[redacted]

MARTIN MARIETTA ENERGY SYSTEMS LIBRARIES
3 4456 0360421 3

ORNL 345
PHYSICS-GENERAL
6a

LABORATORY RECORDS
1954

Classification Cancelled
Or Changed To
By Authority Of AEC 9.13.71
By E. Goldberg Date 11.3.71

MATHEMATICS AND COMPUTING PANEL

QUARTERLY PROGRESS REPORT

DECEMBER, JANUARY, FEBRUARY

A.S. HOUSEHOLDER, CHIEF

AEC RESEARCH AND DEVELOPMENT REPORT

OAK RIDGE NATIONAL LABORATORY
CENTRAL RESEARCH LIBRARY
CIRCULATION SECTION
4500N ROOM 175
LIBRARY LOAN COPY
DO NOT TRANSFER TO ANOTHER PERSON
If you wish someone else to see this report, send in name with report and the library will arrange a loan.
UCN-7969 (3 9-77)

[redacted]

OAK RIDGE NATIONAL LABORATORY

OPERATED BY
CARBIDE AND CARBON CHEMICALS CORPORATION
FOR THE
ATOMIC ENERGY COMMISSION
POST OFFICE BOX P
OAK RIDGE, TENNESSEE

CLASSIFICATION CANCELLED
David R. Hamrin ORNL 5/28/2013
ADD Signature Date
Single review of CCRP-declassified documents was authorized by DOE Office of Declassification memo of August 22, 1994.

[redacted]

5-20-49

[redacted]

ORNL 345

This document consists of 17 pages

Copy 6 of 112, Series A

ISSUED: MAY 20 1949

Contract No. W-7405, eng 26

MATHEMATICS AND COMPUTING PANEL

QUARTERLY PROGRESS REPORT
DECEMBER, JANUARY, FEBRUARY
1948-49

A. S. HOUSEHOLDER, CHIEF

[redacted]

OAK RIDGE NATIONAL LABORATORY

operated by
Carbide and Carbon Chemicals Corporation
for the
Atomic Energy Commission
Post Office Box P
Oak Ridge, Tennessee

[redacted]

MARTIN MARIETTA ENERGY SYSTEMS LIBRARIES

3 4456 0360421 3

[redacted]

ORNL-345
Physics-General

OAK RIDGE NATIONAL LABORATORY INTERNAL DISTRIBUTION:

1. G. T. Felbeck (CCCC N.Y.-N.Y.)
2. 706-A Library
3. 706-B Library
4. Biology Library
5. Health Physics Library
6. Training School Library
7. Training School Library
8. Central Files
9. Central Files
10. Central Files
11. Central Files
12. J. A. Swartout
13. J. H. Gillette
14. A. Hollaender
15. J. H. Frye, Jr.
16. M. D. Peterson
17. C. N. Rucker
18. A. M. Weinberg
19. J. S. Felton
20. A. H. Snell
21. E. O. Wollan
22. K. Z. Morgan
23. A. Householder
24. E. P. Blizard
25. F. C. VonderLage
26. Lewis Nelson

OAK RIDGE NATIONAL LABORATORY EXTERNAL DISTRIBUTION:

27-38. Argonne National Laboratory
39. Armed Forces Special Weapons Project
40-41. Atomic Energy Commission, Washington
42. Battelle Memorial Institute
43-46. Brookhaven National Laboratory
47. Bureau of Ships
48-51. Carbide & Carbon Chemicals Corporation (K-25 Plant)
52-55. Carbide & Carbon Chemicals Corporation (Y-12 Plant)
56. Columbia University (Dunning)
57-60. General Electric Company, Richland
61. Hanford Operations Office
62. Iowa State College
63-64. Kellex Corporation
65-68. Knolls Atomic Power Laboratory
69-71. Los Alamos
72-74. Mound Laboratory
75. National Advisory Committee for Aeronautics
76-77. National Bureau of Standards
78. Naval Radiological Defense Laboratory
79. NEPA Project
80. New Brunswick Laboratory
81-82. New York Operations Office
83. North American Aviation, Inc.
84. Patent Branch, Washington
85. Sandia Laboratory
86-100. Technical Information Branch, ORE
101. UCLA Medical Research Laboratory (Warren)
102-106. University of California Radiation Laboratory
107-108. University of Rochester
109-112. Westinghouse Electric Corporation

