%} + \underset{\text{(longitudinally)}}{0.76\%} = 1.3\%$$

at a cost of

$$(\delta W)_{tot} = 6.5 \text{ tons} + 14.4 = 20.9 \text{ tons of metal}$$

Thus we can get an additional 520 i.h. which would increase the production capacity of the pile to 870 i.h. or a factor of 2.5. No account is taken here of whether it would be possible to operate at the present power with the increased pile size.

<u>Production of 23 in the Thorium Blanket</u> (G. P. Nordheim and H. Soodak)

The calculations of the utilization of leakage neutrons which come out of a reactor and pass through a reflector and are finally absorbed in a thorium blanket have been continued. Up to now only the utilization of the thermal neutrons for various thorium arrays has been considered;

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however, a certain fraction of the neutrons leaking from the reactor are fast and the total number of neutrons absorbed in the thorium is calculated by summing up the weighted contributions of both the thermal and fast groups.

The calculation of the fast utilization has now been carried out. Since it would be quite complicated to make an accurate calculation of this quantity and since the leakage neutrons are predominantly thermal rather than fast, several simplifying assumptions have been made. It was assumed, as in the calculations for the thermal utilization, that the geometry of the system is planar rather than cyclindrical. It was also assumed that the thorium is distributed in a slab rather than in an array of rods and, furthermore, that the fast neutron group is homogeneous in energy and that the slowing down in the reflector can be represented by a Gaussian distribution having a single neutron age. This age is chosen to be the average age of the fast neutrons leaking from the reactor.

For the evaluation of this average age, a separate calculation is necessary and has been carried out. This corrected age is 70.3 cm^2 in D_2O (as compared to 115 cm^2 for fission neutrons). The energy corresponding to this age is, according to a graph given by Fermi (see CP-530), about 10,000 volts, a value which probably represents a lower limit.

In the following table the utilizations of thermal and fast neutrons U_{th} and U_f and the total utilization U (sum of the weighted contributions) are given for D_2O for various slab thicknesses of thorium

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which again (see previous monthly reports) correspond to a certain radius a and rod separation L. The distance of the slab from the pile was taken to be 25 cm.

L →	10 cm			20 cm		
a ↓	U_{th}	U_f	U	U_{th}	U_f	U
1 cm	83.3	83.7	83.3	73.2	73.6	73.3
2 cm	93.2	93.7	93.3	89.7	90.1	89.9

Similar calculations have also been carried out for a graphite reflector. They will be presented in a final report which is now in preparation.

Enriched H_2O-U Lattices (Cashwell)

In the last monthly report (MonP-33), a general method was outlined for computing critical sizes of enriched U-H_2O lattices surrounded by a finite lattice of ordinary U-H_2O lattice, the whole being encased in an infinite graphite reflector.

Calculations for such composite piles of spherical geometry are now complete. In these calculations, the total mass of metal-enriched and ordinary- in the pile is 3.6 metric tons. The mass of the core is expressed as a function of the core enrichment in the following table:

Critical Amounts of Enriched Metal

Mass of metal in core (in metric tons)	0.5	1.0	1.5	2.0	3.6
Enrichment of core	1.54%	1.14%	1.04%	0.98%	0.90%

As the enrichment goes up, the necessary amount of enriched metal falls quite rapidly. For the lowest enrichment listed above (.90%), only 3.6 tons of metal is critical.

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Physics Section III

E. O. Wollan, Section Chief

Total technical personnel (including supervision)..... 10 (this period)

Problem Assignment Number	Subject	Status	Percentage of Section Manpower Report Per.	Next Per.
PX6-1	Pile Oscillator	Active	25	25
PX10-8	Crystal Spectrometer	Active	20	20
PX10-16	Characteristics of Fission Products and Neutron Induced Activities	Active	10	10
PX10-18	Short Half-Life Gamma Energies	Active	15	
PX10-19	Capture Gamma Energies	Active	20	25
PX10-3	Cloud Chamber Studies	Active	10	20
		Total.....	100	100

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PX10-8 - Crystal Spectrometer - (Sawyer, Peterson, Wollan)