[redacted]

[redacted]

QUARTERLY REPORT
MATHEMATICS AND COMPUTING PANEL

The Mathematics and Computing Panel, formerly the Mathematics and Computing Section of the Physics Division, is organized to extend its services to all research divisions instead of the Physics Division only. Personnel at present are the following:

Alston S. Householder, Chief
Rosemary Crook, Administrative Assistant
Mae O. Gill, Secretary
Robert R. Coveyou, Mathematician
Nancy M. Dismuke, Mathematician
M. Ruth Arnette, Computer
E. Ann Forbes, Computer
May K. Hullings, Computer
Kathleen M. Martin, Computer
Donna D. Palmiter, Computer
Professor John von Neumann, Consultant
Professor G. H. Goertzel, Consultant

Purposes of the Panel are to perform computations and provide a consulting service on mathematical, statistical and computational problems arising in the research divisions, and to engage in mathematical research on problems relevant to the overall research program of the Laboratory. A large class of such problems center about the effective use and evaluation of the Monte Carlo method, and of numerical methods in general.

While ORNL has at present no high-speed computing machinery, various facilities are available for its use. There is excellent IBM equipment at both the K-25 and the Y-12 plants and a considerable amount of the heavier computations from the Laboratory has been and is being done at both places. Mrs. Dismuke and Miss Arnette spend a large fraction of their time at Y-12 with these machines. The Mark I at Harvard was used for the Internal Conversion computations reported below. A recent AEC contract with Harvard renders this machine available for other work when the need arises.

[redacted]

[redacted]

Individual problems will be enumerated and described below. However one project of some magnitude falls in a category of its own and will be described here. This is the preparation for a meeting of the Association for Computing Machinery to be held in Oak Ridge on April 18, 19, and 20.

The proposal for this meeting was an outgrowth of a suggestion originally made by Dr. C. C. Hurd of K-25, to hold a conference of representatives of Southeastern colleges on high speed computing. The purpose was to make known to interested research groups the computing facilities now available and anticipated for the future, and to explain their uses. This proposal was discussed with Dr. J. H. Curtiss of the National Bureau of Standards, who immediately recommended holding the conference as a meeting of the Association for Computing Machinery.

After some consultation with Dr. Weinberg, Dr. Murphy and others, the invitation was extended to the Association, and gratefully accepted. In order to orient the meetings toward Southeastern schools, so far as possible, Dr. R. S. Poor of the University Relations Division, ORINS, was asked to be chairman of the local program committee, to send the invitations to the leading speakers, and to mail special notices to those schools which are members of the Institute. A committee on arrangements consisted of A. S. Householder, as chairman, assisted by Rosemary Crook, and of the following members: N. M. Smith and F. C. von der Lage, X-10; F. C. Uffelman, Y-12; C. C. Hurd and G. A. Garrett, K-25; F. A. Ficken, K-25 and University of Tennessee; and R. S. Poor, ORINS.

In planning the program, the endeavor has been to exemplify the range of applicability of the existing high-speed machinery by presenting a variety of problems for which they have been utilized. Thus there will be described several calculations on standard IBM, one on the SSEC, one on the ENIAC, and one each on the Marks I and II. In addition there will be a number of more general papers but all with emphasis upon function rather than structure.

While we were disappointed in that Dr. Warren Weaver and Professor John von Neumann find themselves unable to attend, in general the response from the proposed speakers has been very good, and the program is now virtually completed.

In the following pages are listed the major problems on which work was done during the past quarter.

[redacted]

[redacted]

PROBLEM: DIFFUSION IN MULTI-COMPARTMENT SYSTEMS

ORIGIN: DR. C. W. SHEPPARD, BIOLOGY DIVISION

PARTICIPATING MEMBER OF PANEL: A. S. HOUSEHOLDER

BACKGROUND: In using radioactive tracers in biological systems it is sometimes possible to distinguish a finite number of "compartments" in the organism, within each of which the substance may be regarded as having a uniform distribution at any given time but in an amount which varies with time. In some cases, as in the blood cells within the plasma, or the body cells within the extra-cellular fluid, there may be numerous small compartments, each connected only with a single large compartment (the plasma or extra-cellular fluid). In this case the temporal variation of activity in any compartment may be expected to be representable as a sum of exponentials, though experimentally it often happens that in the outer compartment, where measures can be made, a single exponential gives a very good representation for a considerable period of time. A theoretical analysis is desired for relating the activity to the relevant parameters of the system.

STATUS: Sheppard has obtained the system of equations

$$da_o/dt = \sum^{1,n} A_i \, (a_i - a_o)$$

$$da_i/dt = \alpha_i \, (a_o - a_i)$$

where the subscript o designates the outer compartment, the other subscripts the smaller ones; the a's represent the relative specific activity; the A's the ratio of exchange rate to the volume of the outer compartment; and the α's the ratio of exchange rate to volume of the given compartment. The A's are of the order n^{-1}.

On writing the secular equations in $-\lambda$ instead of in λ, it is found to have one root $\lambda_o = 0$, as it must; n-1 roots λ_i satisfying

$$\alpha_i < \lambda_i < \alpha_i + 1 \quad ,$$

the α's being supposed distinct and arranged in increasing order; and a root

[redacted]

[redacted]

$$\lambda_n > \alpha_n \quad .$$

For initial conditions we take

$$a_o = 1 \; ; \quad a_i = 0$$

signifying that initially all the isotope is in the plasma. Then the solution of interest is

$$a_o = x_o + \Sigma\, x_i \exp\,(-\lambda_i t) \quad .$$

A convenient representation of the x's is as follows: Let $\Delta(\lambda)$ represent the secular determinant,

$$\begin{aligned} \phi(\lambda) &\equiv \Pi\,(\lambda - \alpha_i) \\ g(\lambda) &\equiv \Delta(\lambda)/[\lambda\phi(\lambda)] \\ &\equiv 1 - \Sigma\, A_i/(\lambda - \alpha_i) \quad . \end{aligned}$$

Then

$$(x_o/\lambda) + [x_i/(\lambda-\lambda_i)] \equiv \phi(\lambda)/\Delta(\lambda)$$

where the left member is the partial fraction expansion of the right member. In particular

$$x_o^{-1} = g(o), \quad x_i^{-1} = \lambda_i\, g'(\lambda_i) \quad .$$

If we think of n as becoming large while the α's remain between finite bounds and the A's are fixed in their sum, then x_n and x_o remain essentially fixed while the remaining x_i decrease individually but remain essentially fixed in their sum. Further characteristics of the system are governed by the characteristics of the distribution of the A_i with respect to the α_i.

[redacted]

[redacted]

PROBLEM: DETERMINATION OF EXCHANGE RATES IN A MULTICOMPARTMENT SYSTEM BY MEANS OF TAGGED ATOMS

ORIGIN: DR. C. W. SHEPPARD, BIOLOGY DIVISION

PARTICIPATING MEMBER OF PANEL: A. S. HOUSEHOLDER

BACKGROUND: Exchange rates between pairs of compartments must be inferred from measurements of total contents of the compartments. Sheppard has shown [Journal of Applied Physics 19 (1948) 70-76] that if initial contents are known, and contents can be measured at some subsequent time, then exchanges between pairs of compartments can be inferred in general in case there are as many tagged species as there are compartments. However, it may be known that communication between certain pairs of compartments is not possible. One would like effective rules for determining, in any special case, the number of species required, and the most efficient procedure for solving the equations.

STATUS: With a slight modification of Sheppard's notations, $S_{r,j}$ may denote the increase of species r in compartment j, $S_{r,jk}$ the total amount of species r transferred from compartment j to compartment k, in which case it is supposed that

$$S_{r,jk}/S_{jk} = S_{r,j}/S_j = A_{r,j} \quad ,$$

where the $A_{r,k}$ are known constants. Then

$$\sum_j S_{r,j} = 0 \tag{1}$$

and if one defines S_{ii} so that

$$\sum_k S_{jk} = 0 \tag{2}$$

then Sheppard's equations take the form of the matrix equations

$$AT = S \quad ,$$

where the T is the matrix of the unknown quantities S_{ij} and S that of the

[redacted]

[redacted]

measured quantities $S_{r,i}$. It should be arranged experimentally that A is to be non-singular, in which case clearly

$$T = A^{-1}S \quad .$$

Consistency with the auxiliary equations (1) and (2) is easily shown. When communication between any pair of compartments is known to be lacking, then the corresponding element in the matrix T is known to be zero. This reduces the number of elements to be solved for in a column of T. In the general case, one may neglect the last column of S and T, solve the remaining system, and utilize (1) and (2) to find this last column of T. In special cases it is more expedient to utilize explicitly (1) and (2), and solve a subsystem employing only a suitable minor of A, and hence a smaller number of species.