Last month we reported the first successful attempt to obtain Bragg reflection of neutrons from two crystals. Since then we have made several modifications in the set-up and we have found surprisingly large intensities in the twice reflected beam. Some of the increased counting rate can be attributed to the fact that we have now received an enriched BF_3 counter.* In addition to this, it was found that the peak intensity in the rocking curve of the second crystal is much greater when the two crystals are in the parallel position than when in the antiparallel position. In the notation of Compton and Allison these positions are referred to as $(n_A, -n_B)$ and (n_A, n_B), respectively, where n_A and n_B are the orders of reflection from the first and second crystals. These positions are also referred to as Type 2 and Type 1. The parallel position corresponds to Type 2 reflections when the orders for the first and second crystals are equal. The increased peak intensity in this position arises from the fact that the dispersion is zero for this case.

With our beam restricted only at the pile face by a 1/2" D hole in a one foot thick W shield block (this giving an angular divergence in the beam on the first crystal of about one degree) the peak intensities obtained for Type 2 reflections from the second crystal in the first, second and third orders were 47,500, 3,500 and 980 counts per minute, respectively.

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* We appreciate the efforts of Mr. Wakefield of the Chicago Instrument Section who supplied us with this counter.

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The first order was counted through a Pyrex plate and corrected back to no plate. No significance can be attached to the relative intensities because with an angular divergence of one degree in the main beam the spread of the second diffracted beam in the higher orders was so great that the counter, which is 2" in diameter, was not large enough to receive all the diffracted radiation.

In order to improve the geometry a Soller slit (angular divergence 15 min of arc) was placed in the main beam. With this arrangement the peak intensities were 7850, 1540 and 455 counts per min in the first three orders, respectively. The rocking curves in the first order had a full width at half maximum of about 6.5 min of arc for both the large and small angular divergence in the main beam. For the first order it was then felt that the radiation would be practically all received by the chamber and a preliminary measurement of the integrated reflection, $\frac{E\omega}{P}$, was made. A value of $\frac{E\omega}{P} \cong 5 \times 10^{-4}$ was obtained for our rock salt crystal. This is about the same as obtained for x-ray reflection from imperfect rock salt crystals.

Before accurate measurements of the integrated reflection from crystals can be made we will require a counter of larger diameter so that the whole diffracted beam will pass the full length of the counter.

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PX10-16 - Characteristics of Fission Products and Neutron Induced Activities - (Levy)

Conversion Electron and Beta Spectrum of 27 Day Pa^{233}

The 180° counter spectrometer has been used for this investigation of 27 day Pa^{233}. The source was prepared by sputtering thorium on a thin aluminum foil which was then irradiated in the pile. A large number of weak conversion lines were observed in addition to many strong lines. The strong lines, as indicated in the accompanying table, are easily interpreted as the K, L and M conversion lines of four gamma rays. The weak lines cannot be grouped into K, L and M conversions. They could be spurious, they could represent L and M conversions of gamma rays whose K lines are too low in energy to be observed in the spectrometer, or they could arise from activities built up during the long irradiation of the source. This same source will be run again next month to determine if any of the lines observed decay with half lives different from 27 days. The end point of the beta spectrum is completely obscured by the strong line at $H\rho = 1615$ and consequently the maximum energy of the betas is approximately .2 mev.

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Conversion Electrons from 27 Day Pa^{233}

$H\rho$ of Line Observed	Relative Intensity	Energy of e^-	Shell gamm ray is converted in	Energy of gamma ray giving rise to conversion
876	6	.063	*	
910	3	.068		
1000	10	.081		
1063	3	.091		
1100	2	.097		
1150	1	.105		
1300	1	.131		
1340	1.5	.138		
1385	1.5	.147		
1560	80	.169	K_3**	.283 (obscured)
1615	240	.192	K_1	.306
1750	22	.221	K_2	.335
1915	1	.257	L_3	.277
1984	1	.273	M_3	.277
2005	6	.277	K_4	.391
2050	65	.288	L_1	.308
2125	18	.305	M_1	.309
2175	6	.317	L_2	.337
2550	3	.335	M_2	.339
2425	1.5	.377	L_4	.397
2490	1	.393	M_4	.397

** The subscript is merely a number to identify the conversions of each gamma ray.

* Lines between $H\rho$ = 876, and $H\rho$ = 1385 did not give rise to any conclusive analysis.