PROBLEM: DEVELOPMENT OF PHAGE IN A BACTERIAL SUSPENSION

ORIGIN: DR. S. H. BENZER, BIOLOGY DIVISION

PARTICIPATING MEMBER OF PANEL: A. S. HOUSEHOLDER

BACKGROUND: When a bacterium becomes infected by the adsorption of a phage particle upon its surface, the bacterium ceases to grow and divide. Instead, after a characteristic latent period, the bacterium undergoes disintegration or lysis, releasing a number of new phage particles. A mathematical treatment of the population kinetics is desirable.

STATUS: Accurate treatment leads to a complicated system of integro-difference-differential equations. However, in low concentrations where the adsorption proceeds slowly and the sudden discontinuities caused by the release of phage can be smoothed over, one may hope to approximate the system by equations of the form:

$$dP/dt = \alpha C - \beta P (B + C)$$

$$dC/dt = \beta P B - \gamma C$$

$$dB/dt = \delta B - \beta P B \quad ,$$

[redacted]

[redacted]

where

$$P = \text{number of free phage,}$$

$$B = \text{number of uninfected bacteria,}$$

$$C = \text{number of infected bacteria.}$$

It is convenient to make the substitutions

$$T = B + C, \qquad C = u\,T$$

thus obtaining the equivalent system

$$\dot{u} = (1 - u)\ (P = cu)$$

$$\dot{T} = T\ (b - cu)$$

$$\dot{P} = T\ (au - P)$$

where the dot denotes differentiation with respect to τ, and

$$\tau = \beta\, t, \qquad c = (\tau + \delta)/\beta \quad ,$$

$$b = \delta/\beta \qquad a = \alpha/\beta \quad .$$

Necessarily

$$b < c, \qquad u \leqslant 1 \quad ,$$

and all variables and parameters are essentially positive. In all cases T will increase when u is small, becomes stationary when $u = b/c$, and decreases when $u > b/c$. The ultimate behavior, however, depends upon the relative magnitudes of a and c.

If $a > c$, then though u or P (but never both) may decrease initially, ultimately both will increase and will continue to increase as $u \to 1$ asymptotically. Meanwhile, T may increase to begin with but will ultimately decrease exponentially, while P is approaching a value that is close to a and quite insensitive to the initial conditions.

[redacted]

[redacted]

If, however, $a < c$, then ultimately both u and p will decrease, while T increases at a rate that approaches its natural uninhibited rate of exponential increase. This is due to the fact that the phage become adsorbed almost immediately and new phage are produced too slowly to produce any relatively great effect upon the bacterial development.

To obtain a more accurate quantitative picture of possible modes of development, it is planned to map out some trajectories with reasonable numerical values of the parameters, and perhaps to make some experimental checks.

PROBLEM: STATISTICAL ANALYSIS OF EFFECTS OF BODY IRRADIATION OF RATS

ORIGIN: DR. HENRY I. KOHN, BIOLOGY DIVISION

PARTICIPATING MEMBERS OF PANEL: A. S. HOUSEHOLDER AND DONNA PALMITER

BACKGROUND: In a typical one of Kohn's experiments, each of several groups of rats was subjected to a measured amount of radiation. Thereafter, on succeeding days, two animals from each group were sacrificed and measures made of blood composition. Statistical assessment of deviations from measurements made on controls were desired.

STATUS: On some variables, values differed from those of the controls for only a limited period of time--on others there was oscillation above and below normal as time went on. In most instances it was decided to restrict consideration to a limited interval of time and compare the values of the variables during these intervals with the normal, either by taking a regression on dose, or by merely testing the difference of two means. Computations are under way.

PROBLEM: DETERMINATION OF COEFFICIENTS OF EXPONENTIAL DECAY CURVES

ORIGIN: DR. HENRY ZELDES, CHEMISTRY DIVISION

PARTICIPATING MEMBER OF PANEL: A. S. HOUSEHOLDER

BACKGROUND: Zeldes suggests that in many chemical determinations the periods of decay are adequately representable by a relatively small, discrete, preassigned set, and that numerical analysis is required for ascertaining in-

[redacted]

[redacted]

tensities only. This being granted, one is permitted to fix a set of exponentials, replace them by an orthogonalized set of linear combinations, and perform the analysis in a fairly simple and straightforward manner.

STATUS: Plans are being made for orthogonalizing a small set to be submitted by Zeldes, and to apply these to some experimental data. The advisability of setting up procedures for automatic analysis by IBM is being considered.

PROBLEM: (Continuation) MONTE CARLO ESTIMATE OF AGE OF NEUTRONS IN WATER 35 Mev SOURCE

ORIGIN: MR. P. R. BELL, PHYSICS DIVISION

PARTICIPATING MEMBERS OF PANEL: M. R. ARNETTE, N. M. DISMUKE, A. S. HOUSEHOLDER

BACKGROUND: See previous Quarterly Report of Physics Division.

STATUS: The IBM work is just completed; moments are being calculated and distributions compared with experiment.

PROBLEM: MONTE CARLO ESTIMATE OF AGES AND OF COLLISION DISTRIBUTIONS IN TISSUE OF NEUTRONS FROM HIGH SOURCE TO LOW EPITHERMAL ENERGIES

ORIGIN: DR. WALTER SNYDER AND DR. J. NEUFELD, HEALTH PHYSICS DIVISION

PARTICIPATING MEMBERS OF PANEL: N. M. DISMUKE, R. R. COVEYOU, M. R. ARNETTE, A. S. HOUSEHOLDER

BACKGROUND: At thermal energies estimates of collision densities are provided by solutions to the Milne Problem. Monte Carlo estimates for this problem were obtained last summer (see Quarterly Report for Physics Division, June, July, August, 1948) and numerical iteration of the integral equation is now in progress for special source functions. At higher energies analytical methods are virtually impossible.

STATUS: In principle, if a sample of collisions is obtained for a high source energy, subsamples can be selected appropriate to a source of any given lower energy. However, the source of interest here is a parallel beam, and unless rotations are effected the subsamples become trivially small. Hence more coordinates must be retained than are required for the specific problem, if any generality is to be achieved. Appropriately modified routines are being worked out for the IBM and the problem will be sent to Y-12 early in March.

[redacted]

[redacted]

PROBLEM: (Continuation) STATISTICAL ANALYSIS OF X-10 DISPENSARY VISITS

ORIGIN: DR. J. S. FELTON AND MRS. MARY OWENS, HEALTH DEPARTMENT

PARTICIPATING MEMBER OF PANEL: A. S. HOUSEHOLDER

BACKGROUND: See previous Quarterly Report of Physics Division

STATUS: Product moments have been computed at K-25 by IBM and a great many are sensibly zero, as expected. However, the decision as to which variables can legitimately be eliminated can only be made after the product moments are reduced to correlations, a computation that is now under way. With the acquisition of a 604 multiplier at K-25, the remaining calculations should not take extremely long unless discrimination between variables proves to be too difficult.

PROBLEM: (Continuation) STATISTICAL ANALYSIS OF BLOODCOUNTS ON X-10 EMPLOYEES

ORIGIN: DR. J. S. FELTON AND MRS. MARY OWENS, HEALTH DEPARTMENT

PARTICIPATING MEMBER OF PANEL: A. S. HOUSEHOLDER

BACKGROUND: See previous Quarterly Report for Physics Division

STATUS: Separation was made of those employees who do from those who do not work in the restricted area; and further of those who do from those who do not claim to have contact with fissionable material. Cards have been punched by IBM at K-25 and Mr. Carpenter of K-25 has made a preliminary survey with negative results. However, the previously recommended procedure is now under way, of selecting those individuals who have records taken in the same season of consecutive years, and comparing these records. A number of such comparisons would be required, but it would be of interest to know whether there is a tendency for either the variance to increase significantly, or, the variances remaining homogeneous, for the differences to be significantly positive or significantly negative.