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PX10-18 - High Energy Gammas from Short-Lived Fission Products -(Rose, Burgy, Willard, Bloss)

Further analysis of the data from iron absorption measurements have been carried out and show that in the first 20 seconds after fission the gamma rays from the U^{235} fission products that are above the γ - n threshold of deuterium are of sufficient intensity to yield .034 per cent delayed neutrons from heavy water, i.e., an amount equal to 4 per cent of the total delayed neutrons from U^{235} fission products. The complete report on this work is in preparation.

PX10-3 - Cloud Chamber Studies - (Rose, Bloss)

The large cloud chamber has been completely rewired and is being assembled in preparation for a return to some unfinished work on long range alpha particles from Pu^{239}.

PX10-19 - Capture Gamma Energies - (Koch, Willard, Burgy)

The work on this problem is progressing with tests of the magnetic field coils and cloud chamber equipment.

PX6-1 - Pile Oscillator - (Moak, Strong, Koch, Wollan)

Recent experiments with the Clinton pile oscillator indicate what is known as a proximity effect. When small absorbers are moved to and fro along the sloping part of the pile flux distribution curve, two different effects may be observed. The first effect is the overall effect on the

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pile since the absorber is exposed to a greater flux in the "IN" position than in the "OUT" position. The overall pile power fluctuates in synchronism with the motion of the absorber. An ionization chamber placed anywhere in the pile will then have an alternating current component which can be measured by means of a sensitive a. c. amplifier. The signal will be proportional to steady-state pile-power and to absorber size (i. e. macroscopic cross-section). The second effect is a local one brought about by the existence of a neutron sink or region of depressed flux in the vicinity of the absorber. If a detecting chamber is placed very near the absorber so that this sink may be swept across the chamber, the current will vary due to the local effect as well as due to the overall pile effect. A small chamber was buried in the pile so that samples could be moved beside it in a channel 1/4" away. The zero position of the stroke was variable and could be made to fall very near the chamber or even beyond it into the pile. Comparison of the two effects was made in the following manner: The absorber is kept the same and the distance between the inward end of the stroke and the center of the chamber is varied. The stroke length is kept constant. The signal strength is plotted against distance. After the distance exceeds forty inches the curve levels out indicating that most of the signal is then due to overall pile effect. The plot is shown in Fig. 1.

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Fig. 2 shows the effect of carrying the stroke to the inward side of the detecting chamber so that the proximity effect is reversed and in opposition to the pile effect signal. Fig. 2 is a rough continuation of Fig. 1.

As shown, the signal due to the local or proximity effect is roughly ten times greater than the signal due to the overall pile effect for a given absorber. Then if one could measure cross-sections using the proximity effect rather than the total pile effect the sensitivity of the instrument would presumably be ten times greater. Now it is known that pile-neutron cross-sections of elements depend upon the temperature of the pile used so that corrections must be made between measurements at different piles. It should be of interest to observe whether the neutron spectrum in a sink region may be distorted so that values of cross-sections obtained in this way with, say, a boron-coated chamber detector, may be affected by the cross-section spectrum of the element measured. This possibility is being investigated. It is planned to compare two elements of widely different known cross-section spectrums (i. e. Au and Cd) under the proximity conditions and under overall effect conditions. If the two comparisons give the same ratios, no appreciable error should be expected due to making use of the proximity effect. Considerable improvement in the operation of the oscillator has been effected by the special electronic equipment developed by Pvt. Jon Strong. Most important is the photoelectric

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synchronizer which automatically regulates the speed of the reciprocator motor so that the motion of the absorber is kept in synchronism with the sweep of the resonance galvanometer within $\pm 3^{\circ}$ of a cycle. Synchronizing was previously done by visual methods and hand regulation, often with errors as great as $\pm 30^{\circ}$. Automatic synchronizing removed a great many of the fluctuations in the amplitude of the galvanometer swing, since the response of the galvanometer being used falls to half value when the signal is 0.5% off resonance frequency. The development of a regulated-thyratron rectifier supply for the motor armature has replaced the M-G set which drifted in voltage.

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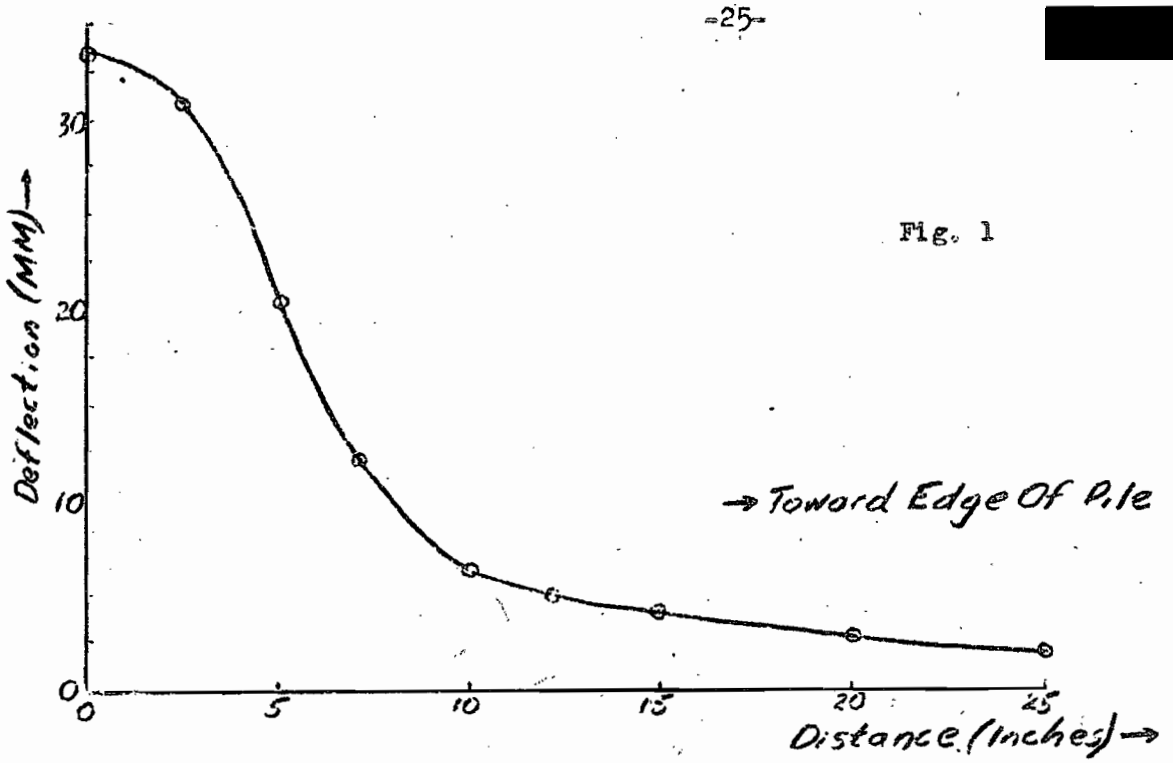