PROBLEM: EXTENSION OF THE NATIONAL BUREAU OF STANDARDS TABLE OF THE COMPLEX Γ-FUNCTION

ORIGIN: MR. P. R. BELL

[redacted]

[redacted]

PARTICIPATING MEMBERS OF THE PANEL: N. M. DISMUKE, R. R. COVEYOU, A. S. HOUSEHOLDER

BACKGROUND: The Computations Laboratory of the National Bureau of Standards has prepared a table of $\ln \Gamma (x + i y)$, $X = 9(0.1)10$, $Y = 0(0.1)10$. Preparation of a table of the Γ—function itself was projected, but uncertain following a recent reduction in staff. Since these functions are in frequent need, it has been suggested that some extension of the present incomplete table should be made, and a conversion to the antilog be made for local use, pending the publication of a more complete set by the Bureau.

STATUS: The project is being evaluated in terms of IBM operations to permit a judgment as to its feasibility.

PROBLEM: NUMERICAL SOLUTION OF THE MILNE PROBLEM

ORIGIN: DR. W. S. SNYDER, HEALTH PHYSICS DIVISION

PARTICIPATING MEMBER OF PANEL: K. M. MARTIN

BACKGROUND: With appropriate choice of the parameters, the solution represents collision densities of slow neutrons in tissue. A Monte Carlo solution of one case has been obtained and reported in a previous Quarterly Report of the Physics Division; a large sample of collisions was accumulated for use in other cases but laid aside for a time. The present project involves iterative numerical integrations of approximations from above and from below in order to assign limits of error.

STATUS: Newly started.

PROBLEM: INTERNAL CONVERSION

ORIGIN: SEE PREVIOUS QUARTERLY REPORT OF PHYSICS DIVISION

PARTICIPATING MEMBERS OF PANEL: R. R. COVEYOU, N. M. DISMUKE, K. M. MARTIN, M. K. HULLINGS, D. D. PALMITER, E. A. FORBES

BACKGROUND AND STATUS: In setting up the calculations for the Mark I the endeavor was made to limit the number of computed coefficients to a minimum, relying upon subsequent interpolation and extrapolation by hand for

[redacted]

[redacted]

completing a set of useful tables. The interpolation has been carried out. The extrapolation to lower atomic numbers, however, turned out to be questionable, and request has been made for a few additional computations by the machine.

Results from standard approximate formulas were checked against the more exact values now available for an assessment of these approximations. This work will be reported in a forthcoming paper by M. E. Rose, B. I. Spinrad and G. H. Goertzel.

PROBLEM: FITTING MONTE CARLO DISTRIBUTIONS BY GRAM-CHARLIER SERIES

PARTICIPATING MEMBERS OF PANEL: N. M. DISMUKE, E. A. FORBES, A. S. HOUSEHOLDER

BACKGROUND: In using the Monte Carlo method on the neutron age problems one obtains a series of samples from populations whose analytical representation is unknown. An approximate representation in some form is desirable. Distributions in Z and those in u are being plotted with their Gram-Charlier representations in the hope that these functions might prove useful.

STATUS: The work is about half finished.

PROBLEM: COMPARISON OF METHODS OF COMPUTING NEUTRON AGES FROM GIVEN MONTE CARLO DISTRIBUTIONS

ORIGIN: DR. B. I. SPINRAD

PARTICIPATING MEMBERS OF PANEL: M. K. HULLINGS, A. S. HOUSEHOLDER, G. H. GOERTZEL (consultant)

BACKGROUND: From the distributions obtained by Monte Carlo, age at a given energy has been computed as follows: One records the location of the collision of each neutron at which it dropped across or from the given energy. The variance of this distribution is taken to be the age at that energy. An experimentally determined distribution, however, would presumably represent the number of neutrons at any point, weighted by the time spent in the neighborhood of that point, i. e. by the secant of the angle made by the path with the Z-axis. It appeared possible that the anomalous concavity in the graph of age against energy for the 100 neutrons from 10 Mev (cf. previous Quarterly Reports of Physics Division) might not occur when distributions of this second type were taken.

[redacted]

[redacted]

STATUS: Results of this computation are given in the following table:

ENERGY RANGE	z^2 MOMENT
$1.5 \times 10^6 - 6.7 \times 10^5$	293.06
$1.5 \times 10^5 - 6.7 \times 10^4$	366.79
$1.5 \times 10^4 - 6.7 \times 10^3$	537.50
$1.5 \times 10^3 - 6.7 \times 10^2$	385.00

Thus the anomalous initial upward concavity was removed, but there appeared, instead, an impossibly high second moment at the energy near 10 kev. This effect was traced to a single aberrant neutron located far from the source at that energy. Since this seems to be a "small-sample" effect, the advisability of a similar recalculation of ages from the subsequent Monte Carlo 1000-neutron calculations seems indicated.

PROBLEM: COLLECTION OF NUCLEAR DATA

PARTICIPATING MEMBER OF PANEL: N. M. DISMUKE

BACKGROUND AND STATUS: This is a continuing cooperative project in which Mrs. Dismuke participates.

PROBLEM: PREPARATION OF A TABLE OF READING ERRORS IN ESTIMATING THE RADIUS OF CURVATURE OF THE PATH OF A PARTICLE IN A CLOUD CHAMBER

ORIGIN: MR. C. MOAK, PHYSICS DIVISION

PARTICIPATING MEMBERS OF PANEL: N. M. DISMUKE, K. M. MARTIN

BACKGROUND AND STATUS: The work is completed and reported elsewhere.

PROBLEM: MISCELLANEOUS SHIELDING CALCULATIONS

ORIGIN: MR. E. BLIZARD, SHIELDING GROUP

PARTICIPATING MEMBERS OF PANEL: N. M. DISMUKE, M. K. HULLINGS

BACKGROUND AND STATUS: These were incidental, minor calculations now completed.

[redacted]

[redacted]

PROBLEM: NEUTRON PENETRATION IN A MIXTURE OF WATER AND ALUMINUM

ORIGIN: DR. F. H. MURRAY, SHIELDING GROUP

PARTICIPATING MEMBER OF PANEL: M. K. HULLINGS

BACKGROUND AND STATUS: An approximate formula developed by Murray gives relaxation lengths as a function of energy, composition of shield, and distance from source. Preliminary calculations are being made for comparison with experiment. The work is under way.

PROBLEM: MONTE CARLO ESTIMATES OF NEUTRON AGE IN GRAPHITE

ORIGIN: DR. L. D. ROBERTS, PHYSICS DIVISION

PARTICIPATING MEMBERS OF PANEL: N. M. DISMUKE, R. R. COVEYOU, M. R. ARNETTE, E. A. FORBES, A. S. HOUSEHOLDER

BACKGROUND AND STATUS: Hill and Roberts have made accurate measurements of age at indium resonance of neutrons in graphite. A Monte Carlo calculation using 1060 neutrons through an energy drop to 10^{-2} that of the source was carried out for purposes of an indirect theoretical comparison. A complete summary of the entire project will be issued on completion.

PROBLEM: XENON CROSS-SECTIONS

ORIGIN: DRS. M. M. SHAPIRO AND SEYMOUR BERNSTEIN, PHYSICS DIVISION

PARTICIPATING MEMBERS OF PANEL: R. CROOK, R. R. COVEYOU, D. D. PALMITER, K. M. MARTIN, E. A. FORBES, A. S. HOUSEHOLDER

BACKGROUND AND STATUS: From the series of experiments now under way it is necessary to estimate the cross-section as a function of energy by making a least-squares fit. Following some preparatory computations, this is being done separately on the results of each experiment. The estimated values with appropriate statistical weights are then being fitted by least squares to the Breit-Wigner formula.

PROBLEM: DETERMINATION OF THE INTENSITY OF THE SOURCES USED IN THE XENON EXPERIMENT

ORIGIN: DR. A. R. BROSI, CHEMISTRY DIVISION

[redacted]

[redacted]

PARTICIPATING MEMBERS OF PANEL: R. CROOK, D. D. PALMITER

BACKGROUND AND STATUS: This is a curve fitting problem requiring the separation of two exponential components, the empirical data being the times at which ionizations occurred. The work has been completed.

PROBLEM: CALCULATION OF CRYSTAL STRUCTURE FACTORS IN Fe_3C

ORIGIN: DR. C. G. SHULL, PHYSICS DIVISION

PARTICIPATING MEMBER OF PANEL: D. D. PALMITER

STATUS: The work has been completed.

[redacted]