Fig. 1

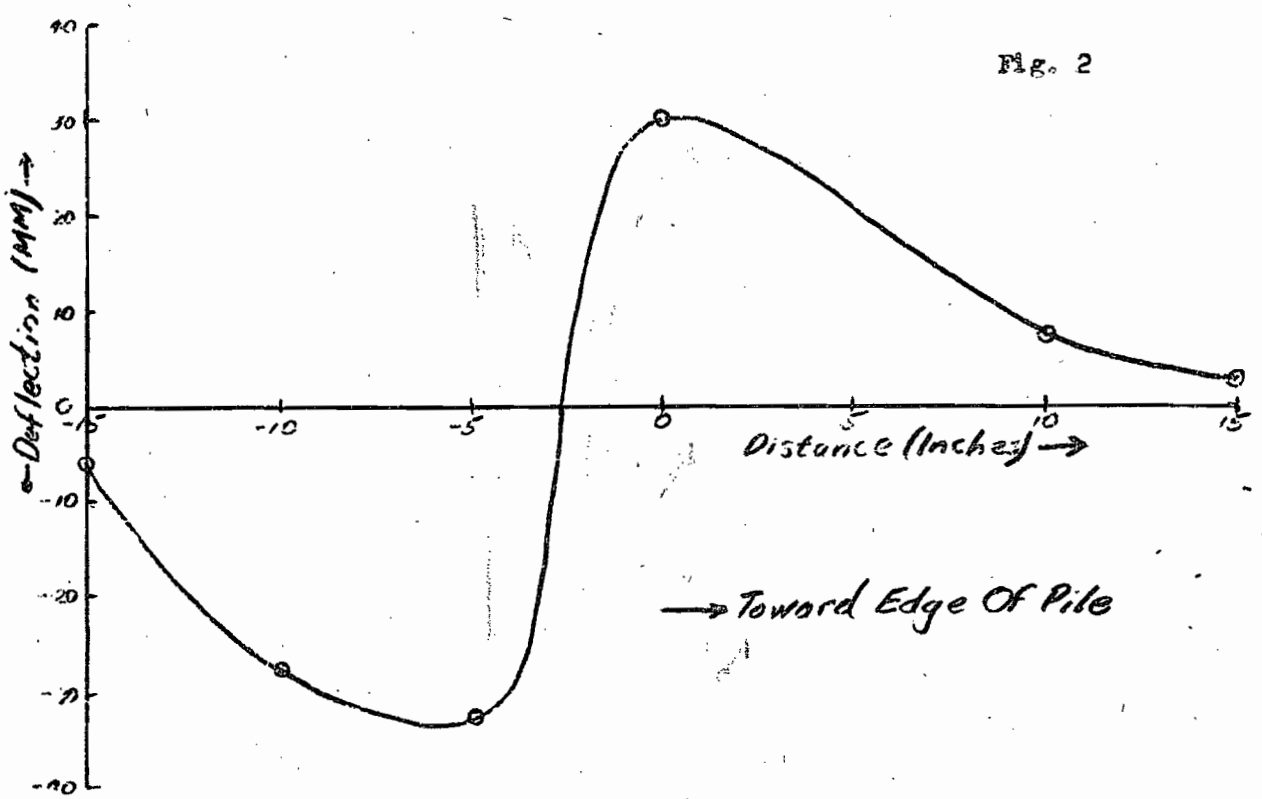

Fig. 2

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Physics Section IV

L. B. Borst, Section Chief
S. Bernstein, Associate Section Chief

Total technical personnel (including supervision)....10 (this period)

Problem Assignment Number	Subject	Status	Percentage of Section Manpower Report Per.	Next Per.
PX10-7	Fissionability of 40-10	Inactive	0	0
PX10-8	Neutron Diffraction	Active	25	20
PX10-10	Deuterium Gamma Ray Spectrometer	Inactive	0	10
PX10-14	Poisoning Coefficients	Inactive	0	0
PX10-15	Photoneutrons from Fission	Active	30	40
PX10-17	Fissionability Studies	Active	35	20
	Heat Evolution from Bombarded Thorium	Active	10	10
		Total.....	100	100

[redacted]

[redacted]

PX10-15 - Photoneutrons from Fission - (Wolfe, Steinberg, Bernstein)

During the past month the difficulties with the operation of the new pneumatic tube have been overcome. By means of the new tube a sample can now be sent from one end of the pile to the other in about 0.4 sec. The fission chambers and accompanying circuits have been put into final shape. The apparatus should deliver some data during the next period.

PX10-8 - Neutron Diffraction - (Osborne, Hasbrouck)

Christmas furloughs have interfered with this work. The fission spectrum of 25 has been extended to somewhat higher energies. Difficulties with the fission chamber have prevented rapid progress.

A single magnesium metal crystal, $1\frac{1}{2}$" x 12", has been successfully grown. The small grating space available should permit high resolution at high energies.

PX10-10 - Deuterium Gamma Ray Spectrometer

No work has been done this period.

PX10-17 - Fissionability Studies - (Floyd, Dial, Schofield)

Measurements have been made upon Np^{239}. The results of these measurements are not yet available.

[redacted]

A 2 mc sample of highly purified polonium was tested for fissionability. The thermal fission cross section, if different from zero, is less than 1 barn. Improved technique will probably permit a value of .01 barn to be observed.

The Nier mass spectrometer to be used for producing deposits of heavy isotopes will soon be completely installed. Initial tests on C^{14} and U will probably be made during the coming month.

Heat Evolution from Bombarded Thorium - (Ulrich)

The differential calorimeter required for this problem is nearing completion in the shop.

[redacted]

MAR 1946
Clinton Laboratories
Central File
Room

57151